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Biological Teleology in the Modern World

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BIOLOGICAL TELEOLOGY IN THE MODERN WORLD

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Abstract

In humans, the heart moves blood through the body. Does the heart therefore have a teleological explanation? Aristotelian teleology (described in Aristotle's *Physics*) is the cause-for-the-sake-of-which, or the end towards which something moves. It is evident from current scientific knowledge that there is some sort of orientation of organisms toward an end. This orientation, following Aristotle's definition of teleology, is conceptually distinct from efficient causation. This orientation is also metaphysically distinct from efficient causation because efficient causal explanations do not properly describe the orientation. However, two common ways of describing teleological explanations imply efficient causation as a metaphysical element. One way is by phrasing the teleological explanation as a counterfactual. The second way is by using consequences in the teleological explanation. Teleological explanations should instead be expressed in terms of function. The function of organisms and all of their component systems is to survive. Ultimately, this paper defends the idea that organisms possess an actual teleological orientation toward survival.

Key Words: philosophy, biology, teleology, biological explanation, teleological explanation

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Biological Teleology in the Modern World

Teleology, especially in connection to biology, is perhaps best known as one of Aristotle's four causes. Aristotle describes the Four Causes in *Physics*: "Something is said to be a cause if it is: [1] The component from which a thing comes to be…[2] The form or paradigm, that is, the account (*logos*) of the essence, and kinds (*genos*) of this…[3] Further, that from which the change or rest from change first starts…[4] Further, the end, and this is the for-the-sake-of-which" (Physics, 2.3, 194b20-35, Reeve). Number three is the efficient cause, which is used in causal accounts. For example, the beating of the heart is the efficient cause for blood moving throughout the body. Number four is the cause-for-the-sake-of-which, which is used in teleological explanations. For example, the heart beats for the sake of moving blood through the body. Today, it is common to reject the cause-for-the-sake-of-which as a metaphysical cause. Although there are many ways to reject teleological explanations, teleological explanations are often rejected as superfluous and metaphysically secondary to causal explanations. This paper will analyze the Aristotelian conception of biological teleology in light of modern philosophy and science and determine if it should be rejected.

This paper aims to defend the ideas that biological teleology is the actual, metaphysical orientation of an organism to survive and that biological teleology exists. Section 1 will show that modern biology supports the existence of a biological teleology similar to that advocated by Aristotle. Sections 2 and 3 will elucidate the differences between efficient causal explanations and teleological explanations to show why they are both conceptually and metaphysically distinct. Section 4 will show why teleological explanations should not be expressed as counterfactuals. Section 5 will begin the positive metaphysical analysis that teleological

explanations are that systems are oriented toward a function. Finally, section 6 will show that organisms are oriented towards the function of survival.

For the purposes of this paper, the "cause-for-the-sake-of-which" will be used interchangeably with "teleology" or "teleological explanation." Additionally, "efficient cause" will be used interchangeably with "causation" or "causal explanation."

Biological Teleology

The notion of biological teleology that will be defended in this paper is as follows: **Biological teleology is the actual, metaphysical orientation of an organism to survive.** This conception of biological teleology is heavily Aristotelian. As was stated above, Aristotle describes his fourth cause as: "the end, and this is the for-the-sake-of-which" (Physics, 2.3, 194b20-35, Reeve). The above definition of biological teleology is a version of Aristotle's fourth cause because it describes the orientation of a subject (i.e., an organism) toward its end (i.e., survival). The biological specificity of the definition comes from including the ends of biology. Monte Ransome Johnson, in explaining Aristotle's teleology, argues that the common teleological end of all organisms is survival and reproduction (174). Johnson writes: "The activities of living, growing, and reproducing thus govern the teleological explanation of all things" (174). A biologically-specific Aristotelian teleological explanation must therefore include survival and reproduction as the end of the organism. However, this paper will only defend the idea that organisms are metaphysically oriented toward survival. Although it is plausible and perhaps even probable that organisms are also oriented toward reproduction, such a claim will not be defended nor evaluated in the current paper. Despite this omission, the above definition is roughly Aristotelian because it is a biologically-specific version of Aristotle's fourth

cause. The question explored in this paper is whether, in light of modern philosophy and science, the above definition of biological teleology has plausibility.

