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Review of Monte Ransome Johnson's *Aristotle on Teleology*

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Aristotle on Teleology. By Monte Ransome Johnson. Oxford: Oxford University Press, 2005. Pp. xi + 339. \$74.00 (cloth). ISBN 0199285306.

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Teleology has a long and sorted past. Johnson's new book, *Aristotle on Teleology*, attempts to make the case that Aristotle was largely an innovator in this area and that teleology's sorted history is not due to Aristotle but rather to a long tradition of competing philosophical perspectives attempting to co-opt his theory for different purposes. Even today there is little consensus about the precise nature of Aristotle's teleology. The main project of Johnson's book is thus, in a nutshell, to separate fact from fiction and present a clear and systematic picture of Aristotle's actual views on the way ends function in scientific explanations. *Aristotle on Teleology* is an important contribution to Aristotelian scholarship in this respect.

The book itself is divided into two main parts. In Part I, 'Teleology as a Critical Explanatory Framework', Johnson examines 'the history, terms, logic, and available alternatives to Aristotelian teleology' (7). The aim is to discover how exactly ends are explanatory according to Aristotle. In Part II, 'Teleological Explanations in Natural Science', Johnson turns to Aristotle's actual teleological explanations of natural substances—including elements, organisms, human beings, cities, and the cosmos—in order to determine the limits of this kind of explanation.

Chapter 1 begins the discussion with a thorough examination of 'the powerful historical circumstances and trends that have influenced the interpretation of Aristotelian teleology' (15). Johnson's purpose is to identify sources of confusion in order to clear the way for a proper evaluation of Aristotle's theory. The careful study of the history of teleology and the development of its different (mis)interpretations is one of the gems of this book. It is exceptionally clear and thorough and will be of great value to anyone teaching an upper-year seminar on the genealogy of this important concept. Chapters 2 and 3 are more technical, devoted to exploring the specific terms and concepts Aristotle uses in connection with his teleology. Of central importance, Johnson argues, is the distinction he makes between two senses of the term 'for the sake of which': 'for the sake of which *of which*' (genitive object) and 'for the sake of which *of whom*' (dative object, e.g., *DA* ii 4.415b3-5). These two senses are characterized as a distinction between *the aim* of something and its *beneficiary*. According to Johnson, all natural changes occur for the sake of something in both these senses (289).

Another aspect of these chapters worth highlighting is Johnson's insightful analysis of *APo.* ii 11, where Aristotle explains (rather cryptically) how final causes function as middle terms in scientific demonstrations. This analysis lays the important groundwork for Johnson's discussion in chapter 7 of the extent to which Aristotle's biological explanations reflect those described as 'scientific' in

the *Posterior Analytics*. (I shall leave it to the reader to judge his success in this regard.)

Chapter 4 examines Aristotle's 'dialectical investigation' of his predecessors. It is in this context, Johnson argues, that many of Aristotle's most important ideas about teleology are revealed. Although I found Johnson's methodology in this chapter somewhat artificial, the overall discussion is meticulous and instructive.¹ The section on Plato is especially illuminating. In *Metaphysics* i Aristotle sets himself up (rightly, Johnson thinks) as the great innovator of teleological thinking by showing that none of his predecessors managed to posit the final cause. What is puzzling is Aristotle's utter refusal to acknowledge any of those places where Plato appears to deploy this cause. The only conclusion to draw here is that Plato did not give teleological explanations by *Aristotle's* standards. Figuring out why, Johnson argues, promises to reveal something important about the way Aristotle understands teleology.²

One of Johnson's suggestions is that in Plato all teleological explanations ultimately reduce to formal replication (119).³ This seems right to me. For example, in the *Timaeus* the starting-point of the explanation for why things are the way they are is the fact that the Demiurge wanted to make the world like 'the best of intelligible things' (30c-d). On this account, the beauty and goodness of particular things becomes a necessary consequence of their imitating changeless Forms (28a-b). Aristotle would have taken this to show that the goodness of the end has no real explanatory force for Plato, teleologically speaking. In selecting good things all the Demiurge is interested in is making copies that instantiate the properties of their model (goodness being one of them). For example, at 31b-d we are told that the Demiurge chose 'the best bonds'. But this is only because, in being the best, those bonds more closely approximate the Forms after which the world is modeled. For Aristotle, reference to the goodness of the end *as good* is an essential feature of teleological explanations. An appeal to teleology must involve showing that something is ultimately present *because* it is good, not because it bears a likeness to some more perfect Form.

