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TELEOLOGY IN BIOLOGY: HADDOX ON THE BASIC PRINCIPLES OF THE LIVING WORLD

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While Jack Haddox's mature philosophical work emphasizes humanistic themes and existential concerns, his earliest major project in philosophy; his 1959 dissertation at Notre Dame: *Reasons for the Importance of a Philosophical Study of Some of the Basic Principles of the Living World*, was a detailed analysis of the methodology of biological investigation. The dissertation examined case studies involving enzymes, proteins, catalysis and other matters apparently far removed from his later work on Mexican and Chicano thought. However, Haddox's existential engagement with basic philosophical questions is evident throughout this work.

This essay describes the argument of the dissertation and attempts to place it in its historical context. Along the way, I will critically examine the general perspective that Haddox, and many other philosophers of biologists who followed in the ensuing decades adopted. Specifically, I will offer a criticism of the notion that specific teleological presuppositions ought to guide the biologist's methodology.

My criticism of the methodological role for teleology defended in Haddox's work is not equivalent to the denial that there exist purposes in nature or even a denial of the epistemological thesis that our understanding of biological phenomena will always be conditioned by teleological principles. Those larger questions are beyond the scope of the current essay. Instead, my concern with an approach to biology which emphasizes the methodological indispensability of specific teleological principles stems from the simple possibility that the choice of such principles may be subject to error. If one admits this possibility, then one's decision to choose one set of teleological principles over another will depend on some non-teleological mode of investigation, or at least on some mode of investigation that does not employ precisely the teleological principles under investigation. To deny the possibility of error in one's choice of teleological

principles is to assume some form of access to the principles of nature which does not involve inquiry. It is difficult to understand what it would mean to have such theoretical access to the character of nature without engaging in inquiry.

An overview of the dissertation

Haddox's dissertation was completed in the heyday of biological reductionism, six years after the double helix structure of DNA was discovered by Watson and Crick and roughly a decade prior to the popular revival of interest in teleology in Anglo-Saxon philosophy of biology - which we can date roughly to Larry Wright's first paper on teleological functionalism in 1968. Thus, Haddox's dissertation was written in an interstitial period in the history of the philosophy of biology. He and other philosophers struggled to appreciate and absorb the implications of the impressive successes of a reductionist approach to biology without fully accepting that it could provide a satisfactory explanation in the biological context. Intuitively, reductionism in biology seems too blunt an instrument for biological investigation. Biological systems are often subject to myriad contextual influences at a range of scales or levels and are often entangled in complex reciprocal relationships with one another. And yet, by questioning reductionism, Haddox and other philosophers at the time were not advocating a return to biological vitalism. At this point, philosophers struggled with reductionism without the functionalist framework which would later allow them to maintain a broadly non-reductive physicalist attitude towards non-physical explanation.

Like the majority of philosophers of mind and philosophers of biology in recent decades, Haddox argued for an anti-reductionist perspective. At the same time, he hoped to remain within the bounds of a broadly physicalistic or naturalistic metaphysics. In the dissertation, he takes a number of steps in the direction of non-reductive physicalism. He provides an outline of a proper functions model of biological explanation and rehearses of a number of anti-reductionist arguments which would also become standard in the late 1960s and 70s. In a number of important respects, Haddox's work was prescient. Having said this, the dissertation is still very much a product of its time, embedded firmly in the disputes and conceptual apparatus that were characteristic of early twentieth century philosophy of biology.

Without the relatively straightforward solutions to ontological questions that functionalists like Wright, Lewis, Putnam and others would provide in the decade that followed, Haddox attempts to characterize the place of living systems in the physical world via the idea of complete explanations. Functionalism rests on the claim that mental states are multiply

realizable. To see them as multiply realizable we take mental states as causal roles rather than particular physical structures. As such, functionalism can be contrasted with metaphysical accounts which treat mental states as instances of a mental substance. Instead of puzzling over the relationship between biological and physical kinds, functionalists understand our accounts of biological kinds as a way of describing the functions of physical structures.