Section 1: Aristotelian Reasoning and Biological Evidence

As the definition being defended is Aristotelian in nature, it is helpful to turn to Aristotle for evidence of the metaphysical reality of biological teleology. According to Johnson, in his writing on Aristotle and teleology, Aristotle thought that the teleological explanation has two senses: the aim and the beneficiary of the aim (Johnson 66, 69). First, for organisms, the teleological "aim" towards which organisms are oriented is survival and reproduction (174). Second, for organisms, the beneficiary of the teleological aim is the organism itself (76). Putting these two senses of the teleological explanation together: "For plants and animals, that benefit is primarily their own survival and reproduction" (Johnson 159). In other words, plants and animals are oriented toward (their aim of) survival and reproduction, which is beneficial for them. This idea of the aim and the beneficiary are not only a human conceptual heuristic. Both the aim and the beneficiary are actual, metaphysical realities: (1) Organisms are really oriented toward survival and reproduction, and (2) organisms actually benefit from surviving and reproducing. Aristotle does not question that either of these two claims are true (175). Johnson writes:

> Thus we do not keep on asking why plants and animals reproduce, or try to survive, any more than we ask why they use food to grow and sustain their bodies….Beyond the survival and reproduction of living things, there is only the axiom that it is better to exist than not exist, and to live than not live. (175)

As such, Aristotle accepts that organisms are oriented toward survival and reproduction, which benefits the organisms.

To evaluate these Aristotelian claims in light of modern evidence, one must decide which parts will be put under scrutiny. Like Aristotle, this paper will not evaluate the truth of the claim that existence is better than non-existence. Such a claim is important for (2), that organisms actually benefit from surviving and reproducing. However, the claim's applicability to (1), that organisms are really oriented toward survival and reproduction, is less evident. This paper will assume the truth of (1) can be evaluated without needing to prove that (2) is true. Further, as was stated above, this paper will only evaluate the claim that organisms are oriented toward survival (and refrain from addressing the claim that organisms are also oriented toward reproduction). The next task, therefore, will be to determine whether organisms are really oriented toward survival in light of contemporary scientific knowledge.

Consider the replication of DNA by a cell. Eukaryotic (e.g., animal, plant) cells can replicate their DNA "at a rate of 10 to 100 base pairs per second" (Blow and Tada 560). In addition, the "frequency of errors during replication corresponds to only one incorrect base per 10^9 to 10^{10} nucleotides incorporated" (Cooper). To appreciate the full force of these facts, one can evaluate what is needed for a strand of DNA to be replicated. DNA is double-stranded, and it is replicated by new, complementary nucleotides being added to each of the old strands ("Deoxyribonucleic Acid"; Cooper). There are four DNA nucleotides organized into two complementary pairs ("Deoxyribonucleic Acid"). A complements and is only attached across from T, and G complements and is only across from C ("Deoxyribonucleic Acid"). Enzymes (proteins) called DNA polymerases take the appropriate dNTP (e.g., A, T, C, or G) and catalyze a reaction that attaches the new dNTP to the growing complementary strand of new DNA (Cooper). Therefore, for a new dNTP to be added to the replicating DNA strand, the correct dNTP needs to be in the vicinity of the replication, the polymerase needs to recognize the dNTP,

the polymerase and dNTP need to be in the correct orientation together, and the polymerase needs to catalyze a reaction to add the dNTP to the chain (Cooper). This is a very simplified description because it does not account for many other important cellular processes, such as the DNA being unwound (Cooper). However, even this simplified account shows how amazing it is that all of those steps occur *extremely accurately* 10-100 times *per second* (Blow and Tada 560; Cooper).

