Theism, Natural Selection, and Teleology: Toward a Theology of Evolution

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THEISM, NATURAL SELECTION, AND TELEOLOGY: TOWARD A THEOLOGY OF EVOLUTION

Seth P. Hart

This thesis examines the concept of natural selection and argues that the traditional, causal interpretation contains implicit teleological assumptions. It further maintains that, when coupled with a classical theistic model of the Good, one can generate a fruitful theological interpretation of Darwinism. I begin by investigating the concept of the Good as it was understood in premodern thought, particularly in the metaphysics of Plato, Aristotle, and Aquinas. I then shift to an examination of natural selection, dividing between what I regard as two competing interpretations. The first, labeled externalism, regards natural selection as an extrinsic force operating on gene frequencies via selective environments. Through the work of Jerry Fodor and Massimo Piattelli-Palmarini, I demonstrate the conceptual difficulties of this model and its implicit teleological assumptions. The second, which I label reciprocalism, grants a more active role to organisms in the evolutionary process. I analyze this view through contemporary debates in the philosophy of science on biological fitness. I argue that standard interpretations of fitness fail and offer, instead, an Aristotelian-Thomistic interpretation of fitness (ATTIF). The ATTIF consists of a fourfold hierarchy of teleologically-ordered aims determined by the organism/ population. I then examine the four aims and corresponding biological models and concepts that reveal the teleological nature of each aim. These include evolutionary landscapes, Hutchinsonian niches, homeostasis/metabolism, homeorhesis, and biological functionality. Interpreted through the lens of the classical theistic model, these biological and evolutionary concepts can be understood as a participation in and a striving towards the Good. I then answer two possible objections—namely, whether essentialism/Thomism is compatible with Darwinism and whether it is rational to invoke theism to explain natural teleology. Finally, I schematize past theological interpretations of evolutionary teleology and embrace a Moorean, conatist model of evolution.

THEISM, NATURAL SELECTION, AND TELEOLOGY
TOWARD A THEOLOGY OF EVOLUTION

By
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ABBREVIATIONS

General Abbreviations:

ATTIF	Aristotelian-Thomistic interpretation of fitness
FP	Jerry Fodor and Massimo Piattelli-Palmarini
PIF	Propensity interpretation of fitness
RP	Reciprocal poiesis

Plato:[1]

Phd.	*Phaedo*, trans. Benjamin Jowett.
Rep.	*Republic*, trans. C. D. C. Reeve.

Aristotle:

DA	*De Anima*, trans. C. D. C. Reeve.
DC	*De Caelo*, trans. C. D. C. Reeve.
GC	*On Generation and Corruptions* (*De Generatione et Corruptione*), trans. H. H. Joachim.
Metaphys.	*Metaphysics*, trans. C. D. C. Reeve.
NE	*Nichomachean Ethics*, trans. W. D. Ross.
PA	*De Partibus Animalium*, trans. James G. Lennox.
Phys.	*Physics*, trans. R. P. Hardie and R. K. Gaye.

Aquinas:

Comm. Ethic.	*Commentary on Aristotle's* Nichomachean Ethics (*Sententia Libri Ethicorum*).
De pot.	*Disputed Questions on the Power of God* (*Quaestiones Disputatae de Potentia Dei*), trans. English Dominican Fathers.
De verit.	*Disputed Questions on Truth* (*Quaestiones Disputatae de Veritate)*, trans. Dom Maria Evagrius Hayden, OSB.
In De Anima	*Commentary on Aristotle's* On the Soul.
In Metaph.	*Commentary on Aristotle's* Metaphysics, trans. John P. Rowan.
In Phys.	*Commentary on Aristotle's* Physics.
In Sent.	*Commentary on the Sentences*, trans. The Aquinas Institute.
SCG	*Summa Contra Gentiles*, trans. Vernon J. Bourke.
ST	*Summa Theologiae*, trans. Fr. Laurence Shapcote, OP.

Other Abbreviations:

CD	*The City of God* by St. Augustine, trans. Henry Bettenson.
Conf.	*Confessions* by St. Augustine, trans. Albert C. Outler and Mark Vessey.
Comp.	*Compendium sive compendiosissima direction* by Nicholas of Cusa.

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[1] For full bibliographic information, please see the bibliography at the end of this thesis.

De ment.	*Idiota de mente* by Nicholas of Cusa.
DH	*De hebdomadibus* by Boethius.
Elem. Theol.	*Elements of Theology* by Proclus.
In Metaph.	*Quaestiones super Metaphysicam* by Francis of Marchia.
In Sent.	*Commentary on the Sentences* by Albert the Great.
LDC	*Liber de causis*, trans. Dennis J. Brand.

INTRODUCTION

1. Background

This thesis has a twofold aim. First, it argues that Darwinism, as it has been traditionally conceived, retains a latent yet fundamental teleology. More specifically, the concept of the good proves vital for understanding how natural selection acts as a cause of evolutionary change. Since the good possesses the same *ratio* as final causation, natural selection bears the logic of both normativity and teleology. The second aim will be to interpret this fact in light of classical theistic models of God that ground creaturely ends within God as the Good-in-itself.[1] The result of these two aims is a theology of evolution that interprets evolutionary change through the lens of a Thomistic metaphysic, though one that is nuanced by contemporary philosophical and theological supplements.

Both aspects of the thesis are controversial. Indeed, the pairing of Darwinism with teleology is often regarded as inconsistent. Just a decade after the publication of *The Origin of Species*, von Helmholtz lauded Darwin's alleged achievement of explaining biological features through the "blind rule of a law of nature" that supposedly lacked any hint of teleological notions.[2] A century later, David Hull echoes this sentiment by declaring teleology to be "stone-cold dead."[3] Philosopher Mark Perlman observed, "By the twentieth century, analytic philosophers were positively allergic to any mention of teleology or teleological function."[4] Some even suggested that not only had Darwinism killed teleology but that teleology's return ought to be resisted actively. For instance, A. J. Bernatowicz does not hide his prejudice when

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[1] By classical theism, I mean the conception of God dominant in Christian, Islamic, Jewish, and pagan philosophies during the late classical and medieval eras. Without denying or overlooking the numerous theological viewpoints during this period, I will, for simplicity, primarily focus on Thomas Aquinas and his influences, Aristotle and Plato, as representatives. For more, see chapter 1.

[2] Hermann von Helmholtz, "The Aim and Progress of Physical Science," in *Selected Writings of Hermann Von Helmholtz*, ed. Russell Kahl (Middletown, CT: Wesleyan University Press, 1971), 238.

[3] David Hull, "What Philosophy of Biology Is Not," *Journal of the History of Biology* 2, no. 1 (1969): 249.

[4] Mark Perlman, "The Modern Philosophical Resurrection of Teleology," *The Monist* 87 (2004): 4.

he declares, “Each of us is for good and against evil. For most teachers of science, teleology . . . [is not an issue] to be debated but to be deplored—we stand against the evil.”[5] And even among those who still embraced some form of biological teleology, many resisted any supposed link to theological implications. George Gaylord Simpson is one example, who, while defending the reality of biological teleology, suggests that biology must pursue a teleology freed from all vitalistic or theistic associations.[6] Similarly, Ernst Mayr, another founder of the modern synthesis, showed sympathies for an Aristotelian teleology he believed was freed from theological grounding.[7]

Yet both assumptions have met with recent challenges. First, the case for biological teleology has seen a major revival. Indeed, even by the end of the 20th century, teleology had become one of the more discussed subjects in the philosophy of biology, consuming 10-14% of the discussion in several major relevant journals.[8] More recently, the John Templeton Foundation has allocated over twenty million dollars towards its *Science of Purpose* funding initiative, whose primary goal is “to identify and fund the development of novel theoretical, philosophical, or scientific concepts useful for advancing the study of goal-directed, goal-seeking, or goal-suited phenomena in nature.”[9] Additionally, a significant publication from MIT Press entitled *Evolution “On Purpose”: Teleonomy in Living Systems* was released in 2023 that largely defended the reality of goal-driven processes and functions in living organisms.[10] It is, in the words of one Cambridge scientist, a demonstration of “how much the landscape has changed” regarding the conversation of teleology and biology.[11] Further efforts

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[5] A. J. Bernatowicz, “Teleology in Science Teaching,” *Science* 128, no. 3336 (1958): 1402.

[6] George Gaylord Simpson, “On Eschewing Teleology,” *Science* 129, no. 3349 (1959): 674.

[7] Ernst Mayr, “The Idea of Teleology,” *Journal of the History of Ideas* 53 (1992): 121

[8] Ibid, 117.

[9] “Science of Purpose Funding Initiative,” John Templeton Foundation, accessed April 8, 2024, https://www.templeton.org/internal-competiton-fund/purpose-initiative.

[10] Peter A. Corning et al., eds., *Evolution “On Purpose”: Teleonomy in Living Systems* (Cambridge, MA: The MIT Press, 2023).

[11] Paul Rimmer, personal communication with author, April 5, 2024.

in resuscitating teleology has been undertaken by Simon Conway Morris, Denis Walsh, J. Scott Turner, and a host of other scientific thinkers. A parallel effort has been made in philosophy—namely, through the work of Neo-Aristotelian philosophers.[12] Much of this interest has been spurned by the supposed eclipse of the modern synthesis by the extended evolutionary synthesis. Accordingly, the extended synthesis's emphasis upon the role of organisms in their own evolution has led to what some call the "return to the organism."[13] Renewed fascination in organisms as teleological agents has additionally motivated treating them as a special form of entity. In other words, the unique ontology of organisms demands its own unique methodology—an approach Walsh has labeled methodological vitalism.[14] While all of these conclusions are controversial, they have gained significant traction over the past few decades.

The connection between biological teleology and theology has also seen some recent work. Most notably, Michael Hanby's *No God, No Science?: Theology, Cosmology, Biology* has challenged many of the presumptions of traditional Darwinism and its supposed neutrality with respect to theology, claiming that Christian doctrine provides the metaphysical resources for an intelligible account of life's history.[15] Erkki Kojonen has attempted to revive a teleological argument from evolution inspired by the writings of Asa Gray.[16] Mikael Leidenhag has written extensively of the connection between natural teleology and theological doctrines, including eschatology, ethics, providence, and theological anthropology.[17] Likewise, Conor

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[12] E.g., William Simpson, Robert Koons, Nicholas Teh, Alexander Pruss, and Christopher Austin.

[13] David J. Depew and Bruce H. Weber, "The Fate of Darwinism: Evolution After the Modern Synthesis," *Biological Theory* 6, no. 1 (2011): 98.

[14] Denis M. Walsh, "Objectcy and Agency: Towards a Methodological Vitalism," in *Everything Flows: Towards a Processual Philosophy of Biology*, eds. Daniel J. Nicholson and John Dupré (Oxford: Oxford University Press, 2018), 167. I leave aside the question of *ontological* vitalism since this would go beyond the scope of this thesis.

[15] Michael Hanby, *No God, No Science?: Theology, Cosmology, Biology* (Oxford: Wiley-Blackwell, 2013).

[16] E. V. R. Kojonen, *The Compatibility of Evolution and Design* (London: Palgrave MacMillian, 2021).

[17] Mikael Leidenhag, "Framing Christian Eschatology through Natural Teleology? Theological Possibilities and Concerns," *The Heythrop Journal* 63, no. 3 (June 2019): 401-13; Mikael Leidenhag, "Purpose *for* and *within* Creation: A Theological Appraisal of Organismic Teleology," *Modern Theology* 37, no. 2 (Apr. 2021): 396-409.

Cunningham has argued for directionality in evolution and connected this with traditional Christian doctrines on creation and Christology.[18]

However, one common feature of these projects (with the slight exception of Hanby) is to argue for a biological teleology that is *extraneous to* natural selection. In other words, these authors have not attempted to demonstrate that the concept of natural selection presupposes certain teleological notions. Such attempts have been made, however. For instance, in their work *What Darwin Got Wrong*, Jerry Fodor and Massimo Piattelli-Palmarini famously denied Darwinism because of its implicit dependence upon teleological thinking.[19] Thomist philosopher Edward Feser echoed their argument; however, he reversed their *modus tollens* into a *modus ponens*, arguing that because Darwinism is true, natural teleology must be, as well.[20] However, as chapters 2-3 explain, their argument suffers from only addressing one form of Darwinism (what is sometimes labeled externalism). Additionally, James Dominic Rooney has offered an apologetic argument from evolution, claiming that Darwinism requires the very teleology inherent in Thomas Aquinas's Fifth Way.[21] Central to Rooney's argument is the claim that the concept of biological fitness is teleological in nature, an assertion that will be defended in chapter 3. However, Rooney's support for this contention is painfully underdeveloped. It engages in none of the relevant philosophy of biology literature, nor does it rebut competing interpretations of biological fitness.

As such, there remains an open space for further development of the relationship between biological teleology and classical theism, specifically with respect to the nature of

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[18] Conor Cunningham, *Darwin's Pious Idea: Why the Ultra-Darwinists and Creationists Both Get It Wrong* (Grand Rapids, MI: William B. Eerdmans Publishing Company, 2010).

[19] Jerry Fodor and Massimo Piattelli-Palmarini, *What Darwin Got Wrong* (New York: Farrar, Straus, and Giroux, 2011).

[20] Edward Feser, *Aristotle's Revenge: The Metaphysical Foundations of Physical and Biological Science* (Neunkirchen-Seelscheid, Germany: *editiones scholasticae*, 2019).

[21] James Dominic Rooney, "Evolutionary Biology and Classical Teleological Arguments for God's Existence," *The Heythrop Journal* 54, no. 4 (2013): 617-30.

natural selection. Three initial clarifications must be made. First, as will be noted in a later chapter, this project will assume a causalist interpretation of Darwinism and what I call the principle of individuation. By causalism, I mean the relatively standard view of natural selection that treats it as both cause and explanation for various traits within lifeforms.[22] By the principle of individuation, I refer to the view that natural selection is objectively distinct from other evolutionary mechanisms like drift or migration. I briefly treat the rejection of these two views in chapter 3, and I will clarify here that alternative perspectives on natural selection are possible, though I believe the solutions proffered in these pages ought to spur a reevaluation of the motives often offered for rejecting causalism and the principle of individuation.[23]

Second, this is not a work of apologetics, though I do not rule out the possibility of developing such a project from my conclusions. I make no claims of offering a proof for God's existence. My more modest assertion is that classical theism provides a metaphysical framework by which we can offer solutions to issues within the philosophy of biology and thus develop a model for God's interaction with the evolutionary process. If one wished to develop an apologetic approach, one would need to address non-causalist interpretations of natural selection. However, since these interpretations are often regarded as denials of Darwinism,[24] theists might still maintain the rather ironic conclusion that only theists can uphold Darwinism.

Third, two authors whose work might be expected to appear throughout this project are the aforementioned Michael Hanby and Conor Cunningham. However, it will be noticed that only a few references to their respective titles appear throughout the text. This is not accidental. While Hanby likewise recognizes the implicit teleology of Darwinism, his overall project is far more hostile to traditional Darwinism than my own as he opts for a more structuralist view of

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[22] For an overview of this debate, see Marshall Abrams, "Measured, Modeled, and Causal Conceptions of Fitness," *Frontiers in Genetics* 3, no. 196 (Oct. 2012): 2-5.

[23] Specifically, chapter 3 undercuts some of the main objections to both views.

[24] See, for example, Fodor and Piattelli-Palmarini, *What Darwin*.

evolution. Hanby criticizes Darwinism (and Darwin in particular) for its defective metaphysics, such as its view of the organism as an aggregate of parts rather than "an incommunicable subject of its own interior being."[25] This project, by contrast, recognizes an implicit Aristotelian-Thomistic metaphysic overlooked by Hanby and others within the concept of natural selection. In other words, rather than merely absorbing the Paleyan view of organisms as artifacts, I will maintain that Darwin allowed us to reintegrate the organism into wholes. The functional parts are only parts on Darwinism via their relationship to the whole and their contribution to the good of the organism/population. In other words, Darwinism might be far more Aristotelian than Paleyan.

Cunningham's work, by contrast, is largely absent due not to disagreement but to irrelevance. While *Darwin's Pious Idea* contains many important points for the conversation between evolution and theology, they are, at best, tangential to this project. For instance, while Cunningham spends extensive time addressing the concerns of biologists, noticeably less effort is given to interacting with philosophers of science. Interaction with his work therefore only appears once in this thesis.[26] One might see my project as complementary to Cunningham's, though one asking different questions and dialoguing with different conversation partners.

2. Outline of Argument

Since my argument seeks to establish that a latent notion of the good (and, therefore, teleology) resides within the conceptual framework of Darwinism, it begins by establishing what exactly is meant by the term "good" and its relationship to teleology. Chapter one therefore begins by analyzing the concept of goodness as it appears in classical thought, particularly in the writings of Aristotle, Thomas Aquinas, and, to a somewhat lesser extent, Plato.[27] The goal of the chapter

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[25] Hanby, *No God*, 128.

[26] See chapter 6.

[27] Plato's works are given less exegetical treatment due not to a lack of significance but to Aristotle and Thomas's increased importance to the later argument.

will be to synthesize their thought and arrive at an ostensive definition for the term. Without overlooking key differences in their thought, I argue that the definition of goodness that emerges from their writings includes its role within all natural causes, its place as the source of creaturely perfections, and its relationship to the divine as its source and ultimate end. Thus, the term was conceptually linked to theology. This conclusion serves two purposes for later chapters. First, it serves as a ground for understanding how certain biological terms—particularly, natural selection—might demand a teleological foundation, for if such terms imply the reality of certain normative facts, then, *eo ipso*, they imply the truth of biological teleology. Second, the conclusion provides historical (and, to some extent, rational) justification for theological interpretations of these biological features.

With this groundwork laid, I move to the primary argument in chapters two and three. Chapter two begins by explaining the two distinct models for how natural selection operates. The first, more traditional view regards natural selection as acting in an asymmetric fashion; selective environments are causes whose effects are seen in the gene frequencies within populations. I refer to this view as externalism. The alternative view, labeled reciprocalism, prioritizes ecosystem-organism interactions as the grounds for selection events. Thus, the causal process is more cyclical, whereby organisms and environments codetermine one another.

As such, if one wishes to reveal natural selection's conceptual dependence upon teleology, one must address both models of selection. Beginning with externalism, chapter two proceeds to resurrect the argument of Jerry Fodor and Massimo Piattelli-Palmarini from their book *What Darwin Got Wrong*. I argue that of the numerous reviews and rebuttals to the work, very few understood it, and even fewer provided a successful retort. Their argument, labeled the selection-for problem, argues that natural selection cannot distinguish the causal contribution of two coextensive traits. In other words, while there might be selection *of* two coextensive traits, there is often selection *for* only one of those traits. Only one trait is the reason why an organism of a certain type survives and reproduces. However, natural selection, here understood as a selective environment "choosing" certain traits, equally selects both traits. Unless the environment has something similar to a mind, it cannot distinguish between the traits. The organisms *in toto* are selected. Appeals to counterfactual truths about the absence of the freeriding trait do little to help, for, again, the selective environment is not sensitive to the truth of counterfactuals (unless, again, it has something akin to a mind). Thus, if one rejects mental causation, teleology, and all similar causes in natural selection, one must reject the theory of natural selection itself as incoherent. A storm of reviews followed the publication of this work, though few addressed the primary concerns Fodor and Piattelli-Palmarini raise. Indeed, I conclude the only successful refutations focus on the particular model assumed by the authors—namely, externalism. Moreover, Fodor and Piattelli-Palmarini leave unexplained how, if natural selection is not a coherent explanation of adaptations, traits appear optimized and specialized for certain functions. I further note that Fodor and Piattelli-Palmarini leave a key term undefined in their discussion: individual fitness.

I then discuss in chapter three how the concept might provide a solution to the selection-for problem. This, I maintain, requires a switch to a reciprocalist model of selection since this latter model includes the causal contributions of organisms in their own evolutionary trajectory. However, while fitness is generally regarded as a vital component of the Darwinian mechanism, philosophical reflections upon the term have provided little clarity on its actual meaning. Indeed, in this chapter, I reveal the problematic nature of defining the term, noting that attempted definitions risk reducing either to pure tautology or to what I label the problem of nominalism. In its simplest form, the more an interpretation of fitness identifies it with the cause of selection, the less unified these various causes will be; thus, the term "fitness" risks losing any unifying feature that would allow us to regard it as a single, distinct cause of selection. However, the more fitness is identified with the effects of selection, the less one can regard it as explanatory. To say that fitness simply *is* survival and reproductive success entails that it can no longer *explain* survival and reproductive success. Because of these issues, some philosophers have advocated abandoning a causal interpretation of natural selection. These "statisticalists" deny that natural selection acts as a cause of evolutionary change. As some have pointed out, by denying causalism (as well as various other standard assumptions about natural selection), statisticalism "is not recognizable as the theory of natural selection at all."[28]

Rather than take this route, I suggest what I label the Aristotelian-Thomistic interpretation of fitness (ATTIF). According to the ATTIF, the causal unity of individual fitness cannot be found in the *efficient* cause. Rather, discovering any form of causal unity requires a radical reevaluation of the term "cause" and a recognition that a form of causal unity emerges only when we examine the *final* cause of selection events. If we understand individual fitness as a measure of particular goods for organisms—namely, the actualization of their traits and the accompanying faculties/functions proper to their species—then, I maintain, we have an interpretation of fitness that avoids the problems plaguing competing theories of fitness. I then divide between the four nested aims within this concept of fitness (development, functionality, survival, and reproductive success) as well as the two distinct beneficiaries of these aims (the organism and the population/biological species). I conclude that when the development and functioning of certain traits leads to enhanced survival and reproductive value, the four components, each being for the sake of the next, are achieving their higher-order aim. This process, I argue, represents a selection event when one set of traits allows for greater reproductive success than another set of traits and thus achieves its aim more successfully.

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[28] Alex Rosenberg and Frederic Bouchard, "Matthen and Ariew's Obituary for Fitness: Reports of its Death Have Been Greatly Exaggerated," *Biology and Philosophy* 20, no. 2-3 (2005): 348.

Chapter four and five then examine the four aims of the ATTIF and biological concepts and models that correspond to them, offering a teleological and theological reading of them. Chapter four examines the aims of reproduction, survival, and development whereas all of chapter five is devoted to the vast literature on biological functionality. For reproduction, I explore the concept of Hutchinsonian niches and evolutionary landscapes and argue that both, under the ATTIF, can be read by classical theists as a "striving" of populations towards particular goods. For survival, I examine homeostasis and metabolism as they are treated in the works of physiologist J. Scott Turner and philosopher Hans Jonas. I note the commonality between these two thinkers and suggest their respective treatments align with the ATTIF and an Aristotelian-Thomistic understanding of lifeforms. For development, I argue that Conrad Waddington's conception of homeorhesis presents a model of development that also suggests the teleological nature of the process. Indeed, Waddington was inspired by two other concepts, evolutionary landscapes and homeostasis, that I previously maintained to be teleological. I end chapter four with a brief theological interpretation of these conclusions, arguing that, given the metaphysical grounding of the Good in God, these various processes might be interpreted as a striving towards God, who is Goodness *simpliciter*.

Chapter five returns to functionality, the one aim of the ATTIF left unaddressed, in order to provide it with fuller treatment. After noting the extensive philosophical literature on biological functionality, I establish a set of desiderata for a successful theory of functions. I then examine the various attempts to interpret functionality in a manner that reduces their teleological nature to fit a naturalistic framework. These include etiological accounts, such as the popular selected effects theory, the weak etiological theory, and the propensity interpretation. In each case, I demonstrate why these proposals fail to meet the standards set for a successful theory of functions. I then examine another set of theories known as systems-oriented theories. While most versions have similar problems, Peter McLaughlin's more

Aristotelian approach is shown to overcome many of these issues, though his account is admittedly simplistic.

I therefore propose my own definition of a biological function—namely, that it denotes the goal-directedness of a trait towards a good end. This simple definition provides the basis for my deeper examination of functionality and its relationship to development and an experienced environment. I label this relationship reciprocal poiesis. Focusing only on developmental plasticity and the DNA damage repair system, it is shown how developmental processes already possess functional traits; simultaneously, developmental processes produce functional traits. Thus, both co-constitute one another. I complicate this picture further by introducing Denis Walsh's Situated Darwinism. Walsh, while arguing for Aristotelian-style biological teleology, maintains that organisms establish a set of affordances that are determined by their individual βίοι. Simultaneously, these affordances determine the evolutionary trajectory of organisms of this particular type. Thus, development and functionality are in constant conversation with an external set of affordances. This more participatory framework forces a modification to the ATTIF wherein developmental processes and functional traits are seen as reciprocally efficient and final causes of one another. Each is for the sake of the other. However, I caution that the original model of the ATTIF still provides a simplified heuristic. Chapter five ends with a similar theological reflection as chapter four. However, I now introduce the work of Andreas Wagner to contend that his conclusions, coupled with the concept of reciprocal poiesis, suggest that the evolutionary process can be regarded as authentically creative in a manner similar to human creativity.

In chapter six, I address two possible objections to the argument thus far. First, I examine whether naturalistic forms of teleological realism represent a simpler alternative than my theistic model. If a readily available theory of biological teleology exists that need not appeal to the divine, why prefer an explanation that does? While I stress again that my project is not one of apologetics, I nevertheless address this objection lest the move to theism appear ad hoc and unjustified. The chapter therefore addresses two proposed models for a purely naturalistic, nontheistic account of biological teleology: panpsychism/neutral monism and emergentism. I show how each account suffers from unique issues that do not similarly affect classical theism. Thus, I conclude that classical theism is a plausible explanation for biological teleology. Next, I examine the common accusation that essentialism is incompatible with Darwinian evolution. Against this, I argue that, in fact, biological evolution presupposes essentialism and that the supposed incompatibility between evolution and essentialism is resolvable. I end the chapter with a suggestion that a form of relational essentialism might serve as the best ontology for biological organisms.

The seventh chapter offers final reflections and clarifications on the nature of the teleological argument I have made and crafts what I argue to be the foundation for the development of a theology of evolution. I begin by delineating the two broad streams of evolutionary teleology that have historically been defended—namely, Darwinian and eschatological teleology. The former denotes the view that the various functional traits of organisms possess objective goals and purposes and that the successful achievement of these ends positively contributes to organisms' evolutionary outcome. I then further subdivide advocates of this position into Paleyan and Moorean varieties. Those of a Paleyan persuasion, such as Asa Gray, accepted Darwinian teleology but then attempted to reinvigorate Paley's watchmaker argument using features of Darwinian evolution. The Moorean view rejected Paley's argument and instead argued from Darwinian teleology to theistic conclusions.

I make a similar distinction between two varieties of eschatological teleology. The first I term finalism, a perspective arguing that evolution is a highly constrained process that leads nearly deterministically towards humanity. The second is a view I call conatism. According to this belief, evolution is teleological, though it is a process far more open and freer than is admitted by finalists. Resourcing the work of Aubrey Moore, Henri Bergson, Pierre Teilhard de Chardin, and Charles Péguy, I argue for a Moorean, conatist teleological perspective of evolution. However, I note that while the ATTIF is seemingly an extension of Moorean teleology, the same cannot be said for conatism. Conatism, while perfectly compatible with the ATTIF, is not entailed by it, though they do correspond at many key points. I then defend the compatibility of Moorean, conatist teleology with the metaphysics of Thomas Aquinas presented in chapter one. The chapter ends by describing a Cusan interpretation of evolution as recently defended by Nathan Lyons. I maintain that Lyons's suggestions present a theological vision of evolution that not only aligns with the scientific and philosophical arguments of my project but also offers us a means for seeing evolution as truly creative, artistic, and meaning making.

CHAPTER ONE: THE NATURE OF THE GOOD

The good has rightly been declared to be that at which all things aim.[1]

-Aristotle-

1. Introduction

In this chapter, I establish a definition of the Good.[2] This chapter will form a foundation for later analyses of the place of the Good in contemporary evolutionary biology. In other words, if one is asking if aspects of biology presuppose the concept of the Good, one must understand what the term "good" denotes. The concept is often regarded as wholly and exclusively relevant to the philosophical disciplines. The natural sciences, by contrast, are generally seen as free of normative judgements. This contemporary bifurcation of metaphysics from the empirical sciences has achieved a peculiar and troubling effect. The concept of the Good, often vaguely understood and rarely defined, is frequently though often tacitly employed, particularly in the context of biological traits and processes. The notion often hides in plain view through conventional terms like "beneficial", "advantageous", "purpose", and "functionality". Thus, it retains a vexing presence despite repeated attempts to excise normative and teleological concepts from the field of biology. It is, in the words of Gadamer, a remnant of an "Aristotelian ideal [that] represented the antagonist: it was dogmatic, teleological anthropomorphism that had to be overcome."[3]

As this quotation suggests, natural teleology is often equated with the work of Aristotle.[4] However, the concept of the Good has a long, intricate history in Western philosophy, and Aristotle represents only one voice within a chorus of thinkers. Yet within this

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[1] *NE*, I.1, 1094a2-3.

[2] This chapter uses a capital "G" when the term "Good" refers to the concept itself rather than a particular good, such as survival or flourishing.

[3] Hans-Georg Gadamer, *The Idea of the Good in Platonic-Aristotelian Philosophy*, trans. P. Christopher Smith (New Haven and London: Yale University Press, 1986), 26.

[4] Monte Ransome Johnson, *Aristotle on Teleology* (Oxford: Clarendon Press, 2005), 6 notes that Aristotle is often considered the originator of teleological reasoning.

ensemble, one can detect some common threads linking the classical and medieval tradition. Thus, if modern biology is beholden to a concept of the Good (as later chapters establish), it dictates questioning just what this conceptual dependency entails and defining what the term means.[5] This is no small task, for as Platonist philosopher Stanley Rosen notes, “The more one thinks about the doctrine of Ideas, including that of the Good, the more perplexed one becomes.”[6] One issue concerns the placement of the Good as a transcendental by many medieval philosophers—a positioning that ensured its indefinability by any conventional means. For these thinkers, a definition results when one indicates an object’s higher genus and specific differentia. However, the medievals maintained that the Good, like being, belonged to no higher genus nor contained any specific attribute that would distinguish it from other species within a given genus. As such, it was, by its very nature, indefinable.[7]

Consequently, this chapter will provide only an ostensive definition of the Good. It will, by no means, seek to erect anything resembling an exhaustive account, either diachronically or synchronically, of the concept’s various facets and nuances. Rather, its more modest goal will be to highlight the relevant thread of continuity within those leading premodern thinkers whose work provided the intellectual scaffolding that, as Gadamer noted, represents both the antagonist and consistent companion of the modern-day biologist. As such, while this brief analysis will incorporate the thought of various thinkers, it will largely restrict itself to the philosophies of Plato, Aristotle, and Thomas Aquinas as these thinkers’ conception of the Good has been most influential and perennial.

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[5] Georg Toepfer, “Teleology and its Constitutive Role for Biology as the Science of Organized Systems in Nature,” *Studies in History and Philosophy of Biological and Biomedical Sciences* 43 (2012): 115 has even provocatively asserted, “Nothing in biology makes sense except in the light of teleology.”

[6] Stanley Rosen, *Plato’s Republic: A Study* (New Haven & London: Yale University Press, 2005), 268.

[7] Jorge J. E. Gracia, “The Transcendentals in the Middle Ages: An Introduction,” *Topoi* 11 (1992): 114, “Being was treated as what we call today a primitive notion, that is, it was thought to be indefinable, and thus no analysis of it could be given.”

An astute observer might object to this project, suggesting that Plato and Aristotle clashed on this subject. Indeed, the two fathers of Western thought are often portrayed as representing two ends of an irreconcilable polarity. While this view might be popular, recent scholarship has challenged this interpretation. For instance, in Lloyd Gerson's magisterial treatment of the topic, he notes, "For a period of about three hundred years, roughly from the middle of the 3rd century C.E. to the middle of the 6th, Aristotelianism and Platonism were widely studied and written about on the assumption that they were harmonious philosophical systems."[8] It seems somewhat unlikely that these thinkers were simply too ignorant to notice the irreconcilability of the two philosophers. Gadamer has supported this interpretation, arguing:

> Aristotle, the creator of physics and founder of practical philosophy, holds fast to the Socratic heritage in Plato: the good is the practically good. On the other hand, as the creator of physics, Aristotle also fulfills the demand made by Plato's Socrates, that is, that we understand the world starting with the experience of the good.[9]

As such, the concept of the Good plays the same fundamental role in each thinker—a role that will be traced in the following pages.

I will center on the two features of the tradition most pertinent to future chapters—namely, on the Good as a final cause and the Good as a transcendental. The former point can be subdivided into three sections: the Good as what is desirable in itself, as the perfection of the form of a creature, and as ordered by and toward divine perfection. The Good as a transcendental will discuss its convertibility with being before ending on Aristotle's supposed critique of this position. I conclude by synthesizing the tradition into a synecdochic description of the Good and its pivotal role in grounding final causation, creaturely motion, and normativity—all of which are derivative from an explicitly theological basis.

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[8] Lloyd P. Gerson, *Aristotle and Other Platonists* (Ithaca and London: Cornell University Press, 2005), 2.

[9] Gadamer, *The Idea*, 128.

2. The Good as Final Cause

I begin with the Good as the logic of final causation. R. J. Hankinson notes, "Whether...nature is such as to be completely describable without remainder in terms of purely mechanical laws of working, or whether rather nature demands to be understood in teleological terms, is the central question of Greek philosophical science."[10] The source and end of motion were, in a word, an abiding question for the Greeks. Nature, it seemed, tended in certain directions rather than others. Whether it was the cyclical motion of the heavens or the predictable growth of living organisms, certain results seemed to act as normal—and, indeed, normative—ends for natural beings. This observation only evokes a further question: Why these ends rather than others? If final causation is to be made intelligible, one must clarify why certain results act as ends while others do not.

The answer, as Jan Aertsen succinctly summarizes, is that "'Good' and 'end' have the same *ratio*, since the Good has the aspect of desirable and the influence proper to the final cause is to be desired."[11] Thus, it is the aspect of desirability that determines which states act as ends and which do not. However, this, by itself, fails to account for why the ends of distinct beings differ so radically. Thus, a full account must distinguish between the goods of distinct natural beings. In other words, what is desirable for one creature (say, an oak tree) will be dissimilar from another (say, a human). To account for this fact, the final cause of diverse natural beings must be distinguished by the perfections proper to their form. Finally, there remains the question of how these diverse ends can be catalogued under the same term. In other words, if the goods of an oak tree differ so radically from that of a human, why use the same term for each? Thus, a full account of goodness as a final cause would seem to include the

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[10] R. J. Hankinson, *Cause and Explanation in Ancient Greek Thought* (Oxford: Oxford University Press, 1998), 6.

[11] Jan A. Aertsen, *Medieval Philosophy and the Transcendentals: The Case of Thomas Aquinas* (Leiden: Brill, 1996), 301.

Good-in-itself—the Good in which all subsidiary goods participate. In effect, if finite goods are to be made fully intelligible, there must be an account of the Good-in-itself. For both classical and medieval philosophy, this was the apparent theological conclusion of their teleological realism.

There are, then, three specific aspects of the Good as final cause: the Good as desirable in itself, the Good as the perfection of the form, and the Good as ordered to the divine. I examine each in turn.

2.1 The Good as Desirable in Itself

If the Good is to be understood as bearing the same *ratio* as final causation, we must recognize its role as the cause of desire or appetite in natural beings. For Plato, the Idea of the Good[12] takes center stage in the *Republic*, acting as the highest, unitive principle for all the other forms.[13] While the Good is also positioned as the font of truth (508e) and being (509b), its role as the ultimate goal of all action takes equal precedence. As the famed analogy of the cave reveals, the highest form of life—the one succeeding in its escape from the shadowy realm of illusion—is a life in the "pure sunlight [of] a perpetual *Wesenschau* or contemplation of Platonic Ideas."[14] This act itself results in what Gerson calls cognitive identification with the forms, which he defines as, "the self-reflexive awareness of one's cognitive state."[15] In other words, one does not know the form via some relationship but immediately in the act of cognition. For example, when one seeks to know justice, one does not wish to know it in one particular circumstance but to know it as it is in itself, outside of all relation. One desires a

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[12] I opt for the phrase "Idea of the Good" over the traditional "Form of the Good" since the former more closely corresponds to the original Greek [*idea*] and distinguishes it from the lower forms, for which Plato universally uses a distinct term [*eidos*].

[13] Lloyd P. Gerson, *God and Greek Philosophy: Studies in the Early History of Natural Theology* (London: Routledge, 1990), 79 argues that this "new hypothetical entity" is posited for three reasons: (1) To counteract the "impetus of scientific reductionism" of prior philosophers, (2) to account for the teleological elements of human cognition, and (3) to protect against accusations by the Eleatics on the multitude of forms.

[14] Rosen, *Plato's* Republic, 272.

[15] Gerson, *Aristotle*, 216.

cognitive “unity” that erases all distance between the thought and the thing thought. Consequently, desire for knowledge and desire for unity merge in Plato’s thought. As D. C. Schindler notes, “Love and reason thus essentially coincide, insofar as both entail an identification of the self with its object in some respect.”[16]

Is such identification possible and, if so, how? In Schindler’s account, he reveals the problematic nature of such knowledge and how a genuine point of disagreement between Plato and Aristotle is used to resolve it. For Aristotle, the Good denotes either those things that are good in themselves (intrinsic or absolute goodness) or things that are good only as a means to some other end (instrumental or relative goodness). Since the latter category’s goodness is parasitic on the first, only the former could be classified as good *simpliciter*. Plato, by contrast, demarcated a third category unique among the classical tradition: the Good as both intrinsic and instrumental. In effect, Plato recognized a new category inclusive of both relative and absolute goodness.[17]

However, since all sensible appearances are mere likenesses of objects (objects as they relate to our senses) rather than things in themselves, knowledge of the world in itself was impossible. Proper knowledge relates to a thing’s being, yet an object’s being is distinct from its relations. Since knowledge seems restricted to one’s relationship to an object, no true knowledge of objects was possible (*Rep.* 479a-d).[18] This limitation also seems to eliminate the possibility of loving any object; love, by definition, is a desire for the whole of the object. Since such unity with the object is impossible, so is love. Thus, it would seem love could only ever be ordered to sensible experience rather than objects themselves.[19] How, then, is cognitive identification possible? If knowledge and love are to attain the highest goodness, they must

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[16] D. C. Schindler, *Plato’s Critique of Impure Reason: On Goodness and Truth in the Republic* (Washington, D.C.: The Catholic University of America Press, 2008), 134.
[17] Schindler, *Plato’s Critique*, 88-9.
[18] Ibid, 97.
[19] Ibid, 96.

transcend relations and embrace both the reality of a thing and its various appearances simultaneously, for "The philosopher is one who loves a thing not only in its relative appearances but in its being beyond appearances."[20]

It is precisely here that Plato's inclusive view of the Good reveals its strength, acting to bridge the gap between intellect and form. Plato writes:

> You must say, then, that what gives truth to the things known *and the power to know to the knower* is the idea of. And as the cause of knowledge [*episteme*] and truth, you must think of it as an object of knowledge. Both knowledge [*gnoseos*] and truth are beautiful things. But if you are to think correctly, you must think of the good as other and more beautiful than they (*Rep.* 508e1-6).[21]

Rosen compares this to how the sun is the cause of a flower's being (by granting it needed sunlight) and also the illuminating factor that allows one to know it: "The sun makes it possible for us to acquire knowledge and truth by illuminating the flower, and so too the Idea of the Good functions in the intelligible domain."[22] Thus, the Good acts to explain both *why* the forms act as ends of cognition and *how* cognition might achieve this end. But how does the Good provoke cognitive identification? It is here that, contra Aristotle, Plato's more inclusive view of the Good takes effect. Since the Good encompasses both being and appearance, it links the divide between them. Schindler writes, "To say that goodness gives things truth and gives the knower the ability to know means that there is one thing that simultaneously 'anchors' things in themselves as real and opens them up to others."[23] He concludes, "Since the *very same form* causes a thing's goodness in relation to me and its goodness in relation to itself, it is the same love that carries the soul from the relative to the absolute."[24]

As the final piece to this puzzle, the above quotation notes how the Good evokes movement from the soul. Since there is an identification of love and reason for Plato, human

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[20] Ibid, 102.

[21] This translation by C. D. C. Reeve includes my own slight modifications.

[22] Rosen, *Plato's* Republic, 261.

[23] Schindler, *Plato's Critique*, 115

[24] Ibid, 129.

cognition is driven by this loving desire—a desire for "self"-transcendence in cognitive unity with another. Love, by its very nature then, is *ecstatic*, and as one ascends the "ladder of love" as detailed in the *Symposium*, one moves from love of mere appearances to love of the thing—the final object of the soul.[25] Without this teleological orientation of the creature, explanations of motion seemed wholly inadequate; indeed, in *Phaedo*, Socrates dismisses and mocks the purely mechanistic explanations of Anaxagoras. Surely an account of human action must appeal to more than just the movement of muscles and bones; it must acknowledge the *purpose* behind these movements. Socrates states:

> There is surely a strange confusion of causes and conditions in all this. It may be said, indeed that without bones and muscles and other parts of the body I cannot execute my purposes. But to say that I do as I do because of them, and that this is the way in which mind acts, and not from the choice of the best, is a very careless and idle mode of speaking. I wonder that they cannot distinguish the *cause* from *condition* (*Phd.*, 99a-b).

In other words, while bones and muscles provide the *conditions* needed for movement, movement only occurs when striving for some good it seeks to obtain. This end, then, serves as the true *cause* of motion.

