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# *Nature as a Good Housekeeper Secondary Teleology and Material Necessity in Aristotle's Biology*<sup>1</sup>

Mariska Leunissen

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## Introduction

It is a well-known characteristic of Aristotle's *De Partibus Animalium* that the parts animals have are explained by reference to their function. For example, birds have wings for the sake of flying, and many of the hoofed animals have horns for protection: according to Aristotle, the function the part performs in the animals that have it explains why it is present. The explanation thus provided is teleological in nature.

My aim in this paper is to further specify this standard (and simplified) depiction of teleological explanation in Aristotle by showing that there are two types of teleology underlying these explanations: a primary kind that involves the realization of an internal, pre-existing potential for form through conditional necessity,<sup>2</sup> and a secondary one that involves the emergence of functions as the result of formal natures using materials that have come to be of material necessity for something good.

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1 I am grateful for, and tried to do justice to, critical comments by Frans de Haas, Jim Hankinson, Devin Henry, and Jim Lennox on earlier drafts of this paper.

2 My characterization of 'primary teleology' throughout this paper builds on Gotthelf's analysis of Aristotle's teleology; see Gotthelf (1976-77) and (1987).

In section one, I use an image Aristotle draws of nature acting as a good housekeeper (in *GA II 6*, 744b11-27) to illustrate how this bifurcation of teleology underlies Aristotle's conception of the hierarchy between different animal parts. I focus on three aspects: first, the ontological status of parts (i.e., whether the part is necessary for or rather subsidiary to the animal that has it); second, their material make-up (i.e., whether the parts are constituted from the best nutriment, the inferior nutriment, or from residues); and third, their place in the order of generation (i.e., whether they come to be first or later during the embryological development of the animal, or not until after the birth of the animal). Next, in section two, I counter a possible objection to the positive role my notion of secondary teleology ascribes to material necessity in natural generation, namely the view that Aristotle's own discussions of the relation between teleology and necessity — notably in *PA I 1* — deny such a positive role.<sup>3</sup> I argue that this objection is grounded in a failure to distinguish between the causal and modal ways in which Aristotle uses the concept of necessity.<sup>4</sup>

The two arguments, which are developed independently of each other, together demonstrate that the material constraints and the influence of material necessity on the goal-directed actions of the formal nature of an animal are relatively strong. Animals are the way they are not just because they have kind-specific potentials for form that are being realized, but also because of the material and the material potentials that are available to the formal nature during embryogenesis and the animal's subsequent development. This is not a negative claim: the goal-directed actions of the formal nature of an animal often (although not always) turn to a good use those materials that have come to be as a result of material necessity, and thereby equip living beings with features that are perhaps not strictly speaking necessary for their survival, but that contribute significantly to their well-being.

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3 Consequently, scholars have explained away all material necessity in biology (Balme, 1987); subsumed it under the operation of conditional necessity (Cooper, 1987; Johnson, 2005); or assigned a mostly constraining role to it in the realizations of function: see, e.g., Gill (1997); Lennox (2001a), especially at 187; 195-6 on 'pre-conditional necessity'; and Pavlopoulos (2003), especially at 164-6. The positive role I assign to material necessity is foreshadowed in Lennox' discussion of the omentum (2001b), 290-2.

4 My account of necessity in Aristotle is much indebted to the analysis of modal and causal uses of necessity by Kupreeva (forthcoming).

## 1 Primary and Secondary Teleology

### *The image of nature as a good housekeeper*

The image of nature that I believe is most helpful for the understanding of the double nature of Aristotle's teleology is part of an investigation into the natural order of generation of the various animal parts within the embryo in *De Generatione Animalium* book II (see GA II 1, 733a32; II.1, 734a16-34; and II 4, 740a2-16). Before quoting the image in full, I shall first sketch its context.

In GA II 4, Aristotle argues that, within the embryo, which 'possesses all parts potentially in a way' (740a2-4), the heart is the first to take shape because it is the source of movement for the developing animal (740b2-4; cf. PA III 4, 666a18-21). In the subsequent chapters, Aristotle determines that the generation of the heart is followed first by the coming to be of the blood vessels, out of which then all the other parts are formed: first the internal, then the external parts; first the upper, then the lower parts (GA II 6, 742a36-b18). Within this sequence of generation, Aristotle notes that the time of the formation of the eyes presents a difficulty: although their formation starts — as one would expect based on their location in the animal body — early on in the formation of the embryo, they are the last organs to reach their completion (743b32-4b11). Aristotle explains this peculiarity by reference to the principle that nature does not create parts too early or too late for an animal to be able to use it (744a35-b1; cf. 742a26-8 and V 8, 788b20-9a2). With the image of nature as a good housekeeper Aristotle returns to his discussion of the *normal* sequence of the generation of animal parts (744b11-27):

Each of the other parts [i.e., all the parts of an animal with the exception of the eye and the heart discussed before] is formed out of the nutriment, (A) the parts that are the noblest and that partake in the most important principle (τὰ μὲν τιμιώτατα καὶ μετελιηφότα τῆς κυριωτάτης ἀρχῆς) are formed from the nutriment which is concocted first and purest; (B) the parts that are necessary, that is to say that are for the sake of the former parts (τὰ δ' ἀναγκαῖα μόρια καὶ τούτων ἔνεκεν) are formed from the inferior nutriment and the residues and leftovers. For just like a good housekeeper, so also nature is not in the habit of throwing away anything from which it is possible to make anything useful (ὡσπερ γὰρ οἰκονόμος ἀγαθὸς καὶ ἡ φύσις οὐθὲν ἀποβάλλειν εἴωθεν ἐξ ὧν ἔστι ποιῆσαι τι χρηστόν). Now in a household the best part of the food that comes in is set apart for the free people (A), the inferior and the residue [of the best food] for the slaves

(B1), and the worst is given to the animals that live with them (B2). Just as the intellect from the outside does those things with a view to growth, so nature in the things coming to be forms from the purest material the flesh and the body of the other sense-organs (A), and from the residues thereof bones and sinews (B1) and hair, and in addition nails and hoofs and all similar parts (B2); for this reason these are the last to assume their formation, for they have to wait till the time when nature has some residue to spare.