When one considers the above reality of DNA replication, it is clear that organisms are oriented toward *something*. All of those specific steps would not happen, time and time again, by molecules bumping around purposelessly. However, this orientation could take a variety of forms and could be toward a number of ends. Two important questions remain to be explored: (1) What are the metaphysics behind organismal orientation, and (2) Is the orientation described above toward replicating the DNA, or is it toward a different goal? In the next section, the idea that teleological orientation is just another way of explaining efficient causation will be explored.

Section 2: Teleology and Efficient Causation

Although it is easy to conceive of teleology as coming from Aristotle's "efficient" cause, teleology is distinct from all other causes and explanations. Teleology is a metaphysically distinct explanation about how the world works, ontologically comparable to causal explanations. The distinct character of teleological explanations is evident in Aristotle's description of the causes because he believes each to provide unique information. In his commentary on Aristotle's teleology, Johnson writes: "When we think in terms of responses to various kinds of simple interrogations (like 'Why?' or 'How?'), Aristotle's insistence that we distinguish between four kinds of causes may seem uncontroversial, even trivial" (43). In other

words, Aristotle knew and articulated the obvious fact that asking different questions leads to different, unique answers. The different causes are answers to those different questions (43). Since the cause for the sake of which (i.e., the teleological cause) is distinct from the efficient cause (Physics, 2.3, 194b20-35, Reeve), then the teleological cause is at least conceptually distinct from the efficient cause.

In fact, teleological explanations can be used with causal explanations. Johnson writes of Aristotle's view about causal and teleological explanations: "Notice that there is absolutely no incompatibility between the two accounts. On the contrary, the accounts are interdependent. If the necessitating causes were not at work, then the cause for the sake of which would be in vain…And if the cause for the sake of which were not present, none of the necessitating causes would be" (57-58). Both causal and teleological explanations are needed because each provides something that the other cannot provide. Without a causal sequence, the chain of events needed to get to the teleological end would be impossible. For example, the beating of the heart is the causal explanation for blood moving through the body. Without the beating of the heart, the blood would not move through the body. Further, without a teleological end, causal sequences would not happen because there would be no purpose for them to happen. One might assume that the blood moving through the body (to support survival of the organism) is the teleological end of the beating of the heart. Without the teleological explanation, the beating of the heart would not happen because there would be no organism surviving. Causal and teleological explanations describe the same phenomenon (i.e., the beating of the heart), but in (at least) conceptually distinct ways.

Given that causal and teleological explanations are conceptually distinct, there are several ways in which they could be metaphysically connected. At first glance, it might appear that

teleological explanations are nothing more than backwards causal explanations, so teleological explanations are metaphysically reducible into causal explanations. An example of understanding teleological explanations in this way is that the heart beats for the sake of moving the blood through the body. Therefore, the blood moving through the body is the teleological cause for the heart beating. Is the blood moving through the body a cause (in the causal sense) for the heart beating so that causation is employed, but backwards? In his writing on Aristotle's teleology, Johnson addresses this objection and how Aristotle would have responded: "The objection has it that 'final causes' mysteriously reach back in time to the present and 'efficiently' cause things to happen. But in fact all that has happened is that the genetic and explanatory orders have been reversed" (56). Here, Johnson maintains that events at a later time "causing" (in a causal sense) events at an earlier time is inappropriate because Aristotle does not maintain that causes (in an efficient causal sense) are applied backwards in teleology. Rather, Aristotle maintains that the *explanation* of events is applied backwards (56).

Explaining events backwards from their causal order does not mean that such explanations must represent a metaphysical reality of backwards causation. In other words, even if Aristotle is interpreted to mean that teleological explanations are just the explanatory reversals of efficient causal explanations, backwards causality need not be a metaphysical phenomenon. There are many sorts of explanations that are not metaphysically accurate but help with human understanding. For example, metaphors and similes explain phenomena in metaphysically inaccurate ways. The expression "it is raining cats and dogs" is an explanation of the weather outside, but is not a metaphysically accurate way to describe meteorological phenomena. Likewise, although teleological explanations could be loosely phrased as backwards causation, this phrasing does not denote a metaphysical reality. It is possible to explain phenomena

teleologically so that backwards causation is the method of explanation, although it is not a metaphysical reality.

