

Allan Gotthelf

Teleology, First Principles, and Scientific Method in Aristotle's Biology.

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Although most of the essays have been published before, Allan Gotthelf's latest book is an indispensable collection for anyone interested in Aristotle's overall philosophical project. Following Balme, Gotthelf shows just how much a close reading of the biological treatises can teach us about Aristotle's philosophy. The collection covers the whole range of philosophical issues in Aristotle's biology, from teleology and explanation to first principles and starting a science. Gotthelf organizes the sections of the book to show the interconnections of his interpretation of these complex issues. The emendations to the main body of the papers are minor, mainly to preserve the flow of the book, but the additions to the footnotes are often substantial and rewarding, responding to recent scholarly debate. There is also the added bonus of a note that begins each chapter that states both its origins and its place in Gotthelf's thinking concerning Aristotle.

In Part I, Gotthelf presents his view that a teleological explanation for Aristotle must include an 'irreducible potential' for form, since the material potentials alone are not sufficient to explain the coming-to-be of living beings. A challenge to this reading is Aristotle's account of the development of the embryo in *GA* II.6, which appears to appeal primarily to material and mechanistic causes. Gotthelf responds, in his newest paper of this section, with a close reading that supports the primacy of form in this account, working out the relation of the final to the efficient cause in this development without confounding the two.

Gotthelf's papers on first principles, Part II, show how Aristotle employs his own theory of demonstration, developed in *Posterior Analytics*, in the explanatory treatises such as *PA*. He argues in "First Principles in Aristotle's *PA*" that there are three kinds of first principles used in explanations: 1) the elementary powers and their interactions, 2) the existence of formal natures, and 3) definitions of kinds. Gotthelf expands this discussion in the next paper, "The Elephant's Nose", exploding the ordinary view that Aristotle appeals to only one middle term for one explanation that only includes a single feature of the essential nature. Gotthelf exposes at least five different features to which Aristotle appeals to explain the elephant having its peculiar nose. These features include where the elephant acquires food, its blooded nature, being something cooled by air, its great size, and being a many-toed, four-footed animal. Gotthelf leaves open the question of whether this explanation can be presented syllogistically.

None of this upsets Gotthelf's overall view. In Part III, which addresses metaphysical themes in Aristotle's biology, he provides textual evidence that Aristotle is willing to include various kinds of features in the definition of substances, such as animal parts, dimensional features, and even material. The object of definition also varies. Aristotle shows no sign of a privileged level, such as the atomic species, but the object is often of higher levels of generality, such as the *megista genē* or blooded animals.

All of the above coheres with Gotthelf's papers on the theoretical aims of *HA*, Part IV of the volume. It begins with a previously unpublished work, "Data-Organization, Classification, and Kinds", that defends Balme's reading of *HA*, both the text's aims and its connection to the theory of science presented in the *Analytics*. On Balme and Gotthelf's reading, Aristotle neither presents a natural history nor aims at a systematic classification, rather, he studies the differentiae of animals by laying them out and grouping them, often regrouping them, for a theoretical purpose: to find causal explanations. Gotthelf's own addition, discovered working together with James Lennox, is that the grouping of differentiae is to find the widest class to which they extend, since the subject and predicate must be co-extensive in a demonstration. The *megista genē* stated in *HA* I.6 are meant to facilitate the discovery and identification of widest-class generalizations.

The collection of essays ends appropriately with an evaluation of Aristotle as a theoretical biologist, which includes a paper on Darwin's appreciation of Aristotle as a biologist and another on a proper verdict on Aristotle as scientist. The latter paper is a superb introduction to Aristotle's philosophy of biology and a solid defense of Aristotle as a scientist in light of the systematic and explanatory character of his work and the methodology he practiced.

