Sophia M. Connell 'The Female Contribution to Generation and Nutritive Soul in Aristotle's Embryology'[1]

Abstract

In the *Generation of Animals* (*GA*) Aristotle argues that both parents contribute to generation through differentiated products of the nutritive process, governed by nutritive soul. This appears to agree in general with the fact that the nutritive soul is the same thing as the generative soul, as set out in *De Anima*. This essay analyses the contribution of the female animal to generation as a nutritive residues and the result of her nutritive functioning. The female contribution to generation is made useful by its location and latent potentials: it ends up in the uterus ready to become all the parts of the new animal's body, once its own nutritive soul becomes actualised. After giving a comprehensive overview of the content of the female contribution as residue of nutrition, the last part of the essay articulates a challenge that this presents for Aristotle's account of nutritive soul. Since the female is unable to generate without the addition of the male generative residue, it would seem that her nutritive soul is defective, lacking the generative capacity that males possess. Articulating this problem requires a closer analysis of the connection between nutrition and generation in Aristotle philosophy. The essay finally concludes that because the female animal's soul attempts to perpetuate an animal the same in form into the next generation this is enough to render it generative as well as nutritive.

In Aristotle's theory of animal generation, the male acts as efficient cause of substantial change and the female as material cause (*GA* I.20, 729a9-12, 22-34). The efficient cause brings form into matter, generating another animal the same in form as the male parent. The materials from the female animal are highly specialised, containing all the parts and the whole body of an animal the same in form as that female animal (*GA* II.4, 738b7-9, 740b19-21). In most animals,[2] these differentiated generative functions are carried out by the products of nutritive processes.[3] The nutritive soul in both parents effect the production of their differentiated seed, semen in the male and menstrual fluid in the female.

This essay will focus on the connections between nutritive soul and the female's spermatic contribution in Aristotle's embryology. The first section (I) sets out Aristotle's general theory of *sperma* as a residue of nutriment. The second section (II) explains how the female's contribution is a 'useful' residue of nutriment different from that of the male. Its usefulness is a combination of its (i) origins (ii) place and (iii) eventual use. The third section (III) discusses the content of the female contribution. The fourth section (IV) explains how the female contribution is connected to the nutritive soul of the embryo as it develops. The final section (V) details how the female condition might be thought to raise difficulties for the unity of the nutri-generative soul. The female retains a

[1] I would like to thank David Lefebvre, Giouli Korobili and Pavel Gregorić for their comments and criticisms on earlier drafts of this paper.
[2] With the exception of insects. See *GA* I.22, 730b25-26, 730b20; II.4, 738b12-14.
[3] This accords with the strong association between generation and nutrition in both Aristotle and his contemporaries (Connell 2016, p. 127-141).

nutritive function while appearing to lack a generative one. Thus, Aristotle's thought that nutrition and generation are somehow the same needs to be carefully nuancing when it comes to explaining the nutritive soul of the female animal in all kinds. The conclusion (VI) will bring together all of these analyses by elaborating further how the female's nutritive soul is generative.

(I) Aristotle's Theory of the Female Contribution

The nature of the female contribution to generation is closely parallel to that of the male – both have the same origins in the body. In order to establish this account, Aristotle focuses on unknown theorists in *GA* I.17-18 who hold that *sperma* comes from 'all the parts of the body'. Balme (1972 [1992]) identifies six objections that Aristotle makes to this. In one prominent argument, Aristotle posits that if *sperma* were from the parts it would be a degenerative fluid (σύντηγμα). He presents his own theory as more viable – that *sperma* is a 'residue' (περίττωμα).[4] Initially, a residue is distinguished from nourishment (τροφήν) (724b25-26). Nourishment is then further divided into useful and useless: 'every residue ***is*** (ἐστιν) either useful or useless nourishment' (725a4-5). *Sperma* is a part (μέρος) of this useful residue (725a11). It is the final (τὸ ἔσχατον) and most nourishing portion (725a14-28).

In order to make his point against the rivals, Aristotle must insist that, for them, *sperma* is a degenerative fluid (σύντηγμα or colliquesence). Aristotle uses the verb *suntêkô* to describe starvation as a process whereby an animal destroys itself like a fire burning itself out (*Somn*. 5, 466b28-33). And so, this degenerative fluid is being broken down rather than being put together (*GA* I.18, 724b35-725a2).[5] Its presence, then, is a sign of disease.[6] It can be distinguished from residue because it does not have a natural place or receptacle in the body, instead flowing all over, causing trouble in seeking a way out (*GA* I.18, 725a34-35). This degenerative *suntêgma* shows that something unnatural is happening (725a28) and so cannot be the origin of the embryo since 'nothing that is in accordance with nature (παρὰ φύσιν) ever comes from what is against nature (κατὰ φύσιν)' (*GA* I.18, 725a2-3). It would be odd for any theorist to consider *sperma* to be like that. Indeed, it may be that Aristotle's linguistic distinction unfairly masks the similarities between his theory and those of his rivals. So, for example, in the certain Hippocratic works, the *sperma* comes from the humours which are potentially constructive, containing powers of their own right.[7] Leaving

[4] He also notes that *sperma* is a residue (περίττωμα) in *Long*. 5, 466b9.

[5] In instances of spontaneous generation, organised living being do come to be from waste material, such as dung (*HA* V.19, 551a4, 552a16-18) and processes of putrefaction can result in living animals (*HA* V.1, 539a23, V.31, 556b26). Putrefaction (σηπομένης), however, would appear to be different from *suntêkô* as the former is external to living bodies. In the case of dung, this is a natural (useless) residue and so may have some positive qualities which aid in the production of simpler animals. In any case, these occurrences would not necessarily count as 'natural' according to Aristotle since they are due to chance (*GA* III.11).

[6] It may be unfair for Aristotle to assume that the process of 'melting' which medical writers associate with 'putrefaction' always produces a morbid secretion. For more on this point, see Coles (1995, p. 61).