However, describing phenomena in a way accurate to their metaphysical reality is, in general, to be preferred. What, then, is this metaphysical reality? Further than the Aristotelian claim that causal and teleological causes are explanatorily distinct, causal and teleological explanations are also metaphysically distinct. Teleological explanations are *not* simply explanatory reversals of causal explanations. Rather, teleological explanations are metaphysically distinct explanations that are completely acausal.

Section 3: Acausal Teleology

That teleological explanations are acausal can be shown by considering their purpose. Aristotle writes about the teleological cause as follows: "for example, of taking walks health is the end. For why does he take walks? 'In order that he may be healthy,' we say. And in speaking that way we think we have presented the cause" (Physics, 2.3, 194b30-35, Reeve). Although this example includes the difficult question of intention that is not addressed in this paper, it is important to note that Aristotle thinks the teleological explanation answers the question "why." Johnson, in his extensive study of Aristotelian teleology, believes it is clear Aristotle means the teleological explanation to answer the question "why" (43).

The question "why," however, could have multiple senses."Why" could be taken to mean: "how did it come to be this way and not another way?" The answer to this sense of the question would be causal in nature because it would explain the circumstances that led to the situation. To give an example that will not presuppose the conclusion of the arguments in this paper, an inanimate object will be used. One could ask "why does a clock's hand move every

second?" In this first sense of "why," this question would mean "how did it come to be that the clock's hand moves every second [and not every two seconds, half second, etc.]?" The answer to this question would be causal in nature, e.g., "the inner workings of the clock ensure such precision by x, y, and z methods." However, "why" could also be taken to mean: "what is the meaning behind it being this way." If the above question about the clock were interpreted in this way, the question would read: "what is the meaning [or purpose] behind the clock's hand moving every second?" Such a question cannot be answered causally because causation cannot give meaning; causation can only give an order of events that led to a situation. An answer to the question might be "to keep track of the time," which is not a causal answer, but is an answer that conveys the meaning behind the clock moving in that way. The sense of "why" being answered by the teleological explanation needs to be articulated.

Aristotle's perspective on this question is useful. Aristotle believed that the cause for the sake of which has two senses that can be simultaneously applied, but need not be (Johnson 66, 69). Johnson writes that "the two senses of 'for the sake of which' may be characterized as a difference between the aim of something and the beneficiary of the achievement of that aim" (66). One example is the heart. The heart pumps blood for the sake of moving the blood throughout the body. However, the heart also pumps blood for the sake of the organism; without pumping blood, the organism would die. If the teleological cause has these two senses, it makes most sense to interpret the "why" question this cause is answering with the "what is the meaning behind it being this way" answer. Determining the aim behind something (e.g., determining why the heart is pumping the blood) is not determining how the heart came to pump the blood, but the meaning behind the heart pumping. Likewise, determining the beneficiary of the aim (e.g., the organism with the heart) is not determining how the organism came to have the heart, but the

meaning behind the organism having the heart (i.e., so the organism can benefit). Therefore, the teleological cause answers an acausal sense of the question "why." Therefore, teleology is a metaphysically acausal phenomenon.

Here, a restatement of ideas in Sections 2 and 3 will be helpful: (1) Different Aristotelian causes answer different questions (e.g., "how," "why") (Johnson 43). (2) Because the teleological explanation answers a different question than the [efficient] causal explanation, the two explanations are at least conceptually distinct. (3) Whether the two explanations are metaphysically distinct depends upon whether they are metaphysically doing the same thing. (4) There are two senses of the question "why," one of which is causal in nature, the other of which is acausal. (5) The teleological explanation answers the acausal sense of the question "why." (6) Therefore, the teleological explanation is metaphysically acausal (i.e., it answers the question "why" in an acausal way).

