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Aristotle and Darwin Hand in Hand: Biologists in Pursuit of Understanding the Underlying Mechanics of the Natural World

From the remnants that remain of Aristotle's works, it is clearly evident that the philosopher was interested in almost every domain of inquiry of the time. Of this vastness, much has been eclipsed by "modern" ideas, and yet, his exceptional observational abilities continue to shine through in his biology.¹ Aristotle's insights into the underlying threads of organisms are still relevant in understanding the reasons why living things live and grow in such a manner that suggests they have ends themselves. However, interpretations of Aristotle's biology have distorted fundamental aspects of his philosophy of natural science. These permutations have significantly contributed to the hesitation and often rejection of teleological accounts in biology. A close examination of Aristotle suggests that many of the primary reasons cited for this rejection are confused. In order to distinguish the viability of his biology, Aristotle's fundamentals will be fleshed out alongside Charles Darwin's Theory of Natural Selection. This should suggest that Aristotle was one step, albeit a necessary one, from the doorstep of the theory of evolution and natural selection, and Darwin used Aristotelian teleology to explain natural selection, although not in such terms. Thus, the claims then become two-fold: first, Aristotle's teleology is free from the typical reasons for removing

¹ Kullmann, W. "Aristotle as a Natural Scientist." *Acta Classica* 34 (1991): n. pag. Web.

teleological accounts from biology, but his biology still requires retooling in light of the mutability of species. Secondly, Darwin's account of natural selection and evolution, which is taken as a foundational assumption in contemporary biology, unknowingly uses Aristotle's teleology to explain Darwin's theory of natural selection and evolution from the perspective of the individual organism and the trajectory of the species. Ultimately, these two points are intended to be the internal components of providing evidence for the necessity of teleological accounts in evolutionary biology.

As such, this paper consists of a brief description of a "normal" scene in the Smokies, followed by the two primary sections of the paper. The former will provide an example of the kind of phenomenon that Aristotle and Darwin were investigating. It will also serve as a reference for specific organisms and structures that will be referred to from the perspectives of Aristotle and Darwin using appropriate terminology and explanations specific to each thinker. The first primary section will state and define Ernst Mayr's three strongest objections against teleology in biology.² As opposed to working through each objection in turn, the analysis and rebutting of each will be realized through two further divisions: the first addressing Aristotle's four causes and their relation towards his theory of science, and the second will provide a brief outline of his souls and their role in his teleological account. This is to avoid laborious repetition as the cause of all these objections stem from an incomplete understanding of fundamental Aristotelian concepts. Ideally, this will provide a robust account of Aristotle that clearly demonstrates why Mayr's three objections do not threaten Aristotle's teleological biology. The

² Mayr, Ernst. "The Multiple Meanings of 'Teleological.'" *History and Philosophy of the Life Sciences* 20, no. 1 (1998): 35–40.

second primary section will be composed of a Darwin led analysis of the shared, fundamental principles that each biologist held to be inextricable from a biological account of the natural world. Ideally, this Virgil-esque accompaniment will suggest Aristotle's biology is impressively "modern" but requires crucial revision, and Darwin's biology was impressively "Aristotelian," although convergently. However, the same mixture of outdated and modern attributed to Aristotle could be said of Darwin's biological works, but it is evident that the magnitude of Darwin's work far outweighs its limitations. Hence, the end of the paper is to arrive at this same conclusion for Aristotle's biology.

One can count on the spring in the Smokies being spectacular, and one can similarly count on many of the similar characters reappearing and blossoming for their roles on the forest floor. In a particularly rich area, there are hundreds of species from all domains of life hanging together from necessity and depending on one another. Starting from the skies where the richness and abundance of creatures is fewer, one could run into an American kestrel lazily floating far above the ridges. Perhaps, if one was a little lower in altitude, burbles and chirps would lead one to the minute chimney swifts hastily weaving between trees, or even lower in the canopy, juncos staring dark-eyed from a branch. These trees could be the magnificent tulip poplars, over one-hundred feet tall, or they could be the more delicate birches, magnolias, and cucumber trees crowding a creek bank, digging their feet into the muddy banks. If the creek is large enough, the brook and rainbow trout are sure to invite a belted kingfisher to a one-diner dinner, but if the creek is a little slower than one has a greater chance of finding a variety of salamander species wedged under their rocks and logs. At night, this creek is sure to be swimming with creatures who only arise when the sun sinks in the cool, wet of the night. Fat

mud salamanders wriggling out of their crevices to prey upon the smaller seals, or perhaps be prey themselves to another larger than themselves. A fat, wild hog, may fill this role, or even a bear who tends to try everything once. While these animals fill the forest floor, the night air is crowded with the howls of coyotes and the eerie cries of the foxes. The lynx slinks in silence. But as the sun rises again, animal activity becomes invisible again, and silent. However, the pink lady slippers and their sisters the pale orchids spectacularly come into focus. Their darker, but equally regal, relatives, the morels, tend to hide in the leaf litter under their host trees. Below their roots is another world of living things, some visible like the rhinoceros beetle larvae, but some far beyond our eyes and our knowledge. This is a small view of the Southern Appalachians, but even still life is great in variety.