In summary, the Idea of the Good acts as a centerpiece within the Platonic system. Already, we have seen how Plato positions it at the center of both his epistemology and theory of agency. Of most immediate concern, however, is his idiosyncratic and inclusive notion of the Good. While not denying true goodness as being desirable in itself, Plato distinguishes himself from Aristotle and others by allowing true goodness to incorporate relative, instrumental goods. Fundamentally, however, a core truth remains—the Good is desirable in itself even as it makes all other, relative goods desirable. Thus, while there are some marked differences in Plato's thought from his successor, the Good as intrinsically desirable is not one of them.

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[25] Ibid, 130-1.

Similarly, Aristotle affirms the inseparability of the notion of the Good and final causality.[26] While the Good's role in practical philosophy consumes most of the Stagirite's attention, this is not due to the limited applicability of the concept. As Gadamer notes, "It is surely not just a superficial equivocation that such a diversity of things are called good."[27] For Aristotle, all natural motion has a logical structure and end, and the Good serves to make intelligible why certain ends acted as final causes. As will be recalled, Aristotle asserts that, contra Plato, only things that are good in the absolute sense can be regarded as truly good.[28] Hence, all natural motion is directed toward some ultimate *telos* which represents the final, definitive good for natural beings. This final end defines the Good of the creature, and all relative or instrumental ends are, as such, only subsidiary goods via their relationship to this ultimate end.[29] In other words, it is this final end that orders subsidiary ends and bestows on them their goodness in relation to the creature.

This principle defines the motion of all natural beings. As Simon Oliver states, "For Aristotle, all motion implies an attainment or fulfilment of something.… If there were no *telos*, there would be no motion, for the *telos* is the reason for the motion. Motion is never for its own sake, but for the attainment of some end or goal."[30] Commenting upon the *Nichomachean Ethics*, Thomas Joseph White similarly asserts, "The good is thought to be that in view of which man acts in his diverse activities."[31] Because natural motion is characterized by having a *telos*, it is consistent, occurring "always or usually" (*Phys.* II.8, 198b35-199a6) and is, therefore, the object of empirical inquiry. For instance, heavy bodies will fall to their proper place, or *topos*, if unimpeded. Likewise, in organisms, infants will mature into adults if given proper care. In

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[26] Thomas Joseph White, O.P., *Wisdom in the Face of Modernity: A Study in Thomistic Natural Theology* (Ave Maria, FL: Sapientia Press of Ave Maria University, 2009), 41.

[27] Gadamer, *The Idea*, 129.

[28] Schindler, *Plato's Critique*, 101.

[29] E.g., *NE* I.6, 1096b14ff.

[30] Simon Oliver, *Philosophy, God and Motion* (London and New York: Routledge, 2005), 31.

[31] White, *Wisdom in the Face*, 40.

each case, the motion of the being is determined by its nature. By contrast, violent motion, such as the hurtling of a rock into the air or the stunted growth of a youth, is alien to the nature of the substance and consequently lacks an intrinsic end and purpose (though such motion may still have an extrinsically imposed end).

Living organisms, however, possess a unique trait, one that positions them as the exemplification of beings-in-act.[32] Unlike the natures of inanimate natural beings, organisms possess "souls," which Aristotle defines as the "first actuality of a natural instrumental body" (*DA* II.1, 412b4-6).[33] As this definition reveals, the body is merely an instrumental good whereas the soul, as the principle of living beings, represents a higher actualization of the body. It is, then, the ultimate goal of creaturely motion. However, the soul is unique from the natures of inanimate beings in that it acts not only as the final (and formal) cause of living creatures but also as its efficient cause. Consequently, lifeforms differ from nonliving things by their ability to perform self-motion, but this motion is not, as Oliver notes, a "spontaneously generating movement independent of everything else."[34] While living creatures are originators of their own motion, they are motivated by external influences such as water and food. The soul must perceive an object as an object of desire for it to initiate motion. It is because some object, such as food, is perceived as an instrumental good for some higher good, such as the nutritive capacity of the soul, that we can properly call food a good for the organism: it helps to sustain these capacities of the soul.[35]

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[32] White, *Wisdom in the Face*, 54, "Living beings exemplify being-in-actuality in a double way: both by the actuality of the substance of a living being… and by the perfection, or actuation, of the vital operations that have their ends in themselves *through their activity*."

[33] As Thomas Kjeller Johansen, *The Powers of Aristotle's Soul* (Oxford: Oxford University Press, 2012), 12 notes, "first actuality" refers to the presence of the soul being maintained even while one is not actively exercising its capacities (such as during deep sleep). Johansen defines first actuality, or "fulfillment" (*entelekheia*), with knowledge and second actuality with the exercise of it. One possesses the former even while it is not being exercised.

[34] Oliver, *Philosophy*, 39.

[35] As Mariska Leunissen, *Explanation and Teleology in Aristotle's Science of Nature* (Cambridge: Cambridge University Press, 2010), 59 notes, lower capacities are subservient to higher capacities (such as nutritive powers serving as instrumental goods for rational powers) and exist only as potentiality within them (like two triangles do within a quadrilateral).

Thus, natural teleology is an integral component of Aristotle's account of motion and causation, yet despite the seemingly unbreakable link between teleology and the Good within his system, many Aristotelian scholars have actively attempted to surmount this very conclusion. While many interpreters still correctly adhere to this traditional interpretation of Aristotle,[36] the majority have taken a reductionistic approach, limiting teleology and the Good's role in it in some capacity.[37] For instance, despite his criticism of teleological reductionism, Allan Gotthelf maintains Aristotle's usage of the normative term "good" is not, in fact, fundamental to his account of final causes. Rather, he contends:

> The concept of an end, on my view, is rather to be understood by reference to Aristotle's conception of an actuality (and of the potentiality for certain actualities). Because of his analysis of the good, the very same states (or activities) which are ends will also be goods, but they will not be ends *in virtue of* being goods.[38]

Gotthelf is certainly correct in asserting the congruence of actuality with the good of the thing.[39] However, his claim fails to fully acknowledge the causal significance Aristotle gives to the concept of the Good. As David Furley notes, a fully actualized heart both circulates blood and makes a distinctive thumping noise, yet only blood circulation is considered the proper end of the actualized state since it provides a necessary good for the organism.[40] It is because the heart provides a *good* that it is sought, not merely because it is a further actualization of the creature's form. Gotthelf's account is therefore guilty of unduly segregating formal causation from final causation in Aristotle. When a creature acts for an end, it does so because that end is good and not *simply* because it is an actualization of the form. If the Good's role in final causation is lost, it becomes unintelligible why actuality functions as the end of

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[36] E.g., Oliver, *Philosophy*, 32.

[37] David Furley, "What Kind of Cause is Aristotle's Final Cause?" in *Rationality in Greek Thought*, ed. Michael Frede and Gisela Striker (Oxford: Clarendon Press, 2002), 74.

[38] Allan Gotthelf, *Teleology, First Principles, and Scientific Method in Aristotle's Biology* (Oxford: Oxford University Press, 2012), 47.

[39] For instance, in *NE* X.7, 1778a, Aristotle asserts, "For what properly belongs to each thing by nature is most excellent and most pleasant for each of them."

[40] Furley, "What Kind of Cause," 66.

natural motion. Thus, any fully intelligible account must conclude that natural motion tends towards ends that are themselves goods and that this claim is not reducible to a non-normative equivalent. It is because these ends are *desirable* that they can properly be said to serve as ends.

Thus, like Plato, Aristotle clung to a notion of the Good as desirable and therefore as the grounds for final causality. Even while restricting the Good to the Good-in-itself, its role in teleology remains strikingly similar. This legacy would pass on into the Middle Ages and its most prominent thinker, Thomas Aquinas, who effected a synthesis of his classical forebearers and provided the fullest exposition of the nature of the Good and its relationship to final causality. Drawing from Aristotle, Thomas defines goodness as what all desire (*De verit.* q.21, a.1).[41] This seems to imply that what is desired is itself desirable (or, at least, perceived as such). Thus, "Desirability is an essential aspect of goodness."[42] Thomas therefore clings to the notion of the Good as appetibility and to its *ratio* as a final cause. Moreover, since all natural agents act for certain ends[43] and only goods act as ends,[44] Thomas argues that all agents are directed towards the Good. As he states, "Every agent acts for an end, since all things seek the good" (*De pot.* q.1, a.5, co.). Thomas also adopts the Aristotelian notion that the final end of a given agent is the Good that orders all subsidiary ends. It is, in the words of Jan Aertsen, "The first in the order of the appetible."[45] Other goods are goods only via participation in this ultimate good.

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[41] "They defined goodness very well, saying that goodness is what all desire." (*Bonum optime diffiniunt dicentes quod bonum est quod omnia appetunt*)".

[42] Eleonore Stump and Norman Kretzmann, "Being and Goodness," in *Being and Goodness: The Concept of the Good in Metaphysics and Philosophical Theology*, ed. Scott MacDonald (London: Cornell University Press, 1991), 99.

[43] Simon Oliver, *Creation: A Guide for the Perplexed* (London: Bloomsbury T&T Clark: 2017), 80, "Indeed, it is fundamental to Aquinas's view of the natural order that every agent acts for an end. The purpose of an action—its goal or end—is what makes the action intelligible."

[44] Mark D. Jordan, "The Transcendentality of Goodness and the Human Will," in *Being and Goodness: The Concept of the Good in Metaphysics and Philosophical Theology*, ed. Scott MacDonald (London: Cornell University Press, 1991), 131, "The good is said to add a relation to the end and to have the formulable notion of the final cause."

[45] Jan Aertsen, *Nature and Creature: Thomas Aquinas's Way of Thought* (Leiden: Brill, 1988), 356.

Similarly, Thomas adopts the notion of living creatures as self-movers and the will as directed only to those things it apprehends as goods (*ST* I-II.8.1). As such, in apprehending some end, the will is motivated toward that end and the means for achieving this end (*ST* I-II.8.3.), but in order to discern these means, an act of deliberation is required prior to willing in order to fix these ends. Thus, there is an alteration between deliberation and will, with one proceeding the other. This inevitably leads to a potentially infinite regress lest some extrinsic principle can break the regress and motivate the first act of willing. For Aquinas, God serves this purpose by initially fixing the ends of persons (*ST* I-II.109.2). In other words, the very nature of humanity presupposes this initial act of grace.[46]

Thomas was also not shy in directing his gaze to the Platonic tradition in order to achieve his synthetic account. From the Platonists (especially through Dionysius), Thomas incorporates the concept of the Good as diffusive of being (*bonum est diffusivum sui esse*)—though in a way that still restrains the Good to final causality (*ST* I.5.4). The Good, he states, functions not only as the goal of being but the origin of it, as well. Oliva Blanchette, in his magisterial treatment of the Dominican's cosmic teleology, summarizes Thomas's rapprochement of the traditions as follows, "The good is diffusive of itself, not as immediately productive, but as 'moving' the effective cause to act or produce."[47] In other words, in the very act of fulfilling their own good, creatures generate new beings (*ST* I.5.4). In the bringing together of these complementary notions of the Good, Thomas erects, in its fullest form, the symmetrical causal structure of *exitus et reditus*. As Aertsen writes, "Principle and end are identical… With the transcending of nature towards being as creature, the motive of circulation acquires a theological dimension, and Aristotelian finality is taken up in the Neoplatonic 'eros'

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[46] Mark Jordan, "Transcendentality of Goodness," 148, "It may be indeed that these texts show the almost seamless transition from nature to grace in Thomas's account of human action."

[47] Oliva Blanchette, *The Perfection of the Universe According to Aquinas: A Teleological Cosmology* (University Park, PA: The Pennsylvania State University Press, 1992), 56.

towards the 'Arche'."[48] Thus, Thomas's account is more than a mere triumph of Aristotelianism over Platonism; rather, it is a natural harmonization of the two traditions.[49]

From these three prominent figures of classical and Medieval thought, one gleans a shared notion—namely, the nature of the Good as desirable in itself and thus the font of all creaturely motion within the cosmos. This is not to deny that some divergences are clearly evident, such as the differences between Platonic and Aristotelian views of relative goods. These differences need not distract from the central objective of this chapter: to gather the "core" principles linking the various metaphysical systems in order to derive an ostensive definition of the Good applicable to these three major thinkers.

2.2 The Good as the Perfection of Form

A lingering question remains from the above analysis—namely, if all creatures are equally drawn to the Good, why do they pursue differing goods? In other words, why are creaturely appetites and desires distinct from or even contrary to one another if all are drawn by the same, universal source? The answer lies in the fact that appetites are specified by the forms of the creature. Since each creaturely form is distinct, each one will participate in the Good in distinct ways and thus acquire different desires.[50] While modern scientific ears might recoil from the introduction of the forms, they were, as Rosen aptly notes, a natural deduction from the presence of features, such as beauty, in sensually distinct objects. The *idea*, which literally means "look", was present not in the physical look itself but in "the pure thought that renders intelligible the existence of individual beautiful things."[51] For natural beings, the forms could then account for why particular things could be regarded as singular instantiations of some class of objects. In other words, the forms define natural objects as a particular instance of *x*,

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[48] Aertsen, *Nature*, 358.
[49] Jordan, "Transcendentality of Goodness," 132.
[50] Ibid, 136.
[51] Rosen, *Plato's* Republic, 258.

and it is the capacities given by these forms that a creature's nature sought to fulfill. Thus, the forms could account for the regular motion of natural objects toward higher stages of their own actualization since each thing seeks the Good proper to its particular nature—namely, the actualization of its form.[52] As Nicholas White summarizes, "To understand what it is to be the Form of F, then, is to understand what it is to be an unqualified, and thus nondefective, and thus perfect, and thus good, specimen of an F."[53] Hence, to know anything at all is to know it teleologically.

While the above account synthesizes aspects from various thinkers to provide one cohesive synopsis, Plato, Aristotle, and Thomas each offer unique emphases deserving of attention. Plato, as has been mentioned, regarded knowledge of and unity with the forms as the goal of human striving (*Rep.* 505d).[54] Yet if the forms act as an end and, accordingly, a good for the human person, "There must be something that *is* goodness owing to which each Form is a goal or end."[55] As Gerson notes, "It is perhaps in the light of this… that the metaphysical priority of the Form of the good is marginally clearer."[56] In the *Republic*, Socrates maintains that the Good is not only the cause of a thing's "being known" but also their "existence and being [*to einai te kai ten ousian*]" (509a9).[57] The Good, then, is productive of the other forms. How is this to be understood? Gerson argues that the relationship of the other forms to the Idea of the Good is "one of virtuality."[58] The Good, while causing the other forms, does not divide itself from them; rather, it continuously "contains its effects."[59] By generating the forms, the

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[52] Scott MacDonald, "Introduction: The Relation between Being and Goodness," in *Being and Goodness: The Concept of the Good in Metaphysics and Philosophical Theology*, ed. Scott MacDonald (London: Cornell University Press, 1991), 5 calls this the "nature approach" to the Good.

[53] Nicholas White, *A Companion to Plato's Republic*, 2nd Ed. (Indianapolis: Hackett Publishing Company, 1978), 101.

[54] For a more detailed account of how knowledge of the forms effects unity with them, see Eva Brann, "The Music of the *Republic*," *St. Johns Review* 39, no. 1-2 (1989-90): 64.

[55] Gerson, *God*, 60. Emphasis mine.

[56] Ibid.

[57] Allan Bloom and Tom Griffith likewise opt for this (Reeve's) translation. Rosen, *Plato's* Republic, 261 elects the more precise translation of "being and beingness".

[58] Ibid, 61.

[59] Ibid.

Good also acts as the principle of unity both for the individual forms and the whole cosmos. Eric Perl summarizes this seemingly necessary conclusion, writing, "Only in virtue of such a principle can being as an organic whole be intelligible, and this principle is therefore the source of being's intelligibility."[60]

The form, then, acts as the measure of a thing's goodness. In analytic fashion, Linda Zagzebski has accomplished perhaps the most succinct summation of this: "Since any object of kind *K* is real to the extent that it approximates perfect *K*-ness, the better an object is as a *K*, the more real it is. The source of the being of any individual object of kind *K* is the Form *K*, and the individual Forms themselves derive their being from the Form of the good."[61] Similarly, Gerson draws out the epistemic consequences of this conclusion, "Since the Form of the good is virtually what all the Forms are, cognitive identity with them is virtual identity with goodness itself, which, whatever else it means, is one plausible understanding of Plato's way of indicating the ideal of human existence."[62] While terminologically anachronistic, Plato's schema would seemingly also follow the structure of *exitus et reditus*; the Idea of the Good emanates the forms and, through them, the imprisoned souls of the lower, shadowy world of appearances. These, in turn, seek the forms and, through this cognitive ascent, attain knowledge of the Good itself.[63] Socrates, in the *Republic*, summarizes this in saying, "So this instrument [the soul] must be turned around from what-comes-to-be together with the whole soul, until it is able to bear to look at what is [*to on*] and at the brightest thing that is—the one we call the good" (518c4-

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[60] Eric Perl, "The Living Image: Forms and the Erotic Intellect in Plato," *American Catholic Philosophical Quarterly* 69 (1995): 194.

[61] Linda Zagzebski, "Goodness, Perfect," in *Routledge Encyclopedia of Philosophy* (Taylor and Francis, 1998), https://www.rep.routledge.com/articles/thematic/goodness-perfect/v-1.

[62] Gerson, *God*, 63.

[63] This reading of Plato also aligns with Schindler's interpretation of the Good as encompassing both absolute and relative goodness (detailed below). Given that the Good is productive of a lower order of goods, this interpretation would explain why the Idea of the Good stands in an efficient causal relationship to other, lesser goods (namely, the forms). To fulfill its nature, the Idea of the Good must generate the very relationships with distinct objects that will fulfill its nature (i.e., as encompassing both intrinsic and relational goods).

d1).[64] Thus, even while the Idea of the Good is inaccessible to *mathema* (learned insight), it can still become present to us through its effects of *gnosis* and *aletheia* (insight and truth).[65]

In one of his many analogies, Socrates illustrates this ascent to knowledge of the forms through the image of a divided line (509d-511e). As one moves across the line from the shadowy knowledge of ephemeral likenesses (*eikasia*), through intermediate forms of knowledge (*pistis* and *dianoia*), and ultimately toward the *telos* of knowledge of the forms (*noesis*), one grasps the in-itself perfection of the thing's form rather than its relational appearance. Simultaneously, one reaches the goal of human perfection. In effect, for Plato, knowledge of a thing's perfections is itself the perfection of the knower; epistemological and ontological excellence are one and the same.[66]

Aristotle's resemblance to Plato on these certain points is striking given the supposed antagonism of the two metaphysical systems. At the foundation of Aristotelian ontology is the concept of hylomorphic substances. For Aristotle, natural beings are a composite of form and matter, whereby the matter designates the "that out of which" (*Phys.* II.3, 194b23-24) and the form denotes the intelligible pattern that identifies the thing as a particular sort of being. Form, then, is the "*logos* of the essence" (194b26-27) of a substance and provides for matter the organizing principle needed for it to be understood and classified as a particular thing. Moreover, the form acts as an intrinsic principle of motion (a "nature"), directing the transition from potentiality to actuality and, thus, toward the fuller actualization of the form. Aristotle defines a nature as the "source or cause of being moved and of being at rest in that to which it belongs primarily, in virtue of itself and not in virtue of a concomitant attribute" (*Phys.* II.1, 192b20-22). In this sense, the nature of a being is to be identified with its form, for as Aristotle

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[64] Emphasis mine. As will be discussed below, this statement seems to attribute being [*to on*] to goodness whereas a previous section of the dialogue positions the Good beyond being.

[65] Gadamer, *The Idea*, 28.

[66] Cf. Perl, "The Living Image," 194–95.

states, "Form is a more plausible candidate for being nature than matter is because we speak of a thing as what it actually is at the time, rather than what it then is potentially" (193b6-8). As motion moves towards its proper end, there is an intensification of being as the form is actualized in the matter.[67] The form is, consequently, also a final cause or, in Aristotelian terms, the "that for the sake of which" motion occurs. Thus, both Plato and Aristotle understand the form teleologically.[68]

Similarly, by identifying the form with a thing's particular goodness, the goods of each creature will divide along the ten categories proper to being.[69] As such, each will bear only an analogical similarity—namely, in their passage from privation (*steresis*) or potentiality (*dynamis*) into form (*eidos*) or actuality (*energeia*). Thus, as Thomas Joseph White summarizes, "The human goodness of a moral virtue (a quality of the soul attained through habitual activity) is understood differently from the goodness of a person's height (the goodness of his or her quantity) or family history (the goodness of his or her relations), and the like."[70] In other words, the traits of piety and being under ten feet tall, even though highly dissimilar, can both be deemed good traits for a person. Each corresponds to the form of humanity in its respective category of being.

Moreover, final causes themselves have a twofold sense—namely, an aim and a beneficiary. Aristotle notes, "The phrase 'for the sake of which' is ambiguous; it may mean either (*a*) the end to achieve which, or (*b*) the being in whose interest the act is done" (*DA* II.4, 415b2-4).[71] For example, the *telos* of the art of medicine can be said to be either health (the

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[67] Oliver, *Philosophy*, 44.

[68] Aristotle also seems to affirm the identity of goodness and oneness since the form is both the principle of unity for natural beings and their *telos*. Cf. Gadamer, *The Idea*, 31.

[69] *NE* I.6, 1096a23-29, "Further, since 'Good' has as many senses as 'being'… clearly it cannot be something universally present in all cases and single; for then it could not have been predicated in all the categories but in one only."

[70] White, *Wisdom in the Face*, 42.

[71] Cf. *Phys.* II.2, 194a33-36; *Metaphys.* XII.7, 1072b2-3.

aim) or the doctor learning to practice it (the beneficiary). Within biological organisms, then, the final cause with respect to aim will differ among the various traits. The aim of a bird's beak and its wings are quite distinct. Nevertheless, the final cause with respect to the beneficiary will always be the organism itself.[72]

Thus far, one might assume that, for Aristotle, the Good only pertains to individual creatures and that one cannot predicate goodness of anything beyond particular substances. Since Aristotle seems to identify the Good with the actualization of substantial forms, this would seem to entail that the Good is *solely* a function of this development. However, one might still ask whether there are higher orders of goodness that transcend the goods of individual forms, and various passages within Aristotle seem to entail this very conclusion. For instance, the much-debated *Physics* II.8 contains what at first might appear to be an affirmation that seasonal rains are for the good of crop growth.[73] The section contains a brief summation of Empedocles' assertion that apparently purposive biological features might result from an accidental conglomeration of parts. Thus, any apparent goods in an organism's physiology are the products of chance, just as seasonal rains are products of necessity rather than for the purpose of allowing crop growth. Aristotle's subsequent rebuttal (*Phys.* II.8, 198b35-199a6) has generated an endless stream of interpretations; some have declared it firm evidence for Aristotle's belief in cosmic teleology[74] while other exegetes, wishing to distance the philosopher from any hint of nonbiological teleology, argue the passage reveals merely the presence of a humanly-imposed teleology upon rainfall.[75] The passage is notoriously difficult

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[72] Johnson, *Aristotle on Teleology*, 65-67.

[73] See *Phys.* II.8, 198b16-a6.

[74] E.g., David Sedley, "Teleology, Aristotelian and Platonic," in *Being, Nature, and Life in Aristotle: Essays in Honor of Allan Gotthelf*, ed. James G. Lennox and Robert Bolton (Cambridge: Cambridge University Press, 2010), 27, "[Aristotle] sees weather as part of an inherently purposive cosmic nature, one which among other things supports agriculture."

[75] Leunissen, *Explanation and Teleology*, 30-43; Johnson, *Aristotle on Teleology*151-7. David Furley, "The Rainfall Example in *Physics* II.8," in *Aristotle on Nature and Living Things*, ed. Allan Gotthelf (Pittsburgh: Mathesis Publications, 1985), 177-82 divides Aristotelians between those who affirm nonbiological teleology and those who do not. The latter position is rendered implausible by Aristotle's statement in *Phys.* II.1 192b8-11 where

to interpret—a problem exaggerated by Aristotle’s failure to explicitly address the issue of crop growth in his rebuttal to Empedocles’ position.

The challenging nature of this passage renders its evidential value for a more global or cosmic teleology limited—at least, on its own.[76] Other sections of Aristotle’s writings demonstrate the nearly unavoidable conclusion that the great thinker affirmed that not only are parts ordered to substantial wholes but also that substances are ordered one to another in a grand cosmic melody. For example, in *On the Parts of Animals*, dolphins and selachians are said to turn upside down during nourishment “for the sake of the preservation of the other animals (for during the turn the other animals escape)” (*PA* IV.13, 696b26-29). The obvious challenge of texts such as these is that Aristotle now seems to have introduced two distinct *ratios* of final causation. One obvious method to preserve the unity of Aristotle’s account would be to suppose some higher ordering principle that is at minimum analogous to a “cosmic form”. If adopted, one could still maintain that the Good is to be identified with the actualization of substantial forms even while there are, in fact, higher-order goods accomplished beyond the individual (or even species) level. This proposal and its connection to Aristotle’s Prime Mover will be discussed below since the topic threatens to venture beyond the scope of this particular section.

After Aristotle, the Neoplatonic tradition acted as an early synthesis of Platonic and Aristotelian philosophies. Broadly speaking, the tradition prioritized a hierarchical view of causation whereby the principle (such as humanity) acts as both the productive efficient cause

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he declares simple bodies to be natural objects and his statement in *Phys.* II.8, 199a7-8 where nonbiological entities are said to contain a “for the sake of which”.

[76] While it is beyond the scope of this chapter to offer a detailed exegesis of the passage, it is the opinion of this author that the likeliest conclusion lies somewhere between the prior two interpretations—namely, that Aristotle is affirming the reality of nonbiological teleology (i.e., winter rainfall) but limiting his argument to the nature of rainfall itself as it is directed toward the Prime Mover. For a detailed analysis of this position, see Margaret Scharle’s excellent article, “Elemental Teleology in Aristotle’s *Physics* 2.8,” *Oxford Studies in Ancient Philosophy* 34 (May 2008): 147-83.

and the final cause for any particular. For instance, one finds in Proclus both the Good as the principle of unity (*Elem. Theol.* XIII) and the desire of all things for the Good (*Elem. Theol.* XXXI). Christian thought would ultimately adopt much of the Neoplatonic scheme, and, in the brilliant hands of St. Augustine, the Neoplatonic system of causation was baptized in the waters of Christian doctrine. For the saint, the Good is identical to the intelligibility of the object—a "good" thing simply *is* what that thing ought to be.[77]

In the hands of Thomas Aquinas, these prior traditions were synthesized into their most influential Medieval form. Regarding final causation, the term "perfection" came to provide the central motif unifying the various subjects he investigates.[78] The term (literally *per-fectum*) is a translation of the Greek *teleion*, the adjectival form of *telos,*[79] and denotes something that is thoroughly made or accomplished.[80] Accordingly, when applied to a creature, it signifies the nature of a thing (*ST* II-II.184.1); creatures can then be said to be perfect to the degree they have actualized those dispositions proper to their form.[81] The form, then, defines creaturely perfection and therefore serves as the final cause towards which creaturely action strives. Inasmuch as the creature actualizes its form, it can be said to be perfect.[82] For Thomas, "It makes no difference… whether one says 'things work for an end'…or 'they tend to their own perfection.'"[83] Nevertheless, Thomas, like Aristotle, distinguishes between this twofold nature of ends. Ends are extrinsic to the extent an agent is moved by some aim outside itself. Intrinsic ends, by contrast, are defined by the form, which is the beneficiary of a thing's motion (*In XII Metaph.* lec. 12, n. 2627). Thomas thus adopts the Aristotelian notion of an *entelecheia*—a

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[77] Oliver, *Creation*, 26.

[78] Blanchette, *Perfection*, 5 notes that the *Index Thomisticus* contains "hundreds of columns" in which a form of "perfection" is used.

[79] Ibid, 43.

[80] Ibid, 41.

[81] Cf. *Liber de Perfectione Vitae Spiritualis* ch. 1.

[82] *ST* I-II.3.2, "Now each thing is perfect insofar as it is actual; since potentiality without act is imperfect."

[83] Aertsen, "Nature," 358. Cf. *SCG* III.24.

telos intrinsic to the creature itself.[84] A being might be said to be "perfect", then, once the creature achieves its *entelecheia*, or, as Blanchette states it, "When it retains nothing of the non-being of what pertains to its being."[85]

In sum, the form represents the perfection of creatures for each of the three philosophers. There is, however, one universal creaturely capacity that seemingly escapes the above analysis—namely, the reproductive capacity. If the good of a creature corresponds to the actualization of its form, what end does reproduction serve? The act often comes at great costs to the parenting organisms; nevertheless, all organisms seek it as an end. Does this therefore negate the necessary link between a creature's formal and final cause by introducing two *ratios* of goodness? Returning to Aristotle, he deduced that the solution lay in the aforementioned distinction between the aim and beneficiary of final causes. Every creature desires, by virtue of aim, to participate in the divine life. As Gerson notes, forms, by themselves, cannot fully account for final causality, for one can still question *why* the form acts as an end rather than, say, its contrary.[86] If the form acts as an end, it can only be because it achieves certain aims which are, in themselves, goods. The aim, then, is an absolute good for the creature and the form is a relative good via its participation in the aim. Thus, within final causation, there appears to be an explanatory priority given to aim over beneficiary. As such, any fully intelligible account requires some measure of goodness that gives a "directionality" to final causation and explains why certain states of beings are desired over others. Only the Prime Mover can serve as this measure since it, unlike other substances, is pure actuality rather than a composite of potentiality and actuality. It is, therefore, the sole substance that lacks nothing

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[84] Blanchette, *Perfection*, 42.
[85] Ibid.
[86] Gerson, *Aristotle*, 122ff.

of its own being. Thus, Aristotle concludes, “That which is first in respect of complete reality is the cause of all things” (*Metaphys.* XII.5, 1071a35-36).[87]

However, in seeking to imitate the eternality of the divine being, mortal creatures find themselves incapable of emulating this trait individually. In the act of reproduction, though, the individual replicates its form, allowing for the preservation of the species. Aristotle writes, “Since, then, [living creatures] cannot share in what is eternal and divine by continuous existence… they share in them insofar as each can, some more and some less. And what persists is not the thing itself but something like itself, not one in number but one in form” (*DA* II.4, 215b2-7). Thus, while the *aim* of the creature is divine participation, the *beneficiary* is the form of the species which persists even while individual instances of it die off.

There is, then, an indispensable theological element to any comprehensive account of final causes,[88] and, unsurprisingly, it is an element Thomas would further expand. In adopting this position, Thomas was able to integrate the Platonic notion of the Good as diffusive of being. He argues that it is a marker of perfection in a thing when it is capable of producing its like (*ST* I.1.19.ad 2; *SCG* I.37.307). Thus, at one and the same time, reproduction could be said to be diffusive of being, the perfection of form, and an imitation of the divine life. Here, again, one sees the seamless integration of the two distinct but noncompetitive traditions (Neoplatonic and Aristotelian) into the existing Christian edifice. Similarly, Thomas is herein able to divide between goods proper to (1) the individual, (2) the species, (3) the genus, and (4) the similitude between the principled (*principiatorum)* and the principle (*SCG* III.24.7).[89] In crafting this taxonomy of goods beginning with the creature and ascending towards God as the first

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[87] For a summary of another Aristotelian argument for the Prime Mover, the argument from actuality, see White, *Wisdom in the Face*, 56-63.

[88] *Contra* MacDonald, “Introduction,” 5, who argues, “The nature approach seems to lead to an account of goodness that is neither essentially theological nor relational.”

[89] Examples of goods proper to each category are (1) food, (2) reproduction, (3) the sun causing light and heat in another, and (4) God’s goodness, which is beyond genus yet gives being to all.

principle, Thomas assimilates not only the great traditions but also the analogical nature of goodness into his analogy of being.[90]

This hierarchical structure of goods pertains even to creatures themselves. While each creature's form defines its own perfection, Thomas nevertheless found himself able to divide the various genera of beings into hierarchies of perfection. Those forms possessing more perfections could be regarded as higher than those with less.[91] Hence, animate beings are said to be more perfect than inanimate ones since the former retain a trait lacking in the latter (*In II De Anima*, lec. 22, n.523). At the peak of this hierarchy stands the one creature with rational faculties: humanity. As Blanchette summarizes, "Forms thus bring matter to perfection in diverse ways by a kind of addition that brings order and different degrees of being and that enables us to classify things as imperfect and perfect, not only according to where each one is along the way to its own per-fection [*sic*], but also according to where they are in relation to one another in the order of being."[92] This "relation to one another" is not a mere hierarchy, however, but designates an ordering whereby a greater good might be served. Aquinas himself states, "The form of any whole, which is one through a certain ordering of parts, is its order: hence it follows that it is its good" (*In XII Metaph.*, lec. 12, n. 2627). In other words, there is a natural harmony within the cosmos; creaturely ends are not merely ordered for their own sake but also correspond to a higher accord among all beings. The universe sings a single melody, and every being is its own note.

A new point of alignment thus emerges between Plato, Aristotle, and Thomas Aquinas—namely, the theological foundation for the Good. It has often been tempting to perceive the Platonic tradition as regarding the divine as source whereas the Aristotelian

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[90] Blanchette, *Perfection*, 16-17.
[91] Stump and Kretzmann, "Being and Goodness," 111.
[92] Ibid, 59.

tradition focuses on the divine as end or goal. Indeed, some scholars maintain that it is only with Aquinas that God becomes both source and end for all creatures.[93] While this synopsis offers a convenient sketch, it suffers from a lack of nuance. We turn now to provide a more detailed account.

2.3 The Good and the Divine

There are three aspects to Plato's view of the divine. As previously noted, the Idea of the Good comes "first" (*to proton*) in the Platonic causal order and therefore serves as a principle for the forms.[94] As Gerson remarks, because the Good serves as the font of reality, Plato's ancient interpreters identified the Good with the divine.[95] While Plato himself never explicitly equates the two, by situating the Good as the source of all knowledge and existence and placing it beyond even being itself (*Rep.* 509b9-10), it seems fair to suppose the univocal voice of antiquity was correct in their assertion of the two's identity. There is, however, a stark contrast between the Platonic conception of the divine and modern notions of the same term. As Gerson continues, the dependence of the forms on the Idea of the Good "is not the dependence of creatures on a creator… Rather, this dependence… is much more naturally viewed as dependence on a mind."[96]

Plato is led to this conclusion by the need to explain difference within identity; in other words, while the Idea of the Good might unite the forms, some other principle would be needed to account for their differentiation. Thus, there was the need to postulate the existence of a divine Mind (*nous*) that eternally manifests and contemplates the individual forms. *Nous*, then, represents the highest realm of cognition—one emanating from and contemplative of the Good-

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[93] E.g., Zagzebski, "Goodness, perfect," "By the time of Aquinas, medieval philosophers had identified the good in both the Platonic and Aristotelian senses with the Christian God and had argued that God is both the perfectly good creative source and the perfectly good end of all beings other than himself."

[94] Gadamer, *The Idea*, 29.

[95] Gerson, *God*, 62. Cf. Gadamer, *The Idea*, 132.

[96] Gerson, *God*, 62.

in-itself.[97] Moreover, while human *nous* might partake in divine *nous*, one cannot identify the one with the other since the former's noetic capacity is limited and flawed.[98]

A third and final element of the divine triad appears in the dialogue *Timaeus* in the form of the much-discussed Demiurge.[99] Written as a theological apologetic against *physiologoi* philosophers who sought to account for the world via chance,[100] Plato herein connects the ephemeral world of becoming with the eternal, unchanging world of the forms, and it is precisely in the former's teleological orientation toward the latter that this is accomplished. The Demiurge, in comprehending the goodness of the forms, sought to align the world with the eternal paradigm. It therefore shaped the cosmos in all its intricacies and imbued upon it the World Soul—the single, animating principle of the cosmos that subsumes all lower forms. Oliver notes that, in crafting the cosmos to reflect the divine, the Demiurge is said to have relied upon persuasion rather than "violent imposition."[101] Just as good rhetoric might persuade the soul towards a certain good, so too did the Demiurge move the world towards the Good-in-itself—the natural *telos* of all things. In this sense, the whole cosmos is teleologically oriented toward the divine. As Oliver summarizes, "Plato's cosmology as expounded in the *Timaeus* is fundamentally 'theological' in character. The cosmos is identified as that which participates in and obtains its being from a transcendent source."[102] Thus, Plato's notion of the Good cannot be reduced to its role as the efficient, diffusive cause of being; his writings similarly prioritize the Good as teleologically ordering the cosmos towards divine participation—an aspect equally at home in the accounts of Aristotle and Thomas.

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[97] Ibid, 80.

[98] Ibid.

[99] Ibid, 81 deems this being a "subordinate deity" to the Idea of the Good. It goes beyond the scope of this chapter to speculate on the exact relationship of this triadic divinity within Plato's writings.

[100] Oliver, *Philosophy,* 8.

[101] Ibid, 20.

[102] Ibid, 27. Cf. White, *Wisdom in the Face*, 39.

It is perhaps unsurprising, then, that this section will argue that Aristotle offers little by way of a radical innovation of his predecessor. I have earlier suggested that Aristotle implies the possibility of a cosmic substantial form. Moreover, I have demonstrated that final causes among natural beings are universally aimed at the Prime Mover. I now draw these two strands together to address more fully the teleological orientation of the cosmos towards the divine. As stated, the aim of all motion is the imitation of the Prime Mover. As such, final causation is simultaneously intrinsically directed towards the form and extrinsically directed towards the divine (*Metaphys.* XII.7, 1072b1-5). However, the Prime Mover itself remains unaffected by all such creaturely motions. For Aristotle, the divine being could not defile itself by participating in the activities of the cosmos. This activity would not only comprise a relationship to a finite, evolving world (and, hence, compromise the unity of the Prime Mover), but it would also be an activity unfit for a perfect being. The sole activity worthy of a fully actualized being would be the act of eternal self-contemplation.[103]

Thus, the Prime Mover initiates cosmic motion by acting as the final cause of motion with regard to aim.[104] Does Aristotle then differ from Plato and Aquinas by denying the divine's role in efficient causation? Many commentators have assumed this, but one alternative possibility has been to regard the Prime Mover as a cosmic soul. Just as the soul acts as the formal, final, and efficient cause in living beings, so, too, the Prime Mover should be regarded, they argue, as performing this task at a cosmic scale. This solution might be suggested in *Metaphys.* XII.10, 1075a11-25 when Aristotle suggests the Prime Mover is the cause of the "nature of the whole." Mariska Leunissen has challenged this reading, regarding this phrase as

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[103] White, *Wisdom in the Face*, 62-3, "In God's immanent operations of knowledge and appetitive delight in the Good, then, he is his own object of knowledge and love. Consequently, these operations are identical to his eternal, living being. God is subsistent contemplation."

[104] *Contra* Fred D. Miller, Jr., "Aristotle's Divine Cause," in *Aristotle on Method and Metaphysics*, ed. Edward Feser (Hampshire, England: Palgrave MacMillan, 2013), 277-298. To state that the divine is the aim of final causation is not to claim it is only a "metaphorical mover" but rather the cause that orders all the other causes. Miller seemingly equates the term "motion" with efficient causality in his analysis.

a "periphrastic for the universe."[105] The cosmic order, she claims, is reducible to the goal-directedness of its individual constituents. David Sedley juxtaposes this position by arguing for the reality of a cosmic form. He states, "Final causality… is primarily present in the world as a whole, and in beings like us only derivatively."[106] Consequently, Sedley argues for the reality of a hierarchy of teleology wherein local teleology is distinguished from yet integrated within a global teleology. Given the aforementioned texts in support of a more global teleology, Sedley's stance seems more plausible. However, Sedley is unclear on whether the cosmic soul merely imitates the Prime Mover or is, in fact, identical with it. Fred Miller has raised a crucial objection to the latter position.[107] He notes that the analogy to an animal soul crumbles when one recognizes that the soul is coincidentally moved in the act of moving the body. Since such motion is denied to the Prime Mover, this seems to rule out its being the cosmic soul. Moreover, the Prime Mover is defined as "separate from perceptible things" (*Metaphys.* XII.7, 1073a4-5). Since the form and matter of hylomorphic substances are inseparable save conceptually, this would equally seem to entail that the Prime Mover could not act as the form of the cosmos.

To answer this riddle, one must turn to the famed army analogy given in *Metaphys.* XII. Here, Aristotle asks whether the good of the cosmos derives from "something separate and by itself, or as the order of the parts." He concludes, "Probably in both ways, as an army does; for its good is found both in its order and in its leader, and more in the latter; for he does not depend on the order but it depends on him" (*Metaphys.* XII.10, 1075a13-16). In other words, just as individual soldiers perform their duties for the good of the whole army, so too do the individual natures of beings act in accord with a universal order. However, an army's order ultimately derives from its general whose commands provide the end that the army seeks to imitate. And

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[105] Leunissen, *Explanation and Teleology*, 47.

[106] Sedley, "Teleology, Aristotelian," 23. Sedley cites *PA* I.1, 641b10-23 in support, which, he argues, is a direct and unnoticed parallel to *Philebus* 29a9-30d9.

[107] Miller, "Aristotle's Divine," 278.

just as an army seeks to imitate the good of a general's orders, the cosmos, both in its individual parts and as a whole, yearns to emulate the supreme goodness of God.