This image is representative for the way Aristotle commonly picks out nature in his explanations of biological phenomena: nature is always personified as an agent, and portrayed as acting for the sake of something, while following a certain *logos* or formula (cf. *PA* I 1, 641b23-37). Aristotle calls this the 'formal nature' of an animal, which incorporates the efficient, final, and formal cause of an animal, and is to be identified with its soul (see, e.g., *PA* I 1, 641a23-8; *DA* II 1, 412a19-21; and *GA* IV 4, 770b17).<sup>5</sup> Contrasted with this formal nature is the animal's 'material nature': this is its body, its basic elemental make-up, and the kinds and amounts of food it can process. The material nature is a source of the constitutive matter for the formation of parts and is thus in constant interaction with the formal nature of the animal.

What is particularly important for our understanding of Aristotle's teleology in this image is the hierarchy of different types of animal parts that Aristotle develops in it, linking the ontological status of a part to the quality of its constitutive material and its place in the sequence of coming into being. According to the image drawn, nature uses the best materials to make the most important parts of the body, and makes those first, just as in a household, the housekeeper gives the best food to the most important members of the household, who are fed first (i.e., nutriment : biological parts :: food : members of household).

Specifically, I take the image to suggest that not all biological parts are 'created equally', which indicates that the underlying teleological processes that account for their coming to be and presence must be different. The most important parts in the image (A) are those that partake in the essence of an animal (cf. *GA* II 6, 742a34-5 and V 1, 778b12-13): they are made of the best nutriment, and come to be first. Elsewhere Aristotle refers to these parts as being necessary (without further quali-

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5 On formal natures, see also Lennox (2001a), 182-94.

fication) for the animal, as they are conditionally necessary for the performance of vital and essential functions. This presumably means that these parts are the result of the standard, primary form of teleology. I shall explain this further below. The other parts in the image (B) are also necessary, but in a more restricted and qualified way.<sup>6</sup> These parts are said to exist for the sake of the first category (which is why I prefer to refer to them as ‘subsidiary’ parts), and are made of inferior nutriment, and only come to be if nature has enough leftovers to spare. In *De Partibus Animalium*, Aristotle somewhat paradoxically refers to these parts as being ‘not necessary’ (presumably, because they are not necessary without qualification, but rather necessary for the sake of other parts) and as being ‘for the better,’ because their presence improves the functioning and well being of the animal in question. Even though the accounts in *De Generatione Animalium* and *De Partibus Animalium* are thus not overtly consistent in their ascriptions of ‘necessity’ to these two types of parts, they do provide the same causal descriptions of the actions of the formal natures in the production of subsidiary parts. In both treatises, they are described as the product of nature *using* leftovers to make useful features for the animal in question. This, I believe, illustrates a different — secondary — kind of teleological causation.

In the next subsections, I shall work out this hierarchical picture of animal parts in more detail, mostly by drawing from passages of Aristotle’s *De Partibus Animalium* (for a schematic outline, see Table 1 below).

#### *Vital and Essential Parts*

I submit that the first category of parts — represented by the ‘free people’ in the image — consists of those parts that are the necessary prerequisites for the performance of the vital and essential functions that are specified by the definition of the substantial being of that animal.<sup>7</sup>

6 I translate the second *kai* in GA II 6, 744b14 epexegetically as ‘that is to say,’ which is arguably not the most natural reading of the text. However, I believe that I can justify this reading based on how Aristotle treats this group of parts in *other* contexts, most notably in *De Partibus Animalium*. See my discussion below.

7 For examples of parts whose function is mentioned in the definition of the substantial being, see Code (1997), 139-40 and Gotthelf (1987), 190-1. I take it that the definition of the substantial being is not of the genus and species type, but that it rather specifies a whole array of features that characterize the animal, including the essential and vital functions to be performed by the animal (e.g., reproducing,

**Table 1: The hierarchy of parts in the image of nature as a good housekeeper**

	Biological Part	Timing in growth	Material used	Example
A	Vital and essential parts ↔ Free people <i>perform necessary functions</i>	Made 1 <sup>st</sup>	Best nutriment	Fins <i>necessary for swimming</i>
B1	Subsidiary parts ↔ Slaves <i>contribute to necessary functions</i>	Made 2 <sup>nd</sup>	Inferior nutriment	Kidneys <i>help collection of residue</i>
B2	'Luxury' parts ↔ Animals <i>perform non-necessary functions</i>	Made 3 <sup>rd</sup>	Residues	Horns <i>provide protection</i>

(This is what it is to partake in the 'most important principle' or essence of the animal.) Elsewhere Aristotle claims that their presence is *necessary* for the animal: without these parts, the animal would not be able to survive, or it would not be able to be the specific kind of animal it is.

Outside the *De Generatione Animalium*,<sup>8</sup> Aristotle employs a very strict notion of necessity in his characterizations of such vital and essential parts. He calls a part necessary for an animal when he believes that nature could not have 'designed' that animal without the part in question; for, without the part, the animal would *immediately* fail to reach its natural ends (cf. *GA* IV 4, 771a11-14). This is clear from, for example, his description of the liver, which he considers to be a vital part of all

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flying, thinking, etc.); the dimensions of the animal (e.g., the length and thinness of a certain kind of octopus; see *PA* IV 9, 685b12-15); and possibly also the material constitution of the animal (e.g., that the animal is blooded or bloodless; see *PA* IV 5, 678a31-5).

8 For evidence within the *De Generatione Animalium*, see *GA* I 4, 717a11-21.

blooded animals (*PA* IV 2, 677a36-b5): ‘For it is reasonable that, since the nature of the liver is vital (ἐπικαιρον) and necessary (ἀναγκαίαν πᾶσι τοῖς ἐνάμοις ζῴοις) to all the blooded animals, its being of a certain character is a cause of living a shorter or longer time. ... and none of the other viscera is necessary to these animals, but only the liver.’ According to Aristotle, the presence of the liver is so basic to the life and survival of blooded animals that it is the only visceral organ without which blooded animals absolutely cannot be; that is, of course, in addition to the heart, which Aristotle had already established as being the *origin* of blood (cf. *PA* II 1, 647a35-b8 and III 4, 665b10-15). The other visceral parts, such as for instance the kidneys and the spleen, are not in the same way necessary for all blooded animals (Aristotle even calls them ‘non-necessary’; see my discussion of the kidneys below), which is why they are also not present in all blooded animals (cf. *PA* III 7, 670a30; III 9, 671a26-30; and III 12, 673b12-14). In other words, nature cannot produce blooded animals without a heart and liver, but it is among the natural possibilities to produce blooded animals lacking some of the other visceral parts.

