Metaphor and Meaning in the Teleological Language of Biology

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Abstract

In the early twentieth century, neo-Darwinian evolutionary theory replaced traditional teleological causality as the accepted explanatory basis for biology. Yet, despite this rejection of teleology, biologists continue to resort to the language of purpose and design in order to define function, explain physiological processes, and describe behavior. The legitimacy of such teleological language is currently debated among biologists and philosophers of science. Many biologists and educators argue that teleological language can function as a type of convenient short-hand for describing function while some argue that such language contradicts the fundamentally ateleological nature of evolutionary theory. Others, such as Ernst Mayr, have attempted to redefine teleology in such a way as to evade any metaphysical implications. However, most discussions regarding the legitimacy of teleological language in biology fail to consider the nature of language itself. Since conceptual language is intrinsically metaphorical, teleological language can be dismissed as decorative if and only if it can be replaced with alternative metaphors without loss of essential meaning. I conclude that, since teleological concepts cannot be abstracted away from biological explanations without loss of meaning and explanatory power, life is inherently teleological. It is the teleological character of life which makes it a unique phenomenon requiring a unique discipline of study distinct from physics or chemistry.

> "Teleology is like a mistress to the biologist;
> he dare not be seen with her in public
> but cannot live without her."
>
> —J. B. S. Haldane

1 Introduction

In the early twentieth century, neo-Darwinian theory replaced traditional teleological causality as the accepted explanatory basis for biology. However, despite a public rejection of teleology, biologists continue to resort to the language of purpose and design in order to identify function, explain physiological processes, and describe behavior. Biology textbooks, articles, and papers are indeed filled such explanations as "A flower produces perfume *in order to* attract pollinizers," "The *function* of the heart is to pump blood," or "Felines have developed sharp protractile claws *in order to* hunt down prey" (Galli and Meinardi, 2011). To be meaningful, each of these claims depends upon reference to some kind of purpose. Even on the cellular and molecular level, biologists rely liberally on the services of their intentional handmaiden, describing "insights into the *'thought'* processes of a cell" and the "*perceptual* components of a cell" which are "making *decisions* about the *appropriate* use of resources" (Hyduke and Palsson, 2010).

Words that imply purpose, design, intention, and desire provide the standard language of biology, and yet both the legitimacy and the meaning of such teleological language is the subject of extended debate among both biologists and philosophers of science. Some scientists and educators argue that teleological language can function as a type of convenient short-hand or heuristic device for describing biological forms while others argue that the employment of any such language contradicts the fundamentally ateleological nature of modern evolutionary theory. Others, such as Ernst Mayr, have attempted to redefine teleology in such a way as to evade any metaphysical implications.

In Section 2 of this article, I will briefly consider the historical context of this debate and outline the sustained modern attempt to remove teleological concepts from biology. In Section 3, I will then examine the claim that the teleological language of biology can be dismissed as superfluous heuristic metaphor and argue in response that this is true if and only if teleological metaphors can be replaced by alternative metaphors without loss of essential meaning. In Section 4, I will consider whether teleological metaphors can be elimi-

nated from biological discourse and demonstrate that every time teleological language is removed from biological explanations, it either jettisons important explanatory elements or still depends upon unstated teleological concepts that have been reintroduced through the backdoor. I conclude in Section 5 that, since teleological concepts cannot be abstracted away from biological explanations without loss of meaning and explanatory power, life is inherently teleological. Therefore, it is disingenuous to continue pretending that teleology is or can be divorced from biology. Indeed, it is the teleological character of life which makes it a unique phenomenon requiring a unique discipline of study distinct from physics or chemistry.

2 The History of Teleology in the Biological Sciences

Before directly entering into the contemporary debate over the role of teleological language in modern biology, it will prove helpful to understand the historical relationship between teleology and the study of life. The term 'teleology' derives from the Greek word *telos* which Aristotle defined as "the end, that for the sake of which a thing is done" (Aristotle, *Physics,* II.3.). This end purpose for which something exists is also called its final cause and is one of the four fundamental causes included in Aristotelian physics. Teleological concepts include everything involved in the pursuit of an intrinsic, purposeful end: intentionality, purpose, design, motivation, direction, strategy, aims, goals, problems, solutions, invention, and agency. While efficient causality, which Aristotle defined as "the primary source of the change or rest," (Aristotle, *Physics,* II.3.) explains the source of movement, final causality explains the purpose for which the efficient cause acted. Thus, unlike efficient causality, teleological causality implies the ability to imagine and plan for a future state of affairs, an ability that can only exist within a mind or some other kind of non-physical or transcendent reality.

While Aristotelian science included the study of all four causes—material, efficient, formal, and final—the founders of modern science began to exclude final and formal causes from their methodology. Inquiries into the meaningful purpose of rocks and stars and basic elements seemed to obscure knowledge more than they aided it, for it is difficult to ascertain with certitude the purposes for which a Cosmic Mind made the moon or the mountains. Neither Bacon nor Descartes nor Newton denied the existence of God or his causal activity in creating the world. However, in order to advance scientific knowledge, the founders of modern science endeavored to make a clear distinction between God as the first cause of the world and the secondary causes he set to govern the material world. In the Cartesian separation of *res extensa* and *res cogitans*, efficient causality—proper to the physical realm—was separated from the intention and purpose of mind which seemed proper only to the metaphysical realm. Scientists gained reliable knowledge of the material world by isolating and determining the natural laws which function at all times and in all contexts regardless of intent or purpose. In order for empirical tests to yield such knowledge, the objects of scientific study must be reduced to the level of regular and therefore predictable laws and mechanisms. Teleological causality, however, implying the personal agency and intentionality characteristic of psychic realities, is not predictable according to set and inviolable laws. This exclusive focus on efficient causality proved incredibly successful, allowing technology to develop rapidly as scientists gained the knowledge necessary to manipulate the efficient causes present in material entities toward our own practical ends.

While the disciplines of physics and chemistry advanced through the elimination of teleological considerations, biological realities seemed inseparable from the concepts of design and purpose. Even contemporary neo-Darwinian materialists acknowledge that the appearance of design is what distinguishes the objects of biological study. Richard Dawkins famously defined biology as "the study of complicated things that give the appearance of having been designed for a purpose" (Dawkins, 1996, pg. 1). Jerry Coyne opens his book, *Why Evolution is True,* with the observation that "if anything is true about nature, it is that plants and animals seem intricately and almost perfectly designed" (Coyne, 2009, pg. 1). Philosopher of science Michael Ruse also affirms that "the key fact about organisms is that they are design-like, they exhibit final causes" (Richards and Ruse, 2016, pg. 35). Until the nineteenth century, biologists generally accepted the teleological character of life at face value. Life *seemed* designed because it *was* designed; life appeared purposeful because it was purposeful.

Immanuel Kant also argued that teleology is the defining characteristic of biology which differentiates it from physics or chemistry. Renowned twentieth century biologist Ernst Mayr describes Kant as "a strict mechanist with respect to inanimate nature but a teleologist in the treatment of the world of life" (Mayr, 1988, pg 59). According to Kant, design, purpose, and intentionality are the features which distinguish life from non-life. Moreover, Kant did not believe that physical laws alone could ever account for the existence of these teleological qualities. In his *Critique of Judgement* Kant boldly contends,

> It is quite certain that we can never get a sufficient knowledge of organized beings and their inner pos-

> sibility, much less explain them, according to mere mechanical principles of nature. So certain is it, that we may confidently assert that it is absurd for men to make any such attempt, or to hope that maybe another Newton will some day arrive to make intelligible to us even the production of a blade of grass according to natural laws which no design has ordered. Such insight we must absolutely deny to mankind.
>
> (Kant, *Critique of Judgement*, translated by James Creed Meredith)

Philosopher of science Robert J. Richards explains that Kant believed life was irreducible to mechanical causes because for Kant, "the design features of an organism cannot be explained mechanically, but must be assumed to have been the product of a plan, an idea" (Richards and Ruse, 2016, pgs. 160–161). Since the many features of an organism function together in an intricately coordinated manner to create a purposeful whole, Kant believed that life required intelligent foresight. According to Kant, the idea for an integrated, purposeful whole must have existed prior to the coordinated arrangement of its parts. Yet such an idea, a plan for the purposeful coordination of integrated parts, "could only be produced by an intellect. So the naturalist, in giving an account of the teleological features of organisms, must ultimately assume they have arisen because of a plan formulated by a powerful intelligence" (Richards and Ruse, 2016, pg. 161). Since Kant believed that organisms could not be fully explained by material and efficient causality alone, he concluded that biology could not be a science in the same sense as physics.

However, biologists have suffered from what Ernst Mayr famously called "physics envy." By the mid-eighteenth century, the modern scientific method had gained such philosophical, cultural, and technological power that many biologists endeavored to conform the study of life to the same methods of inquiry that served physics and chemistry so well. Yet life continued to stare at her interrogators with a stubborn, purposeful intentionality and design that seemed irreducible to mere mechanism. Thus, as Mayr describes, "the history of the biological sciences from the seventeenth to the nineteenth centuries [was] characterized by a constant battle between extreme mechanists, who explained everything purely in terms of movements and forces, and their opponents, who often went to the opposite extreme of vitalism" (Mayr, 1974, pg. 91).

Although Kant had condemned biology to a sub-scientific status, Michael Ruse notes that "Darwin was determined to show him wrong" (Richards and Ruse, 2016, pg. 34) and to raise biology to the status of a law-based science like physics and chemistry. When Darwin published *The Origin of Species*, evolutionary theory was not new; his unique achievement was not to convince the world of universal common descent but to propose a plausible law-based, mechanistic explanation for the transmutation of species which then made an ateleological explanation of life possible. Darwin's theory of natural selection acting on random variations appeared to answer "the problem of final causes" (Richards and Ruse, 2016, pg. 37). Ruse maintains that "for Darwin natural selection is not just a cause, but a force in a kind of Newtonian sense" (Richards and Ruse, 2016, pg. 44). In the "mechanism" of natural selection acting on random mutations, the teleological character of life finally appeared to be demystified and brought under the rule of physical laws and mechanical processes. While some scholars such as Robert J. Richards and J. Scott Turner argue that Darwin never intended to strip biology of its vital, teleological character, his endeavor to discover the explanatory law ultimately led to the mechanistic, reductionist theory of life we know today. In retrospect, prominent biologist Francisco Ayala calls Darwin's "idea that the design of living organisms can be accounted for as the result of natural processes governed by natural laws" a "conceptual revolution" that "has forever changed how mankind perceives itself and its place in the universe" (Ayala, 2007).