[7] See E.g. *Genit*. 3.1, L VII 474-5. The Hippocratic works *On Generation, The Nature of the Child* and *Diseases 4* which are the most detailed account of the origins of *sperma* in the bodily parts/humour never use the term '*suntegma*'. As Balme remarks: 'The extant Hippocratic writings do not call seed a colliquation, but Aristotle considers their view tantamount to it' (Balme 1972, p. 146). The idea that Aristotle's view is not so far away from that of Presocratic 'pangenesis' is a point originally made in a slightly different manner by Coles (1995, p. 59-61. See also Louguet on how Aristotle's argument also does not really work against Anaxagoras (Louguet 2015, p. 129-133).

aside whether Aristotle rightly characterised these opponents, let's now analyse more closely his own view that *sperma* is a sort of 'residue'.

Aristotle presents a new refined position on the connection of 'residue' to nourishment in the *GA*.[8] More generally, he prefers to contrast the two. For example, in the *Parts of Animals* bile is said to be a residue (περίττωμα) of the liver and that 'residue is the opposite of nourishment' (*PA* IV.2, 677a27); it is contrasted with 'healthy blood' which is sweet (as opposed to being bitter).[9] In the *GA*, in contrast, Aristotle allows for residues to be healthy and so they are not 'opposite' to nourishment in the sense of being pathological. Useful residues are (potentially) positive.

> All residue is either useless or useful nourishment. By 'useless' I mean that nothing natural can be further constructed out of it, but copious consumption of it harms greatly, and useful is the opposite (*GA* I.18, 725a3-7).

Useless residues (usually termed just 'residues' elsewhere) are the liquid and solid by-products of nutrition, and have a particular place to be stored before exiting the body.[10] These useless residues are a potential cause of disease (presumably disease of a different sort that that indicated by the presence of σύντηγμα). The useful residues, being contrary to the useless ones, must be those which can still contribute to the construction of natural parts and which can be consumed without any harm ensuing. The nutritive process begins, properly speaking, in the stomach, liver and spleen before a final concoction takes place in the heart; blood is the ultimate and most useful residue and *sperma* is a portion of this blood.[11] If we are led to wonder why, since it is useful, it is left over and not used to nourish, Aristotle offers an explanation as follows.[12] The useful final nourishment is meant to make up and maintain the adult's living body but an animal that is fully grown and reasonably well fed will have a little bit of this left over. This move ingeniously explains why animals that are too young, not well fed or in some other way infirm do not produce *sperma* or it is non-fertile (non-nourishing) (*GA* 1.18, 725b19-25). It also explains why those who are too fat are infertile (726a3-7).[13]

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[8] This may be because the *GA* focuses on animals in the prime of life, when most of their residue is useful. Other biological works, in contrast, deal with animals at all stages of life and so spend more time considering useless residues. I thank Giouli Korobili for this point.

[9] See also *GA* II.6: 'residue is unconcocted stuff, and the most unconcocted thing in the body is earthy' (745b19-20).

[10] Further descriptions of the anatomy associated with these waste products can be found at *GA* I.13, 719a29-720a11; *PA* III.8, *HA* I.2, 489a3-8; III.15, IV.2, e.g. 527a8, 529a14; V.5, 541a3-11.

[11] See e.g. *GA* I.19, 726b2-3; for further references Boylan (1982), Althoff (1997) and Connell (2016, p. 141-151). The first entry of food often comes about through the mouth and the teeth play a role – but these organs do not begin any digestion or concoction only preparing the food to be cooked (*PA* III.1 and Lennox 2001, p. 243-246).

[12] Lennox makes a similar point about Aristotle's characterisation of male and female contributions to generation as residues: 'One might ask, why they are considered to be residues at all - why not suppose that the amount of blood produced was just the amount needed for nutrition and reproduction? Perhaps because, while semen and menstrual blood are occasionally used for reproduction, often they are not. They are residues because they only occasionally play a biological role' (Lennox 2001, p. 186-7).

[13] Other than *sperma*, potentially useful resides are produced during the nutritive process on the way from raw food to internal ultimate nourishment (i.e. blood). These are then used to form non-essential body parts, such as extra fat, horns, hair etc. (See e.g. *HA* IX(VII).2). See note 30.

The identification of *sperma* as a useful residue comes before Aristotle distinguishes male and female contributions.[14] Although they are different (*GA* I.18, 724a36-724b8), the origins of the female *sperma* is the same as that of the male variety.[15] The difference between them is slight – one of degree of concoction, the menstrual discharge being less concocted (*GA* I.20, 728a26-27, IV.1, 765b35-766a3). Recall that Aristotle defines *sperma* in general as 'some part of the useful residue.' This 'most useful' residue 'is the last from which come to be each of the parts [of the body]' (725a11-13). This description is actually most applicable to the female contribution that will become the body of the new living animal (*GA* II.5, 741b7, II.4, 738b26).[16] However, thinking of the female contribution as a 'useful residue' is complicated by two factors. First of all, it is often characterised in a negative way as waste and compared to pathological fluids. Secondly, Aristotle suggests that there are two grades of menstrual discharge. The next section (II) will consider the first problem. The second issue will be the focus of Section (III) on the content of the female contribution.

(II) Is the female contribution to generation a useless or useful residue?

To make a case against his rivals, Aristotle presses hard on the idea that the new animal cannot be made up of something that is 'against nature' (*GA* I.18, 725a2-3). Useless residues can also be unhealthy and contrary to nutrition and so it looks as if they could not become a natural embryo.[17] Useful can be distinguished from useless and/or pathological residues by determining three things: (i) their origins; (ii) their location in the body; (iii) what they can be used for. Bone fide generative residues (i) originate in the digestive system as the final nourishment; (ii) are located in the generative organs (uterus, male genitals or female breasts, *GA* I.18, 725b3-4); (iii) can successfully generate a new animal. In making his case for *sperma* as useful rather than unnatural, Aristotle focuses on the male experience of ejaculation of seminal fluid. It must be useful since its removal results in exhaustion (*GA* I.18, 725a4-9; 725b18). But he seems aware that an opponent might claim that ejaculation actually results in a feeling of relief, similar to the removal of harmful fluids. He does not deny that this sometimes occurs, explaining that in those cases semen is mixed with diseased fluids, which it is a relief to get rid of (725b14-17; 726a14-16).[18] These superfluous fluids could even be *suntêgma* insofar as they do not have a place in the body but seek an exit where they can.[19] Later on Aristotle explains this phenomena.