Gotthelf has contributed immensely to our current understanding of Aristotle's biology, often with careful and erudite analysis, but I question his claim that *HA* is actually devoid of a systematic classification of animals. Likewise, I question whether his overall interpretation of Aristotle's biology is fully coherent. Let us begin with the former problem. Gotthelf accepts Balme's four objections that are meant to establish that there is no systematic classification of animals in *HA*, which he takes together to be conclusive. But each objection is questionable. 1) Aristotle's use of division aims at definition, not classification. Although I accept this point, it is not clear why classification for Aristotle does not aid in seeking of definitions. Balme and Gotthelf appeal to *APo.* II.14, where Aristotle stresses finding the right level of generality to explain the predicate by using information imbedded in divisions, to defend their reading of *HA*. But the language of the passage suggests that the divisions are nested and ordered, one below the other, and not of multiple lines simultaneously, as Gotthelf reads the divisions in *HA*. Such divisions also imply a hierarchical classification and would aid in seeking definitions. 2) What appears to be a classification of animals is actually a classification of animal features, which generates different animal groupings. But Gotthelf's own example here, modes of reproduction, speaks against this claim (267). Aristotle does not organize his discussion of modes of reproduction along its differentiae but rather by means of the *megista genē*. The latter kinds do not map onto the former, but there is cross-division. 3) Aristotle has no terminology for fixed classificatory levels. But for this criticism to be effective, one must first show that Aristotle needs such language to mark off classificatory levels. It is not clear that he does. 4) Even though Aristotle marks off the *megista genē*, they are not exhaustive and Aristotle rarely, if ever, seeks intermediate kinds. These last two criticisms assume that Aristotle would have had aims similar to a biologist practicing taxonomy in the modern period. If he does not, and I agree with Gotthelf that he does not, then these criticisms may not be relevant.

We should raise the question of whether Aristotle has his own conception and need for a systematic classification of animals. Gotthelf provides what he means by "systematic classification" (264), and I suggest that we can map out such a project in Aristotle's biology on

those terms. First, the grouping of animals must be both mutually exhaustive and mutually exclusive at any upper level. The blooded-bloodless division of animals fulfills both requirements, and Aristotle uses this division to provide some measure of organization to the first six books of *HA* (along with the *megista genē* and the external-internal part distinction). Systematic classification for Gotthelf also means that the groupings are by essential nature. Aristotle claims that these features are in the essences of such animals (e.g., *PA* IV.5). Now, the *megista genē* are grouped as either blooded or bloodless and marked off by features that are predicated in their species' essences, most likely features pertaining to the mode of locomotion (e.g., *PA* IV.12–13). The blooded-bloodless division also marks off kinds by mode of locomotion generically, whether the kind or species moves by four points or more than four points (*HA* I.5 490a26–b3). So, it is plausible that these kinds are nested. But the *megista genē* are not exhaustive of all lower animal kinds. Is this a problem for Aristotle? By rejecting dichotomous division, Aristotle need not accept that every kind is divisible by two. So, blooded and bloodless animals could be divided into many forms by means of many differentiae, those forms being either atomic species or kinds that are further divisible.

Now, this view is just speculative, but my point is that Gotthelf has not ruled it out. He might respond that such divisions do not include mode of reproduction in the essence, but Aristotle oddly never states that such kinds are features in the essence. Aristotle can accept that it is part of the essence of an animal to reproduce without accepting that particular kinds of animals are differentiated essentially by these features. The *megista genē* are not differentiated by their perceptive capacities but Aristotle does accept these features are in the *logos* of the *ousia* of animals (*PA* II.8).

Something interesting comes out of this reading of Aristotle's biology. The explanation for the elephant's nose could include three nested kinds – blooded, having a lung, and four-footed, live-bearing animal (since Aristotle also accepts that having a lung is in the essence in *PA* III.6). The features in the middle term on this alternate view are more unified than on Gotthelf's reading, although it is not clear whether the other two features used in the explanation are in the essence. This result questions the unity of the form. Gotthelf's view suffers the same problem: the form is defined by many features with no clear account of how these features are one. Yet Gotthelf must accept the unity of form, since he argues that the coming-to-be of an animal is caused by an irreducible potential for form. Since this motion is one, the form must be one. This problem does not belong only to Gotthelf's interpretation; rather, it is one of the core problems of Aristotle's conception of form in the biological treatises. Unfortunately Allan Gotthelf recently passed away, a sad loss for all of us working on Aristotle and his scientific treatises. We have lost one of this generation's greatest minds on Aristotle's biology.

Chad Wiener
Pacific University