

## CHAPTER I

*Explanatory Strategies in the De incessu animalium**Andrea Falcon***The Initial Agenda of the *IA***

In the *IA*, Aristotle is concerned with many complex questions (some interrelated and some independent or at least outlying) about how animals move themselves by using parts of their bodies as instruments of locomotion. The key questions are recalled at the outset of the work, which begins with an agenda of eleven questions that Aristotle promises to answer in the course of his investigation by employing three explanatory principles explicitly introduced for that purpose in *IA* 2.

These are not all the questions that Aristotle will try to answer in the *IA*. It is quite telling that, at the end of his agenda, Aristotle adds that we have to look for the causes of the facts that have been singled out (*sc.* in the agenda), *or for other similar facts*.<sup>1</sup> Evidently, his initial list does not contain all the questions that are relevant to the topic of animal progression. In the course of his investigation, Aristotle is able to consider issues that are not in his initial purview. A good example is offered in *IA* 14 and 15, where two questions that are not announced at the outset of the work are discussed. Sarah Ruth Jansen argues that these new questions naturally arise from the need to deal with *prima facie* exceptions to the account of animal progression developed up to that point.<sup>2</sup> Evidently, the agenda does not impose a rigid structure on Aristotle's inquiry but rather constitutes a convenient platform from which to embark on a study of how animals move that must account for the complexity of the zoological data.

My interest in the *IA* goes back to a reading group devoted to this work held at the University of Pittsburgh in the Winter Semester of 2009. The reading group consisted of four people: Allan Gotthelf, Keith Bemer, Peter Distelzweig, and myself. I am happy to acknowledge that my ideas on the initial agenda of the *IA* were first developed at those meetings as a result of our teamwork. I remember those meetings with a mixture of fondness and sadness as both Allan Gotthelf and Keith Bemer are no longer with us. This introductory essay as well as the essay on *IA* 1–3 (ch. 3) are dedicated to the memory of Keith Bemer, whose intelligence, curiosity, and above all kindness, are greatly missed.

<sup>1</sup> See *IA* 1, 704b8.

<sup>2</sup> See below, "Teleology Across Kinds" (ch. 10).

With the caveat introduced in the above paragraph, it remains true that the initial agenda provides not only a theoretical framework to the entire investigation but also unity to the treatise as a whole. Moreover, Aristotle's methodological explicitness gives us a way to assess the outcome of his investigation. In other words, explanatory success (or failure) in the *IA* can be measured against the initial agenda. If Aristotle is able to offer an adequate answer to the eleven questions on his agenda, he has completed his task as stated at the outset of the work; if he is not, he has fallen short of the task that he has set for himself. Of course, it remains to be seen if by answering those questions Aristotle has also offered an adequate explanation of the phenomenon of animal progression. For example, one might acknowledge that at the end of the *IA* Aristotle has answered all the questions on his agenda (as well as a few additional questions) and at the same time object that Aristotle has not given us a completely adequate explanation of animal progression. To counter this objection we would need to be able to establish, among other things, how Aristotle has arrived at the formulation of his initial questions. This would not be an easy task, especially since Aristotle does not elaborate on the origin of his agenda. He does not tell us how the agenda is organized, or why the questions that we have to answer are exactly those eleven questions.

This last observation makes it even more pressing for us to try to explain why Aristotle does not defend the adequacy of his initial agenda. In the absence of an explicit statement on the part of Aristotle, we can only venture an educated guess. His position may be that answering the initial eleven questions is also a vindication of the list itself and its merits as an initial agenda for the inquiry conducted in the *IA*. Put differently, when we follow Aristotle in his attempt to answer the questions on his agenda, we are also expected to come to see their relevance for the investigation, and see that an answer to the eleven questions on the agenda amounts to an adequate account of animal progression.

Here are the eleven questions in the order in which Aristotle lists them in *IA* 1:

- [Q1] What are the fewest points at which animals move?
- [Q2] Why do blooded animals move by means of four points while bloodless animals move by means of more than four points?
- [Q3] Why, in general, are some animals footless, some two-footed, some four-footed, and some many-footed?
- [Q4] Why do all the animals that have feet have an even number of feet?

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- [Q5] Why, in general, are the points by means of which animals move even in number?
- [Q6] Why are human beings and birds two-footed whereas fishes are footless?
- [Q7] Why do human beings and birds, being both two-footed, bend their legs in opposite directions (human beings convexly while birds concavely)?
- [Q8] Why do human beings bend their legs and arms in opposite directions?
- [Q9] Why do the four-footed animals that are live-bearing bend their legs in the opposite way to human beings and also in opposite ways with respect to themselves (front legs convexly while hind legs concavely)?
- [Q10] Why do the four-footed that are egg-laying bend their legs in a way unique to them, namely laterally away from their body?
- [Q11] Why do four-footed animals move their legs diagonally?