> Likewise some animals are prolific and have abundance of *sperma* because they are able and some due to inability. The latter is due to much useless residue getting mixed in so that in some animals, disease occurs because the discharge (ἀποκάθαρσις) has no clear passage

[14] The idea is that 'everything comes to be from *sperma*, and that *sperma* comes to be from the parents (plural).' (*GA* I.17, 721b7-8, Cf. I.18, 724a16-19). See also Lefebvre (2016, p. 44).
[15] This is noted by many scholars, e.g. Coles (1995), Deslauriers (1998), Henry (2006), Mayhew (2004).
[16] The male does not contribute any matter to generation (*GA* II.4, 738b20-26).
[17] Lennox (2001) and Balme (1972 [1992]) touch on these issues in their commentaries. Claire Louguet (2017) is currently working on a detailed analysis of this section of the *GA*.
[18] Although these emissions are said to be non-fertile, some mixing in of useless residues may be inevitable given the fact that they share the same passages out of the body (*GA* I.13, 720a9-10). See also *HA* IX(VII).1 'in all boys and girls who had residues in their bodies, when these are discharged together with the seed or the menses respectively, their bodies become healthier and more thriving with the departure of that which was impeding their health and nutrition' (581b29-33).
[19] Aristotle seems to borrow some of these views from the medical tradition, for whom '[w]hether these emissions become morbid depended…on their subsequent free movement around the body and their occasional fixation' (Coles 1995, p. 62). See also the Hippocratic work: *Loc. Hom.*

> out. Some of these recover their health, others die. A diseased breakdown (συντήκονται) occurs as in the urine (*GA* I.18, 726a10-15).[20]

The useless residues present along with the male *sperma* in these instances may be finding the correct location (ii) but do not meet criteria (i) or (iii).[21] Any *suntêgma* that is present fails on all three counts.

In the male, pathological fluids exit in the ejaculate, in the female, there are different useless residues which gather in the uterus. Unlike the male, the female has a useless secretion that is not directly mixed in with her spermatic one but leaves the body separately. This is discharge of white materials (*GA* II.4, 738a25-30). The so-called whites must have the same origins (i) as menstrual fluid and end up in the same place (ii) but being less concocted, cannot do what menstrual blood does and (iii) result in generation. Aristotle notes the following about both useful and useless female discharges:

> Both of these secretions of residue when of a moderate amount preserve the body, as it is purified of residues which are the cause of disease to the bodies (*GA* II.4, 738a27-30)

The menses are put together with useless residues in the above passage because they become useless once they have not been employed in generation. In both sexes, once spermatic residues lose their effectiveness, they become waste products, which must exit the body or else they cause difficulties.[22]

Similar to the male experience of voiding his body of spermatic secretions, according to Aristotle, the loss of menstrual discharge results in fatigue and weakness (*GA* I.19, 727a3). There seems, however, to be another reason for the fatigue which is that *other* useful residues exit along with the menses. If these other residues were in a male system they would have gone to make up fit and healthy (and superior) parts and aspects of his body:

> Further [evidence]: females are not so full of veins and likewise are neater and smoother than males because the residues which go into these parts are discharged along with the menses. It is necessary to think as well that this is the cause of the lesser bulk and body size of females than males in the live bearing kinds. For only in these animals does the menstrual discharge flow externally, and most obviously in women. Women of all animals emit the most discharge. Because of this they are most obviously always pale and their blood vessels are less articulated, and they clearly have bodies that are falling short of males (*GA* I.19, 727a16-26).[23]

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[20] At 726b25-30 Aristotle discusses something he refers to as 'the spermatic colliquesence'. This is usually taken to be an interpolation and to refer to gonorrhoea. See Balme (1972 [1992], p. 146); Mich. Eph. 47.3, Galen XIX.426, K).

[21] Aristotle makes clear that useless residues normally occur along with *sperma* in males and females: 'In those animals that emit semen, when the *sperma* of the male has entered, it sets the purest part of the residue, for most of the menses is useless (ἄχρηστον) fluid, just as the seminal discharge (γονῆς) of the male is mostly fluid' (*GA* II.4, 739a6-10).

[22] The health effects of the emission of semen and the evacuation of menstrual fluid is dealt with in much more detail in contemporary medical literature.

[23] Aristotle posits that sexual dimorphism is most pronounced in the human kind (E.g. *HA* VIII(IX).1, 608b4-7; *GA* IV.8, 776b25-28). Here is a rationale for that supposed fact.

The female systematically fails to add these extra useful residues to itself which makes it seem that this residue of nourishment is wasted. Also it seems accidental that they end up where they do. When the fine blood vessels that terminate in the uterus are overfull, which is due to the inability of the female, residues pass into the uterus (*GA* II.4, 738a10-15).

In some passages, Aristotle puts his theory of *sperma* as useful residues under some strain by implying that the female contribution is useless or even harmful. He says that males that have damaged generative organs and cannot produce seminal fluid, 'suffer from looseness of the bowels caused by residue which cannot be concocted and converted into semen being secreted into the intestine' (*GA* I.20, 728a15-18). These residues are useless because the concoction has not taken place that would have made them into useful residues. The situation is then compared to the female state:

> Just as in the gut due to lack of concoction diarrhoea happens, likewise in the blood vessels haemorrhages and the flow of menstrual discharge occurs. For it is the same bloody flow, but that one is due to disease and this one natural (*GA* I.20, 728a21-25)

Aristotle also likens menses to pathological haemorrhoids and nose bleeds (727a13-14). How could the natural and useful female residue be comparable to these three pathological ones? In fact, the female contribution can be distinguished from these. The residues in the bowels are obviously useless due to their origin (i), location (ii) and capacity (iii). Nose bleeds, haemorrhages and menstrual discharges all have the same origins (i) as the final form of nourishment.[24] They can also become parts of the body (iii) and thus have a use.[25] The only reason why these other fluids do not qualify as useful residues is their location (ii). Nose bleeds are in the nose and haemorrhages can occur anywhere in the body. And so it appears that in the case of the female *sperma* as useful residue depends on a principle of proper place to differentiate it from other similar liquids.

