
WHY BIOLOGISTS SHOULD
READ ARISTOTLE
(OR WHY PHILOSOPHY
MATTERS FOR THE LIFE SCIENCES
AND WHY THE LIFE SCIENCES MATTER
FOR PHILOSOPHY)

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It is commonly said that the corpus of Western philosophy springs out from the works of Plato and his former disciple Aristotle, who detaching himself from the over-intellectual views of his master, that considered the ever-changing material reality as a source of confusion but not of true knowledge. Aristotle became the first scientist properly speaking by applying himself to the painstaking observation of the structures and life histories of living things. Thus, as a field naturalist Aristotle was too much involved with life moving before his eyes instead of wasting his time with the eternal and perfect forms of a hypothetical Platonic heaven. In such a way that the fundamental epistemological problems posed by Plato became non-relevant once Aristotle decided that it was truly possible to attain the certain knowledge of a real world constituted by embodied forms. Perhaps D'Arcy Thompson was the first to suggest that Aristotle's biology may have provided the foundation stone for his philosophy [1], suggestion strongly supported by the fact that from the 1,462 pages of the classical Bekker edition of Aristotle's *Collected Works* [2], 426 are devoted to biological issues thus representing the single largest component (~ 30%). Indeed, in the past century both Düring and Grene carefully analyzed such biological corpus and concluded that it represents Aristotle's coherent and mature view that illuminates his logic, physics and metaphysics [3, 4]. While rejecting the ideal Platonic world of pure and eternal Forms, Aristotle nevertheless agrees that the objects of knowledge must be permanent and stable and yet in the living world only individuals that change size as well as place, which are born and die are fully real. However, as a scientist Aristotle observes both *génos* (type or kind) and *eidos* (the species: a specific form within a kind) in the individual animals that means the universal in them. Thus, the spots on a given frog are irrelevant accidents

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but not the structure of the frog that only exists in the present, past and future frogs. Hence, Aristotle establishes the relationship between the particular (the individual) and the universal that is the bedrock of knowledge so that form is the source of intelligibility.

Since form is the principle by which things become intelligible to our mind and as such the source of knowledge, then the subject matter of science is the study of form as it is clearly stated by Aristotle: "Absence of haphazard and conduciveness of everything to an end are to be found in nature's works in the highest degree, and the resultant end of her generations and combinations is a form of the beautiful.

If any person thinks the examination of the rest of the animal kingdom an unworthy task, he must hold in like disesteem the study of man. For no one can look at the primordia of the human frame-blood, flesh, bones, vessels, and the like-without much repugnance. Moreover, when any one of the parts or structures, be it, which it may, is under discussion, it must not be supposed that it is its material composition to which attention is being directed or which is the object of the discussion, but the relation of such part to the total form. Similarly, the true object of architecture is not bricks, mortar, or timber, but the house; and so the principal object of natural philosophy is not the material elements, but their composition, and the totality of the form, independently of which they have no existence. (*De Part. An.* I.5, 645 a 4-37).

Anyhow, the notion of species implies the classical philosophical problem of what is the status of the universals, since a universal is that quality or property that some particular things have in common: do the universals exist by themselves independently of the particular objects that instantiate them? (i.e., do the universal frog exists independently of whether there are particular frogs or not?). Or do the universals are mere words (*flatus vocis*) without necessarily a corresponding objective reality? For Aristotle the answer to this problem is that universals are real, but their existence depends on the particulars that exemplify them, therefore "frogness" exists provided that there are real frogs but in this case knowledge corresponds to the understanding of "frogness" not to the mere enumeration of particular frogs. Thus, the form of an individual frog is what we, as knowers, understand, not the particular specimen but the universal instantiated by the specimen. Hence the universal is a secondary substance as it is something predicable of a primary substance (i.e., the ordinary concrete individuals such as the individual frog or the individual human) but it corresponds at the logical level to what the primary substance is at the ontological level. Thus, it is only in the mind where the *eidōs* becomes truly universal as a concept and as such it exists in the mind like in a substance and so it corresponds to an accident: a quality. Therefore, the science of

Aristotle is a science of qualities, such is *natural history* (the original name for biology).