One can come to a broadly functionalist position via at least two distinct routes. On the one hand, functionalism supports the idea that there are biological or mental kinds and that our talk about them is legitimate in spite of a commitment to a broadly physicalistic ontology. The other is related, but is more explicitly epistemological, emphasizing the idea of irreducible kinds or levels of explanation. In his dissertation, Haddox opts for the second route to anti-reductionism. Reductionism is deficient, according to Haddox, because it fails to answer the kinds of questions we ask about biological phenomena. This epistemological focus leads to some important insights, but it also weakens his project in significant ways. His principal arguments involve an appeal to the notion of partial and complete explanations and the claim that biologists must satisfy our demand for distinctively biological explanations.

In the background of Haddox's work were the growing influence of biochemical explanation and the residual influence of organicist philosophical principles in biology. Organicism was central to biology since at least the 18th century. Reductionism, by contrast, was a relatively new strategy in biological investigation. For reductionists, the influence of genetics encouraged the idea that the physical properties of the constituents of a biological system, in isolation from their place in the context of the organism, could suffice for an understanding of the system as a whole. By contrast, organicists emphasize the role of the constituents in the activity of the system as a whole. Whereas a reductionist sees bodies as composed of cells, cells composed of organelles and these in turn as composed of some ground-floor molecular constituents, the organicist understands the parts as having properties by virtue of their role within the activity of the whole.

Haddox reads this debate as a conflict between distinct types of explanation and argues, from an Aristotelian perspective, that both strategies must be integrated, in order to achieve a satisfactory understanding. Most of the dissertation involves a defense of the position that a complete understanding of biological phenomena must take a functional and a teleological form in addition to providing molecular biological mechanisms. In broad terms, Haddox's view seems to adopt precisely the right methodological standpoint to biology. It would, after all, be absurd to suppose that we could deduce non-trivial properties of biological systems from chemical principles alone. Scott Gilbert and Sahotra Sarkar take a roughly similar position to Haddox

when they defend a methodological version of organicism. (2000) They argue for a very minimal version of organicism which is roughly equivalent to the recognition that biological systems are complex and that it is important to avoid neglecting relationships and reciprocal causal influences of various kinds. However, while it may be true that even the most hardcore reductionist will find some reference to relations and initial conditions indispensable and while such relations and initial conditions might be contingent from the perspective of chemistry, this would not suffice as a defense of organicism. Presumably, the organicist would hope for more than the simple claim that biological systems are complex and subject to a large number of causal influences.

Aristotle, Aquinas and complete explanations

A complete understanding, on Haddox's view, is one which satisfies the relevant demands for explanation. Accounts of biological function, he argues, must be responsive to four types of demand. These four demands correspond directly to Aristotle's four causes. According to Aristotle, a satisfactory account of, for example, the heart or the liver must not only describe its material constituents and their efficient causal interactions, but must also provide an account of the formal and final causes of the living heart. One could disagree with Haddox in his interpretation of the original Aristotelian home of the four causes. For Aristotle, the four causes did not indicate a set of strategies for satisfying our epistemic needs, but rather served as a metaphysical recipe for the natural order.

The title of the dissertation refers to basic principles of the living world. Haddox finds these basic principles articulated by Aristotle and Aquinas and the project as a whole can be read as a defense of the ongoing relevance of these philosophers for scientific investigation. While he acknowledges what he sees as the weakness of Aristotelian physics, Haddox is eager to save Aristotle's core theoretical insights even here. He writes for instance that while Aristotle's physics is "ruined by mistakes of fact…the truly valuable material in Aristotle's and St. Thomas' study of the physical world is to be found in their basic and general principles." (1959, 8)

It is more difficult for Haddox to remain confident that mistakes of fact will leave the general principles of biological study untouched. This is because, as the dissertation progresses, Haddox emphasizes the specificity of biology and the importance of applicability in the evaluation of biological explanations.

What emerges from the dissertation is, on the one hand an insistence that our explanatory needs must be satisfied in a way that remains faithful to the specificity of the biological subject

matter and that the Aristotelian and Thomistic principles which he recommends, provide non-trivial insight into that specifically biological subject matter.