Aristotle's natural science aimed to describe the regularity of all living things. Even though Aristotle never saw the virgin mixed hardwood stands of the Southern Appalachians, not the towering tulip poplars, nor the clustered bunches of pink lady slippers dotting the forest floor, but an account of his natural science optimally would be capable of explaining this regularity. Paramount to this account, The philosopher observed that living things seem to live in such a manner that they have end-oriented behavior and structures of parts, but many organisms do not have the capacity to reason towards an end.³ Further, these things regularly produce more like themselves and consistently grow in set patterns despite states changing. Aristotle's natural science sought to explain this regularity of nutritive, reproductive, and end-oriented life.⁴ This pursuit distinguished the natural from unnatural, the living from non-living,

³ Allen, Colin and Neal, Jacob, "Teleological Notions in Biology", The Stanford Encyclopedia of Philosophy (Spring 2020 Edition), Edward N. Zalta (ed.).

⁴ Kullmann 1991

and ultimately pursued a kind of explanation that would explain the fundamental characteristics shared by all living things.⁵ Aristotle took the study of the natural world to be one inherently concerned with motion/change and the source of motion/change because the locale of motion internal to living things fundamentally defined this domain.⁶ This is to say that for living things, the source of natural change is internal as opposed to external. There is some principle inherent in living things, which will be discussed in the section on souls, that is the cause of change for them. Hence, the primary division, for this paper, is between living things and non-living things, and the delineation between the two can be made along the lines of the source of motion for both. Living things have a principle of internal motion, which allows for locomotion or growth, but non-living things can only have a source of motion from an external source, or if internal then not for the non-living thing qua non-living thing. With a great number of stipulations, it is possible a bed of wood may begin to “grow” in some sense, but it is experiencing this change not because it is a bed but because its components are of wood, which have the principle of internal motion to itself.⁷ Thus, the formal domain of inquiry is compound bodies with an internal source of motion.⁸ The informal domain of inquiry is organisms like that have been described in the Smokies, but ultimately that cover the earth.

Aristotle’s biology requires teleological accounts to explain why living things and their structures exist. However, Aristotle thought that the best explanation of the reoccurring patterns of behavior and development of living things in predictable forms would include a

⁵ Johnson, Monte Ransome. *Aristotle on Teleology*. Oxford: Clarendon Press, 2005. Print.

⁶ Johnson 2005

⁷ Gotthelf, Allan. “Aristotle’s Conception of Final Causality.” *Teleology, First Principles, and Scientific Method in Aristotle’s Biology*. Oxford University Press, 2012. Web.

⁸ Johnson 2005

teleological perspective, but not a merely teleological perspective.⁹ As such, the philosopher classified a variety of explanations that answered different questions regarding biological observation, which are known as the four causes, but they apply to more than just biological investigations. There is a priority, or difference in importance, of these causes for the sake of explanation for living things because the features that distinguish living things are necessarily end-oriented. Further, when explaining things, there is a distinction between incidental and intrinsic causes because there is an infinite number of incidental causes and a finite number of intrinsic causes.¹⁰ Therefore, intrinsic causes provide richer explanation than incidental causes. Difference in explanatory power and priority does not assume that one kind of explanation could constantly be applied to all matters, but that when applicable, certain kinds of explanation have greater explanatory power than others, which should be clear. However, the teleological cause, or the cause for the sake of which, has been the subject of long held scrutiny for some biologists allege that claiming organisms have ends is inappropriate for biological investigation.¹¹

The implications of holding teleological accounts are distilled into three objections, famously propounded by Ernst Mayr, for including teleological accounts in biology.¹² These are that teleology supposedly: requires backwards causation, is incompatible with mechanistic explanation, and is Vitalistic.¹³ Each of these issues will briefly be defined here, but thorough investigation of the first two objections will occur in the section on the four causes and the

⁹ Johnson 2005

¹⁰ *Phys ii* 5, 196b24-9

¹¹ Mayr, Ernst. "Darwin's Impact on Modern Thought." *Proceedings of the American Philosophical Society* 139, no. 4 (1995): 317–325.