The explanations Aristotle offers for such parts in *De Partibus Animalium* provide textbook examples of what I call primary teleology. For example, Aristotle explains the presence of fins in fish by reference to the definition of their substantial being. Fish are essentially swimmers, that is, being able to swim is part of the nature or substantial being of fish, and having fins is a necessary condition for fish being able to swim: hence fins are *kath’hauta* features of fish.<sup>9</sup> The coming to be and presence of these parts is thus explained by reference to their necessary function (cf. *PA* I 5, 645b18-20), and that function in its turn is grounded

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9 *PA* IV 13, 695b17-26: ‘Fish do not have distinct limbs [such as arms or feet], owing to the fact that their nature according to the definition of their substantial being is to be able to swim (*dia to neustikên einai tēn phusin autōn kata ton tēs ousias logon*), and since nature makes nothing either superfluous or pointless. And since they are blooded in virtue of their substantial being, it is on account of being swimmers that they have fins (...).’ Cf. *PA* III 6, 669b8-12; IV 5, 678a31-5; IV 13, 697b1-13. Fish without fins are considered to be ‘paradoxical’ exceptions that deserve special explanation: see, e.g., *PA* IV 13, 696a10-21. Note that this type of explanation also holds for those parts whose presence can be deduced directly from the presence of necessary parts or that can be ‘traced’ to the definition of the substantial being of an animal (cf. *GA* V 1, 778a34-5): for example, while wings and being blooded are necessary parts of birds (i.e., they are *kath’hauta* features of birds; see *PA* IV 12, 693ab10-14), being two-footed is a *kath’hauta sumbebēkos* feature of birds; see *PA* IV 12, 693b5.

in the substantial being of the animal. Teleological explanations of this primary kind exhibit parts to be the necessary prerequisites for the performance of vital or essential functions.

Aristotle introduces this type of teleological explanation in his methodological introduction to biology in *PA I 1*, 639b13-19:

Now it is apparent that the first [kind of explanation] is the one we describe as being for the sake of something. For that is an account (*λόγος*), and an account is a starting point alike in things that are composed according to art and in those composed by nature. For after having defined by thought or perception — the physician [having defined] health, and the house-builder [having defined] the house — they [i.e., the physician and the house-builder] provide the accounts and the explanations of that which each of them produces, and the reason why they have to be produced in that way.

Just as in art the artifact that is produced and the way in which it is produced are explained by reference to the definition of the end product (i.e., 'house') that specifies the function of that product (i.e., 'shelter'), so too in nature the coming to be of an animal and its parts is explained by reference to the definition of the substantial being of that animal, which specifies the functions to be realized (cf. *Metaph VII 7*, 1032b5-22).

The process responsible for the coming to be of these parts is conditional necessity: *given* that the animal has to realize its form, it has to have such and such parts, and such and such differentiations of parts, made of such and such constitutive materials, put in such and such a structure or configuration.<sup>10</sup> In the context of *De Generatione Animalium*, Aristotle describes the actions of the formal nature of an animal in these cases as first using the spermatic residue present, but then as '*making*' the required materials by processing (i.e., concocting) the incoming food,<sup>11</sup> and shaping them into parts. The formal nature of an animal

10 Cf. *PA I 1*, 640a33-5: 'Therefore one should state in particular that since that is what it is to be a human being, on account of that it has these things: for it is not possible to be without those parts'; *I 1*, 642a7-12; *IV 10*, 689a20-1; and *GA V 1*, 778b15-19.

11 In *GA II 6*, 744b27-36, Aristotle distinguishes between the spermatic residue (744b27) already available for the development of the embryo and the 'natural food' (744b30), coming in later through the process of nutrition of the mother and later of the animal itself. There are two kinds of natural foods: the first is 'nutritious' and is used for the formation of complete parts; the second is 'conductive



thus conditionally necessitates the materials it needs for the formation of parts that are necessary for the performance of necessary functions (cf. *GA II* 6, 743a36-b5).

### *Subsidiary Parts*

The second category of parts — represented by the slaves in the image — consists of parts that are not themselves necessary for the performance of vital or essential functions. Instead, they are necessary in the sense that they *exist for the sake of* ‘the noblest’ parts. The function of this second category of parts is thus to *contribute* to the performance of necessary functions (without having a proper function of their own) and thereby to contribute to the well-being of the animal.<sup>12</sup> Since the coming to be of these parts is said to be dependent upon and later in generation to that of the first category of parts, I propose to call these parts ‘subsidiary’. I also follow Aristotle’s practice in the *De Partibus Animalium* of referring to these parts as being ‘non-necessary’ and as being ‘for the better’.

Consider Aristotle’s explanation of the presence of kidneys (*PA III* 7, 670b23-7):

The kidneys are present in those that have them *not of necessity* (οὐκ ἐξ ἀνάγκης) but *for the sake of the good and doing well* (ἀλλὰ τοῦ εἶ καὶ καλῶς ἕνεκεν ὑπάρχουσιν). That is, they are present, in accordance with their distinctive nature, for (χάριν) the residue which collects in the bladder in those animals in which a greater amount of such excrement comes about, in order that the bladder may better perform its own function.

Kidneys are viscera, but unlike a heart and liver, they are not present in all blooded animals. They are present only in animals with blooded lungs, because they *help the bladder* perform its function better by pro-

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to growth’ and is used for the quantitative increase of existing parts (744b34-6). Within the animal there may be residues of both types of food (745a1-4).

12 The distinction is similar to the one Aristotle makes with regard to the capacities of the soul in, e.g., *DA III* 13, 435b20-1, where the most basic capacities (such as nutrition and touch) are said to be necessary for *living*, and the more complex ones (such as perception) are characterized as being necessary for the sake of *living well*.

viding extra storage-room for residue. Kidneys do not possess a function of their own. Apparently, Aristotle thinks that the kidneys are not themselves strictly necessary<sup>13</sup> for the collection of residue (only the bladder is), even though animals that have a bladder usually also have kidneys (see *PA* III 9, 671a26-b3 and *GA* IV 4, 771a2-6, where Aristotle claims that while no animal can live without a heart or a liver or any other of the necessary parts, it can live 'without a spleen or with two spleens or with one kidney'). In the animals that do have kidneys, they contribute to their well-being.

According to the image, the matter nature uses to make the subsidiary parts is second best: presumably, it is the nutritious residue left over from the foodstuffs concocted for the formation of the necessary parts (cf. *GA* II 6, 744b26-5a1). However, since these parts are not themselves a necessary prerequisite for the performance of a necessary function, it seems that their coming to be cannot be conditionally necessitated by a potential for form, and is therefore not due to primary teleology. Instead, Aristotle suggests (in *GA* II 6, 744b16-17) that it is the presence of residues that allows nature to *use* these extra materials to make parts that are serviceable to the animal's well-being.