Although evolution itself was widely accepted, Darwin's mechanism of natural selection acting on random mutations did not become the prevailing explanatory principle in evolutionary biology until the Modern Synthesis of the mid-twentieth century. Although biologists were not yet generally convinced that natural selection alone could fully account for the transmutation of species from a common origin, Darwin had made a mechanistic explanation of life seem truly possible. The holy grail of biology, a completely mechanistic and materialistic explanation for the nature of life, now seemed inevitable. Thus, according to science writer Jonathan Bartlett, as various theories contended for dominance, those biologists who continued to suffer acutely from physics-envy "were careful not to ascribe any purposefulness to organisms out of fear of being labelled as teleologists" (Bartlett, 2017, pg. 3). In 1958, Colin Pittendrigh famously quipped that "biologists for a while were prepared to say a turtle came ashore *and* laid its eggs, but they refused to say it came ashore *to* lay its eggs" (Pittendrigh, 1958, pg. 394). The Scientific Revolution had redefined science as the study of efficient causality alone and biologists wanted to be 'real' scientists, so "despite the fact that it is obvious that turtles do indeed come to shore *for* the purpose of laying their eggs, biologists were uncomfortable with stating that plainly" (Bartlett, 2017, pg. 3, emphasis mine).

However, the development of a viable model for genetic in-

heritance appeared to vindicate Darwin's theory of natural selection. R. A. Fisher, S. G. Wright, and J. B. S. Haldane devised statistical methods of analysis that reconciled the mutationism of Mendelian genetics with the gradualism of Darwinian evolutionism. As J. Scott Turner describes in his book, *Purpose and Desire*, adaptation or "fitness could now be dispassionately and precisely expressed as the tendency of an allele to replicate" (Turner, 2017, pg. 150). Natural selection acting on gene variation seemed able to explain the "appearance" of designed organisms apart from any real teleological, that is metaphysical, cause. This modern synthesis of Darwin's mechanism of natural selection with modern genetic theory seemed—for the moment—to solve the problem of final causes by providing a predictable, measurable, and testable mechanistic explanation for the development and functionality of life.

After the triumph of neo-Darwinism, teleological phraseology seemed either eliminable or able to be explained away, and biologists became freer with their language. It became safe for a biologist to say that "a turtle came ashore *to* lay her eggs," without worrying about implied metaphysical content. The purposiveness of organisms was reduced to a kind of epiphenomenon or secondary characteristic that could be fully explained by the law-based mechanism of natural selection acting on random mutations. According Bartlett, "evolution itself cut any teleological connection between the organism and any higher organizing principle. Because evolution proceeded by random or happenstance changes... there was no linkage between the results of evolution and any purposes within nature" (Bartlett, 2017, pg. 3). Random variations could account for the arrival of a new trait while natural selection accounted for the survival of the trait. This seemed to separate the creation of functionality from any kind of intentional design. Since most teleological terms and phrases appeared drained of metaphysical implications, biologists felt increasingly free to indulge them. Teleology seemed merely "a leftover relic that would soon go the way of alchemy" (Bartlett, 2017, pg. 3).

However, teleology has not died. As the discipline of biology has advanced, the mysteries of life have kept pace with our increase in knowledge, and what had for a moment seemed like a settled debate is far from over. Although teleological causality has been excluded by definition from modern science, biologists continue to not only indulge but actually depend on teleological language. Satisfying mechanistic explanations continue to evade biologists as life proves to be far more complex than Bacon or Descartes or Darwin ever imagined. Advances in biology have compelled scientists to increasingly reach for the language of purpose and design to explain the intricately ordered structures and dynamic systems found within even the simplest organisms. Mechanistic, ateleological models have failed to provide the linguistic resources necessary to explain life. At the same time, strident materialists such as Dawkins, Dennett, Hitchens, and many others have become more insistent on the purposeless, undesignedness of nature. Thus, as biologists need teleological language more than ever to explain their new observations, the ideological pressure to reject such language is also intensifying. The debate over the role of teleology in biology has been revived.

3 Teleological language is Essential to Biology

Ironically, the fact that scientists earnestly debate the legitimacy of teleological language in biology lends support to the claim that teleological language is essential to a meaningful and coherent explanation of biological phenomena. Most modern biologists are so strongly committed to methodological naturalism that the use of teleological language, with all its messy metaphysical implications, would have indeed "gone the way of alchemy" and disappeared from biological discourse if it were inessential. That the language of purpose and design persists to annoy so many committed naturalists is itself evidence that the language of teleology is important to the study of life.

In this section, I will first consider the common claim that teleological language functions merely as a decorative or heuristic metaphor that need not carry meaning into our theoretical understanding of life. In response to this objection, I draw from the linguistic philosophy of Owen Barfield, George Lakoff, and Mark Johnson to argue against the possibility of "mere metaphors" in any kind of discourse. Second, I will outline the arguments of those who claim that teleological language can and must be eliminated from biological discourse. Using the work of Ernst Mayr and Michael Ruse, I will then demonstrate that it is impossible to remove teleological language or concepts from the discipline of biology.

3.1 Teleological Language as Mere Metaphor

Beginning with Darwin, modern biologists commonly argue that teleological language is merely metaphor; it is a matter of words and not of concepts. Many science writers and educators (especially those who work at a popular or introductory level) claim that our common sense, everyday language of intention and design has nothing to do with the real

truths of biology. Teleological metaphors can be brushed aside as a "harmless figure of speech" (Regenmortel, 2007, pg. 967) derived from our subjective experience as purposeful agents and thus are inessential to the objective nature of life. From this perspective, teleological language is employed decoratively for heuristic, educational, or rhetorical purposes; biologists simply use metaphors to translate between a true scientific understanding of the world and our colloquial ways of speaking about life. Most who consider the language of purpose and design to be a "mere metaphor" in biology usually believe that such language could theoretically be removed from biological descriptions and explanations without altering their essential meaning.

Charles Darwin himself dismissed his teleological language in the *Origin* as mere metaphor. In his essay "Charles Darwin: Rhetorician of Science," John Angus Campbell argues that Darwin believed that his own metaphors functioned simply as non-essential rhetorical devices. According to Campbell, "Darwin's public account of his metaphors creates the impression that his images could be replaced by literal statements if time were not a factor" (Campbell, 1997, pg. 11). Although Darwin employed anthropomorphic images and intentional narratives when describing key aspects of his theory, he nonetheless "explained away his originality by insisting that his ideas were the result of 'facts' and his metaphors *mere* expressions of convenience" (Campbell, 1997, pg. 6, emphasis mine). Campbell claims that Darwin's concern for persuasiveness accounts for the "heavily metaphorical character of his thought" (Campbell, 1997, pg. 10). Darwin understood that in order to make a compelling case for the theory of natural selection, he would need to "appeal to common sense" and persuade "his peers and the wider community by using plain English words and plain English thoughts" (Campbell, 1997, pg. 3). Thus, Darwin turned to the same rhetorical techniques of metaphor, personification, and poetic description which all persuasive writers employ. Indeed, Darwin's use of metaphor in the *Origin* enabled him to skillfully accommodate "his message to [both] the professional and lay audiences whose support was necessary for its acceptance" (Campbell, 1997, pg. 3).

However, Darwin's imagistic language caused confusion and was, according to Campbell, "a center of controversy from the very first" (Campbell, 1997, pg. 10). The "conventions of Baconian induction and quasi-positivistic standards of proof," which profoundly influenced nineteenth century understanding of science, created a tension between Darwin's imaginative language and the scientific idea he wished to defend. As Campbell explains, his metaphorical images "lent his ideas popular appeal, but since they drew attention to themselves as images, explaining them away posed a distinct rhetorical challenge" (Campbell, 1997, pg. 10). Darwin clearly wanted to demonstrate that his theory was objectively true according to the quasi-positivist standards of modern scientific discourse, yet the progression of his argument frequently depended on imaginative speculation and metaphorical descriptions. In protest of these imaginative lines of argument, Darwin's staunch critic, the anatomist Richard Owen, complained that "we do not want to know what Darwin believes & is convinced of, but what he can prove" (Dear, 2006, pg. 102).

Darwin's descriptions of the term 'natural selection' were especially problematic. Many of the images Darwin used to explain natural selection were teleological and therefore implied a goal-directed agency, yet his theory was purported to be an explanation based on the accepted scientific principles of material and efficient causality, not old, discarded notions of final causality. In a later edition of the *Origin,* Darwin expressed surprise that "several writers have misapprehended or objected to the term Natural Selection." He complained that some readers "have objected that the term selection implies conscious choice in the animals which become modified; and it has even been urged that as plants have no volition, natural selection is not applicable to them!" (Darwin, 1860, pg. 81) Darwin's readers were confused, at least in part, because the term *selection* itself implies intentional agency, a mind that can choose one thing rather than another. If the biological realm were indeed driven by purely efficient causes, then the language of *choice*—the idea that some natural force 'chooses' between the reproductive advantage of either organism A or organism B—should not be required. Object X would simply cause Y according to set, automatic laws. For example, the moon causes the Earth's oceans to move via tidal forces; there is no choice involved nor is the language of selection required to explain the phenomenon. Peter Dear maintains that because Darwin's "term retained the word 'selection'... the old natural-theological sense of intelligent designfulness still lurked in the background" (Dear, 2006, pg. 97). The term 'natural selection' gave Darwin so much trouble that "he soon expressed the wish that he had used some other phrase that avoided the impression of conscious intent given by the word 'selection' " (Dear, 2006, pg. 111).