One way that this argument can be obscured or seem to be false is when teleological explanations are constructed as counterfactuals. Counterfactual construction of teleological explanations is examined below.

Section 4: Teleology in Terms Counterfactuals

Counterfactual constructions of teleological explanations use causal terms implicitly, which can lead to false conclusions about the relationship between biological teleology and causal explanations. In his paper "Types of Causal Explanation in Science," Ernest Nagel writes the following:

> a teleological account of some element in a system can often be formulated in purely physico-chemical terms and, in any case, does not differ in its verifiable content from a

> causal explanation of the same facts. Indeed, a teleological explanation can always be transformed into a causal one, even if the causal explanation thereby obtained is relatively primitive. (25)

Clearly, Nagel thinks that teleological explanations are causal in some sense; after all, he writes that a teleological explanation can be "transformed into a causal one" (25). However, as was outlined above, teleological explanations answer a different, acausal question why and the teleological explanations must be acausal. The question then becomes where Nagel differs in his conception of teleology so that he could arrive at a causal explanation from a teleological explanation. Earlier in his paper, Nagel defines teleology as follows:

> The notion I do want to defend is employed in both the physical and biological sciences, whenever some component part or process in a self-regulating system is explained by exhibiting its role in maintaining the system in a specified operative condition. Teleological explanations of this sort account for a component in terms of the *consequences* for a given system resulting from the presence of the component. (24)

An important note about this view is that it is applied to self-regulating systems only. Nagel uses the example of kidneys in the body (25-26). A causal explanation of kidney function is that [cause] kidneys take molecules in and out of the blood, so [effect] the blood has a certain chemical composition. In Nagel's version of teleological explanation, causation is still used, but the explanation is backwards (similar to what was discussed above in section 2 with Aristotle). Nagel writes: "Teleological explanations of this sort account for a component in terms of the *consequences* for a given system resulting from the presence of the component" (24). In other words, the causes (i.e., the functioning of a component) are explained in terms of the effects (i.e., the consequences of the functioning of that component). Referring to his kidney example, Nagel

writes: “Thus, to explain the human kidneys teleologically by saying the human body has them in order to keep the blood in a certain chemical state is tantamount to making the causal statement that unless men had kidneys the chemical equilibrium of their blood could not be preserved” (25-26). This re-statement of the teleological explanation is a counterfactual statement. The re-statement could be again rephrased as: “If men did not have kidneys (x), then the chemical equilibrium of their blood could not be preserved (y).” The problem with construing teleological statements as counterfactuals is that evaluating counterfactuals of this sort is usually causal, which entails that the teleological statement itself will be causal.

Consider again the example of the heart moving blood through the body. A counterfactual teleological explanation of the heart pumping blood through the body might be: “if the heart did not move the blood throughout the body to benefit the human, then the heart would not be in the human body.” Perhaps the most common method of truth-evaluating counterfactuals is by examining the closest possible world(s) where the antecedent is true and determining whether the consequent is true. The example counterfactual “if x, then y” is thus evaluated by finding the closest possible world where x is true and deciding whether y is true. Since the *closest* possible world is used, the only relevant difference should be x and any changes that occur because x is true in that world. The *closest* possible world where x is true will have every other factor held constant. However, this strategy will often imply causation because, often, the reason a factor is different in the possible world is because changing x *caused* y to be changed.

Applying this idea to the heart example, consider the closest possible world(s) in which the heart does not move the blood throughout the human body. In that world, would humans still have hearts? Presumably, humans would not have hearts. However, this conclusion is the result of causal reasoning: Why would humans not have hearts? One explanation is that hearts would

not have been selected by evolution since they did not perform a useful function in humans (One theory of biological teleology that incorporates evolution is articulated by Francisco J. Ayala in "Teleological Explanations in Evolutionary Biology"). However, evolution is a causal explanation that employs the idea of how humans causally came to have hearts. It seems that every other explanation of why humans would not have hearts in a world where the heart did not move blood throughout the body will also implicitly employ causality. If the only thing changed in the possible world is that the heart does not move blood throughout the body, then it seems that if the heart is not in the human body, it is causally because of the change.