Thus, it is perhaps safest to infer that the Prime Mover effects motion only as the aim of final causes. In this sense, one must postulate the reality of the Prime Mover in order to provide a causally complete picture of the cosmos, for just as the concept of health acts as the aim of the practice of medicine, so also the Prime Mover acts as the limit toward which all natural motion strives.[108] In addition, though, the textual evidence suggests the need to posit that the cosmos itself is a substance with its own form—one that acts to bring order to the disparate elements of the world as a loving response to the Prime Mover.[109] And, indeed, Mohan Matthen has argued persuasively that Aristotle's language and logic in *DC* I.9 demonstrates Aristotle's belief in a substantial form for the cosmos.[110]

Like the Demiurge, the Prime Mover orders the cosmos in a method very similar to persuasion rather than active tinkering. As such, there is little difference between Plato and Aristotle's accounts save the collapse of the Demiurge into the Idea of the Good in the latter's theology;[111] in fact, Gerson has even ventured, "It is not so far-fetched to suppose that the prime unmoved mover is Aristotle's version of the Demiurge *if* we do not think that the latter is more than a separate intellect."[112] André Laks concurs, claiming the Prime Mover must be viewed against "the Platonic horizon of Aristotle's approach here."[113]

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[108] White, *Wisdom in the Face*, 43 argues that Aristotle's novelty lies in the "absolute transcendence of God with respect to all physical realities." If White is contrasting the Prime Mover to the Demiurge, this analysis is correct. If, however, one regards the Idea of the Good as the true, sole locus of divinity in Plato, his analysis breaks down.

[109] Oliver, *Philosophy*, 49, "Actuality is therefore equated with the good and likewise with the first unmoved mover such that all motion within the universe, as that which is ecstatic with an end, limit and final cause outside itself, is determined towards that one ultimate goal which is eternal perfection."

[110] Mohan Matthen, "The Holistic Presuppositions of Aristotle's Cosmology," *Oxford Studies in Ancient Philosophy* 20 (2001): 171-199; see Johnson, *Aristotle on Teleology*, ch. 9 for a rebuttal.

[111] Plato's notion of the Good as the efficient cause of being might also be added. However, since Aristotle leaves little comment on the ultimate origin of being (save for the eternality of the cosmos), I restrict myself from speculating on any continuity or disagreement.

[112] Gerson, *Aristotle*, 126. Emphasis original.

[113] André Laks, "*Metaphysics* Lambda 7," in *Aristotle's Metaphysics Lambda*, ed. M. Frede and D. Charles (Oxford: Clarendon Press, 2000), 225.

Later Neoplatonic accounts would preserve this tradition, and despite their criticisms of Aristotle for collapsing the two divine orders,[114] there was an eventual merger of the two thinkers. Unsurprisingly, Christianity found the Neoplatonic system, whereby God serves as both source and end, to be a welcome pagan ally. Augustine, for instance, adopted the system while also emphasizing the creation of the world through a *willful* act of God.[115] The addition of this Christian doctrine entailed that, "The only efficient causes of events are voluntary causes, that is, they proceed from that nature which is the 'breath of life'" (*CD* 5.9). Since the created natures of corporeal bodies are products of the will of God, all efficient causation ultimately derives either from the will of God or the incorporeal souls of angels or humans. Bodies themselves are merely the vehicles through which the will acts towards its ends. Also like the Neoplatonists, Augustine locates the final cause of volitional efficient causes in their ultimate source, for, as he famously states, "You have made us for yourself and restless is our heart until it comes to rest in you" (*Conf.* I.1.1).

By the time of Thomas Aquinas, it spoke in a nearly univocal voice concerning the divine ground of final causation. This connection was so assured that Thomas considered the very reality of final causes to be a rational basis for inferring God's existence, and while many are familiar with his famed Fifth Way, the argument appears in varying degrees of sophistication throughout his corpus.[116] The various renditions of the argument prove reliant on both the Aristotelian distinction between aim and beneficiary (in order to place God as the ultimate end in any ordered series of goods; see *SCG* III.17.5) and the Augustinian implementation of the divine will (in order to order natural beings towards their ends; see *ST*

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[114] Gerson, *Aristotle*, 202-5 notes that this collapse entailed that later Neoplatonists assumed Aristotle's god to be second in the order of causality. Plotinus' provided a sustained critique of Aristotle, noting that thinking is self-reflexive and thus inherently complex (dividing between the act of thinking and the thought). As such, the Prime Mover is first in the order of substance but not in the order of being.

[115] Andrew Davison, *Participation in God: A Study in Christian Doctrine and Metaphysics* (Cambridge: Cambridge University Press, 2019), 96-7.

[116] E.g., *SCG* I.13.35; II.24.4; III.17.5-7; *ST* I.2.3; I.103.1, ad.1; *De verit.* V.2.

I.2.3 and *In XII Metaph.* lec. 12, n. 2631). Hence, since creaturely goodness derives from divine goodness, the very act of a creature seeking its own good is identical with its pursuing greater participation within God (*ST* I.44.4). Moreover, even while creaturely ends are wildly distinct, they are each directed to God—the one good that is good essentially rather than via participation. In the eloquent words of Aertsen, "The things which are as it were dispersed, insofar as they are ordained to their own different ends, are gathered in the directedness to this final end."[117] He continues, "Because God is the universal good, every creature naturally loves Him more than it does itself."[118]

And, in continuity with the tradition, cosmic perfection is said to reflect divine perfection far more than its individual parts.[119] Thus, as discussed above on Thomas' division of goods into four categories, the goods of any particular thing can be seen not only in relation to the individual and to God but also to the goods of the species and the whole order of the cosmos. And it is this order that constitutes the unity of the *uni*verse, giving to each of its parts its proper end within the grand scheme of cosmic motion.[120] As unmoved mover, God provides the limit for all subsequent creaturely motion, beginning with the celestial spheres (moved by the angelic separate substances) and ending with the sublunary creatures—each thing imitating the immortal first cause with its motion towards its unique perfection. For the celestial spheres,

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[117] Aertsen, *Nature*, 356. However, Aertsen, "Good as a Transcendental and the Transcendence of the Good," in *Being and Goodness: The Concept of the Good in Metaphysics and Philosophical Theology*, ed. Scott MacDonald (London: Cornell University Press, 1991), 72 argues that Thomas herein synthesized the Platonic and Aristotelian notions of the Good.

[118] Ibid, 357.

[119] Thomas's system does not, however, allow for the possibility of the cosmos being one substantial form since it holds to the unicity of substantial forms, which states that a substance can possess only one substantial form. Thus, if the cosmos possessed a substantial form, nothing within the cosmos could possess a substantial form. See John Goyette, "St. Thomas on the Unity of Substantial Form," *Nova et Vetera* 7, no. 4 (2009): 781-90.

[120] As Blanchette, *Perfection*, 24 notes, Thomas herein draws heavily from the *Liber de causis*. Blanchette's conclusion contrasts with Étienne Gilson, whom, Blanchette claims, "tends to belittle" the importance of this particular work. Leo J. Elders, "The Metaphysics of the *Liber de causis,*" in *Thomas Aquinas and His Predecessors: The Philosophers and the Church Fathers*, ed. Leo J. Elders (Washington, D.C.: Catholic University of America Press, 2018), 243 notes the work is cited over 230 times in Thomas's corpus. Of note, Thomas seems to have been the first person to realize the work's false attribution to Aristotle, demonstrating its heavy reliance on Proclus.

this involves their eternal cyclical motion; for living beings, this entails their act of generation through reproduction. Each natural thing attempts to replicate the divine first cause in accordance with the good proper to its mode of being. But in their separate acts, each thing complements the other; the ends of distinct substances mutually work in harmony. Borrowing from Aristotle, Thomas writes, “Whenever certain things are ordered to a definite end they all come under the control of the one to whom the end primarily belongs. This is evident in an army: all divisions of an army and their functions are ordered to the commander’s good as an ultimate end, and this is victory” (*SCG* III.64.2).

In sum, a common core of teachings can be extracted from these thinkers pertaining to the nature of the Good as a final cause: 1.) The Good is desirable in itself and thus the source of creaturely motion, 2.) Individual goods are defined by the creature’s form, 3.) There are higher-order goods, both at the level of species and within the overall cosmic order, and 4.) The divine life is the ultimate end that all creatures seek to imitate. Having summarized the role of the Good in final causation, I turn now to revisit the place of the Good as a transcendental.

3. The Good as Transcendental

A transcendental is a positive predicate that is applicable across all ten of Aristotle’s ten categories of being. As such, it “transcends” classification into a specific genus, becoming, in effect, an aspect of all existing things. “Being” is an obvious example of such a predicate, since the Aristotelian categories were created to subdivide beings, but other less apparent yet common examples include “one,” “true,” and “good”. While more commonly associated with medieval philosophy, the Good as a transcendental found rudimentary expression within the great classical thinkers. As such, it presents another strand connecting the tradition, though, admittedly, in a looser fashion than final causation. As will be seen, there is a manifest diachronic development of this notion.[121] I will focus solely on the convertibility of the Good with being, disregarding the other transcendentals, in order to emphasize the primary and most relevant point: goodness as a universal aspect of all existing things (what I will deem the thesis of convertibility). I begin by tracing the development of this thesis through the tradition, though initially leaving aside Aristotle and his notorious critique until the final section.

3.1 The Good as Convertible with Being

While the notion that goodness was an attribute of being was commonly accepted by the High Middle Ages, it only arose after an intense discussion regarding the exact nature of this relationship. Within Plato, one sees the rudiments that would eventually emerge as the thesis of convertibility. As noted, Gerson interprets the relationship of the forms to the Idea of the Good as one of virtuality. In other words, the Good contains within itself all its effects—namely, the forms—and is the cause of their being.[122] One might, therefore, interpret Plato as espousing something like an early version of the thesis of convertibility, and some interpreters have arrived at this very conclusion.[123] However, as previously noted, a thing's being only corresponds to the "in-itself" character of a thing rather than to any relationships it might bear to other things, yet Plato regarded goodness as extending to both the being (absolute goodness) and the relationship of things (relative goodness). In fact, the intrinsic being of the forms results only from a "measured relation" of the thing to itself. [124] Thus, the Good, as this measure, surpasses being by causing it, entailing that the range of goodness exceeds that of being.[125]

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[121] W. Norris Clarke, S.J., *The One and the Many: A Contemporary Thomistic Metaphysics* (Notre Dame: University of Notre Dame Press, 2001), 291, "The doctrine of Transcendental properties developed piecemeal in Western thought."

[122] Gerson, *God*, 61.

[123] See, for instance, Gracia, "The Transcendentals," 117.

[124] Schindler, *Plato's Critique*, 113. Cf. Aertsen, *Medieval*, 292.

[125] Gerson, *God*, 58 suggests, "The Form of the Good is hypothetically crafted to meet the criteria for the subject of Parmenides' logical hygienic discourse" since the latter asserted that the *archē* of being must be separate from the things possessing being.

Indeed, in a famous passage of the *Republic*, Plato declares the Good to be “beyond being, superior to it in rank and power” (509b8-10).

As such, while Plato would accept that all instances of being are good, goodness itself transcends being.[126] This stance would come to characterize many of his later devotees, including influential Christians like Pseudo-Dionysius,[127] who argued that the predicate “good” applies to both being and nonbeing equally. The latter, they maintained, denoted primary matter which is itself ordered toward the Good in its striving for being.[128] Since the scope of its causal reach exceeds that of even being, the Platonists held goodness to be an even more universal cause. Thus, even being is a created effect of goodness. In the words of the deeply Platonic *Liber de causis*, “The first of things created is being” (*LDC* IV.37). Since any two things that are not coextensive could not be regarded as convertible, the Platonists denied the thesis of convertibility.

While this tradition represents a strong branch of Platonism, Augustine offers an alternative vision—one that would eventually triumph in later Western thought. For the saint, the degree to which one thing exists corresponds to its degree of goodness.[129] Moreover, Augustine regarded many of the transcendentals—unity, truth, goodness, and being—to be predicated of God primarily and only derivatively of creatures.[130] By attributing being and goodness to a common source, Augustine’s hamartiology can identify evil with the privation

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[126] This conclusion is highly debated. As noted, in 518d, Plato refers to the Good as, “The brightest thing that *is*” (Emphasis mine). It goes beyond this chapter’s scope to attempt a reconciliation of these seemingly paradoxical statements. Since the later tradition opted for the priority of goodness, I have chosen to focus on this interpretation as the chief competitor to the thesis of convertibility.

[127] *De divinis nominibus* 2.3.

[128] Aertsen, *God*, 296.

[129] Gracia, “The Transcendentals,” 118.

[130] Wouter Goris and Jan Aertsen, “Medieval Theories of Transcendentals,” *The Stanford Encyclopedia of Philosophy* (Fall 2019 ed.), ed. Edward N. Zalta, https://plato.stanford.edu/archives/fall2019/entries/transcendentals-medieval/.

of being (*Conf.* VII, IX).[131] Thus, a primitive conception of what would later become the convertibility of the transcendentals emerges in his thought.

In terms of impact on the later tradition, Augustinianism reigned supreme. Indeed, MacDonald even attributes the prevalence of allusions over direct quotations of his work to the fact that "Medieval philosophers could take for granted their audience's familiarity with the Augustinian texts."[132] Only Boethius' *De hebdomadibus* offered a comparable influence on later discussions of the nature of the Good. There, Boethius distinguishes between goodness with regard to substance (a category exclusive to God alone) and goodness with regard to existence (*DH* II). No creature is good via its own substance, meaning that creatures are good only with respect to their derivative existence from the First Good. The good of creatures is therefore a relational property rather than an accidental or substantial property, and it is on account of this relation alone that we can predicate goodness of creatures.[133] Boethius's treatise would receive extensive commentary from a host of Medieval figures.[134] However, the first systematic treatment of the transcendentals would only arrive in the early 13th century with the publication of *Summa de bono* by Philip of Chancellor.[135] As the title implies, the Good represents the primary focus of the work. Two decades later, Albert the Great would offer his own treatment by the same name.[136]

Albert's greatest student would therefore inherit a tradition at the zenith of rich speculation regarding the convertibility of being and goodness. Thomas would bring the tradition that began in Augustine to its fullest realization in his statement that being and

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[131] As MacDonald, "Introduction," 10 notes, this notion develops in response to Augustine's repudiation of Manichean theology.
[132] Ibid, 9.
[133] For a fuller treatment (and critique) of Boethius' position, see Aertsen, "Good as a Transcendental," 59ff.
[134] E.g., Gilbert of Poitiers, Thierry of Chartres, Clarembald of Arras, and Thomas Aquinas.
[135] MacDonald, "Introduction," 12-3.
[136] As ibid, 14 notes, Albert's work was an early synthesis of Aristotelian notions of the good with rival Platonic conceptions found in the works of Avicenna and Algazel. Albert "claims that the apparent rivals are both defensible insofar as each draws attention to different features of one and the same underlying theory."

goodness are convertible (*bonum et ens convertuntur*) and coextensive (*In II Sent.* d.34, q.1, a.2, ad. 1).[137] For Thomas, something is desirable to the extent that it is a perfection of the agent who desires it. Moreover, a perfect being is one that is free from any defect proper to its nature; in other words, perfection is the actualization of a creature's being. Given these two statements, it follows that a state that is most desirable (and, therefore, the most good) is one that is most fully actualized.[138] Thus, being and goodness are convertible in the sense that the good of a thing simply is its more fully becoming the thing that it is. Because of this, Eleonore Stump and Norman Kretzmann have called goodness a supervenient property in the sense that the property "supervenes" over various unrelated natural properties.[139]

How, then, did Thomas respond to the alternative Platonic tradition? While most of the Platonic corpus was lost to Medieval thinkers, the concept was preserved in the work of Pseudo-Dionysius. Thus, through his interaction with the Areopagite in *De divinis nominibus*, Thomas was familiar with the Platonic prioritization of the Good over being. In response, Thomas accepts the extension of goodness to prime matter. However, Thomas equally recognizes Aristotle's critique of the Platonic conflation of matter with privation in *Physics* I. There, Aristotle notes that matter is often found under a form and could therefore not simply be equated with nonbeing.[140] Thomas instead equates prime matter with potency—a mode of being ordered to act. Since the term "good" is applied not just to things that are ends or to those that have attained their ends but also to anything that is ordered to an end, then even though matter has its being only in potency, it can still be called "good" without qualification because of this ordering to act. The brilliance of Thomas' position is that it enables him to affirm with

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[137] As Christopher Hughes, *Aquinas on Being, Goodness, and God* (London and New York: Routledge, 2015), argues, the thesis of convertibility "seems to imply that being is both necessary and sufficient for *being good*."
[138] Stump and Kretzmann, "Being and Goodness," 99-100.
[139] Ibid, 105.
[140] Aertsen, *Medieval*, 310.

the Platonists that “the good is, in a way, of wider scope than being” (*SCG* III.20)[141] without jeopardizing the thesis of convertibility, and even while he criticizes the Platonic conflation of nonbeing with matter, he ultimately integrates their central insight regarding the extension of the Good to potentiality. Thus, in terms of predication, goodness and being are convertible, yet in terms of causality, the Good has the *ratio* of a final cause and therefore has causal primacy, extending in an unqualified sense even to matter in potency.

In other words, even while being and the Good might be *coextensive*,[142] there is an *intensional* distinction between the terms. While both are the same in reference, goodness adds the notion of appetibility and thus is conceptually different from being.[143] Being, by contrast, expresses only the actuality of a thing. Thus, following Islamic sources, Thomas adopts the idiom, *idem in subiecto* (or *secundum rem*)*, different ratione*, meaning, “The same in subject (or reality), different in intension.”[144] Thomas, therefore, is able to demonstrate that goodness is an essential property of created substantial beings rather than a mere relational one—a feat Boethius failed to achieve. Goodness is proper to the substances of things because they are ordered to an end—namely, their own actualization and the First Good. Created beings are good not via their relationship as creations of the First Good but via their ordering to this First Good as an end.

3.2 Aristotle's Critique

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[141] Vernon J. Bourke remarks in his translation of this passage that Cajetan believed Thomas had later changed his position on this (cf. *ST* I.5.3). Aertsen, *Nature,* 312-3 holds a more likely position, regarding Thomas's statements in *SCG* to concern causality whereas his later statements pertain to predication. Given Pseudo-Dionysius' concern with causality and Thomas's statement that final causation is the “cause of causality,” Aertsen's position has the advantage of contextual support.

[142] Coextension is likely not a strong enough term for what Aquinas and the scholastics intended. The thumping noise of heartbeat and blood circulation are coextensive in creatures but represent two distinct features. By contrast, the transcendentals denote the same reality even if in conceptually distinct ways.

[143] Aertsen, *Nature*, 305.

[144] Gracia, “The Transcendentals,” 116. Albert the Great, as well, maintained a similar position (*In I Sent.* 1.20).

Perhaps the most famous critique of the concept of a universal good stems from Aristotle's *Nichomachean Ethics*.[145] Aristotle offers a variety of objections, though only a few pertain to the actual reality of the Idea of the Good rather than its relevance to ethics. Specifically, I will focus on the claims that (1) the Idea of the Good cannot be predicated univocally and therefore does not constitute a true universal, and (2) the Idea of the Good explains nothing that is not already explicable via particular goods. Concerning (1), Gerson has aptly noted that Aristotle here seems to regard the Idea of the Good as a substance (something the *Republic* denies), for only substances can be univocally predicated of many things.[146] Yet, as shown, the Idea of the Good is not some independent form in addition to the other forms but virtually contains all the other forms.

Moreover, as Gadamer recognizes, Aristotle's arguments here "prove… uncomfortably more than they should."[147] If his arguments are effective against the concept of the Good, they prove equally effective against the concept of being—an object of his own study.[148] Thus, even if the term "good" is not used univocally, it is unlikely to be the case that it is used equivocally, even in Aristotle's own writings.

Indeed, Gadamer notices that Aristotle's treatment of analogy provides a solution for his own critique.[149] In *Metaphysics* IX.6, 1048a30-b9, Aristotle accepts that the same term can be used analogically with regard to different modes of actuality.[150] Why then, Gadamer questions, is this solution not offered here? Gadamer's suggestion echoes Thomas Aquinas who

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[145] See *NE* I.4, 1096a17-1097a14. See parallel arguments in *Magna Moralia* 1182a25ff and *Eudemian Ethics* I.8, 1217b22-6.

[146] Gerson, *Aristotle*, 261-2.

[147] Gadamer, *The Idea*, 151.

[148] Ibid, 139-40.

[149] Ibid, 151ff. Cf. ibid, 131, "As a matter of fact, in regard to both being and the good, Aristotle directs us to the problem of analogy (*analogia*). So he is not at all blind to the universal ontological question of the good, despite his critique of Plato in the three ethical treatises."

[150] White, *Wisdom in the Face*, 55.

equally offered analogy as a solution (*Comm. Ethic.* I.7.96).[151] In any case, as has already been noted, Aristotle did not ultimately deny the need for a highest good to act as a measure for lesser goods. Gadamer here posits that Aristotle's critiques are therefore not meant to abolish some ultimate Good-in-itself but to replace Plato's version of it with his suggestion of a Prime Mover.[152] If this is the case, then Aristotle's critiques ought not be interpreted as a rejection of the transcendentality of the Good.

Similar objections would equally nullify (2), for the Idea of the Good can explain (a) why the same term is used of disparate objects in a non-equivocal manner, (b) why certain states act as aims of natural motion, and (c) the universal measure of all particular goods. All of these functions are fulfilled in a surrogate manner by Aristotle's Prime Mover. Thus, one cannot appeal to Aristotle in any argument against the transcendental nature of the Good. According to the Stagirite, the Good functions to orient *all* natural beings toward the actualization of their form and the imitation of the divine life. While nothing like the sophisticated later thesis of convertibility appears in the philosopher's works, this fact has not prevented some commentators from noting that "he may have worked out such a doctrine."[153]

4. Conclusion

We can, therefore, demarcate a common tradition concerning the nature of the Good—namely, as the *ratio* of final causation and as an aspect applicable to all existing things. We can, in sum, produce an ostensive definition of the Good as follows: *the Good denotes the universal tendency of natural beings to strive for that which is desirable in itself since such ends result in the perfection of a thing's form and/or the thing's imitation of divine goodness—the "measure" of all subordinate goods*. A few key points to derive from this definition are (1) the

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[151] Aertsen, "Good as a Transcendental," 57 notes that Aristotle's critiques of any univocal notion of the Good were regarded as proof of its transcendental nature.

[152] Gadamer, *The Idea*, 158.

[153] Gracia, "The Transcendentals," 117.

Good is inextricably bound up in the notion of natural causes and motion, (2) particular final causes of creatures are determined by a desire for perfection and the imitation of the divine, (3) higher-order goods likewise result from an intrinsic ordering principle and the universal desire to imitate the divine life, and (4) therefore, the Good, even while pertaining to creatures, is an unavoidably theological concept.

While this tradition and its robust theory of the Good endured through the life of Thomas Aquinas, it would not long survive his death, having received repeated attacks from numerous opponents. Already in the late 13th century, Henry of Ghent, while not denying the role of the Good in directing the will, nevertheless grants the will the capacity to direct itself to ends that deviate from the light of the intellect (*Quodlibet* I.14.2-5). By the early 14th century, Nicolaus Bonatus would question the theological identification of being with the divine.[154] In the same era, Francis of Marchia completed the divorce between the study of being and the study of God.[155] Moreover, Francis's writings brought into question the conceptual priority of the transcendentals, introducing concepts (such as "something") that supposedly superseded them in precedence.[156] In addition, much ink has been spilled over the contributions of John Dun Scotus, such as his separation of commonness from transcendentality, the univocity of being, and the nonconceptual distinction of the transcendentals.[157] Because of these figures, Wouter Goris has marked this period as the "dispersion of the transcendental."[158]

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[154] As Wouter Goris, "After Scotus: Dispersion of Metaphysics, of the Scope of Intelligibility, and of the Transcendentals in the Early 14th Century," *Quaestio* 8 (2008): 145 notes, by making the science of being distinct from theology, "Bonetus relegates theological issues, like God, separate substances and intelligences to a separate science, which he calls 'natural theology' (*theologia naturalis*), which comes last in the order of sciences, since it discusses the most difficult matters."

[155] This was achieved through his division of general and particular metaphysics (*In I Metaphys*. ch. 1). He would later exaggerate this division in his commentary on Lombard's *Sentences* by rebranding the pair as metaphysics and divine sciences.

[156] Goris, "After Scotus," 155.

[157] See a summary in Goris and Aertsen, "Medieval Theories."

[158] Goris, "After Scotus," 156-7.

It was, however, the figure of William of Ockham who would come to represent the most radical departure from the classical tradition; for him, final causation was limited to creatures with cognitive powers, for an end must be "loved and desired efficaciously by an agent, so that the effect is brought about because of the thing that is loved" (*Quodlibet* IV.1.1).[159] The Good, therefore, was not a universal aspect of being but a property of willing, intellectual beings alone. Motion was understood as merely the reduction of potentiality to actuality in some predetermined and necessary manner; no appeal need be made to an appetite or goal since this would additionally imply a power of intellect operating in noncognitive creatures. By divorcing efficient causation from final causation, Kara Richardson declares that Ockham was "a developer of a more modern view on… efficient causality."[160] Efficient causes could now be understood without appeal to appetitions or ends.

Further names, such as the Oxford calculators, Jean Buridan, and Nicholas of Autrecourt, could be added to this list of transitional figures. By the era of Descartes and Bacon,[161] empirical researchers increasingly began to deny the role of the Good in their scientific research—that is, in all fields except British biology. Through the works of William Harvey, Robert Boyle, and the infamous William Paley, teleological language survived in biological discourse yet only through a radical reevaluation of its origins. By reconceiving final causes in creatures as the products of extrinsic divine design rather than intrinsic forms, British scientists were able to demonstrate not only the theological value of teleological inferences but also their scientific fecundity.[162]

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[159] Translation found in Kara Richardson, "Efficient Causation: From Ibn Sīnā to Ockham," in *Efficient Causation: A History,* ed. Tad M. Schmaltz (Oxford: Oxford University Press, 2014), 129. Marilyn McCord Adams, "Ockham on Final Causality: Muddying the Waters," *Franciscan Studies* 56 (1998): 1-46 does, however, note the often-contradictory statements of Ockham at this point, suggesting, perhaps, a wavering of his opinion.

[160] Richardson, "Efficient Causation," 130.

[161] For instance, Francis Bacon, "The Advancement of Learning," in *The Works of Francis Bacon, Lord Chancellor of England*, vol. 1, ed. Basil Montagu (Philadelphia: Carey and Hart, 1844), 198, asserts that final causes have "intercepted the severe and diligent inquiry of all *real* and physical causes" (emphasis mine).

[162] See, for example, James G. Lennox, "Robert Boyle's Defense of Teleological Inference in Experimental Science." *Isis* 74, no. 1 (1983): 45.

This would, of course, lead to the supposed destruction of biological teleology by Charles Darwin, though he himself would cling to the usage of teleological language in the very description of his own theory.[163] Darwin is not alone in violating this supposed scientific taboo. It is a habit that continues to haunt the entire biological establishment. Given the very pervasiveness of teleological language in biology and, most notably, in contemporary evolutionary biology, the question must be raised as to whether the specter of the classical tradition might still reside within the very conceptual framework of the discipline and whether all attempted exorcisms of teleological language have only revealed it to be the theoretical bedrock of biology itself. These provocative questions are quite easy to raise but far more difficult to determine. As such, in the next two chapters, I will focus solely on the concept of natural selection to determine if the very heart of Darwinism can be understood in a nonteleological manner. First, I examine natural selection as an extrinsic, ecological efficient cause, particularly through the works of Jerry Fodor. I next consider the literature on natural selection as a cause operating through fitness gradations and provide a novel interpretation of natural selection that seeks to solve the problems posed by both conceptions of natural selection. While the work of this initial chapter will not reappear until the end of chapter 3, it will become relevant for this final resolution of the philosophical problems currently hounding our understanding of Darwinism.

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[163] Michael Hanby, *No God, No Science?: Theology, Cosmology, Biology* (West Sussex, UK: John Wiley & Sons, Ltd, 2013), 211 even jokes, “Darwin can hardly write three words without smuggling the despised teleology back into his conception of the organism.”

CHAPTER TWO: EXTERNALISM – JERRY FODOR'S CRITIQUE

Darwin pointed the direction to a thoroughly naturalistic - indeed a thoroughly atheistic - theory of phenotype formation; but he didn't see how to get the whole way there. He killed off God, if you like, but Mother Nature and other pseudo-agents got away scot-free. We think it's now time to get rid of them too.[1]

-Jerry Fodor and Massimo Piattelli-Palmarini-

1. Introduction

In the next two chapters, I explore the question of the explanatory and causal nature of natural selection. I provisionally adopt what I consider to be two desiderata of a theory of natural selection. First, the theory of natural selection attempts to provide a single causal mechanism that can account for differential reproduction (a perspective sometimes called causalism).[2] This is perhaps the standard view of natural selection among philosophers and scientists.[3] Second, natural selection is objectively distinct from other evolutionary causes, such as drift and migration (henceforth, the principle of individuation). In addition, I will contrast between two methods for understanding the causal mechanism of natural selection: an externalist understanding, a view common among practicing biologists, and a reciprocal understanding, which will be explored in the next chapter. In each case, I will demonstrate that teleological reasoning is an unavoidable part of the conceptual framework. Externalism can broadly be defined as the perspective that evolution by natural selection occurs via the selective pressures imposed on a population by its environment.[4] Evolution, under this schema, is often envisioned as analogous to a "force" acting upon populations.[5] In other words, the efficient causal arrow

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[1] Jerry Fodor and Massimo Piattelli-Palmarini, *What Darwin Got Wrong* (New York: Farrar, Straus, and Giroux, 2011), 163.

[2] Causation here (and in the rest of the chapter unless otherwise stated) is understood in the contemporary sense of mechanistic, efficient causation. Chapter 3 will challenge this reductionistic approach to causation.

[3] For example, Robert A. Skipper and Roberta L. Millstein, "Thinking about Evolutionary Mechanisms: Natural Selection," *Studies in History and Philosophy of Biological and Biomedical Sciences* 36 (2005): 328-9 note that, "There is no question that contemporary evolutionary biology exemplifies the view that natural selection is a mechanism." I will not defend the more ambitious claim that natural selection is a mechanism.

[4] The term "externalism" derives from Peter Godfrey-Smith, *Complexity and the Function of Mind in Nature* (Cambridge: Cambridge University Press, 1996).

[5] See Elliott Sober, *The Nature of Selection* (Cambridge, MA: MIT Press, 1984).

is asymmetrical, proceeding from the selective environment to gene frequencies within the population via their effects on the reproductive success of individual organisms. Externalism also typically regards natural selection primarily as a genetic phenomenon, whereby selective environments cause shifts in gene frequencies within populations. Organisms are often treated as mere vehicles for these interactions. Reciprocalism envisions the efficient causal arrow in a more symmetrical or cyclical fashion; individual organisms participate in their own evolutionary trajectory and are not mere passive agents mediating the effects of environments to gene frequencies.[6] Reciprocalism prioritizes ecosystem-organism interactions and thus regards natural selection as an ecological process.[7] However, I begin with an examination of Jerry Fodor's critique of explanatory externalism.

In the wake of the celebrations in 2009 regarding the 150th anniversary of Darwin's publication of *The Origin of Species*, the work *What Darwin Got Wrong* appeared, a title that would, according to famed biologist Richard Lewontin, receive "a volume of critical comment from biologists and philosophers that has not been seen since 1859."[8] The work maintained that Darwinism was irreparably wrong; under close examination, the foundations of Darwinism reveal themselves to be built upon philosophical sand, and this work would endeavor to be the storm of its demise. The authors, Jerry Fodor and Massimo Piattelli-Palmarini (hereafter FP), could not easily be dismissed as mere creationists or intelligent design theorists driven by religious ideology. Both were, by their own admission, "outright, card-carrying, signed-up, dyed-in-the-wool, no-holds-barred atheists."[9] Moreover, both were well-respected experts in their fields. Fodor ranks as one of the most important philosophers of mind and cognition in

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[6] The contrast of these views is further outlined in Björn Brunnander, "What is Natural Selection?" *Biology and Philosophy* 22 (2007): 231-46.

[7] See Bendik Hellem Aaby, "The Ecological Dimension of Natural Selection," *Philosophy of Science* 88, no. 5 (Dec. 2021): 1199-1209 for a more thorough analysis of these positions.

[8] Richard C. Lewontin, "Not so Natural Selection," *New York Review*, May 27, 2010. https://www.nybooks.com/articles/2010/05/27/not-so-natural-selection/?lp_txn_id=1041565.

[9] FP, *What Darwin*, xv.

the latter half of the 20th century, having "an enormous influence on virtually every portion of the philosophy of mind literature since 1960."[10] Similarly, Piattelli-Palmarini is an esteemed cognitive scientist with a background in molecular biology and biophysics, having previously worked under the Nobel Prize winning biochemist Jacques Monod.

Needless to say, their prestige did not prevent their colleagues from warning them against their attempts to challenge orthodoxy.[11] Adherence to Darwinism has, according to FP, "become a litmus for deciding who does, and who does not, hold a 'properly scientific' world view."[12] Regardless, FP's book sought to challenge the predominant view of biology, yet the crux of their assault does not focus on empirical discoveries (though these inevitably do play a role) but on "the metaphysics of reference, the status of biological teleology and, above all, in the psychology of learning."[13] Namely, the principle argument of the work strove to demonstrate that natural selection did not provide the causal mechanism necessary to explain biological evolution. Without its causal mechanism in place, Darwin's theory would cease to play the explanatory role it was assumed to play. In evaluating their claim, I will begin by outlining the development and details of FP's central assertions. Next, I will show how the multitudinous critiques that appeared in the wake of the book's publication have failed to deconstruct the book's principal argument. Finally, a possible solution for further investigation will be proposed, one that, oddly enough, may have been anticipated by Darwin himself.

2. The Argument

Before undertaking an examination of how FP criticize the theory of evolution via natural selection, it is vital to understand how the term "natural selection" is understood by the authors.

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[10] Bradley Rives, "Jerry A. Fodor (1935—2017)," *Internet Encyclopedia of Philosophy*. https://iep.utm.edu/fodor/.

[11] FP, *What Darwin*, xxii.

[12] Ibid, xv.

[13] Ibid, 2.

According to FP, natural selection is a method for connecting shifts in phenotypic frequency within a population with ecological variables.[14] The causal interaction between the creature's environment and the diversity of phenotypic traits within the population results in differential reproduction due to the varying levels of fitness expressed by the diversity of traits. In other words, certain traits within a population are selected for due to their greater levels of fitness and thus increase in frequency over time. This is a fairly standard definition and one shared by many of their opponents.[15] However, the term "fitness" carries much of the causal weight in this formulation, being the source of differential reproduction and thus for the evolution of life, yet despite its importance, the proper definition of the term remains mysterious. They note, "The issue of what fitness is is notoriously controversial…But it will do for our purposes to assume, as adaptationists generally do these days, that whatever fitness consists of, it is proportional to a creature's likelihood of reproducing."[16] Of course, this gives little by way of a definition; it is merely to regard it as the cause whose effect is greater reproductive success. This important deficiency in our understanding of natural selection will be examined further in the next chapter, but for now, it is sufficient to note that FP are aware of this deficiency yet do not examine it any further.

Another vital concept in natural selection is the notion of selection-for. Traits are said to be selected-for when ecological variables filter for traits with increased fitness. It is through this selection process that certain traits increase within a population while others are weeded out or diminished. FP add, "Notice that if you don't have a notion of 'a trait that's selected for' then (a fortiori) you don't have a notion of trait selection, so you can't state the fundamental Darwinian thesis: that creatures have the traits they do because those traits are selected-for their

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[14] Ibid, 3.

[15] Cf. Evan Thompson, "Picking Holes in the Concept of Natural Selection." *BioScience*, 64, no. 4 (April 2014): 355.

[16] FP, *What Darwin*, 233.

connection with fitness."[17] Consequently, like the concept of fitness, the concept of selection-for is vital to Darwinism, and it is upon this latter foundation that FP erect their critique.

Their work is divided into two halves.[18] The first, primarily written by Piattelli-Palmarini,[19] provides an array of empirical studies demonstrating that internal constraints are an often-overlooked cause of both phenotypic expression and evolution.[20] The sheer barrage of empirical studies provided by this section attempts to lessen (though not completely remove) the burden left for natural selection to perform. Seasoned biologist and critic of the book Jerry Coyne commented, "To the layman, this salvo of arcane terms is daunting, and even I, an evolutionary geneticist of forty years' standing, was taken aback."[21] I will give only a brief overview of some of these studies since, though they are not relevant to this chapter, many do become relevant to future chapters and will be revisited then.

Particularly noteworthy for FP has been the rise of evolutionary development (evo-devo). The discovery of highly conserved "master genes" that tightly control gene expression and organismal development demonstrates the rigidity of possible phenotypic options that natural selection has to work with. They write, "The old argument in evolutionary biology was about whether internal constraints are the exceptions or the rule; the present consensus is increasingly that they are the rule."[22] Additionally, recent studies have shown that mutations,

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[17] Ibid, 236.

[18] An earlier version of the argument appears in Jerry Fodor, "Why Pigs Don't Have Wings," *London Review of Books* 29, no. 20 (October 2007). https://www.lrb.co.uk/the-paper/v29/n20/jerry-fodor/why-pigs-don-t-have-wings.

[19] Suzan Mazur, "Jerry Fodor Held High Ground to Evolution's Militant Fundamentalist," *Huffpost*, Dec. 23, 2017. https://www.huffpost.com/entry/jerry-fodor-held-high-ground-to-evolutions-militant_b_5a3ec86ae4b0d86c803c722f#:~:text=Jerry%20Fodor%3A%20Evolution%20applies%20to,change%20in%20a%20heritable%20fashion.&text=Jerry%20Fodor%3A%20The%20Darwin%20story,or%20other%20god%20knows%20what.

[20] FP, *What Darwin*, 60, "The very complex interplay of all these factors, of internal constraints, internal selection and external selection, is arguably the very core of evolution which is a different and vastly more complex story than the one told by classical neo-Darwinism."

[21] Jerry A. Coyne, "The Improbability Pump," *The Nation*, April 22, 2010. https://www.thenation.com/article/archive/improbability-pump/.

[22] FP, *What Darwin*, 32.

while often regarded as purely random incidences with a fixed probability of arising, are, in fact, far more nonrandom than previously conceded. Particular sections of the genome are now labeled “hypermutable” or “hotspots” for mutations. Thus, mutation rates can range from the standard one chance in a million to nearly 20% between generations.[23]

The work of Andreas Wagner on robust traits provides another layer to their argument. Robustness denotes the persistence of a trait under perturbations and shifts. For instance, if certain mutational changes to the genotype do not affect the phenotypic expression of the gene, the trait is said to be robust. This imperviousness to change allows hidden genetic alterations to accumulate and later provide a resource for evolutionary creativity and adaptation.[24] Thus, robust genes provide another endogenous factor contributing to the origin of a creature’s phenotype. Additionally, FP cites laboratory-induced results that demonstrate the linkage of various traits, resulting in the conclusion that “natural selection cannot select isolated traits, but rather coordinated complexes of traits.”[25]

A final chapter is devoted to the role of structure and form in the evolution of phenotypes.[26] Natural selection, they argue, cannot be responsible for the recurring appearance of Fibonacci patterns within biological organisms. Hence, there must be some appeal to what they deem the “law of form”. A multitude of other examples, from optimal foraging strategies among bees to perfect wing strokes among flying creatures, go beyond the explanatory power of Darwinian evolution. They quote from scientists ranging from Stuart Kauffman, D’Arcy Thompson, Ilya Prigogine, Rene Thom, and C. H. Waddington in support of their position, concluding that if we seek to find an explanation via natural selection, “we will never have one.”[27]

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[23] Ibid, 32-3.
[24] Ibid, 42.
[25] Ibid, 50.
[26] Ibid, ch. 5.
[27] Ibid, 91.

The second section of the work shifts dramatically away from empirical evidence and toward what Fodor deems the selection-for problem. Indeed, its conclusion—that the theory of natural selection is demonstrably flawed—has drawn most of the ire from a sea of critics. Due to its complexity, the problem will be explained in various ways. In its simplest form, the argument posits that natural selection cannot distinguish between the causal roles of coextensive traits. As an example, the heart has two coextensive traits: circulating blood and making a "thump-thump" noise. As such, both traits will be perfectly correlated with reproductive success; wherever one trait succeeds, the other follows. Thus, there is an equal *selection of* both traits. However, only one of those traits is *selected for*. Only one of those features is the source of reproductive success, yet natural selection does not distinguish this in the selection process. Hence, it does not give an adequate explanation of selection-for.

A helpful example is drawn from the work of Richard Lewontin and Stephen Gould in their discussion of spandrels.[28] The two biologists note that certain biological features are not selected for their advantageous selective effects; rather, they freeride on the backs of other advantageous traits. The "thump-thump" noise, for instance, is a freeriding trait corresponding to the advantageous trait of blood circulation. Similarly, when architects design arches in churches, a triangular shape known as a spandrel appears where two arches meet. The arches serve a vital function in the construction of the chapel; the spandrels, meanwhile, appear merely as a byproduct of the arches. The same freeriding effect is true of many biological features, yet whereas one can know that the arches are the cause of the spandrels by appeal to the mind and intentions of the designer, the same cannot be said for biological traits. Architects select arches, and this is known through a counterfactual truth about the intentions of the architect; were architects able to create arches without spandrels, they may very well choose to do so.