However, Darwin defended his metaphorical language by insisting that the meaning of a concept can be independent of the metaphors used to explain it. When criticized for his use of metaphors, Darwin enigmatically responded "by pointing out that certain of his metaphors were in fact metaphors" (Campbell, 1997, pg. 10). In the second edition of the *Origin,* Darwin concedes that, "in the literal sense of the word, no doubt, natural selection is a misnomer" (Darwin, 1860, pg. 81). However, he protests that such metaphorical language is tolerated in chemistry and physics: "who ever objected to chemists speaking of the

elective affinities of the various elements?—and yet an acid cannot strictly be said to elect the base with which it will in preference combine." Darwin implies the possibility of detaching a concept from its descriptive metaphor by complaining that "every one knows what is meant and is implied by such metaphorical expressions." Darwin justifies the use of metaphors whose meaning must be disregarded by claiming that they are "almost necessary for brevity." While admitting that "it is difficult to avoid personifying the word Nature," Darwin suggests that given enough effort it is always possible to translate teleological language into metaphysically neutral statements. For example, he explains that by "Nature" he means "only the aggregate action and product of many natural laws, and by laws the sequence of events as ascertained by us." Darwin trusts that "with a little familiarity such superficial objections" about the implied meaning of his metaphors "will be forgotten" (Darwin, 1860, pg. 81).

Despite Darwin's protests, there remains a fundamental disconnect between what Darwin claims to say about natural selection and what he actually said. Campbell contends that it is "worth considering" why "the very connotations we are warned not to take seriously were instrumental in his ability to persuade both his professional peers and the general public" (Campbell, 1997, pg. 10). Darwin's images and metaphors made his theory meaningful and persuasive, but they also carried implications he wanted his readers to ignore. Darwin frequently personified natural selection—describing it as a power that can act, reject, economize, overmaster, disregard, succeed, seize upon, overcome, and govern—yet apparently assumed that his readers would disregard the implication of purpose and intention inherent to his verbs. The most famous passage of the *Origin* is laden with teleological meaning; Darwin imagines that "natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life" (Darwin, 1859, pg. 27). It is the sense of intelligent, purposeful activity that gives this passage a compelling and coherent meaning, yet that is the very meaning we are supposed to ignore. Thus, Campbell concedes that "a certain disingenuousness was necessary for Darwin to be persuasive" (Campbell, 1997, pgs. 8–9).

What Campbell describes as "the distance between Darwin's public quasi-positivistic account of his metaphors and the actual use he made of figurative language"(Campbell, 1997, pg. 11) is so great that modern scholars continue to vigorously debate as to whether or not Darwin really intended to remove teleology from his theory of life. Michael Ruse and Robert J. Richards co-authored a book debating this very point. While Ruse contends that "it was the whole purpose of his mechanism to eliminate or at least to render redundant" (Richards and Ruse, 2016, pg. 38) the world of teleology, Richards argues that "we have mistakenly assumed that Darwin banished final causes and notions of progress from biology" (Richards and Ruse, 2016, pg. 84). Ruse seems to believe that Darwin's scientific ideas could be detached from his metaphorical language, for he weakly asserts that Darwin's anthropomorphisms were "no more essential than if we say something like 'the eye is incredibly well designed' " (Richards and Ruse, 2016, pg. 46). While then acknowledging that "the eye is design-like in a way that the moon, for example is not," Ruse still maintains that such phraseology does not entail "an Aristotelian vital force objectively out there in nature making for final causes" (Richards and Ruse, 2016, pg. 47). Ruse dismisses the language of design as simply "our way of thinking about a mechanistic system." However, Richards objects to Ruse's suggestion that Darwin's language "was 'merely' metaphorical" (Richards and Ruse, 2016, pg. 155). Richards states, "What I believe to be defective about Ruse's analysis of Darwin's theory is the assumption that metaphors are only decorative and can be safely ignored in the construction of a scientific theory. I believe they do real work" (Richards and Ruse, 2016, pg. 158).

This continued confusion over the meaning of natural selection and the metaphysical implications of Darwin's theory demonstrate the problem with simply dismissing teleological language as "mere metaphor." Those scientists who follow Darwin's lead in considering their metaphors to be merely decorative additions that can be abstracted away from the meaning of the concept seem not to have thought very deeply about the nature of language. As the following discussion of linguistics will explain, Robert J. Richards rightly perceives that metaphors do real conceptual work, for the meaning of a concept is actually contained *in* the metaphor itself.

3.2 The Meaning is in the Metaphor

Rhetorical metaphors in biology cannot be ignored as inessential decoration because our conceptual language draws its meaning from metaphor. Unless a term refers to a concrete object or activity, its meaning will be created and sustained through some kind of metaphorical reference. In *Poetic Diction,* philosopher and philologist Owen Barfield argues that "if we trace the meanings of a great many words... as far back as etymology can take us, we are at once made to realize that an overwhelming proportion, if not all of them, referred in earlier days to one of

these two things—a solid sensible object, or some animal (probably human) activity" (Barfield, 1973, pgs. 63–64). All our words either directly refer to a concrete reality, such as a table or a falling leaf, or else draw their meaning from a metaphorical connection to some physical reality. As an example Barfield offers the terms 'abstract' and 'elasticity' which "are both traceable to verbs meaning 'draw' or 'drag' " (Barfield, 1973, pg. 64).[1] When we endeavor to think of what these conceptual terms *mean*, we may imagine something stretching like a form drawn in outline or a well-kneaded dough. Admittedly, as we think or read a text, we are not normally conscious of our conceptual metaphors, yet our ability to use abstract language in meaningful ways is not a freedom from metaphor as such but rather the "power of changing the metaphors in rapid succession" (Lewis, 2013, pg. 262).

The metaphorical nature of human thought is why Barfield's Oxford colleague C.S. Lewis calls reason the organ of truth and the imagination the organ of meaning (Lewis, 2013, pg. 154). While reason gives order and truth value to our thoughts, it is the imagination that gives content to our thought by mediating between our embodied experience and our thinking. Abstract terms depend upon metaphors in order to have meaning, and these metaphorical meanings are not arbitrarily invented; they are rooted in our experience of the objective physical reality.

The concepts to which our terms refer not only draw their meaning from metaphor, they are also metaphorically structured. In other words, we not only use metaphorical language to create meaning, we actually organize our thoughts through physically-based metaphorical models of the world. In their book *Metaphors We Live By*, George Lakoff and Mark Johnson argue that "the only reason our linguistic metaphors make sense is because our concepts are themselves metaphorically structured" (Lakoff and Johnson, 2003, pg. 6). As embodied creatures, both our language and our ideas develop through our physical experience in the world.[2] For example, we think of such ideas as happiness and health and power as being 'up' because our bodies literally droop and fall when they are tired, sick, or dead. Thus, we speak of being "in *top* shape" or "feeling *up* today" or "being *on top of* the situation" (Lakoff and Johnson, 2003, pg. 15). According to Lakoff and Johnson, we are always conceptualizing "the nonphysical *in terms of* the physical" (Lakoff and Johnson, 2003, pg. 59). As examples, consider the way we think of theories and arguments as buildings that can have a shaky *foundation* or a strong *framework* (Lakoff and Johnson, 2003, pg. 46), or how we conceptualize love as a physical force that can have *momentum* or cause *sparks* (Lakoff and Johnson, 2003, pg. 49). Lakoff and Johnson offer dozens of other examples as they contend that our "conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature" (Lakoff and Johnson, 2003, pg. 3).

Scientific concepts and terminology are not exempt from this dependence on metaphor. Biological language can be literal when describing concrete, sensible objects, which is why no one is confused over the meaning of terms such as 'feather' or 'bullfrog'. However, abstract scientific concepts will depend on metaphor for meaning.[3] Barfield explicitly contends that all "linguistic symbols have a *figurative* origin; a rule from which high-sounding 'scientific' terms like *cause, reference, organism, stimulus*, etc., are not miraculously exempt!" (Barfield, 1973, pg. 134, emphasis in original) Lakoff and Johnson agree that the "so-called purely intellectual concepts, e.g. concepts in a scientific theory, are often—perhaps always—based on metaphors that have a physical and/or cultural basis" (Lakoff and Johnson, 2003, pgs. 18–19). In his essay, "The Language of Nature," Stephen Talbott quotes the mid-twentieth century philosopher Kurt Riezler as "chiding physicists with these words: "You use the word 'force' and, when queried, you define it by law, field, and vector; but *what you really have in mind* is the force you feel in commanding your muscles" (Talbott, 2007, pg. 63, emphasis mine). Riezler reminds scientists that they too must use metaphors in order to under-

[1] Of course, by connecting a word to our own lived experience, it is possible to correctly understand a term even when we do not know the original metaphorical meaning. For example, I may not know the ancient etymological connection between spirit and breath, yet my own observation of the same reality may lead me to independently connect breath with the word 'spirit'. Although ignorant of the original metaphor, I have not attained a meaning that is independent from all metaphor; I have given the term meaning through my own concrete experiences of the same reality.

[2] In the updated afterward to *Metaphors We Live By,* Lakoff and Johnson maintain, "After twenty years of research by hundreds of investigators, vast bodies of empirical evidence for conceptual metaphor have been gathered from studies in a wide range of fields within the cognitive sciences. We initially had two primary sources of evidence—polysemy generalizations and inference generalizations. We now have at least seven other types of evidence derived from various empirical methods: (1) extensions to poetic and novel cases (Lakoff and Turner 1989); (2) psychological research, for example, priming studies (Gibbs 1994; Boroditzky 2000); (3) gesture studies (McNeill 1992); (4) historical semantic change research (Sweetser 1990); (5) discourse analysis (Narayanan 1997); (6) sign language analysis (Taub 1997); and (7) language acquisition (C. Johnson 1999).

