

## Aristotle on Seed

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The topic of *de Anima* II.4 is nutritive soul (*threptikê psyche*). Nutritive soul is the “primary” (*prote*) and “most common” (*koinotatê*) psychic capacity, that “in virtue of which living (*to zên*) belongs to everything [alive]” (415a23-5). Having this constitutes *living* at its most basic level: it is what the algae has, but what the rock on which the algae sits lacks. It is in virtue of its possession of nutritive soul, Aristotle says, that an organism is able to generate another living being, to nourish itself, and to cause itself to grow.<sup>1</sup> Performing these three vital functions constitutes its own form of living, one distinct from perceiving or locomoting.

It is not obvious, however, why these vital functions should belong to a single psychic capacity, particularly since they are not even “extensionally equivalent” by Aristotle’s own lights.<sup>2</sup> For, Aristotle thinks that spontaneously generated organisms nourish themselves, although they do not generate. So, why are nutrition, growth and generation all activities and functions of the same psychic capacity?

One thought is that these functions are unified in virtue of sharing a single goal, or because they contribute (though perhaps in different ways) to the same end. This seems very plausible: if A, B, and C are all functions and activities of a single capacity to  $\Phi$ , then it is reasonable to suppose that A, B, and C are all teleologically directed towards  $\Phi$ -ing. However, it is not obvious what Aristotle takes the end of this psychic capacity to be. For example, one finds at least the following two broad types of competing characterizations in the scholarly literature.

According to one kind of characterization, the end is keeping oneself in existence. On this view, nourishment and generation are both types of *self-preservation*: nourishment is preservation

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In addition to Caleb Cohoe and to the participants of the *de Anima* conference in Denver, I wish to thank Kathleen Cook, Mary Louise Gill, Emily Kress and Jim Lennox for very helpful discussion of the issues and feedback on earlier drafts.

<sup>1</sup> In *DA* II.4, Aristotle says that the works (*erga*) of nutritive soul are “to generate and use nourishment” (415a25-6) and describes its power as “nutritive and generative” (*threptikê* and *gennetikê*) (416a19). Nutritive soul is not explicitly said to be the cause of growth (*auxêsis*) until 416a8-9, though it is implied throughout the chapter.

<sup>2</sup> As noted by Shields 2016: 202.

of oneself, while generation is preservation of another like oneself.<sup>3</sup> Hicks, for instance, says that both are “moments in that instinct of self-preservation, which aims at the continued existence of the individual and through him of the race”.<sup>4</sup> This idea is suggested, for instance, in passages where Aristotle appears to be appealing to a shared desire to “partake in the eternal and divine”—at least by remaining one “in form” (*eidei*), though not “in number”—in order to explain why organisms reproduce.<sup>5</sup> Generation occurs, on this way of understanding things, because that is the only manner in which generated beings can be eternal (*GA* II.1, 731b-33).

Another kind of characterization treats generation, not self-preservation, as the end. Its advocates construe self-nourishment as being for the sake of or perhaps even as a special case of *form (re)production*. According to Johansen, for example, generation “is concerned with reproducing the form quite generally, whereas nutrition is more narrowly concerned with reproducing the form for oneself”.<sup>6</sup> On one version of this view, nourishment of oneself is described as a kind of constant “remaking” of one’s organs.<sup>7</sup> If Aristotle is thinking of generation as the paradigm activity in terms of which nourishment is to be understood, as this view has it, this would explain why Aristotle calls generation the end (*telos*) of this soul capacity (416b23-5).

So, does Aristotle treat these functions as naturally grouped together because he thinks that generation is ultimately a way of keeping ourselves alive (in the only manner available to enmattered creatures)? Or, does he think that self-maintenance is to be understood “on the model of generation”<sup>8</sup>? The questions are difficult to answer, depending as they do on reaching verdicts about thorny interpretive controversies, where it is unclear what would count as definitive textual evidence for settling the matter.

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<sup>3</sup> Alternatively, Coates and Lennox (forthcoming) argue that reproduction is the “culmination and completion of all of an organism’s self-perservative efforts”. The goal of reproduction, on their interpretation, is not merely to produce something *like* the parent but to maintain the form of the parent (which form, in their view, is not species form).

<sup>4</sup> Hicks 1907: 339-40. Similarly, Ross says that “both are forms of self-preservation. Nutrition is strictly so; reproduction is so in a way, since it is the production of a creature which is ... ‘like the producer’” (Ross 1961: 228). According to Shields, “Aristotle seems to be thinking of nutrition and generation as twin aspects of the same overarching function, one serving the drive for self-preservation” (Shields 2016: 201).

<sup>5</sup> *DA* II.4, 415a26-b7; *GA* II.1, 731b24-732a1

<sup>6</sup> Johansen 2012:109

<sup>7</sup> Menn 2002: 122

<sup>8</sup> Menn 2002:122

Pierre Pellegrin has recently offered an altogether different sort of explanation for Aristotle's grouping of these functions. Pellegrin proposes that the reason these functions are all assigned to a single psychic capacity is that "the digestion for the preservation of the animal, the digestion for the growth of the animal...and the formation of the embryo are really one and the same process".<sup>9</sup> As I understand the crux of this proposal, it is that these functions constitute the collective manifestation of a single psychic capacity in virtue of being stages in a continuous biological process.

In this chapter, I would like to pursue this suggestion further. For, although not quite "one and the same", Aristotle's biological treatment of nutrition, generation and growth does render them continuous, conceiving of them as comprising a single, multi-stage process. However, pointing to this fact is not fully satisfying as an answer to the question about why the three functions are united and so subsumed under a single psychic capacity. For to say that the three processes are continuous in Aristotle's biological theory seems merely to push the question back: *Why* are these processes continuous, in Aristotle's biological theory?