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[28] Stephen Jay Gould and Richard Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme," *Proceedings of the Royal Society of London B* 205, no. 1161 (Sept. 1979): 581-98.

However, they would not design the church with spandrels and no arches. Hence, the arch explains the spandrel, yet whereas the truth of this counterfactual is solved by the intentions of the architect, what solves the analogous issue in biology? In the case of lifeforms, the naturalist cannot appeal to the intentions of some biological architect to distinguish counterfactual truths. All natural selection has to work with is the *actual* data rather than *counterfactual* truths, so one cannot appeal to counterfactuals to solve this dilemma. Thus, if natural selection is to be the causal mechanism of evolution, something else is needed to distinguish the intensional context of two or more coextensive traits.[29] This is, for FP, the selection-for problem.

One obvious rebuttal is that one trait is *directly* correlated with reproductive success while the other is not. In other words, one might say that the freeriding trait only persists in a population due to its connection to the selected-for trait. If one were to remove the selected-for trait, the freeriding trait would lose its connection to reproductive success. Taking the freeriding trait away, by contrast, would not result in the same effect. This, however, seems to only bolster FP's claim, for the rebuttal assumes that selection must be sensitive to this counterfactual. In reality, though, neither trait *is* removed. As they state, "Outcomes of merely counterfactual events cannot exert selection pressures: merely possible predators do not affect the evolution of a population."[30]

A comparable issue formed around the Skinnerian theory of operant conditioning, a theory largely abandoned after the 1950s. In fact, FP claim, "Skinner's account of learning and Darwin's account of evolution are identical in all but name."[31] Both theories involve the same

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[29] "Intensional" here should not be confused with intentionality. As FP, *What Darwin*, 236 explain, "A context is intensional if the substitution of coextensive terms is not truth-preserving in that context." An example would be that Lois Lane loves Superman but does not love Clark Kent. Extensionally, Clark Kent and Superman describe the same individual. Intensionally, however, the substitution of "Superman" with "Clark Kent" in the sentence, "Lois Lane loves Superman" would render it false.

[30] FP, *What Darwin*, 113.

[31] Ibid, xviii.

mechanisms, functions, and constraints.[32] Thus, the failure of one demonstrates the failure of the other. FP assert that both theories treat their subjects as “black boxes.” For Skinner, behavioral traits plus reinforcements at one period will result in a set of behavioral traits at a later period. Likewise, under Darwinism, phenotypic distribution plus ecological stressors at one period will result in a phenotypic distribution at a later period.

While the comparison to Skinner’s operant conditioning is apt, there are many who still fail to understand the nature of FP’s criticism. I will, therefore, attempt to clarify where one major misunderstanding occurs. As will be recalled, one view of natural selection has been labeled externalism and envisions it as a mechanism by which selective environments are the efficient cause of shifts in the gene frequencies within a population. The causal arrow moves in one direction: from environment to genes by way of individual organisms within the population. Organisms serve merely as vehicles for genes. If natural selection is conceived in this manner, then when organisms of a particular kind are “selected,” no one trait in particular is selected. The whole organism, with both its adaptations and spandrels, survives and reproduces; every trait is selected, spandrels included. As soon as one responds that this overlooks the causal contributions of certain traits that allowed some organisms to outcompete others, one has dropped the asymmetrical causation of externalism. One cannot appeal to the organisms as causes and still maintain externalism, for in doing so, one has flipped the causal arrow; organisms’ exercising their traits now serves as the cause of reproductive success rather than selective environments.

FP freely admit that if natural selection had a mind, it would solve this issue by providing the intentional content missing from the causal picture.[33] Natural selection, as an intentional external agent, could literally *select* between two coextensive traits. However, being

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[32] Ibid, 3.
[33] Ibid, 121.

committed physicalists, this possibility is not entertained, nor are any analogies in the form of "Mother Nature, the Blind Watchmaker, the Selfish Gene, or, for that matter, God."[34] The issue, they assert, stems from the fact that Darwinism was "built on analogy to a case of intelligent design, viz. the intelligent design of phenotypes by breeders."[35] In other words, FP maintain that Darwin's initial formulation relied upon an analogy between artificial and natural selection—an analogy that cannot hold due to the lack of mental causation within natural selection. Thus, if evolution is to have "an entirely *naturalistic* mechanism," it must achieve this without "*assuming that selection-for a trait is the effect of mental causes*."[36] The issue, however, is that it appears "only minds are sensitive to distinctions among counterfactuals."[37]

Thus, they conclude that the theory of natural selection fails as a causal account for biological evolution. As such, evolutionary theory must be reexamined in this new light in order to determine a possible solution. Otherwise, the evolutionary history of life will lack a unified theory to account for the variety of distinct phenotypes. Of course, this conclusion relies entirely upon whether FP have, in fact, accomplished the destruction of the theory of natural selection, and a host of incensed commentators have arisen to deny this conclusion.

3. The Response

As noted, the reaction to FP's work was nearly universally hostile. For many academics, it was "as if one of their previously esteemed colleagues had entered the senior common room naked,"[38] said one reviewer. Reviewers describe the authors and their work as "irrational,"

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[34] Ibid.

[35] Ibid, 237. The same, they argue, could be said for Gould and Lewontin's distinction of selection-for and spandrels.

[36] Ibid, 116. Emphasis in original.

[37] Ibid.

[38] Oliver Burkeman, "Why Everything You've Been Told about Evolution Is Wrong," *The Guardian*, Mar. 19, 2010. https://www.theguardian.com/science/2010/mar/19/evolution-darwin-natural-selection-genes-wrong.

"laughable," "dangerous,"[39] "sterile,"[40] "arrogant," "ignorant,"[41] and "irritating."[42] The emotionality displayed in these reviews often comes at the sake of objectivity. Richard Lewontin, perhaps the most distinguished reviewer, states, "When two accomplished intellectuals make the statement 'Darwin's theory of selection is *empty*,' they generate an anger that makes it almost impossible for biologists to give serious consideration to their argument."[43] FP themselves, in an added appendix to the work, state that the frequency in which reviewers "blatantly misread" their work initially disturbed them.[44]

Nevertheless, some sympathetic treatments of the work did appear. The aforementioned Richard Lewontin, while never fully agreeing with the authors, provided a nuanced and somewhat genial review.[45] Philosopher Evan Thompson, while ultimately critical of the conclusions, noted that the book "raise[s] important questions and merit[s] reading by anyone concerned with understanding our present scientific worldview and its possible limitations."[46] Thompson even declares himself "sympathetic" to efforts reconceptualizing natural selection in the face of mounting evidence in favor of other factors.[47] The most glowing review, however, appeared from philosopher Mary Midgley, who praised the "powerful little book" for its challenge to "the whole neo-Darwinist orthodoxy."[48] She continues that this "overdue and valuable onslaught on neo-Darwinist simplicities"[49] demonstrates that attempts to keep natural selection central while merely accommodating endogenous factors is comparable to the

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[39] Daniel Dennett, qtd. in ibid.

[40] Massimo Pigliucci, "A Misguided Attack on Evolution," *Nature* 464, no. 353-354 (2010): 354.

[41] Coyne, "The Improbability."

[42] Michael Ruse, "Origin of the Specious," *The Boston Globe*, Feb. 14, 2010. http://archive.boston.com/ae/books/articles/2010/02/14/new_critique_intends_to_rebut_darwins_ideas/?page=full.

[43] Lewontin, "Not so Natural."

[44] FP, *What Darwin*, 182.

[45] Lewontin "Not so Natural."

[46] Thompson, "Picking Holes," 355.

[47] Ibid, 356.

[48] Mary Midgley, Review of *What Darwin Got Wrong* by Jerry Fodor and Massimo Piattelli Palmarini, *The Guardian*, Feb. 5, 2010. https://www.theguardian.com/books/2010/feb/06/what-darwin-got-wrong.

[49] Ibid.

addition of epicycles to the Ptolemaic system. She is particularly praiseworthy of their discussion of the law of form and the work of Thompson, Waddington, and Prigogine, though she adds, "Though they don't actually mention Goethe, that reference still rightly picks up an important, genuinely scientific strand of investigation which was for some time oddly eclipsed by neo-Darwinist fascination with the drama of randomness and the illusory seductions of simplicity."[50] The value of this statement comes from the fact that Midgley, uniquely among FP's reviewers, has noted the overt similarities between the project of FP and that of Goethe and the minority scientific tradition that has followed him. It is, unfortunately, a fact that may have even been lost to FP.[51]

Beyond this, however, little appreciation was shown for the book.[52] Within the reviews, dozens of objections were raised concerning FP's logic, conclusions, or qualifications for making such claims. Despite this, it will be shown that every objection fails to land a deadly strike against FP's primary argument. In order to divide the arguments into a somewhat logical order, the first set of objections will be grouped as those founded on a crucial misunderstanding of FP's thesis. The second set will deal with more serious objections but ones that fail to ultimately undermine the case. The final series will deal with objections that do, in fact, force a nuancing or further interpretation of FP's premises but which do not ultimately undermine them.

3.1 Misunderstandings

A relatively easy response can be given to the review by famed philosopher and biologist Massimo Pigliucci. In it, he accuses the authors of "ignor[ing] the entire field of evolutionary

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[50] Ibid.

[51] Particularly noteworthy is Fodor's repeated assertion that adaptationism does not explain why certain features are *lacking*, such as wings on a pig. This is similar to the *Bauprincipien* which grounded animal forms for Goethe. Hence, as Goethe notes in one of his poems, "Wherefore our mother eternal e'en if she endeavoured to do so, / Could not in all her creation engender such forms as horned lions." Qtd. in D. R. Oldroyd, *Darwinian Impacts: An Introduction to the Darwinian Revolution* (Milton Keynes: Open University Press, 1980), 311.

[52] One final positive but nonacademic review was given by Mazur, "Jerry Fodor Held".

ecology, countless examples of convergent evolution of similar structures in different lineages that show the historical predictability of evolutionary processes."[53] However, FP did not deny that evolutionary theory does not have any sort of predictability. Rather, their claim is that natural selection is not the causal mechanism which accounts for it. Pigliucci's claim conflates natural selection with evolution itself and thus fails to understand the nature of FP's argument.

Another, more common mistake is that FP deny that scientists can *know* which of two coextensive traits is being selected-for. In other words, they render the argument as an epistemological one rather than a causal one. This confusion appears in some form in the reviews of Jerry Coyne,[54] Douglas Futuyma,[55] Robert Richards,[56] and Michael Ruse.[57] Coyne, for instance, interprets FP's claim that natural selection cannot distinguish counterfactuals as the assertion that, "We simply don't know which changes reflected natural selection."[58] Likewise, Futuyma and Ruse argue that scientific experiments that separate linked traits somehow act as a rebuttal to FP's claims.

FP, responding to this objection, have clarified that they never said that natural selection does not work "because it's so hard for us to understand how it works." Rather, their assertion is that explanations via natural selection are "based on correlations (between the presence of a trait and greater reproductive potential), not causes."[59] Stated differently, the theory proports to demonstrate the selection of certain traits through the correlation of their presence and a given set of ecological variables. What it cannot explain, however, is why only certain traits

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[53] Pigliucci, "A Misguided."

[54] Coyne, "The Improbability."

[55] Douglas J. Futuyma, "Two Critics Without a Clue," *Science* 328, no. 5979 (May 2010): 692-3.

[56] Robert J. Richards, "Darwin Tried and True," *American Scientist.* https://www.americanscientist.org/article/darwin-tried-and-true. It should be noted, however, that Richard's statements are rather unclear, and it is not certain whether he is correctly categorized in this instance. Other, more definitive arguments from his work will be discussed below.

[57] Ruse, "Origin of the Specious."

[58] Coyne's review is littered with misunderstandings of this sort. For instance, against Fodor's previous claims about a lack of flying pigs, Coyne, "Improbability Pump," responds, "Haven't [FP] heard of bats?" It is slightly peculiar that a biologist of forty years fails to recognize that bats are not, in fact, flying pigs.

[59] FP, *What Darwin*, 174.

are causally relevant to evolution since natural selection equally selects for both traits. Thus, the argument has nothing to do with scientists' ability to decouple linked traits. Indeed, the very fact that the decoupling of these traits establishes one, rather than the other, as causally relevant demonstrates that more than exogenous selecting factors *must* be at play.

A similar rebuttal can be given to a very similar objection. Samir Okasha,[60] Evan Thompson,[61] and Ned Block and Philip Kitcher[62] assert that FP defend the claim that there is, in fact, no distinction between "selection of" and "selection for". Block and Kitcher write, "They appear to be making the very ambitious claim that *whenever there are correlated traits* there is no fact of the matter about which of the traits causes any effect."[63] FP have declared this interpretation of their work "preposterous."[64] In fact, if one *could not* distinguish the causal powers of two correlated traits, FP's argument would be sufficiently dead. Natural selection "recognizes only exogenous variables as selectors, and the only (relevant) fact to which such variables are sensitive, according to [the theory], is the strength of the correlations between phenotypic changes and changes in fitness."[65] In other words, a creature's selective environment can only "recognize" and therefore "select" those traits that correlate with survival. Since there is, in fact, one trait that is the cause of this correlation, there must be some *additional factor* not recognized by natural selection.

3.2 Failed Rebuttals

Another common counterargument has been that between two coextensive traits, only one trait is the *cause* of increased reproductive success, and to say that something is "selected-for" is to

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[60] Samir Okasha, Review of *What Darwin Got Wrong*, *Times Literary Supplement*, March 26, 2010.

[61] Thompson, "Picking Holes," 356, "Sometimes, the authors seem to argue that there can be no real distinction between what is selected for and what is simply selected."

[62] Ned Block and Philip Kitcher, "Misunderstanding Darwin: Natural Selection's Secular Critics Get It Wrong," *Boston Review*, March 1, 2010. http://bostonreview.net/ned-block-philip-kitcher-misunderstanding-darwin-natural-selection.

[63] Ibid. Emphasis in original.

[64] FP, *What Darwin*, 181.

[65] Ibid, 182.

say nothing more than this. Elliott Sober,[66] Peter Godfrey-Smith,[67] Evan Thompson,[68] and Stevan Harnad[69] have all independently offered this rebuttal. For instance, Godfrey-Smith argues, "If there are correlated traits, where one of them is the causally effective one and the others just happen to be coupled with it, evolution could not 'care' less."[70] Similarly, Sober argues for a "definitional connection" between selection-for and a trait's causing reproductive success.[71] Immediately, one will notice a shift in the definition of natural selection initially offered by FP. Now, the cause of differential reproduction no longer primarily concerns exogenous ecological factors but rather the causal contributions of distinct, endogenous traits. In other words, this rebuttal abandons the externalist explanatory model of natural selection.

However, this distinct rendition escapes one problem only by introducing another, equally fatal one. If selection-for is *defined* as reproductive success, it cannot simultaneously *explain* reproductive success. As FP explain in their rebuttal, "The very heart of [the theory of natural selection] is the thesis that, in the paradigm cases, traits are selected-for *because* they are causes of fitness; that is, differences of their effects on fitness *explain* why some traits are selected-for and others aren't."[72] Yet to say that selection-for simply means the same thing as causing reproductive success would "reduce [the theory] to *a trait's being a cause of reproductive success explains its being a cause of reproductive success.*"[73]

FP elsewhere list an even greater problem with replies of this sort. Simply offering that one trait is the cause of reproductive success is not a theory; it is merely a statement that

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[66] Elliott Sober, "Natural Selection, Causality, and Laws: What Fodor and Piatelli-Palmarini Got Wrong," *Philosophy of Science* 77, no. 4 (Oct. 2010): 594-607.
[67] Peter Godfrey-Smith, "It Got Eaten," *London Review of Books* 32, no. 13 (8 July 2010). https://www.lrb.co.uk/the-paper/v32/n13/peter-godfrey-smith/it-got-eaten.
[68] Thompson, "Picking Holes," 357, "[Counterfactual statements about selection] can be underwritten by causal explanations that specify and describe the mechanisms by which traits (such as blood circulation) are produced."
[69] Stevan Harnad, "On Fodor on Darwin on Evolution," arXiv preprint arXiv:0904.1888 (2009). https://arxiv.org/pdf/0904.1888.pdf.
[70] Godfrey-Smith, "It Got Eaten."
[71] Sober, "Natural Selection," 603.
[72] FP, *What Darwin*, 180. Emphasis in original.
[73] Ibid, 179.

wherever reproductive success increases, there is a cause of this. This, they argue, is given by the principle of sufficient reason.[74] They write, "A theory of Fs is an account of what Fs have in common as such."[75] In other words, for a theory of selection to be a proper theory, it must designate what all selection events have in common. Merely demonstrating in one case why trait X succeeded is not sufficient. Fodor, in a lecture given on this topic, adds, "The fact that you can tell a story in one case is of no particular interest unless you can tell the same story in another case."[76] Otherwise, natural selection reduces from a theory to "a historical-geographical survey of how particular traits got fixed in particular phenotypes."[77] To give an analogy, there are no theories of biological extinction. Instead, there are simply distinct stories about the causes of each species' extinction. No one explanation is sufficient; thus, no one theory could ever suffice. Similarly, if traits that increase survival and reproductive success share no common property, one cannot form a theory of trait selection for the exact same reasons.[78] Thus, causalism, the first desideratum listed at this chapter's opening, must be abandoned if one adopts this approach.

The weight of this reply has been felt by FP's critics. Harnad, for instance, admits that the principle of natural selection is tautological "to a degree," but nevertheless regards this as unproblematic since this "(true) tautology[79] had never occurred to anyone before Darwin."[80] This statement, even if granted, does little to solve the issue.[81] It is perhaps for this reason that

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[74] Ibid, 187.

[75] Ibid, 186.

[76] *University of California Television (UCTV)*, "Debating Darwin: From the Darwin Wars," filmed September 15, 2011, video, 53:31. https://www.youtube.com/watch?v=bIYKCHPe5n8.

[77] Ibid.

[78] Another, more mundane example might be a theory concerning why individuals live in a certain city (say, Atlanta). If one aspired to give a theory for this phenomenon, one would need to find some common trait that persons living in the city shared that collectively explained their choice in geographic habitation. Otherwise, one is left with a long list of individual stories, and a series of disconnected stories is not a scientific theory.

[79] This is rather odd phrasing since tautologies are statements that are true by definition. Thus, to say that a tautology is true is itself a tautological statement.

[80] Harnad, "On Fodor."

[81] The statement should not, however, be granted since it is factually untrue. Even ignoring Alfred Russel Wallace as the co-discoverer of natural selection, Edward Blyth's usage of the concept (though not the term) as an explanation for the restoration of creaturely archetypes predates Darwin's by decades.

Harnad considers the principle of natural selection to be purely methodological—a position that will be examined below. Alex Rosenberg has also shown some sympathy for FP’s concerns. In his article reviewing the book, he writes, given the widely used propensity definition for fitness, “the [principle of natural selection] sails very close to the winds of analyticity.”[82]

One argument anticipated by FP is that there are laws about which traits are selected for in a given selective environment. FP contend that while such a proposition is not impossible, it is extremely unlikely. Laws aspire to generality, and the most general law one could give regarding these interactions would be the following form: assuming no interference, trait Z has an X probability of outcompeting trait Z* in ecological circumstance A. The context sensitivity of these relationships undermines the likelihood of discovering some general law governing their interaction. Not only are such laws unlikely to exist, FP offer other reasons for doubting their possibility. Traits are not adaptive on their own. For instance, the trait of being large is adaptive for certain creatures in some ecological contexts but not in others, yet a law of selection would require ignoring the other traits of any given creature. Traits, however, are not chosen in isolation; whole phenotypes are. Moreover, FP maintain, “Phenotypes aren't *bundles* of traits; they're more like *fusions* of traits.”[83] Isolating one trait from the creature is simply not how selection works.

Nevertheless, certain opponents of the book have disputed this claim. Elliott Sober has argued extensively for the reality of laws of selection, claiming they take on the nomenclature of “models” for the biologist.[84] Sober’s argument has three strands. First, Sober gives the analogy of gravitational laws. The actual gravitational force exerted on any given celestial body is determined by its context with respect to the multitude of other large object surrounding it.

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[82] Alexander Rosenberg, “How Jerry Fodor Slid down the Slippery Slope to Anti-Darwinism, and How We Can Avoid the Same Fate,” *European Journal for Philosophy of Science* 3, no. 1 (2013): 15. Thus, Rosenberg’s answer to FP targets another aspect of the theory which will be examined below.

[83] FP, *What Darwin*, 126.

[84] Futuyma, “Two Critics,” 693 has made a similar (though less robust) case.

These added factors, no matter how complex, do not negate the fact that the object's motions are determined by the laws of gravity. As such, just because a law is sensitive to its particular context does not undermine the fact that it is, in fact, a law. Secondly, Sober maintains FP have done little to show that such laws cannot exist. Finally, Sober states, "My view is that mathematical biology has such laws aplenty. Biologists usually do not call them 'laws.' Rather, they talk about 'models.'"[85] Sober selects a few prominent examples, including Fisher's principle of sex ratios and optimal foraging. These laws, he insists, support counterfactuals and thus fulfill the requirements set by FP.

In response to the first point, it must be observed that even many of Sober's allies concede natural selection admits no laws.[86] FP themselves have countered that the sheer complexity needed to ground such laws is "without precedent in the other sciences."[87] Since the success of each trait depends on its integration within the whole phenotype, the law would require placeholders in exactly the manner that the simple laws of gravity do not. As such, Sober provides a false analogy when comparing the supposed laws of selection to laws within physics. Concerning Sober's second argument, FP admit that while they have not conclusively proven that selection does not operate under laws, no purely empirical inquiry could ever demonstrate this conclusion. Empirical investigations, by their very nature, cannot rule out such hidden laws. Nevertheless, they provide two arguments.[88] Their first response is the aforementioned complexity of such laws. Second, they observe that no such laws seem to be forthcoming. Scientific advances within the field have failed to determine any such examples, yet if such laws are, in fact, operative, why are they not evident? While FP say little with respect to this point, it has a powerful implication. If natural selection is grounded upon unknown

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[85] Sober, "Natural Selection," 598.

[86] See, for instance, Harnad, "On Fodor," "The principle of natural selection is not meant to be a 'law,'" and Rosenberg, "On Fodor," 8, "In fact, there are no laws about the selection of any trait."

[87] FP, *What Darwin*, 184.

[88] Ibid, 183-4.

(unknowable?) laws of selection, then the actual explanations behind most evolutionary change have remained beyond science's reach for 150 years and will likely remain so for the foreseeable future. While Sober may be correct that this does not discount their reality, this does move the mechanisms of evolution beyond the realm of current scientific inquiry. Thus, the very causes of evolutionary change are rendered unscientific philosophical speculation—an epistemological ramification many will find unwelcoming.

Finally, FP deny Sober's claim that mathematical models substitute for biological laws. They write, "The most strenuous defenders of the modern synthesis state explicitly that, although causal inference is desirable, mathematically, all that is required is correlation."[89] As such, models provide a method for predicting the correlation of traits with a given ecological context, but the underlying causal mechanism is simply not provided. Rosenberg concurs on this point, stating, "These models are of course mathematical truths. They support no (synthetic, contingent, causal) counterfactuals. Like Euclid's axioms, they are approximated to greater or lesser extents in some domains and not to others."[90] In fact, there are many cases where these laws fail to apply to certain populations.[91] David Depew and Bruce Weber have made a similar point, noting that the probabilistic-statistical models that ground population genetics garner "considerable dispute" with regard to the actual causes of population dynamics.[92] They conclude, "Population thinking may be a good way to keep track of such changes as they spread or fail to spread, but it seems an empty gesture to say that anything causal happens at that level."[93] At best, then, these models provide predictable generalizations for the correlation of traits to a given selective environment, not a new law of nature.

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[89] Ibid, 188.

[90] Rosenberg, "How Jerry Fodor," 12.

[91] Ibid.

[92] David J. Depew and Bruce H. Weber, "The Fate of Darwinism: Evolution After the Modern Synthesis," *Biological Theory* 6 (2011): 99.

[93] Ibid, 98.

Sober, however, suggests one final rebuttal. He offers the analogy of a sieve that only allows for balls of a certain size (say, one inch in diameter) to pass through it.[94] One could suppose, also, that all the balls small enough to pass through are blue in color while all the larger balls are red. One would intuitively understand that the sieve selects for size rather than color even though there is a perfect correspondence between color and the ball's ability to pass through the sieve. Natural selection, he offers, operates in a similar manner, whereby the size corresponds with traits that increase reproductive success while the color relates to the spandrels.

FP object that the sieve analogy fails because "we know how it works."[95] By contrast, in adaptations, "we (typically) don't know what causal mechanism mediates the covariance." This is a rather odd objection by FP, for it seems to contradict their claim that the trait being selected-for *is* knowable and, in fact, forms the grounds for their objection. They offer another objection: how does one know which set of balls is being selected for? One could arbitrarily decide that the sieve sorts for the red balls at the top rather than the blue balls that pass through the device. Thus, they argue, the device still requires a mind to make this sort of discrimination. Sober, however, offers a rebuttal. He writes, "It does not matter which description you choose; the point is that there is selection for size, not for color."[96] This does, in fact, seem to be a satisfactory reply. If one supposes, for analogy's sake, that passing through the sieve represents survival, FP's objection disappears. The sieve does not, on this rendition of the analogy, need to make intensional distinctions regarding the attributes of the balls.

However, there seems to be other issues with Sober's sieve that have escaped FP's attention. First, Sober's sieve would exemplify selection as a *law*. No ball of a given diameter

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[94] Sober, "Natural Selection," 603-4.

[95] FP, *What Darwin*, 128.

[96] Sober, "Natural Selection," 604.

is physically able to pass through the sieve; thus, Sober's sieve is an analogy only under the hypothesis that there are laws of selection—a view FP have already dismissed. Second, on this analogy, a single attribute—namely, size—explains the distinction between why only certain balls pass through the sieve. As previously mentioned, there is no common trait that explains why certain features are preserved in populations. Thus, even granting the adequacy of Sober's analogy for *individual* traits, it fails to supply an adequate analogy for the *theory* of natural selection—namely, the common attribute of traits that increases reproductive success.

Another, more recent critique has been penned by the philosopher Alex Rosenberg. In his otherwise critical review, Rosenberg defends FP against many of the claims of prior critics. Perhaps sensing a failure in the rebuttals, Rosenberg crafted his own response three years after the publication of the work. Rosenberg freely recognizes the troubling nature of FP's argument, confessing that, "There was of course no more serious challenge facing naturalism than the problem of intentionality."[97] The stakes, then, were very high, adding, "if there are any truths that are intensional in their semantics, then as we already know too well, no physical theory can accommodate them."[98] Nevertheless, the failure in FP's argument, he claims, was supposing Darwinism required a notion of selection-for. Instead, Rosenberg contends there is only selection-against. Thus, he concludes, "Darwin doesn't have to tell the difference between [coextensive traits] if one is an adaptation and the other is neutral. It's only selecting-against."[99] One apparent objection might be to assert that selection-against entails selection-for; whatever trait is not being selected against is selected for. In response, Rosenberg notes that this objection ignores the reality of neutral traits; thus, simply because something is not selected against does not entail it is selected for.

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[97] Rosenberg, "How Jerry Fodor," 3.

[98] Ibid, 5.

[99] Ibid, 7.

Rosenberg's claims are rather unusual and do not seem to avoid the problem of selection-for.[100] In an interview recorded late in his life, Fodor responded to Rosenberg's claims, stating, "Since it is tautological that there can't be selection for or against a neutral trait, it follows that, if there is selection at all, then it is selection for a trait iff it isn't selection against it."[101] Consequently, Rosenberg's objection has not done away with selection-for. Moreover, an identical challenge can be offered for the concept of selection-against. FP could merely reverse the argument, asking how natural selection can distinguish between traits selected-against and traits that freeride and are coextensive with these maladaptive traits. As such, Rosenberg's criticism collapses under even the simplest analysis.[102]

The final objection to be analyzed in this section is, perhaps, the most conciliatory. It is the claim that the principle of natural selection does not aspire to be a theory, at all, but only an explanatory schema or methodology.[103] In other words, for any given evolutionary scenario, one approaches it under the assumption that adaptations explain the shifts in phenotypic/genotypic frequency by providing a response to an ecological problem.[104] Thus, there is nothing that all cases of natural selection have in common. The issue, however, with this reformulation of natural selection is that it reduces itself to a tautological truth. An adaptation, under this schema, merely denotes a trait that solves an ecological problem, while an ecological problem is defined as the challenge to which an adaptation provides a solution.

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[100] In FP, *What Darwin*, 244, the duo anticipates this objection, calling it the "occasional last refuge of neo-Darwinians."

[101] Jerry Fodor, in Richard Marshall, "Jerry Fodor: Meaningful Words Without Sense, and Other Revolutions," in *Philosophy at 3:AM: Questions and Answers with 25 Top Philosophers* (Oxford: Oxford University Press, 2014), 253.

[102] It must also be noted that Rosenberg's article is riddled with contradictions and errors. For instance, in Rosenberg, "How Jerry Fodor," 3, he claims natural selection "builds and operates purposive systems in nature," yet two sentences later, he states, "There really aren't any purposes in nature and no purposive processes ether [*sic*]."

[103] Harnad, "On Fodor," "Darwin's [principle of natural selection] 'merely' provides a methodology for investigating what happened in particular cases (particular traits, particular creatures, particular environments)."

[104] Thompson, "Picking Holes," 357 provides a similar (though slightly distinct) version of this argument, claiming that natural selection is not a *cause* but merely the statistical trend of many distinct causes. This statistical interpretation will be examined in the next chapter.

Hence, because the terms are interdefined, the claim that adaptations solve ecological problems becomes a tautological truth rather than a genuine empirical claim.[105] Moreover, this position would essentially reduce Darwinism from a theory to a series of historical narratives. To say that certain traits will cause differential reproduction is certainly true, but without some common explanation for why this occurs in each individual case, biological evolution will lack a unifying theory.

Thus, after examining this extensive (though by no means exhaustive) list of failed objections to FP's work, one final list of objections can be analyzed. In a few, rare instances, critics of the work have noticed legitimate errors or ambiguities within FP's thought. However, these more fruitful efforts, while initially intriguing, will similarly fail to topple the central claims of *What Darwin Got Wrong.*

3.3 Refining Rebuttals

One of the more noteworthy and forceful objections has been that the two sections of FP's work seem to contradict each other. In the first section, FP state, "We think of natural selection as tuning the piano, not as composing the melodies."[106] However, the second section of the work attempts to portray natural selection as causally effete. As Robert Richards notes, "Natural selection, then, seems to be real precisely in the sense that it is not."[107] Evan Thompson concurs, asking, "If the theory of natural selection cannot possibly be true for conceptual or logical reasons, why go to the trouble to argue that other causal factors are more important than selection in evolution?"[108]

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[105] FP, *What Darwin*, 131.
[106] Ibid, 21
[107] Richards, "Darwin Tried."
[108] Thompson, "Picking Holes," 356.

This objection carries force for the simple reason that no direct answer is given by FP regarding this apparent conundrum. However, a careful reading of the work might reveal a possible reconciliation. FP appear to draw a sharp distinction between natural selection and the *theory* of natural selection. This is evidenced by the fact that the second section has multiple, brief comments affirming their belief in adaptationism. For instance, FP write, “Surely, some sorts of interactions between organisms and their environments are causally implicated in the evolutionary fixation of some phenotypic traits; if that weren't so, it really would be miraculous that there are reliable correspondences between the two.”[109] If this is the case, what place is there for their objection? They continue, “What is denied, however, is that there is a unitary theory (e.g., a unitary theory of organism-environment interactions) in terms of which most or all such phenomena are explained.”[110] Thus, it appears the reader is meant to draw a distinction between natural selection and the theory that accompanies it—a distinction very rarely made either by them or by their reviewers. This reading has been all but confirmed in a later appendix added to the book. In it, they write, “So the book proposes a dilemma: either there is no such thing as natural selection, or, if there is, the Theory of Natural Selection misdescribes it.”[111] This clearly demonstrates the distinction they make between the theory and the fact of natural selection. Thus, while this objection demonstrates a weakness in FP’s presentation of their argument (and likely the cause of many misreadings), it does not undermine any of the central argument’s premises.[112]

Another helpful response has been given by Block and Kitcher. They note correlated traits can be multiplied *ad infinitum*. They give the example of two universally correlated

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[109] FP, *What Darwin*, 163; cf. 132, 150.

[110] Ibid, 163.

[111] Ibid, 180.

[112] A similar objection found in Futuyma, Godfrey-Smith, Thompson, and Richards argues that endogenous factors have always been part of evolutionary explanations, and recent advances in the extended evolutionary synthesis decrease the role of natural selection. However, as long as the theory of natural selection gives *some* explanation for evolutionary history, FP’s critique (as well as the conclusions of this thesis) remains valid.

traits—being-a-melanic-moth and being-a-melanic-moth-and-smaller-than-Manhattan.[113] If biologists were asked to recognize the causal distinctions between these two properties, they would likely find this impossible. How, then, is natural selection expected to perform the same operation? At first, it seems as though this objection could easily be answered in a similar manner to previous ones—namely, that Block and Kitcher fail to recognize that FP do, in fact, believe in the distinction between selection-for and selection-of. Moreover, because natural selection is ignorant of these intensional distinctions, it is unable to fully explain biological evolution.

However, Block and Kitcher's point deserves special attention since it treats an issue left slightly ambiguous by *What Darwin Got Wrong*. Specifically, the book fails to clarify which sort of traits need to be distinguished if a theory of natural selection is to be successful. Block and Kitcher are correct, of course, that correlated traits can be multiplied *ad infinitum*. Simultaneously, it is obvious that a theory of natural selection need not distinguish between the properties of being-a-melanic-moth and being-a-melanic-moth-and-smaller-than-Manhattan, but why is this? The answer, it seems, lies in the fact that in the latter example, the causal powers of both traits are identical. Attempting to decorrelate the causal powers of these two latter traits is an impossible task. Where one is the cause, the other is simultaneously a cause. In the cases that FP isolate, the causal powers of coextensive traits are unique. For instance, one can easily isolate the effects of a heart's circulation of blood from its making a "thump thump" sound. Thus, while Block and Kitcher's argument is ineffective, it evokes a helpful distinction left untouched by FP.

The final and most crucial rebuttal leveled against FP's work concerns the explanatory vacuum left in the wake of their objections. If FP are correct about the theory of natural

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[113] Block and Kitcher, "Misunderstanding Darwin."

selection, how is one to explain the fit that often appears between organisms and their environments? While one might assume FP leave some room for adaptationism in their explanation of this apparent phenomenon (having already granted "some sorts of interactions between organisms and their environments"),[114] this assumption will prove inaccurate. In fact, FP deny that such phenomena need any explanation, at all. They write, "It is just a tautology that (if it isn't dead) a creature's phenotype is appropriate for its survival in the ecology that it inhabits."[115] Why is this? They note that in biology, an ecology is defined as "whatever-it-is-about-the-world that makes its phenotype viable."[116] Thus, by definition, a creature's phenotype fits its given ecology. They conclude, "What, then, is the interesting truth about the fitness of phenotypes that we require adaptationism in order to explain? We've tried and tried, but we haven't been able to think of one."[117] As such, the "Platonic" conception of ecological niches that creatures simply move into must be dispensed.[118] Niches, they assert, are described post hoc by how a phenotype relates to its environment. They do not preexist in any sense. Simultaneously, the "exquisite fit"[119] of creatures to their ecology needs no explanation beyond the fact that such creatures would go extinct if this were not the case.

FP's critics were unconvinced by these claims. Futuyma, for instance, argues that the complexity of organs developed by creatures for the sake of exploiting their ecological niche requires some further explanation.[120] Likewise, in his otherwise positive review, Lewontin declares that filling niches is "half the story."[121] The other half, he argues, is given by niche construction and how organisms actively shape their ecology to fit their needs. These reviews are certainly correct. While FP rightly note that it should not surprise the biologist that creatures

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[114] FP, *What Darwin*, 163.
[115] Ibid, 142.
[116] Ibid, 143.
[117] Ibid, 144-5.
[118] Ibid, 144 cite Ernst Mayr as guilty of this conception.
[119] Ibid, 147.
[120] Futuyma, "Two Critics," 692-3.
[121] Lewontin, "Not so Natural."

fit their ecology, it should surprise them when they *optimally* fit it. Nonoptimal traits could easily survive in a given ecology; however, optimality modelling has proven a fruitful enterprise for biologists. FP leave the successes of these experiments inexplicable. Creatures evolve in a way to maximize the functions of their various adaptations. Likewise, the niches certain creatures occupy require highly specialized traits. For instance, the woodpecker's beak and ability to sustain high impact collisions allows it to access insects otherwise unreachable. Is the explanation for these traits nothing more than that the woodpecker would have died out had it not had such features? This is obviously not the case, for certainly the answer lies in the fact that woodpeckers evolved in order to take advantage of untapped resources lying behind the tree's bark. Thus, FP's treatment leaves two features of biology wholly unexplained—namely, the *optimal* fit between phenotypes and ecologies and the evolution of highly specialized traits.

4. Conclusions and Next Steps

What, then, is the result of this analysis? For FP, the conclusion must be that evolutionary history is just that—a history. There is no "unitary theory of organism-environment interactions"[122] but merely a long list of distinct ways certain phenotypic traits managed to succeed and spread. Evolutionary history, much like human history, admits of neither laws nor fundamental theories. This conclusion, however, leaves unsolved the baffling proficiency of biological organisms in discovering and proceeding toward optimal fitness. Indeed, the as-yet undefined term "fitness" might provide the key to answering FP's argument and rescuing Darwinism's place within biological evolution. As previously noted, the term carries much of the causal weight in the theory. Creatures within a population are said to have a higher likelihood of reproductive success if their traits give them increased fitness.

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[122] FP, *What Darwin*, 163.

Could increased fitness provide the unifying property missing from the account thus far? This depends entirely on how fitness is defined. As the next chapter will illustrate, if a resolution is to be found for FP's argument against natural selection, it must lie in the discovery of a proper definition of biological fitness. FP consider one possibility offered in a brief comment by Richard Dawkins—namely, that traits are selected for "being good at something."[123] In other words, Dawkins gestures towards a conceptual dependence of fitness differences on the concept of goodness. Unconvinced, FP respond that an adaptation and being-good-at-something are interdefined: "Each is explicated by reference to the other, so neither is able to stand alone."[124] They conclude, "There is no notion of a trait 'being good for something' that doesn't presuppose the notion of an adaptation."[125]

But is this necessarily the case? They give no argument to support their claim. As such, the next chapter will seek to define fitness in a manner that brings conceptual clarity to the notion of an organismal good. If successful, two coextensive traits could then be differentiated via a causal distinction (though one of *final* causation rather than *efficient*); it is the goods provided by one trait that explain its selection. Moreover, this perspective could provide the common property needed to unite natural selection into one, coherent theory. All instances of natural selection are explained via fitness differentials; thus, a definition of fitness would give the causal unity FP believe is missing from the theory of natural selection. It should be noted, as well, that this view would be closer to the model of explanatory reciprocalism described at the chapter's start. This model of selection reintroduces the active role of the organism, for individual fitness only arises as the organism expresses its traits within its environmental context. It would also require replacing a mechanistic view of causation with one closer to the view outlined in chapter 1. This is a promising avenue of exploration, but it rests firmly on

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[123] Ibid, 145-6.
[124] Ibid, 146.
[125] Ibid.

whether a proper understanding of this term and the role it plays in natural selection is sufficient to carry the full weight of Darwinism on its back.

CHAPTER THREE: RECIPROCALISM – THE NATURE OF BIOLOGICAL FITNESS

Fitness: Something everyone understands but no one can define precisely.[1]

-Stephen Stearns-

1. Introduction

In this chapter, I examine how an analysis of the concept of fitness might provide the path forward in understanding the explanatory nature of natural selection. I have adopted two desiderata for such an account: that natural selection is a single, unified cause of differential reproduction (i.e., the principle of causalism) and that it is distinguishable from other evolutionary causes, such as drift (i.e., the principle of individuation).[2] I have also distinguished between an externalist and reciprocalist model of natural selection. I concluded in the last chapter that FP's critiques of the externalist model survived most criticisms. However, FP's alternative suggestion fails to account for the optimality and specialization so prevalent within lifeforms. In fact, natural selection was originally proposed not merely as a mechanism for evolution (plenty of those were on offer in Darwin's day) but as an explanation for the "perfection of structure and coadaptation" within living organisms.[3]

Thus, FP's suggested alternative leaves large swaths of biological features inexplicable. We can, therefore, add a third desideratum to a successful account of natural selection: the capacity to explain specialized and optimized traits. Despite this failure, FP's critique does problematize the view that natural selection can be regarded as an exogenous causal mechanism (unless, of course, one is willing to adopt the teleological conclusions FP ardently sought to avoid). As such, the last remaining alternative for the naturalist would be to opt for some form of explanatory reciprocalism. In the last chapter, Godfrey-Smith, Sober, and Harnad all alluded

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[1] Stephen C. Stearns, "Life-History Tactics: A Review of the Ideas," *The Quarterly Review of Biology* 51, no. 1 (Mar. 1976): 4.

[2] "Cause" in this sense normally denotes efficient causes, though this chapter will challenge this narrow view of causation. Therefore, causation in the chapter, unless otherwise stated, refers to efficient causation.