The importance of this evidence is that it comes from many different methodologies and no longer rests exclusively on data from linguistic forms and inferences. These new sources have produced converging results concerning the way metaphor lies at the heart of abstract thought and symbolic expression." (Lakoff and Johnson, 2003, pgs. 248–249, adapted slightly for spacing).

[3] Lakoff and Johnson argue that "our most fundamental ideas—not just time, but events, causation, morality, the self, and so on—were almost entirely structured by elaborate systems of conceptual metaphor. Even the basic concepts of causation used in the physical and social sciences are primarily constituted by a system of nearly two dozen distinct metaphors, each with its own causal logic" (Lakoff and Johnson, 2003, pg. 250).

stand what their mathematical models mean. The concept of force becomes what Barfield calls "those verbal ghosts of the physical sciences" (Barfield, 1973, pg. 140) unless we give it meaning by connecting the term metaphorically to our lived experience of the world.

If both our language and our concepts are metaphorically structured, then there is no such thing as a 'pure concept'. Drawing from Barfield's argument, Lewis concludes that we can have "either literalness, or else metaphor understood: one or other of these we must have; the third alternative is nonsense" (Lewis, 2013, pg. 262). According to Lewis, we never "really pass from symbol to symbolized, but only from one set of symbols to another" (Lewis, 2013, pg. 261). Therefore, contrary to the naïve protests of some scientists, we cannot simply disregard teleological metaphors as "nothing but linguistic expressions" or "a mere matter of words" (Lewis, 2013, pg. 245). Our linguistic options are to either talk about a literal entity (frog) or a metaphorically rooted concept (force). But if we attempt to make a clean break between a concept and its metaphor, we are not talking about anything. As Richards argued in his debate with Ruse, the meaning of a concept is *in* the metaphor. Thus, biologists are fooling themselves when they try to construct an ateleological concept of life that is consistently expressed in terms of teleological metaphor. They are speaking nonsense.

Of course, the meaning of a certain metaphor may indeed be *in*essential to a particular concept *if* the concept can be adequately communicated through an alternative metaphor. According to Lewis, a concept can possess meaning apart from a particular metaphor but only "in so far as these metaphors are optional: that is in so far as we are able to have the same idea without them" (Lewis, 2013, pg. 258). For example, Lakoff and Johnson discuss the metaphor "argument is war." The metaphor of war is inessential to our concept of argument insofar as we can conceptualize an argument without reference to war. Indeed, we can conceptualize an argument as more like a building or even a dance. Argument does not have to be characterized by destructive conflict; it can be constructive or playful. However, if we could not fully conceptualize argument without constant recourse to the language of war, we must conclude that destructive conflict was essential to the nature of argument. Lewis contends, "In so far as we cannot express the same idea apart from a given metaphor, so far it will be the unique expression, and therefore the iron limit of our thinking" (Lewis, 2013, pg. 255). If we cannot talk about or conceptualize a particular idea without recourse to a specific metaphor, it is because the meaning gained by the metaphor is essential to the reality being explained.

Accordingly, certain metaphors can be helpful to scientists heuristically without being essential to the concepts being explained *if* the same concept can be conceptualized another way without the given metaphor. Heuristic devices are important tools, and teleological metaphors need not always have teleological implications. As Darwin rightly perceived, chemists can talk about "molecules *wanting* to have eight electrons in their outer shell" without students thinking electrons have actual desires. However, this is because the teleological metaphors of chemistry can be replaced by ateleological descriptions without losing any explanatory power. Students can have an accurate idea of atomic structure without depending on the metaphor of desire. Chemical bonding patterns are ultimately derived from mathematical equations that can be conceptualized without teleological language. We can say, for example, that "the forces present in an atom are equalized when it has eight electrons in the outer shell."

Therefore, living organisms can be understood ateleologically *if and only if* it is possible for biological explanations to be conceptualized and communicated without teleological language. Darwin could have justified his artificial selection metaphor, just as chemists can justify their heuristic "desire" metaphor, if he could have provide an adequate conception of natural selection without it. But he couldn't. Darwin depended upon the intentional model of artificial selection in order to explain how natural selection could provide an exogenic and therefore mechanistic cause of evolution that avoided the vitalism haunting endogenic explanations. In *What Darwin Got Wrong,* Jerry Fodor and Massimo Piattelli-Palmarini agree that "Darwin was inadequately impressed by the fact that breeders have minds... whereas, of course, nothing of that sort [sic] is true in the case of natural selection. It would be startling, in light of this difference, if theories of the one could be reliable models for theories of the other" (Fodor and Piatelli-Palmarini, 2011, pg. xxi). Since the meaning is in the metaphor, Darwin could not make the teleological analogy of artificial selection work ateleologically just "by abstracting away the minds away" (Fodor and Piatelli-Palmarini, 2011, pg. 116). While adaptationists continue to see artificial selection as a "harmless exegetical metaphor," Fodor and Piattelli-Palmarini maintain that it is "the putative analogy to artificial selection that bears the whole weight of adoptionism" (Fodor and Piatelli-Palmarini, 2011, pg. 99). Take away the mental causality and the whole ability to explain anything collapses. Without teleology there is no way to construct a notion of natural selection "that isn't just empty" (Fodor and Piatelli-Palmarini, 2011, pg. 138), which is why *What Darwin Got Wrong* opens with Noam Chomsky's assessment that "It is perfectly safe to attribute [evolutionary] development to 'natural selection' so long as we realize that *there is no substance to this assertion*; it amounts to no more than a belief that there is some natural-

istic explanation for these phenomena" (Fodor and Piatelli-Palmarini, 2011, opening page, emphasis mine).

If neo-Darwinists are to defend a truly ateleological theory of life, they will need to show that the language of purpose and design can be removed and replaced with ateleological metaphors that give coherent meaning to their explanatory model. If it proves impossible to eliminate teleological language from biological discourse, then we have good reasons to conclude that teleology—the realm of purpose, intention, desire, and design—is indeed essential to the nature of life.

3.3 Teleology Expelled: Sacking Biology's Mistress

Many scientists have intuited that metaphors do not function as harmless figures of speech and therefore actively contend for the removal of teleological metaphors from biology. Uneasy with the language of purpose and design within a discipline that endeavors to explain the natural world through material causality alone, several prominent scientists argue that such language is misleading, incorrect, and the primary cause of the public's failure to accept evolutionary theory.

In his influential essay, "Evolution and Tinkering," François Jacob demonstrates the way biologists expect their readers to ignore the very meaning on which their argument seems to depend. Jacob describes the causal efficacy of natural selection through language littered with intentionality and goal-directed agency. He describes natural selection as a force that "*integrates* mutations" and "*orders* them into adaptively coherent patterns" (Jacob, 1977, pg. 1163). He explains that natural selection "*gives* direction" and "progressively *produces*" (Jacob, 1977, pg. 1163, emphasis mine), doing "*what it could* with the materials at its disposal" (Jacob, 1977, pg. 1164, emphasis mine). Jacob explains how natural selection "adjusts" and "alters" and "arranges" an organism as it "tinkers" to create new life forms. All these verbs imply intentional, purpose-driven agency, the very qualities that neo-Darwinianism is supposed to explain away.

Jacob's presiding metaphor also implies teleology, although the analogy of the tinkerer was ironically conjured for the very purpose of denying purpose. Jacob rejects the comparison of "the action of natural selection... to that of an engineer" because the latter, "in contrast to what occurs in evolution,... works according to a pre-conceived plan" (Jacob, 1977, pg. 1163, emphasis mine). In other words, the metaphor of an engineer implies the real existence of a designing intelligence. Instead, he explains the action of natural selection by comparing it to the action of a junk yard tinkerer who works with whatever random items he might find around him. Although his tinkerer has "no special project in mind," Jacob's analogy still obviously implies a process driven by intentionality and intelligence. In conclusion, after liberally employing anthropomorphic language and teleological metaphor to explain natural selection, Jacob contradicts himself by claiming that "natural selection has *no* analogy with *any* aspect of human behavior" (Jacob, 1977, pg. 1163, emphasis mine). Jacob would have his readers ignore what his language means in their attempt to understand what he says.

Such passages are endemic in biological literature, which makes it no wonder that recent studies show that biology students as well as the public in general continue to interpret evolutionary processes as inherently goal-oriented. According to philosopher of science and science educators L.M. González Galli and E.N. Meinardi, "Comprehensive research in many different countries has shown that students' misconceptions are as diverse as they are abundant" (Galli and Meinardi, 2011, pg. 145). For example, Galli and Meinardi report that "many biology students believe that: acquired traits are inherited / the onset of the human species was predetermined / evolution implies progress / living organisms can change according to their needs" (Galli and Meinardi, 2011, pg. 146). These ideas imply a goal-directed view of the world which modern neo-Darwinian theory flatly denies.

In response to the public misunderstanding, Dr. Marc Van Regenmortel contends for the rejection of all "design phraseology," which he sees as detrimental to progress in biological research. Specifically, in his paper, "The Rational Design of Biological Complexity: A Deceptive Metaphor," Van Regenmortel argues that "the design metaphor is shown to originate in human intentionality and in the anthropomorphic fallacy of interpreting objects, events, and the behavior of all living organisms in terms of goals and purposes" (Regenmortel, 2007, pg. 965). While it is natural for humans to use teleological language, since purposeful action is intrinsic to our way of experiencing the world, Van Regenmortel maintains that the language of design wrongly projects the human experience of intentionality and foresight onto what we otherwise know—through neo-Darwinian theory—to be mindless physical entities. According to Van Regenmortel, "a biological function does not entail design for that function and functional descriptions need not be based on psychological notions of design, intention, and purpose" because functionality develops "blindly through the increased survival and reproduction of adaptive random variations" (Regenmortel, 2007, pg. 967). Accordingly, he argues that the language of design ought to be eliminated from biology because it can perpetuate "the un-

scientific mental habit of supposing that objects or events have a purpose" (Regenmortel, 2007, pg. 967).