Some might object that counterfactuals should not be evaluated in terms of the closest possible world or that causality is not necessarily related to counterfactual evaluation. However, the general claim of this section remains relevant in the face of these objections. Generally, if counterfactuals are to be evaluated, they are evaluated with possible worlds. Further, in the case of biological systems, if a consequence of the system is changed (e.g., if the heart no longer pumps blood through the body), then the implications in the possible world are evaluated using causation. Therefore, although not a deductive argument proving that teleological explanations phrased as counterfactuals are necessarily causal, this argument seems to show that, generally, teleological statements phrased as counterfactuals imply causality.

Overall, this argument adds to the conclusions drawn in sections 2 and 3. There, it was concluded that teleological explanations are acausal. This section expands on this conclusion to show that counterfactual phrasing of teleological statements tends to be causal and teleological explanations should therefore not be phrased as counterfactuals. The conclusions of sections 2-4 are an extensive negative characterization of teleology, but they do not explain the positive metaphysics behind teleology. If teleological explanations are not metaphysically causal, what

metaphysics do they have? Section 5 will attempt to sketch a beginning to the metaphysics of teleology.

Section 5: The Metaphysics of Teleological Explanations

In order to understand the positive metaphysics of teleological explanations, the counterfactual phrasing of teleological explanations will again be explored as a contrast. Counterfactuals phrase the teleological explanation in terms of the consequences of the system. Nagel writes that the teleological explanation of the functioning of the kidneys can be correctly rephrased by a counterfactual statement: "unless men had kidneys the chemical equilibrium of their blood could not be preserved" (25-26). Here, the rephrasing is in terms of the consequences of the system. The consequence of the kidneys is that the chemical equilibrium of the blood is preserved. In other words, when the kidneys are active, the consequence is that the blood remains at equilibrium. Nagel explicitly makes this point when he writes: "Teleological explanations of this sort account for a component in terms of the *consequences* for a given system resulting from the presence of the component" (24). Prima facie, phrasing teleological explanations in terms of consequences is accurate. To go back to the example used in section 1, the consequence of DNA replication systems is that the DNA is replicated. It seems that the orientation of the system is to replicate the DNA because that is the consequence of the system, which would mean that the system's teleology (because teleology is described in section 1 as an orientation toward something) is to replicate DNA. When deciding whether the consequences of a system are relevant for a system's teleological explanation, it is important to note that explaining a system by its consequences is *not* the same as explaining a system by its function.

That explaining a system by its consequences is different than explaining a system by its function is clear on a closer examination of the concepts. The consequences of a function can be reached, but being in the function's end state is not the same as the function itself. For example, one might say that the function of the kidneys is to preserve the chemical equilibrium of the blood. Further, the consequence of the kidneys is the preservation of the chemical equilibrium of the blood. However, the state of the chemical equilibrium of the blood is not the function itself. The function exists regardless of the state of the blood; the function of the kidneys exists both when there is chemical equilibrium in the blood and when there is not. In other words, the *consequences* of a system only exist when instantiated by the correct sequence of efficient causation. The *function* of a system, on the other hand, exists whether or not the end-state of the function is currently instantiated. If expressing teleology in terms of consequences is different from expressing it in terms of function, then, which method of expression should be adopted?