I refer the reader to the first interpretative essay for additional reflection on the organization and structure of this agenda.<sup>3</sup> For the time being, I am content to make the following observation: the above questions are not established independently of the investigation conducted in the *IA*. In other words, Aristotle is not recalling an agenda that was generated at a *pre-explanatory* stage of inquiry by merely collecting and organizing the relevant empirical data and is now available to us as we are about to approach the *explanatory* stage of inquiry. On the contrary, his agenda reflects (at least in part) the results reached in the course of the explanatory stage of inquiry. Consider, in particular, [Q1], [Q2], and [Q5]. These questions are concerned with “points of motion.” We do not see points of motion when we observe an animal moving from one place to another. Rather, the points of motion by means of which the animal moves with respect to place are an important explanatory device that Aristotle introduces in the course of his attempt to develop a conceptual model to deal with animal locomotion.<sup>4</sup> The significance of this observation can hardly be overstated. At the very least, we are able to infer that our initial agenda

<sup>3</sup> See “The Theoretical Framework and the Beginning of the Actual Investigation” (ch. 3).

<sup>4</sup> *HA* I 5, 490a26 ff. refers to points of motion, but this stretch of text seems to presuppose the discussion offered in *IA* (rather than *vice versa*). We should bear in mind that *HA* may have been the last work that Aristotle wrote on the topic of animals, entailing some rethinking of the results achieved in the rest of the zoological corpus. David Balme was the first to suggest this possibility. The best, and indeed clearest, presentation of this suggestion – with a wealth of evidence – is LENNOX 1996: 229–248.

is not entirely innocent with respect to the explanatory work done in the *IA*. This last point can be restated as follows: while it is true that Aristotle refers to a collection of the relevant facts (ἱστορία) right after he has given us his initial agenda, this collection alone does not deliver the questions on our initial agenda.<sup>5</sup>

### Points of Motion and Number of Feet

One important distinction, which also marks the beginning of Aristotle's actual investigation in *IA* 3, is that bodily displacement takes place by means of either jumping or progression (πορεία). In calling the second mode of bodily displacement progression, I am following William of Moerbeke (the first translator of the *IA*), who rendered πορεία with *progressus*.<sup>6</sup> While in jumping the body is displaced all at once, in progression the body is displaced part by part (κατὰ μέρος). This second mode of bodily displacement is Aristotle's primary focus in the *IA*. The parts of the body involved in animal progression are called instrumental parts.<sup>7</sup> By adopting this expression, Aristotle indicates that these parts are used by the animal as a tool to produce motion. Hence, my decision to say that Aristotle is concerned with how animals move themselves by using parts of their bodies as instruments of locomotion. As Aristotle explains toward the end of *IA* 3, the animal that moves itself displays a minimal level of complexity: one part is acted upon by the other by being compressed, the other acts on it by pressing. Hence, nothing that is partless can move itself.<sup>8</sup>

Aristotle begins his investigation with a study of how animals progress on land by means of feet. Moreover, he defines the foot as the part that is in contact with the ground and as such is productive of locomotion.<sup>9</sup> We can restate this first move by saying that Aristotle begins his study by focusing on the case of *footed* animals. If, however, we want to appreciate Aristotle's overall explanatory strategy, we need to bear in mind another important decision implicitly made at the outset of the *IA*. The study of how animals move from place to place begins with a study of locomotive parts in *blooded* animals. The focus on blooded animals is already in place

<sup>5</sup> The language that Aristotle adopts in referring to the collection of facts is quite interesting. For more on this point, see the first interpretative essay.

<sup>6</sup> See below, "The Reception of the *De incessu animalium*" (ch. 2).

<sup>7</sup> *IA* 3, 705a20.

<sup>8</sup> *IA* 3, 705a20–24. Full discussion in "The Theoretical Framework and the Beginning of the Actual Investigation" (ch. 3).

<sup>9</sup> *IA* 5, 706a31–32.

at the outset of *IA* 6. It is in this chapter that Aristotle lays down the foundation for the claim that opens *IA* 7: motion with respect to place belongs, either only or above all, to those animals that make change with respect to place either by means of two or four points.<sup>10</sup> The animals in question are blooded animals, which are used as a paradigmatic case. It is telling that it is only when a study of the locomotive parts in blooded animals is firmly in place that Aristotle ventures into the study of bloodless animals, which are lower on the *scala naturae*.