[3] Charles Darwin, *On the Origin of Species by Means of Natural Selection* (New York: P. F. Collier & Son, 1909), 20.

to this possibility, claiming that certain traits acted as the cause of differential reproduction. In other words, the asymmetrical model of externalism fails to account for the causal contributions of individual organisms and their traits. However, as was shown, this suggestion, on its own, reduced to a tautology—namely, that a trait's being the cause of reproductive success explains its being the cause of reproductive success. In other words, a suitable account of natural selection includes a fourth desideratum: having some degree of explanatory content. To summarize, then, a successful model of natural selection will adhere to explanatory reciprocalism and satisfy the principles of causalism, individuation, optimization, and explanatory content.

How might an analysis of biological fitness help satisfy these conditions? The concept of fitness has been an aspect of Darwinian terminology since Herbert Spencer's famed aphorism "survival of the fittest". Intuitively, the concept seems straightforward and naturally harmonious with a reciprocalist model of selection. There must exist a certain "fit" between organisms and their environment, and those organisms best "fitted" for a given environment outcompete other organisms. While seemingly simple, the concept's definition has become a heated topic within the philosophy of science. One issue seems to be the lack of any univocal meaning within scientific writings since the term is often employed idiosyncratically by different scientists.[4] Because of this, much of the philosophical reflection on the term begins by delineating the various possible usages. For this chapter, however, I will avoid becoming entangled in a descriptive taxonomy of the various employments of the term "fitness" and focus exclusively upon the normative question of how the term ought to be employed if it is to satisfy the four desiderata and provide some conceptual clarity on the nature of selection. Indeed, assuming the success of FP's critique of externalism, I will focus on the type of fitness most

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[4] Denis M. Walsh, André Ariew, and Mohan Matthen, "Four Pillars of Statisticalism," *Philosophy and Theory in Biology* 9, no. 1 (2017): 4.

likely to satisfy the above conditions: individual fitness (i.e., vernacular/ecological fitness). This fitness type, defined as the "fit" between organism and ecosystem, is the one most closely focused on the reciprocal causal interactions between organisms and their environments. The chapter begins by detailing the importance of fitness for biological research and the difficulties that have arisen in identifying its proper referent. From there, I will sketch the two most prominent positions and their critiques. I will conclude by proposing my own solution to the question that avoids the problems latent in other interpretations of fitness and satisfies the desiderata for a theory of natural selection.

2. Fitness: Its Role and its Problems

Since most biologists are committed to the principles of causalism and individuation, much of the literature on natural selection views it as analogous to a Newtonian "force" in competition with other causal forces, such as genetic drift.[5] Accordingly, Lewontin's influential schema of the conditions for natural selection—namely, trait variation, heritability, and fitness differentiation—has formed the backbone for discussions of how natural selection causes evolutionary change.[6] It is generally agreed that without these three cogs, the engine of natural selection fails to run.

According to Ramsey and Pence, evolutionary biologists primarily focus on "fitness differences and their consequences" rather than on the other two aspects of selection.[7] The emphasis upon fitness is not accidental, for, as Ginnobili warns, without fitness, "Explanations would become incomplete: the possession of a trait and reproductive success would cease to be related 'causally' and explanations would no longer rise above the status of mere statistical

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[5] Christopher Stephens, "Selection Drift, and the 'Forces' of Evolution," *Philosophy of Science* 71 (Oct 2004): 550-70; Elliott Sober, *The Nature of Selection* (Cambridge, MA: MIT Press, 1984). Drift is defined as a shift in genotypic frequency due to chance events rather than selection. An example might be a chance avalanche annihilating a subpopulation with higher fitness while leaving the lesser fit subpopulation unscathed.

[6] Richard Lewontin, "The Units of Selection," *Annual Review of Ecology and Systematics* 1 (Nov. 1970): 1-18.

[7] Grant Ramsey and Charles H. Pence, "Fitness: Philosophical Problems," *eLS* (June 2013): 1.

correlations between the possession of the trait and reproductive success."[8] In other words, a recognition of fitness differences prevents natural selection from reducing to a stochastic process with no intelligible patterns since it explains how adaptations become fixed within a population. Thus, any population that varies in fitness is deemed to be undergoing selection. As such, the variable of fitness is essential to the mathematics of population genetics.[9]

Yet while population geneticists freely help themselves to both modelling and measuring fitness, the practice begs a further question: what precisely is being measured? What exactly *is* this property? Moreover, which biological entity ought we regard as the possessor of this property? Genes, individual organisms, populations, and even whole species might be argued to be the fundamental bearers of fitness.[10] Unfortunately, philosophers have reached no consensus on these issues.[11] To again cite Ramsey and Pence, "Few concepts have elicited such a long and heated debate in the philosophy of biology as that of fitness."[12] While the issues are numerous, I will focus on two relevant to the question of fitness's causal status with respect to the four desiderata (namely, the first and fourth): nominalism, and tautology.

I label the first issue the problem of nominalism, and it denotes a failure of any concept of fitness in meeting the principle of causalism.[13] The sheer quantity of different features that confer fitness makes any attempt at discovering some unifying property an impossible task. What physical similarities are shared between the white fur of a polar bear and the sharp teeth of a shark so that both might be considered bearers of increased fitness? While both might produce the same *effect* (i.e., survival and increased reproduction), it is difficult to see how they

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[8] Santiago Ginnobili, "Missing Concepts in Natural Selection Theory Reconstructions," *History and Philosophy of the Life Sciences* 38, no. 3 (2016): 19.

[9] The variable of fitness within these equations is W.

[10] Ramsey and Pence, "Fitness," 1.

[11] Henry C. Byerly and Richard E. Michod, "Fitness and Evolutionary Explanation," *Biology and Philosophy* 6 (1991): 1, "Discussions of fitness in the recent philosophical literature have, however, failed to clarify the concept of fitness."

[12] Ramsey and Pence, "Fitness," 1.

[13] The terminology derives from Michael Hanby, *No God, No Science?: Theology, Cosmology, Biology* (Oxford: Wiley-Blackwell, 2013).

can be treated as a unified *cause*. As such, fitness appears to be a mere name we have given to any property that results in a creature's enhanced survival and/or reproduction.[14] If this is the case, natural selection cannot satisfy the desideratum of causalism.

Philosophers are not unaware of this difficulty. For instance, Byerly and Michod have observed, "There is no overall fitness disposition of organisms which plays the same role which mass does as a property of physical bodies."[15] Ginnobili writes similarly, declaring, "The problem is that there is no specific 'physical' property that is uniquely relevant to the determination of ecological fitness and hence could provide a basis for unification."[16] To overcome this, many philosophers define fitness as a nonphysical, supervenient property. For instance, Alex Rosenberg notes that two physically dissimilar creatures inhabiting the same environment can have the same fitness, entailing that levels of fitness cannot be thought of as a physical trait.[17] This, he argues, makes natural selection "methodologically suspect" since "its key term cannot… be 'cashed in.'"[18] He continues, "Only on the assumption of supervenience can different combinations of manifest and ecologically relative properties constitute the very same level of fitness."[19] Yet even if supervenience is correct, it fails to account for what fitness *is*. What is it that is supervening? Rosenberg offers no answers in this article. Thus, the addition of supervenience does little to solve the issue of nominalism; fitness appears to be only an empty term used to group disparate physical traits based upon their shared outcome and thus fails to resolve the need for a unified causal explanation.

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[14] The only other option would be an enormous disjunctive property (either *X* or *Y* or *Z*, etc.). Few philosophers would likely be satisfied with this solution.

[15] Byerly and Michod, "Fitness and Evolutionary Explanation," 14.

[16] Ginnobili, "Missing Concepts," 2.

[17] Alexander Rosenberg, "The Supervenience of Biological Concepts," *Philosophy of Science* 45, no. 3 (Sept. 1978): 370-1.

[18] Ibid, 371.

[19] Ibid, 376.

This difficulty is often masked because the practicing geneticist treats fitness as a purely quantitative property, yet as Abrams writes, "Purely mathematical fitness concepts as such are not causal, because mathematical terms without an interpretation or application are, of course, merely mathematical."[20] Lewontin has noted this issue, as well: "A population geneticist will say that one genotype has a fitness of 0.78 compared with a fitness of 1.0 of another genotype, although an explanation is rarely offered about the way in which the superior genotype actually 'fits' into some environment. As the terms are actually used there may not even be any implication that such a story could be uncovered."[21] Nevertheless, the term "fitness" is often tasked with denoting both a trait's quantifiable *effect* on reproductive success *and* the property of the trait that *causes* such contributions. In other words, the term could apply to the actual product of natural selection (e.g., an increased frequency of a certain genotype) or to the underlying cause that explains that effect (e.g., the organismal traits producing a selective advantage). The subtle shift between these meanings has often masked the problem of nominalism. Yet the issue remains that while fitness as an effect has a single referent, fitness as a cause refers to nothing in particular *except* to any cause that leads to this particular effect.

Thus, by treating fitness as a purely mathematical term, much of the relevant literature gives the illusion of some fundamental unity denoted by the concept. The issues raised here overlap with the problem of coextensive traits, for a selectively neutral spandrel will have the same mathematical relationship as the advantageous trait to which it is attached. Both traits rise and fall together in the population, and fitness understood purely quantitatively cannot distinguish which trait is the cause of selection. Thus, fitness, measured as the correlation of a trait's presence to reproductive success, would map equally to both traits even though only one

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[20] Marshall Abrams, "Measured, Modeled, and Causal Conceptions of Fitness," *Frontiers in Genetics* 3, no. 196 (Oct. 2012): 6.

[21] Richard Lewontin, *The Triple Helix: Gene, Organism, and Environment* (Cambridge, MA: Harvard University Press, 2000), 43.

is the cause of the selective advantage/disadvantage. As such, while treating fitness in a purely quantitative fashion might be effective for population genetics, it risks hiding the deep metaphysical issue raised by the problem of nominalism.

The second problem relates to whether treatments of fitness avoid the issues of tautology that motivated the introduction of the principle of explanatory content. One of the oldest accusations against natural selection is that it reduces to a pure tautology, and it is an issue that has dogged the theory ever since.[22] In fact, Rosenberg admits that natural selection is "often mistaken even by biologists for an empirically empty theory unconnected to other theories in natural science."[23] The issue arises from the fact that fitness is invoked to *explain* differential reproduction, yet it is often treated as *identical to* differential reproduction. As Hanby succinctly asserts, "Survival explains fitness and fitness explains survival."[24] The fit are simultaneously both the cause and the effect of differential reproduction. Attempts to avoid this problem have been described as "tortuous."[25] As a summary, the closer one identifies fitness differentials with the *cause* of selection, the more one runs into the problem of nominalism, yet the more one aligns fitness with the *effects* of selection, the more the issue of tautology emerges.

3. Fitness: Competing Interpretations

If any concept of fitness is to prove adequate, it must avoid the twin problems of tautology and nominalism. Innumerable attempts have been made to solve these issues, yet for simplicity, I

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[22] See, for example, J. J. C. Smart, *Philosophy and Scientific Realism* (London: Routledge, 1963), 59; C. H. Waddington, *Towards a Theoretical Biology* (Edinburgh: Edinburgh University Press, 1968), 19.

[23] Rosenberg, "Supervenience of Biological," 368.

[24] Hanby, *No God*, 226.

[25] Henry C. Byerly and Richard E. Michod, "Fitness and Evolutionary Explanation: A Response," *Biology and Philosophy* 6 (1991), 45.

will restrict myself to the two most prominent contemporary positions.[26] These are known as the propensity interpretation and the statistical interpretation.[27]

3.1 Propensity Interpretation

One solution that has historically commanded much attention has been the propensity interpretation of fitness (henceforth, PIF). As the 1970s drew to a close, two different papers emerged that proposed a nearly identical solution—namely, that fitness ought to be conceived as a propensity.[28] The authors attempted to circumvent the aforementioned problems by suggesting that fitness ought to be defined not as survival and reproduction but as the properties that are disposed towards them as effects. In other words, the probabilities assigned to the expectation of a certain outcome (i.e., a certain number of offspring) are grounded on a set of physical facts (i.e., propensities) that ought to be treated as causal in nature. As Elliott Sober writes, "Propensities are causal powers."[29] Mills and Beatty give the analogy of water-solubility; an object is deemed water soluble if it has the propensity to dissolve when submerged in water.[30] However, unlike water solubility, fitness is a stochastic disposition, leading to its merely probabilistic values. Nevertheless, such dispositions are sufficient for explaining their effects. By treating fitness as a propensity, the PIF appears to offer an (efficient) causal interpretation of fitness. Additionally, since the propensity is common to all

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[26] For fourfold divisions, see Abrams, "Measured, Modeled," 2, who divides between statistical, parametric, tendential, and measurable fitness; Byerly and Michod, "Fitness and Evolutionary Explanation," by contrast, divide between r-, f-, a-, and p-fitness.

[27] Fitness defined as the actual reproductive output (i.e., realized fitness) will not be considered here since it is merely the measured effect of fitness differentials. Thus, realized fitness falls prey to the problem of tautology if considered to be the cause of differential reproduction. For its origins, see R. A. Fisher, *The Genetical Theory of Natural Selection* (Oxford: Clarendon Press, 1930).

[28] Robert Brandon, "Adaptation and Evolutionary Theory," *Studies in History and Philosophy of Science* 9, no. 3 (Sept. 1978): 181-206; Susan K. Mills and John H. Beatty, "The Propensity Interpretation of Fitness," *Philosophy of Science* 46, no. 2 (June 1979): 263-286. The interpretation relies on the propensity interpretation of probability. See Karl Popper, "The Propensity Interpretation of Probability," *The British Journal for the Philosophy of Science* 10, no. 37 (1959): 25-42.

[29] Elliott Sober, "Trait Fitness Is not a Propensity, but Fitness Variation Is," *Studies in History and Philosophy of Biological and Biomedical Sciences* 44, no. 3 (2013), 338.

[30] Mills and Beatty, "Propensity Interpretation," 270-2; cf. Sober, "Trait Fitness," 338.

cases of selection, it alleviates the problem of nominalism, and because a propensity toward some effect is not identical with that effect, one seems to avoid the issue of tautology.

While this interpretation quickly rose to prominence and still retains a loyal following, major deficiencies soon began to emerge. Ramsey and Pence diagnose the current state of the interpretation, asserting that this version of the PIF "now certainly shows its age, and has accumulated several counterexamples that are quite probably fatal."[31] The list of issues is extensive. Thus, for simplicity, I will list only a select set of these objections.

First, while the PIF might initially promise to alleviate fears of nominalism, this hope may be misplaced. To explain why a substance (say, sugar) dissolves in water by appealing to its property of (or propensity for) water-solubility adds little explanatory value without some further comment concerning the nature of the substance. What is it about the nature of sugar that grants it the property of water-solubility? Likewise, to explain a creature's survival and reproductive success by appealing to a propensity for this effect says little about what the actual efficient causes are, which will, indeed, be unique to each organism and the traits it possesses.[32] To put it differently, the properties that give rise to water-solubility in sugar (temperature, polarity, pressure, and molecular size) are the same for all substances. Hence, one can form a general theory of water-solubility. No such analogy is possible in the case of selection, where the underlying causes of fitness differences will be unique in each case. Thus, the problem of nominalism has not been solved. Rosenberg, observing these difficulties, has thus concluded

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[31] Ramsey and Pence, "Fitness," 1.

[32] Alex Rosenberg, *The Structure of Biological Science* (Cambridge: Cambridge University Press, 1985), 160 has argued similarly, though he compares it to Molière's *Le Malade imaginaire* in which a learned doctor questions why opium causes sleep and is answered with the assertion that the substance has a dormitive virtue. This incident has often been used to argue against Aristotelian powers as explanations, though I will argue below that an appeal to the nature of a substance and its intrinsic powers overcomes the problem of nominalism. Thus, Aristotelian natures actually solve the issue raised by the problem of nominalism.

that the PIF "opens up again the prospects for the circularity charges it was meant to forestall."[33]

Second, the values assigned to a certain outcome fail to explain, *eo ipsum*, why the outcome occurred. In fact, the values themselves appear to do little explanatory work. As Drouet and Merlin note, the probability of leaving a certain number of offspring can equally explain any actual reproductive output. In other words, stochastic propensities underdetermine their effect. Any given effect with a nonzero probability is equally explained by the propensity. They therefore conclude, "Probabilities, here, do not measure anything like explanatory power."[34] Since the traits that ground the propensity (rather than the value assigned to it) explain a given effect, the values alone are not sufficient in accounting for any given result. Thus, it would be inadequate to explain the survival and reproductive success of an organism by its greater propensity for this result. One must give the actual causal history of the organisms in question, and, as noted, this will be unique in every case.

Matthen and Ariew arrive at a similar conclusion, offering the analogy of an expected rate of return on an investment. The expected rate does not cause its growth; rather, the growth is the effect of the underlying causes, and merely treating the quantities as a propensity for growth does nothing to elaborate on the causes that actually affect the investment's rate of growth.[35] The propensity for growth is merely the confluence of several factors that gives a certain effect a probabilistic value. They write, "From an economist's point of view, explaining an investment's propensity to grow is no different from explaining its expected growth."[36] In other words, at an individual level, the reproductive output is explained by circumstances

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[33] Ibid, 164.

[34] Isabelle Drouet and Francesca Merlin, "The Propensity Interpretation of Fitness and the Propensity Interpretation of Probability," *Erkenntnis* 80, no. 3 (2015), 464.

[35] Mohan Matthen and André Ariew, "Two Ways of Thinking about Fitness and Natural Selection," *The Journal of Philosophy* 99, no. 2 (Feb. 2002): 56-7.

[36] Ibid, 56.

unique to each organism rather than by probabilities. Any explanatory work for these probabilities must occur at the population level, yet even here, the explanatory work is done not by propensities but simply by the law of large numbers. However, “the law of large numbers is not causal and… differs from explanations that specifically rely on propensities and the explanatory power of dispositional properties.”[37]

Additionally, Abrams notes a seemingly serious dilemma. If propensities are stochastic, how are we to interpret their stochasticity? One option would be to grant objective indeterminacy to biological organisms. While possible, the position has been accused of reifying scientific ignorance concerning the actual causes/conditions of evolutionary processes.[38] Nevertheless, it would preserve the PIF, though it would be forced to grant that individual propensities change with every minor environmental and populational perturbation. This would render individual fitness practically unknowable. Since an organism’s overall fitness would be in constant flux, one would need to measure an almost unlimited number of similar (if not clonal) organisms in a nearly identical environment to determine the overall fitness with any degree of confidence. As Ramsey and Pence wryly remark, “In almost all biological cases, this will be exceedingly difficult.”[39] One might object that trait fitness, which attempts to measure the causal contribution of individual traits, might overcome this issue. However, trait fitness provides only an idealized and abstract property that does not correspond to the actual population itself.[40] Indeed, as will be discussed below, while trait fitness might provide some explanatory value, it ought not be regarded as the *cause* of selection events.

Other epistemic and methodological issues have also been noted. These include determining the set of facts that establish the value of the propensity, a task that proves

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[37] Drouet and Merlin, “Propensity Interpretation,” 466.

[38] See, for instance, Alex Rosenberg and Frederic Bouchard, “Fitness,” *The Stanford Encyclopedia of Philosophy* (Spring 2020 Edition), ed. Edward N. Zalta, https://plato.stanford.edu/archives/spr2020/entries/fitness/.

[39] Ramsey and Pence, “Fitness,” 3.

[40] Walsh, Ariew, and Matthen, “Four Pillars,” 9-11.

exceptionally tricky to accomplish in a nonarbitrary manner. How many generations ought to be measured? What is the scope of the environment and time scale?[41] Finally, even if an abstract fitness value is determined, stripped of any too narrowly construed environmental and chronological parameters, how could this value then relate to the individual organism in its specific conditions and contexts? To cite Lewontin at length:

> The fitness at a single locus ripped from its interactive context is about as relevant to real problems of evolutionary genetics, as the study of the psychology of individuals isolated from their social context is to an understanding of man's sociopolitical evolution. In both cases, context and interaction are not simply second-order effects to be superimposed on a primary monadic analysis. Context and interaction are of the essence.[42]

While epistemic and methodological issues are not lethal *in se*, these problems, along with a general preference for deterministic interpretations within science, have led many to adopt determinism. As noted, no evidence exists that fitness probabilities reflect anything more than our failure to identify underlying causes and conditions. Indeed, such probabilities are often simply interpreted as places of scientific ignorance.

However, adopting determinism would render fitness identical to its effect. The stochasticity would disappear, and the probability values assigned to certain propensities would reflect only our ignorance of a fundamentally deterministic process. As Byerly and Michod note in their extensive criticism:

> The propensity interpretation of fitness only saves the principle of natural selection from degenerating to the tautology 'the reproductively successful are reproductively successful' by shifting to 'organisms with a propensity to be reproductively successful are those which are in fact reproductively successful.'[43]

Said differently, since the PIF is saved from tautology only by distinguishing *expected* reproductive output from *actual* reproductive output, the problem of tautology would reemerge if this stochasticity was denied. Given all relevant facts, the expected offspring would always

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[41] Ibid.

[42] Richard Lewontin, *The Genetic Basis of Evolutionary Change* (New York City: Columbia University Press, 1974), 318.

[43] Byerly and Michod, "Fitness and Evolutionary Explanation," 12.

match actual offspring, reducing the interpretation back to tautological emptiness.[44] Whatever effect is measured was the only effect that was possible.[45]

Byerly and Michod were perhaps too generous, for while they rightly note the propensity interpretation barely avoids tautology for any *retrodictive* explanations, it cannot avoid this fate for any *predictive* estimations it might give. The following would be an example of a prediction made under the propensity theory: Organisms possessing a higher propensity for survival and reproduction will, more than likely, be those that survive and reproduce. Given that a propensity is merely a probabilistic disposition, the above statement amounts to saying that creatures that are more likely to survive and reproduce will likely survive and reproduce.

Thus, either horn of the dilemma proves problematic for the PIF. More recent attempts to update portions of the PIF have been made.[46] However, such offerings have been incapable of overcoming the litany of issues plaguing any version of the PIF. As such, the PIF, while likely still the most popular position, seems an unlikely answer for the question of the nature of biological fitness.

3.2 Statistical Interpretation

Due to the ongoing and intractable problems related to defining fitness, some philosophers have opted for a more radical solution. Denis Walsh, André Ariew, Tim Lewens, and Mohan Matthen are among a collection of scholars who deny to fitness and natural selection any unique causal role distinguishable from genetic drift or other evolutionary forces. Natural selection, as it functions in the modern synthesis, is merely the statistical results of disparate individual-level causes; it is not an additional cause on top of that. As such, natural selection denotes

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[44] Ibid, 14.

[45] Abrams, "Measured, Modeled," 7.

[46] E.g., Robert Brandon, *Adaptation and Environment* (Princeton, NJ: Princeton University Press, 1990), 20ff; Roberta Millstein, "Probability in Biology: The Case of Fitness," in *The Oxford Handbook of Probability and Philosophy*, ed. Alan Hájek and Christopher Hitchcock (Oxford: Oxford University Press, 2016), 601-22.

nothing more than one's expectations of shifts in gene frequency within a given population. Deviations from this expected result are branded as genetic drift. Thus, both terms express nothing more than the statistical expectations measured against the actual data. Matthen and Ariew are not shy about the implications, stating their interpretation will demand "a far-reaching revision of some widely accepted notions of causal relations in evolution."[47] Lewens, likewise, notes the position "offends those who are sensitive to how most biologists actually describe things."[48]

Regardless, Lewens finds any narrower construal of selection and fitness unconvincing since there is no non-arbitrary method for delineating which factors count in favor of fitness. An organism's reproductive output cannot be classed as an instance of selection-for or selection-against without factoring in the remaining population, the reproductive success of the offspring, and a host of other factors. Statisticalists therefore deny that population-level causation salvages the traditional understanding of natural selection, arguing, "All the causing goes on at the individual level, despite the fact that the regularity is only observable at the ensemble level."[49] Higher-order explanations, such as shifts in gene-frequency within a population, do not need to appeal to the underlying individual-level causes but need only note their distribution. An apt example is the movement of molecules to areas of lower density; one need not explain the cause of all the individual molecules but only their collective motion. This higher-order explanation is not causal in nature and signifies nothing more than the aggregated motion of the individual molecules.[50]

The profound implication of this proposal is that causalism, interpreted here as a population-level cause, is false. Rather, population genetics merely map the "statistical 'trend'"

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[47] Matthen and Ariew, "Two Ways," 55.

[48] Tim Lewens, "The Natures of Selection," *The British Journal for the Philosophy of Science* 61, no. 2 (2010): 330.

[49] Walsh, Ariew, and Matthen, "Four Pillars," 8.

[50] Ibid.

within populations and cannot provide any information about the individual-level causes behind such trends.[51] Having features that promote survival and reproduction (i.e., individual fitness or what statisticalists will sometimes label vernacular fitness) does, of course, play some role in determining evolutionary change. Nevertheless, statisticalists reject that the various supposed "causes" of evolution (selection, drift, migration, etc.) can be parsed in any meaningful and exact way.

Lewens illustrates this with a thought experiment in which there is a population with two distinct disease-resistance traits.[52] The first (trait 1) protects against one sort of disease (disease A) and the other, fitter trait (trait 2) protects against two other sorts of diseases (diseases B and C). Supposing that the likelihood and virulency of each disease are equal, trait 2 would be considered the fitter of the two traits since it protects against more diseases. However, purely by chance, disease A strikes three seasons in a row, killing off organisms possessing trait 2. Would this be an instance of selection or drift? With trait 1 fixed within the environment, ought we to declare it the more fit trait? For Lewens, while the actual ecological factors favored trait 1, many still intuitively believe this thought experiment demonstrates a case of drift since the actual results did not correspond to the most likely predicted scenario. Yet the choice to measure from the actual ecological conditions versus the expected ones can only be made by the researcher herself. Thus, either drift or selection is a viable explanation for this event. One can push Lewen's analogy further by imagining a third group of organisms that bears neither trait (trait 0) and is equally killed off when disease A strikes. In this circumstance, one cause (disease A) would result in the elimination of both the fittest and the least fit trait. It would then be odd to interpret this monocausal incident as actually the result

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[51] Matthen and Ariew, "Two Ways," 57.
[52] Lewens, "Natures of Selection," 322.

of *two* competing causes, drift and selection, each eliminating the two other traits present within the population. Thus, a causal view of drift and selection must be flawed.

Walsh, Lewens, and Ariew elsewhere note other difficulties in distinguishing drift from selection. They observe that the researcher's choice of environmental range will determine whether she designates the cause as drift or selection.[53] For instance, one could suppose in the case of the famed peppered moths that an isolated patch of light trees existed within a wider forest of darker trees. Lighter moths would thrive in this environment, being camouflaged here and here alone. Outside this patch, the population is predominantly darker colored. If the researcher focuses solely upon the population isolated in the patch, she will conclude it to be a case of selection. However, if the scope is broadened to the population as a whole, it will be judged to be an instance of drift.

As such, while drift and selection are commonly regarded as opposing causal "forces," statisticalists conclude that no such objective delineation is possible since the distinction results from deviations in statistical trends or expectations rather than an actual difference in underlying causes. Statisticalists offer two analogies to illustrate their points. If evolutionary changes were the product of competing forces, it would be comparable to dropping a feather. The final resting place of the feather is accounted for by the work of contending influences (wind speed, gravity, air resistance, etc.). However, if the cause of evolutionary change is the statistical structure of either traits or organisms, it is better compared to a series of coinflips.[54] In a sequence of ten tosses, the expected outcome will be 50% heads and 50% tails. If the actual ratio is 60% to 40%, how might we explain this unexpected result? One incorrect conclusion would be to assume some additional force (analogous to drift) acted upon the coin and caused

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[53] Denis M. Walsh, Tim Lewens, and André Ariew, "The Trials of Life: Natural Selection and Random Drift," *Philosophy of Science* 69 (Sept. 2002): 466.

[54] Walsh, Lewens, and Ariew, "Trials of Life," 454.

the ratio to deviate from expectations. This is because the same event—namely, ten tosses—can equally account for both outcomes.[55] As Lewens writes, "There is no distinctive cause acting on individual tosses that ensures that the right number land heads and tails."[56]

These conclusions lead statisticalists to fully embrace the problem of nominalism, arguing the various forces of evolution (predation, competition, sunlight, etc.) must be treated individually and uniquely. They write, "This would reinstate the dynamical conception of selection, without reifying a distinct force of selection."[57] Thus, even when individual instances of evolution have a clear causal explanation, such cases provide little grounds for supposing that one could isolate the common feature prevalent to all or most cases of genotypic fixation within a population.[58] By treating trait fitness as a mere statistical projection, it allows researchers to understand evolution via common distribution patterns rather than common causes. They conclude, "Consequently, we can only say that a population is undergoing MS [modern synthesis]-selection, or drift, or both, *relative to an MS-model*. It follows that there is no model-independent fact of the matter whether a population is undergoing MS-selection, drift, or both."[59] The emphasis upon the modern synthesis model here is noteworthy, for statisticalists will commonly distinguish Darwinian-models, which focus on organism-ecosystem interactions and individual-level causes (i.e., vernacular fitness), from modern synthesis-models, which focus on trait types and population-level events. In other words, statisticalists make clear that they do not deny the causal reality of vernacular (i.e., ecological/individual) fitness but only fitness as treated by population genetics. Since models invoking the latter are substrate neutral, they do not concern themselves with the actual causes of population change. However, there is, at least in theory, some conceptual work left to do

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[55] Matthen and Ariew, "Two Ways," 60-61.
[56] Lewens, "Natures of Selection," 315.
[57] Walsh, Lewens, and Ariew, "Trials of Life," 466.
[58] Walsh, Ariew, and Matthen, "Four Pillars," 8.
[59] Ibid, 12. Emphasis in original.

regarding fitness even for statisticalists—namely, regarding the nature of vernacular fitness. Nevertheless, by embracing nominalism, statisticalism overcomes the problem of tautology by avoiding the question of causation and explanation altogether, thus alleviating it of any need to circumvent tautological reasoning.

Yet despite these apparent advantages, enthusiasm for the statistical interpretation is dampened by what some find to be its unwelcome implications. Matthen and Ariew present this forcefully:

> In an important sense, the mathematical-statistical treatment of natural selection eliminates evolutionary process. That is, it shows that earlier and later states of population fitness or adaptedness in an evolutionary process should not be considered stages in the unfolding of a fundamental process.[60]

They continue, "Fitness and natural selection have no reality except as accumulations of more fundamental events…. In our conception, it makes dubious sense to hold evolution is different from natural selection, much less that it is caused by it."[61] One might notice from these quotations the remarkable similarity to FP's arguments. Both distinguish between individual-level competition and adaptations and the theoretical mechanism (i.e., the *theory* of natural selection) that can explain all such instances under the same explanatory rubric.[62] In each case, the latter is denied due to the problem of nominalism.[63] Both likewise note that adaptationism is equally prepared to explain both likely and unlikely outcomes under the same explanatory scheme.[64] One distinction, however, is how FP treat natural selection. While statisticalists preserve the term as it is invoked within the probabilistic modelling of population genetics, FP replace it entirely with the term "natural history."[65] This is likely due to FP's focus on the cause of evolution and statisticalism's focus on the statistical measure of evolutionary change.

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[60] Matthen and Ariew, "Two Ways," 80.

[61] Ibid, 82.

[62] FP, *What Darwin*, 132; cf. 149-160.

[63] Ibid, 186, "A theory of Fs is an account of what Fs have in common as such…. So what does [the theory of natural selection] say about what instances of trait evolution have in common as such?"

[64] Ibid, 134-5.

[65] Ibid, 159-160.

Nevertheless, while statisticalism preserves a place for prediction within biological evolution, FP's treatment leaves open whether there is any role for evolutionary biologists beyond post hoc explanations of evolutionary events.

Unsurprisingly, due to these seemingly distasteful consequences, the statistical interpretation has garnered its fair share of critics. For instance, Rosenberg and Bouchard have challenged Matthen and Ariew's comparison of selection to thermodynamics[66] and, more importantly, to coin tossing, writing, "We know perfectly well where this probability 'comes from': the initial conditions of the coin flipping, which deterministically bring about an outcome of H or T in each case, are distributed into two sets."[67] They continue, "What does all this have to do with drift and selection? When organisms of lower fitness leave more viable offspring than fitter organisms in four consecutive mating seasons out of say, 1000, then the likely explanation is 'drift'."[68]

The force of this response is null. If one only considers a narrow set of initial conditions (all that result in either heads or tails), one will, indeed, arrive at a 50:50 result, but why are researchers confined to this set of initial conditions? Why not narrowly focus on, say, the conditions that arrived at a string of ten straight heads (or the four consecutive mating seasons)? Indeed, this less abstracted approach more nearly arrives at the actual causes of each result. In other words, Rosenberg and Bouchard fail to provide a nonarbitrary means for determining the initial conditions by which to make selection/drift differentiations. For the investigator looking at the four consecutive mating seasons in question, the "lower fitness" organisms will appear to be selected for, and the factors that allowed this creature to survive and reproduce more

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[66] Alex Rosenberg and Frederic Bouchard, "Matthen and Ariew's Obituary for Fitness: Reports of its Death Have Been Greatly Exaggerated," *Biology and Philosophy* 20, no. 2-3 (2005): 348ff. Cf. Matthen and Ariew, "Two Ways," 72-79.

[67] Rosenberg and Bouchard, "Matthen and Ariew's," 351.

[68] Ibid, 352.

favorably in these circumstances could, in theory, be touted as the reasons for attributing it with higher fitness.

Rosenberg and Bouchard's response is primarily motivated by their desire to retain vernacular fitness as a true cause of evolutionary change, which they argue Matthen and Ariew attempt to eliminate.[69] This is a misunderstanding of statisticalism. It does not attempt to undermine the notion of either adaptationally advantageous traits or better adapted organisms. Again, statisticalism makes a distinction between Darwinian selection (called D-models) and modern synthesis models (called MS-models).[70] Darwinian selection, or the survival of organisms with traits better-adapted to their environment, is a causal process fully embraced by statisticalists. Indeed, the statistical properties of traits are at least partially a result of these individual-level causal interactions. What statisticalists deny is that these individual-level causes, each distinct in its own right, constitute a unified causal force that is, in turn, measurable by MS-models. At this higher level of inquiry, causation does not enter into the equation.

An additional objection offered by Millstein similarly fails to undermine statisticalism. She distinguishes between two sets of trees both killed off by fires: 1.) those whose deaths are due to some heritable trait, and 2.) those whose deaths are not attributable to any heritable trait. These easily distinguishable events, she argues, demonstrate the difference between the discriminate and indiscriminate sampling that separates selection from drift at a population level.[71] This analogy is, at best, incomplete. To illustrate, one could imagine two other sets of trees which differ due to some heritable factors (soil requirements, temperature preferences, etc.). Thus, the two populations (populations A and B) sprout in different locations. Suppose, as well, that fires are equiprobable in both locations. If then, a chance fire starts in population

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[69] Ibid, 344ff.

[70] Walsh, Ariew, and Matthen, "Four Pillars," 5.

[71] Roberta L. Millstein, "Natural Selection as a Population-Level Causal Process," *The British Journal for the Philosophy of Science* 57, no. 4 (Dec. 2006): 645ff.

A and exterminates all specimens, this destructive result is explained by the heritable trait unique to population A (namely, the traits restricting their biogeographical spread). Indeed, this "discriminate sampling" would qualify as selection according to Millstein's parameters.[72] Nevertheless, one would still classify this event as a case of drift since the location of the fire is a chance event. As such, Millstein's clean distinction between selection and drift fails to account for such scenarios. It is a failure to account for events such as these (or Lewen's illustration of the traits with various resistances to diseases) that motivates statisticalism to deny the distinction between drift and selection.

Matthen offers additional objections to Millstein. He notes that causal views of drift can offer no account of why drift acts as a cause in only some instances.[73] Why are seemingly identical populations affected by drift differently? Drift appears as an uncaused cause that strikes without reference to prior conditions. In addition, Matthen notes the problem of nominalism is equally troubling for causal concepts of drift. It is difficult to see how two causally unrelated incidents, such as the deaths of two different organisms by "drift" events, can be grouped together and considered a single "process."[74] If one snail is trampled by cows, this might be considered an instance of drift, but what unites this to another snail's trampling in the next field by a different set of cows? Why are we justified in viewing these disparate events as the outcomes of one causal "force"? As Matthen's writes, "Such collections of events are merely aggregates – 'heaps" of events collected together for some extrinsic reason (such as co-location) or no reason at all."[75] Thus, in spite of its lack of a warm welcome, the statistical interpretation has been able to withstand its critics' blows.

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[72] Ibid.

[73] Mohan Matthen, "What is Drift? A Response to Millstein, Skipper, and Dietrich," *Philosophy and Theory in Biology* 2, no. 2 (May 2010): 4-5.

[74] Ibid, 5.

[75] Ibid.

3.3 Is There a Solution?

Despite the seeming strength of statisticalism, there are two potential obstacles for the position. First, as Lewens summarizes, “This position is metaphysically principled, but it is let down by its poor performance when measured against biological use.”[76] Biologists commonly divide between drift, selection, and other evolutionary forces and consider this to be an objective delineation of distinct evolutionary causes. Yet, as this chapter has shown, such conceptual distinctions have proven difficult to maintain. Thus, Lewens concludes, “Once the biologist embarks on the project of understanding trait fluctuations in populations, there is no good principled account that will tell her how she should perform this balancing act.”[77] Yet such conceptual distinctions have and continue to be made. These divisions are often important to scientific work, yet statisticalism provides no guidance on how this can and ought to be done except as heuristic conceptual devices that are relative to the aims of the researcher. Second, statisticalism denies the desiderata of causalism and individuation that have been motivating our analysis of natural selection. Indeed, Rosenberg and Bouchard are correct to assert that statisticalism “is not recognizable as the theory of natural selection at all.”[78] Thus, statisticalism might be one possible solution, but it is not a solution for one seeking to preserve the theory of natural selection.

The sheer weight of this problem has led at least one observer, the ecologist Bertram Murray, to declare, “Biologists and philosophers are unable to define fitness precisely because their conception of natural selection is too vague.”[79] Murray opts for an (early) Popperian view

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[76] Lewens, “Natures of Selection,” 330. Lewens is speaking here of Matthen and Ariew’s particular position of defining natural selection as equivalent to evolution. Lewens suggests that natural selection can be arbitrarily defined based upon the needs of the researcher. However, most scientists regard their work as an *objective* delineation of causes. As such, it is questionable if Lewen’s version of statisticalism is free from this same objection, though this may depend on how Lewens defines “use”.

[77] Ibid, 331.

[78] Rosenberg and Bouchard, “Matthen and Ariew’s,” 348.

[79] Bertram G. Murray, “Are Ecological and Evolutionary Theories Scientific?” *Biological Reviews* 76, no. 2 (2001): 275.

of natural selection, instead—namely, that Darwinism is a metaphysical research program rather than a predictive scientific theory. Cambridge biologist David Hanke has offered another conclusion. In a diatribe directed against any specters of teleology within his field, he concludes, “Fitness does not exist—it is another phantom construct of the human mind.” Hanke continues:

> There is no selection, only differential survival, and since ‘fitness’ is defined as anything that promotes the chances of survival, both ‘natural selection’ and ‘survival of the fittest’ amount to no more than survival of the survivors, reflecting the uncreative emptiness of the continuous sieving of living things.[80]

Others have not been as willing to jettison a core foundation to Darwinian theory. For instance, Mary Williams has argued that the concept of fitness must be treated as a primitive term and left undefined.[81] But surely *any* coherent concept of fitness would be preferable than none at all. Thus, if it is possible to provide such conceptual clarity in a manner that satisfies the above desiderata, this ought to be preferred over Williams’ position.

As such, if statisticalists truly demonstrate genuine issues in the received view of Darwinism, then adaptations can no longer be said to be the result of a single causal process. They write, “If the statistical conception is correct, then natural selection theory can no more explain why a particular individual has the traits it has than the kinetic theory of gases can explain why a particular molecule has the velocity it has.”[82] Consequently, if the theory of natural selection plans to carry the causal weight it has been given, a radical revision of the concept of fitness may be in order.

4. A New Interpretation of Fitness

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[80] David Hanke, “Teleology, the Explanation that Bedevils Biology,” in *Explanations: Styles of Explanation in Science*, ed. John Cornwell (Oxford: Oxford University Press, 2004), 148.

[81] Mary B. Williams, “Deducing the Consequences of Evolution: A Mathematical Model,” *Journal of Theoretical Biology* 29, no. 3 (Dec. 1970): 343-385.

[82] Walsh, Lewens, and Ariew, “Trials of Life,” 469-470.

At this juncture, it is prudent to recount the path the argument has so far taken. In the last chapter, it was shown how conceiving of natural selection as an extrinsic causal process led to the problem of counterfactuals. Since natural selection (conceived of as "selection-for") cannot distinguish between coextensive traits, it fails to isolate those traits that are being selected for against those that are mere spandrels. An obvious solution posed by many of FP's critics is to conceive of natural selection in an explanatory reciprocalist model—namely, to understand organism-ecosystem interactions, predicated upon the "fit" between environment and organismal traits, as the cause of differential reproduction. However, FP and others noted that such a conception would lead to two distinct problems, which I have labeled in this chapter as the problems of nominalism and tautology.

Thus, the theory of natural selection seems to meet an inescapable dilemma. There appears to be no property common to all selection events that would allow us to regard it as the outworking of a single causal process, and attempts to generalize to some universal causal property reduce the concept of fitness to explanatory vacuity. The theory is trapped between the twin horns of nominalism and tautology, leaving only more revolutionary proposals such as statisticalism that question the causal status of natural selection. The most one could salvage from the theory at this point is the assertion that certain (unspecified) traits provide advantages to organisms in certain (unspecified) ecological contexts, but this is a far cry from a genuine scientific *theory*. It generates no predictive hypotheses, nor does it identify the cause common to all these events. What, then, can be said in defense of biology's most famous theory?