In Part II Johnson turns to Aristotle's actual teleological explanations of natural substances. The discussion is nicely organized around the recommendations of *Meteorologica* i 1 concerning the proper study of nature, which involves following a hierarchy of increased complexity (339a5-10). After a brief analysis of Aristotle's account of natural change, Johnson proceeds to examine the use of teleology as applied to the elements (chapter 5), organisms (chapters 6-7), human

¹ Johnson takes Aristotle to associate each of his predecessors exclusively with one kind of cause and then proceeds to examine each in connection with 'their' cause. This does not seem right to me, especially in the case of Empedocles. Johnson claims Aristotle identified Empedocles (for dialectical purposes) exclusively with the cause 'luck' (*tuchê*). Yet in the opening argument of *Physics* ii 8 Empedocles is clearly associated with 'spontaneity' (*automaton*, 198b29-31).

² In a recent review T.K. Johansen identifies Johnson's treatment of Plato as a major weakness of his book.

³ Johnson follows Sedley 1988 here. Johnson also stresses that Aristotelian teleology requires specifying both a goal *and* a beneficiary, which is lacking from Plato's account.

beings and cities (chapter 8), and finally to the cosmos as a whole (chapter 9). The entire discussion has a nice flow to it that would have seemed natural to Aristotle. More importantly, it gives the reader a good sense of how teleology is applied across all aspects of Aristotle's philosophy. In the remainder of this review I shall focus on Johnson's analysis of the first two kinds of natural substance, elements and organisms.

Perhaps the most controversial aspect of Johnson's argument is his claim that Aristotle extended teleology all the way down to the level of elements. According to Johnson, Aristotle holds that both the locomotion of the elements to their proper place and their reciprocal transformation into one another are teleologically explicable, the former 'because their motion can be completed when they arrive at their natural place in the cosmos', the latter 'because through cyclical transmutation they resemble the circular motions of the heavenly bodies' which secures for them a kind of immortality (141). Johnson's view occupies a middle position in the literature between those who deny that Aristotle considered elemental motion to be teleological and those who take the teleological explicability of the elements as evidence that Aristotle endorsed a universal (even anthropocentric) view of teleology. Against the former Johnson argues that the fact that the elements have their own inclination towards an end shows that every complex substance that is composed of elements is from the bottom-up teleologically explicable (145). Against the latter he argues that Aristotle places strict limits on what can and cannot be explained teleologically. Rainfall, for example, is a regular process that does *not* take place for the sake of its outcome, even if it may be (coincidentally) beneficial to humans.⁴ Thus, for Johnson, Aristotle's views on elemental motion cannot be taken to support an 'over-all' teleology. More importantly, Johnson argues, the teleological explicability of the elements is not the essence of Aristotelian teleology (*contra* Lang 1988). For the motion of the elements to their proper place has little direct import for the application of teleology to living things, which Johnson maintains is at the core of Aristotle's theory (143).