The answer I will give here is that Aristotle's yoking together of generation, the "use of food", and growth is due to his particular understanding of what seed is (section I), how it is made (section II), and how living things come to be formed out of it (section III). As I argue, the way Aristotle conceives of these physiological processes is a consequence of more general, metaphysical commitments. Aristotle thinks that seed is produced in a certain way because he thinks *genesis* takes place in a certain way, and that *genesis* takes place in a certain way because that is how his biological theory can satisfy various constraints that any change must satisfy, while cohering with the empirical data. If helpful, one can think of this alternative, given at the level of the physiological processes, as providing an explanation for the unity of these functions in terms of material and efficient causes.<sup>10</sup> While consistent with the sorts of formal or final cause explanations that interpreters have focused on, this account offers a different kind of motivation for Aristotle's linking the functions together which—unlike those that appeal to shared goals of these vital processes—does not require that we settle hard issues about how those processes are more abstractly conceived.

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<sup>9</sup> Pellegrin 2018:84-5

<sup>10</sup> Credit for this way of putting the contrast is due to conversations with Jim Lennox.

## I. What seed is

Aristotle thinks that everyone would accept a pre-theoretical characterization of seed as that “out of which” living things come to be, and which comes to be “out of” the generators.<sup>11</sup> This very general description of seed is taken by Aristotle to be uncontroversial common ground.<sup>12</sup> There was disagreement, however, both about *how* living things come to be out of seed, and about *how* seed comes to be out of the generators. That is, there were divergent views about what it is, more substantively, that occupies the position of seed in various embryological theories.

Aristotle does not hold a “container” theory: unlike the view he attributes to Anaxagoras and some unnamed “other *physiologi*” (IV.1, 763b30ish), Aristotle does not think that the male (alone) produces a seed which is then deposited into the female, as if into a receptacle. Rather, Aristotle thinks that *both* the male and the female contribute to the production of seed.<sup>13</sup>

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<sup>11</sup> *GA* I.2, 716a8-9; I.17, 721b6; I.18, 724a17-18. Aristotle does not consistently use the Greek word *sperma* to refer exclusively to seed, understood in this theory-neutral way. Sometimes, for instance, *sperma* is used to refer to semen, and at times to the female contribution as well (see note 20, below). However, although semen and seed are coextensive in some theories, in Aristotle’s theory they are not. This is true, despite Aristotle’s use of *sperma* to refer to both. Here I translate *sperma* as “semen” when it refers exclusively to the male contribution, and reserve “seed” for *sperma* when it refers to that from which living things come to be (which in Aristotle’s theory, is something produced by contributions from both parents, as we will see). See de Ribera-Martin 2019 for a careful examination of Aristotle’s uses of *sperma*.

<sup>12</sup> That this is uncontroversial is why, as we will see below, in discussing an *aporia* about what sort of ‘agent’ could be building the new body parts, Aristotle rejects as “impossible” the idea that it could be some part of the new plant or animal which is present in the seed from the beginning. For, it is impossible for any part to be present in the seed, since every part of the plant or animal comes to be out of *it*. See *GA* II.1, 734a33-b2. See also Code 1997 for a discussion of Aristotle’s use this shared conception of seed (as what generation is from) in the context of a debate about natural teleology, in undermining the Empedoclean position that there might be merely a chance connection between seed and what comes to be from it.

<sup>13</sup> Connell correctly rejects such “container” or “feedbag” descriptions of Aristotle’s theory (Connell 2016:129). Connell instead calls Aristotle’s theory a type of “two seed” theory: it is what she calls a “differentiated seed” as opposed to “parallel seed” theory (*ibid* 95-6). It is important to bear in mind, however, that what Connell is calling “seed” is not what I am referring to here. Given the use of “seed” under discussion, the description of Aristotle’s theory as “two-seed” would be misleading, insofar as there is only *one* seed being formed out of the contributions from both parents. Aristotle’s view is not that each parent contributes a seed, but rather that both parents contribute *to* seed.

Aristotle also rejects the so-called “pangeneses” theories, such as that put forward in the Hippocratic treatises *On Seed* and *On the Nature of the Child*, according to which the seed is formed from portions “drawn away” from each parent’s entire body.<sup>14</sup> There are many absurdities and impossible consequences of this theory, Aristotle thinks.<sup>15</sup> For instance, proponents of pangeneses cannot explain why *two* organisms are not produced, since the seed would contain portions drawn from both parents’ body parts (722b6-7), or why females do not generate on their own (722b13-14).

One of the criticisms Aristotle raises against pangeneses in the first book of *GA* is directed at a particular version of the theory that he attributes to Empedocles, according to which the seed is a “tally”—half from male and half from female:

But as it seems, it either does not come from all the body, or comes in the way that Empedocles says, not the same things from each parent, and this is why they need intercourse. Yet this too is impossible. For they cannot survive and be ensouled if “sundered”, any more than when they are large, as Empedocles generates them in the period of “Love” —

‘Where first there sprouted many neckless heads’

—and then says that the parts grew together. But this is plainly impossible. For without soul and without some kind of life they could not survive; nor, if they were like several living animals, could they grow together so as to become one instead. Yet this is what follows from asserting that seed comes from all the body: what happened then in the earth

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<sup>14</sup> For a discussion of Aristotle’s criticisms of this theory, see Morsink 1982 (esp. 67-85).

<sup>15</sup> One of Aristotle’s arguments against pangeneses (*GA* I.18, 722a16-b2) is potentially illuminating to compare with *Metaphysics* Z.17, 1041b11-33. In *Metaphysics* Z, he argues that a whole composite, such as a syllable or flesh, cannot be composed merely of its elements. For, the whole composite might be destroyed, yet the elements remain (1041b14-16). So, there must be “something else” besides the elements that make up the whole. In *GA*, the argument runs the other way: the elements “drawn away” from the whole body might all be present and yet not the whole body. For that “something else” that puts together the whole body (the “assemblage”) is not one of its elements. “And yet without this assemblage the parts would not have the resemblance; so if there is something which sets to work later on to bring this assemblage about, then surely this something, and not the ‘drawing from the whole’ would be the cause of the resemblance” (722a35-b2, Peck trans, slightly modified).

in the period of Love must on this view happen in the body. *GA* I.18, 722b14-26 (Balme trans.)

