

Mariska Leunissen, *Explanation and Teleology in Aristotle's Science of Nature*. Cambridge: Cambridge University Press, 2010. Pp. vii + 250. \$85.00. ISBN 978-0-521-19774-8 Hrbk.

In a text explaining his methodology in biology, Aristotle distinguishes between traits that an animal must have if it is to be a member of a species within one of the nine or so “great kinds” and traits that make its species-specific life go better (*Parts of Animals* I.1.640a33–b4). The former are necessitated. If there is to be a bird it *must* have wings, since by definition birds are flyers. This kind of necessity is qualified, however, or based on a hypothesis, because there is nothing that says that this bird, or this kind of bird, or even birds in general, must exist in the unconditionally necessary way in which Aristotle thinks the stars and planets must exist. Aristotle makes this point by laconically remarking, “It is not necessary if your father came to be that you come to be, but if you came to be then he [necessarily] came to be” (*Generation and Corruption* II.11.6–11).

In our time, Aristotle scholars have concentrated on hypothetical necessitation in order to show that Aristotle’s natural science, with functional analysis of traits or biological teleology at its center, is real science, if not quite our real science. They have, accordingly, neglected or minimized what Leunissen regards as a separate and distinct model of biological-teleological causation and explanation according to which organisms have some of their traits because they make their way of life go better. The restriction of the second model to peripheral “backup” or “luxury” traits, such as why we have two kidneys, is understandable. Does not passing out traits for the sake of making life better betray a whiff of what got Aristotelianism, or at least what passed for it in early modern times, into trouble of the sort that Voltaire skewered when in *Candide* he made fun of the philosopher Pangloss, who maintained that we have a nose bridge in order to support eyeglasses?

Leunissen attempts to alleviate this worry in several ways. She is not the first to point out that Aristotle never has a functional trait arising without specifying materials whose physical and chemical properties can and do support that function. Moreover, she rightly acknowledges that secondary teleology can be in play only where its agent is a process that exhibits primary teleology. She argues more categorically than others, however, that whereas (a) nature *produces* the biochemical materials on which hypothetically necessitated traits rely, it makes life better—her second model of biological teleology—by *using* material whose properties are by-products of hypothetically necessitation. A quadruped that lives on land (one of Aristotle’s great kinds) must have a sturdy bone structure, and gets it by virtue of being a quadruped land animal. No bones, no four-footed land animal. But if the land animal is to be a rhinoceros it is better if some of whatever bony material happens to be available in the ontogenetic process is allocated to making a defensive horn (or two) rather than to, say, giving its feet sharp talons. Leunissen’s inference is that the second model is not restricted to traits like having two kidneys, but extends to most or all of the traits by which animals defend themselves, and perhaps others.

This approach gives Leunissen a chance to propose solutions for several persistent problems in interpreting Aristotle's theory of sub-lunar teleology. At *Physics* II.8.198a14–199a8, he seems to claim that while frequent rainfall in the summer happens by chance frequent rainfall in the winter is for the sake of growing crops. Leunissen comments: "Aristotle believes that winter rain is for the sake of growing crops where the type of teleology at stake is an external form of secondary teleology. ... It is due to the actions of human beings who ... impose the art of agriculture on what is naturally available" (30–31). In this way Leunissen evades the cosmic teleology attributed to Aristotle by David Sedley. "Serving an anthropological goal is something that is imposed on natural processes from the outside, not something intrinsic to their internal natures" (31).

One might think that Leunissen's expansion of the second model's scope intensifies our Panglossian worries about Aristotle more than it alleviates them. Perhaps for this reason she assures us that Aristotle does not treat maxims such as "Nature does nothing in vain" as premises in function-ascribing arguments, but merely as heuristic guides for discovering real causes. In this matter, she is taking issue with contemporary Aristotle scholars who to her mind overextend the model of hypothetical necessitation by treating this well-known maxim as a justificatory warrant for deductive derivations of trait distributions. In this matter I think she is correct. She strengthens her point by arguing in what is perhaps the most subtle chapter of her book that the purposes, goals, or ends for which organisms have their traits are stated in the major premises of explanatory syllogisms, not in the distributed middle terms that do the explaining. Noting subtle distinctions in Greek that usually escape translation into English, or even Latin, such as that between *to aition* (the cause) and *he aitia* (the explanation) and between *to hou heneka* (the for-the-sake-of) and *heneka tinos* (for the sake of a beneficiary), Leunissen suggests that the middle term in functional explanations picks out efficient causes that lead to the final causes established as end points in major premises. The major premise identifies a purposive phenomenon that is to be explained, such as health. The middle term provides an ordered sequence of events that leads up the end, such as walking after meals. In this way Panglossian "just so" stories, founded as they are on question-begging shifts of final causes from premises to conclusions without specifying relevant middles, are avoided. This, too, seems to me essentially correct.

Leunissen's argument would have been even more convincing if she had not largely restricted herself to Aristotle's discussions of why animals have their parts in *Parts of Animals*. The substantive and methodological points she is making are more apparent in Aristotle's seminal treatment of embryology and reproduction, *Generation of Animals*. This treatise makes it clear that secondary biological teleology occurs solely in developmental processes that are, overall, aimed at an end. This treatise also shows the importance of temporal order, based on priority in allocating materials, for causal analysis. Potentially the greatest source of support for Leunissen's analysis might come from Aristotle's *Politics*. He argues there that unless political organization is viewed as a natural developmental process (albeit not as an organism) use-teleology, of which he gives many examples, will never reach or sustain good functioning. When Leunissen

does mention texts from *Generation* and *Politics* it is invariably to good effect (84–85, for example).

All this might make Aristotle a bit more palatable to us moderns than he is often assumed to be. Still, the picture Leunissen paints comes from a worldview fundamentally alien to ours. For Aristotle, the principle of biological (and social) order is the expression in organic kinds of as full an array of psychological capacities as possible, ranging from basic metabolism to sensation, memory, and cognition. In this picture lower is for the sake of higher. Aristotle palpably fears that this natural hierarchy will be overturned if we say anything as seemingly innocent as that slaves are as necessary for masters as masters for slaves, businessmen for leisured landowners as the reverse, and means of defense like horns as important to a rhinoceros as its bones, heart, or liver. If mutual survival and reproduction were the point these reciprocities would be true. In fact, if survival were the point means of defense would be far more important than Aristotle seems to suggest in invariably assigning them, if Leunissen is right, to secondary teleology. From this perspective, it seems that the Darwinian revolution has in effect turned Aristotelian biology upside down. In a world of unrestricted desires and scarce resources, hypothetical necessitation working by means of mechanisms like natural selection makes means of defense basic. Psychological capacities that would seem to Aristotle to be valuable for their own sake, notably cognition, are treated as means of survival.

Anyone interested in Aristotle's philosophy can profit from this book, but assessment of its claims will require other Aristotle scholars. They will find much to think about here.

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