At times, Aristotle appears conflicted about the production of *sperma* in the female – is it an accident or purposive? It looks, on the one hand, like the striving of the female animal's nutritive soul to both maintain the being of the female animal herself and toward the generation of another animal the same in form, since it goes to the uterus to serve as the matter for the living body of the embryo. And yet he indicates that instead of nature aiming directly for that end, these residues accidentally end up in the uterus, where nature makes use of them.[26] However, there isn't anything in Aristotle's theory of male *sperma* to suggest that it is any more purposive. In the male body, the pure portion of the final residue is just there and thus used by nature for the sake of generation. For both male and female the location of their generative secretions is crucial to its influence. [27]

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[24] This is presumably why if a woman has too many nose bleeds or haemorrhages there will be no residue left to contribute the menstrual flow (E.g. *HA* IX(VII).11, 587b30f.).

[25] Although the blood of nose bleeds and haemorrhages could not have become a new animal, they could have maintained the parts of the body (or even built these up to be stronger).

[26] Leunissen's 'secondary teleology'. For further discussion of this point see Leunissen (2017, p. 143-5) and Connell (2016, chs. 8.6, 10.1).

[27] 'Each of the residues at the same time is in its proper place and comes to be a residue. Before that none [of them] unless by much force and against nature' (*GA* II.4, 739a3-4). The importance of the proper place is reinforced by Aristotle's insistence that male *sperma* cannot serve its purpose if it is deposited in the stomach rather than the uterus (*GA* III.5, 756b5-11). Although it is not explicitly defined as such, the uterus for Aristotle is a specialised organ of concoction (see e.g. *GA* I.12, 719a34). The female's uterus is thus analogous to the

(III) The content of the female contribution to generation

The female *sperma* is a useful residue because (i) it is the most refined portion of the final nourishment (blood), (ii) it resides in the uterus and (iii) it can become the body of the new animal. It is not clear at first what the content of the female contribution is. We know that the female *sperma* constitutes the material existence of the new animal, whereas the male fluid does not. Other key differences from the male *sperma* include the possibility of an initial differentiation into two parts, the more soul-like portion and the more nutritive one (as in wind eggs, see below) and that the female's spermatic contribution continues to nourish the offspring in *utero* in live-bearing animals (*GA* II.7, 745b29).[28]

In many animals the male sets the female contribution into parcels with coherent edges (*GA* I.20, 729a10, II.4, 739b21-24). In some cases, the female can make such parcels without male input.

> In some animals, as in female birds, nature can generate up to a point: the female of these kinds do actually set a fetation, but what they set is incomplete, i.e. so-called wind-eggs (*GA* I.21, 730a29-33).

Wind eggs contain both white and yolk. For Aristotle the white portion of the egg is closer to form and 'contains in itself the soul heat' (*GA* III.1, 752a2).[29] In contrast to certain unnamed opponents who argue that these eggs are the 'relics of earlier impregnations' and contain the male input,[30] Aristotle insists it 'is not due to the male and the female, the white being male and the yolk female: both are from the female' (751b26-7). In addition, in describing the epigenetic development of the embryo, Aristotle distinguishes between 'nourishing' (θρεπτικὸν) and 'growth-promoting' (αὐξητικὸν) nourishment.

> Nature generates bones in the first construction, from the spermatic residue and as the animal grows, it gains growth from the natural nourishment, which supplies the supreme parts, but these are the mere leavings or residues of it. In all generation there is a first and a second nourishment, the nourishing and the growth promoting: the nourishing is that which maintains the being of the whole and the parts, the growth-promoting is that which contributes to making larger (*GA* II.6, 744b27-36).

He notes that the secondary, growth-promoting nourishment comes 'from the female or from outside' (745a4).

Dually differentiated wind eggs and the two sorts of nutriment used in embryonic development might make it seem that the female *sperma* comes in degrees. However, as we will see, neither phenomenon actually show that the female contribution has different parts; and there are many reasons to think that it does not. First of all, the two grades of nutriment that occur in development are not necessarily the same as the initial female *sperma*. Instead, these become differentiated later

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male sexual organ. For Aristotle, penile concoction during copulation only occurs in certain animals, see *GA* I.6, 717b24, 718a6-7. See also the Hippocratic work *Genit*. 1.2 for this idea.

[28] The female menses are not wasted during pregnancy in live-bearing animals but continue to be 'useful' residues of nutrition. In those that lactate, the female residue continues to be useful after parturition.

[29] For a fuller discussion of the origin and principle of the new animal in bird eggs see *HA* VI.2.

[30] In fertilised eggs, 'once the white and the yolk have been separated, they already possess the principle that comes from the male' (*GA* III.7, 757b13).

on in a process which involves the embryo's own nutritive soul. The good nourishment is used on the best parts and the less noble parts are constructed out of leftovers or residues. In *GA* II.6, after having detailed the eyes which he lists as 'the final parts to be differentiated', Aristotle writes this:

> Each of the other parts come to be from nutriment, the noblest which share in the controlling principle from the most concocted and purest first nutriment, the necessary parts which are for the sake of those out of the inferiority and leftover residues. For like a good manager of a household, nature discards nothing out of which something useful can be made. In household management, the best of the nutriment produced is stretched to the free people, the worse and the residue of this to the household staff, and the worst aiding the nourishment of animals. Even as an external intellect makes these for growth, thus nature in generating things constitutes from the purest matter, flesh and the other sentient bodily parts; and from the residues, bones and sinews and hair (also nails and hooves and all such things). So these are the last to take shape, when residues of nature are generated (*GA* II.6, 744b12-28).