Aristotle takes Empedocles' theory to be an improvement over some other versions of pangenesis, insofar as it can explain why only one organism results from the contributions from both parents. But Empedocles' theory is impossible, too, since what is being formed out of this tally is something *alive*. If the parts are separated and have no soul or any sort of life, how could they survive? If, on the other hand, the parts were living when separated, how could they grow together again to form *one* animal?<sup>16</sup>

In addition to the many questions pangenesis leaves unanswered, Aristotle calls the observed reproductive behavior of certain insects the “greatest witness” (723b19) to the falsity of that theory. For, when these insects copulate, the females insert part of themselves into the males.<sup>17</sup> This observation is proof that males do not contribute “parts drawn from the whole body” and it shows that nothing bodily needs to come from the male at all.<sup>18</sup> So, the pangenesis theory, Aristotle thinks, is simply a non-starter. Seed is not formed out of portions drawn from all the parts in the parents.

Aristotle is in agreement with the pangenetic theorists, however, in holding that the seed is made out of contributions from *both* parents. In his theory, what plays the role of seed is the first compound or mixture (*migma*) from the female and male principles (I.20, 728b32-4). This is perhaps what is for us the zygote or fertilized ovum. Aristotle often refers to this ‘first mixture’ generically as the *kuêma*,<sup>19</sup> which corresponds in the case of live-bearers to the pre-embryonic

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<sup>16</sup> See also *GA* IV.1, 764b10-17: “If, however, the facts about seed are such as we have actually stated, if it does not come from the whole of the body of the male parent and if the secretion of the male does not give any material at all to the embryo, then we must make a stand against both Empedocles and Democritus and anyone else who argues on the same lines. For then it is not possible that the body of the embryo should exist ‘sundered’, part in the female parent and part in the male...” (Platt trans., slightly modified)

<sup>17</sup> I.18, 723b19-24. Cf. I.16, 721a13-14; I.21, 729b21-33; I.22, 730b24-32; II.4, 738b11-18.

<sup>18</sup> This observation will become important for Aristotle later, because it is evidence that the bodily part of semen—its material substance, so to speak—is not the causally efficacious part of the male’s contribution.

<sup>19</sup> Since *kuêma* refers to the initial mixture of male and female principles not only in animals but also in plants, I think “fetus” and “embryo” are both misleading translations. Sometimes it is translated “fetation”, which is better, though that term refers to pregnancy or gestation (i.e., the state or the process) rather than to what one is pregnant with or to what one is gestating. “Zygote”

fetus. In plants, this first mixture or *kuêma* is simply called “seed” (I.23, 731a1-4). And for an egg-layer, the *kuêma* is the fertilized egg (*ôion*).<sup>20</sup>

Well then, semen (*gonê*) is what that which comes away from the generator is called, in animals that naturally copulate, the first possessor of the principle of generation. But seed (*sperma*) is that which has the principles from both animals who have copulated, just as the seeds of plants and of some animals—those among which male and female are not separated—being just like the first mixture produced out of male and female, as a sort of *kuêma* or egg. For these already have what has come from both parents. *GA* I.18, 724b12-19<sup>21</sup>

Although Aristotle also uses the word *sperma* to refer to the male semen (*gonê*) and occasionally even to the female contribution,<sup>22</sup> the *sperma* or seed which is that “out of which” living organisms come to be (and not merely that which comes away from one or the other of the generators)<sup>23</sup> is

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(as used, e.g., by Henry 2006: 293,4) has the correct extension, though is too theory-laden to be appropriate for Aristotle’s use of *kuêma*, which I will instead transliterate here.

<sup>20</sup> Both eggs and plant seeds have both principles, though they differ from the *kuêmata* of live-bearers in also containing within themselves the nourishment to be used in the initial stages of growth, rather than receiving that nourishment from the mother’s uterus via the umbilicus. This is why Aristotle praises Empedocles for speaking of trees as “egg-layers”: “For the egg (*ôion*) is a *kuêma*, and the animal comes to be out of a certain part of it, but the remainder is nourishment (*trophê*), so also from a part of the seed the growing plant comes to be, the rest is nourishment for the shoot and the first root.” *GA* I.23, 731a5-9

<sup>21</sup> See de Ribera-Martin 2019: 90-100 for a defense of the authenticity of this passage, which is disputed by Peck 1942: 76. Balme 1972/92: 145 claims it is probably an insertion, though “need not be non-Aristotelian”.

<sup>22</sup> Aristotle sometimes calls the female contribution “spermatik” (725b3, 746b28, 750b5, 771b23, 774a5), but he very rarely calls it *sperma*. When *sperma* does refer to the female contribution, it is often qualified as “unconcocted” (*apepton*) (774a2) or “not pure” (*ou katharon*) (728a26, 737a28). More typically, in fact, Aristotle explicitly denies (*contra* the pangenetic theorists) that the female contributes *sperma* (727a28, 727b6, 727b33, 728a31).

<sup>23</sup> In many of the passages where Aristotle uses *sperma* to refer to either the male or female contribution exclusively, it seems as though this is because the characterization of *sperma* as “that which living things come be from (*ek*)” leaves undetermined *in which way* living things come to be from it, whether from it as “matter (*hulên*) and thing that is affected (*paschon*)” or from it as

that which has both the male and female principles.<sup>24</sup> This is true even in plant seeds and in the seeds from those animal kinds which do not have separate male and female organisms, both of which Aristotle thinks of as hermaphroditic.<sup>25</sup> Since the production of seed is their only “function and activity” (I.23, 731a25), plants have both the male and female principles mixed together and not separated, unlike in most animals.<sup>26</sup>

In all animals that can move about, the female is separated from the male, i.e., one animal is male and another female, though they are the same in species, for instance both (the male and female) is a human or horse. In plants, however, these powers (*dunameis*) are mixed together, and the female is not separate from the male. That is why they generate out of themselves and emit not semen (*gonê*) but a *kuêma*, and these are called “seeds”. *GA* I.23, 730b33-731a4

Importantly, then, the seed out of which any kind of living creature comes to be is, in Aristotle’s theory, comprised of both the male and female contributions. That is why the male and female are principles (*archai*) of every kind of generation, in Aristotle’s theory, and thus why even plants are assumed to have both sexes mixed. However, the type of generation for which we have the most details is that of sexually dimorphic animals, especially the blooded ones. Consequently, in the remainder, the bulk of the attention will be paid to how Aristotle’s theory explains the production of seed, and the subsequent growth of the organism out of seed, in sexually dimorphic, blooded animals.