¹² Ernst Mayr 1988

¹³ Ernst Mayr 1988

investigation of the third will occur in the section on souls. The first objection is that arguments employing backwards causation use events in the future to explain a current state of affairs, which is clearly incompatible with evolutionary thought.¹⁴ For instance, if one examined the *Archaeopteryx* and claimed that the species had feathers then because eventually the feathers would be crucial for flight, then that explanation requires future events to understand present situations. Evolution does not build consciously towards ends. Similarly, if teleological accounts were incompatible with mechanistic explanation then a teleological biology would exclude an entire domain of explanation inherent in biological accounts.¹⁵ Mechanistic explanations being defined as “the use of ideas and techniques drawn from the field of mechanics to explain the natural world.”¹⁶ This would entail that a teleological biology could not provide explanations of how something comes to be and why something comes to be. Again, in the example of *Archaeopteryx*, if teleological accounts are incompatible with mechanistic accounts, then one could not explain how the genomic sequence for feather production operates if one had already given an explanation of why the feathers produced. Modern biology requires mechanistic explanations. Finally, Vitalism is the notion that “living organisms are fundamentally different from non-living entities because they contain some non-physical element.”¹⁷ If these faults are indeed true of Aristotle, then it should be evident that modern discoveries have indeed moved beyond this kind of thought. However, as hopefully will be demonstrated, these faults do not ring true, and the relevance of Aristotle in biology becomes a

¹⁴ Allen and Neal 2020

¹⁵ Mix, Lucas. “Nested Explanation in Aristotle and Mayr.” *Synthese* (Dordrecht) 193, no. 6 (2016): 1817–1832.

¹⁶ Berryman, Sylvia. “Teleology Without Tears: Aristotle and the Role of Mechanistic Conceptions of Organisms.” *Canadian Journal of Philosophy* 37.3 (2007): 351–369. Web.

¹⁷ Klerk, Geert. “Mechanism and Vitalism. A History of the Controversy.” *Acta Biotheoretica* 28.1 (1979): 1–10. Web.

much more complicated question. This question must first be addressed with the rejection of Mayr's three objections.

Aristotle used a variety of kinds of explanations that when employed together would answer four questions: namely, what is it, how is it, from what is it, and why is it. His four explanations are the cause out of which, whence the source of change, the form and what it is to be something, and that for the sake of which.¹⁸ In an attempt to stay as true to Aristotelian terminology as possible, these phrases will be used as opposed to more common renderings: the material cause, the efficient cause, the formal cause, and the final cause. The primary reason for choosing not to use the common vernacular is because "final cause" has internalized the objections posited by Mayr and many others¹⁹, and Aristotle "never uses the phrase X cause."²⁰ In order to understand the role of the cause for the sake of which, one must understand this kind of explanation's relation to the other kinds of explanation and the questions that could be answered through its employment.

The first cause, or the "cause out of which," is the explanation of what constitutes a thing, be it matter or parts.²¹ Aristotle uses this explanation to explain, "how elements and parts relate by necessity to certain functions for 'the sake of which.'"²² For this reason, Aristotle treats this kind of explanation as functionally very similar to the cause for the sake of which.²³ In the illustrative portion of the forest, if one intended to note the "cause of which" of the

¹⁸ *Phys* ii 7, 198a21-8

¹⁹ Mayr, Ernst. "The Multiple Meanings of 'Teleological.'" *History and Philosophy of the Life Sciences* 20, no. 1 (1998): 35-40.

²⁰ Johnson 2005

²¹ Johnson 2005

²² Johnson 2005

²³ Johnson 2005

salamander eggs, then an appropriate account would contain the elemental composition of the different parts of the eggs in order to explain why they are the way they are. In this manner, the upshot of this kind of cause can be the teleological explanation of why the egg is composed in this manner.²⁴ However, Johnson qualifies that it is inappropriate to think of this kind of explanation as merely the elemental constituents because Aristotle makes explicit reference to syllables being the cause out of which words come.²⁵

The second kind of cause, “whence the source of change” fundamentally identifies “whatever active principle initiates change (or rest).”^{26 27} Johnson also contends that the adverb “whence,” demands that a location, be it internal or external, be preserved in the explanation because the origin of change delineates natural action from unnatural action for living things.²⁸ For the ends of living things, the source of change will be internal to them, but for actions that are not end-oriented, or against the nature of a thing, the source of change is external.²⁹ Thus, the wind is the source of change for the tree being knocked down, but this change comes from an external force. However, if one wanted to understand the source of change for the tree growing prior to its knockdown, then “whence the source of change,” would be a principle internal to the tree, for it changes because of itself and not an external factor.

The third cause is often translated as “the what it was to be something.”³⁰ Often, this causes is taken to mean the form of a thing or species but not in a “strict taxonomic sense.”³¹

²⁴ Boylan, Michael. “Mechanism and Teleology in Aristotle’s Biology.” *Apeiron* 15.2 (1981): 96–102. Web.