#### *'Luxury parts'*

The presence of animals in the image, which receive the worst of food (presumably the residues from the growth-conducive food as described in *GA* II 6, 745a1-4), suggests that there exists a second kind of subsidiary part. These are the parts that are neither immediately necessary for nor contribute to the performance of necessary vital or essential functions. Their presence rather contributes to the well-being of animals in some other way. For lack of a better term, I shall refer to these parts as 'luxury parts'.<sup>14</sup>

This distinction between two kinds of subsidiary parts is not explicit in the final section of the image (*GA* II 6, 744b24-7). There Aristotle men-

13 Similarly, Aristotle describes the presence of limbs as being 'not among the necessities of life' (*PA* III 4, 665b21-7; 25-6: *ouk esti tōn pros to zēn anagkaiōn*).

14 Note that Sorabji (1980, 157-8) uses the term 'luxurious' with regard to all non-necessary parts, while I use it in a more restricted manner to refer only to those parts that are not the necessary prerequisites for the performance of the functions that are specified in the definition of the substantial being of the animal, nor contribute to their performance.

tions bones, sinews, hair, nails, hoofs, 'and all similar parts' as all being examples of parts that are made from residues. However, in the discussion that follows Aristotle separates this group into two: while bones and sinews are formed from the same material, namely the spermatic and nutritious residue, parts like nails, hairs, hoofs, horns, beaks, the spurs of birds, etc. are made from 'the nutriment that is taken in later and that is concerned with growth, which is acquired from the mother and from the outer world' (745a3: *ek tês epiktêtou trophes kai tês auxêtikês, hên te para tou thêleos epiktatai kai [tês] thurathen*). From this I conclude that the 'luxury parts' are made from the residue of nutriment concocted for the sake of sustaining the parts that perform necessary functions, which have already fully developed before the animal's birth (i.e., they are fully developed in the sense of being complete; they may still grow in size). Since there will be a continuous supply of this kind of nutriment and hence of residues thereof throughout the animal's life, it is a distinctive feature of these parts that they can come into being after the birth of the animal, and often can keep on growing (745a4-19).

From Aristotle's discussion of these parts in *De Partibus Animalium*<sup>15</sup> we learn that they share two more distinctive features. First, since all of these parts are earthy and uniform, Aristotle calls them 'tool-like': they have to be moved 'from the outside' and are therefore only produced in animals that are able (and strong enough) to use them, which is why parts such as stings, spurs, horns and tusks are often present in males, but absent in females (see *PA* III 1, 661b28-2a2 and *HA* IV 11, 538b15-22). Their earthy and uniform nature also explains why these parts can only perform simple functions (*PA* II 1, 646b10-25) and why there is no sensation in these parts (*DA* III 13, 435a11-b4). Second, most of these parts serve the function of protection, defense, or coverage: a function that is not listed among the typical functions of the soul in Aristotle's *De Anima*. Perhaps, given that for Aristotle species are eternal, and that nature — as a good housekeeper — provides food for each kind of animal, protection and defense are not strictly necessary functions to be performed by the animal in order to survive or to reproduce. Presumably, then, there is no internal potential for form of which these defen-

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15 See *PA* III 2, 663b31-5 (teeth, tusks, and horns in the four-footed animals); IV 10, 687b22-4 and IV 10, 690a4-9 (nails and hoofs); IV 12, 694a22-7 (hard and large beaks, and spurs or claws in birds); II 14, 658b3-5 (hair in human beings); IV 5, 679a28-30 (ink in sepia).

sive parts are the realization. Luxury parts are parts *actual* animals can — at least temporarily — do without.

The causal pattern underlying the production of luxury parts, which is identical to that of the subsidiary parts, is outlined in the image: Aristotle explains that nature is not in the habit of throwing away residues if it is possible to make something useful from them (GA II 6, 744b16-17) — an image that is reflected in the actual explanations provided in *De Partibus Animalium*.

Take the example of horns. After having explained that horns are *present* for the sake of self-defense and attack, Aristotle explains their *coming to be* as a case of a formal nature using what is present of necessity (PA III 2, 663b21-2): ‘We must say what the character of the necessary nature is, and how nature according to the account has made use (*katakechrêtai*) of things present of necessity for the sake of something.’ Horns are made in larger animals from the surplus of earthen material that has come to be of necessity, which is then used by the formal nature (i.e., ‘the nature according to the account’) of those animals to make defensive parts, *because* of the kind of material potentials the available material has (663b25-35). Aristotle does not refer to a potential for form that would have been realized by the coming to be of horns, but instead points to the kind of potentials the residues happen to have that are used for the production of horns. Because those materials are hard, they have a potential for defense (cf. PA II 9, 655b2-12), and this makes them suitable for the production of defensive parts.

In many cases, the materials that have come to be ‘of necessity’ will be the result of material processes (see, e.g., PA III 10, 673a32-b1; IV 3, 677b22-9; and IV 4, 678a3-10), which themselves take place in an animal body of conditional necessity for the sake of sustaining the parts performing necessary functions. However, these material processes lead *incidentally* to the generation of residues (which are thus technically speaking not conditionally necessitated for the sake of realizing some pre-existing form), some of which<sup>16</sup> are then used by nature for (*pros* or *charin*) something — a purpose which is usually picked out in the second half of the explanation of the presence of parts such as these. In

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16 Cf. PA IV 2, 677a15-18: ‘Sometimes nature makes use even of residues for some benefit (*katachrêtai men oun eniote hê phusis eis to ôphelimon kai tois perittômasin*), yet one should not on this account search for what something is for in every case; on the contrary, when certain things are such as they are, many other such things happen from necessity because of these.’

a few cases, the materials — and sometimes even complete functional parts — are the result of material elements acting entirely on their own accord. This is, for instance, how eyebrows and eyelashes come to be (*PA* II 15, 658b14-25):

The eyebrows and eyelashes are both for protection ... The eyelids are at the ends of small blood vessels; for where the skin terminates, the small blood vessels also reach their limit. So because the moist secretions oozing are bodily, it is necessary that — unless some function of nature stops it with a view to another use (ἄν μή τι τῆς φύσεως ἔργον ἐμποδίσῃ πρὸς ἄλλην χρῆσιν) — even owing to a cause such as this, hair from necessity comes to be in these locations.