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“certain form (*eidos*) and maker (*poioun*)” (724b4-6). The latter, in Aristotle’s theory, is the male contribution, and the former is the female contribution.

<sup>24</sup> There is a lengthy discussion of Aristotle’s definition of *sperma* in *GA* and its relation to Aristotle’s views about scientific methodology more generally in Bolton 1987. However, Bolton’s discussion does not seem sensitive to the contexts in which Aristotle uses the term. For example, in his discussion of a passage in *GA* IV.3 (767b18-20), Bolton replaces the word for semen (*gonê*) that appears in the text with *sperma*, saying that Aristotle uses these synonymously (164 and fn.59). That is neither accurate in general, nor is it true in this particular case, which is a passage making a point about the male semen, and not about seed. Consequently, some of the conclusions Bolton reaches about *sperma* are also not correct, in my view.

<sup>25</sup> Cf. *GA* IV.1, 763b21-25 and I.18, 724b10-12.

<sup>26</sup> The spontaneously generated hard-shelled animals (*ostrakoderma*) are a notable exception, which are discussed in *GA* III.11.



## II. How seed is made

In Aristotle's theory, both parents are principles of generation, but they are not principles in the same way: unlike pangenesis, Aristotle's theory does not have the male and female making the same kind of contribution to the production of the seed. On the contrary, he thinks there must be a division of labor. Among sexually dimorphic kinds, the male is the principle that "generates in another" whereas the female is the principle that "generates in itself" (*GA* I.2, 716a13-15). This feature of Aristotle's theory—that the male and female are principles in different ways—is a consequence of Aristotle's general understanding of what any change involves, since the theory of generation is a specific application of Aristotle'shylomorphic framework. According to this hylomorphic framework, any change requires both an active potential to impose form, and a passive potential to take on that form. So, too, in animal generation, the one parent provides the active principle of the change, and one parent provides the passive principle—the matter.<sup>27</sup> These roles are assigned to the male and female, respectively, in Aristotle's embryological theory: the male provides the "form and principle of motion" whereas the female provides "the body and the matter" (I.20, 729a9-11).<sup>28</sup>

For there must be that which generates and that out of which. Even if these are one, they must at least differ in form, i.e., in having separate definitions. In animals that have the powers separated, both their bodies and their nature must be different as between the active one and the passive one. If therefore the male is the mover (*kinoun*) and maker (*poioun*), and the female (*qua* female) is to be acted upon (*pathêtikon*), the female's contribution to the male's semen will not be semen but matter. *GA* I.20, 729a24-31 (Balme trans., modified)

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<sup>27</sup> See, e.g., *GA* I.2, 716a4-7; I.20, 729a9-11; I.21, 730a27; II.4, 740b24-5.

<sup>28</sup> For a useful discussion of Aristotle's motivations for assigning the passive role to the female, and the very plausible suggestion that this assignment was overdetermined, see Cook 1996: 52-7.

Aristotle takes this particular assignment of the active and passive roles to the male and female, respectively, as confirmed by the fact that in live-bearing, sexually dimorphic kinds of animals, generation takes place *in* the female.<sup>29</sup>

It is also why the generation of the offspring takes place in the female: neither the male itself nor the female emits the semen into the male, but both contribute into the female that which is produced from them, because it is the female that contains the matter out of which the product is fashioned.” *GA* I.22, 730a32-730b2 (Balme translation)

In live-bearing kinds, generation takes place in the female, because that is where the matter is present, and where the matter is, that is where the change occurs: the building takes place in the bricks, the learning takes place in the pupil, and in general, changes take place *in* that which is changed or moved (*Phys* III.3, 202a12-13). So, the active principle from the male works upon the matter present inside the female.

...for the carpenter too is by the timber, the potter is by the clay, and in general every act of working-upon and proximate movement (*eschatê kinêsis*) takes place by (*pros*) the matter, for example housebuilding (*oikodomêsis*) takes place in what is being built. *GA* I.22, 730b4-8 (Balme trans., slightly modified)

## IIa. The passive principle

As with any change, that which is acted upon or changed in generation must be appropriate to the change that it will undergo. Not simply any old matter can be acted upon to produce anything whatsoever. More specifically, the matter must be, “in potential”, that which is coming to be out of it. This means that in the substantial generation of a living being, the matter must be, in potential, all of the organism’s body parts. Since the female contribution to generation is the passive principle of matter, the female contribution to the seed must be, in potential, all of the body parts that will be formed out of it.

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<sup>29</sup> This appears to be a good example of Aristotle generalizing on the basis of what is observed in the familiar, human (or at least mammalian) case to nature as a whole.

In Aristotle's theory, the matter satisfies this requirement by being produced by a process continuous with that by which the female nourishes itself. The female contribution to seed is derived from what Aristotle calls the "ultimate nourishment" (*eschatê trophê*). This ultimate nourishment, used by the adult organism to maintain and preserve its own living body, is produced out of food by means of a process he calls "concoction" (*pepsis*).<sup>30</sup> Concoction is "the completion or perfection (*teleiôsis*), by the agency of something's natural and proper heat, out of the opposite affections" (*Meteor.* IV.2, 379b18-19). In animals, the source of natural heat is internal,<sup>31</sup> and so animals must have a heart or analogous part, to serve as a sort of hearth (*PA* III.7, 670a24).