Johnson makes a strong case for treating the elements teleologically. While I

⁴ Part of Johnson's argument for denying that rainfall (and other meteorological phenomena) is teleologically explicable is the idea that only *substances* are subject to teleology (156-158). For only substances can be said to have a 'nature' and there is nothing about a non-substance that can be described as 'a thing in a state of completion' (*entelecheia*). However, this suggests that *processes* cannot be explained teleologically, whereas Aristotle clearly thinks some can: e.g., the development of an embryo into its adult form. So the fact that rainfall is a process, not a substance, is not sufficient here. However, we can take Johnson to mean that there must be some substance underlying a process whose own nature is the source or origin of that change. In this way, although animal development is not itself a substance, it is the change *of* a substance (or *into* a substance). On the other hand, there is nothing underlying the process of rainfall that we could identify as a single, unified substance whose nature is an intrinsic cause of that change. Rainfall is a sort of epiphenomenon (ontologically speaking) of the transmutation of the elements and can be explained solely in terms of the sum of actualizations of the natures and potentials of the elements involved (none of which are intrinsically directed towards *rainfall*).

am not yet convinced that he is right, anyone who wants to deny that Aristotle extends teleology to the elements must first contend with his arguments. For my part, I think that *if* the elements are teleologically explicable at all, they will turn out to be so only in a very weak sense.⁵ Moreover, Johnson is certainly correct that one cannot hope to understand what Aristotle means by saying the parts of living things come to be for the sake of something by examining his views on elemental motion.

Johnson's conclusions about the teleological explicability of the elements provide the basis for his argument against the 'heuristic' (or 'Kantian') interpretation in chapter 6. According to this interpretation, Aristotle posits ends merely as a guide to discovering mechanical (material-efficient) causes and is happy to dispense with them once those 'real' causes have been found. On this reading, an appeal to teleology is only legitimate when a complete reduction to mechanical causes is unavailable. Once we are able to reduce the phenomenon to mechanical causes, the final cause is eliminated from the explanation. Johnson argues that this interpretation is misguided. Aristotle thinks nature really does contain ends and thus reference to them is an ineliminable feature of a complete scientific explanation. More importantly, the heuristic interpretation depends on the assumption that Aristotle recognized a fully independent level of existence where 'mechanistic' explanations are sufficient. However, on Johnson's interpretation Aristotle extends teleology all the way down to the simplest level of existence (the level of the elements and their locomotions). Since Aristotle thinks final causation is necessary, and indeed prior to material-efficient causation, even at this level, there is no possibility of reducing teleological explanations to mechanistic ones 'since, in the final analysis, that reduction would itself result in a teleological explanation' (185).

Johnson employs this same argument against the 'strong irreducibility' interpretation defended by Gotthelf 1987. According to Gotthelf, Aristotle believed that living things and their parts do not come to be through material necessity alone and that the absence of an account in terms of such necessities is what sanctions the use of teleology, 'since that absence alone entails that the form of the living organism has a real causal role (as aim) in the organism's generation' (Gotthelf 1997, 74). On this interpretation, the answer to the reducibility question (Can the development of a living thing be reduced to material necessity?) is the key to understanding Aristotle's teleology. Johnson argues that this interpretation is equally misguided. Since Aristotle extends teleology all the way down to the lowest level of existence, it does not make sense to talk of reducing the teleological to the non-teleological. Moreover, Gotthelf equates 'material necessity' with the sum of actualizations of elemental natures and potentials. However, Johnson argues that 'actualization' (*entelecheia*), 'nature' (*phusis*), and 'potential' (*dunamis*) are themselves teleologically rich concepts, so to speak of 'the sum of

⁵ Johnson does hold that Aristotle recognizes a scale of teleology ranging from the simple elements, on the one hand, to complex organisms and their parts, on the other (143).

actualizations of elemental natures and potentials' is already to invoke teleological language (184-186).

Johnson's arguments against the heuristic interpretation of Aristotle are important. No one who reads the biological works could take seriously the idea that Aristotle sees final causes as subjective concepts of the mind useful only in the search for efficient causes. Indeed, the central argument of *PA i 1* is that final causes are prior to efficient causes, both ontologically and in the order of explanation. I also think Johnson is right that *if* Aristotle extends teleology down to the lowest level of existence, then it does not make sense to speak of reducing the teleological to the non-teleological. My worry, however, is that even if one accepts Johnson's argument that the elements are teleologically explicable, this is not enough to rule out such a reduction. For in point of fact the simplest level of existence in Aristotle's system is not the elements, as Johnson suggests, but their *dunameis* (hot/cold/moist/dry) whose interactions are said to be responsible for 'all unqualified generation and natural change' (*Meteor.* iv 1.378b10-30).