Eyebrows and eyelashes come to be of material necessity and because the formal nature did not *stop*<sup>17</sup> the flow of materials in order to use it for something else. Their presence is for (*charin*) protection — a function they seem to be able to perform due to the material potentials and the structure they have of necessity (cf. also Aristotle's account of the omentum in *PA* IV 3, 677b22-32).

In short, both subsidiary and luxury parts *come to be* of material necessity, but they are *present* for a function. The formal natures of animals make use of the extra materials, and it is this use that determines the function of these parts and that explains why the materials are still present. Hypothetically speaking, nature could have designed fully functioning animals without these parts (they are not the necessary prerequisites for the performance of necessary functions), but by co-opting the extra materials and by turning them into subsidiary or luxury parts, nature increases the well-being of those animals in which this is possible.

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17 Lennox (2001a), 192 and (2001b), 42 translates this section as 'unless some function of nature *redirects* it to another use' (emphasis is mine) and concludes in (2001a), 192 that the necessity involved must be conditional. However, nature is not doing anything yet, but may *stop* the flow with a view to another use; this suggests that the operation of necessity cannot simply be a case of conditional necessity and primary teleology. For similar examples of the formal nature of an animal refraining from taking action in the formation of parts that take place of material necessity, see *GA* I 8, 718b16-28 and I 11, 719a14-15.

*Secondary Teleology*

Summing up, the causal processes responsible for the coming to be and presence of both kinds of subsidiary parts are teleological in Aristotle's view (since all parts are present for the function they perform), but they are not so without qualification.<sup>18</sup> The formal nature of the animal assigns a function to (1) a flow of materials or (2) a part, but only *after* this material or even the whole part has already come into being as a result of material necessity. In the first case, nature actively *uses* materials that have come to be of material necessity for the formation of parts by redirecting, distributing, or organizing these materials, instead of throwing them away (see, e.g., *PA* II 9, 655a26-8; III 2, 664a1-3; IV 12, 694a28-b1; *GA* III 1, 749b27-50a4). In the second case, nature passively 'co-opts' entire parts that have come to be solely of material necessity. It does so simply by not intervening in the materially necessitated process, because their coming to be will be useful for the animal (see, e.g., *PA* II 15, 658b14-25 and IV 3, 677b22-32). In neither case does the function the part ends up performing conditionally necessitate its coming into being, even though that function does explain why the part is present (for it explains why the formal nature of the animal retained the materials) and is thus a necessary part of our knowledge of it (see *PA* II 9, 655b15-20).

Additionally, Aristotle oftentimes seems reluctant to say that these parts are *for the sake of something* (*heneka tinos*) in the more technical sense, and rather speaks in terms of something being 'for' (*pros, charin, eis* or *epi*) some function.<sup>19</sup> Both Aristotle's cautious use of teleological language and his references to material necessity as a cause of coming to be suggest that the teleology involved is 'secondary',<sup>20</sup> rather than primary.

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18 This is also why Aristotle recommends us to use an alternative mode of explanation for those parts that are not the necessary prerequisites for an essential or vital function; see *PA* I 1, 640a35-b4. I discuss this more fully in Chapter 3 of my forthcoming book.

19 Cf. Lennox (2001b), 291.

20 My distinction between primary and secondary teleology does not rely upon Aristotle's own distinction between two types of final causes, which are 'that for the sake of which' and 'that for the benefit of which' (he makes this distinction in, e.g., *Ph* II 2, 194a34-b1; *DA* II 4, 415b2-3 and 415b20-1; *Metaph* XII 7, 1072b1-3; and *EE* VII 15, 1249b15), and differs in that way from the interpretations of Kullmann,

If my interpretation is right, then the material nature of an animal has a much larger and more positive influence on the generation of animals and their parts than is usually attributed to it: the material nature does not merely constrain the realizations of parts necessary for the animal's life or being,<sup>21</sup> but also creates possibilities for the formal nature of the animal to make additional, 'non-necessary' parts that will contribute to the animal's well-being or even produces parts independently of the actions of the formal nature. While primary teleological processes thus guarantee life and identity to a living being, I believe that secondary teleology is responsible for the living being's quality of life and its well-being.

## 2 'Necessity is spoken of in many ways'

### *The problem of necessity*

The positive role I attribute to material necessity in natural generation needs further argumentation, since many scholars believe that Aristotle's own discussions of the relation between teleology and necessity (in *APo* II 11, 94b27-5a3; *Ph* II 8-9, 198b10-9a7; *Ph* II 8-9, 199b34-200b11; *GC* II 11, 337a35-8b19; *PA* I 1, 639a1-42b4, and *Metaph* I 3, 983a24-4b22) deny such an independent role of material necessity in the sublunary natural realm. These scholars argue that, because Aristotle denies that there is any *unqualified* necessity in the sublunary natural realm, ultimately, references to material necessity in biological explanations need to be subsumed under, if not reduced to, the operation of *conditional* necessity.<sup>22</sup>

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Bodnár, and Johnson. Kullmann (1985), 173 uses the term 'secondary teleology' to indicate that an end is the beneficiary of something, but not a 'that for the sake of which' in a strict sense. Bodnár (2005; 24-5) also builds upon Aristotle's own distinction: in 'straightforward' teleology, the goals are not also the beneficiary of the teleological structure, while in inter-species teleology the goals are the beneficiary of the teleological structure. Finally, Johnson (2005) uses the distinction between the 'that for the sake of which' and the beneficiary as one of his central tools for making sense of Aristotle's explanations. None differentiate between 'primary' and 'secondary' teleology in the way that I propose.

21 On this 'constraining' role of material necessity in the generation of animals, see Lennox (2001a), 182-204.

22 See Cooper (1987), 255-9 and Lennox (2001a), 36n38; (2001b), 233. My account is most congenial to that of Gill (1997), 146-7.

Building instead on Kupreeva's analysis of necessity in Aristotle,<sup>23</sup> I shall here argue that this view rests upon confusions about the ways in which Aristotle uses the different concepts of necessity.