The final result of the concoction of food is the ultimate nourishment, which in blooded animals is blood (*PA* II.3, 650a34-5). The blood is carried in vessels that begin from the heart, and extend throughout the whole body, providing the nourishment and matter for the parts (*PA* III.5, 667b36-668a4). The vessels, Aristotle says, carry blood to all the parts of the living body, like irrigation channels in a garden carry water (668a11-33).

Some of the leftover ultimate nourishment is further converted, again by concoction, into the spermatic fluids. These spermatic fluids are what Aristotle calls "residues" (*peritomma*) made from "useful" nourishment, which is the nourishment produced last and which is also that "out of which" the parts are formed (I.18, 725a11-12). In blooded females, the residue is the menses (*katamênia*). Since the menses is a residue made from the blood that serves as the matter for body parts, the production of the female contribution to the seed is continuous with the nourishment of the adult organism's body.<sup>32</sup> As a consequence of this continuity between the processes whereby

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<sup>30</sup> Concoction occurs when something's matter and moisture is "mastered" (*kratêthêi*) (379b33), and what is concocted is thereby denser and warmer, since such is what heat brings about: it makes things "more compact, denser, and drier" (380a5-6). Specific instances of concoction are ripening (*pepansis*), boiling (*epsêsis*), and roasting (*optêsis*).

<sup>31</sup> In plants, what is responsible for the initial concoction of food into nourishment is the heat in the surrounding earth (*PA* II.10, 655b34-35). So, the surrounding earth provides nourishment that is already "worked up" (*kateirgasmenên*) that the plants then take up through their roots (*PA* II.3, 650a20-1).

<sup>32</sup> Aristotle distinguishes between nourishment's being "nourishing" (*threptikon*), which "provides the being to the whole and the parts", and nourishment's being "growth-promoting" (*auxêtikon*), which "creates the increase in bulk" (*GA* II.6, 744b32-6). This is echoed in *DA* II.4, at 416b11-17, where Aristotle speaks of two ways of understanding "what it is to be" nourishment: All *trophê* is related to what is living (it is always *pros empsychon*, 416b11), but the living thing can be considered either as a "certain quantity" (*poson ti*) or as a "certain this" (*tode ti*) and substance (*ousia*). In relation to the first, the nourishment is growth-promoting and in relation to the second,

both usable nourishment (i.e., blood) and menses are formed, the menses—the matter for generation—is in potential, the parts that will be formed out of it.<sup>33</sup>

## IIb. The active principle

In organisms that emit it, the male semen is also derived (by concoction) from the leftover nourishment that constituted and preserved the male’s living body.<sup>34</sup> Semen, too, is a “residue” from the blood that is “finally distributed to the parts of the body” (I.19, 726b10-11). So, as with the menses, the production of semen is continuous with the organism’s self-maintenance. However, Aristotle does not think semen’s corporeal substance is essential. In fact, at least in principle, no material need pass from the male at all. That is clear, Aristotle says, first of all “according to reason” (*kata ton logon*) (I.21, 729b8). For, nothing material comes away from that which is acting upon matter, in general. And it is clear “with regard to the facts” (*epi tôn ergôn*) (729b9). After all, when certain insects copulate, the female inserts a part of itself into the male.<sup>35</sup> These insects offer proof that it is not the corporeal part of semen that is causally efficacious in generation. So, it is not by any material part of the semen that the male conveys the active principle to the matter. Rather, in Aristotle’s theory, the male contribution is made by means of *motion*.

One may also grasp from this how the male contributes to generation. For not every male emits semen,<sup>36</sup> and in those that do emit it the semen is no part of the *kuêma* that is produced, just as nothing comes away from the carpenter to the matter of the timber, nor

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it preserves the being. Aristotle adds here that this *trophê* is also “productive of generation, not of the thing fed, but of something like the thing fed” (416b15-16). See also *GC* I.5, 322a23-7.

<sup>33</sup> This is also true of the mother’s milk, which is derived from that same useful nourishment: “The material which supplies nourishment and the material out of which nature forms and fashions the animal are one and the same” (IV.8, 777a5-6, Peck trans., modified).

<sup>34</sup> In *GA* I.18, Aristotle provides several observations as evidence that semen is derived from leftover nourishment. For instance, the loss of even a small quantity results in great exhaustion, which is only to be expected from a loss of *nourishment* (725b6-8). And no semen is produced where there is no nourishment *leftover*, such as when children are growing (725b22).

<sup>35</sup> “For the effect that the seed, in those that emit, brings about in the female, is brought about in these insects by the heat and capability (*dunamis*) in the animal itself when the female brings into it the part that is receptive of the residue.” (729b25-28, Balme trans.)

<sup>36</sup> Here is an instance in which Aristotle uses *sperma* though he is clearly referring to semen, not seed.

is there any part of carpentry in the product, but the shape and the form are produced *from* the carpenter *through* the motion *in* the matter. His soul (in which is the form) and his knowledge move his hands or some other part in a motion of a particular kind—different when the product is different, the same when it is the same—the hands move the tools, and the tools move the matter. Similarly, the male’s nature, in those that emit semen, uses the semen as a tool containing motion in actuality, just as in the productions of an art the tools are in motion; for the motion of the art is in a way in them. Those then that emit semen contribute in this way to generation. *GA* I.22, 730b8-25 (trans. Balme, modified)

Here Aristotle draws an analogy between the motion of a craftsman’s tools and motion in the seminal residue. Just as the motion of the tools conveys the form to the matter in craft production, so, too, does motion in the semen convey the principle of form in the generation of living beings. And just as the motion of a craftsman’s tools is carrying out the activity of the art, so, too, the male parent’s vital activity is carried out by means of the motion conveyed in the semen, which motion is described as “having a *logos*” (IV.3, 767b20). In both artistic production and the generation of living organisms, the active potential to fashion its products is manifested by means of motion—and not just any motion, but the *logos*-bearing motion specific to the product being formed. For there is a different motion “when the product is different, the same when it is the same” (I.22, 730b16-18).