The central claim made in *IA* 6 is that there has to be a common origin of motion that is equally disposed with respect to the locomotive parts. In other words, the locomotive system described in *IA* 6 is envisioned as a centralized system with a single source of locomotion. Aristotle makes this source the cause of motion with respect to place.<sup>11</sup> Given that Aristotle is firmly committed to cardiocentrism, there is no doubt that he thinks that this source of motion is a perceptual soul, and that in the case of blooded animals this soul is located in the heart. Still, it is significant that Aristotle refrains from talking about the soul and the heart in *IA* 6. It is not immediately clear why Aristotle does not elaborate on the soul and the heart in the *IA*. In the absence of clear hints in the text, we can only offer an educated guess. In all probability, a discussion of the soul and its relation to the body pertains to the study of what is common to the body and the soul rather than to a study of the locomotive parts and their role in the explanation of animal locomotion. In his interpretative essay, Klaus Corcilius expands on the reasons why Aristotle remains silent on the topic of the soul and the heart in *IA* 6.<sup>12</sup> Here I am content to stress that if we accept Corcilius' reading of *IA* 6, we have a very good reason to resist the temptation to assimilate the *IA* to the short essays on natural philosophy that are collectively known as *Parva naturalia*. This conclusion is important because the place of the *IA* in the larger project that is known as Aristotle's natural philosophy is far from being obvious. Evidence of this is that the position of the *IA* in the Aristotelian corpus is notoriously unstable.<sup>13</sup>

In *IA* 6 Aristotle develops a highly abstract account of what a certain kind of locomotive system requires in order to perform its primary function, which is to move from one place to another. Although Aristotle generates this account for the explanation of how blooded animals move,

<sup>10</sup> *IA* 7, 707a16–19.

<sup>11</sup> *IA* 6, 707a12.

<sup>12</sup> See "The Architecture of Locomotive Bodies" (ch. 5).

<sup>13</sup> See below, "The *IA* in the Early Printed Editions of Aristotle" (ch. 2).

he subsequently adopts it to explain the motion with respect to place of *bloodless* animals. Aristotle's explanatory strategy becomes clear as soon as we realize that Aristotle conceives of bloodless animals as locomotive systems to which *additional* points of motion are attached to the original four. Moreover, because additional points are attached, these systems do not display the same level of integration and unity as the one studied in *IA* 6. One concrete example may help to illustrate Aristotle's strategy and overall approach to the study of bloodless animals. An ant moves by means of six feet. By Aristotle's lights, an ant is neither a two-footed nor a four-footed animal: rather, it is a *many-footed* animal. Aristotle conceives of such an animal as a locomotive system consisting of four + two points of motion. We may think that having more than four feet allows an animal to perform its function – moving with respect to place – in a better, quicker, and indeed more efficient way. But Aristotle never makes this observation. His first and most important concern is to stress that a unit consisting of more than four points of motion is a less unified, and indeed less well-integrated, locomotive system. It is a less unified, and less well-integrated, locomotive system precisely because Aristotle thinks of this unit as having four + two points of motion. Of course, Aristotle will have to posit that there is still a controlling center in this system if he wants to account for the locomotive behavior of the animal. By his lights, however, this controlling principle, which is situated in the analogue to the heart,<sup>14</sup> is not equally well disposed with respect to all the six points of motion.

It is along these lines that we must understand Aristotle's claim that, while blooded animals cannot continue to live and move if they are severely mutilated, some many-footed bloodless animals can. They can because they are compounded out of several animals.<sup>15</sup> In this context, Aristotle mentions the centipede. By his lights, all animals that have an elongated body and are like the centipede enjoy a weaker type of unity compared to blooded animals. In a few cases, the unity is so weak that the animals consist of relatively independent locomotive units. As a result, each unit can survive and move even if separated.<sup>16</sup>

The significance of the decision to study bloodless animals by analogy with blooded animals can hardly be overestimated. This decision allows

<sup>14</sup> Recall that, according to Aristotle, bloodless animals do not have a heart but they do have something that plays an analogous role in their physiology.

<sup>15</sup> *IA* 7, 707a27–31.

<sup>16</sup> For full discussion of this claim, see "Number and Distribution of Feet in Animal Progression" (ch. 6).