Evolutionary biologist W. J. Bock of Columbia University also agrees that "the concept of design is inappropriate in biology and should be eliminated from all biological explanations" (Bock, 2009, pg. 7). Like Van Regenmortel, Bock contends that all biological processes are fundamentally random and therefore ateleological and un-designed. While conceding that natural selection cannot be defined as strictly accidental, since selection is indeed aimed at survival and reproduction, Bock maintains that natural selection acts subsequent to the random changes making evolutionary mechanisms ultimately driven by accidental, ateleological causes. Like Van Regenmortel, Bock contends that design terminology "carries with it too many undesirable connotations, such as the existence of a creator, and should not be used in evolutionary theory" (Bock, 2009, pg. 8). Furthermore, he acknowledges that even when teleological language is carefully nuanced and contextualized so as to specify an ateleological source for the appearance of design, "future workers frequently overlook this restriction and use the words in a broad, general way" (Bock, 2009, pg. 8). Precise, technical meanings are easily lost in the more natural and enticing language of intention, purpose, and design. For this reason, biologists themselves are tempted to use teleological language because the technical language is dull, unrelated to normal human experience, and does "not readily capture the reader's attention" (Bock, 2009, pg. 8). Although Bock humbly admits that his proposed substitute terms, "non-accidental and non-stochastic... are awkward and *not really informative*" (Bock, 2009, pgs. 8–9, emphasis mine), still he contends that it is time to "drop all usages of design from evolutionary biology" (Bock, 2009, pg. 9).

In an editorial from the *BioEssays* journal, editor-in-chief Andrew Moore echoes these concern and argues that using teleological language is "one of the worst things we can do" as biologists. He claims that the use of intentional, purposeful language in biology is "far from being 'excusable short-hand'" but is rather "an important contributor to a false impression of evolution among many non-scientists" and thus "a major reason for the lack of public acceptance of evolution" (Moore, 2011, pg. 237). When biologists speak of "strategies" or biological "problems" and "solutions," it implies some kind of aim or target which ought to be met or which the processes of evolution are striving to meet. Moore claims that any goal-oriented language which implies a movement "towards" something or "in order to" is misleading. Such concepts imply intentionality, purpose, and desire—the very things which neo-Darwinian theory purportedly explained away. Therefore, Moore insists that the anthropomorphic language of purpose must be removed from the discipline of biology in order to promote an accurate understanding of the evolutionary processes which ground our modern theory of life.

Arguing that biologists "must find alternatives to anthropomorphic terminology," Moore suggests new ways to describe biological phenomena without recourse to "motivation, design, or strategy" (Moore, 2011, pg. 237). Instead of describing how "nature *solved* this problem," a verb which implies intention, purpose, and forethought, Moore suggests explaining "how evolution *resulted* in x" (Moore, 2011, pg. 237, emphasis mine). Rather than "Organism X evolved to exploit niche Y," ecologists should state that "Organism X evolved and occupied niche Y." Through careful attention to meaning, Moore maintains that biologists can cultivate a metaphysically neutral language that will help resolve common misunderstandings of evolutionary theory as well as help the discipline of biology progress.

3.4 The Mistress Vindicated

Van Regenmortel, Bock, Moore, and others who call for a purge of teleological phraseology are right to take the language of biological discourse very seriously. However, they fail to take language seriously enough. These scientists have only begun to wrestle with the degree to which their language carries teleological implications. Upon closer examination, it becomes clear that even those who stridently oppose teleological language still cannot help but to continue employing it themselves. As the work of Mayr and Ruse will show, it is impossible to eliminate teleological terms and concepts from biological discourse.

Despite Moore's careful attempt to articulate his ideas in metaphysically neutral verbiage—that is, using language which in no way relies on an intelligence or a vital essence as a cause of material realities—most of his suggestions are still riddled with teleological implications. Moore rightly observes that the "innocent little word 'to'" implies an operative will which seeks "to" work "in order to" or "with the purpose of" (Moore, 2011, pg. 237). To remove the purposeful agency implied by the devilish word "to" in the claim, "to accomplish metabolic process X, enzyme Y evolved a specificity for Z," Moore suggests that biochemists should instead state that "in accomplishing X, Y concomitantly evolved a specificity for Z" (Moore, 2011, pg. 237). Moore has rid himself of the pesky "to" but the word "accomplish" still implies some goal which an agent desired to work toward. Accomplishment is an empty, meaningless term without the implication of a *goal* that can be attained. Again, rather than describe Structure X as "perfectly adapted to perform function Y," Moore suggests that biologists should say "Structure X very efficiently performs Y" (Moore, 2011,

pg. 237). Yet terms like "efficiently" and "performs" still imply a particular goal. How could we differentiate efficiently from inefficiently unless some targeted process were used as the standard for our evaluation? And per-forms means to accomplish through the means of form.

Let us go further than Moore: perhaps "efficient" could mean "maximizing power utilization on this effect." This will not work either, for maximization still implies a target functionality. Perhaps "accomplish" could be changed to "enzyme Y eventually transformed to a sustainable equilibrium under different physiological constraints." While "sustainable equilibrium" sounds less purposeful, the "innocent little word 'to' " has returned, and in the context of biology equilibriums are always purposeful. A living organism is different from a rock because a rock passively yields to entropy and the other forces of physics and chemistry while an organism's activity is directed toward fighting entropy and sustaining its own unique form of equilibrium. Living things are defined by their active, systematic striving toward the goal of being themselves. Life is fundamentally formal. This is why, as Turner argues in *Purpose and Desire*, the concept of homeostasis is necessary for any coherent definition of life and any language that accurately describes the function of a living organism will carry with it teleological implications.

Like Moore, Paul Kramer of Duke University also uses teleological language to argue against using teleological language. In his editorial in the journal *BioScience,* Kramer decries terms such as 'strategy' and 'tactics' as "philosophically objectionable," for such language "misleads readers not trained in science who often mistake the metaphor for the truth" (Kramer, 1984, pg. 405). However, when attempting to describe the ateleological evolution and nature of plant life, Kramer still uses such terms as "compromises" and "regulating," both of which imply some target toward which the organism strives. He credits natural selection with the ability of "screening" random variations in a way that "minimizes deleterious effects and maximizes advantageous effects" (Kramer, 1984, pg. 405). Screening for what? Yet again, none of these terms make any sense unless they refer to a particular goal or purpose which can provide a normative foundation for why one variation would be advantageous while another is deleterious. Unless there is a goal to achieve, a final cause, one cannot meaningfully distinguish between a success or a failure. And life is intrinsically a matter of success or failure, of life or death.

Teleological language has proved so difficult to eliminate that even some neo-Darwinists have come to its defense.[4] In the second half of the twentieth century, Ernst Mayr argued extensively for the necessity of purposive language in evolutionary biology. He observed that "we find in all organisms a fitting together of inborn actions or structures so perfect that one can hardly avoid such terms as 'design' or 'purposefulness'" (Mayr, 1976, pg. 31). Frogs and daisies demonstrate a purposeful functionality that is absent from water molecules and limestone rocks. Accordingly, Ruse insists that "the metaphor of design continues to be appropriate in Darwinian biology in a way that is not true of physics" (Richards and Ruse, 2016, pg. 47). Mayr also agrees that design metaphors "express something important which is lost when teleological language is eliminated from such statements" (Mayr, 1988, pg. 38).

Teleological explanations are necessary to the science of biology not only because organisms are themselves purposeful but also because organisms are historically contingent beings. Mayr explains that biological "phenomena have a history and cannot be explained directly through a strictly causal mechanical explanation, as is possible for processes in inanimate nature" (Mayr, 1988, pg. 59). There is no historical component to the rules which govern hydrogen and oxygen bonding; the chemicals simply have the properties they have in all times and places. The way organisms work, however, is historically developed. Thus, biological explanations cannot be reduced to merely material and efficient causes. When biologists endeavor to explain the laws of life, they are not only looking for *how* an organism functions now, they are also seeking explanations for *why* an organism came to function in a particular way. For a chemist or a physicist, *how* and *why* have the same answers. A chemist can explain *why* sodium nitrate bonds in a particular way by referring to the set laws of chemistry which determine *how* sodium nitrate bonds. While inanimate objects act according to set laws that do not vary according to time or place, animate beings demonstrate contingencies and variability. Accordingly, Mayr asserts that "it is no exaggeration to claim that most of the greatest advances in biology were made possible by asking 'Why?' questions" (Mayr, 1988, pg. 55).

Since organisms are historically contingent phenomena, biological explanations involve a kind of contingency with which physicists and chemists need not contend.[5] At every level of life, we observe behaviors and processes that are not fully reducible to set, mathematically definable laws. *How*

[4] See, for instance, Galli and Meinardi (2011, pg. 140).

[5] There is some controversy over the role of contingency in biological history. While some biologists such as Stephen Jay Gould maintain that life could have evolved in many different ways, or not at all, others like Simon Conway Morris contend that evolutionary mechanisms are more deterministic and thus certain outcomes are largely inevitable. Fodor and Piattelli-Palmarini assume determinism *a priori* but believe biological causality is so complex and multilayered that a unified predictive theory will be epistemically unavailable and that biologists will therefore still depend upon apparently contingent, historical explanations.

an organism functions does not answer *why* it functions in that particular way because—as the diverse abundance of organisms demonstrates—there is no physical law that dictates how life *must* work in all places at all times. This is why evolutionary theory provides the theoretical basis for all modern biology. Unless species were in fact created by a direct act of God, *why* explanations must be answered by an evolutionary history. If biologists are not to answer the question "why do fish swim?" with the unscientific answer "because God wanted fish to swim," they must seek some evolutionary explanation for why fish developed into swimmers.