Although the details must to some extent be reconstructed, it is safe to assume that motion, and the vital heat with which motion is associated,<sup>37</sup> is also doing the work of nutritive soul in the male parent’s body. For, although I know of no explicit reference to motion *in the blood*, the semen is concocted out of blood, and so the motion the semen contains is either already present in the blood or is due to the concoction of the blood by the heat of the male parent’s heart. The motion

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<sup>37</sup> There is clearly a connection, though it is difficult to precisely determine what it is, between the motion that is the “actuality” of soul *dunamis* and what Aristotle calls “psychic heat”. My own best guess is that psychic heat is related to motion as a capacity to  $\Phi$  is related to  $\Phi$ -ing: the motion is just what the psychic heat is *doing* (i.e., *heating*). It also appears to be Aristotle’s view that the motion resides in something he calls the “innate *pneuma*”, though he says less about this than one might hope. For the sake of keeping this discussion manageable, I am going to set these aside and speak only about the motion. There are useful discussions of *sumphuton pneuma* with references to Aristotle’s use of it throughout the corpus in Peck 1942 (Appendix B, 576-593).

that conveys the male's active contribution to the seed is, at any rate, conceived of as continuous with the generator's active capacity to nourish and maintain its own living body.

The significance of Aristotle's positing motion as the manifestation of the male's active potential to produce a new living organism is illuminated by his discussion of a "considerable difficulty" (*aporia pleiôn*) in *GA* II.1. This puzzle concerns *how* a plant or any animal comes to be out of (*ek*) seed. The difficulty is in identifying something that can satisfy two general requirements for being the agent that produces the parts of the new organism.

First, Aristotle holds, as a general metaphysical principle, that the agent of any change must be something "synonymous" with, or the "same in form" as that which is coming to be.<sup>38</sup> He reminds us of this principle in *GA*, saying that "things that come to be by nature or art are made by something which is, in actuality, such as what is coming to be is, in potential" (734b21-22). The male parent, being the same "in form" as the offspring, is the obvious candidate: The male parent is "in actuality" what the matter out of which the offspring will be made is "in potential" (734b35-6).

The male parent, however, does not seem to satisfy a second requirement, namely, that there be *contact* between the agent and patient.<sup>39</sup> As Aristotle says here, "it is impossible to change a thing without touching it, and if it does not change the thing, the thing cannot be affected by it" (734a3-4). So, it would seem that the agent must be something inside the seed, so as to be able to "touch" the matter. However, nothing inside the seed can be the "same in form" as what comes out of it. For, if it were, it would be something actually living.<sup>40</sup> But there could not be something living *inside* the seed from the beginning, because living things come to be *out of* seed. That is just what seed is: it is what living things come to be out of, so there cannot be anything already living inside of it.

The puzzle, then, is that it is not clear what can satisfy both requirements for change. On the one hand, the male parent is, in actuality, what the new organism is in potential, and so satisfies

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<sup>38</sup> See, e.g., *Metaphysics* VII.9, 1034a20-21; IX.8, 1049b24-29; XII.3, 1070a4-5.

<sup>39</sup> This "contact" requirement is also referred to in *Phys* III.2, 202a6-7 and discussed at greater length in *GC* I.6-7.

<sup>40</sup> Although not actually alive, Aristotle does think the seed is so potentially: the seed has soul *in potential* (735a8-9).

the first requirement. The male parent, however, does not make contact<sup>41</sup> with the matter, so fails to satisfy the second requirement. That second requirement, on the other hand, could be satisfied by something existing inside the seed which directly touches the matter. But there is nothing inside the seed that is actually a living being, and so nothing inside the seed that could satisfy the synonymy requirement.

Aristotle's resolution of this puzzle involves seeing that the motion conveyed by the semen is a subsidiary agent in generation: The motion is carrying out the male parent's activity just as the motion of craftsmen's tools carries out their activity. Because the motion is the means by which the male's agency is exercised, what "makes" (*poiei*) the embryo is not any determinate *thing*—it is not "some this" (*tode ti*). Rather, the motion that the generator imparts to the matter makes the parts.

In a way it is the internal motion that does this, as the act of building (*oikodomêsis*) builds the house. Well then, that there is something which makes the parts, though not as some determinate thing (*tode ti*) or as something completed (*tetelesmenon*) from the beginning, is clear. *GA* II.1, 734b16-19

The motion is that by which (*hupo tinos*) the new organism's parts are formed, just as the housebuilding process (*oikodomêsis*) is that by which the house is built.<sup>42</sup> Like the *oikodomêsis*, the motion is "internal", and so can make contact with the matter. Moreover, the motion is "from the generator, who is in actuality what [the matter] out of which the offspring is formed is potentially" (734b34-6). Thus, Aristotle says, in speaking about the agent "by which" the parts are

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<sup>41</sup> At least not directly. In *GC* I.6-7 Aristotle discusses an attenuated type of contact, where the "touching" is accomplished through intermediate or subordinate movers or agents. (See Gill 1989: 195ff. for a discussion of Aristotle's definition of "strict" and more relaxed senses of contact.) This type of contact seems to be precisely what is involved in this case, and thus it might seem strange that there is a puzzle here at all. Regardless, as I understand it, what is generating the puzzle in *GA* II.1 is that the male parent does not make (strict) contact with the matter, and the resolution involves seeing that there is nevertheless a way in which the male parent does make (mediated) contact, *via* the motion he conveys to the matter.

<sup>42</sup> The male's active contribution was likened earlier to the housebuilding process (*GA* I.22, 730b4-8) in that each is the "proximate movement" occurring in the matter that is acted upon.

formed, it “makes no difference whether we say ‘the seed’ or ‘that from which the seed comes’, insofar as the seed has in itself the motion initiated by the other” (734b7-9).<sup>43</sup>

Importantly, because the motion is manifesting nutritive soul activity, Aristotle’s biological theory of generation can identify the male parent as the agent, being “synonymous” with the new offspring. The father can be the agent, despite his not making direct contact with the matter, by “using semen as a tool, containing motion in actuality” (730b19-20), just as craftsmen can exercise their agency by means of the motion of their tools. So, the motion from the male, carried in the semen, is like the moving tools of the artist that build the product being formed.