The study of the simplest level of being forms the subject of *Meteorologica* iv. Aristotle begins by stating that the four *dunameis* are 'causes' of the elements (cf. *PA* ii 1.646a12-21) and says that by looking at 'the account we give when we define their natures' we will find that two of them (the hot and the cold) are active and two (the dry and the moist) are passive. The problem for Johnson is that throughout the discussion of these elemental forces and their natural interactions (chapters 1-11) Aristotle never once appeals to teleology. Every one of the changes described is accounted for strictly in terms of material necessity without ever invoking the cause 'for the sake of which'.⁶ So there is good evidence to suggest that at the simplest level of being change is governed entirely by *non*-teleological necessity. Johnson's failure to account for this is an important omission in his case against the heuristic and reductionist views. For without an argument to show that teleology is operative at the level of elemental *dunameis*, Johnson has left the possibility of a complete reduction of the teleological to the non-teleological on the table.

In his defense, Johnson does emphasize the importance of *Meteor.* iv 12 where Aristotle tells us that even the elements must be defined by their *ergon* and *telos* (390a7-17). One might take this to qualify the thoroughgoing materialism of the previous eleven chapters.⁷ But that does not seem right to me. As Gill 1997 has argued, *Meteor.* iv 12 is meant as a bridge between Aristotle's works on inorganic matter (*Meteor.* iv 1-11) and his study of living things. According to Gill, Aristotle's point in that final chapter is that *within a biological context* the interactions between all material-level forces (including the elements and their *dunameis*) are determined by reference to natural goals, and so *in that context* they must be defined by reference to an *ergon* and a *telos*. However, *Meteor.* iv

⁶ I am grateful to Jim Lennox for bringing my attention to this point.

⁷ Johnson has made it clear to me in conversations on this point that he understands *Meteor* iv 12 as applying retrospectively to those chapters. But there are no arguments for this (or any significant discussion of chapters 1-11) in the book. Yet some attention to the problem is surely needed.

12 also insists (in line with iv 1-11) that *outside organisms* the behaviors of such materials are fully explicable in mechanical terms without reference to ends (390b2-14).⁸

Johnson's treatment of Gotthelf's position is also somewhat unfair. For there is an important ontological dimension to Gotthelf's thesis that is untouched by the question of the teleological explicability of the elements (or their *dunameis*). Gotthelf raises the issue about the ontological relation between the developmental capacities of organisms and the basic capacities of the elements that compose them. The key question here is whether or not the nature that controls growth and development can be reduced to a set of elemental *dunameis*. If not, Gotthelf argues, then it must be a distinct potential which is *irreducibly for* an organism of some specific form. This nature would impose its own *primitive directedness* on the process of development that could not be accounted for solely in terms of a sum of actualizations of element-potentials. What is irreducible to element-potentials, here, is not final causation *per se* but the directedness of the process onto the adult form.⁹

To bring the ontological issue into focus consider the fact that Aristotle does recognize at least some developmental processes that can be fully reduced to the simple natures and potentials of the elements. Curly hair is a paradigm example:

The hairs become straight and curly on account of the vapor arising in them. If it is 'smoky', it is hot and dry and so makes the hair curly, for it gets twisted through being subject to a double-motion, the earthy part tending downwards and the hot part tending upwards. Thus, being easily bent, the hair is twisted owing to its weakness and this is what is meant by curliness in hair. (GA v 3.782b19-24)