Since historically conditioned, biological functions cannot be exclusively understood in terms of lawful necessity, teleological concepts must drive biological inquiry if theoretical questions are to be answered at all.[6] As biologists cannot ask why a fish *must* swim, they ask why a fish *can* swim. In his essay "Teleology: Yesterday, Today, and Tomorrow," Michael Ruse explains that "whether or not God stands behind the design-like nature of organisms, inasmuch as one is doing biology one is simply treating organisms as if they were designed" (Ruse, 2000, pg. 226). Biologists must use the concept of functionality to frame their inquiries, for the functional benefit of a certain adaptation is an essential part of explaining *why* that particular feature of the organism exists. As Stephen Talbott at *The New Atlantis* explains, without a *telos*, a purposeful end in view, biologists cannot offer any kind of meaningful explanation "because no one state of affairs would be preferable to another or mean anything different from another" (Talbott, 2017, pg. 65). Evolutionary explanations depend upon final causes in order to describe how a particular feature contributes to the benefit of the whole organism. According to Ruse it is "because, and only because, evolutionary biologists think of organisms as if they were humanly-made artifacts can they produce answers to questions about the ways in which these organisms survive and reproduce; that is to say, can they produce answers about the ways in which natural selection functions in the organic world" (Ruse, 2000, pg. 230). Geologists do not ask for what purpose Mt. Fuji towers above the Japanese skyline, but in order to study any organ or plant feature, a biologist must always ask for what purpose the feature exists. Ruse goes so far as to insist that "you *cannot do biology* without the metaphor" of design (Richards and Ruse, 2016, pg. 47, emphasis mine).

Therefore, the removal of teleological language from biology excludes information and concepts that are essential to accurate descriptions and meaningful explanations. Mayr insists that "a crucial portion of the message of a teleological sentence is invariably lost in the translation" (Mayr, 1988, pg. 55). For instance, Mayr considers the following sentence: "The Wood Thrush migrates in the fall into warmer countries *in order to* escape the inclemency of the weather and the food shortages of the northern climates" (Mayr, 1974, pg. 106). If biologists replace the words "in order to" with "and thereby," they jettison perhaps the most important and interesting question of *why* the Wood Thrush migrates. Mayr claims that "the majority of modern philosophers are fully aware of this and agree that 'cleaned-up' sentences are not equivalent to the teleological sentences from which they were derived" (Mayr, 1974, pg. 107). The original statement implies a "goal-directed migratory activity" (Mayr, 1974, pg. 106) but the purified sentence "is greatly impoverished" in "information content" and "casual strength" (Mayr, 1974, pg. 107). By removing any sense of purpose or intention, the ateleological sentence excludes the possibility of a meaningful relationship between the organism, its behaviors, and its environment. The action of the Wood Thrush and the resulting state of affairs appear to be happenstance, and the appearance of disconnection is not likely to stimulate fruitful investigation. While many biologists have "maligned" teleological language "as stultifying and obscurantist," Mayr maintains that "this is simply not true" since "the nonteleological translation is invariably a meaningless platitude, while it is the [teleological] statement which leads to biologically interesting inquiries" (Mayr, 1974, pg. 107).

Ruse also analyzes "nonteleological translations" and claims that, not only are these statements lacking in important content, they still depend indirectly upon teleological concepts. The concept of purposeful design is used to construct all biological explanations even when scientists manage to cleanse their explanations of explicitly teleological language *post hoc*. Scientists might be able to construct a non-teleological description of an organism's features but *only* because one already knows the function. Consider the Wood Thrush example given by Mayr above: A biologist can only join the clause about southern migration and the clause about escaping food shortages because he first assumed that the change in habitat had a purpose. Only by assuming a purpose could a biologist make inquiries into the function of the bird's behavior. Without this teleological assumption, no biological hypothesis could be formed. Therefore, Ruse asserts that even if "one's finished formal theory makes no direct reference to the metaphor of design,

[6] Some evolutionary biologists, such as W. J. Bock, disagree with Mayr and Ruse, arguing instead that the contingent nature of organisms can be explained through random or stochastic processes. However, as illustrated by the inability to purge biology of teleological language and concepts, recourse to randomness is really no explanation at all. To explain something by chance is the equivalent of arguing that it simply happened because it happened. As Barfield remarked, it is the task of science to explain natural phenomena through its hypotheses, but "the concept of chance is precisely what a hypothesis is devised to save us from. Chance, in fact, = no hypothesis" (Barfield, 1988, pg. 64).

and thus eliminates the teleology... in order to achieve the end results one has had to use the metaphor with all of the teleological implications that it carries" (Ruse, 2000, pg. 230).

To illustrate his point, Ruse considers a typical evolutionary explanation for the development of fins on Stegosauri dinosaurs. To construct a nonteleological explanation,

> One would say that those Stegosauri with more and more diamond-like-shaped fins were those that survived and reproduced, and those which did not have such fins did not. One could even go on to say precisely why it was that the successful Stegosauri survived and reproduced: the more diamond-like fins acted as efficient heat transfers, whereas those less diamond shaped acted as less efficient heat transfers. There was a consequent differential reproduction of the respective possessors.
>
> (Ruse, 2000, pg. 228)

However, Ruse asks "how did one know in the first place that the fins would or would not be efficient for heat transference? The answer of course is because one has been relying on the metaphor of design!" (Ruse, 2000, pgs.228–229) Only by understanding the fin's function in the organism can one then in retrospect "ferret out in which ways they work" (Ruse, 2000, pg. 229) and construct an explanation that employs the past-tense language of efficient causality. After using the metaphor of design to understand the functional features of an organism, a scientist might find a way to then "drop the metaphor-like talk," but Ruse maintains that really "one is not doing without it: one is simply not acknowledging it" (Ruse, 2000, pg. 229). Thus, according to Ruse, this attempt to eliminate teleological language from biology "is all a little bit bogus. One is using a sleight of hand. First, one uses the metaphor with all of its teleological implications. Then second, when once one has achieved the ends one desires, one drops the metaphor like an unwanted spouse and one pretends that one never had anything to do with it at all" (Ruse, 2000, pg. 229). If teleological metaphors are necessary to the process of answering biological questions, then teleology is an essential part of the answer itself. It is deceptive to re-word our answers so as to deny the role teleology played in providing them.

Fodor and Piattelli-Palmarini take a different approach to the problem of teleological concepts in biology (what they call the "selection-for" problem) but make the same essential point as Mayr and Ruse: a coherent, unified theory of life requires teleological causality. Based on the problem of "free-riders" developed by Gould and Lewontin, Fodor and Piattelli-Palmarini argue that without recourse to mentally based final causes, natural selection cannot distinguish between coextensive traits when selecting for fitness and, therefore, natural selection cannot function as the explanatory basis for evolutionary theory.

Because organisms are complex functional wholes, phenotypic traits are never presented to natural selection in isolation. Long necks are coextensive with long esophagi and the ability to vocalize is usually coextensive with the ability to swallow. As Gould and Lewontin demonstrate, some of these traits are "free-riders" that were selected along with the adaptive trait. Sometimes traits increase and persist in a population not because they are advantageous but just because they were there. How can natural selection explain the difference between a free-rider and an adaptive trait?

Fodor and Piattelli-Palmarini argue at length that free-riders pose an insurmountable problem for neo-Darwinism; natural selection cannot distinguish free-riders from traits that are "selected-for" because natural selection cannot provide grounds for distinguishing between counterfactuals. Since organisms are historically contingent beings, an explanatory theory of evolution must be able to decide between the statements "if X hadn't been selected, then Y would not have been selected either" and "if Y hadn't been selected, then X would not have been selected either." But natural selection, like all mechanistic causes, cannot take past or future events into account, which means it cannot provide grounds for deciding among these kinds of counterfactuals. As Fodor and Piattelli-Palmarini explain, "counterfactual events cannot exert selection pressures: merely *possible* predators do not affect the evolution of a population (although, *actual* predators are quite likely to do so)" (Fodor and Piatelli-Palmarini, 2011, pg. 113, emphasis mine). Only a mind can imagine future scenarios and thus distinguish between counterfactuals. Appeal to the mental causes in the breeder can distinguish between the selection-for thicker wool and the free-rider of curly wool that may accompany it, but if natural selection is to provide an ateleological theory of life, it cannot likewise appeal to a mind in order to solve the "selection-for" problem presented by the coextensive traits of organisms. Because it cannot account for counterfactuals, "the theory of natural selection cannot predict/explain what traits the creatures in a population are selected for" (Fodor and Piatelli-Palmarini, 2011, pg. 110).

According to Fodor and Piattelli-Palmarini, the inability to distinguish counterfactuals is why attempts to remove teleology result in tautological explanations while purpose, desire, and intentionality are brought in the back door to provide narrative accounts of evolutionary changes. For example, hearts pump blood but they also make noise. Which

trait is selected for fitness and which trait is a free-rider? We instinctively choose the ability to pump blood as the trait "selected-for," but that is because, as Ruse argued, we assume a purpose in order to explain "selection-for." However, if we remove the assumption of intentionality, adaptationist explanations become question begging. If we ask *why* the heart pumps blood, the explanation cannot be that natural selection selected this trait for its fitness. The fitness of the heart was already at work before natural selection could select it. Thus, it is the teleological concepts, the clear purpose of the heart and it's functional design, that actually provide the explanation for the trait's fitness; biologists only clandestinely credit the fitness to natural selection *post hoc*. Remove the teleology, and all that remains is the same tautology that dogs all adaptationism (Fodor and Piatelli-Palmarini, 2011, pgs 131 and 145). Being "selected-for" an adaptation cannot be the *cause* of the adaptation that is being selected just as being a bachelor cannot be the cause of being unmarried. Theoretical explanations are empty if they prove merely definitional.

Fodor and Piattelli-Palmarini conclude that a theory which cannot explain the phenomena studied is a dead, empty theory. Darwinism has not dissolved traditional teleology; it is "intentionality that is the universal acid dissolving the neo-Darwinian modern synthesis" (Fodor and Piatelli-Palmarini, 2011, pg. 132). However, because they are *a priori* unwilling to return to a teleological explanation, Fodor and Piattelli-Palmarini opt to conclude that there "can be no general theory of evolution" (Fodor and Piatelli-Palmarini, 2011, pg. xxii).