To answer, I will draw attention back to the question of individual fitness. As previously mentioned, Byerly and Michod astutely note that the notion of an organism's individual fitness does not factor into evolutionary accounts simply from the fact that it is nonquantifiable.[83] As

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[83] Byerly and Michod, "Fitness and Evolutionary Explanation," 2.

such, while the concept of an organism's overall adaptedness is commonly referred to as its fitness, it serves no place in population genetics, which is solely concerned with trait fitness at a population level.[84] Given the critiques of statisticalism, the predominant quantitative, mathematical approaches to fitness fail to capture the essence of what makes both traits and creatures adaptive. In other words, the reason statisticalism has proven so successfully impervious to rebuttal is that it has centered its objections on the modern synthesis's understanding of natural selection (MS-models) while retaining some concept of individual (or vernacular) fitness.

This alternative model is rightly labeled Darwinian (D-models) by statisticalists because it is more authentic to Darwin's own work, and it is perhaps the modern synthesis's divorce from the theory's founder that has led to its current predicament.[85] Bruce Glymour has argued this point, claiming, "Largely as an historical accident, many biologists and nearly all philosophers have over-invested in population genetics, in that, implicitly or explicitly, population genetics is taken to provide the core formal machinery for describing selection processes."[86] David Depew and Bruce Weber have even maintained that the fundamental error of *What Darwin Got Wrong* is its failure to distinguish between Darwinism itself and the contemporary dominance of population genetics within Darwinian research, arguing that FP have only discovered problems with the latter.[87]

What, then, did Darwin himself consider to be the engine of selection? While much debate surrounds the specifics of Darwin's own formulation, James Lennox exhaustively

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[84] Ibid, 3.

[85] Ginnobili, "Missing Concepts," 5.

[86] Bruce Glymour, "Wayward Modeling: Population Genetics and Natural Selection," *Philosophy of Science* 73, no. 4 (2006): 388.

[87] David J. Depew and Bruce H. Weber, "The Fate of Darwinism: Evolution After the Modern Synthesis," *Biological Theory* 6, no. 1 (2011): 91.

demonstrates that Darwin often appeals to the "end" or "purpose" as the reason behind a trait's selection. Passages, such as the following one, are ubiquitous within Darwin's writings:

> Variations, however slight and from whatever cause proceeding, if they be in any degree *profitable* to the individuals of a species . . . will tend to the preservation of such individuals, and will generally be inherited by the offspring . . . I have called this principle, by which each slight variation, if *useful*, is preserved, by the term Natural Selection."[88]

By using terms like "profitable" and "useful", Darwin cannot merely mean that these traits aid in survival and reproduction, for this would reduce his first statement to "Variations tending to the preservation of individuals will tend to the preservation of said individuals." In fact, Darwin often uses the term "final cause" in his argumentation and consistently maintains that, "Natural selection acts for the good of each being, and that its products are present for various functions, purposes and ends."[89] Lennox summarizes Darwin's thought as follows: "The beneficial consequences of a variation explain why it is selectively favored."[90] He adds, "As in domestic selection, the *good* served by a variation continues to be causally relevant to its increasing frequency, or continued presence, in a population—but the causal mechanism, and the locus of goodness, shifts."[91]

The terms "purpose" and "end" are rarely received favorably within biology, and even less popular is the term "good". For example, while Byerly, Michod, and Ginnobili appeal to biological function in their attempted solutions, they bid to remove any teleological content from those terms.[92] Likewise, it might be recalled that FP briefly considered the "goodness" of traits as a possible solution. They cite Richard Dawkins, who states, "Biologist can be much more specific than that about what would constitute being 'good for something'. The minimum

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[88] Darwin, *Origin of Species*, 77. Emphasis added.

[89] James G. Lennox, "Darwin *was* a Teleologist," *Biology and Philosophy* 8 (1993): 411. Emphasis in original.

[90] Ibid, 415.

[91] Ibid, 417. Emphasis added.

[92] Byerly and Michod, "Fitness and Evolutionary Explanation," 21ff appeal to the selected-effects theory whereas Ginnobili, "Missing Concepts," 20 embraces the work of Robert Cummins. See chapter 5 for a treatment of functionality.

requirement for us to recognize an object as an animal or plant is that it should succeed in making a living of some sort."[93] They retort, "That is surely truistic, since an object that can't make a living is *ipso facto* not alive, and a dead animal or plant isn't an animal or plant *sans phrase*."[94] They further argue that the usage of "good for" by Dawkins commits the fallacy of *petitio principii*. A trait is considered *good* if and only if it resolves an ecological problem (i.e., is an adaptation), and a trait is an adaptation if and only if it provides a good for the creature. Thus, they conclude, "There is, to our knowledge, no more an un-question-begging account of 'being good for something' than there is an un-question-begging account of 'being an adaptation'. Each is explicated by reference to the other, so neither is able to stand alone."[95]

This unfortunate remark, stemming from a duo that includes one of the 20th century's great philosophers, explicitly ignores the rich philosophical history of the concept of the Good explored only briefly in chapter one. As a reminder, the ostensive definition I concluded that chapter with goes as follows: *the Good denotes the universal tendency of natural beings to strive for that which is desirable in itself since such ends result in the perfection of a thing's form and/or the thing's imitation of divine goodness—the "measure" of all subordinate goods*. I will label this the *metaphysical notion of the good*.

Certain aspects of the metaphysical notion do not align with Darwin's more simplistic teleological framework, such as a thing's imitation of the divine. However, other aspects, such as the perfection of a thing's form, might have been the implicit and perhaps unrecognized conceptual foundation behind Darwin's teleological expressions. In other words, both Darwin and Aristotle, while differing in many respects, agree that a trait is good in that it, minimally, performs its respective function, achieves its respective end, and results in the preservation and

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[93] FP, *What Darwin*, 145. Originally from Richard Dawkins, *The Blind Watchmaker* (New York: W. W. Norton & Company, 1986), 9.
[94] FP, *What Darwin*, 146.
[95] Ibid.

wellbeing of the organism. Put in more analytic terms, Mark Bedau has called such explanations grade-three teleological explanations.[96] Where A is an agent bearing some property, B, for the sake of some end, C: "A Bs in order to C *iff* A Bs because [A's Bing contributes to Cing and Cing is good]."[97]

If we entertain a reintroduction even of this minimalistic concept of goodness, one that seems implicit in Darwin's own conception of his theory, how might it affect the aforementioned problems with fitness? In other words, how might treating fitness differentials as distinctions in the goodness of the organism's traits solve the problems around defining fitness? Simplifying the metaphysical notion, we can define Darwin's (and later biology's) *adaptational notion of the good* as *the actualization of traits and the accompanying faculties/functions proper to a natural kind*.[98] Biological organisms possess adaptations that are proper to their species, and these are retained due to the function they perform in the growth, maintenance, and propagation of the species. I label this interpretation of fitness as the Aristotelian-Thomistic teleological interpretation of fitness (ATTIF).[99] The ATTIF immediately demonstrates its benefits if one considers the four desiderata guiding our investigation as well as the oft-repeated problem of coextensive traits:[100]

1.) *The Principle of Causalism*: While causalism has normally regarded natural selection as an extrinsic cause acting upon populations, this view has proven

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[96] Grades one and two are defined in Mark Bedau, "Where's the Good in Teleology?" *Philosophy and Phenomenological Research* 54, no. 4 (Dec., 1992): 781-806.

[97] Ibid, 790. The brackets here signify that both parts of the conjunction explain A's Bing. Bedau gives no definition of the value-laden term "good", leaving it open for my own analysis of the concept.

[98] To be more specific, the traits that would (or, at least, could) qualify as having normative properties would include both essential traits and propria (nonaccidental traits belonging to organisms of a certain type that are not essential, such as risibility in humans).

[99] While other thinkers, such as Plato, were obvious influences on this interpretation, I leave them out for simplicity.

[100] By reducing the definition of goodness from the ostensive definition of chapter 1, I am not denying that the missing aspects of the metaphysical notion are essential for a philosophically robust definition of fitness. Rather, this reduction is meant purely to demonstrate how the earlier metaphysical understanding of goodness filtered into Darwin's conception of natural selection, though in a manner bereft of the philosophical sophistication of prior ages.

untenable. As such, natural selection, if it is to remain a cause in any form of evolution, must be recast. In this regard, the ATTIF supplies a form of causal unity missing from other concepts of fitness and selection. While the *efficient* causal sequence for each case of adaptive evolution is distinct, the ATTIF provides a unified *final* cause, giving the theory at least some form of causal unity and thus avoiding the problem of nominalism. Selection events result from the goods provided by the traits and functions of the organism. It is the good that evolved traits grant for their host organisms that accounts for their preservation within a population.[101] Thus, the ATTIF asks us to abandon the contemporary reduction of causation to efficient, mechanical causes and adopt the more wholistic view of causation in the classical/medieval tradition.

2.) *The Principle of Individuation*: The ATTIF likewise provides a clean distinction between the process of drift and selection, since only the latter makes reference to the nature, functions, and goods proper to organisms of a particular kind. While drift events might *result* in some organismal goods (namely, the survival/reproductive success of a certain type of organism), the explanation for these events is chance rather than the success of an organisms' adaptive traits achieving their particular ends and outcompeting other organisms. This is what Aristotle labels "coincidence". He gives the example of a person digging a hole for a plant and discovering a treasure, instead (*Metaphys.* X.30, 1025a13-20). The result is good, but the method for achieving it cannot be attributed to the particular ends or intentions of the agent. In the same way, drift events might lead to less fit

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[101] While causalism is normally contrasted with statisticalism, the ATTIF would, to some extent, reconcile both positions since it also acknowledges the main critiques of statisticalists.

traits/individuals/groups outcompeting the more fit, yet this result occurs *in spite of* their lesser capacity to achieve certain beneficial ends, not because of it.

3.) *Explaining Optimized/Specialized Traits:* The ATTIF can account for the production of optimized or highly specialized traits. In Darwin's original conception of selection, evolution is biased towards the production of optimization (Darwin preferred the term "advantage").[102] "Optimization" is a teleologically-laden term when used in the context of biological functions, for it denotes the achievement of the highest good for a particular adaptation and thus the end towards which selection is biased.

4.) *The Problem of Nominalism/Principle of Explanatory Content:* The actualization/development of a trait and its proper functioning are not identical to their effect—namely, survival and reproductive success. As such, it escapes tautology.

5.) *The Problem of Coextensive Traits:* The ATTIF can distinguish between the causal properties of coextensive traits. As an illustration, I will utilize FP's example of a polar bear and its trait of having white fur and the separate trait of blending in with the environment. Which of these two traits, they ask, is being selected for?[103] Given the reintroduction of Aristotelian-style teleology, since the latter trait acts as the final cause for the former (the polar bear is white *for the sake of* blending in with its environment), it provides the causal language for distinguishing the traits and identifying the latter as the *telos* of the former. Hence, camouflage is the end that causally orders the means to its achievement (i.e., white fur). We can therefore distinguish the causal properties of both traits: it is the polar bear's need for

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[102] Lennox, "Darwin *was*," 410.

[103] FP, *What Darwin*, 118.

> camouflage that *causes* its white fur. Similar distinctions can be made between adaptations and spandrels; adaptations *cause* the emergence of spandrels, though, in this case, spandrels exist mere byproducts.[104]

This leads to an important point—namely, that ends can be divided between more proximal aims (having white fur) and more distal aims (blending into the surroundings). In his famed study of biological teleology, Francisco Ayala (echoing Aristotle) adds that the more distant the aim, the greater its explanatory priority since distal aims determine the steps needed to achieve it.[105] Ayala regards reproduction as the ultimate aim determining more proximal aims.[106] Thus, we must add survival and, ultimately, reproduction as two more components of the explanation. There are, then, four components, which, moving from most proximal to most distal, are 1.) the actualization/development of a physical trait, 2.) the functioning of that trait within certain environmental parameters, 3.) the survival of the organism, and 4.) the reproductive success of the organism. However, it might be noted that the beneficiaries of this last component (reproduction) differ from the prior three stages. While the individual organism profits from the first three levels of the explanation, the beneficiaries of the latter stage are the offspring and, through them, the population/species as a whole.[107]

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[104] One might wonder what role the environmental context plays in these explanations. For instance, a white polar bear is well suited to the Artic terrain but would struggle to find similar success in the Amazon. Thus, one organism can have two distinct fitnesses depending on the environmental context. However, the ATTIF need only refer to the functioning of the trait, which is restrained by certain environmental parameters (a *natural* habitat). In other words, traits are adapted *for* certain functions which can only be achieved given the right environmental context. A polar bear's coloration is *for the sake of* blending into its environment, a function it can only accomplish if the terrain is predominantly white. Thus, all references to trait functions must be understood as including an environmental parameter.

[105] Francisco J. Ayala, "Teleological Explanations in Evolutionary Biology," *Philosophy of Science* 37, no. 1 (March 1970): 1-15. Cf. *NE* I.6, 1096b14ff.

[106] Ayala does not consider the possibility of higher order aims, such as imitation of the divine since his study was restricted to a purely biological domain.

[107] For Aristotle and Aquinas, survival does not represent an organism's *highest* good (i.e., *eudaimonia*); indeed, many human faculties are aimed at more than just survival. Nevertheless, I focus on survival/reproduction for the sake of simplicity and dialoguing with existing scientific literature while also recognizing the reality of other goods.

Thus, the ATTIF must additionally denote the object who benefits at each stage. In other words, there are two aspects of a biological teleological explanation—the aim (the good towards which organisms are directed) and the beneficiary (the recipient of the goods provided by the aim). As noted, the former can likewise be subdivided into proximal and distal ends; the polar bear has white fur (proximal aim) *for the sake of* blending into the environment (distal aim). Similarly, the beneficiary can be subdivided into a proximal beneficiary (organism via the aim of survival) and a distal beneficiary (the offspring/species via the aim of reproduction). Here, again, proximal ends are regarded as means by which some ultimate end is accomplished. In this case, the organism survives *for the sake of* reproducing and ensuring the continuity of its offspring. In this manner, the beneficiary aspect of the ATTIF captures both aspects of fitness—survival *and* reproduction—in a manner that clarifies the explanatory priority of the one (reproduction) over the other (survival). Other interpretations of fitness have struggled to synthesize the relationship of these two facets of fitness. For instance, Daniel Dennett proposes treating fitness as the organism's capacity to solve "design-problems" posed by the environment.[108] Yet, as Saúl Pérez-González and Victor J. Luque note, a perfectly adapted creature that suffers from sterility would solve all its environmental design-problems yet would not be considered a perfectly "fit" organism since it would be quickly weeded out by natural selection.[109] The ATTIF, however, is able to interpret the conjunction of these two elements in a teleological manner—the organism survives *for the sake of* its offspring.

One might wonder if I have introduced two different concepts of a good. I have defined the adaptational notion of the good as the actualization of the traits and functions proper to an organism's nature. However, reproduction does not seem to fall under this definition. Indeed,

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[108] Daniel Dennett, *Darwin's Dangerous Idea: Evolution and the Meaning of Life* (New York, NY: Simon & Schuster Paperbacks, 1995).

[109] Saúl Pérez-González and Victor J. Luque, "Evolutionary Causes as Mechanisms: A Critical Analysis," *History and Philosophy of the Life Sciences* 41, no. 13 (2019): 13.

many organisms undergo great sacrifices to ensure successful reproduction. Are there, then, two different definitions of a good? The distinction between the beneficiaries proves vital here. In the proximal sense, the actualization of traits benefits the particular organisms that bear the traits. Reproduction, by contrast, is the production of new organisms bearing the same essential traits, propria, faculties, and functions.[110] Thus, reproduction is a special instance whereby the goods proper to species are instantiated in new, unique organisms. In this sense, it is simply another instance of the actualization of the traits and functions proper to a species, yet, in this case, the beneficiary is not the parent organism but other members of the same species—namely, the offspring. To reference again Aristotle's treatment of reproduction, the offspring are "not one in number but one in form (*DA* II.4, 215b2-7). As such, reproduction is not an instance of a good distinct from the definition given above—only an instance of it where the beneficiary is distinct.[111]

The reality of two beneficiaries has some implications for our understanding of fitness. Specifically, since the goods of populations/species are more distal aims, the goods of individuals may be sacrificed for the sake of some greater populational good. This sacrifice may include individual fitness, for if a lower average individual fitness benefits the overall populational fitness (as seems to be the case in some circumstances and often resulting from genetic constraints),[112] this higher-order good explains why populations will trend towards this outcome rather than, say, the highest possible average individual fitness.[113]

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[110] This is not to deny that some propria and other traits might, in theory, be lacking. The question of speciation is also not being denied here (see chapter 6).

[111] As chapter 1 noted, Aristotle also believed the aim of reproduction is imitation of the divine's eternality.

[112] Samir Okasha, *Agents and Goals in Evolution* (Oxford: Oxford University Press, 2018), 80-1.

[113] This also prevents a reduction of the value of survival to an instrumental good. The organism is the beneficiary of nonsexual traits and their functions. Thus, *qua* organism, survival is the intrinsic good. No reference need be made to reproduction, for even a sterile organism would benefit from the proper function of its traits, and such traits would still be regarded as aimed at this intrinsic good. Yet, *qua* species, the survival of the individual is merely an instrumental good. Only if the organism reproduces will the species continue to maintain itself.

Having defined fitness *in general*, what does it mean *specifically* for one organism to be fitter than another? One organism is fitter when its functional traits (e.g., white fur) better enable the goods proper to the organism's form of life (e.g., camouflage). While bearing greater fitness will frequently lead to survival and reproductive success (selection events), this is no guarantee. Drift events occasionally yet equally explain the proliferation of less fit traits within species. A drift event might even include the unique functional traits of a population as part of its explanation. To recycle an earlier illustration, suppose population A has disease resistance to one form of deadly plague while population B has disease resistance to two other forms of equally virulent diseases. All else being equal, population B is more fit, yet if the disease population A is resistant to strikes repeatedly by pure chance, population B might be wiped out. Thus, the possession of a functional trait explains why population A survived, yet according to the ATTIF, this must still be classified as a drift event.[114] While the population's fitness explains its survival, it was nevertheless less fit than its competitors. Population B better actualized the adaptive trait of disease resistance. Thus, it was not *merely* the possession of functional traits that led to population A's success but also a series of serendipitous events that wiped out a fitter population. As such, drift events, unlike selection events, always appeal to some level of stochasticity in their explanations.

Returning to the ATTIF's general definition of fitness, an organism's fitness becomes the product of multiple factors: 1.) The actualization and perfection of the physical traits (1st order aim), 2.) The functional aim of these traits (2nd order aim), 3.) The survival of the organism (3rd order aim), and 4.) The reproductive success of the organism (4th order aim). The beneficiary of steps 1-3 is the organism while the beneficiary in step 4 is the species/population. As is evident, each aspect is teleological in nature, and, as will be recalled from the initial chapter, this scheme aligns with the very same distinctions Aristotle presents in his own

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[114] Other interpretations, such as the PIF, would agree with this assessment.

writings. The Stagirite also differentiates between the "aim" (genitive object) and the "beneficiary" (dative object) of a final cause (*DA* II.4, 415b2-4)[115] and notes the subordination of relative (proximal) goods to ultimate (distal) goods (*NE* I.6, 1096b14ff). Thus, the ATTIF ends up resembling Aristotle's views in more than one way. This conclusion is shared by philosopher David Depew who states, "[In] Aristotle's technical terms Darwinian adaptations do have properly final causes. They reliably have certain effects and they come to be precisely because they have these *good* effects."[116]

It may also be recalled from the first chapter that Thomas Aquinas likewise crafts a similar hierarchy of teleological beneficiaries. Thomas divides between goods proper to (1) the individual, (2) the species, (3) the genus,[117] and (4) the similitude between the principled (*principiatorum)* and the principle (*SCG* III.24.7). Examples of aims aligning to each category would be (1) food, (2) reproduction, (3) the sun causing light and heat in another, and (4) God's goodness, which is beyond genus yet gives being to all. As Thomas writes, "It is evident, next, that the more perfect something is in its power and the higher it is in the scale of goodness, the more does it have an appetite for a broader common good, and the more does it seek to become involved in the doing of good for beings far removed from itself" (SCG III.24.8). In other words, Thomism equally recognizes that while survival denotes the primary aim of most organismal activities, these same creatures will expend tremendous resources, often at the cost of their own lives, in ensuring the survival of their offspring. For Thomists, this reality does not convey two disparate and unequal goods competing within the creature but the subordination of a lower order good to a higher good. Thus, the priority of populational fitness

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[115] See also Monte Ransome Johnson, *Aristotle on Teleology* (Oxford: Oxford University Press, 2005), 65ff. Cf. *ST* I-II.1.8, where Thomas also divides between the *finis quo* and the *finis cuius*. There is, however, a debate whether Thomas' interpretation of Aristotle is accurate. See Simon Oliver, "Aquinas and Aristotle's Teleology," *Nova et Vetera* 11, no. 3 (2013): 852.

[116] David Depew, "Accident, Adaptation, and Teleology in Aristotle and Darwinism," in *Darwin in the Twenty-First Century: Nature, Humanity, and God*, eds. Phillip R. Sloan, Gerald McKinney, and Kathleen Eggleson (Notre Dame, IN: University of Notre Dame Press, 2015), 126. Emphasis added.

[117] "Species" and "genus" are defined here by their classical definitions rather than the modern, biological ones.

over individual fitness aligns with a Thomistic understanding of the Good. Moreover, in crafting this taxonomy of goods beginning with the creature and ascending towards God as the first principle, Thomas provides a system for understanding the two disparate elements of fitness (i.e., survival and reproduction) not as mere conjuncts but as two aspects of an ordered hierarchy. In other words, the ATTIF does not merely borrow the tradition's definition of a good but also aligns with the two philosophers on a number of different aspects concerning the scope and nature of such teleological explanations.

Thus, if fitness is understood in a manner similar to Darwin's original conception and open to the philosophical tradition of classical and medieval thought, it escapes the problems inherent to both selection-for and analytic notions of fitness.[118] It also preserves the mathematical usage of fitness so valued by population geneticists by distinguishing between the measured value assigned to fitness (trait fitness) and fitness itself. While the former is explanatorily valuable for population genetics, it merely tracks trait frequencies through models of the statistical properties of these trait types. It does not reference the individual-level causal processes that impact these measures. However, my proposed solution works only by bringing forth concepts—namely, goodness and purposiveness—which, while implicit (or even explicit) within the language of many biological works, are denied the moment their presence comes to light.[119] FP themselves take this rejection as a given for their project, declaring, "It is our assumption that evolution is a mechanical process through and through. We take that to rule out not just divine causes but final causes, *élan vital*, entelechies, and the intervention of extraterrestrial aliens and so forth."[120]

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[118] Recent effort has increasingly been made to return to a more original Darwinian picture of natural selection. See, for instance, Bendik Hellem Aaby, "The Ecological Dimension of Natural Selection" *Philosophy of Science* 88, no. 5 (Dec. 2021): 1199-1209.

[119] E.g., Rosenberg and Bouchard, "Fitness," "Since Darwinian theory provides the resources for a purely causal account of teleology, wherever it is manifested, its reliance on the concept of 'fitness' makes it imperative that conceptual problems threatening the explanatory legitimacy of this notion be solved."

[120] FP, *What Darwin*, xv.

This is a relatively recent development in biology. According to Depew and Weber, the usage of "value-laden 'grades'" (both within and between species) was permissible for most of biology's history—that is, until the advent of the modern synthesis.

> Since grades inevitably contain traces or echoes of the ancient and medieval "great chain of being" that is deeply embedded in the "folk ontology" of the West, moving entirely to "cladism" by completely eliminating the notion of higher and lower that is reflected in the concept of evolutionary grades is still very much in process.[121]

Is, then, Darwinism a relic of medieval and classical metaphysics? If statements like Dawkin's (or the numerous other biologists who speak of "advantages", "purposes", and evolutionary "goods") are to be taken seriously, then the metaphysic is implicitly smuggled in whenever convenient despite the more public denial by biologists of such "folk ontology". This is, perhaps, the most likely reason why Darwin's original formulation of natural selection, which drew freely on teleological language, seems far less explanatorily and causally problematic than any of the more recent analytical attempts. While Darwin himself never elaborated on the philosophical implications of his language,[122] the theory's seemingly overt reliance upon final causes harkens biology to reconsider whether its most iconic theory demands a reevaluation of its own philosophical commitments. Depew himself has gestured toward this possibility, claiming, "[In] Aristotle's technical terms Darwinian adaptations do have properly final causes. They reliably have certain effects and they come to be precisely because they have these *good* effects."[123] Ironically then, despite their provocatively titled work, FP have only aided in revealing that Darwin, rather than any of his followers, may have been right all along.

5. Conclusion

In this chapter, I have argued that the conceptual problems surrounding natural selection can be solved with the adoption of an Aristotelian-Thomistic teleological interpretation of fitness.

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[121] Depew and Weber, "Fate of Darwinism," 92.

[122] Lennox, "Darwin *was*," 418, "Though Darwin occasionally endorses his own teleology, to my knowledge he never provides a philosophical commentary on it."

[123] Depew, "Accident, Adaptation," 126. Emphasis added.

The acceptance of this interpretation removes the problems of nominalism and tautology and satisfies all four desiderata of a successful theory of natural selection. If this conclusion proves viable, it opens a Pandora's Box of implications and unsolved questions. Arguably most important is the question of the theological implications. Does the adaptational notion of goodness imply the metaphysical notion and its theological commitments? While the ensuing chapters will be working under the assumption of this theological entailment, it must be noted that some authors have reached similar conclusions but denied these results have any significance for theology.[124] This question will be set aside until a later chapter. In the meantime, I will operate under the assumption that the compatibility of the ATTIF with classical theism is, at least, plausible, ignoring for now whether the former suggests or even demands the latter as a metaphysical basis. With this in mind, the next chapter will explore the implications of the ATTIF to various key concepts within biology and then provide a theological "reading" of these concepts from the perspective of classical theism.

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[124] Edward Feser, *Aristotle's Revenge: The Metaphysical Foundations of Physical and Biological Science* (Neunkirchen-Seelscheid, Germany: *editiones scholasticae*, 2019) reaches a similar conclusion to this chapter in his review of FP's work. However, Feser believes an "Aristotelian" version of teleology where ends flow directly from creature's natures without any reference to higher-order ends is a plausible atheistic alternative. See chapter 6 for a critique of this position.

CHAPTER FOUR: THE ATTIF ANALYZED – REPRODUCTION, SURVIVAL, AND DEVELOPMENT

What if purpose and desire are the *fundamental attributes of anything that lives, and everything about them?*[1]

-J. Scott Turner-

1. Introduction

This chapter examines four concepts/models within the biological sciences, each corresponding to the various, hierarchical aims outlined by the ATTIF.[2] It will demonstrate how these models and concepts provoke a teleological interpretation and thus further evidence and illuminate the ATTIF. I will work backward from the most distal aims of the ATTIF to the most proximal since the former are the instrumental means for achieving the latter. The first two, Hutchinsonian niches and evolutionary landscapes, parallel the fourth aim (reproductive success) and second beneficiary (populations/species) of the ATTIF. While it might seem paradoxical to include these concepts given the emphasis upon organisms and individual fitness, the ATTIF recognizes both populations and individual organisms as unique beneficiaries with their own sets of teleological aims. Thus, both individuals and populations/species are causally relevant to an account of selection. The next two concepts involve instances of teleological ends proper to individual organisms—namely, metabolism/homeostasis and homeorhesis. The former parallels the aim of survival while the latter the aim of development. The second aim (biological functions) will be treated more extensively in the next chapter due to the wealth of literature on the topic. I will end by bringing these analyses into conversation with chapter 1 and its metaphysical notion of goodness by providing a theological "reading" of these scientific concepts.

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[1] J. Scott Turner, *Purpose & Desire: What Makes Something "Alive" and Why Modern Darwinism Has Failed to Explain It* (New York: HarperOne, 2017), 289.

[2] The four aims, briefly summarized, are: 1.) The development/perfection of a trait, 2.) The functioning of the trait, 3.) Survival of the organism, and 4.) Reproductive success. See the end of chapter 1 for the metaphysical notion of goodness.

2. Population-Level Teleology

I begin with two concepts—namely, Hutchinsonian niches and evolutionary landscapes—that correspond to the aim of reproductive success. Both concepts are methods for modelling populations within a given environmental context and providing means for measuring their respective evolutionary change. The models seem to offer a mathematically visualizable means for mapping the teleological trajectories of populations towards greater goods. The "striving" of populations towards these goods is commonly compared to human agents attempting to reach a goal. As Samir Okasha has observed, the "personification of natural selection" as a rational agent choosing the best phenotypes for fitness-maximization has a history dating back to Darwin himself.[3] While imperfect, the heuristic power of the analogy has repeatedly proven itself even beyond the two concepts examined below.[4] This analogy is perhaps unsurprising if, indeed, the ATTIF is correct, for both are end-directed processes ordered towards certain goods. I examine each in turn.

2.1 Hutchinsonian Niches

One of the most fundamental concepts in ecology and evolutionary biology is the niche.[5] Stated simply, a niche is the "matching" of a species to a particular environment. For ecologists, the term has served a crucial role in explaining the origin and distribution of lifeforms as well as offering models for predicting future suitable habitat ranges for species. However, the term's usage has undergone its own evolution in the past century and now exists in various forms.[6]

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[3] Samir Okasha, *Agents and Goals in Evolution* (Oxford: Oxford University Press, 2018), 15-16; Elliott Sober, "Three Differences between Evolution and Deliberation," in *Modeling Rationality, Morality and Evolution*, ed. Peter Danielson (Oxford: Oxford University Press, 1998), 408-22 has called it the "heuristic of personification."

[4] See, for example, John Maynard Smith, *Evolution and the Theory of Games* (Cambridge: Cambridge University Press, 1982).

[5] Robert D. Holt, "Bringing the Hutchinsonian Niche into the 21st Century: Ecological and Evolutionary Perspectives," *PNAS* 106, no. 2 (Nov. 2009): 19659.

[6] Richard Lewontin's niche construction will be discussed in a later chapter.

The earliest conception of a niche was developed by Joseph Grinnell and was used to define the environmental parameters that impose limits on species' distribution. Because resources are finite and subject to competition, Grinnell envisioned a niche as containing only one species at a time—a concept that became known as competitive exclusion.[7] Thus, the more similar two species were, the less likely they could share the same habitat as competition between them would quickly force some resolution, whether that be the extinction or expulsion of one species. A second niche concept was developed by Charles Elton, who suggested in his work *Animal Ecology* that the niche was better understood as the role a species plays in its given ecological context.[8] Consequently, many texts have opted for labelling Grinnellian niches as "habitat" niches and Eltonian niches as "functional" niches.[9]

Despite their differences, these two early niche concepts shared the attribute of ascribing niches to environments rather than organisms. A single environmental niche might be filled by various species at different times or, in some instances, lie vacant when their occupying species goes extinct. However, Grinnell argued that such vacancies are quickly filled by selection since "Nature abhors a vacuum."[10] Similarly, distinct environments will have "ecological equivalents," or different species performing the same role within their habitat.[11]

However, the concept of vacant niches lying around, waiting to be filled, has drawn sharp criticism.[12] Indeed, the notion of empty niches luring evolving populations into them

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[7] James R. Griesemer, "Niche: Historical Perspectives," in *Keywords in Evolutionary Biology*, ed. Evelyn Fox Keller and Elisabeth A. Lloyd (Cambridge, MA: Harvard University Press, 1992), 234.

[8] Sonia E. Sultan, *Organism & Environment: Ecological Development, Niche Construction, and Adaptation* (Oxford: Oxford University Press, 2015), 33.

[9] Griesemer, "Niche," 235.

[10] Joseph Grinnell, "Geography and Evolution," *Ecology* 5 (1924): 227.

[11] Robert K. Colwell, "Niche: A Bifurcation in the Conceptual Lineage of the Term," in *Keywords in Evolutionary Biology*, ed. Evelyn Fox Keller and Elisabeth A. Lloyd (Cambridge, MA: Harvard University Press, 1992), 241-2.

[12] See especially Richard Lewontin, *The Triple Helix: Gene, Organism, and Environment* (Cambridge, MA: Harvard University Press, 2000). Some have argued there is empirical support for empty niches. See, for example, J. H. Lawton, "Vacant Niches and Unsaturated Communities: A Comparison of Bracken Herbivores at Sites on Two Continents," *Journal of Animal Ecology* 51 (1982), 573-95; D. Quamman, "Aliens," *The Pan American Review* (Oct. 1987), 27-30. These studies, however, offer only limited support.

seems to venture into explanatory externalism by conceiving of species as passive objects manipulated by a selective environment. As such, Sonia Sultan's caution in this regard is instructive: "The niche can best be understood as a joint property of the organism and its environment."[13] The niche and its occupying species are each defined with respect to one another; thus, the term is a relational one and is best understood under a reciprocalist model of selection. However, if one accepts this conclusion, then Grinnellian and Eltonian niches are conceptually flawed.

For this reason, G. E. Hutchinson's formalization of the niche around populations has garnered praise for advancing the concept. Thomas Schoener, for instance, has deemed Hutchinson's efforts "revolutionary."[14] J. Scott Turner has likewise labeled it "one of the most influential concepts in the history of ecology."[15] Nancy Slack has even crowned him as the "father of modern ecology".[16] According to Hutchinson, a niche should be conceived neither as an environmentally determined limit on a species nor the role played by the species in its ecosystem but rather by how the species or population actively utilizes its environmental context.

The niche is mapped as an *n*-dimensional hypervolume, where every added dimension corresponds to an ecologically relevant factor influencing a creature's survival and reproductive success.[17] This results in a hyperspatial geometric figure where "every point… corresponds to a state of the environment which would permit the species… to exist

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[13] Sultan, *Organism & Environment*, 34.

[14] Thomas Schoener, "The Ecological Niche," in *Ecological Concepts*, ed. J. M. Cherrett (London: Blackwell Scientific Publications, 1989), 90.

[15] Turner, *Purpose & Desire*, 274. Ibid, 281 accuses the Hutchinsonian niche of "crypto-Platonism"—an accusation stemming from its apparent commitment to a view that the environment is "just there… and that organisms either adapt to it or they don't." This ignores the distinction between Hutchinson niches and earlier versions (Grinnellian/Eltonian). In Hutchinson's model, the niche emerges from the particularities of the *organisms*, and it can (as later developments of Hutchinson's idea would show) evolve over time.

[16] Nancy Slack, *G. Evelyn Hutchinson and the Invention of Modern Ecology* (New Haven, CT: Yale University Press, 2011), xi.

[17] For more details on this mapping process, see Benjamin Blonder, "Hypervolume Concepts in Niche- and Trait-Based Ecology," *Ecography* 41 (2018): 1441-55.

indefinitely."[18] This geometric figure maps what Hutchinson calls the fundamental niche, the widest possible range of environmental factors that would allow for the survival of a population. By contrast, the realized niche represents that subsection of the fundamental niche currently occupied by the population.[19] The failure of a species to fully occupy its fundamental niche results from competition between species for finite resources. As Griesemer explains, "Competition became of central importance in understanding the realized niche, because competitors interacted to restrict each other's occupancy of regions of overlapping niche space."[20] Hutchinson later observed points of "continual pressure" where two species' fundamental niches overlap—a pressure he attributes to natural selection.[21] Colwell has thus likened the conception to an "improvisational theater—each species writes its own script, scene by scene, as the drama unfolds."[22]

While the niche concept has not failed to generate critics,[23] Hutchinsonian niches have found continued acceptance over the past decade thanks in part to advancing computational resources. Ecologist Benjamin Blonder remarks that interest has been "rapidly growing,"[24] and applications of this niche concept have led to the quantification of both the fundamental and realized niche.[25] Furthermore, Robert Holt has declared the Hutchinsonian niche to be an "essential conceptual tool for understanding range limits."[26] Holt adds, "Hutchinson's niche

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[18] G. E. Hutchinson, "Concluding Remarks," *Cold Spring Harbor Symposia on Quantitative Biology* 22 (1957): 416.

[19] Blonder, "Hypervolume Concepts," 1443-4 adds potential niches, which is a subsection of realized niches which accounts for the change in conditions over time.

[20] Griesemer, "Niche," 238.

[21] G. E. Hutchinson, *An Introduction to Population Ecology* (New Haven, CT: Yale University Press, 1978), 161.

[22] Colwell, "Niche," 242.

[23] E.g., Greg J. McInerny and Rampal S. Etienne, "Ditch the Niche – Is the Niche a Useful Concept in Ecology or Species Distribution Modelling?" *Journal of Biogeography* 39 (2012): 2096-2102.

[24] Blonder, "Hypervolume Concepts," 1445-6.

[25] E.g., Nancy C. Emery and D. D. Ackerly, "Ecological Release Exposes Genetically Based Niche Variation," *Ecology Letters* 17 (2014): 1149-57.

[26] Holt, "Bringing the Hutchinsonian," 19659. Holt's work adds additional components, including the establishment niche and the population persistence niche. Bassett Maguire, Jr., "Niche Response Structure and the Analytical Potentials of Its Relationship to the Habitat," *The American Naturalist* 107 (1973): 213-46 further distinguishes between a reproductive and survival hypervolume.

concept, 50-plus years after its formalization, when enriched with an appreciation of space, feedbacks, density-dependent impacts on persistence, and evolution, is as lively and important now, as ever."[27]

Given the ATTIF, the Hutchinsonian niche provides a model that maps the contexts that best correspond to the teleological ends of organisms. The niche itself is shaped by the particular adaptive traits a population possesses and how these influence populational persistence. Moreover, certain regions, normally towards the center of the figure, are assumed be more ideal than others—an expectation labeled the "central-marginal model".[28] These centers represent the locus of highest fitness since the goods of the species are most easily attained here.

Indeed, the concept of a Hutchinsonian niche corresponds well with the view of organisms as teleological agents, whereby certain aspects of the organism's environment act as good ends.[29] In fact, the very distinction between fundamental and realized niches seemingly presupposes that certain resources are unrealized goods for a population—goods that remain suppressed due to competition from other species whose fundamental niches overlap. The fundamental niche therefore maps the potential goods corresponding to the organism's nature.[30] The distinction is therefore one of potentiality and actuality, where the fundamental niche

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[27] Holt, "Bringing the Hutchinsonian," 19664. Interestingly, Andrew D. Leiten, Po-Ju Ke, and Tadashi Fukami, "Linking Modern Coexistence Theory and Contemporary Niche Theory," *Ecological Monographs* 87, no. 2 (2017): 161-77 have recently even combined all three niche concepts (Grinnellian, Eltonian, and Hutchinsonian) to capture the best of each.

[28] Samuel Pironon et al., "The 'Hutchinsonian Niche' as an Assemblage of Demographic Niches: Implications for Species Geographic Ranges," *Ecography* 41 (2018): 1103-1113.

[29] The Hutchinsonian niche also successfully addresses the objection of Lewontin, *Triple Helix*, 54, where he states, "If one wants to know what the environment of an organism is, one must ask the organism." Indeed, when paired with the concept of niche construction, whereby organisms actively shape their niche to fit their own ends, the teleological aspect of the niche concept is only exaggerated. For an example of this integration, see Martin Ackerman and Michael Doebeli, "Evolution of Niche Width and Adaptive Diversification," *Evolution* 58 (2004), 2599–2612.

[30] This understanding corresponds well with Denis Walsh's concept of affordances discussed in the next chapter.

specifies the teleological end towards which species naturally strive.[31] Thus, the fitter the average member of a population, the more its realized niche will overlap with its fundamental niche since it will be better able to outcompete other species and achieve its aims of reproductive success. Moreover, species that succeed in fully occupying their fundamental niche have realized the limits of the potential goods for the species within the given environmental strictures. Yet Hutchinsonian niches provide only one avenue for the application of the ATTIF. A similar and highly related concept—one that may have even inspired Hutchinson[32]—is the evolutionary landscape.[33] I move now to consider this other famed concept of evolutionary biology.

2.2 Evolutionary Landscapes

Evolutionary landscapes are, according to David McCandlish, "one of the most influential concepts in evolutionary biology."[34] Daniel Dennett adds that the fitness landscape "has become a standard imagination prosthesis for evolutionary theorists" and "has proven its worth in literally thousands of applications, including many outside evolutionary theory."[35] In Sewell Wright's original conception, the genetic "distance" between distinct genotypes is plotted to demonstrate the number of mutational steps needed to cross from one to the next. Having charted all possible genotypes (known as a genotype space), another dimension is added that measures the mean reproductive output for every combination. Once completed, Wright observes that one combination might give "maximum adaptation and that the adaptiveness of the other combinations falls off more or less regularly according to the number of removes."[36]

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[31] Cf. Jonathan M. Chase and Mathew A. Leibold, *Ecological Niches: Linking Classical and Contemporary Approaches* (Chicago: University of Chicago Press, 2003), 53, "[The fundamental niche is where] the species can *potentially* exist" (emphasis mine).

[32] Turner, *Purpose & Desire*, 274.

[33] Indeed, Holt, "Bringing the Hutchinsonian," 19664 has delineated three "landscapes" relevant to evolution: the actual environmental landscape, the niche, and evolutionary landscapes.

[34] David M. McCandlish, "Visualizing Fitness Landscapes," *Evolution* 65, no. 6 (June 2011): 1544.