Along these lines, he argues for instance that Aquinas' philosophy of biology has been unfairly criticized by interpreters. Contrary to the popular impression of Aquinas' philosophy as disengaged from biological detail, Haddox highlights Aquinas' view that applications of general principles to specific cases of plant and animal life is one of the three principal roles that philosophical reflection on biology must assume. (*De Sensu* 1.1) Applicability proves to be a central, but problematic notion for Haddox to defend in the dissertation. Ultimately the most difficult gap for him to bridge involves the relationship between descriptions of biological phenomena and our epistemic demands with respect to what we conceive as the distinctively biological realm.

After a detailed analysis of Aristotelian and Thomistic philosophy of biology, Haddox claims that reductionism "is open to serious objection because such an explanation does not take into account the functional unity and the organic wholeness of the living organism." (1959, 151-2) He writes "the parts and operations of a living being are related to one another and subordinated so that they work together, for the most part, harmoniously for certain ends – the preservation and well-being of the individual living being and its species" (155) By contrast, Haddox criticizes the reductionist approach to biology, writing that the

> "…analytic approach to living beings in terms simply of their chemical parts and the physico-chemical reactions taking place in and among these parts has a fundamental weakness in that the parts of the organism are not seen as parts of an organized whole in which the parts function together for the good of the whole organism." (1959, 4-5)

The weakness that Haddox notes is an alleged epistemic failure on the part of scientists. They do not "see" the parts as serving a teleological function. It is important to note that his objection to reductionism is not ontological. Later in the dissertation he writes:

> "It is true that [physico-chemical] explanations are necessary as part of biology. No one denies this. They are useful as a tool for discovering regularities and correlations among the complexities of biological phenomena, and they provide much matter for the biologist's consideration. This approach seems to have been very successful, but certain biologists ask: is this enough to explain the living?" (ibid 26)

Haddox appeals for teleological explanations which are suited to the specificity of biological activity rather than any ontological specificity. He claims that there is an objectively teleological mode of activity that characterizes the biological realm. (ibid 27) And throughout the text, Haddox approvingly cites E.S Russell, a biologist who reacted strongly against the impingement of physical and chemical methods in biology, writing that while reductionism "provides us with information about living organisms it gives little understanding." (ibid 28)

Haddox contends that an Aristotelian/Thomistic approach to biology can provide the methodological principle which integrates reductionist and organicist approaches. Recognizing the significance of molecular biology, Haddox is also critical of purely organicist approaches. These, he argues, overemphasize Aristotelian final and formal cause. Reductionist approaches come in for more criticism for neglecting final and formal cause. But a proper understanding of living systems according to Haddox, requires attention to all four types of what some readers of Aristotle call the four "be-causes".

Some historical context

In order to appreciate Haddox's account of biological function it is important to understand a little about the historical context in which the dissertation was written. By 1958, early 20th century defenses of vitalism and organicism from Dreisch to Goldstein, were becoming increasingly irrelevant to the working scientific community in light of the impressive successes that molecular biology had wrought. For philosophers, the appeal of organicism and vitalism had already been significantly reduced thanks to critical philosophical analysis. Moritz Schlick, Phillip Frank and others, argued that there is a basic contradiction in the assertion of the existence of a special additional irreducible metaphysical stuff, an élan vital or a vital force, which existed over and above the constituents of the living system, but which nevertheless gave living systems their distinctive life-like properties and which played some causal role in the physical world.

Given the closed causal economy of the physical world, Frank, Schlick and others pointed out that the non-physical characteristics of this additional stuff were otiose when it came to an explanation of the putatively distinctive properties of living things. This line of criticism against vitalism was relatively conclusive and quite convincing.

However, what is less well understood about the Vienna circle's response to vitalism is that, in the case of both Schlick and Frank, there was considerable tolerance of the possibility that some positive account of organic purposiveness could be provided. It is important to note that both Schlick and Frank had generous readings of Bergson and Driesch.