For Aristotle and for pre-Darwinian biology knowledge of the structures and life histories of whole organisms, is the most relevant quest since morphology, development and reproduction (that it is true to type) entail continuity, regularity and so stability in this ever-changing world. Hence in the composite of matter and form that constitutes a particular thing, it is the formal component that is the primary substance. This formal component is the thing's nature (essence) and so the development of an animal is the path to its nature as form which is not only mere shape because it also implies function (since function follows form). Therefore, a sculpture may have the shape of a horse, but it is obviously not a horse since it cannot fulfill the activities proper to a horse.

Given that for Aristotle all sensible substances are the composite of matter and form, and accidents like quantity, quality or place cannot be except in reference to the being of substances, the embryo could not be except in reference to the full issue of its development (its final form). Thus, the morphologist finds in substance as form the essence of being and the embryologist finds in the relation of the egg to the adult the workings of causality in the world, since as the issue of development (its *telos*) governs the course of ontogenesis, and the same goes for causality in general. Therefore, the end-point, the developed adult is the goal to which the runner nature moves: 'nature as generation is the path to nature as goal'. For Aristotle the actual dominates the potential, thus *entelechy*, the complete realization (actualization) of the final form of some potential concept or being, presides over the potential. It is the control of every step in the natural process of development by the character of the final organism that enables Aristotle's notion of 'final cause'. Hence to detach efficient from final, or material from formal causes as it happens in contemporary biology, equals to sending the intelligible back into the unintelligible, the principles of things into their mere conditions, since without the directedness of nature there would be nothing for us to know.

Aristotle distinguishes two types of necessity: a simple one that only applies to things that are forever, things the causes of which cannot be other than they are, and another one that operates in the living world; the hypothetical necessity that depends on an end beyond itself, since the nature (form) of a living thing is the internal source of change within itself, the organizing principle directs its development towards its particular end. If nature as form is prior to nature as matter, nature as that-toward-which, nature as end, is the biological manifestation of nature as form. Therefore, that what will be, the culmination of development, controls necessity. Thus, necessity subordinated to end is what the true biologist is seeking to understand. Moreover, for Aristotle the function of each part, of each

organ can only be fully understood by relation to the whole: "For no bone in the body exists as a separate thing in itself, but each is either a portion of what may be considered a continuous whole, or at any rate is linked with the rest by contact and by attachments... And similarly no blood-vessel has in itself a separate individuality; but they all form parts of one whole" (*De Part. An.* II.9, 654 a34-b6).

Thus a major constituent (if not the major constituent) of Western philosophy was born as biology and biology was born as philosophy and their current separation is an undesirable situation that hinders the possibility of reaching further deep biological insight, given that most contemporary biology is lost in the mere gathering of big data, the enumeration of quantities and the analysis of parts separated from their wholes. Indeed, the anti-essentialism of the mainstream in contemporary biology works against the logical coherence of the discipline. Consider the case of the identification and study of species given that for current biology the species is just an operational concept (*species* are groups of interbreeding natural populations that are reproductively isolated from other such groups) and in fact it is continuously redefined according to the taste or current fashion in biological research [5]. Indeed, after the establishment of Neo-Darwinism as the main theoretical framework within biology this fundamental loss of coherence mars biological research, since biologists persist in identifying, classifying, characterizing and talking about something that most of them consider (implicitly or explicitly) that it actually does not exist: the species, because, according to the current perspective, it is constituted by similar individuals which nevertheless are different at the genetic level (as this genetic diversity is the source of variation necessary for the operation of natural selection) and so the species is (genetically speaking) an elusive entity in continuous flux. Therefore, for as long as formal and final causes remain excluded from current biological thinking the path towards the understanding of factual biological complexity remains hidden [6].

Finally, let us consider once more what Darwin said about Aristotle: "...Linnaeus and Cuvier have been my two gods, though in very different ways, but they were mere schoolboys to old Aristotle... [7]." Thus, why most contemporary biologists nurtured by neo-Darwinism ignore Aristotle? In any case, for those biologists who think that reading ancient philosophy is boring I suggest the reading of Thompson's *On Growth and Form* [8] where they may appreciate how biology and philosophy smoothly blend into a single endeavor towards the future.

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The quotes from Aristotle were taken from *De Partibus Animalium*, trans. W. Ogle, 1911. Oxford University Press, Oxford, U.K.