[35] Daniel Dennett, *Darwin's Dangerous Idea* (New York: Simon and Schuster, 1996), 190.

[36] Sewall Wright, "The Roles of Mutation, Inbreeding, Crossbreeding and Selection in Evolution," *Proceedings of the Sixth International Congress on Genetics* 1 (1932): 357.

Due to the effects of selection, any population located within the vicinity of this peak will "move up the steepest gradient toward the peak" and remain there unless a new mutation offers a more favorable alternative (a "higher peak").[37] There is, then, a trajectory within natural selection towards optimization.

Wright also crafted another, more controversial version of a landscape where he mapped the relationship between allele frequency and mean population fitness.[38] In this version, populations are represented as a point rather than a cluster of points, as they are in the original model. Provine would later classify this second version as an adaptive landscape rather than a fitness landscape. For Provine, the term "fitness landscape" is reserved for models that represent populations as points clustered around a genotype space.[39] This terminological distinction is rarely followed, though. "Adaptive landscapes" and "fitness landscapes" are regularly conflated or distinguished differently by different authors.[40]

A third version, sometimes called a phenotypic landscape, is preferred among morphologists and quantitative geneticists and measures phenotypic morphologies against adaptiveness. In this version, the horizontal axes denote phenotypic frequencies within populations while the vertical axis represents the mean realized fitness of the population. To make the terminology even more confusing, George McGhee, one of the foremost writers on evolutionary landscapes, classifies this latter version as an adaptive landscape, conflating both earlier, genotypic versions under the label of fitness landscapes.[41] For clarity, I will adopt the more common practice of differentiating fitness, adaptive, and phenotypic landscapes. It is this

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[37] Ibid, 358.

[38] William B. Provine, *Sewall Wright and Evolutionary Biology* (Chicago: University of Chicago Press, 1986), 310 calls the diagrams "unintelligible" and "meaningless in any precise sense." However, Michael Ruse, "Are Pictures Really Necessary? The Case of Sewall Wright's Adaptive Landscapes," in *Picturing Knowledge: Historical and Philosophical Programs Concerning the Use of Art in Science*, ed. Brian S. Baigrie, (Toronto: University of Toronto Press, 1996), 303-337 staunchly defends Wright's adaptive landscapes.

[39] This distinction is adopted by David McCandlish and Samir Okasha.

[40] Other names include adaptive topographies and surfaces of selective value.

[41] George McGhee, *The Geometry of Evolution: Adaptive Landscapes and Theoretical Morphospaces* (Cambridge: Cambridge University Press, 2007), 1-5.

final, phenotypic version that is most relevant to the topic of evolutionary causation, for, given the ATTIF, it is the causal interaction between environments and organisms, not their genes, that is the locus of natural selection. As Depew and Weber observe, thinkers after Wright (notably, Dobzhansky, Mayr, Huxley, and Simpson) came to similar conclusions, observing "the causal primacy of matches or mismatches between environments and phenotypes, noting that even the best genotypes can make it across the generational bottleneck only if they succeed at the phenotypic level."[42] In fact, George Gaylord Simpson was the first to transform Wright's method into a phenotypic landscape as a way of mapping macroevolution (distinguishing it from Wright's method for mapping microevolution).[43] Thus, while all three versions suggest a teleological trajectory for the evolutionary process, phenotypic landscapes offer a mapping at the actual causal level of natural selection.

Wright hypothesized that the sheer number of genetic combinations entailed that "there will be an enormous number of widely separated harmonious combinations,"[44] leading to a rugged look to the terrain with multiple peaks separated by vast fitness "valleys"—a conclusion that represents a consensus view among biologists.[45] Gavrilets summarizes, "Different peaks can be viewed as alternative solutions to the problem of survival, which all biological organisms face. Fitness peaks that are sufficiently far away from each other in the genotype space may be thought of as corresponding to different species (real or potential)."[46] While, according to Wright, natural selection drives populations up adaptive peaks via the steepest

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[42] David J. Depew and Bruce H. Weber, "The Fate of Darwinism: Evolution After the Modern Synthesis," *Biological Theory* 6 (2011): 92.

[43] George Gaylord Simpson, *Tempo and Mode in Evolution* (New York: Columbia University Press, 1944).

[44] Wright, "Roles of Mutation," 358.

[45] Sergey Gavrilets, *Fitness Landscapes and the Origin of Species* (Princeton and Oxford: Princeton University Press, 2004), 53. Stuart Kauffman, *At Home in the Universe* (Oxford: Oxford University Press, 1995) has given this argument extensive mathematical rigor. He labels a uniform landscape with a single peak a Fujiyama landscape. These, he maintains, are exceedingly rare due to the frequent interactions between genes that affect overall fitness (a process known as epistasis). Kauffman's work also reveals the highest peak is climbable from the largest number of regions, leading to the frequency of convergent evolution.

[46] Gavrilets, *Fitness Landscapes*, 35.

gradient (a feature known as “hill climbing” or directional selection),[47] this process does not entail that the highest peak is ever reached. If a shorter yet closer peak is available, a population may follow that trajectory and remain evolutionarily static once reaching its shallower summit—an effect called stabilizing selection.[48] Only other effects, such as genetic drift, can cause the population to plummet off a local peak into maladaptation and explore nearby terrain for higher elevations.[49] This movement from adaptive valleys to peaks is synonymous with a species’ evolution towards specialization—a process Richard Strathmann argues accounts for most evolutionary scenarios.[50] Thus, if “peak jumping”—the transition of a population from one peak to another—occurs, it will most likely come from generalists occupying the lower valley regions of the landscapes.[51]

In nature, these peaks are unstable; thus, a more realistic (and complex) mapping involves a landscape topography that is in constant flux. In fact, there are circumstances where a population will continuously “chase” a peak, climbing uphill endlessly while the peak perpetually retreats. These scenarios have been labeled the “Red Queen Hypothesis”, paying homage to Lewis Carroll’s *Through the Looking Glass*. Local extinctions may even result in circumstances where a peak recedes quick enough to force the population downward toward maladaptive valleys. As Samir Okasha summarizes, “‘Mother nature’ is continually striving for a goal but not necessarily getting any nearer it.”[52]

Due to the need to equate each genotype/phenotype with a corresponding dimension (plus one for realized fitness), the most accurate and valuable landscapes will often necessitate hundreds of dimensions. As Sergey Gavrilets wryly remarks, “Obviously, these numbers are

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[47] McGhee, *Geometry of Evolution*,9.
[48] Ibid, 11.
[49] Gavrilets, *Fitness Landscapes*, 53.
[50] Richard Strathmann, “Progressive Vacating of Adaptive Types during the Phanerozoic,” *Evolution* 32 (1978): 907-914.
[51] McGhee, *Geometry of Evolution*, 23.
[52] Okasha, *Agents and Goals*, 20.

much bigger than the two or three dimensions we are used to."[53] Only the simplest visualizations can be achieved in two or three dimensions, and these are mostly used only for didactic purposes. Heuristically valuable landscapes cannot be described graphically, leading to Gavrilets distinction between a true landscape and its three-dimensional "metaphor".[54] In their high-dimensional, nonmetaphorical form, the simple topography of a landscape disappears, leading to qualitatively different outcomes. For instance, McCandlish notes that the distance between peaks is radically diminished, so that "the set of high fitness genotypes generically forms a connected network."[55] Thus, traversing peaks becomes far more trivial in these more complex models. Gavrilets and Janko Gravner have also utilized a Boolean-style mathematical model to craft a multidimensional alternative that looks radically different from the familiar hilly landscapes. Their results show a flatter surface with numerous holes—a result they aptly title the "holey landscape."[56] Accordingly, evolution proceeds in this model not by hill climbing but by jumps from one hole to the next through dimensional bypasses. Thus, the metaphor of a landscape, while heuristically valuable, lacks many of the qualities revealed by these more realistic, higher dimensional models.[57]

Yet these issues only reveal the need for more complex models; they do not seriously challenge the basic conclusions of Wright regarding the directionality of natural selection and the possibility of mapping its vector. However, more serious objections to evolutionary landscapes come from Samir Okasha. While more accepting of biological teleology within individual organisms, Okasha resists personifying natural selection itself as a rational agent with the goal of maximizing fitness.[58] Accordingly, he notes sexual reproduction problematizes

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[53] Gavrilets, *Fitness Landscapes*, 28.

[54] Ibid, 34.

[55] McCandlish, "Visualizing Fitness," 1545.

[56] Sergey Gavrilets and Janko Gravner, "Percolation on the Fitness Hypercube and the Evolution of Reproductive Isolation," *Journal of Theoretical Biology* 184 (1997): 51-64.

[57] McGhee, *Geometry of Evolution*, 51 calls these simplistic illustrations "imaginary or conceptual."

[58] Okasha, *Agents and Goals*, 15-6

the premise that selection events inevitably drive fitness upward. Sexually reproducing organisms do not perfectly transfer their traits to their offspring but only via random sampling with their mate. As such, their offspring will not share their fitness.[59] Okasha also demonstrates populations do not always follow the steepest gradient up a hill. If multiple alleles are present (rather than just two), the hill climbing will follow a curved path.[60]

Superficially, Okasha's argument would seem to demonstrate that natural selection need not be oriented toward the good of the species (in this case, the reproductive success of the population)—a conclusion at odds with the ATTIF. However, Okasha recognizes that these problems only emerge in the genotypic versions of landscapes. As he states, "In its phenotypic version the situation is somewhat different. Standard quantitative genetics does recover the hill-climbing property for phenotypic evolution" provided certain standard assumptions.[61] He therefore concludes:

> The quantitative-genetic analysis of phenotypic evolution… partially vindicates the adaptive landscape view of evolution, by showing that the hill-climbing property holds in an important class of evolutionary models. This suggests that critics who dismiss the adaptive landscape as "mere metaphor" have overstated their case.[62]

Thus, Okasha admits, "Evolutionary models in which the hill-climbing property obtains can be regarded as formal expressions of Darwin's argument that natural selection will tend to produce well-adapted individuals."[63]

Okasha offers another objection to the analogy of a rational agent. He notes that the failure of a population to demonstrate hill climbing is not *always* the result of extraneous constraints. For instance, offspring of sexually reproducing species will often fail to bear the

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[59] Ibid, 76.
[60] Ibid, 78.
[61] Ibid.
[62] Ibid, 79.
[63] Ibid, 81; ibid, 80-81 also notes that certain genetic limitations often prevent the highest average individual fitness from corresponding to the highest populational fitness. However, as noted in chapter 3, this results from the subordination of a lower good (individual fitness) to a higher good (populational fitness).

fitness of their parents. This, argues Okasha, is not a "perturbing factor" but "a structural feature of biological populations."[64] However, this objection fails to justify Okasha's broader project of dismantling any teleological interpretation of landscapes; sexual reproduction evolved *for the sake of* some greater good—namely, the reproductive success of species bearing this feature. If passing on a fit trait faithfully—a near guarantee in asexual reproduction—was, overall, a better method for ensuring the fitness of a population, then it becomes inexplicable why sexual reproduction would have succeeded in so many distinct lineages. Sexual reproduction evolved and persists due to the fact that it produces greater diversity through recombination. Thus, populations are better able to explore and discover nearby fitness peaks. In short, the real problem is not the similarity between evolutionary landscapes and rational agents but Okasha's failure to note just *how similar* the two are. Rational agents will make tradeoffs and sacrifices; similarly, while sexual reproduction may temporarily reduce a population's fitness, it is an overall good for a species. Species need to have inbuilt mechanisms for occasionally reducing their average fitness in order to explore the nearby terrain for higher peaks. As Wright himself argues in his original article, the ideal for a population is a "certain balance" between variation and selection.[65] Each factor serves a vital role in the evolution and fitness of the species.[66]

Another objection is that evolutionary landscapes, while heuristically useful, are ineffective in any real analysis. Okasha acknowledges the analytical value of evolutionary landscapes but only denies any further teleological implications. However, the contention that landscapes fail even to provide heuristic value still appears occasionally, such as in Peter O'Donald's assertion that the concept is a "seductive and erroneous metaphor of the

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[64] Ibid, 83.

[65] Wright, "Roles of Mutation," 365-6.

[66] Cf. Daniel J. Nicholson, "Is the Cell *Really* a Machine?" *Journal of Theoretical Biology* 477 (2019): 118 for an analogical phenomenon in cellular development.

evolutionary process."[67] This claim is demonstrably mistaken. For instance, John Reiss documents the common usage of adaptive landscapes in protein and nucleic acid evolution.[68] Similarly, George McGhee demonstrates that phenotypic landscapes, when combined with theoretical morphospaces, reveal efficiency peaks for the various theoretical morphologies. In one example, McGhee demonstrates how the evolutionary trajectory of ammonoid morphology matches what is predicted by these landscapes. In their actual evolutionary history, ammonoid shell morphology largely explored only those regions within the morphospace matching higher degrees of swimming efficiency.[69] He therefore concludes that a phenotypic landscape "is not merely a conceptual model, a heuristic device for thinking about evolution. It is an actual analysis of the adaptive significance of morphology that has been evolved by an actual group of animals."[70]

Thus, by conjoining phenotypic landscapes with theoretical morphospaces, biologists can determine why only certain regions of morphospaces are explored by evolving populations. Moreover, they can also reveal highly adapted morphologies that are unexplored, due either to geometric, phylogenetic, or developmental restrictions.[71] According to McGhee, this revival of study on morphological and developmental constraints on the evolutionary process resuscitates the project of Johann Wolfgang von Goethe and the early morphologists, harkening them back into conversation with Darwin.[72]

Wright's landscape has thus proven to be a valuable asset in biological research—one that is not only compatible with the ATTIF but overtly suggestive of the very same teleological

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[67] Peter O'Donald, Review of *Foundations of Mathematical Genetics* by A. W. F. Edwards, *Heredity* 84 (2000): 621.

[68] John O. Reiss, *Not by Design: Retiring Darwin's Watchmaker* (Berkeley: University of California Press, 2009), 187.

[69] McGhee, *Geometry of Evolution*, 72-6.

[70] Ibid, 82.

[71] Ibid, 175.

[72] Ibid, 180-3.

conclusions. Indeed, Okasha is not alone in noticing the inherent teleological character of evolutionary landscapes. John Reiss also describes these models as "a fundamentally teleological way of thinking about evolution."[73] Populations are treated as being teleologically drawn toward regions of higher fitness, and current conditions of maladaptation can be resolved by natural selection impelling populations towards some potential future state of greater adaptation. Thus, landscapes treat fitness peaks as "goals" that populations are drawn towards.

Perhaps unsurprisingly, Wright's landscapes were initially inspired by his observations of another teleological process—namely, domestic breeding.[74] Yet while the values and goals of breeders are obvious, Reiss objects, "No such a priori standard of overall value exists in nature."[75] Reiss thus dismisses such metaphors purely for their intrinsic teleological nature and despite their merit in scientific research. Yet if a concept has proven its theoretical value as part of our best theories (as fitness has), any metaphysical prejudice ought to be put aside, lest the biologist allow personal philosophies to dictate the measures of what constitutes good science. Indeed, biology is inescapably metaphysical; one either treats organisms mechanistically or teleologically. The question then becomes which of the two fits better with our best scientific models. Given this, it is reasonable to interpret evolutionary landscapes as analogous to rational agents choosing a good—a good understood by the ATTIF—and it is suggestive that Wright's original work was inspired by this very practice among domestic breeders.

Yet Wright offers another metaphor for the evolutionary process—one equally teleological and perhaps more appropriate for biological lifeforms. As noted above, Wright documented the delicate balance populations must maintain between variation and selection.[76]

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[73] Reiss, *Not by Design*, 176.

[74] Sewell Wright, *Evolution: Selected Papers*, ed. William Provine (Chicago: University of Chicago Press, 1986), 1.

[75] Reiss, *Not by Design*, 174.

[76] Cf. Kurt Schwenk and Günter Wagner, "The Relativism of Constraints on Phenotypic Evolution," in *The Evolution of Complex Phenotypes*, eds. Massimo Pigliucci and Katherine Preston (Oxford: Oxford University Press, 2004), 390.

Too much of either would be detrimental to the evolution of the population. He then notes, “In this dependence on balance the species is like a living organism. At all levels of organization, life depends on the maintenance of a certain balance among its factors.”[77] In other words, just as an organism maintains its internal balance through its homeostatic functions, so also there are mechanisms for preserving the internal balance within a population’s evolutionary process. In each case, organisms/populations are drawn to certain ends as goods and, once achieved, attempt to maintain a state of stability. For populations, this is stabilizing selection whereas, for organisms, this is homeostasis. I turn now to consider homeostasis and other such instances of individual-level teleology.

3. Individual-Level Teleology

Under individual-level teleology, I will examine the concepts of homeostasis/metabolism and homeorhesis. Unlike niches and landscapes, the teleological beneficiaries of these processes are the organisms themselves rather than some broader population/species. Homeostasis/metabolism corresponds to the third aim of the ATTIF—namely, survival—whereas homeorhesis aligns with the first aim of development.[78] In other words, I will treat organisms as self-organizing, autonomous agents with their own intrinsic aims and ask how this affects our understanding of the evolutionary process. Since survival is the more distal aim, survival acts as the end and ordering principle of prior teleological aims. I will, therefore, consider this more distal aim first before considering development.[79]

Rather than merely outlining these biological activities—a description that can be found in most biology textbooks—I will instead examine the works of scholars who have noted the

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[77] Wright, “Roles of Mutation,” 365. Nicholson, “Is the Cell,” 123 notes a similar balance in cells between structural stability and functional plasticity.

[78] As Okasha, *Agents and Goals*, 31 notes, while individual traits have unique functions, these are all subsidiary to and ordered by the “unity-of-purpose” exhibited by organisms. The exceptions to this rule are sexual traits which function for the sake of reproduction (the more distal aim for which they are a prerequisite) rather than survival.

[79] Functionality, the secondary aim of the ATTIF, will be considered separately in the next chapter.

teleological character of these processes. For the former, I will compare the work of physiologist J. Scott Turner and philosopher Hans Jonas. Though vastly different in academic backgrounds, they have arrived at remarkably similar conclusions—a fact seemingly unnoticed by other scholars.[80] For the latter section, I will examine the work of Conrad H. Waddington, whose work and influence on modern biology is commonly overlooked.

3.1 Metabolism/Homeostasis

Treating biological lifeforms as self-organizing dynamical systems has become far more common within theoretical biology in the past few decades. This entails treating organisms as systems in which there is (or often can be) a diminution of entropy, resulting in what is known as a dissipative system. While such systems are not unknown to naturally occur, in lifeforms, this dynamic, responsive process is produced and maintained by the organisms themselves. As philosopher Spyridon Koutroufinis writes, "In modeling organisms as dynamic systems, these changes ought to be described as internally controlled changes of many parameters, if the model makers are to make good on their claim to have created a model that… gives an insight into a real organism's causality."[81] The difficulties of explaining these systems on purely mechanistic terms without resorting to the goals and aims of the organism leads Koutroufinis to conclude, "We should endeavor to think about concepts of teleology beyond contemporary mainstream physicalism."[82]

Two radically distinct yet equally prolific scholars who have already pressed for this conclusion have been J. Scott Turner and Hans Jonas. While the former is a trained biologist and the latter a product of the continental philosophical tradition, each has observed the same

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[80] The single exception I have found is Carmody T. S. Grey, "Theology, Science and Life with John Milbank and Hans Jonas," PhD diss. (University of Bristol, 2017), 259.

[81] Spyridon Koutroufinis, "Teleodynamics: A Neo-Naturalistic Conception of Organismic Teleology," in *Beyond Mechanism: Putting Life Back into Biology*, ed. Brian G. Henning and Adam C. Scarfe (Lanham, MD: Lexington Books, 2013), 327.

[82] Ibid, 331.

responsive, agential properties of lifeforms and treated these features as not only *one* key attribute of living organisms but *the* key features that define what it means to be alive.[83] Turner considers this process under the label homeostasis—a concept he traces back to Claude Bernard.[84] By contrast, Jonas opts for the label "metabolism." Despite the differences in terminology—a fact that has likely prevented any earlier comparison of their works—the underlying thesis is strikingly similar.

3.1.1 Homeostasis and J. Scott Turner

According to Turner, biology's unspoken first law has been evolution via natural selection. While true, this law, on its own, deprives life of what makes it ontologically unique. Thus, Turner proposes the need for "Biology's Second Law" which would allow "reintroducing purposefulness to biology."[85] Accordingly, his thesis asserts that "evolution is driven not by natural selection, but by homeostasis, and the implied striving and desire that homeostasis implies"—a proposal he rightly calls a "radical idea".[86] However, Turner does not deny the role of natural selection. Rather, he maintains that Bernard's concept of homeostasis delivers a vision "complementary" to Darwin's.[87]

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[83] Mark Bedau, "Where's the Good in Teleology?" *Philosophy and Phenomenological Research* 54, no. 4 (Dec. 1992): 787 has equally noted that self-sustaining processes are teleological only in those cases where the end achieved is good. A stick in a river pinned against an obstacle might create a backwash, thus generating a stable state. However, this is not considered an example of teleology. He therefore writes, "This suggests that only when the causal history identified by the etiological analysis involves a value-centered system can teleology be present."

[84] Arran Gare, "Chreods, Homeorhesis and Biofields: Finding the Right Path for Science through Daoism," *Progress in Biophysics and Molecular Biology* 131 (2017): 62 notes that Friedrich Schelling offered a more primitive version of the concept in 1799. Daniel J. Nicholson, "Reconceptualizing the Organism: From Complex Machine to Flowing Stream," in *Everything Flows: Towards a Processual Philosophy of Biology*, eds. Daniel J. Nicholson and John Dupré (Oxford: Oxford University Press, 2018), 145 adds that the concept was not fully systematized until Ludwig von Bertalanffy and was not termed "homeostasis" until 1926 by Walter Cannon.

[85] J. Scott Turner, "Biology's Second Law: Homeostasis, Purpose, and Desire," in *Beyond Mechanism: Putting Life Back into Biology*, ed. Brian G. Henning and Adam C. Scarfe (Lanham, MD: Lexington Books, 2013), 195.

[86] Turner, *Purpose & Desire*, 153.

[87] Turner, "Biology's Second," 186; in J. Scott Turner, *The Tinkerer's Accomplice: How Design Emerges from Life Itself* (Cambridge, MA: Harvard University Press, 2007), 27, Turner provides what is perhaps his best illustration of this complementarity by contrasting a Bernard machine, which is "simultaneously structure and function" with a Darwin machine, which is a self-replicating system driven by natural selection.

Claude Bernard is one of the central figures of nineteenth-century biology, credited for the invention of experimental physiology. Yet despite his place in scientific history, his conclusions regarding homeostasis are, according to Turner, at odds with the prevailing mechanistic assumptions of our day, for they are formed around a “profoundly vitalist idea.”[88] As Bernard himself states:

> The result is that physicists and chemists can reject all idea of final causes for the facts that they observe; while physiologists are inclined to acknowledge an harmonious and pre-established unity in an organized body, all of whose partial actions are interdependent and mutually generative.[89]

Bernard is thus driven to admit that an organism’s unity-of-purpose is fundamental for the physiologist’s project of understanding the composition of lifeforms—a conclusion Turner asserts derived from the vitalist tradition. While his defense of any form of vitalism will undoubtedly startle his scientific readership,[90] Turner quickly specifies why Bernard’s analysis provides an exceptional case that offers “a middle path that was not quite mechanism and not quite vital essence, but a hybrid, and an extraordinarily fruitful hybrid at that.”[91]

In fact, the concept of homeostasis has already proven fruitful in cybernetics through the work of Norbert Weiner.[92] Yet Turner cautions that this success has blinded us to the fact that machine learning, driven only by a negative feedback mechanism, is not equivalent to actual homeostasis since, in the latter case, organisms *want* certain states over others.[93] If organisms are not analogous to machines, what, then, would be a more appropriate metaphor for life? Turner opts for Theophile de Bordeu’s analogy of “many little lives” since it rightly captures the semiautonomous agencies of the parts of organisms that are coordinated around a

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[88] Turner, *Purpose & Desire*, 38.

[89] Claude Bernard, *An Introduction to the Study of Experimental Medicine*, trans. Henry Copley Greene (New York City: Henry Schuman, Inc., 1949), 89.

[90] Turner reminds his reader that Lamarck, Cuvier (see Turner, *Purpose & Desire*, 91), and even Paley (see Turner, “Biology’s Second,” 188) had vitalistic influences on Darwin’s thought.

[91] Turner, *Purpose & Desire*, 44.

[92] Gare, “Chreods, Homeorhesis,” 62.

[93] Turner, *Purpose & Desire*, 60ff offers some examples, such as research into body temperature control.

central goal through a process of accommodation and cooperation.[94] In other words, if Wright revealed how a population compares to an organism, de Bordeu has returned the favor. Similar teleological structures of cooperation towards a unifying goal appear in each case.[95]

Given this, an organism is best conceived not as a static object but as a process—or, better yet, an act. According to Turner, Bernard's novel application of the "many little lives" analogy was relating it to the phenomenon of adaptation. Organisms' ability to negotiate with rapidly changing environmental conditions suggested a level of independence from the environment, whereby the "many little lives" of an organism mutually accommodated one another in the face of these environmental stressors.[96] Put in the language of open-system thermodynamics, adaptations are the responses by the "many little lives" that maintain thermodynamic disequilibrium and resist changes to the internal state of the organism.[97] Thus, "Adaptation in the physiological sense is really a phenomenon of… striving, and desire" which requires living bodies "to be aware of their surroundings, to be aware of what they are, and to strive…to a particular state."[98]

Turner asserts that contemporary scientific treatments of homeostasis have overlooked this vital (and vitalistic) feature in order to constrain it within mechanistic metaphysics, leaving the concept in a "cramped and desiccated form."[99] This contemporary, mechanistic version, what Turner calls "a clockwork homeostasis," has maintained itself "on narrative, rather than on evidence."[100] Against this view, Turner cites a catalog of research demonstrating the

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[94] Ibid, 31.

[95] Depew and Weber, "Fate of Darwinism," 100 make a similar comparison: "Organisms can be viewed in this light not simply when they are seen as intrinsically tied to the ecological systems of which they are crucial components, but when they are defined as ecological systems themselves—bounded and tightened ecosystems governed by massive feedback, both positive and negative, from and to the species-specific environments to which they are by definition related." It should be noted that I am *not* here saying that organisms are mere aggregates of parts.

[96] Turner, *Purpose & Desire*, 39.

[97] Turner, "Biology's Secon," 193.

[98] Turner, *Purpose & Desire*, 72.

[99] Ibid, 26.

[100] Ibid, 47.

autonomous yet cooperative action of individual cells and organs in the maintenance of blood acidity, blood sugar, stress, adaptive responses, and body temperature. Additionally, certain cells "seem to be homeostatic agents unto themselves, capable of sensing temperature, making comparisons, and even bringing about a degree of self-maintenance of temperature on their own."[101] In short, it is difficult to account for these actions on purely mechanistic grounds without acknowledging the *wants* of the organism and its "little lives." This is, for Turner, perhaps best demonstrated by thermoregulation among certain lizards. These cold-blooded organisms will bask in the sun for inordinately long periods when they are sick so that they can raise their body temperatures and combat the disease. Additionally, lizard behavior responds to environmental factors, so that lizards in shadier environments will risk being preyed upon in order to soak in more of the sun's rays. Turner summarizes: "It appears, then, that lizards actively take stock of their environments and determine what temperature they will sustain based upon a perceived matrix of costs, benefits, and risks."[102] Against a Darwinian paradigm that has treated individual organisms as mere repositories of genes, Turner offers a view that treats the organism "as a universe unto itself."[103]

How does this conclusion support the central claim of homeostasis's role in evolution? According to Turner, Darwinism, as currently conceived, relies upon an etiological view of adaptations: traits that work now do so because they did in the past. Yet if organisms are conceived as "many little lives" displaying a unity-of-purpose, a more accurate statement would be "what works now works because there is (was) an *intention* to make it work."[104] Against a Darwinian mindset and its "utter absence of intentionality or goal directedness,"

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[101] Ibid, 65.
[102] Ibid, 70.
[103] Ibid, 190.
[104] Ibid, 180. In Turner, "Biology's Second," 194ff, he even posits a "physiological definition of evolutionary fitness" as a resolution to the problem of fitness (see chapter 3). Living systems capable of more robust homeostasis (labeled "persistors") will enhance an organism's survival and reproduction, thus providing another subject of natural selection beyond genetics.

Bernard's conception is "frankly teleological, imbued with the goal-seeking behavior and purposefulness that is at the heart of homeostasis."[105]

And herein lies one of Turner's most provocative claims: all biological agents (including cells) are cognitive beings. Turner's usage of "cognitive" can be easily misinterpreted, as he defines the term in its "broadest possible sense" to denote any mapping by an agent of an external environment that impacts its internal processes.[106] Thus, Turner avoids attributing consciousness to unicellular beings. Under this more restricted definition, cells can be regarded as cognitive agents since they possess a litany of protein receptor molecules that enable an environmental response. As Turner writes, "Cognitive mapping of this sort appears to be a universal phenomenon of cellular life."[107] This cognitive mapping is the "flip side" of intentionality, as these maps are connected to mechanisms that operate to mold and utilize the environment in response to certain goals.[108]

Without this distinction between a homeostatic inner life and an external ambient environment, Turner maintains there can be no coherent concept of an organism. In other words, it is the teleological unity-of-purpose that constitutes a single lifeform in distinction from its environment.[109] Turner labels the barrier between the organism and its exterior as its "adaptive boundary". This seemingly simple distinction entails a significant conclusion. As noted, an individual cell is itself a cognitive agent with its own internal homeostatic mechanism, implying that it, too, ought to be treated as an independent organism. Turner freely accepts this conclusion, arguing that boundaries are nested layers of intentionality.[110] Cells, organs, and organisms constitute only three layers of this hierarchy, one that Turner believes

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[105] Turner, *Tinkerer's Accomplice*, 28.
[106] Turner, *Purpose & Desire*, 180.
[107] Ibid, 181.
[108] Ibid, 181-2.
[109] Ibid, ch. 9.
[110] Turner, "Biology's Second," 194.

can be extended to insect colonies, Clementsian ecosystems, and "ultimately to the planetary scale."[111] This radical concept of the extended organism suggests homeostasis and cognition are the only adequate means for discerning an individual organism (defining an individual as "a cognitive being that has a sense of itself as something distinct from its environment").[112] In all these instances, the case could be made that the minimum requirements for cognition are, in fact, met. While it goes beyond the scope of the chapter to defend this particular view of organisms, I will note the similarity between the teleological hierarchy of Turner's proposal and the ATTIF's hierarchical notion of goods, which (when combined with the metaphysical notion of goodness) could potentially extend upward to God as the ultimate *telos* of all things.

To summarize, life, at all its levels, is teleological, and its evolution through time is no exception. As Turner himself states, "Evolution now becomes a phenomenon driven largely by the intentions of the cognitively individual actors."[113] The purposeful and desiring aspect of life is the "missing ingredient" without which "modern evolution is just a magnificent contrivance,"[114] for natural selection, as noted, does not generate homeostasis but is driven by it, acting to preserve only those systems that most reliably preserve themselves. Caricaturing Dawkins, Turner declares that homeostasis "makes it possible to be an intellectually fulfilled vitalist."[115] While, as his reviewers have noted, these claims are sure to make "traditional neo-Darwinists recoil aghast," they are nevertheless "arguably empirically irrefutable."[116]

3.1.2 Metabolism and Hans Jonas

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[111] Ibid. Turner does not endorse the Gaia hypothesis since this conflates global consciousness, something Turner denies, with global cognition.

[112] Turner, *Purpose & Desire*, 221.

[113] Ibid, 222.

[114] Ibid, 290.

[115] Ibid, 292.

[116] Addy Pross, Review of *Purpose and Desire: What Makes Something 'Alive' and Why Modern Darwinism Has Failed to Explain it*, *The Quarterly Review of Biology* 93, no. 1 (Mar. 2018): 18-19.

For Hans Jonas, by contrast, the fundamental feature of living organisms is identified not as homeostasis but rather as metabolism. However, for reasons that will become clear, the terms are largely coextensive. And, in fact, Daniel Nicholson, whose philosophical work is in many ways a contemporary extension of Jonas's, has used the two terms interchangeably to account for the unique thermodynamic character of organisms.[117] Nicholson, along with Denis Walsh, are among a growing number of philosophers of biology who are encouraging a revival of interest in Jonas's thought.[118] For these reasons, a comparison is warranted between the philosopher and the physiologist.

Jonas, a student of Heidegger, was unsatisfied by the denial of purpose and order in the cosmos—a rejection he believed derived from modern materialism.[119] If the true phenomenological "testimony of life" was not to be "suppressed," modern scientific modes of understanding must be surpassed.[120] What is this testimony? It is that life reveals a hierarchical scale of freedom—a freedom conferred by the process of metabolism. The emergence of metabolism first allowed for the independence of the creature from its environment and, consequently, the first inklings of mentation in the form of purposive responses by an independent organism to its habitat. In short, "Life means spontaneous and teleological motion."[121]

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[117] See Nicholson, "Reconceptualizing the Organism," 145. Nicholson declares metabolism "as the single most important characteristic of life" (ibid).

[118] Ibid. Cf. Denis M. Walsh, "Objectcy and Agency: Towards a Methodological Vitalism," in *Everything Flows: Towards a Processual Philosophy of Biology*, ed. Daniel J. Nicholson and John Dupré (Oxford: Oxford University Press, 2018), 169. The concept of metabolism has also motivated Humberto Maturana and Francisco Varela's work on autopoiesis.

[119] Lewis Coyne, *Hans Jonas: Life, Technology, and the Horizons of Responsibility* (London: Bloomsbury Academic, 2021), 37.

[120] Hans Jonas, *The Phenomenon of Life: Towards a Philosophical Biology* (Evanston: IL: Northwestern University Press, 2001), 2.

[121] Ibid, 74. Cf. Dorian Sagan and Lynn Margulis, "'Wind at Life's Back'—Toward a Naturalistic, Whiteheadian Teleology: Symbiogenesis and the Second Law," in *Beyond Mechanism: Putting Life Back into Biology*, ed. Brian G. Henning and Adam C. Scarfe (Lanham, MD: Lexington Books, 2013).

This was, for Jonas, the traditional understanding of the world prior to modernity. In fact, for earlier humanity, "Bare matter, that is, truly inanimate, 'dead' matter, was yet to be discovered."[122] Panvitalism reigned as an obvious truth, and it was death, not life, that posed the most perplexing question in need of resolution (most often answered by the hypothesis of the postmortem survival of the soul).[123] By contrast, modern thought inverted this polarity: death is the norm, and life is the problem to be solved.[124] The "lifeless" thus constituted "the knowable par excellence and for that reason also [was] considered the true and only foundation of reality."[125] Life, once a universal feature of a dynamic cosmos, was reduced to a property of organisms alone, and what was "the least intelligent has become the most intelligible, the least reasonable the most rational."[126] How, then, does the materialist explain the odd exceptions to the reign of death? For Jonas, "Precisely this is the task set to modern biological science by the goal of 'science' as such."[127]

In sum, "Our thinking today is under the ontological dominance of death."[128] The world, once sensed as imbued with life, has been diminished via the subtraction of its inner vitality and transformed into the panmechanistic monism of the moderns. The only place left for life is in a separate world of the *res cogitans* achieved by Cartesian dualism—a renaissance of classical Gnosticism according to Jonas. Any postdualistic metaphysics, be it physicalist or idealist, achieves its results only by ignoring the aspect of the world represented by the other half of the Cartesian divide. If any real progress is to be made, "A new, integral, i.e., philosophical monism cannot undo the polarity: it must absorb it into a higher unity of existence

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[122] Jonas, *Phenomenon of Life*, 7.

[123] Jonas himself was likely not a panvitalist, despite his positive descriptions of these ancient beliefs.

[124] In ibid, 38, he does concede that early deistic moderns were still able to privilege life by declaring God, the great mathematician, as the font of creation—though it was a creation that was wholly mechanical. He later cautions that this theology "raises the question whether the mathematician that is the great architect of the universe is also the architect, great or little, of the amoeba. He must be both, or he is neither" (ibid, 65).

[125] Ibid, 10.

[126] Ibid, 69.

[127] Ibid, 11.

[128] Ibid, 12.

from which the opposites issue as faces of its being or phases of its becoming."[129] Philosophy, then, must embrace a "psychophysical unity," for any comprehensive description of the physical aspect of biological life is forced into the realm of the mental and vice versa.[130] There cannot be any sharp division of the two. As Lewis Coyne notes in his commentary, "The living body straddles the purported division of mind and matter."[131]

From this conclusion, Jonas rejects modernity's misplaced anathematization of anthropomorphisms, for it is only through the body and its experiences that we come to know the world at all. It is our sole mode of access to reality, and it reveals that matter in space has an "inner horizon."[132] Therefore, by rendering life (including human life) unintelligible, as moderns have achieved by granting intelligibility first and foremost to dead matter, one "renders the world unintelligible as well."[133] If the testimony of life cannot be trusted, we are left without access to the world.[134] Thus, our psychophysical nature is not a detriment to knowledge but the very means to its acquisition. As living beings, we "happen to have inside knowledge" that grants the biologist the capacity to distinguish her subject matter—a *living* organism—from nonliving entities.[135] This distinction is made through the recognition of teleological agency in other beings. As Jonas succinctly summarizes, "There is no organism

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[129] Ibid, 17.

[130] Ibid, 18.

[131] Coyne, *Hans Jonas*, 39. Coyne further argues that Jonas regarded this to be a principal failure of Heidegger's account of *Dasein*, for Heidegger "had from the beginning overlooked the corporeality of *Dasein* and its connection to nature" (ibid, 43). Heidegger thus became a victim of modernity's failed ontology.

[132] Jonas, *Phenomenon of Life*, 24. Jonas thus criticizes Humean causation: "Force indeed is not a datum, but an 'actum' humanly present in effort." Causation, as such, is not a percept but the objectification of what is experienced internally.

[133] Ibid, 25. Jonas also denounces Francis Bacon for initiating this rejection of teleology. Bacon, he argues, had relegated teleology to humanity alone, "implying that no inference must be drawn from the former [humanity] to the later [the universe], which again implies a basic difference of being between the two" (ibid, 33).

[134] As ibid, 36 further notes, the wresting of teleology from the physical sciences would ultimately see the decline of efficient causation, as well, under the withering critiques of Hume. Consequently, "Explanation has thus been forsaken for mere description, which…becomes pure mathematical description."

[135] Ibid, 79.

without teleology; there is no teleology without inwardness; and: life can be known only by life."[136]

How, then, does Jonas account for Darwinism and its supposed banishment of biological teleology? While, for most, the theory of natural selection may have "completed the extrusion of teleology from nature,"[137] Jonas argues a more careful examination would prove the opposite.[138] By asserting a common ancestry for all life and, by extension, the origination of life from nonlife, the question of mind's origin could no longer be avoided. Humanity could no longer be isolated from the rest of nature, for its evolutionary origins blurred such distinctions. As he writes, "Evolution precisely abolished the special position of man which had warranted the Cartesian treatment of all the remainder."[139] There no longer remained any reason to deny that animals were "bearers of that inwardness of which man… is conscious in himself."[140] How far back can mind be placed in the evolutionary tree? Jonas proposes no nonarbitrary line could be drawn, concluding that the presence of appetition in the most primitive of lifeforms suggests that "inwardness is coextensive with life."[141] Thus, like Turner, Jonas asserts that the unique teleological aims of organisms suggest an interiority that separates them from a broader environment. So, as Coyne summarizes, "It transpires that the Darwinian revolution, typically thought of as the final victory of mechanistic biology, in fact plays a key part in materialism's overcoming."[142]

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[136] Ibid, 91.

[137] Ibid, 44.

[138] Ibid, 51-2 characterizes natural selection as "a negative substitute for teleology," accounting only for the removal of forms rather than their emergence. The emergence of new forms, by contrast, is the product of stochastic mutations. For Jonas, this account creates a new dualism—namely, between the soma and its germ. Like the Cartesian model of "two noncommunicating substances," Weismann's barrier between soma and germ erects a barrier between the histories of these two aspects of the organism. Cf. Turner, *Purpose & Desire*, 39, who makes a similar observation.

[139] Jonas, *Phenomenon of Life*, 57.

[140] Ibid.

[141] Ibid, 58.

[142] Coyne, *Hans Jonas*, 47.