This image suggests that in the gradual construction of the embryo, materials that are less and less good are used.[31] It would be surprising if Aristotle thought that these less good materials came directly from the female. The fresh supplies of menstrual blood arriving in live-bearers via the umbilical cord (equivalent of the egg yolk) ought to be of the same uniform superior quality. One sure indication of this is Aristotle's belief in the possibility of superfetation where the menstrual discharge that comes after forms another viable embryo (*GA* IV.5, 773b8-25).

The uniformity of the female's spermatic contribution also makes best sense of it as the material cause. If it were already differentiated into different types of matter, then this would be too close the rival view that the parts are present in the *sperma* already. Instead, for Aristotle, the soul of the new animal brings about differentiation in the parts, exploiting the potentials present in the female contribution – which must be uniformly able to become *any* bodily part (*GA* II.4, 738b7-9), like pluripotent stem cells.

In adult animals, useful residues come in different degrees, since they can occur at different stages in the digestive process between external food and the ultimate internal nourishment (blood or its analogue). This is how the adult gains fat, hair, bodily bulk instead of spermatic residues, since that which would have ended up as a portion of the ultimate residue is diverted and used up early on in the digestive process.[32] An embryo, however, initially does not have any stomach, liver or spleen to bring about this gradual transformation. Even when these organs are present, they are not operative until after birth. The only digestive organ the embryo has is its heart, with which it completes the final concoction (*GA* II.6, 742b4, b35-7; II.5, 741b16-18). This heart then concocts the female's spermatic contribution into all the principle parts of the body, and when this digestive process is

[31] This section of the *GA* is a more general illustration of 'indirect' or 'secondary' teleology, i.e. 'the product of nature using leftovers to make some useful feature for the animal in question' (Leunissen 2010, p. 84). 'Indirect' teleology is what Lennox calls this at *PA* IV.5, 679a1-30 and IV.3 (Lennox 2001, p. 291-2). For further discussion of this passage see the paper by Carbone in this volume.

[32] Fat: *GA* I.18, 725b31-33, I.19, 727a33-37; bodily bulk: *GA* II.8, 748b20-24; IV.4, 771a28-30; hair: IV.5, 774a35-774b4).

complete, only the scraps are left for certain less important parts.[33] It is only at a late stage in the construction of the embryo that the above left-overs become available (744b28); thus they are the embryo's and not the mother's residues.[34]

Next, the phenomenon of wind eggs also does not indicate that the female contribution is two-fold. This is mainly because wind eggs do not have the same potency as female menstrual blood. The wind egg is a failed animal which has been ruined by overheating. Male and female generative residues must strike the correct temperate balance in order to bring about generation: the female cools and the male heats (*GA* IV.2, 767a16-24).[35] Once the wind egg has been differentiated into two parts, it can no longer develop. The egg can only become fertile if copulation occurs *before* the white and yolk have separated (*GA* I.21, 730a5-8; III.7, 757b6-8). The female contribution, in contrast, retains a pluripotency and can still become the body of a new animal. The wind egg shows that if the female contributes too much heat, generation is not possible. However, it also provides the following insight about the female's nutritive soul: in this case, it is clearly striving to produce an animal the same in kind, differentiating out the portion of matter that is to become the animal's heart.

(IV) The female contribution and the embryo's nutritive soul (*GA* II 5).

As we have seen, the female animal can overcook the initial portion of ultimate residue so as to separate out another portion. This means that the female, as Aristotle puts it, can 'generate up to a point'. But it cannot start the generation of an animal without male input. The male establishes the heart (or its analogue) which is then generative of the other parts. In the following passage, Aristotle phrases this as the wind egg possessing potential nutritive soul.

> If the female has the same soul and the matter is the residue of the female, why is the male required in addition? Why doesn't the female generate by itself from itself? The reason is that an animal differs from a plant through perception. It is impossible without the presence of sentient soul for there to a face or hand or flesh or any other part [of an animal] either actually or potentially, whether in some way or absolutely so. For that would be like a dead thing or a dead part. So if the male is the active agent of this sort of soul, where male and female are separated, the female is unable by itself to generate an animal from itself. For it was said that this is what it is to be male. However, spelling out this puzzle is reasonable, as it is clear in those wind eggs generated in birds, that the female is able to generate up to a point. Further, there is this puzzle: in what sense are these eggs said to live? For they are not so like fertilised eggs (for what comes to be from these are actually ensouled) but neither are they like wood or stone. For these eggs rot so that before that, they were in a certain manner living. It is clear that they have

[33] This account of how the embryo is developed from blood must be part of what Aristotle points us to at *PA* II.3: 'the way in which the parts derive their growth from blood, and the subject of nourishment generally, is more appropriately considered in the works on generation' (*PA* II.3, 650b8-10).
[34] When Aristotle says that they come 'from the female' (745a4), he must mean initially.
[35] '[T]hey [i.e. male and female] must stand in the right proportional relationship (συμμετρίας) to one another, since everything that is formed either by art or by nature exists in virtue of some due proportion. Now if the hot is too powerful it dries up fluid things; if it is very deficient it fails to make them set; what it must have in relation to the object which is being fashioned, is the mean proportional, and unless it has that, the case will be the same as what happens when you are cooking; if there is too much fire it burns up your meat, if there is too little it will not cook it – either way what you are trying to produce fails to reach completion. The same applies to the mixture of the male and the female'.

> some sort of potential soul. But which sort? It must be the least, i.e. the nutritive sort. This is present in all animals and plants alike. Why are the parts and the animal not completed? Because the parts of the animal are not like those of the plant. Because of this, the male must share [the work]. For in these the male is separated (*GA* II.5, 741a6-30)

The initial question arises because the female has the 'same soul' as the male.[36] The nutritive soul is supposed to strive to make another animal like itself, so why wouldn't the female, which clearly has a nutritive soul, do this on its own? The answer at first seems to separate female and male into nutritive and sentient.[37] In fact, that reading is not necessary. The passage says that the male establishes 'soul of this sort' (741a13-14 τὸ τῆς τοιαύτης ποιητικὸν ψυχῆς), i.e. an animal soul, with both nutritive and sentient faculties combined.[38] This is the sort of soul the female cannot generate on its own. As for defining male as the producer of sensory soul this hardly fits with previous definitions of male in the text, which all relate to agency in generation.[39] The male is that which is able to initiate the generation of a new animal of the same sort, i.e. with the same sort of soul, as the parents.