In the case of the female contribution to seed, the continuity between the processes of self-nourishment and menses-production explains why the menses is fit to be the matter for generation: it is potentially the living parts, because it is derived (by concoction) from the matter for the body parts, the final or last form of nourishment. In the case of the male contribution, the continuity of the processes of self-nourishment and semen-production also explains why the contribution is suited to do its job: The continuity between the processes of self-nourishment and semen-production results in semen having the same active capacity to build, nourish and maintain the living body, conveyed via motion, as that which is present in the male parent.

### **III. How living things come to be out of seed**

At least in blooded animals, once the seed is formed from the contributions of both generators, the motion from the male is transferred to the material principle in the female.

Since the semen<sup>44</sup> is a residue, and is being moved in the same motion as that with which the body grows when the final nutriment is being particularized, when it comes into the

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<sup>43</sup> The fact that the motion is the physical manifestation of soul’s activity does not thereby make nutritive soul simply reducible to that motion. It is important for Aristotle that the motion be subordinate to soul, not merely a different description of it. I discuss this issue and provide references to alternatives in “Soul’s Tools” (Gelber 2020).

<sup>44</sup> “Semen” translates the word *sperma* here, since Aristotle is clearly referring to the male contribution and not seed: It is being contrasted with the female contribution, and is said to enter the uterus, both of which apply to semen but not to seed.



uterus it constitutes and moves the female's residue in the same motion in which it itself is actually moving. For that too is residue and contains all the parts potentially, though none actually. *GA* II.3, 737a18-24 (Balme translation, slightly modified)

Out of this initial mixture of male and female spermatic residues, the parts are then formed. They are formed not because "like is naturally carried to like" (740b12-18). Rather, the parts are formed because "the female residue is, in potential, such as the animal is by nature, and has in potential the parts, though it has none in actuality" (740b18-20). Once the principle from the male enters, and the motion is transferred to the female residue, the parts are formed "in succession like the marvelous automata" (741b8-9), and they come to be "in actuality" what they were previously only "in potential" (741b14-15).<sup>45</sup> The male's active principle, in those creatures that emit semen,<sup>46</sup> "fashions (*dêmiourgei*) the thing being put together (*sunistamenon*) by the motion in the semen, out of the matter in the females" (*GA* II.4, 738b12-13).

In Aristotle's theory, the formation of the parts does not occur all at once, but rather there is a principled order of development.<sup>47</sup> The first part to be formed is the heart in blooded animals, and what is analogous to the heart in others.<sup>48</sup> That the heart is formed first, Aristotle says, is clear "not only to perception" (*GA* II.3, 740a1-4), i.e., that is what is observed to happen, but also "to reason":

For, once the thing coming to be is separated off from both (parents), it needs to manage itself by itself, just like a child sent away from his father. So that it is necessary to have the

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<sup>45</sup> Cf. "Well then, the semen is such, and has such a motion and principle in it, with the result that when the motion stops, each of the parts comes to be and is ensouled." (*GA* II 1, 734b22-24)

<sup>46</sup> Those creatures that do not emit semen but instead transfer the motion directly "bring the same to pass by the motion within themselves in that part from whence the semen is secreted. This is the region about the heart in all those animals which have one, for the heart or its analogue is the first principle of a natural body..." (*GA* II.4, 738b13-17, Platt trans., modified).

<sup>47</sup> The principles governing the order of embryonic development are discussed in *GA* II.6, though Aristotle concedes that it is "not easy" to tell which parts come to be prior to which (742b10). It is clear, however, that the heart is first.

<sup>48</sup> *GA* II.5, 741b15-16. See also *de Juv* 468b30-31.

principle from which also, later, the orderly arrangement (*diakosmêsis*) of the body for animals comes to be. *GA* II.3, 740a7-9

The heart is formed first, because in it resides the soul principle, which is needed to regulate the continual development of the new organism's body. This is why the heart is the "source" from which the other parts are formed, both uniform and non-uniform parts (740a10-19). For while nothing "generates itself", once it has been generated, it "makes itself grow".<sup>49</sup> That is, the part in which the new organism's nutritive soul resides must be formed first, because the new living organism's nutritive soul is the principle organizing its own growth:

And as the products of art are made by means of the tools of the artist, or to put it more truly by means of their motion, and this is the activity of the art, and the art is the form of what is made in something else, so is it with the power of the nutritive soul. As later on in the case of mature animals and plants this soul causes growth from the nourishment, using heat and coldness as its tools (for its motion is in these), and each thing comes into being in accordance with a certain proportion (*logos*), so also from the beginning does it form the product of nature. For the matter by which it grows and from which it is first constituted are the same, so also this moving power is the same as that at the beginning. But that one is greater.<sup>50</sup> Well, then, if this is nutritive soul, it is also the generator. And this is the nature of each, existing in all plants and animals. *GA* II.4, 740b25-741a3

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<sup>49</sup> "The cause of this generation then is no part, but the first external mover. For nothing generates itself. But once generated, a thing makes itself grow. For which reason something comes to be first, and not all at the same time. And it is necessary that what comes to be first is that which has the principle of growth. For whether plant or animal, similarly this nutritive part (*to threptikon*) belongs to all." (*GA* II.1, 735a12-17). See also *de Motu* V, 700a35-36; *DA* II.4, 416b15-17; *GA* II.4, 740a20-21.

<sup>50</sup> The interpretation this sentence is disputed: There is disagreement about the referent of "that one" and the meaning of "greater". For some discussion, see Lefebvre 2021:12, Menn 2002:122, fn. 52 and Pellegrin 2018.