Haldane was correct; biologists cannot live without their ill-reputed mistress. The language of purpose and design cannot be simply dismissed as harmless figures of speech nor can it be eliminated without a significant loss of explanatory power. Teleological language is essential to a meaningful and coherent explanation of biological phenomena and it is impossible to conduct meaningful biological inquiry and discourse without it. To describe purposeful agents, a language of purpose will be required.

Despite over a century of effort, Talbott contends that "it is no more possible than it was two hundred years ago to construct a single paragraph of proper biological description that does not draw on meaningful language of living agency considered improper in chemistry or physics" (Talbott, 2010b, pg. 47). And because language is rooted either directly or metaphorically in our concrete experience of the world, language itself leads us toward truthful insight into nature.[7] Remarking on Ruse's argument in "Teleology: Yesterday, Today, and Tomorrow," Galli and Meinardi concede that "as long as it is not possible to explain adaptation phenomena without resorting to the metaphor of design (evidently teleological), then both the phenomenon to be explained and the explanations themselves are, in a relevant sense, teleological" (Galli and Meinardi, 2011, pg. 150).

It now remains to determine the full meaning of this teleological language. Can 'teleological' be conceptualized in such a way as to remove the metaphysical implications which seem so antithetical to modern biological theory? Or does re-admitting the language of purpose and design pose an insurmountable problem to naturalistic explanations of life?

4 If teleological language is essential to biology, then life must be teleological

In this section, I will argue that since teleological language is essential to a meaningful and coherent explanation of biological phenomena, life must be inherently teleological. Biologists and philosophers of science who accept the need for teleological language object to this conclusion in two primary ways, either by attempting to redefine teleology in such a way as to remove its metaphysical implications or by arguing that the cumulative evidence in support of universal common descent is sufficient to prove that life is reducible to material and efficient causality alone. First, I will consider how attempts to redefine teleology inevitably fail to shake the implication of an originating mind. Secondly, I will briefly consider the arguments for common descent and show how the claim that life cannot be teleological since it originated from a common ancestor simply assumes the conclusion it presumes to prove. These modern attempts to deny the teleological nature of life in the classical, metaphysical sense are not based on the study of life itself but from *a priori* commitments to materialist philosophy.

While a growing number of biologists and philosophers of science agree that the language of design is essential for a coherent explanation of life, many still argue that such language can be redefined or "naturalized" in order to elim-

[7] The view of language argued in Section 3 of the present essay supports a moderate form of scientific realism, that is the idea that science can give us real knowledge of the objective world. Even if, as anti-realists argue, our scientific explanations are based on metaphorical models vulnerable to underdetermination, yet those metaphorical models are not arbitrary but grounded in reality because language is itself metaphorically grounded in our embodied experience of the real world. While science may not give us perfectly objective knowledge of the mind-independent world, yet neither is scientific knowledge purely subjective.

inate the metaphysical implications of traditional teleology. Since our conceptual language is metaphorical in nature, biologists need some ateleological metaphor that can ground and structure the meaning of an inanimate, unintelligent creative power in order to reject the metaphysical intelligence and intentionality integral to the traditional concept of teleology. If the anthropomorphic metaphor of mind-based design can be replaced by a different metaphorical understanding of purposeful function, then perhaps we can coherently conceive of a mindless teleology that need not threaten methodological naturalism. This is precisely the proposal which Ernst Mayr made in the mid-twentieth century. Mayr argued that teleology can be cleansed of its metaphysical implications by uprooting the anthropomorphic metaphor of mind and replanting teleology in the metaphor of the cybernetic program.

In 1958, Colin Pittendrigh introduced the term 'teleonomy' as a metaphysically neutral replacement for teleology. By changing the suffix from –ology to –onomy, Pittendrigh endeavored to distinguish between goal-oriented processes that imply a metaphysical causality and goal-oriented processes that emerge as a secondary characteristic of efficiently caused material organisms. At a time when biologists were afraid to say "a turtle came ashore *to* lay its eggs" (Pittendrigh, 1958, pg. 394), Pittendrigh believed that "the biologists' long-standing confusion would be more fully removed if all end-directed systems were described by some other term; like 'teleonomic' " (Pittendrigh, 1958, pg. 394). A different term would "emphasize that the recognition and description of end-directedness does not carry a commitment to Aristotelian teleology as an efficient causal principle" (Pittendrigh, 1958, pg. 394). Perhaps by using a different term, biologists would remember that purpose and intention are not ontological qualities inherent in the turtle's nature but only observed functional attributes that emerge from the complex material laws that truly govern biological phenomena.

Mayr adopted Pittendrigh's term and used concepts from the new field of cybernetics to explain how *teleonomic* explanations could be distinguished from *teleological* explanations and thereby freed from any metaphysical implications. Mayr conceived of DNA as the biological code that formed the program of life. According to Mayr, "a program is (1) something material, and (2) it exists prior to the initiation of the teleonomic process" (Mayr, 1974, pg. 101). First, a program must be materialized somehow if it is to be any kind of physical cause, which a program for life certainly must be. Abstractions, such as the number 5, cannot exert a causal force in the material world, but embodied data such as a braille pattern or an encoded microchip can. Second, the program must exist prior to its function. We can't read a book that hasn't been written and we can't use software that hasn't first been coded.

The existence of a program prior to its function, or what Mayr terms its "teleonomic process," is essential to the definition of teleonomy. Mayr thus defines 'purpose' and 'function' as processes which physically result after the code exists and exerts its effect on the material world. If a particular code originates from purely materialistic processes, then no metaphysical reality need be implied by the secondary 'emergent' function. For Mayr, the functional effect which a program produces is totally independent from the way the program was formed. This crucial gap between life's creation and life's purpose is how Mayr proposes to prevent any metaphysical realities from intruding into the realm of biology.

Because the randomly created program of life, DNA, always exists prior to its emergent function—that is, the genotype is created before any kind of phenotype is then tested by natural selection—the final causality attached to traditional teleology is removed from the concept of teleonomy. According to twentieth century genetics, meaningless, chance mutations in the DNA create the program code independent of any purposeful functioning. Sometimes these different sequences have an emergent effect that is beneficial to the organism. When this randomly occurs, natural selection then preserves the trait within the species *because of* its functional advantage. As Mayr explains, the action of "natural selection is strictly an *a posteriori* process which rewards current success but never sets up future goals" (Mayr, 1974, pg. 96). The functional features of organisms are *preserved* teleonomically but not *created* teleologically. In this way, mechanical processes appear to create functionality without any intentionality. There is no teleological purpose in the creation of life's program—which is made by random, purposeless variations—but there is a teleonomic purpose in the program's preservation.

Purpose in this teleonomic sense does not refer to an ontological purpose but only to an emergent functionality. Mayr insists that "teleonomic explanations are strictly causal and mechanistic," and thus, "the acceptance of a teleonomic explanation... is in no way in conflict with the laws of physics and chemistry. It is neither in opposition to a causal interpretation, nor does it imply an acceptance of supernatural forces in any way whatsoever" (Mayr, 1974, pg. 92). The difference between a teleonomic and teleological purpose is the difference between an *apparent* telos—a function which emerged as the consequence of unrelated efficient causes—and a causally active, ontological purpose rooted in the essential nature of the being. As Bartlett phrases it, Mayr's principal claim is that "organisms do have purposes, but they didn't arrive at their purposes through a purpose" (Bartlett, 2017, pg. 4).

Mayr's teleonomic model appeared to have resolved the tension between the teleological nature of life and its assumed material origins by explaining how "natural selection itself turns accident into design" (Mayr, 1976, pg. 43). François Jacob claimed that "the concept of program has made an honest woman of teleology" (Jacob, 1973, pg. 9). The program metaphor seemed to give meaning and coherence to the new concept of teleonomy as it reduced life to a mechanistic reality ultimately explainable through material and efficient causality alone. J. Scott Turner describes this alluring model succinctly: "Organism as algorithm. Life is code. Evolution is modification of code. We are all beta versions of something, with infinite updates coming" (Turner, 2017, pg. 211).

However, Mayr's tidy and clever solution has two fatal problems: first, the program metaphor still carries metaphysical implications, and second, advances in the last two decades of biology have shown that life does not actually function like a computer program after all.

The program metaphor fails to naturalize teleonomic explanations because programs still imply a mind as the originating cause. As philosopher of science Stephen Meyer explains:

> A computer user who traces the information on a screen back to its source invariably comes to a mind—that of a software engineer or programmer. The information in a book or inscriptions ultimately derives from a writer or scribe—from a mental, rather than a strictly material, cause. Our experience-based knowledge of information-flow confirms that systems with large amounts of specified complexity (especially codes and languages) invariably originate from an intelligent source from a mind or personal agent.
>
> (Meyer, 2004)

When attempting to distinguish the new meaning of teleonomy from traditional teleology, Mayr still exclusively depends on design metaphors. He refers to blueprints, instructions, loaded dice, 'fixed' number wheels, computer programs, and a clock—all of which are intentionally created by intelligent agents. While many biologists hoped that the new mechanical and information metaphors derived from computer technology would help set the study of life on firmly materialistic ground, in truth it has done just the opposite. All known sources of coded information to which we may meaningfully compare DNA have been created by minds.

Furthermore, programs do not actually exist prior to function as Mayr argued; in truth, a program's function always first exists in the mind of the programmer. As Turner points out, "Anyone who has done any coding appreciates that an algorithm must *do* something, and that something usually begins as a desire somewhere in the mind of a coder" (Turner, 2017, pg. 211). This is why teleological language always carries metaphysical implications; the functional coherence of a purposeful object requires foresight. Those future outcomes can only operate in the present through the imaginative activity of an intelligent mind. A computer programmer has an idea for a design, a future outcome, which he uses to guide the process of programming. If biological phenomena display evidence of design, this implies the existence of some kind of transcendent mind or intelligent world soul capable of foresight on a cosmic scale. Only through the existence of a metaphysical reality—something that can transcend the temporal march of the efficient causes that govern physical reality—can teleological causality actually exist.