It is better to express teleology in terms of function rather than in terms of consequences because consequences are the result of causal sequences. For example, the proper working of the kidneys has the consequence of the maintenance of the chemical equilibrium of the blood. The chemical equilibrium of the blood is the causal *consequence* of the kidney's taking certain molecules out of the blood and putting some molecules into the blood. However, as was determined in section 3, teleological explanations are acausal. Teleological explanations in terms of functions better expresses this acausal nature of teleological explanations. A function is not something that has a direct cause, as consequences have a cause. The function of the kidneys is not caused by the proper working of the kidneys. The *function* of the kidneys exists whether the kidneys are properly working or not. Therefore, because of their acausal nature, teleological explanations are in terms of functions rather than in terms of consequences. However, the

metaphysical characterization of teleological explanations being oriented toward functions does not explain what function(s) organisms are teleologically oriented toward. This question will be explored in section 6 below.

Section 6: The Teleological Function

The question of what biological systems are oriented toward is often articulated in terms of consequences because many characterizations of teleology are in terms of consequences. In these terms, the idea can be expressed as the problem that: biological systems have many consequences, but only one or some of those consequences are generally expressed in terms of teleology. Francisco J. Ayala, in his evolution-based account of teleology, raises this issue. He writes: “The configuration of a molecule of sodium chloride contributes to its property of tasting salty and therefore to its use as food, not vice versa; the potential use of sodium chloride as food is not the reason why it has a particular molecular configuration” (14). Like sodium chloride, each organismal system has many consequences, but not all of those consequences are expressible with teleology. For example, in the DNA replication system, one consequence of the system might be that each polymerase catalyzes x reactions per day. In this scenario, the system has at least two consequences: the polymerases catalyzing x reactions per day, and the replication of the DNA. However, intuitively, it seems that the function of the system is replication of the DNA and not for the polymerases to catalyze x reactions per day. In other words, if teleology were expressed in terms of consequences, one would need to distinguish between consequences that are the result of teleology and those that are not. However, the function of a system is independent of the consequences of the systems, as was demonstrated in section 5. Therefore,

determining the teleological orientation of an organism is not simply choosing the correct consequence; the *function* needs to be determined.

As is explained in Johnson's analysis, Aristotle thought the teleological end of organisms is to survive and reproduce (Johnson 159), and that this end of organisms is (in essence) a basic fact (175). It seems that Aristotle was, at least mostly, correct in this assessment. The claim that organisms are oriented toward reproduction will not be defended here and is not a part of the definition of biological teleology being defended. However, that organisms are oriented toward survival seems a basic fact. That organisms are oriented toward survival can be seen in all of the examples of seeming teleological systems discussed in this paper. No matter any other function of the DNA replication system, of the heart, or of the kidneys, each system/organ could not achieve any function without existing in a live organism. Therefore, if there is to be teleological explanations in living organisms at all, it seems that at least one of the teleological functions must be survival. Without survival, any other teleological functions could never be achieved. Another indication that survival is the teleological *function* of the organism is that survival seems to be the goal of the organism, even if it is not achieved. When an organism dies (i.e., the consequences are no longer survival), it seems that the organism has stopped performing its proper function and has failed. From this reasoning, it may be concluded that the teleological orientation of organisms, and at least one of the teleological orientations of all biological systems, is toward the function of survival.

One might object against the above view that biological systems have teleological explanations in their own right and not just teleological explanations about the overall survival of the organism. For example, the DNA replication system seems to be oriented toward replicating the DNA as well as ultimately toward the survival of the organism. It is not necessary to this

paper that the *only* function present in any biological system is the survival of the organism overall. However, it seems likely that only one function (toward survival) is present. Here, the distinction between the function and consequences of a system are again important. The teleological end, and the function, of any organismal system is to help the organism survive. The consequences of organismal systems can include replicating DNA, moving the blood throughout the body, keeping the blood in equilibrium, etc. These consequences are not teleological ends because they do not answer the acausal sense of the question "why" like teleological explanations should. Why is (what is the meaning behind) DNA being replicated? Because replicating the DNA (to replace dead skin cells, etc) helps achieve the survival of the organism. Why (how did it come to be that) DNA is replicated? Because the DNA replication system has the consequence of replicating the DNA.