Not only is the matter that constituted the seed, passed from the female, the same as that by which the new organism's parts develop, so, too, the active principle that passes from the male parent is that which orders the process of development.<sup>51</sup>

Appreciating why Aristotle insists that the soul be present at the outset—namely, so that there be a principle that organizes the changes involved in the development of the new organism's body—helps to illuminate another feature of *DA* II.4. For, some find it puzzling that Aristotle includes in this chapter a general discussion of the way that the soul is the cause and principle of the living body. It is so, he says, in three ways (415b8-12): it is efficient (*hothen hê kinêsis*), final (*hou heneka*), and formal (*ousia*) cause. Such a general discussion of the soul as a cause would be more appropriate elsewhere, it is thought, rather than in a chapter purportedly devoted to nutritive soul alone.<sup>52</sup>

As I understand it, however, this is not a digression. For, earlier in *DA* I, in his survey of the *endoxa* about the soul, we learned that what most of Aristotle's predecessors consider distinctive of soul-possessors is locomotion and perception (403b25-27). But Aristotle is including, among the activities that count as *living* activities, these other kinds of changes—those involved in nutrition, generation and growth—and not merely those involved in locomotion and perception.<sup>53</sup> That is, Aristotle is explicitly widening the scope of the sorts of changes that the soul is the efficient cause *of*. Empedocles was wrong in thinking that growth is to be explained by the natural motions of the elements. What holds the elements together must be soul (416a8-9). And fire, though a subsidiary cause (*sunaitia*) (416a13-14), cannot be the cause of nourishment and growth (416a9-10). Soul, not fire, is the cause of there being a limit and proportion to the magnitude and growth of what is being fed (416a14-18). Finally, although not named in *de Anima*,

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<sup>51</sup> The failure to posit an ordering principle is why people such as Democritus are altogether wrong about embryonic development: Democritus wrongly said that external parts were formed earlier than internal ones, for instance, because he did not appreciate that, unlike stone or wooden animals, living ones have *principles* that order their activities from the very beginning. See *GA* II.3, 740a13-17.

<sup>52</sup> Shields 2016: 203; Hicks 1907: 341

<sup>53</sup> As noted by Falcon 2009: 170, and 169-170, fn 9, one of Aristotle's great innovations is that he treats 'plant life' as a distinctive kind of life. His predecessors, insofar as they took plants to be alive, tended to ascribe to them desires or perception. Polansky 2007: 151 similarly observes that Aristotle's predecessors "tend to limit life to animals, or if they include plants, they assume plants have some sort of awareness."

surely Aristotle's targets must also include those whose accounts of generation omit any reference to the soul principle that, Aristotle thinks, must be invoked to explain it.

And just as we should not say that an axe or other instrument or organ was made by the fire alone, so neither shall we say that foot or hand were made by heat alone. The same applies also to flesh, for this too has a function. While, then, we may allow that hardness and softness, stickiness and brittleness, and whatever other qualities are found in the parts that have life and soul, may be caused by mere heat and cold, yet, when we come to the principle in virtue of which flesh is flesh and bone is bone, that is no longer so; what makes them is the movement set up by the male parent, who is in actuality what that out of which the offspring is made is in potentiality. This is what we find in the products of art; heat and cold may make the iron soft and hard, but what makes a sword is the movement of the tools employed, this movement having the principle of the art. For the art is the starting-point and form of the product; only it exists in something else, whereas the movement of nature exists in the product itself, issuing from another nature which has the form in actuality. *GA* II.1, 734b28-735a3 (Platt trans., modified)

Consequently, it is not at all surprising to find a discussion of the ways that soul is a cause here in a chapter devoted to nutritive soul activities. For it is a cause not only of perception and locomotion, Aristotle thinks, but also nutrition, growth, and generation.

## **Conclusion**

The question addressed here has been why generation, growth and nutrition are all activities of the same psychic capacity, as Aristotle reports in *de Anima* II.4. The way I have tried to answer this is by showing why the production of seed from the generators, growth of the parts from the seed, and the "use of food", are all construed, in Aristotle's biological theory, as constituting a continuous physiological process. His theory joins these activities together as stages of a continuous physiological process because by doing so, Aristotle is adhering to his own theoretical commitments as well as the observed phenomena.

This approach is distinct from (though compatible with) those that would explain the unity of the functions by appealing to a common goal. Such approaches begin from considerations about

Aristotle's understanding of the nature of generation (e.g., as self-preservation) or nourishment (e.g., as quasi-generative). My strategy has been to focus instead on the underlying physiological basis of the functions and activities, rather than their more abstract and formal characterizations. This is attractive, insofar as it allows us to extract a coherent and well-motivated explanation for the linking together of these three as the functions of *threptikê psychê*, without having to settle questions about how Aristotle is thinking, again in an abstract or formal way, of these functions and activities. At the physiological level, the processes form a continuous cycle, and viewed at this level, it is left open which of the stages is privileged. This is not to deny, of course, that one of them is, in fact, the privileged end of the process, and that whichever stage is the end in the "order of being", so to speak, that is the cause and source "as end" of these three activities being unified.<sup>54</sup> The answer sketched here merely provides an additional cause and source of their unification, rooted in the physiological continuity of generation, growth, and nourishment, and conceptually independent of their respective priority.

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<sup>54</sup> Although the cause as *telos* of their unity would be, in the order of being, prior to the physiological account given here, it is not clear that this is true of Aristotle's own order of discovery. For it is possible that Aristotle did not begin with the idea that there is a shared goal of these three functions, based on reflections upon the nature of nourishment or generation. Perhaps the unity of these functions was instead the result of an inquiry, not its starting point. Such an inquiry may have proceeded from a commonly held, pre-theoretic understanding of what seed is (e.g., that "out of which living things come to be"), and arrived at a theoretically-informed conception of seed (something having both active and passive principles), from which Aristotle worked out how seed is made (by contributions from both male and female principles) and how the growth of organisms from it proceeds (starting from the heart or the analogous organ), given the principles of his own physics and metaphysics, and given the available empirical evidence.

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