Writing in 1925 Schlick (86-87) clears away talk of non-spatial entelechies with standard arguments of the well-known sort. What is less well understood is Schlick's elegant recognition of the role of structure in biological phenomena. Haddox too points to the importance of structure and distinctive formal features of biological activity. However, in Schlick's hands, the distinctive spatio-temporal characteristics of living things become precisely the factor that encourage us to reject the organicist or vitalist line. In spite of the fact that the organicist or vitalist rests his case on the allegedly distinctive features he sees in the biological realm, the distinctiveness of biological patterns and structures is actually one of the important reasons not to be a vitalist or an organicist.

If a non-spatial entelechy existed, Schlick notes, it should be "capable of realizing the goals it aims at quite regardless of the structure at hand." (87) Why, Schlick asks "does the entelechy's differing mode of operation not suffice by itself; why is there any such extensive difference at all in the spatial pattern of organic cells? Driesch appears to assume that the difference of structure is necessary as it were to acquaint the entelechy with what it has to do, so that upon this stimulus it effects the necessary change… But if the state completely determines the entelechy, it must be regarded as a sufficient cause of the resulting process as such."

Haddox, unlike Driesch emphasizes the distinctive patterns of activity that characterize the biological realm without claiming the need for some non-physical metaphysical principle. His claims center on epistemological rather than ontological concerns and as such can be understood to escape the compelling mid-century criticisms of vitalism. Haddox's anti-reductionism is not intended as an argument in support of a substance dualism. He writes for instance that: "[the] physico-chemical approach to the living is necessary for a complete knowledge of life because living things are material (physico-chemical) beings." (ibid 56)

Schlick and Haddox would part ways in deciding what could possibly count as a complete explanation. While Haddox recognizes that reductionism has achieved successes in the explanation of biological phenomena, he claims that these explanations are incomplete. (ibid 26)

Conclusion

As we have seen, Haddox's work is ostensibly an attempt to reconcile reductionism and organicism in biology, but more deeply it is an Aristotelian reflection on the metaphysical status of living substance. The project is complicated by Haddox's vacillation between purely epistemic considerations and occasional insistence on the objectivity of certain teleological features of biological phenomena. There is a tension, for instance between his repeated claim that

reductionism is descriptively adequate, while at the same time claiming at the same time that it fails to capture what is most interesting to us about the biological realm. The tension can be resolved, of course, via the distinction between description and explanation. Reductionism provides good descriptions of certain levels of biological phenomena, but it fails to satisfy our demands for explanation. (ibid 58) Our demands for explanation result from our belief that the patterns we see in the activity of biological phenomena warrant explanations that make reference to purpose.

In Haddox's account of biological phenomena, one striking feature is his insistence on the objectivity of certain features of the natural world. Reductionists are at fault he claims because they fail to "see" what to him and to the organicists is completely obvious. However, in order to avoid the trap of begging the question, the organicist's argument cannot rest solely on what she thinks she sees. As Aquinas reminds us, the principles governing our biological investigations stand and fall in part depending on their adequacy with respect to the biological facts. Further, our understanding of those facts is fallible and must be held open to revision in light of the results of inquiry.

Perhaps, for instance, the kind of unity and wholeness that we see in the activities of living system is better understand as the result of a community of biological agents with distinguishable and often divergent goals and purposes. Similarly, it might be that we misidentify the relevant kinds of unities. For instance, we might come to understand human bodies as sybiogenetic ecosystems rather than organisms. It can be argued that even at our most basic cellular and molecular level we have a symbiogenetic nature. We are, after all, the combination of mitochondrial and nuclear DNA each having distinct evolutionary origins.

In conclusion, even admitting talk of interests, purposes and the like for epistemic, ontological or methodological reasons, we can still imagine arrangements of interests/purposes/etc. which are at variance with our presuppositions. Thus the real danger with teleological thinking is not that it violates some metaphysical scruple, but that we might simply have the wrong teleological account in mind. There may be important reasons to refer to teleological principles in our biological reasoning. However, in order to be sure we have our story about purposes straight and can exclude other possible stories, we will actually have to inquire using methods other than those which depend on the presuppositions we are testing.

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