In their paper, "Why Machine-Information Metaphors are Bad for Science and Science Education," Massimo Pigliucci and Maarten Boudry recognize that program metaphors, which they term "machine-information metaphors" (Pigliucci and Boudry, 2011, pg. 460), are inherently teleological and consequently imply an intelligent cause. As committed materialists, Pigliucci and Boudry therefore argue stridently for the elimination of these misleading program metaphors. They claim that machine-information metaphors have not only "been grist to the mill of ID creationism" (Pigliucci and Boudry, 2011, pg. 469) but have also been "deleterious for science education" and hindered biological research by misdirecting "what sort of research programs biologists ought to carry out and how" (Pigliucci and Boudry, 2011, pg. 466). Accordingly, these authors argue that it is "time to dispense with them altogether" (Pigliucci and Boudry, 2011, pg. 469).

Ironically citing the work of Lakoff and Johnson, Pigliucci and Boudry admit that "metaphorical thinking seems to be a biologically entrenched functional mode of our brains" (Pigliucci and Boudry, 2011, pg. 469). Accordingly, they reason, as I have done, that biologists will need to use alternative metaphors to counter the metaphysical implications of machine-information metaphors. However, Pigliucci and Boudry confess that "we certainly have not found one that we would recommend as a replacement" (Pigliucci and Boudry, 2011, pg. 468). They tentatively offer only a single alternative conceptual metaphor: that DNA sequences can be likened to a recipe for a cake. This bizarre analogy (which has actually been used in a high school biology textbook, Mader and Windelspecht (2015, pg. 258)) still implies both a set of *informative* instructions for a particularly *designed* cake as well as an *intelligent* source for

both the recipe and the 'cook' who is able to interpret and act upon the instructions for the *purpose* of making something to eat. While avoiding the limits of mechanistic thinking, this metaphor actually increases the teleological implications for life as it requires more intelligent involvement than a machine, which can, once created, function mindlessly.

As with all efforts to eliminate teleological language, the pressure to find an ateleological model for biology has been great, yet still there are no feasible alternatives available. All the metaphors that help to frame our understanding of the way organisms actually work carry teleological implications. Analogies to watches, machines, factories, languages, computer code, blueprints, cake recipes, and mousetraps—all of these examples depend on an intelligent source as a cause. We have no direct, concrete experience with a purposeful entity arising through an unintelligent process. Every known cause of functional design is an intelligent cause. The world simply affords no ateleological design from which biologists can draw to give meaning to a metaphysically neutral concept of teleonomy.

Furthermore, not only do program metaphors fail to inoculate biology from design arguments, but recent developments have shown that life does not actually function like a program. While the cybernetic models on which Mayr based his teleonomic argument have offered important insight into the physiological dynamics of an organism, they do not accurately predict all organism behavior. Although the genetic revolution appeared to promise the tidy reduction of life to a single DNA code, the subsequent epigenetic revolution has quickly dispelled the myth of life as mere program. Cellular development also depends on epigenetic processes unrelated to DNA transcription and translation. These include glycosylation, the transfer of spatial information stored in the cellular membranes, bioelectric codes, three-dimensional folding of proteins, and others which biologists are only beginning to discover. None of these cellular processes can be directly coded for by DNA sequences which themselves only code for proteins. Rather than the DNA serving as the dictating, cybernetic 'master controller' of the cell, it has become clear that DNA simply serves as the stored blueprints for protein construction which the cell references as needed according to the discernment of the organism as a whole.[8]

There may be one other objection that can be raised against my second claim that if teleological language is essential to a coherent explanation of biological phenomena, then life must be inherently teleological. Although I have not explicitly encountered such an argument, one might claim that, based on the strength of evidence for common ancestry, we can simply assert that teleology can and ought to be redefined as teleonomic even in the absence of any ateleological metaphor that can conceptually structure this new understanding. Based on the standard cumulative argument for common ancestry which draws from multiple non-Darwinian lines of evidence such as biogeography, fossils, homology, embryology, and dysteleology[9] one might argue that an alternative metaphor is not necessary because life itself gives us a direct experience of design originating from a mindless, purposeless source. Although Darwinian mechanisms may no longer be adequate to explain exactly *how* design can emerge from ateleological causes, based on evidence for common descent we know that they *did.*

However, this objection only begs the real question at hand: are living processes teleological? Evidence that organisms evolved from a common ancestor does not itself prove that such a process was ateleological. As discussed above, some philosophers and scientists such as Robert J. Richards accept common ancestry yet still argue that Darwin conceived of natural selection and evolution as teleological processes. Some biologists such as J. Scott Turner argue that evolutionary processes are better accounted for by teleological explanations. Arguments for common ancestry do not adjudicate between a teleological or ateleological explanations of those evolutionary processes. Furthermore, any direct observation we have of evolution at work is not an observation of *de novo* design creation, but simply the adaptation of pre-existing design, which can be interpreted in and of itself as a feature of an organism's functional design, i.e.

[8] It is beyond the scope of the present article to discuss the inadequacies of the program metaphor factors in detail. For more information, see part one of Fodor and Piatelli-Palmarini (2011), Talbott (2010a), or Wells (2017).

[9] A recent paper in *Evolution: Education and Outreach*, "Teleology's Long Shadow" by A. Werth and D. Allchin, comes close to making this argument. Like Pigliucci and Boudry, Werth and Allchin acknowledge that teleology is endemic to biological discourse and that "teleology is deeply rooted in human cognition," but still Werth and Allchin argue that "historical contingency (or "chance" or "accident") natural selection as stepwise and local, changing environments, evolutionary "reversals," vestigial structures, pleiotropy, genetic drift, evolutionary branching, and the role of teleonomic explanations" all show that teleological causality is imposed on biological phenomenon by human understanding rather than a reality observed in organisms (Werth and Allchin, 2020, pg. 2). Most of these points have been addressed elsewhere in this paper, but I will here add a word regarding dysteleology.

Dysteleological arguments use examples of supposed 'poor design', such as the Pandas stumpy thumb or the indirect route of the recurrent laryngeal nerve in humans, to argue that organisms could not be purposefully designed because any good cosmic designer would have created only perfect designs. Such arguments at most rule out the existence of a mind that only allows the creation or evolution of optimal design, but most importantly, such arguments can actually only be made within the context of a teleological world. The idea of suboptimal design is only meaningful with a world of real design. Dysteleolgical concepts are parasitical on design concepts and do nothing to actually explain away the reality of design.

the organism was designed to be adaptable.

As teleological language has proven essential to a coherent explanation of biological phenomena, there seems no way to deny that life must be inherently teleological. Arguments against this conclusion are based not on scientific evidence but on materialist assumptions that are brought to, not derived from, the study of life. The endeavor to remove teleological causality from biology began and remains an *a priori* philosophical commitment.

5 Conclusion: Life All the Way Down

Teleological language and concepts are essential to the study of life, and biologists compromise the integrity of their science when they deny the meaning of the very language on which their discipline depends. Life appears purposefully designed because it is purposefully designed. The endeavor to redefine or remove teleology from the study of life is an attempt to deny what an organism essentially is: an animated, integrated being full of will and intention and purpose. Stephen Talbott in *The New Atlantis* contends that "the misrepresentation of this organic coherence in favor of supposed controlling mechanisms is not an innocent inattention to language; it is a fundamental misrepresentation of reality at the central point where we are challenged to understand the character of living things" (Talbott, 2010b, pg. 29). Whether it is the DNA that 'regulates' or 'controls' the functions of the cell or whether epigenetic factors 'inform' and 'regulate' the DNA, what all these cellular descriptions imply is not merely the 'appearance' but the reality of design and purpose and intent. Something beyond mere physical mechanisms, something *meta*physical is at work at every level in the origin, development, and functioning of living organisms. This 'something' is what differentiates a living organism from a dead one. Both a living and a dead organism have the same component parts, but the dead organism is the one fully yielded to the inanimate processes of physics and chemistry, not the living one.[10] What makes a creature *alive* is its teleological process: a material form animated by the striving of a unique being to become and remain itself.

Biology resists transformation into a "hard" law-based mechanistic science because it studies the realm of life wherein the laws of physics and chemistry mingle with the psychic realities of will and mind. It is the purposeful desires of the organism as a whole that guide and direct its interaction with the material world of efficient causality. We observe physics and chemistry together with cognitive intention in living organisms. Where living beings exist, no physical law can ever adequately predict and account for their real ability to exercise willful activity in the world.

The more our biological understanding grows, the more we are confronted with the teleological nature of life. Modern biologists have peeled back the skin of life, expecting to find robotic, mechanistic realities at work beneath the living exterior. However, as Talbott explains, biologists have "plunged headlong toward the micro and molecular in their drive to reduce the living to the inanimate" only to "find unapologetic life staring back at them from every chromatogram, every electron micrograph, every gene expression profile. Things do not become simpler, less organic, less animate" (Talbott, 2010a, pg. 24). It is "life all the way down" (Turner, 2017, pg. 181) to the molecular level where biologists still perceive the dynamic, intentional, responsive activity of a cognitive being animated by purposeful striving to become and be its unique self.

[10] Considering the difference between a living dog and a dead one, Talbott writes, "Virtually the same collection of molecules exists in the canine cells during the moments immediately before and after death. But after the fateful transition no one will any longer think of genes as being ***regulated***, nor will anyone refer to ***normal*** or ***proper*** chromosome functioning. No molecules will be said to ***guide*** other molecules to specific ***targets***, and no molecules will be carrying ***signals***, which is just as well because there will be no structures ***recognizing*** signals. ***Code***, ***information***, and ***communication***, in their biological sense, will have disappeared from the scientist's vocabulary" (Talbott, 2010b, pg. 25, emphasis in original).

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