Aristotle to arrive at a unified account of animal progression – namely, an account that applies to both blooded and bloodless animals without reducing or eliminating the differences between the two groups of animals.<sup>17</sup> But this decision is not without costs. One thing that is obvious, even from a cursory glance at the *IA*, is how selective the treatment of progression in bloodless animals is. It is hard to resist the conclusion that Aristotle's approach to the progression of bloodless animals would have been significantly different if it did not depend on the assumption that their progression ought to be understood in light of the results achieved in the study of blooded animals.

In *IA* 6 Aristotle lays the theoretical foundations to answer the first two questions on his initial agenda. Both are questions dealing with points of motion. While the first is about the fewest number of points by which an animal moves, namely [Q1], the second is concerned with those points of motion in blooded and bloodless animals, [Q2]. It is worth noting, however, that Aristotle does not announce *IA* 6 as an attempt to answer those questions; rather, our answering them is a by-product of Aristotle's study of what it takes for a locomotive system of the kind he envisions in *IA* 6 to move from place to place. This observation confirms a point I made earlier in dealing with the agenda of the *IA* – namely, our agenda cannot be established independently of the investigation conducted in the *IA*.

With this observation in place, we can turn to how Aristotle organizes his discussion in *IA* 7–8. A close look at the explanatory strategy adopted in these two chapters helps us appreciate how Aristotle deals with the complexity, and indeed the variety, of animal progression. First, Aristotle begins his investigation by (re)stating the main result reached in *IA* 6: if  $x$  is a blooded animal, then  $x$  moves by means of four points of motion; moreover, if  $x$  moves by means of four points of motion,  $x$  is a blooded animal.<sup>18</sup> Then, he turns to *footless* animals in order to show that, despite appearances to the contrary, they too move by means of four points. Dealing with footless animals, and dealing with them at this stage of the argument, is crucial because these animals are a potential counterexample to what Aristotle has just established. Footless animals with an elongated body such as snakes or eels move on the ground or in water by means of two bends. Aristotle argues that we can distinguish two points of motion

<sup>17</sup> Recall that the transition from blooded to bloodless animals is made by invoking analogy. Bloodless animals have a bodily part that is *analogous* to the heart. In the Peripatos, analogy is an explanatory tool specifically designed to deal with reality without reducing or eliminating its complexity.

<sup>18</sup> *IA* 7, 707a20–23.

at each of the two bends. Hence, despite the appearance to the contrary, footless animals such as snakes and eels move by means of four points of motion like all blooded animals.

By dealing with an apparent challenge to his basic account – footless animals – Aristotle is able to vindicate the statement made at the outset of *IA* 7 – namely that all blooded animals move by means of four points of motion. Moreover, he is able to give us a better understanding of the sort of locomotive systems he has in mind. It is only at this point that Aristotle turns to the case of snakes in order to explain why they are footless. This happens in the first part of *IA* 8, which is also one of the best-known sections of the *IA*. Here Aristotle applies the explanatory principle outlined at the outset of the *IA* – namely, that nature does nothing in vain but always what is best with the possibilities available for each kind of animal.<sup>19</sup> Scholars have often returned to Aristotle's explanation of why snakes are footless in the attempt to shed light on how Aristotle understands this teleological principle. The reader will find in the essay by Stasinou Stavrianeas a careful discussion of how Aristotle applies this principle in *IA* 8, and a reflection on what we can learn from Aristotle's discussion of the absence of feet in snakes.<sup>20</sup>

Once Aristotle has dealt with the absence of feet in snakes, he is able to return to *footed* animals in order to show why all footed animals must have an even number of feet (second part of *IA* 8). At this point, we also have an answer to two other questions on our agenda. While the first has to do with the even distribution of feet, namely [Q4], the second restates the same point with respect to points of motion, [Q5]. One final point is in order. The discussion conducted in *IA* 7–8 alone does not confirm that all blooded animals move by means of *exactly four* points of motion. More directly, humans and birds may be thought to move by means of two rather than four points of motion. Aristotle has a great deal more to say on the topic of birds and humans in the course of *IA* 10 and 11. It is only when this discussion is finally in place that we can be confident that *all* blooded animals move by means of exactly four points of motion. Until then, a perceptive reader may wonder about possible exceptions to the rule of the four points of motion. For a lucid discussion of this aspect of Aristotle's overall strategy, I refer the reader to the introductory remarks Timothy Clarke offers in his interpretative essay.<sup>21</sup>

<sup>19</sup> *IA* 2, 704b15–17.

<sup>20</sup> “Number and Distribution of Feet in Animal Progression” (ch. 6).