There are three relevant factors mentioned in connection with the formation of curly hair: (1) the natural motion of its earthy elements; (2) the natural motion of its fiery elements; and (3) its weak constitution. The production of curly hair is entirely reducible to the sum of actualizations of these three capacities. The downwards motion of the earth together with the upwards motion of the fire combine to create a twisting effect; the hair then curls under the force of this contrary impulse owing to its weakness. If Gotthelf is right, then this reduction means that a teleological explanation of *curly hair* is inappropriate (and Aristotle does not give us one). Curly hair cannot be identified as the *telos* of the process leading up to it, since none of the potentials actualized in that process are potentials *for* that end. Since Aristotle thinks the explanation for the development of the entire living organism must make reference to its adult form (as end), it follows that the process cannot be the result of a sum of actualization of element-

⁸ Gill 1997, 145 and 153. Gill's reading is bolstered by Aristotle's remarks at GA ii 6.743a36-b8, on which see further below.

⁹ Gotthelf himself does not separate the ontological thesis that organismal natures cannot be reduced to element-potentials from the epistemological thesis that teleological explanations cannot be reduced to non-teleological explanations. (See Gotthelf 1987, 208n10.)

potentials alone. Rather, it must be due (at least in part) to the actualization of a distinct potential which is irreducibly for that outcome.¹⁰

Notice that the teleological explicability of the elements is irrelevant here. If Johnson is right, then a reduction of development to element-potentials would not completely eliminate *teleology* from the explanation. For the motions of the elements will each be directed to their own natural places, and so we could not explain their behavior without reference to *some* end. But that is not the point. The point is that an account of development in terms of element-potentials alone would not include any reference to *the form of the organism coming to be* and so would not be a teleological explanation of *the development of that organism*.¹¹

After a thorough exploration of what Aristotelian natural teleology *is not* ('not anthropocentric, not committed to backwards causation, and not a mere heuristic for materialist and mechanistic explanations'), chapter 7 finally turns to the question of what his teleology *is*. The essence of Aristotle's natural teleology, Johnson argues, is found in the important distinction he draws between absolute and hypothetical necessity. The project of chapter 7 is to investigate the concept of hypothetical necessity through an examination of the biological works, where that type of necessity is most present.

The main focus of the chapter is the relationship between Aristotle's two primary modes of explanation in biology: teleological explanations in terms of hypothetical necessity and (so-called) mechanical explanations in terms of material necessity. For example, at *PA* iii 15.568b20-26 Aristotle tells us that eyelashes are formed *both* through material necessity *and* for the sake of something. On the one hand, eyelashes are causally necessitated by the oozing secretions that form at the ends of small blood vessels on the eyelids. On the other hand, they come to be in order to protect the eyes from debris. Johnson argues that Aristotle does not see these as two incompatible explanations; rather, the latter tells us *how* eyelashes come to be while the former tells us *why* they do. These two explanations are integrated into a unified account through the concept of hypothetical necessity. Although material-level forces necessitate the eyelashes, the activity of those forces is itself *conditionally* necessary for bringing about the end for the sake of which eyelashes exist. Thus the order of explanation must run from the *why* (teleology) to the *how* (material necessity). For it is not until we have established why some part exists by specifying what it is for that we can go on to describe the causal mechanisms that necessitate it (cf. 191-192).

¹⁰ Gotthelf allows that the development of an organism will incorporate element-potentials; it is simply not reducible to them.

¹¹ This point is made best when Gotthelf says: 'his [Aristotle's] view was that the development of a living organism is *not* the result of a sum of actualizations of element-potentials *the identification of which includes no mention of the form of the mature organism*' (1987, 213, second emphasis added). The ontological counterpart of this claim is that if development was reducible to a sum of actualizations of element-potentials, then the directedness of the process onto the organism's form would be an epiphenomenon of a series of teleological changes directed towards *other* ends. Compare Johnson's understanding of the cycle of rainfall (149-157 and note 4 above).

What Johnson nicely shows is that Aristotle is quite willing to make use of explanations in terms of causal mechanisms that appeal to material necessities, as long as we keep in mind that the functioning of those mechanisms occurs for the sake of something. This is not a novel claim and will come as no surprise to those who have paid attention to the biological works. However, it is a point worth stressing, and Johnson does an excellent job of giving the idea centre stage.