In particular, I believe that scholars have mistakenly taken Aristotle to be talking uniformly about the nature of *causality* that governs natural processes in his discussions of teleology and necessity, while in fact (or at least so I shall argue) he is often rather concerned with the nature of *causal inferences* and with the necessity that obtains between cause and effect in causal sequences (i.e., with whether cause and effect follow each other always and necessarily, or rather for the most part and contingently). In addition, it appears that in some cases they have wrongly identified Aristotle's notion of material necessity with his notion of unqualified necessity.<sup>24</sup>

Since it is not possible to present a discussion of all the relevant texts here, I shall instead offer an overview of the different uses of necessity in Aristotle and apply those to key passages in *PA* I 1, the text that is most relevant for the understanding of Aristotle's theory of explanation in biology.

### *Three types of necessity: material, conditional, and unqualified*

The crux for a better understanding of Aristotle's use of the different notions of necessity lies in what Kupreeva calls a difference between a 'causal' and a 'modal' use of necessity.<sup>25</sup>

Usually, and especially when discussing the types of cause that are operative in nature (such as in *Ph* II 9, 199b34-200a15), Aristotle refers to necessity to indicate a particular type of causality. This is the causal use of necessity: it refers to the necessity of materials acting according to their own material nature in a way that is either dependent or indepen-

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23 Kupreeva (forthcoming)

24 For the identification of material necessity with unqualified necessity, see Cooper (1987), 259-60; 266; Gill (1997), 147; and Johnson (2005), 154-5; 191.

25 Note that Kupreeva's observation that Aristotle sometimes *uses* (his familiar notions of) necessity in a *modal way* (i.e., in order to identify the type of necessity that obtains between cause and effect in causal sequences) does not require us to attribute a (contemporary) notion of 'modal necessity' to Aristotle, which is a move I would resist.



dent of some pre-existing potential for form that needs to be realized (i.e., conditional versus material necessity).

In other contexts, however, and in particular when discussing the type of demonstration required in the natural sciences as opposed to that required in the other theoretical sciences dealing with eternal objects (such as in *PA* I 1, 639b29-40a9, *Ph* II 9, 200a15-22, and *GC* II 11, 337b14-25), Aristotle uses necessity to refer to a particular type of modal relationship between two consecutive or simultaneous states of affairs in a continuous causal sequence. This is the modal use of necessity: it pertains to the question of whether in such a causal sequence a cause necessitates its effect always (in which case the relation between cause and effect is one of unqualified necessity), or only for the most part (in which case the relation between cause and effect is one of necessity in a qualified way). Aristotle is interested in the nature of the relation between cause and effect in causal sequences, because it determines what kind of inferences we can draw about the phenomena in question, and these inferences in their turn determine the kind of demonstrations one ought to give. Let me further clarify these distinctions below.

First, Aristotle uses 'necessity' *simpliciter* (or more specifically, the expression 'of necessity', *ex anagkês*) for the most part to refer to the causal process of coming to be in which some outcomes are necessary, given the *material natures* of the things involved in that process. This is the type of necessity that is known in the scholarly literature as 'material necessity'. Aristotle uses this expression to either refer to a certain type of causality (in opposition, for instance, to final causality), or to a certain type of causal chain. That is, within a materially necessitated causal sequence in which the cause (e.g., a complete cessation of heat in water) is responsible for the coming to be of the effect (e.g., the formation of ice; for the example, see *APo* II 12, 95a16-21), the expression 'of necessity' signifies that it is the material nature of the subject (e.g., water), which — in the sublunary realm: for the most part — necessitates the coming to be of the effect (e.g., given the material nature of water, a body of water will solidify due to complete cessation of heat). Because material necessity does not always necessitate its effects in the sublunary realm, the inference we can draw on the basis of the presence of the cause in such rectilinear materially necessitated processes is that only *for the most part* the effect will come to be as well, but not that it always does.

Secondly, 'conditional necessity' usually refers to the kind of causal necessitation involved in primary teleology, in which the things that come to be do so because they are necessary for the realization of an

end, which is itself specified by the definition of the substantial being of something. When used in reference to a causal chain, it indicates that the coming to be of the prior event in that causal chain is conditional upon the necessity of the posterior, i.e., the effect and final cause, to come to be. The prior is a necessary precondition for the realization of the posterior, which when realized constitutes that for the sake of which the prior is present. The direction of necessity here works from the (prior) necessitating causes to the effect, although what chronologically comes to be last (i.e., the end that constitutes the final cause) is prior in explanation. In those cases where conditional necessity obtains, the coming to be or presence of the prior (e.g., foundations) is necessary *only on the condition* that the posterior (e.g., a house; for the example, see *APo* II 12, 95b32-8) is to be realized. Inferences in these cases are one-directional: the coming to be or presence of the prior does not always necessitate the coming to be or presence of the posterior, and hence one can only draw the inference that if the posterior has come to be or is present, then necessarily also the prior has come to be or is present. In other words, the chronological end point of the causal chain provides the starting point for the inference to be used in a demonstration or explanation.<sup>26</sup>

Finally, Aristotle mostly uses the expression ‘unqualified necessity’ to refer to the ‘absolutely’ necessary relation between the prior and the posterior in a consecutive causal sequence, in which the prior always, without exception, necessitates the posterior, because the occurrence of the posterior is necessary without qualification — the process of necessitation cannot be stopped by the interference of other factors. This allows for inferences from the prior to the posterior in those cases where unqualified necessity obtains (for instance, in mathematics, or in cyclical natural processes): if the prior (e.g., clouds) comes to be, then necessarily and without exception, the posterior (e.g., rain) will come to be too. As we would say, the prior in these cases is both necessary and sufficient for the coming to be and presence of the posterior. In cyclical processes, the inference works in both directions, because the causal nexus is reciprocal.<sup>27</sup>

In some cases, Aristotle also uses the expression ‘unqualified’ to indicate that the necessity responsible for some outcome does not pre-

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<sup>26</sup> I explain this in Leunissen (2007), 168-70.

<sup>27</sup> Cf. Charles (1988), 14-17.

suppose and is not dependent on the presence of a form that is to be realized, and that in that sense, the necessity involved is 'simple' or 'unconditional', as opposed to 'conditional' (see for instance *Ph* II 9, 199b34-200a15). This use, however, is less prevalent than the modal one. Unqualified necessity, understood as a means to qualify the necessity between two events in a causal chain, cannot as easily be identified with material necessity, which indicates primarily a type of causality. This is even more so, because most materially necessitated processes in the sublunary realm are rectilinear and allow for exceptions (the effect need not always come about), while unqualified necessity indicates that effect follows cause necessarily and always.