<sup>21</sup> “Flight and Two-Footedness” (ch. 8).



### Bending

A quick look at the initial agenda of the *IA* suffices for one to realize that the eleven questions are divided into two blocks: while the first block is concerned with number of points of motion and distribution of feet, the second is about bending and its role in animal progression. Aristotle is far from having exhausted the first block of questions at the end of *IA* 8, but he is nonetheless ready to approach the second.

Aristotle turns to bending at the outset of *IA* 9. His main claim in this chapter is that without bending (and straightening) there would be no bodily displacement. He proves this claim by focusing on the case of footed animals. Once more, footless animals can be seen as a potential counterexample. As in his discussion of points of motion, Aristotle shows that they are not. Their bodily displacement and progression on land (or in water) takes place by bending. Once established that all progression takes place by bending, Aristotle adds that also jumping requires bending in the supporting part of the body. This is a hardly surprising result, but it is required to show that *all* modes of bodily displacement require bending (and straightening).

By the end of *IA* 9, Aristotle has given us the promised explanation of why bending (and straightening) is necessary for all animals to move from place to place. However, this does not exhaust the topic of bending. His study of bending continues all the way to the end of *IA* 15 and remains a main focus in the discussion of bloodless animals offered in *IA* 16 and 17. Evidence of this is that answers to all the questions that are concerned with bending on our initial agenda can be located in this stretch of text.

1. We find an answer to the question why humans and birds bend their legs in opposite directions, namely [Q7], in *IA* 15.
2. We are offered the resources to explain why humans bend their arms and legs in opposite directions, [Q8] on the agenda, in *IA* 12.
3. We find an answer to the question why four-footed animals that are live-bearing bend their front and rear legs in opposite directions, namely front legs convexly and rear legs concavely, [Q9] on the agenda, in *IA* 12.
4. We can also locate an answer to the question why the four-footed animals that lay eggs move their legs obliquely and away from their body, namely [Q10], in *IA* 15.
5. Last but not least, the question why four-footed animals move their legs diagonally, namely [Q11], takes up a large part of *IA* 14.

Still, we may wonder whether locating an answer to the questions on the initial agenda helps us advance our understanding of the overall strategy that Aristotle adopts in this stretch of text. I don't think so. Clearly, there is a great deal more going on than an attempt to answer those questions in this section of the *IA*. Let us return to the end of *IA* 9, which consists of a few remarks on swimming and flying animals and how bending is necessary in their case as well. This discussion is carried over into *IA* 10. As soon as we realize that these animals are a focus of the chapter, we see why Aristotle finds it convenient to deal with topics such as the role of the tail in flyers, or the slow and not so efficient flight of certain insects that do not have a tail, in the course of this chapter. I refer the reader to the interpretative essay by Timothy Clarke for a detailed discussion of the various statements that Aristotle makes in the course of his analysis of flying animals.<sup>22</sup> What matters here is that the occasional discussion of bloodless animals and their locomotion – as in the case of the flyers that bump around because they have no tail – is not necessarily a violation of the overall strategy adopted in the *IA*. Aristotle has programmatically postponed the study of bloodless animals after that of blooded animals, but he deals with particular aspects of their motion in the course of the study of blooded animals, and under a common rubric, if he thinks that this strategy results in an optimal treatment of certain topics.

In *IA* 11 we are back to the study of *footed* animals – with a concentration on *two-footed* animals. Aristotle's main claim is that humans alone are, strictly speaking, two-footed. This chapter contributes to the investigation launched in *IA* 5. There, Aristotle has provided an initial description of the distribution of feet in footed animals by using the concepts of dimensions (διαστάσεις): a two-footed animal is an animal in which the front part and the upper part are clearly demarcated, whereas a four-footed or a many-footed animal does not display this distinction.<sup>23</sup> This distinction is meant to be at most an initial characterization of what it is to be two-footed (or, for that matter, what it is to be a four-footed or a many-footed animal). It is only in *IA* 11 that Aristotle completes his discussion with a close analysis of the anatomy of a bird. From this point of view, *IA* 11 does not only complete the discussion started in *IA* 5 but also continues, quite naturally, the discussion of flying animals started at the end of *IA* 9.

<sup>22</sup> "Flight and Two-Footedness" (ch. 8).

<sup>23</sup> Of course, we can still draw this distinction in four-footed and many-footed animals by invoking the different functions associated with those parts: while their upper part is the entry point of nourishment, their front part is where their organs of perceptions are implanted.