The passage, therefore, does not say that that the female contribution to generation is only potential nutritive soul; it is referring to the wind egg phenomenon, where the female product is an overcooked failure. It does, however, gesture toward a close relationship between the female contribution and the nutritive soul of the embryo. After fertilisation, nutritive and sentient soul are present in the embryo but it will at first most strongly display growth, a function of the nutritive soul. Although the nutritive soul of an animal immediately begins to develop sense organs from a sensory core of the heart, it does not start off as sentient. The sense organs are at first dormant; and the embryo is mostly as-if asleep (*GA* V.1, 778b23), without any impressions that could form dreams (*Insomn*. 3, 461a12-13). The most explicit articulation of the stage where nutritive soul is activated but sentient soul dormant come when Aristotle discusses the phenomenon of sleep. In the *GA* V puzzle concerning whether sleep or waking come first; Aristotle decided that sleep does, partly based on his embryology which specifies that embryos are in a sleep-like state.

> Because of the phenomena that as time goes on they become more and more awake, it is reasonable that the opposite, sleep, is the case in the beginning of their generation. Furthermore, the change from not-being to being comes to be through the intermediate and sleep seems to be naturally something like that, being like a borderline between living and not living, and the sleeper neither exists completely not does not exist. Life exists most of all in waking due to perception. If an animal has to have perception and it is first an animal when it first gets perception, then it must be thought that at the start of its constitution it is

[36] They are the same in form (*GA* I.23, 730b34, *Metaph*. I.9) and form in animals is their soul (*de An*. II.1, 412a20).

[37] A certain interpretation of this passage has become ubiquitous, i.e. that the male contributes sentient soul (Henry 2016a). There is nothing inevitable about that conclusion. For scepticism see e.g. Connell (2016, p. 172-7), Carraro (2017, p. 285-6).

[38] Sentient soul is ontologically inseparable from nutritive soul (*de An*. II.3, 415a1-2, Cf. *PA* II.1, 647a25-27; *Somn*. 455b34-456a6).

[39] *GA* I.2 says what it is to be male is to possess the principle of [substantial] change and generation (716a5-6; cf. IV.1, 765b14-15). *GA* II.4 defines the male as the 'maker' (τὸ δημιουργοῦν) (738b21). We must also note that plants contain the male principle, and none of them are sentient, so maleness simply cannot be equivalent to the contribution of this sort of soul (I.23, 731a24-33; II.1, 732a12-14).

> not asleep but in a sleep-like state, similar to what plants have. For it happens that at this time animals live the lifestyle (βίος) of a plant (*GA* V.1, 778b25-779a2).[40]

The animal embryo is taken to live a sort of plant-like life, devoid of sensation, pain or pleasure.[41] This similarity to plant life is further reinforced by the way in which the foetus feeds. The nutritive soul is first activated when the animal embryo when it begins to draw nourishment to itself (*GA* II.3, 736b10-11). This requires the sending out of a root and a shoot:

> Once the fetation is set, it acts almost like sown plant seeds. The principle also in those seeds is the first thing. And when this is distinguished, being potentially present in it earlier, a shoot and root are sent out from [this first actualised part]. From this nourishment is obtained. For the plant must grow. Likewise in the fetation, in the same way, all the parts are in it potentially, the principle has made the most progress. For this reason the heart is the first part to be separated in actuality (*GA* II.4, 739b34-740a4).

Aristotle proceeds to explain that the embryo at this stage, because it is only potentially an animal has to get its nourishment from elsewhere, and is again like a plant. Its initial lack of any stomach, liver, spleen or intestines which are not among the first parts to be formed in the embryo, means that it cannot digest its own external food.[42] Furthermore, since it cannot locomote (740a25-7), it cannot get to its food; instead it has to send out a shoot to bring food to itself. The preparation of external food must still be undertaken by the mother's organs. The fact that the embryo's heart is operative first of all is where the comparison to the plant fails – for no plant has a heart or its analogue. The plant only draws in simple nourishment and grows in all directions (*de An*. II.2, 413a28-30). The heart is the centre of the animals' nutritive soul, and so maintains all the sentient parts of the body, as well as becoming the centre of sentient operations in due course. Plants never have this integrity.[43]

Although animals have a source of sensation from the very outset, the point of the continual comparison to plants is to emphasise that the embryo is not really properly alive yet, because in order to live, it must live the life of an animal, which is sentient.[44] From the female spermatic contribution, the next stage is the actualisation of the nutritive soul and the gradual development of the sentient body parts which can eventually actualise the passive potentials to sense (Connell 2016, p. 172-77). It is important, however, not to make too much of the nutritive/sensory division in embryological development. Although the fetation while it is developing the parts of its body, including the sense organs, will not sense, it is not nutritive only. Just as a child begins its life behaving like a non-human animal, but is not a beast, because it will become fully human (*EN* I.10, 1100a3), so also, the fetations of animals are not literally plants.

(V) *Sperma* production, nutritive soul and the failure of the female

Aristotle distinguishes the nutritive faculty from other soul functions in the *de Anima* and the *Parva Naturalia*. One convincing interpretation is that the nutritive soul is distinct for two reasons: (1) it can exist independently of the other parts and (2) there is an account of it that does not depend on

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[40] As also does the embryo inside the egg, *GA* III.2, 753b26-27.

[41] At *GA* II.3 Aristotle explains that 'fetations' (τὰ κυήματα, the initial fertilised embryo of animals) are alive insofar as they 'possess nutritive soul' (736a35-36).

[42] Aristotle explains that plants use the earth as their external stomach, i.e. their food is pre-cooked for them.