These distinctions between 'causal' and 'modal' uses of necessity, and between material and unqualified necessity, are important, for it is only unqualified necessity in a modal sense that Aristotle denies applies to rectilinear natural processes in the sublunary realm.<sup>28</sup> That is, in the sublunary realm, Aristotle says that we cannot simply draw inferences from the existence of the prior to the existence of the posterior. The difference between the two domains is that in the realm of the heavenly bodies, where all causal chains are eternal and cyclical, the prior always necessitates the posterior (i.e., sequences are necessary without qualification); however, in the changing, sublunary realm the prior necessitates the posterior only for the most part (either by material or by conditional necessity). Aristotle needs to clarify these distinctions, because the validity of demonstrations — especially in the natural sciences — depends on the correct representation of the necessary relation between items in a causal sequence in those demonstra-

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28 Aristotle explains the difference between a conditionally necessary causal chain and an absolutely necessary causal chain in *GC* II 11, 337b14-25: in the case of conditionally necessitated processes, the coming to be of the prior (e.g., foundations) is necessary *if* the posterior (e.g., a house) is to be, but it is not the case that once the prior has come to be, the posterior necessarily will come to be as well (i.e., the presence of foundations does not guarantee the presence of the house). Only if a process of coming to be is absolutely necessary, for instance, when we posit that the relationship between foundations and a house is necessary 'without qualification', would the causal inference 'if there are foundations, the house will be as well' be valid. Aristotle explains that this kind of unqualified necessity only holds for things that are eternal and/or are subjected to eternal cyclical processes (such as the movement of the heavens, the evaporation-cycle, and the cycle of air; see 337b30-8a18), whereas conditional necessity holds of the generation of animals, which is a sublunary natural process that is rectilinear and that concerns beings whose substances are perishable (338b6-11).

tions.<sup>29</sup> The problem of the structure of demonstration in the natural sciences is central to Aristotle's discussion of teleology and necessity in *PA I 1*, to which I shall turn now.

*Teleology, necessity, and demonstration in PA I 1*

In *PA I 1* Aristotle sets out to solve a number of methodological dilemmas pertaining specifically to the study of nature. The discussion of demonstration in the natural sciences, and how it is different from demonstration in the other theoretical sciences, is itself part of a critique of the modes of explanation employed by Aristotle's predecessors, who attempted to trace back all their explanations to necessity (639b21). Aristotle faults them, not for picking out a type of causality that has no independent role to play in the sublunary world, but rather for not making the right distinctions between the ways in which necessity in nature is spoken of (639b22: *ou dielomenoi posachôs legetai to anagkaion*). Aristotle puts forward two types of necessity that both pertain to natural beings: 'unqualified necessity' and 'conditional necessity' (639b22-9):

The [necessity] that is unqualified belongs to the eternal things, and the one that is conditional also belongs to all things that come to be (τὸ δ' ἐξ ὑποθέσεως καὶ τοῖς ἐν γενέσει πασιν), as well as to things produced, such as to a house and to any other such thing. For it is necessary that such material is present, if there is to be a house or any other end: and it is necessary that first this comes to be and is changed, and next that, and so step by step up to the end and that for the sake of which each thing comes to be and is. It is the same way too for things that come to be by nature.

In this passage, Aristotle differentiates the domains of the natural world<sup>30</sup> according to the type of necessity that pertains to it, and thereby introduces a special type of necessity into the domain of generated natural beings. While unqualified necessity holds of the eternal, natural

<sup>29</sup> See *APo* II 11, 94b23-6; II 12 and II 16; cf. Charles (1988), 7-8.

<sup>30</sup> Pace Gotthelf (1987; 170-1), I believe the contrast between the eternal and the generated to be a contrast *within* the realm of the natural, and not between mathematics and the science of nature; this is clear from the introduction of the issue (*PA I 1*, 639b20: *to d'ex anagkês ou pasin huparchei tois kata plusin homoiôs*).

realm of the heavenly bodies, among the *generated* natural beings there is *also* a kind of necessity present, namely conditional necessity (this is what I take to be the most natural reading of the particle *kai* in 639b23). Aristotle then gives a characterization of conditional necessity in terms of the material that has to be present first, and the changes that have to take place, if some end is to be realized.

The aim of this passage is not to deny the existence of material necessity in the sublunary realm, but to introduce a special kind of necessity in that realm, which is conditional, and which involves a special form of causal inference. Aristotle's explication of conditional necessity (in 639b26-9) is important in this context, because it shifts the focus from causality to causal inferences: it specifies the causal sequence and the type of inference that belongs to (non-cyclical) generations of sublunary natural things. The 'mistake' Aristotle's predecessors have made is to have neglected the conditionality of necessity pertaining to all generated things, both natural and artificial. Thus, when giving explanations in terms of necessity with regard to (non-cyclical) *generated* natural things, one should not make the mistake of thinking that the necessity of the causal sequence is absolute (as is the case in eternal natural processes). That is, one should not think that the prior *necessitates without exception* the coming to be of the posterior, but rather acknowledge the fact that the prior is merely a necessary precondition of the posterior.

The distinction between the necessity involved in different kinds of causal sequences is relevant for the discussion of demonstration proper, to which Aristotle turns next (639b29-40a9):

However, the mode of demonstration and of necessity is different (ἀλλ' ὁ τρόπος τῆς ἀποδείξεως καὶ τῆς ἀνάγκης ἕτερος) in the natural and the theoretical sciences. These have been discussed elsewhere. For the starting point is in some [i.e., the theoretical sciences] what is, but in others [i.e., the natural sciences] what will be. For: 'since health or man is such, it is necessary that this is or comes to be', but not 'since this is or has come to be, that of necessity is or will be'. Nor is it possible to connect the necessity in such a demonstration to eternity, so as to say, 'since this is, therefore that is'. These matters too have been determined elsewhere, namely in what sorts of things [this kind of necessity] is present, what kind of processes convert and because of what cause.

Demonstrations have to pick out the right kind of necessity: for most generated natural beings, causal sequences from the prior to the poste-

rior can be interrupted (for the necessity is not connected to eternity), which is why one can only draw inferences from what has already come to be to its antecedent causes. The starting point for demonstrations in the natural sciences<sup>31</sup> is thus the posterior, or the realized end, from which its necessary antecedents can be deduced: the inference in natural demonstrations is one-directional from end to the preconditions of the end. For the objects of the theoretical sciences, where the necessity can be connected to eternity and where the sequences of causes convert, the inferences work in two directions: if this is, then that, too, will be.<sup>32</sup> For a demonstration to be valid, it has to capture the ‘direction’ of the inference in the right way.