²⁵ *Phys* ii 3, 195a 16-21

²⁶ *Phys* ii 3, 194b29-32

²⁷ Johnson 2005

²⁸ Johnson 2005

²⁹ Johnson 2005

³⁰ Johnson 2005

³¹ Johnson 2005

This kind of explanation answers the question of “what is it,” and is the most “general answer to this question would be ‘that what it is to be something.’”³²

Finally, there is the fourth cause, the cause for the sake of which. This account does not answer how things come to be or from what but why. Aristotle employed this account to explain the regular occurrence of natural phenomenon. For example, one could ask why it is that tulip trees consistently produce the same shaped leaf or why red-cheeked salamanders dance the same courtship dance every year. Aristotle claims that without this kind of account, one cannot provide a satisfactory explanation of this consistency. In *Physics* II.8, Aristotle contends that “an opponent who claims that material and efficient causes alone suffice to explain natural change fails to account for their characteristic regularity,” which can be seen throughout the natural world. This should suggest why Aristotle took the cause for the sake of which to be a necessary kind of explanation, but he also took this kind of cause to be not only compatible with the other kinds of explanation but richer in their company.

The cause for the sake of which has several distinct features that make it readily clear that as an explanation it does not require backwards causation nor is incompatible with mechanistic explanation. First of all, Aristotle notes that for the cause for the sake of which the temporal sequence is the “reverse of the case of the cause of motion.”³³ This is to say that which happens first in time happens second in explanation. For instance, the tulip poplar seed that begins to sprout is explained by first referring to its final state, the mature tulip poplar tree. However, the final state itself temporally comes after the seed, but explanatorily must be

³² *Phys* ii 3, 195a20

³³ *Posterior Analytics* ii 11

understood to answer why the seed sprouts.³⁴ This does not require any future event influencing the present but is merely a distinction in priority of temporal sequences and explanatory sequences. While clearly confused, this misguided fault of Aristotle's teleology continues to be a nuisance.

According to Aristotle, not only are mechanistic (material) and teleological explanations compatible, but a richer understanding of the thing in question is reached when there is an understanding of both.³⁵ Mechanistic explanations are a kind of explanation that explains how something comes to be by way of describing the physical state of affairs.³⁶ A mechanistic explanation of how spores detach from the hymenium of the oyster mushroom would examine the physical structure of the basidiospore relative to its basidium. A good analysis and subsequent explanation would reveal that the shape and attachment of the spore necessarily is conducive to be broken easily from its perch by way of growth and ejected into the world. However, this does not explain why the spores detach from the hymenium. Aristotle would then employ a teleological explanation that would satisfy the why of this singular event.

Ideally, the importance and relation between the four causes is clear in the specific case of explaining the regularity of naturally occurring phenomenon. This clarity should remove any lingering suspicion that Aristotle's teleological biology required backwards causation or is incompatible with mechanistic explanations. However, the assertion that vitalism is not necessary for the cause for the sake of which should materialize more substantially through an

³⁴ Johnson 2005

³⁵ *Posterior Analytics* ii 11, 94b27-95a3

³⁶ Berryman, Sylvia. "Teleology Without Tears: Aristotle and the Role of Mechanistic Conceptions of Organisms." *Canadian Journal of Philosophy* 37.3 (2007): 351–369. Web.

examination of the nutritive soul being the cause for the sake of which of organisms. Thus, an application of Aristotle's conception of nested souls and functions conjoined with the previous matter on causes to our forest setting should definitively vanquish the Vitalist worry.

All living things have souls in Aristotle's estimation, but these souls are better understood to be the capacity to perform various activities than the immortal substance of the Judeo-Christian tradition.³⁷ As the souls are nested, the possession of inner souls presupposes the possession of outer souls. Hence, if an organism "possesses" one of the inner souls, then that organism has the capacity to actualize the associated action of that soul and the outer ones as well.³⁸

The myriad creatures in the forest setting should suggest that there is abundance of variety in the domain of life in form, trophic modes, behaviors, etc. However, Aristotle's souls were meant to capture the fundamental capacities of life. These capacities vary depending on the kind of soul, but Aristotle claims that a complete explanation of living things requires establishing an activity "common to all living things" and "prior to all other activities of other things."³⁹ This fundamental thread is the capacity to reproduce and grow, which are the capabilities of the nutritive soul.⁴⁰ As this is a trait shared by all living things, all living things possess the nutritive soul.⁴¹ Once again, this kind of change is internal to the kinds of things that are the subject of biological investigation. In support of this, it seems clear that all living

³⁷ Grene, Marjorie. "Aristotle and Modern Biology." In *The Understanding of Nature*, 74–107. Dordrecht: Springer Netherlands, n.d.