[43] The principle of soul in plants is diffuse which explains how cuttings can grow separately (see *de An*. I.5, 411b19-20).

[44] See the interesting analysis along these lines by Carraro (2017).

reference to any other aspect of soul (Corcilius and Gregorić 2010; *de Anima* I.5, II.2-4, III.9-10; *Somn*. 1, 454a11-19). (1) is simply the point that some entities exist which only have this aspect or faculty of soul, i.e. plants (*de An*. II.2, 413a31-2 *GA* II.4, 1-3). For plants, nutritive soul is not a soul part but their entire soul (*de An*. I.1, 411b27-30; Corcilius and Gregorić 2010, p. 92). (2) depends on the idea that nutritive soul is what 'maintains its possessor as such' (*GA* II.4, *de An*. II.4, 416b17-19; Corcilius and Gregorić 2010, p. 109). In this manner, the distinctness of nutritive soul from the other soul functions is secured. There is, however, a further question about its unity. The nutritive and generative soul are said to be one and the same (*de An*. II.4, 415a23; 416a19).[45] Thus, self-preservation is, in some sense, the same as the preservation or perpetuation of the kind. Scholars who have considered the nutri-generative soul sometimes attempt to explain how these two functions are really the same. Thus, Corcilius and Gregorić write: 'the object of the reproductive capacity is really the same substantial form that the nutritive capacity maintains for the individual living being by means of taking in and processing food. What the reproductive capacity does is perpetuate this form in another individual' (Corcilius and Gregorić 2010, p. 112-3). Here the focus is on the conceptual point and not the ontological one and female animals are not considered.

The fact that female animals do not generate on their own appears to show that there are certain (regularly occurring) animals that exists with nutritive but not generative functions.[46] On the above criteria, the two functions, far from being unified, would count as ontologically distinct. If it is true that female animals do not have a generative function, then it would seem that nutritive minus generative is ontological separable from nutritive plus generative. This ontological divide, then, destabilises the unity of this fundamental soul capacity.[47]

In order to mitigate this result, it is important to first get clear on the conceptual unity. This requires considering the structure of soul faculties. Aristotle explains that the different parts of soul have different objects, so, for example the sensory soul has sense objects that concern it.[48] The idea seems to be that there is one function if there is one type of object; perception and intellect have objects that differ from the object of nutrition/generation – which is 'food'. For the nutritive soul, there are further complications concerning its object. First of all, food is two-fold, the external food that the animal consumes and the internal food that sustains its substantial being. The internal food, blood or its analogue, is what sustains the functioning body and its parts. This is made by the nutritive soul to be able to do maintain an animal of the particular sort that it is. Next, Aristotle specifies two objects of the nutri-generative faculty, 'food' and 'generation' (περὶ τροφῆς καὶ γεννήσεως, *de An*. II.4, 415a23). This may still yield conceptual unity as both are centred in the 'substantial being' of the animal. This idea is elegantly elaborated in Thomas Johansen's book *The Powers of Aristotle's Soul*, who makes 'the unity of nutritive soul' a problem to solve (Johansen, 2012, p. 106-115). The 'food' indicated in this definition is not external or raw food (which is unlike the animal) but the final nourishment which has become like it.[49] This means that 'food' as the final

[45] See also *de An*. II.3, 415a2-3, 27, II.4, 416b13-15, 26; *GA* II.1, 735a16-19.
[46] This point also applies to those animals that are sterile, such as mules (*GA* II.8) and certain spontaneously generated kinds.
[47] On fundamental importance of nutritive soul see especially King (2001, p. 81) and Johansen (2012, p. 118).
[48] In fact, of course, it is more complicated than this since there are five varieties of sensory object and there is also the common sense and the capacity to store images (φαντάσματα). See Gregorić 2007.
[49] To the question of whether food is like or unlike the body, Aristotle answers that it is both. Before it is processed, it is unlike and after it is like (*de An*. II.4).

nourishment, according to Johansen, is the same in form as the animal; 'the object of nutrition is the form of the living being' (Johansen 2012, p. 109). This then explains how an animal the same in form can be generated; the form is in the residue of final nourishment which is 'isomorphic with the living body whose form is the soul' (Johansen 2012, p. 102). But if this is the case, then the female *sperma* would seem not to fit. Although it is a pure portion of the final nourishment it cannot convey form to the new animal.[50] Does this constitute any reason to separate the nutritive and generative functions conceptually? [51] Let's consider more closely the connection between the nutritive soul, the final nutriment and form.

The idea of nutrition and generation as the same capacity requires thinking about the process of concoction (πέψις) (Johansen 2012, p. 106-115).[52] Through various complex stages of this process, the nutritive soul transforms the external food into internal nourishment, which is what each of the parts of the body require for its particular type of activity, often peculiar to the type of animal in question. In the *GA* Aristotle is pretty explicit about how specialised this finished nutriment is. Rejecting the idea that nutrition is brought about by a like-to-like action, he states: 'instead it is [the fact] that the female residue is such as to be naturally the same as the animal, and the parts are in it potential, but none in actuality' (*GA* II.4, 740b19-21). The uniform and non-uniform parts develop simultaneously from this specialised material – and although Aristotle insists here that no parts exist 'in actuality' (ἐνεργείᾳ) there is a way in which this final nourishment is an agent with a (latent) form. Food at this stage is like the animal, not in the way that like dead body parts are, since it is not possible for there to be any animal parts without soul in them (*GA* II.5, 741a10-12). As Aristotle explains in his *Generation and Corruption*, food is not mere bulk but something that actively maintains the form of the animal (*GC* I.5, 322a20-3; Johansen 2012, 110). And by the form of a particular part like 'flesh' Aristotle means living, sentient flesh (*GC* I.5, 322a10-13). Thus, the nourishment is similar to a living part. Furthermore, the process of concoction itself, something that happens only in living beings through their nutritive capacity, aims to produce the being of the kind, its form:

> [W]hen concoction has taken place we say that a thing has been perfected and has come to be itself…In some cases of concoction the end of the process is the nature of the thing – nature, that is, in the sense of form and the essence (*Mete*. IV.2, 379b18-26; translation after Johansen).