One problem I have is that Johnson's account gives us little sense of how teleology and material necessity are connected at the *causal* level. What is the *causal* relation between the oozing secretions that form the eyelashes and the function that eyelashes perform in the developed organism? The idea that the explanation of eyelashes must begin by stating what they are for before describing what things necessitate them does not seem to advance us much beyond the heuristic interpretation of Aristotle that Johnson rejects. What is needed is an account of how teleology makes a difference at the developmental level.

This gap between explanation and causation is bridged by an important passage in *GA* ii 6. After giving what looks to be a complete material-level account of the formation of the uniform parts (743a3-20), Aristotle introduces the following important qualification:

Now cold is a privation of heat. And both of these are used by the nature <of the embryo> insofar as they have a capacity for making one thing this way and another that way *from necessity*; so that in the context of development at any rate it is *for the sake of something* that the heating and cooling of these and the formation of each of the parts takes place, the flesh being made soft—heating and cooling making it such on the one hand from necessity and on the other hand for the sake of something—while sinew is made solid and elastic, and bone solid and brittle... We must state then, as we have said, that all of these things come into being on the one hand by necessity and on the other hand not by necessity but for the sake of something. (743a36-b8)

According to Johnson the pattern of explanation exhibited here—some part comes to be on the one hand by necessity and on the other hand for the sake of something—is not an appeal to two *contrasting* ways of accounting for the same phenomenon, one appealing to the necessity rooted in material-level forces versus one appealing to final causes. They are two parts of a *single* explanation. This passage adds an important element to that story. It tells us how these two causes are related in the actual development of a living thing and thus identifies that feature of the world that ties the two parts of the explanation together. Aristotle tells us that material forces have the capacity to necessitate certain changes in virtue of their own natures (simple or absolute necessity); in the context of development these necessities are exploited by the embryo's formal nature in order to achieve certain developmental goals. It is in this way that material necessity is subordi-

nated to teleology in the formation of living things.¹²

This passage could help improve Johnson's case against the heuristic reading by putting us in a better position to see exactly why Aristotle thinks teleology is an ineliminable feature of the world. Since mechanical causes are regulated and structured by the embryo's formal nature for the sake of an end, we cannot eliminate final causes from the world without fundamentally changing the way things turn out.¹³

Teleology is clearly central to Aristotle's philosophy. One cannot hope to understand Aristotle without understanding his views on the nature of teleological causation. In this respect Johnson's book is a major contribution to the field and makes great strides towards a clearer and more systematic understanding of this controversial topic. There are, I think, at least two major pay-offs of Johnson's account that are worth stressing. First, it shows us that for Aristotle teleology has to be grounded in a metaphysics of substances with their own intrinsic principles of change (or 'natures', see n4 above). Second, it underlines the extent to which Aristotelian teleological explanations are exclusively oriented towards the good of those substance themselves.¹⁴ For Johnson these were among Aristotle's most radical innovations in teleological thinking. However, the value of Johnson's book goes beyond what it teaches us about Aristotle's teleology. It also provides insights into other facets of his thinking, including the way he reads his predecessors, how he understands the structure of scientific explanation, and how he views human beings and their relation to nature. Finally, *Aristotle on Teleology* has value for contemporary philosophical debate. For many prominent philosophers of biology continue to insist that some form of naturalized teleology is an indispensable feature of organic nature (see, e.g., Lennox 1992; Ayala 1998). As Johnson eloquently shows, it is here that Aristotle has the most to teach us.

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¹² This idea has its roots in *Laws* x, which raises further questions about the way Aristotle reads Plato.

¹³ Of course this cannot be the whole story. For one thing the idea that the embryo's nature 'uses' material necessity needs to be cashed out in terms that do not require intentional desires. However, this at least takes us beyond the structure of teleological *explanations* to an account of how teleology and material necessity interact at the causal level.

¹⁴ This is most salient in his arguments against anthropocentrism (the view human beings are the ultimate beneficiaries of all natural substances and processes).

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