³⁸ *De Anima* 2.2, 413a32; 2.3, 415a9

³⁹ *De Anima* ii 4, 415a23-b7

⁴⁰ Johnson 2005

⁴¹ Shields, Christopher, "Aristotle", *The Stanford Encyclopedia of Philosophy* (Spring 2022 Edition), Edward N. Zalta (ed.)

things partake in some dimension of reproduction: a mess of spotted salamander eggs cohabitating with algae symbionts is just as the fungal spores beneath these eggs undergoing plasmogamy despite the shocking difference in means. Further, it also seems clear that all living things have structures and/or behaviors that benefit them in acquiring nutrients: burrowing spiders digging traps to catch prey, seal salamanders carving through streams with their powerfully keeled tails. Here, benefit is understood in the objective sense that there are goods/requirements necessary for life, and in the interest of organisms it is better to be alive than dead. As the nutritive soul satisfies both criteria for a complete explanation of the regularity of natural phenomenon, it is the cause for the sake of which organisms act.

Aristotle's cause for the sake of which is teleologically twofold: the aim of the action and the beneficiary of the action.⁴² He calls this division "that of which" and "that for which."⁴³ The nutritive soul is the internal principle that can consistently explain the regularity of end-oriented behavior and structure for it is the aim of organisms' actions. The beneficiary of the action is the organism itself and the aim of the action is "eternal existence."⁴⁴ Aristotle's "eternal existence" is the eternal chain of organisms produced through reproduction. In this way, Aristotle claims that the nutritive soul can be thought of as the cause of living things in three different ways: "substance, source of change, and the cause for the sake of which." Here is a big chunk of Aristotle to work through:

"Nature has generated the physical bodies of plants and animals. But physical bodies are the instruments of the soul, and so exist for the sake of them. But again, in two ways. The body

⁴² *Phys* ii 2, 194a35-6

⁴³ *Meta* xii 7, 1072b1-8

⁴⁴ *De Anima* 2.2, 413a32; 2.3, 415a9

exists for the aim of the soul's functioning, and the soul's functions exist for the benefit of the individual organism that lives through the soul and with the body."⁴⁵

Notice that the bodies of organisms are generated through this natural principle. Hence, an explanation of what something is can be explained by the soul. Similarly, the source of change is again the soul because it is internal principle that initiates change for the organism. Finally, the soul is the cause for the sake of which organisms act, both for themselves as individuals but also for the sake of reproduction to participate in the divine. Therefore, the activities of "living, growing, and reproducing thus govern the teleological explanation of living things."⁴⁶ With this explanation of souls, the way forward rejecting vitalism is clear.

Vitalism is the notion that "living organisms are fundamentally different from non-living entities because they contain some non-physical element."⁴⁷ From this definition, it is understandable why some contend that Aristotle's souls require this "non-physical element" because Aristotle does claim that there are characteristics of living things inherent in only them. However, according to one conception of vitalism, the non-physical force that animates living things is "likened to a current of consciousness injected in or permeating matter," which would seem to suppose that all living things have some level of consciousness or "pre-consciousness."⁴⁸ Supporters of Vitalism contend that goal-directed behavior is evidence of a pre-consciousness, which supports the notion that all living things consciously strive towards ends. If this is true, then it must be so that plants also desire to act towards ends. This claim is

⁴⁵ *De Anima* ii 4, 415B7–21

⁴⁶ Johnson 2005

⁴⁷ Klerk 1979

⁴⁸ Catenazzo, Anthony, and Michael Vater. "Hegel's Assimilation of Aristotelian Teleology: Hegel after Darwin." ProQuest Dissertations Publishing, 1996. Web.

neatly contained in Collingsworth statement that “the seed only grows because it *wants* to become a plant.”⁴⁹ Indeed, this raises the difficult question of whether goal directed behavior can occur without consciousness as the plant here is obviously portrayed as knowing the end towards which it grows. However, this illustration is contrary to Aristotle’s account of the soul for Aristotle clearly contends that plants have ends, as they are living things, but they are fully without the ability to desire.⁵⁰ The nutritive soul accounts for the plant’s ability to reproduce and feed itself and even develop structures that achieve these ends. In this manner, the tulips grow towards the sunlight because the sunlight will benefit them but also for the sake of reproduction. However, there is no description of the nutritive soul enabling the ability for an organism to desire this action. In fact, Aristotle makes it clear that it is the sensitive soul that allows for pleasure and pain, and thus desire, but plants only have the nutritive soul.⁵¹ It should be clear then that plants are incapable of desiring, and any notion of plants *wanting* to become something for the sake of being that thing because of a notion of a “pre-mental” substance cannot be attributed to Aristotle. Hence, there is no substance to the claim that Aristotle’s teleology entails a vitalistic dimension of life.