At the end of *PA I 1*, Aristotle offers an example of what such a demonstration in the natural sciences should look like (642a32-b2):

One should give demonstrations in the following way, for example, breathing *exists* for this [i.e., cooling], while it [i.e., cooling] *comes to be* from necessity because of these (δεικτέον δ' οὕτως, οἶον ὅτι ἔστι μὲν ἡ ἀναπνοὴ τοῦδὲ χάριν, τοῦτο δὲ γίγνεται διὰ τάδε ἕξ ἀνάγκης). But ‘necessity’ sometimes means that if this is to be that for the sake of which, then these must be so [i.e., by conditional necessity]; but at other times it means that things are so in respect of their character and nature [i.e., by material necessity]. For it is necessary for the hot to go out and come in again upon meeting resistance, and for the air to flow in — that is already necessary. But because the heat meets internally

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31 Normally, Aristotle depicts natural science as being itself one of the theoretical sciences (see Lennox 2001b, 129; *Metaph VI 1*, 1025b18-6a23 and *PA I 1*, 641b11), and distinguishes the theoretical sciences from the practical and productive ones. Here Aristotle singles out that part of the science of being that is concerned with *generated* things from that which is concerned with *eternal* things. I believe that this reading is most consistent with the preceding distinctions between the natural generated beings on the one hand and the eternal (natural) beings on the other. Natural science thus has to be understood in the narrow sense of the science that deals with natural, perishable substances. For alternative interpretations, see Lloyd (1996), 29, and Johnson (2005), 162-3.

32 Cf. *Ph II 9*, 200a15-22, where Aristotle discusses the validity of inferences from the prior to the posterior (and the other way around) in causal sequences dealing with mathematical objects on the one hand, and natural, generated objects on the other hand. The inferences in both domains are one-directional, but the direction is reversed: in mathematics, the inference is from the prior to the posterior, while in natural generation the inference is from the posterior to the prior. See Gotthelf (1987), 197-8.

with resistance, the reason of the entrance and the exit [of the air] is in the cooling (ἐν τῆ ψύξει; for this use of *en* compare *Ph* IV 3, 210a21).

In this example, Aristotle illustrates the structure of demonstrations in the natural sciences, but also, and perhaps more importantly, acknowledges explicitly the explanatory power of references to both conditional necessity and the type of necessity power of references to both conditional necessity and the type of necessity rooted in the material nature of elements. Breathing is for the sake of something, namely cooling, and an animal will have to be able to cool itself if it is to live (cf. *PA* III 6, 669a11-13; 669a12-13: *hōst' en tōi pneumati autōn einai to telos tou zēn*); hence the organs for cooling come to be by conditional necessity and primary teleology. However, the circulation of air itself does not occur for the sake of something, nor is it conditional upon some end: it happens in accordance with and due to the element's natures and powers. As Aristotle puts it: the circulation of air is *already* (i.e., not conditionally, but materially) necessary (*PA* I 1, 642a36: *hêdê anagkaion*), and can subsequently be used by the formal nature of an animal for a secondary purpose (such as voice: see *DA* II 8, 420b13-20). In sum, if Aristotle's own example<sup>33</sup> of an explanation of a natural phenomenon refers to both conditional and material necessity, we should expect his actual explanations to include references to material necessity as well.<sup>34</sup>

### 3 Conclusion

In this paper, I have outlined an interpretation of teleological explanation in Aristotle's biology that integrates both conditional and mate-

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33 However, as Lennox (2001b), 151, points out, this example does not exactly represent Aristotle's own account of the mechanics of breathing as he describes it in *Juv* 27, 480a25-b4. Of course, it is not uncommon for Aristotle to use examples that draw from common beliefs, rather than from his own theories (cf. Balme 1972, 101), but this does not mean that Aristotle is not committed to the general pattern of explanation — especially since he is giving an example of good practice. Bos and Ferwerda (2008, 189-96) suggest that the main subtext for Aristotle's example is Plato's account of respiration in *Ti* 78d and 79d. Under this interpretation, Aristotle acknowledges the causal influence of material necessity in the process of respiration as described by Plato, but corrects him for having neglected teleology: ultimately, it is the function of cooling that explains why breathing takes place in animals.

34 Cf. Cooper (1987), 257-8.

rial necessity. I have argued that in his explanations Aristotle picks out (roughly speaking) two types of teleology that go together with two types of necessity: primary teleology with conditional necessity, and secondary teleology with material necessity. Parts are always *present* in the animals that have them because of the function they perform, but their *coming to be* is due to either one of two different kinds of necessity, in interaction with different kinds of actions performed by the formal nature of an animal. Usually, nature conditionally necessitates the coming to be of the part's constitutive materials and 'makes' that part. Sometimes, however, nature simply 'uses' materials already available due to material necessity for the production of beneficial features, or even 'lets' materially necessitated processes take their own course in the formation of such structures. All these processes are teleological, but not in the same way.

This integration of material necessity in secondary teleological explanations lends support, I believe, for the view that Aristotle's theory of teleology was not developed for the sake of replacing the materialist explanations of his predecessors.<sup>35</sup> For Aristotle, material natures usually operate under the constraints of teleology, but not always, and not every feature of an animal is a realization of a pre-existing potential for form. When Aristotle restricts unqualified necessity to the eternal realm of the heavenly bodies he does not thereby deny the existence of material necessity in the sublunary realm. He rather points out that in causal sequences that take place in the heavenly realm the prior always necessitates the coming to be of the posterior, because the coming to be of the posterior is necessary 'without qualification'. In the sublunary realm the posterior in a causal sequence is (unless the sequence is circular) never necessary 'without qualification', whether it is necessitated by conditional necessity or by material necessity — a fact which has repercussions for the structure of demonstrations to be offered in the natural sciences.

The role of material necessity in the sublunary realm is therefore not confined to the negative part of constraining the realizations of ends in natural beings. It also has a more positive role to play, in that it provides extra possibilities — 'extra' in the sense that the possibilities are not already given with the soul a certain kind of animal possesses — for the realization of features that may contribute to the animal's well-being.

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35 First put forward by Sauvé Meyer (1992), 794-5; 820-5.



Nature does more than just providing the means for living — if possible, it also provides the means for living well.

Washington University in St. Louis  
Department of Philosophy  
Campus Box 1073  
One Brookings Drive  
St. Louis, MO 63130-4899  
U.S.A.  
mleuniss@artsci.wustl.edu

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