This final nourishment appears to have agency insofar as it is the instrument of the nutritive soul. As Johansen notes, nutrition is a prime instance of the soul's self-motion. The nutritive soul is not changed, but changes something external, i.e. food. It employs this food as an instrument to maintain its own being. As with any other instruments, this concocted food is both changed and changing. The final nourishment is capable of producing growth (*de An*. II.4, 416b13) and of producing generation (416b15). This description of the final nourishment certainly fits with the male's contribution to generation, which Aristotle likened to tools used to shape craft products (*GA*

[50] The female, we are told, does not contribute form, e.g. *GA* I.2, 716a8, I.20, 729a11, 729a33, II.1, 732a10.
[51] Corcilius and Gregorić (2010) and Johansen (2012) who do not think that such a division is necessary but fail to discuss the complication produced when considering the female animal's nutritive soul.
[52] See also Lloyd (1996, ch.4).

II.4, 740b26-30).[53] The equivalence between the action of the nutritive soul and the action of its instrument is clear when Aristotle remarks of the male contribution which is, of course, the final concoction of nourishment: 'we specify either the semen or that from which the semen comes, since that which has the change in itself is no different from the one changed it' (*GA* II.1, 734b7-9). The problem is that the female contribution is also a further concocted portion of the residue of final nourishment. Her blood maintains the being of her body and is potentially all the living parts of another animal like herself (*GA* I.19, 726b16; *GA* III.9, 762b3-4). Since the male and female of the kind have the same nutritive soul, why then can't the female perform this same magic and make another like itself? Aristotle is adamant that it cannot:

> Being a residue *sperma* is being changed by the same change as they by which the body grows through distribution of the final nourishment, when it enters the uterus it sets and changes the residue of the female by the same change which it itself happens to be changed by. For [the female matter] is a residue, and it has all the parts in it potentially, none in actuality. For it has those parts potentially which differentiate male from female. Just as from deformed parents sometimes deformed offspring are generated and something they are not, thus from the female sometimes a female is generated and sometimes not [a female] but a male. For the female is like a deformed male, and the menstrual fluid is *sperma*, but impure. For it does not have only one thing, the principle/start of soul (*GA* II.3, 737a18-30).

The female is said to lack 'the principle of soul'. All animals, through the nutritive faculty, strive to be eternal in the way open to them, i.e. to generate another like in kind to themselves (*de An*. II.4, 415a22-415b7). Can it really be that the female lacks this drive to generate? [54] If the nutritive and generation functions are completely indistinguishable then the female would end up lacking the nutritive function which is nonsensical; female animals would not be alive.

One possible solution is to take the generative to be a sub-part of the nutritive soul. A soul part is conceptually separable if the account of it does not require reference to any other parts. When considering the generative function, it cannot be conceptually separated from the nutritive one, but is dependent on it.[55] The nutritive one, though, arguably does not entail the generative one. An animal can maintain its own being without producing another being like in kind. This is not, however, a conceptual distinction that threatens the unity of this soul part. Instead, it helps to clarify how they are 'the same'. They are not identical; rather the generative function is a sub-part of the nutritive, contained within it. On this reading, the female lacks this sub-part, which would help to explain why Aristotle describes her as 'in a way maimed' (*GA* IV.2, 767a27-28; IV.6, 775a15-16). However, this option is unattractive in some ways. It does not explain how it is possible to prise apart the generative from the nutritive function given that both strive to maintain the form of the kind. Another possibility is to view the generative products of female animals as just that –

[53] After all, '*sperma* is a residue of nourishment undergoing change' (*GA* II.3, 736b27-8). Johansen (2012, p. 132-5).

[54] Generation is the 'most natural' function (*de An*. II.3, 415a27).

[55] As Corcilius and Gregorić note, 'the account of the reproductive capacity does make reference, if only implicitly, to the nutritive capacity of the soul, so that we should not count it as a [conceptually separable] part of soul' (Corcilius and Gregorić 2010, p. 113).

generative. And so, the nutritive soul of the female animal also strives to maintain the being of the kind into the next generation.

(VI) Conclusions

The object for the nutritive soul is not only food but also 'generation' (*de An*. II.4, 415a23), meaning that nourishing is in essence the same thing as generating. Let's take as the example of a mature dolphin. In this case, what is nourished is this dolphin; nutritive soul aims to sustain a dolphin. What is generated is another dolphin; the same soul aims to sustain dolphinness (by generating another dolphin). A male animal, that is not defective, achieves the second related aim by providing the source of substantial generation. The female animal cannot do that. But this need not create an unbridgeable divide between the nutritive functions and aims and generative ones?[56] The female's nutritive soul does aim toward the generative goal – and generation couldn't happen if it did not. It must also have the generative variety of nutritive soul. The female achieves the generative aim differently from the male, by providing the materials that are ready to become all the parts of the body of an animal the same in form to her. As detailed in the previous section, internal nourishment is dynamic and aiming for the form of the kind. Just as the male's does, the female's generative residue is moving towards a new substance. This is very much apparent in the wind egg, produced by the female alone, which has already been undergoing a change toward the form. Because it rots, when the wind egg is not yet rotten, there is something striving toward that living state which is not present in the rotten egg – an in-between position.[57] And this must be what the female *sperma* is also like – given that it is in a ready state, a portion of the ultimate nourishment, poised to become all the parts of the functioning body. It is only by a conjunction of male and female that any new animal comes into existence and so, the crucial work undertaken by the female animal's nutritive soul ensures the existence of a new animal the same in kind as herself. The menses, then, are generative and constitute the female's attempt to generate another living being like itself.[58]

[56] Neither male nor female residue are 'without soul' (*GA* II.3, 736a32-35).
[57] Like all useful residues of nutrition, it is both changed and changing. See note 51 above.
[58] The female contribution also contains δυνάμεις which strive to generate a female animal resembling the female animal and her family (see *GA* IV.3, 767b33-768a9, 768a10-21).

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