This section had two objectives: provide a brief introduction of the necessity of teleology in Aristotle’s biology and rebuttal of Mayr’s serious objections. The evidence thus brought forth should suggest that these specific objections are not tenable in Aristotle’s biology. Proceeding, the final section will consist of a strict analysis of Aristotle in light of Darwin and Darwin in light of Aristotle. Aristotle’s conception of the nutritive soul and the two-

⁴⁹ Collingwood, R. G. *The Idea of Nature*. London: Oxford University Press, 1968. Print.

⁵⁰ *De Anima* ii.4, 415a22-415b12

⁵¹ *De Anima* ii 1, 412a27-412b9

fold end of organisms is remarkably akin to Darwin's primary principles that logically entails natural selection.

What is the future for teleology if it is clearly evident that Aristotle's teleological biology is free from Mayr's objections? Its future lies in Darwin's paradigm shifting discovery of natural selection and evolution. Once proclaimed as the vanquisher of teleology in biology,⁵² a thorough investigation of Aristotle's teleology may in fact suggest the opposite: Darwin cemented the need for teleology in biological explanations.

Darwin never saw the cucumber trees in full blossom alongside their sibling magnolias, nor the juncos peppering the branches, flitting between flowers heard, mere shadows singing. Just like Aristotle, Darwin's life was spent investigating these kinds of things despite never seeing these particular individuals, and his life-long observations across the world culminated in his world shattering, seminal work, "*The Origin of Species*."⁵³ The theory of natural selection and evolution proposed in this book explains the regularity in pattern of living things in both reproduction and behavior, but revolutionarily, it definitively charts the ramifications of heritable variation in populations, which is the evolution of species. Within the biological community, some have heralded this work as the vanquisher of teleology in biology forever, for it gives a satisfactory explanation of organisms and parts without any final cause, allegedly.⁵⁴ These claims are made by those confused, or unaware of, Aristotle's biology, for a claim as bold as this fails to grasp fundamentally teleological dimensions in "*The Origin of Species*." However,

⁵² Allen, Colin and Neal, Jacob, "Teleological Notions in Biology", The Stanford Encyclopedia of Philosophy (Spring 2020 Edition), Edward N. Zalta (ed.).

⁵³ Darwin, Charles. *Origin of Species*. New York: American Home Library Co., 1902.

⁵⁴ Lennox, James. "Darwin Was a Teleologist." *Biology and Philosophy* 8.4 (1993): 409–421. Web.

this kind of claim does rightly suggest that this seminal work did put to rest the notion of eternal species that is clearly a part of Aristotle's biology and the dominant biological thought of Darwin's time. This claim should then suggest that Darwin discovered what was missed by Aristotle, but part of Darwin's explanation of this discovery was first Aristotle's discovery.

This claim will be addressed in three sections, which all focus on startling similarities between the two biologists. These similarities divided into sections are similarities in: agenda, explanation, and first principles. The first subsidiary division is brief but importantly contends that Aristotle and Darwin shared the same agenda from both the same starting point of observation and for the same end. This end being an explanation of the explosively complex but regular natural world. The second division builds upon this shared agenda to suggest that both biologists were unsatisfied with explanations of chance for the regularity in nature, and as such, sought principles that could explain this regularity. Hence, a satisfactory explanation can explain why organisms and their parts bring about similar ends through a multitude of means. Such a claim will be substantiated with a comparison of Aristotle's necessary and incidental parts and Darwin's homologous and accidental parts. Finally, the third division fleshes out the first principles that the thinkers took to follow from these observations. Primarily, the function of this section will be to elucidate why Darwin's work is teleological in an Aristotelian sense.

Thus, these three sections should propose that modern biology requires teleology, is built upon the shoulders of Aristotle and Darwin and many others, but the paradigm shifting theories proposed by both biologists have portions reasonably no longer supported by modern biology for substantive discoveries and research completed after their deaths.

Aristotle and Charles Darwin both looked to individuals in the natural world for answers. In this manner, their starting points of explanation were the same, but they also shared the same goal. This goal was a kind of explanation, rooted in a fundamental principle applicable to the natural world, that could explain why living things are the way they are. The puzzle seems to be that the web of living things is incredibly complex and varied, and yet, there is a regularity and predictable pattern to this complexity. The two components in question are regularity and variation. Complexity is a bit of a red herring, which is not say that complexity plays no role in providing this sought-after explanation, but that it is not the key to understanding why. Perhaps, this is a difference in necessity as living things necessarily display a trackable level of regularity *because of things they are*, but complexity may either derive from regularity or is subordinate to regularity. It appears that both Aristotle and Darwin arrived at a similar conclusion that there must be constant principles of nature that are the cause of its regularity. Darwin exclaims that if one were to “throw up a handful of feathers... all must fall to the ground according to definitive laws; but how simple a problem this is compared to the actions and reaction of the innumerable plants and animals.”⁵⁵ Here, Darwin notes the complexity the problem at hand, but also alludes to a similar law for nature as gravity is to physics, albeit harder see clearly. Johnson contends that the nature of Aristotle’s science “is almost exclusively concerned with bodies, most clearly with their magnitudes, their affections, and their motions, and also with their principles, all that are of that kind of substance.”⁵⁶ Johnson claims that this statement conveys Aristotle’s belief that “natural science is fundamentally a set of principles for

⁵⁵ Darwin 1902

⁵⁶ Johnson 2005

different kinds of bodies and their motions.”⁵⁷ It then seems clear that Aristotle is certain of a fundamental principle that can explicate natural things. What kind of cause is capable of explaining this regularity?