This distinction might be identified as similar to the common "proximate vs ultimate" distinction often used in biological, teleological explanations. In his defense of an evolutionarily-based teleology for organisms, Ayala writes that "[there] are in all organisms two levels of teleology that may be labeled *proximate* (or *particular*) and *ultimate* (or *generic*)" (18). Ayala describes the proximate end as existing "for every feature of an animal or plant. The existence of the feature is thus explained in terms of the function or property it serves" (18). The ultimate goal, in contrast, is one in which "all features contribute or have contributed in the past - reproductive success" (18). These distinctions are very similar to the kind drawn here, where the proximate goal is similar to what is described as the "consequences of the system" and the ultimate cause is similar to what is described as the teleological explanation. However, there are some differences.

One obvious difference between the views is that the ultimate goal is defined differently. Ayala claims the ultimate goal of organisms is reproductive success, while this paper claims that the ultimate goal of organisms is survival. However, the more important distinction is that Ayala's proximate and ultimate goals are of the same *type*. Ayala claims that "the ultimate source of teleological explanation in biology is the principle of natural selection" (18). Natural selection is a causal process - whatever is retained through natural selection will be retained causally. Further, Ayala describes the proximate causes in terms of their consequences, or what it does (18), which was argued above is also not teleological (in the sense of this paper). Therefore, although a similar distinction is made in this paper between the proximate and the ultimate, this paper proposes a fundamental distinction between the two. The proximate can be described in terms of consequences, but the ultimate must be described in terms of function (with a definition as used in this paper). Ayala describes the proximate in terms of consequences and the ultimate in terms of efficient causation. Therefore, neither qualifies as a teleological explanation by the definition given in this paper. Although the proximate/ultimate distinction might be helpful to understand the view presented in this paper, one must be careful to understand the differences this paper's theory has from other uses of the proximate/ultimate distinction.

As for the immediate consequences of organismal systems (e.g., the replication of DNA, the movement of blood, etc.), the relevancy of these consequences can be chosen or ranked in order of preference according to one's favorite theory. For example, Francisco Ayala creates three categories of teleology that apply to organisms: intentional actions, self-regulating systems, and parts of the body adapted to a specific role (16-17). Nagel only counted self-regulating systems as teleological (24) (although as was described above, he used a different sense of "teleological"). The exact method of determining the relevant consequences of any organismal

system is beyond the scope of this paper. What is being established in this paper is that the teleological function of all systems in an organism and in the organism as a whole is survival. Since the metaphysics of a teleological end is an orientation toward a function, and the function of an organism is to survive, **biological teleology is the actual, metaphysical orientation of an organism to survive**.

Conclusion

This paper has shown that **biological teleology is the actual, metaphysical orientation of an organism to survive**. The Aristotelian view of teleological explanations in organisms has been evaluated according to modern philosophy and science. Section 1 explored Aristotle's assertion of biological teleology and agreed that modern biology supports the existence of some sort of biological teleology. However, the metaphysics behind the teleological explanation and what the teleological system pointed toward needed to be explored. Sections 2 and 3 established that teleological explanations are distinct from efficient causal explanations because the different explanations answer different questions. Because teleological explanations answer a question that efficient causal explanations cannot answer, teleological explanations are acausal. Section 4 explained that acausal teleological explanations should not be expressed as counterfactuals and the negative construction of teleological explanations was complete. Section 5 finishes the characterization of teleological explanations with a positive metaphysical analysis that teleological explanations consist of an orientation of the system toward a function. Finally, section 6 concludes the characterization of teleology by showing that the function towards which organisms are oriented is survival.

Although biological teleological explanations are sometimes rejected in favor of a purely causal account, biological teleology is a reality that should be more widely recognized. As was discussed in section 3, causal accounts do not give meaning. If any biological processes or organisms are thought to have meaning, tools beyond simple causal accounts need to be employed. Both philosophers and biologists should accept biological teleology as a legitimate metaphysical reality and should work towards a more complete understanding of organisms using all of their available tools.

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