Aristotle and Darwin explicitly claimed that chance was not a satisfactory explanation for the regularity of natural things, and both sought principles outside of this possibility. As part of his reasoning towards this conclusion, Aristotle notes distinctions between things that come into being either always, for the most part, or neither always nor for the most part. Initially, Aristotle claims that “luck does not always come about nor for the most part,” but the implications for a natural science explanation are only clear when we consider how living things and their parts come to be.⁵⁸ Up and down this paper is the notion of the regularity of living things. When lady slippers grow, their leaves have for the most part parallel veins, zygomorphic flowers, and mutualistic relationships with fungi. As these characteristics are empirically constant for the most part, from our perspective in time, it is clear that these traits either come to be always, or for the most part. Right now, we cannot distinguish which, but we can conclusively contest that they do not come to be neither always nor for the most part. This is Aristotle’s line of reasoning for finding chance to be inadequate to explain “the cause of living things for the sake of something.”

Like Aristotle, Darwin clearly finds no utility in chance as the primary explanatory principle and makes several remarks to this effect. He claims that “we are tempted to attribute the proportional numbers and kinds [of plants and bushes clothing an entangled bank] to what

⁵⁷ Johnson 2005

⁵⁸ *Phys* 196b23-31

we call chance. But how false a view this is!”⁵⁹ Notice here the implicit reference to complexity of the “entangled bank,” which echoes the importance of the complexity of nature as a means of cloaking deeper designs.⁶⁰ And again, Darwin remarks that when faced with the overwhelming diversity of life one might desire to look to chance as the generator of regularity and variety but he remarks that this is “a wholly incorrect expression, but it serves to acknowledge plainly our ignorance of the cause of each particular variation.”⁶¹ Clearly, Darwin contends that there is an underlying principle of all living things to explain variation, but he cannot find it in chance as an explanatory principle.

What kinds of structures suggest that organisms do not come to be by chance? Both biologists look to structures and activities that, for the most part, bring about the same end. First of all, it is evident that neither Aristotle nor Darwin think that living things always bring about the same end, for both thinkers work through creatures that are malformed or “abnormal.”⁶² Aristotle arrives at the conclusion that living things and their parts come to be for the most part by rejecting the two alternatives. It has been demonstrated that living things at least regularly come about, which is why chance is not a satisfactory explanation. This eliminates “neither always nor for the most part.” Do living things then come into being either always or for the most part? Aristotle denies that they come about always, and as evidence, he focuses on the case of freaks. From this, Johnson claims that “in the normal cause of development of an organism, whether animal or plant, the ends determined by the formal

⁵⁹ Darwin 1902

⁶⁰ Darwin 1902

⁶¹ Darwin 1902

⁶² GA iv 4, 770b9-17

genetic program conditionally necessitate certain processes that are associated with material and moving factors. However, in some cases, the form is not completed in the normal way: a freak. Now necessary connection between some internal state, here genetic program but in the mind of Aristotle the nutritive soul, and some external, developed state is the key to the third claim. There are ends of organisms, which could be tusks or mating dances that come to be as a necessary result of an internal state, but in some instances, these ends are not completed. In such instances, Aristotle refers to these mixes as “freaks.”⁶³ This case demonstrates that living things do not always come into being but do so for the most part. Hence, Aristotle supports the third case where living things come into being for the most part.

Darwin comes to a similar conclusion that there is a variable regularity of living things, but organisms change. As demonstrated prior, Darwin rejects that living things neither come about always nor for the most part, and one should likely already be disposed in rejecting that Darwin would support living things coming to being always. However, in the case one wasn't of this leaning, a quick glance in the *Origin of Species* will completely resolve this hinderance.

Darwin definitively quips that “no one supposes that all individuals of the same species are cast in the very same mold.”⁶⁴ The importance of these variations are “highly important” to Darwin's theory of natural selection and the main point of contention with Aristotle, but again, it is only necessary to note that Aristotle and Darwin both recognize this fundamental, irregular regularity. What then does this fundamental characteristic look like for both biologists?

⁶³ GA iv 4, 770b9-17

⁶⁴ Darwin 1902

The fundamental characteristic that both biologists look to explain the regularity of living things is the relation between parts and activities of organisms and the ends that fruit because of those things. As evidence of this kind of regularity, Aristotle distinguished between parts of organisms that are hypothetical necessary, incidentally necessary, and hypothetically beneficial.⁶⁵ If a part is hypothetical necessary then given the form and definition of an organism, this part is necessary. If a part is incidentally necessary, then the part is necessary, but its necessity is not directly connected to the definition of the living thing.⁶⁶ Finally, if a part is hypothetically beneficial, then the part is not necessitated by definition, but the presence of the part is better for the organism.⁶⁷ Ultimately, Aristotle's explanations has two characteristics. He explains "what something is in terms of how it benefits the survival of the kind," and he describes "what necessities follow from this in order to achieve the stated aim," which is to give a full description of why this thing occurs.⁶⁸ Finally, Aristotle goes on to claim that that "all homogenous parts of animals exist either directly for [organisms'] benefit or indirectly for the support and safety of those parts that directly benefit them."⁶⁹ As the nutritive soul, whose powers are held by all living things, seeks to grow and reproduce, is the cause for sake of which organisms exist, and the cause for the sake of which entails benefit for the individual but also for the sake of reproducing another of its like, then it seems to follow that necessary parts are for the sake of the benefit of the individual and for the sake of

⁶⁵ PA I 1, 642a31-b4

⁶⁶ Johnson 2005

⁶⁷ Johnson 2005

⁶⁸ Johnson 2005

⁶⁹ Johnson 2005

reproducing. This is a rather “modern” idea, and it is at the core of Darwin’s theory of natural selection.

Darwin looked at the structures of parts and behaviors and took them to confer upon the individual some advantage. An organism would not possess a trait that served only to harm it, for this would inhibit the organism’s likelihood of reproduction. (look at different kinds of parts because Darwin does make similar distinctions to Aristotle). This is natural selection, which Darwin defines as the process that arises from the struggle of life whereby

“any variation, however slight and from whatever cause proceeding, if it be any degree profitable to an individual of any species, in its infinitely complex relations to other organic beings and to external nature, will tend to the preservation of that individual, and will generally be inherited by its offspring. The offspring, also, will thus have a better chance of surviving, for, of the many individuals of any species which are periodically born, but a small number can survive can survive.”⁷⁰

Darwin begins this claim by looking at variation in parts and behaviors of individual organisms relative to others in the species. The question is again, why does this variation exist, and what principle can explain its regularity? Darwin answers this question twofold, perhaps strikingly similarly to Aristotle, by addressing the reason for this variation, which just so happens to be for the sake of the individual and for the sake of reproduction. Any variation, if “it be any degree profitable to an individual,” then it tends to the “preservation of that individual,” and it “will generally be inherited by its offspring.”⁷¹ In an eloquent passage, Darwin

⁷⁰ Darwin 1902

⁷¹ Darwin 1902

demonstrates the relation between part and end by referencing human war artifacts that bring about very specific ends:

“The males of carnivorous animals are already well armed; though to them and to others, special means of defense may be given through means of sexual selection, as the mane to the lion, the shoulder-pad to the boar, and the hooked jaw to the male salmon; for the shield may be as important for victory, as the sword or spear.”⁷²

Clearly, no one would accuse Darwin of supposing that nature “pre-designed” these adaptations as if there were some evolutionary stopping point for all living things, but this passage does demonstrate that Darwin clearly believed parts of organisms had ends for the sake of the individual and reproduction. This is the core of Aristotelian teleology for living things, and Darwin’s theory of natural selection requires it.

This paper’s objective was to demonstrate the importance of Aristotle’s teleological explanation for modern biology through an analysis of Charles Darwin’s Theory of Natural Selection. In order to demonstrate this importance, one section of the paper was dedicated to extricating Aristotle’s teleology from common, but confused, claims against including teleological claims in biological accounts. As such, the objections raised by Mayr do not hold for Aristotle’s teleology of living things. The second section of the paper built upon the foundations of the former and specifically examined how Darwin’s account is teleological in the Aristotelian sense. However, what this paper does not contend is that all components of Aristotle’s natural science is wholly intelligible in light of modern discoveries. Indeed, there are important components of Aristotle’s natural science that must be abandoned, like the eternity of

⁷² Darwin 1902

species, but this should not suggest either that there is nothing to be learned from Aristotle nor that his work is merely outdated. If thinkers are abandoned for some ideas that no longer are tenable, then Darwin ought to be joining Aristotle in the scrap heap for some of his work on the good of species is confused, but no one benefits from such silliness. Science constantly builds and reflects. It not be that those in the present condemn the past for not being the present for those that came before laid the foundations that are stood on now.