Having sketched Jonas's critique of contemporary biology, I return to what Jonas deemed the core feature of biological entities: metabolism. For Jonas, the identity of a lifeform is separate from its physical composition. The Aristotelian implication of this, he notes, is that there is "a certain independence of form with respect to its own matter,"[143] a distinction he regards as emerging "only with life."[144] As Daniel Nicholson writes, "For Jonas, organisms invert the ontological relation between matter and form found in inanimate objects" since in lifeforms, matter is subordinated to form rather than form to matter.[145] The form's freedom from matter, however, sets up an array of antinomies that life must contend with. An organism is alive, yet it contains within it the possibility of its opposite: death.[146] Its identity is not material, though it is dependent upon matter for its maintenance. It is thus free from matter yet enslaved by physical needs. It opposes the rule of entropy, yet it cannot overcome it.[147] The very means by which life contends with these negative poles of its own existence is the continual process of metabolism. Life, as such, is a processual act, remaining itself only via a continual replacement of its matter.[148]

Jonas can therefore conclude, "The organism must appear as a function of metabolism rather than metabolism as a function of the organism."[149] Metabolism thus serves an identical role for Jonas as homeostasis does for Turner; each asserts their respective biological process as constitutive of an organism. And, in each case, organisms are sustained only by the stability of this process—a result achieved only via the teleological orientation of the process towards

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[143] Jonas, *Phenomenon of Life*, 81.
[144] Ibid, 80.
[145] Nicholson, "Reconceptualizing the Organism," 156.
[146] Renaud Barbaras, *Introduction to a Phenomenology of Life* (Bloomington, IN: Indiana University Press, 2021), 209 criticizes Jonas at this point, for despite critiquing the ontological priority of death over life, Jonas here seems to embrace it. One could, in theory, rescue both parts of Jonas's thesis, though it would require regarding death as alien and intrusive to life, such as in the traditional Christian understanding of sin.
[147] Jonas, *Phenomenon of Life*, 5.
[148] Ibid, 76. More modern research has confirmed that the material substrate by which life subsists appears to be less important than once thought, as many bacteria use oxidize sulfur, iron, manganese, and other elements to power their metabolism.
[149] Jonas, *Phenomenon of Life*, 78.

its own continuity. In other words, organisms simply *are* the acts of metabolism/homeostasis. While the terms differ between the two authors, they are arguably coterminous.[150]

The form/matter distinction is not the only aspect of Aristotelianism Jonas adopts. Appropriating the Stagirite's terminology, Jonas asserts that the "*fact* of metabolic continuity is comprehended as an incessant *act*; that is, continuity is comprehended as self-continuation."[151] This continuous action is predicated upon an organism's cognitive capacities (to borrow Turner's phrase), for Jonas remarks, "Only by being sensitive can life be active" for it is "against the otherness without" that selfhood emerges.[152] In other words, the "self" of an organism is identical to its form, and, thus, "maintenance of form in an organism is actually a type of self-maintenance."[153] Echoing Turner, the organismal self that emerges is differentiated from its environment by an adaptive boundary that is consistently maintained by the process of metabolism.[154] For this reason, organisms cannot be reduced to their physical composition, which is endlessly renewed and replaced.[155] Because of these overt parallels to Aristotle, Coyne concludes that Jonas's "underlying aim" was a "partial rehabilitation of Aristotle's description of nature as immanently teleological."[156]

Jonas then clarifies that this teleological nature appears in two forms: the "self" and its behavior. First, the "self" that emerges as separate from the environment appears only via the

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[150] Nicholson, "Reconceptualizing the Organism," 158 evidences this in his commentary on Jonas where he defines metabolism as "persistence… grounded in the continuous self-maintenance of form." In Nicholson, "Is the Cell," 112, he recognizes that this processual persistence "implies shifting our attention from matter to form." Cf. Denis Walsh, "Aristotle and Contemporary Biology," in *The Cambridge Companion to Aristotle's Biology*, ed. Sophia M. Connell (Cambridge: Cambridge University Press, 2021), 294: "[Processual-emergence] forms the basis of Aristotle's theory of the organism."
[151] Jonas, *Phenomenon of Life*, 82. Emphasis in original.
[152] Ibid, 85.
[153] Nicholson, "Reconceptualizing the Organism," 157.
[154] Coyne, *Hans Jonas*, 57.
[155] Jonas, *Phenomenon of Life*, 99-100 further observes gradations in species' freedom from matter.
[156] Coyne, *Hans Jonas*, 46.

teleological unity-of-purpose of the organism, and it is this teleological unity which gives identity to the various physical traits of the organism. To quote Jonas at length:

> Eyes do have in their physical make-up a reference to seeing, and ears to hearing, and organs generally to their performance—and, more generally still, organisms to living. This is not just an additional aspect of them, or an optional mode of interpretation: it is their own teleological nature.[157]

In other words, an eye's identity does not derive merely from its physical structure; rather, *eyes see*. It is their particular function with respect to the organism that grants them their specific identity. The second type of teleology, organismal behavior, is equally defined by its goal.[158] For instance, the behavior of hunting takes many forms within the animal kingdom (with widely differing results), yet it constitutes only one type of behavior due to the common motivation of the activity—namely, catching prey.

Turner and Jonas thus offer strikingly similar cases for life's teleological underpinnings; moreover, their accounts corroborate the ATTIF at several points. To begin, Turner's analogy of "many little lives" provides a vivid image of the subordination of more proximal ends—namely, the functions of cells, tissues, and organs—to more distal ends—in this case, survival conceived of as homeostasis. In addition, Jonas freely acknowledges his argument is not value-neutral. He writes, "[W]ith any de facto pursued end […], attainment of it becomes a good, and frustration of it, an evil; and with this distinction the attributability of value begins."[159] Jonas further details the distinction between instrumental and intrinsic goods, regarding a creature's adaptations as mere means towards the one intrinsic good of survival. He writes, "Beyond all

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[157] Jonas, *Phenomenon of Life*, 90.

[158] Ibid, 86 demarcates between the temporal and spatial dimensions of organisms' behavior. The latter is defined by the aforementioned adaptive boundary that establishes an "external direction toward the co-present not-itself which holds the stuff relevant to its continuation" (i.e., the creature's habitat). The former term can likewise be divided into its forward-looking aspect, marked by appetition, and, in reminiscence of Bergson, a backwards-looking aspect defined by durational memory—the "subjective form of its identity."

[159] Hans Jonas, *The Imperative of Responsibility: In Search of an Ethic for the Technological Age*, trans. Hans Jonas and David Herr (Chicago: Chicago University Press, 1984), 79

instrumentality, [the organism] is for its own sake and an end in itself."[160] Jonas thus connects axiology and teleology in his philosophy of life—a feature it shares with the ATTIF. Moreover, it is the form of the species that provides the very metric by which such value judgments can be made. To declare a certain specimen as a "good" or "bad" representative of a species' way of life posits some normative standard that it is being measured against.[161] Thus, Jonas, in conjunction with Aristotle and Thomas, posits that the good of a creature is constituted by the actualization of its form.

One objection might be to ask whether the processual view of organisms, a view held by both authors, challenges the hylomorphic conception of Aristotle and Thomas. If organisms are processes rather than substantial "things", would this not hamper the application of Thomistic metaphysics to biology? Yet, according to Denis Walsh, the two views are a natural fit, for it is only the matter that is in process while the form provides the perduring identity. Thus,

> Aristotle's own theory of being – hylomorphism – … is admirably suited to the challenge of accounting for the "processual-emergent" nature of organisms. Organisms are clearly, according to Aristotle, dynamic and self-changing. They alone among complex things have inherent in them the capacity to move and change themselves.[162]

Moreover, as Nicholson reminds us, organisms move and change themselves *adaptively*, "in a way that optimizes their physiological performance."[163] Organisms are, as such, fundamentally teleological—a conclusion at home in Aristotle's biology. Having compared the work of Turner and Jonas with the ATTIF's more proximal aims, I turn now to the final concept: homeorhesis.

3.2 Homeorhesis

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[160] Hans Jonas, *Mortality and Morality: A Search for the Good after Auschwitz*, ed. Lawrence Vogel (Evanston, IL: Northwestern University Press, 1996), 93.

[161] Coyne, *Hans Jonas*, 101 has rightly labeled this "an Aristotelian notion."

[162] Walsh, "Aristotle," 293.

[163] Nicholson, "Reconceptualizing the Organism," 147.

Thus far, we have examined core concepts of biology as they relate to the teleological aims outlined by the ATTIF, transitioning from more distal to more proximal aims. I turn now to the concept of homeorhesis, which corresponds to the first aim of the ATTIF (development). While the developmental processes of organisms have been largely ignored by the modern synthesis, recent discoveries within the extended evolutionary synthesis have reversed this trend.[164] Specifically, the process of epigenetic development[165] has garnered increasing attention, thanks in part to the renaissance of interest in the efforts of Conrad Waddington,[166] whose work has, by one account, become "the standard theoretical reference point for the molecular explanation of developmental canalization."[167] During the mid-twentieth century, Waddington and a group of fellow scientists, known as the organicists, attempted to pave a middle path between mechanism and more extreme forms of vitalism.[168] Waddington, in particular, strove to develop a model for conceptualizing the goal-oriented pathways of embryonic development, and his final product, the epigenetic landscape.

Like Turner and Jonas, Waddington was fascinated by the capacity of life to maintain form through constant material transition, observing that an organism "is more nearly comparable to a river than to a mass of solid rock."[169] Similarly, Waddington marveled at the "almost… aesthetic quality" of the unity-of-purpose within organisms—a feature he struggled to express, variously calling it "wholeness," "integration," and "completeness."[170] These

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[164] Depew and Weber, "Fate of Darwinism," 97.

[165] Epigenesis is here defined as the generation of the form of an organism via cellular differentiation.

[166] Eva Jablonka and Marion J. Lamb, *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variations in the History of Life* (Cambridge, MA: The MIT Press, 2005), 265-6 credit this resurgence to research demonstrating ecological impacts on development and the applicability of Waddington's ideas for understanding gene regulatory networks.

[167] Flavia Fabris, "Waddington's Processual Epigenetics and the Debate over Cryptic Variability," in *Everything Flows: Towards a Processual Philosophy of Biology* (Oxford: Oxford University Press, 2018), 260.

[168] For a detailed account of the organicists and the Cambridge-based Theoretical Biology Club, see Erik L. Peterson, *The Life Organic: The Theoretical Biology Club and the Roots of Epigenetics* (Pittsburgh: University of Pittsburgh Press, 2016).

[169] Conrad Waddington, *The Strategy of the Genes: A Discussion of Some Aspects of Theoretical Biology* (London and New York: Routledge, [1957] 2014), 2.

[170] Ibid.

observations motivated his iconoclastic philosophical presuppositions. While much of the field had embraced both mechanism and the marginalization of developmental genetics with the arrival of the modern synthesis, Waddington (along with fellow organicists) embraced, instead, the process philosophy of Alfred North Whitehead and the morphology of D'Arcy Thompson,[171] which he believed better corresponded to his observations of dynamic living systems.[172] Against certain modern models that assumed a one-way relationship between a gene and its expression, Waddington's processive view was among the first to note the plasticity of phenotypes among genotypically identical organisms. Similarly, the same phenotype could be expressed by genotypically distinct organisms (a fact he labeled "genetic assimilation"), thus challenging the modern synthesis's assumption that natural selection acted directly upon genes.[173]

The additional factor neglected by his contemporaries, he notes, was the process of development and how the organism directed developmental trajectories along certain paths, resisting any major deviations. He labeled this resistance to perturbations "homeorhesis" (meaning "similar flow") to compare it with the more static process of homeostasis (which translates to "similar stillness"). Unlike the latter, however, it is the *path* that is maintained rather than any particular *state*. As he writes, a homeorhetic system "exhibits a tendency towards a certain kind of equilibrium, which is restored after disturbance; but this equilibrium is not centred on a static state but rather on a direction or pathway of change."[174] To illustrate this process, Waddington drew inspiration from evolutionary landscapes, developing what he called the epigenetic landscape—an action Depew and Weber interpret as "declaring that

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[171] Peterson, *Life Organic*, 100ff adds Jan Smuts's *Holism and Evolution* as a third impact on Waddington.

[172] The conferences emerging from the movement in the 1960s and 1970s are compiled in the four-volume work *Towards a Theoretical Biology*. According to Gare, "Chreods, Homeorhesis," 62, "These [volumes] have been a major reference point for strong anti-reductionist theoretical biology ever since."

[173] David J. Depew and Bruce H. Weber, *Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection* (Cambridge, MA: The MIT Press, 1995), 416.

[174] Waddington, *Strategy*, 32.

development and genetics are, and should be, integrated."[175] Thus, Waddington's ideas were motivated by two concepts (homeostasis and evolutionary landscapes) that are, I argue, teleological.

And, just like evolutionary landscapes, the epigenetic landscape is marked by hills and valleys—though, for Waddington, the y-axis is "flipped". Motion, usually visualized as a rolling ball, is directed towards valleys, providing an analogy closer to gravitational pull than Wright's hill climbing. Therefore, the valleys, called "creodes",[176] represent possible developmental pathways flowing downhill from a single peak (the initial fertilized egg) to certain endpoints (the developed, functioning traits). The incline of the creodic valleys ensures that slight disturbances to the path of the ball will be offset and the final state remains the same. The larger the incline of the creode and the steeper its peaks, the more rigidly will the process of development prevent any deviations from the norm—an effect Waddington labeled "canalization".[177] Thus, creodes are the means by which homeorhesis is instantiated. At certain loci, the paths will diverge, representing two possible developmental pathways; only slight perturbations at these points will trigger development to shift—sometimes quite radically. These adjacent paths allow the organism to "respond creatively to new contingencies, as with preadaptation where a trait evolved to serve one function is co-opted to solve a new problem."[178] Since these diverging creodes map a single genotype, the landscape provides a method for showing how identical genes might generate distinct phenotypes.

The landscape also provides a means for visualizing how identical phenotypes arise from distinct genotypes. Below the entire landscape, the genes are represented as anchor points

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[175] Depew and Weber, *Darwinism Evolving*, 417.

[176] Waddington, *Strategy*, 32 defines it as, "A pathway of change which is equilibrated in the sense that the system tends to return to it after disturbance." The neologism "creode" emerges from the Greek words for "necessary" and "path".

[177] Ibid, 39.

[178] Gare, "Chreods, Homeorhesis," 83.

with various "ropes" attached between them and the bottom of the landscape, creating the various creodes. However, since one creode might be anchored at various points (having multiple "ropes" attaching it to various anchor points), a change in one gene might not affect the phenotypic outcome, entailing it has a high degree of canalization. This has been shown in "knockout experiments" where genes are disabled yet no effect is observed on the phenotype.[179] Thus, as Kirschner, Gerhart, and Mitchinson note, "The genotype, however deeply we analyze it, cannot be predictive of the actual phenotype, but can only provide knowledge of the universe of possible phenotypes."[180] Moreover, while the actual development itself strongly restricts the number of possible phenotypes, the one that is realized "might depend as much on external conditions and random events as the genome-encoded structure of the molecular components."[181] The implications for evolutionary theory are, according to Waddington himself, significant. He concludes, "The conventional statement that the raw materials of evolution are provided by random mutation appears hollow." While genetic mutations might be characterized as random, their phenotypic effects cannot, for "they are conditioned by the modelling of the epigenetic landscape into a form which favours those paths of development which lead to end-states adapted to the environment."[182]

Admittedly, Waddington's ideas initially received scant attention and have only returned to favor in recent years.[183] Nevertheless, there were a few, prominent early adopters of his thoughts. For instance, mathematician René Thom helped Waddington to develop the mathematics of creodes and homeorhesis, devising the term "attractor" to label the endpoint of development. On his own, Thom advanced Waddington's ideas with the usage of differential

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[179] Jablonka and Lamb, *Evolution*, 65.

[180] Marc Kirschner, John Gerhart, and Tim Mitchinson, "Molecular 'Vitalism'," *Cell* 100 (Jan. 2000): 87.

[181] Ibid.

[182] Waddington, *Strategy*, 188.

[183] Jablonka and Lamb, *Evolution*, 265-6.

topology[184] while also proposing the usage of creodes and attractors in understanding animal behavior. Waddington's novel ideas also inspired the work of biologists Brian Goodwin and Gerry Webster who have suggested a structuralist theory involving morphogenetic fields (an implicit development of the creode) as an additional force in evolution.[185] Moreover, their founding of the field of theoretical biology and their organization of various conferences (including a 1987 one in honor of Waddington and attended by Thom) has been a self-conscious attempt to further Waddington's research. Goodwin and Webster's contributions have assisted in helping to establish Waddington's ideas within contemporary biology. As Arran Gare notes, "Goodwin's work shows that Waddington's concepts can be rigorously defended and can guide further developments."[186] He adds that their research surrounding structuralism brought Waddington's research program "up-to-date and [opened] new directions for research" though at the cost of reducing its challenge to the metaphysical assumptions of most biologists.[187]

The work of Mae-Wan Ho has also strengthened Waddington's claims about the developmental responses of organisms to their environment, employing concepts markedly close to those of the late British biologist.[188] Ho's research has actively challenged the passive role of organisms in their own evolutionary process, and she has openly embraced an alternative philosophy of biology inspired by Bergson, Goethe, and the *Naturphilosophie*.[189] Accordingly, she concludes, "The organism, as well as the human observer as organism, are firmly located within nature where they are empowered to shape their own evolution and destiny."[190] While her work remains controversial, similar advances in evolutionary

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[184] Gare, "Chreods, Homeorhesis," 64.
[185] Depew and Weber, *Darwinism Evolving*, 418 note that the field "can model the cellular cleavage patterns of early ontogeny up to 128 cell divisions, when the symmetry breaking of gastrulation sets in."
[186] Gare, "Chreods, Homeorhesis," 67
[187] Ibid, 68.
[188] E.g., Mae-Wan Ho and Peter T. Saunders, "Beyond neo-Darwinism – An Epigenetic Approach to Evolution," *Journal of Theoretical Biology* 78, no. 4 (1979): 573-591.
[189] Gare, "Chreods, Homeorhesis," 76.
[190] Mae-Wan Ho, "On Not Holding Nature Still: Evolution by Process, Not by Consequences," in *Evolutionary Processes and Metaphors*, ed. Mae-Wan Ho (New York: Wiley, 1988), 14.

developmental biology (Evo-Devo) have become well accepted, further revitalizing work in epigenetics and challenging the assumptions of genocentric adaptationism.[191] Additionally, Gare has proposed the extension of creodes to learned cognitive behaviors, whereby "the conscious reflective re-presentation of the past, contextualized through stories… situate the present in history." Thus, "Organisms, on the basis of memory, are oriented to the future."[192]

Waddington's epigenetic landscape has thus provided a heuristically valuable asset to biology, and within the context of the ATTIF, it is easily interpreted in a similar, teleological fashion as evolutionary landscapes. Even the label of "attractor" for certain, desired endpoints reflects the implicit teleology of these constructions, and the canalization that promotes these effects suggests that such ends align with the Aristotelian definition of a final cause which, as Aristotle notes, ought to occur "always or usually" (*Phys.* II.8, 198b35-199a6). In other words, to fully understand these epigenetic processes, it is not enough to see them as being "pushed" from their past; they are also directed toward some future state. Consequently, Waddington's work provides an additional heuristic visualization for the teleological nature of living organisms and their desire to achieve good ends.

4. A Theological Reading

According to Nicholson, the ontological lesson one learns from these analyses is that "for an organism, activity is a necessary condition for existence" and that rather than existence being ontologically prior to activity, "activity and being necessarily presuppose one another."[193] Another way of phrasing this conclusion would be to say that all (living) being is being-in-act. To be alive simply *is* to be actively engaged in teleological processes, which, as has been shown, occur at various levels. This is, according to Walsh, an "unimpeachable" fact, no more

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[191] Depew and Weber, "Fate of Darwinism," 99.
[192] Gare, "Chreods, Homeorhesis," 82.
[193] Nicholson, "Reconceptualizing the Organism," 153.

subject to doubt than the properties of fluidity and viscosity.[194] Yet, as Jonas notes, the perduring identity of organisms resides not in their material nature but in their form. The form plays the role of a theoretical concept, defining the teleological end towards which the material processes of living beings are directed and establishing an ipseity that persists despite constant material exchange. In other words, what an organism strives for defines what it is. In life, teleology and ontology unite.

But if form is distinct from an organism's matter, it is, by nature, nonphysical. What are the ontological grounds for these nonphysical forms? Two nontheistic options (which will be discussed elsewhere) are emergentism, which posits that formal and final causes emerge naturally from a physical substratum, and panpsychism/dual-aspect monism, which states that reality is fundamentally and universally composed of both mental and physical properties. The third option, favored by the premodern philosophers, is theistic. In other words, if we assume (as Plato, Aristotle, and Aquinas did) that any form of natural teleology implies the metaphysical notion of goodness outlined at the end of chapter one, then the concepts examined in this chapter are open to theological interpretation. Form would then find its ontological foundation in God: being-in-act in *actus purus*.

One ramification of this third option might be the extent to which we regard the cosmos as teleological. As has been noted in a previous chapter, Aristotle and Thomas did not restrict teleology to life; rather, teleology formed an indispensable part of the logical structure of causation, both animate and inanimate. Thus, one might theoretically extend Jonas's justification of anthropomorphisms to subjects beyond biology, as some philosophers have already attempted. For instance, Dorion Sagan and Lynn Margulis argue humanity is "part of a teleological continuum of gradient-reducing, energy-spreading arrangements of cycling matter

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[194] Walsh, "Objectcy and Agency," 173.

in regions of energy."[195] They therefore ask, "Why should we not consider human purposefulness as rooted in the thermodynamic teleology of nature?"[196] Like Turner, they maintain that the earth's whole biosphere has mechanisms for maintaining a state of equilibrium—a stability that can equally be read as teleological. In reminiscence of Plato, Aristotle, and Thomas, all of creation might then be regarded as teleologically structured and ordered to the divine. Thus, these three classic philosophers, rather than proposing a system made obsolete by modern science, might provide the best means for interpreting the emerging facts of contemporary research.

This does not negate the uniqueness of life, though. As Thomas Aquinas notes, life was a perfection limited to only a few creatures, and the possession of life entails that one participates more eminently in God (*ST* I-II.2.5). For Thomas, it is this greater level of participation that enables living beings to act both from and for themselves. These twin properties of life have been labelled spontaneity and interiority.[197] Spontaneity denotes the capacity for self-motion, though such motion is not random. Rather, interiority expresses the fact that organismal motion is directed towards the creature's good—goods determined by the mode of a creature's participation in God. Life, then, is a higher expression of the teleological orientation of the cosmos toward its divine end.

Fundamental niches, then, would be defined as the spaces in which the goods of a population can be actualized in a given environmental context and their realized niche as their success in achieving this goal. Evolutionary landscapes would prove to be not merely valuable heuristic devices but as the mapping out of actual creaturely goods and the movement of organisms toward peaks corresponding to the highest actualization of the goods proper to their

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[195] Sagan and Margulis, "Wind at Life's," 225.

[196] Ibid, 226.

[197] Juan Eduardo Carreño, "From Self Movement to *Esse*: The Notion of Life and Living Being in Thomas Aquinas," *Angelicum* 92 (2015): 355.

mode of being. Hill climbing must then be seen not merely as a struggle for survival but the *conatus* of creation for its Creator who is Goodness *simpliciter*. Like Moses ascending Mount Sinai, the higher one ascends the peak, the greater God's perfection becomes manifest in creation.[198]

Metabolism, homeostasis, and homeorhesis are likewise examples of this same principle enacted in individual creatures. In all these cases, organisms seek their own good—a good given by and directed back towards their divine source. Evolution, then, can only be properly understood when seen from its theological context—namely, as a striving towards God and an attempt to replicate the Creator's goodness, however incompletely, in itself.

In this chapter, we have expanded upon the ATTIF by examining three of its aims (reproductive success, survival, and development) through the lens of various biological concepts. It was shown how each of these concepts, under close examination, point towards a teleological interpretation consistent with and illuminative of the ATTIF. I then interpreted these concepts through the lens of the metaphysical notion of goodness and classical theism. I now turn to biological functionality, the most complex and debated aspect of the ATTIF.

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[198] As noted above, the hill metaphor is often too simplistic to be applicable in the real world, yet this theological interpretation remains the same regardless of the shape the landscape actually takes.

CHAPTER FIVE: THE ATTIF ANALYZED – FUNCTIONALITY

Final causes have disappeared from science, but have they disappeared from the minds of the scientists?[1]

-Étienne Gilson-

1. Introduction

In the last chapter, I explored and interpreted four biological concepts through the lens of the ATTIF, each corresponding to distinct teleological aims outlined by the interpretation.[2] I dedicate this chapter exclusively to the topic of functionality, the second aim of the ATTIF. The goal of this chapter is to provide a clear definition of biological functionality—a problem that has plagued biology for decades. I will proceed in five stages. First, I summarize how the term operates as an important teleological concept within contemporary biology and why this has motivated attempts to redefine it in a nonteleological manner. Then, I will detail briefly what a theory (i.e., clearly defined account) of functions ought to accomplish and the methods for analysis. From there, I will summarize and critique efforts to naturalize teleology—a project appropriately known as teleonaturalism.[3] Full volumes have been written on this topic; therefore, I will focus only on some of the more prominent theories. Next, I will offer an alternative position, one grounded in the unique ontology of biological organisms and consistent with the ATTIF. Finally, the chapter will close with a theological and philosophical reflection relating these conclusions to the work as a whole.

2. Functionality in Contemporary Biology

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[1] Étienne Gilson, *From Aristotle to Darwin and Back Again: A Journey in Final Causality, Species, and Evolution*, trans. John Lyon (Notre Dame: University of Notre Dame Press, 1984), 127.

[2] The four aims can be briefly summarized as 1.) development, 2.) functional traits, 3.) survival, and 4.) reproduction.

[3] Colin Allen and Jacob Neal, "Teleological Notions in Biology," in *The Stanford Encyclopedia of Philosophy*, Spring 2019 edition, ed. Edward N. Zalta, accessed April 5, 2019, https://plato.stanford.edu/entries/teleology-biology/. "Naturalize" in this context should not be confused with the Aristotelian natures. Here, it denotes attempts to interpret teleology in a manner consistent with metaphysical naturalism.

As Justin Garson notes, biological functionality "is one of the foundational concepts of the life sciences. As a consequence, functionality touches upon almost every major debate in the philosophy of biology."[4] However, like the concept of fitness explored in chapter 3, the definition of a biological function remains debated.[5] In general, the term is used to denote not simply what a biological trait *does*, but what said trait *ought to do*. Traits have activities they are supposed to perform, regardless of whether or not they actually succeed in doing them. In other words, it is possible to say a biological trait, such as a heart, is dysfunctional, whereas no such functional ascription would be appropriate for, say, a planet, atom, or geological formation. While this general description has sufficed for most biologists, its lack of conceptual clarity has plagued philosophers. Nevertheless, this has not hindered biologists' usage of the concept.

This is due to the prevalence of a view known as adaptationism. Adaptationism is the practice of treating and explaining biological traits like human artifacts.[6] In other words, adaptationism explains the appearance of traits by appealing to the purpose they play within the organism (i.e., their function), just as one explains the invention of artifacts via their contribution to human society. The heuristic dividends of this practice are undeniable; as Daniel Dennett states, "Adaptationist reasoning is not optional; it is the heart and soul of evolutionary biology."[7] Samir Okasha concurs, deeming the comparison "deep and instructive."[8] Adaptationists are, as Stephen Gould notes, inheritors of the British functionalist tradition—a tradition that includes Spencer, Buffon, Cuvier, Darwin, and Paley.[9] As such, the practice has

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[4] Justin Garson, *A Critical Overview of Biological Function* (New York: Springer, 2016), 3.

[5] See, for instance, the high-profile debate in "Form and Function," *Nature* 495 (2013): 141-2.

[6] For an outline of the two different types of adaptationism (reverse-engineering and adaptive thinking), see Tim Lewens, *Organisms and Artifacts: Design in Nature and Elsewhere* (Cambridge, MA: The MIT Press, 2004), 40.

[7] Daniel Dennett, *Darwin's Dangerous Idea* (New York: Norton, 1995), 238. Dennett does not, however, believe the similarity in reasoning implies any teleological conclusion.

[8] Samir Okasha, *Agents and Goals in Evolution* (Oxford: Oxford University Press, 2018), 39.

[9] Stephen Jay Gould, *The Structure of Evolutionary Theory* (Cambridge, MA: Belknap Press, 2002). This tradition contrasted with a stream of thought that emphasized development and form over function. These "structuralists" include Richard Owen, Louis Agassiz, Étienne Geoffroy Saint-Hilaire, and D'Arcy Thompson.

deep roots in the discipline, both diachronically and synchronically, and it is unlikely to disappear soon.

Yet the usage of this methodology and its accompanying teleological concepts has generated no small backlash within biology due to its perceived ontological entailments. Lewens notes that biology is unique in its usage of functional concepts—concepts that seem appropriate only for artifacts. In the case of artifacts, though, teleological language is easily justified and explained; artifacts receive their goals and purposes from the mental intentionality of an intelligent agent. The same cannot be said of biological traits if, indeed, one embraces biological evolution, yet such teleological language would seemingly support theistic assumptions.[10] Thus, functional language has been accused of revitalizing the "menace of creationism."[11] This fear has provoked a wealth of academic literature attempting to define biological functions without invoking theism. Indeed, in 2004, Mark Perlman declared the subject of biological functionality the "hottest topic in philosophy of biology, psychology and mind."[12]

3. Goals and Methods of Analysis

The difficulties surrounding a theory of biological function go beyond the desire to avoid teleology. Indeed, there is widespread disagreement about what such a theory ought to accomplish. Fortunately, Garson and Lewens note three "canonical" desiderata common among most positions: (1) how functions are explanatory, (2) how functions are normative, and (3) how they are distinct from accidents.[13] Unfortunately, the similarities tend to end here, as even what an "explanation" is and what features need to be explained differ between authors.

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[10] Lewens, *Organisms*, 1.

[11] Lenny Moss, *What Genes Can't Do* (Cambridge, MA: MIT Press, 2003), 4.

[12] Mark Perlman, "The Modern Philosophical Resurrection of Teleology," *The Monist* 87 (2004): 46.

[13] Justin Garson, *What Biological Functions Are and Why They Matter* (Cambridge: Cambridge University Press, 2019), 4. Lewens, *Organisms*, 88-9.

For instance, the etiological and systems-oriented views each believe functions have explanatory power, yet the explanandum differs between them.[14] Other desiderata, such as avoiding epiphenomenalism[15] and applying hierarchically,[16] have also been suggested, as well.[17] However, I will initially assume only the three "canonical" desiderata and the relatively common (though not universal) position that functions explain the existence of their respective traits by appealing to a certain effect.[18]

As a final note, unlike philosophers of religion, philosophers of science tend to be more dismissive of "science-fiction counterexamples," such as the famed swampman thought experiment.[19] However, the justification for this tendency is rarely provided except on intuitional grounds.[20] Philosophers of science likely disregard such cases since they are not relevant to the scientific work they are analyzing. While this practice is acceptable in the case of conceptual analyses (scientists rarely need to care if their terminology applies to bizarre, unrealistic examples), it is not acceptable if one is attempting to provide a theoretical definition, as I am attempting in this chapter. Definitions, by their nature, apply in all possible worlds. Consequently, counterexamples, no matter how impractical, can demonstrate a failure of this project. I will therefore attempt to perform the more difficult task of making my theory immune to such counterexamples; by the same token, I will apply similar rigor to competing theories,

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[14] For etiologists, functions explain why a trait has retained itself within a population. Systems-oriented theorists argue functions explain the persistence of a given system via the function's efficient causal contribution to it.

[15] Matteo Mossio, Cristian Saborido, and Alvaro Moreno, "An Organizational Account of Biological Functions," *British Journal of the Philosophy of Science* 60, no. 4 (2009): 821.

[16] Philip Kitcher, "Function and Design," *Midwest Studies in Philosophy* 18 (1993): 379-97.

[17] Lewens, *Organisms*, 91 notes that many have taken a pluralist approach, believing disagreements amount to no more than competing intuitions. However, Lewens adds that this view fails to account for why teleological language is appropriate for these particular contexts and thus may lead to a fictionalist view.

[18] Like chapter 3, this chapter will not merely attempt a conceptual analysis but instead offer a theoretical definition. In other words, I am not merely analyzing how functionality *is* employed in the literature but how it *ought to be* employed given a set of desiderata.

[19] Garson, *Critical Overview*, 10.

[20] E.g., Garson, *What Biological*, 24, "To the extent that I take intuitions seriously, I take them more seriously when they're about true-to-life cases." He gives no reason for this restriction.

though, for the sake of argumentation, these counterexamples will always be accompanied by other, more accepted types of arguments.

4. Teleonaturalism

Most modern philosophers have attempted to confront the issue of functionality by reducing it to a purely naturalistic explanation devoid of any unwanted metaphysical baggage. For instance, Garson begins his investigation by discarding the "extreme" position of theism.[21] Similarly, many teleonaturalists are often dismissive of teleological realism, and some even claim not to understand what such a teleological commitment would express.[22] While more limited "teleological" explanations are often entertained (such as in cases where past effects explain a current state of affairs), the more robust, Aristotelian-Thomistic form of teleology is routinely dismissed *ab initio*. Thus, the unquestioned assumption of nearly all work in the field is the truth of naturalism.[23]

Agreements tend to end here, however, as the field has been plagued by a cacophonous surge of competing voices—a feature that has marked it since its inception. In fact, two of the earliest teleonaturalists, Ernest Nagel and Carl Hempel,[24] immediately disagreed on whether functions actually have explanatory power.[25] Today, the primary division among teleonaturalists is between those who prefer an etiological account of functions and those who

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[21] Ibid, 19.

[22] Ibid, 26 provides a particularly glaring example of this: "I have no clear idea of what it is for a trait to be for something…. I read this 'for' talk as, at best, a loose or metaphorical way of conveying that stripes were selected *for* deterring flies" (Emphasis mine). Garson overlooks that the terminology "selected for" is teleological.

[23] Ibid, 55 declares naturalism as the "default" for philosophy and that any theory of function should be neutral towards the existence of God and values. How such "neutrality" differs from outright rejection is not clarified.

[24] Ernest Nagel, "The Structure of Teleological Explanations," in *The Structure of Science: Problems in the Logic of Scientific Explanation* (New York: Harcourt, Brace, and Word, 1961), 401-28; Carl Gustav Hempel, "The Logic of Functional Analysis," in *Aspects of Scientific Explanation and other Essays in the Philosophy of Science* (New York: Free Press, 1965), 297–330. For decisive critiques, see Robert Cummins, "Functional Analysis," *The Journal of Philosophy* 72, no. 20 (Nov. 1975): 741-65; Peter Lipton, "Nagel Revisited: Review of Teleology Revisited and Other Essays in the Philosophy and History of Science by Ernest Nagel," *The British Journal for the Philosophy of Science* 33, no. 2 (June 1982): 186-94.

[25] Garson, *What Biological*, 14.

oppose such accounts.[26] Since etiological accounts have attained the greater level of historical support, I will begin with an extensive evaluation of its various offerings before assessing one of the leading non-etiological alternatives.

4.1 Etiological Accounts

Etiological accounts denote a set of theories that affirm the (efficient) causal-explanatory character of functions and seek to describe them within the existing paradigm of naturalism.[27] These accounts generally assert that to ascribe a function to trait A is to cite the role A plays in its preservation within a population.[28] The overwhelming consensus prior to the turn of the millennium has been in favor of etiological-style explanations. The attraction came largely from their supposed ability to account for all three desiderata for a theory of function. Accordingly, trait functions under etiological accounts 1.) explain a trait's presence within a population, 2.) are labeled dysfunctional when a trait fails to produce the effect that explains its presence, and 3.) can be differentiated from accidents (though the means will differ between competing theories). I begin by providing an extensive evaluation of the selected-effects theory, which remains the most popular theory of functions. Then, I will provide a brief critique of less popular accounts—namely, the weak etiological and propensity theories.

4.1.1 Selected Effects

The most prevalent theory of functions is the selected effects theory. Indeed, many theorists still believe it is the only adequate means for establishing the explanatory depth of functions.[29] In fact, Denis Walsh notes it was regarded as "that rarest of things: a philosophical result—a genuine problem that has yielded unconditionally to philosophical analysis."[30] While the theory

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[26] The best taxonomy of the various positions is given in Perlman, "The Modern."

[27] Causation in this section should be understood as efficient, mechanistic causation.

[28] For a pivotal early account, see Larry Wright, "Functions," *Philosophical Review* 82, no. 2 (1973): 139-168.

[29] Garson, *What Biological*, 62.

[30] Denis Walsh, "Function and Teleology," in *Evolutionary Biology: Conceptual, Ethical, and Religious Issues,* ed. R. Paul Thompson and Denis M. Walsh (Cambridge: Cambridge University Press, 2014), 195.

is credited to the independent work of both Ruth Millikan and Karen Neander, other philosophers, such as Michael Ruse, had subtle glimmerings of the account decades prior.[31] Nevertheless, it wasn't until the independent publications of Millikan and Neander in the early 1980s that the position came to prominence. Millikan, in her title *Language, Thought, and Other Biological Categories*,[32] argues that a "proper function"[33] derives from a trait's contribution toward the survival of a reproductively established family.[34] Thus, functionality arises from the historical role the feature has played in the evolutionary history of a group.[35] In other words, the trait's *effects* are likewise the *cause* of its persistence within a population due to the workings of natural selection, and this, in turn, confers functionality. If the feature performs the operation that had previously allowed it to establish itself within the population, it can be said to be functioning properly. Thus, the account claims to preserve normativity. Millikan's extended and complicated argument also claims to provide a satisfactory distinction between functions and accidents;[36] accidental traits, while possibly contributing to reproductive success, have not met the right criteria—namely, a history of selection—to be regarded as a function.[37]

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[31] See ibid, 196.

[32] Ruth Garrett Millikan, *Language, Thought, and Other Biological Categories: New Foundations for Realism* (Cambridge, MA: The MIT Press, 1984).

[33] Millikan uses this term in a technical sense and seeks to differentiate it from more common uses of the term "function". This distinction will not affect my analysis.

[34] Karen Neander and Alex Rosenberg, "Solving the Circularity Problem for Functions: A Response to Nanay," *Journal of Philosophy* 109, no. 10 (2012): 613-22 have more recently replaced this terminology with a "lineage of traits parsed by changes in the selection pressures operating on it."

[35] Ibid, 17ff. Another simplified account can be found in Peter Godfrey-Smith, Review of *Language Thought, and Other Biological Categories*, *Australasian Journal of Philosophy* 66, no. 4 (Dec. 1988): 556. Godfrey-Smith's account has also apparently received the approval of Millikan herself. See Alvin Plantinga, *Warrant and Proper Function* (Oxford: Oxford University Press, 1993), 202.

[36] Plantinga, *Warrant*, 202 has called it "formidably difficult."

[37] Rowland Stout, *Things that Happen Because They Should: A Teleological Approach to Action* (Oxford: Oxford University Press, 1996), 101 has therefore declared this account to be "a non-teleological, historical explanation" since the goodness of a feature is secondary to its efficient causal history.

Karen Neander's nearly contemporaneous account is strikingly similar.[38] She summarizes her perspective as, "The simple idea that a function of a trait is the effect for which that trait was selected."[39] If the effect of a trait is the reason ancestral organisms had an increased level of reproductive success, then one is justified in declaring that effect to be the function of the trait.[40] Neander has differentiated her position, which she labels "Low Church," from Millikan's "High Church" stance.[41] The distinction, though, merely concerns when it is appropriate to define a process as dysfunctional.[42] As such, my evaluation of their position will take a "Broad Church"[43] attitude that incorporates the position as a whole.

I will particularly focus on the more updated case made by Justin Garson, whose work remains one of the most thorough and relevant defenses of the selected effects account.[44] Garson's "Generalized Selected Effects theory" rests on three principles: differential reproduction, differential retention, and population.[45] Given that certain traits are retained by a population due to their effect, Garson affirms that functions are objective features about populations (rather than individuals) that denote causal explanations regarding past selection events (i.e., how a trait's effects explain the trait's persistence within a population). Garson provides three criteria for testing the selected effects theory: how biologists use the term, how our practices are shaped by our understanding of the term, and philosophical intuitions.[46] For the sake of argument, I will add these three criteria to the desiderata noted above in order to

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[38] Karen Neander, *Abnormal Psychobiology,* (PhD diss., La Trobe University, 1983); Karen Neander, "The Teleological Notion of 'Function,'" *Australian Journal of Philosophy* 69, no. 4 (1991): 454-468.

[39] Neander, "Teleological," 460.

[40] Ibid, 461.

[41] Karen Neander, "Misrepresenting and Malfunctioning," *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition* 79, no. 2 (Aug. 1995): 109-41.

[42] Walsh, "Function," 200 has also noted a divergence between the two accounts on whether an analysis must be coextensive with the pre-theoretic analysandum.

[43] This term is borrowed from Robert C. Koons and Alexander Pruss, "Must Functionalists Be Aristotelians?" in *Causal Powers,* ed. Jonathan D. Jacobs (Oxford: Oxford University Press, 2017), 200.

[44] Garson, *What Biological.*

[45] Ibid, 3.

[46] Ibid, 23.

offer a detailed critique of his position. I begin with some of the more well-rehearsed objections.

Perhaps the most common complaint is the bizarre notion that the first appearance of a trait, no matter how beneficial, would be functionless since it has not undergone any selection yet.[47] This has been called the problem of epiphenomenalism; selected effect theorists must deny any relationship between the trait's present contribution and its functionality.[48] Thus, Garson's selected-effects theory appears to fail two of his own criteria. First, while Garson believes biologists implicitly assume selection in their usage of functions,[49] this is demonstrably incorrect. In the field of paleontology, for instance, a fossilized holotype may have belonged (for all we know) to the first specimen to bear a particular beneficial trait; however, paleontologists need not entertain this possibility when determining the functions of the extinct organism's various traits.[50]

Second, Garson appears to violate his own criterion of intuition; it seems bizarre to suppose that a trait physically identical to those appearing later in a population lacks a function simply by virtue of appearing first. Garson attempts to evade this objection by declaring such traits to be lucky accidents: "Suppose the members of a religious cult abduct me, and just when they are about to sacrifice me, they notice a birthmark on my shoulder that faintly resembles one of their religious symbols—and they let me go. Still, the birthmark has no function; this was a lucky accident."[51] In response, the analogy may prove too much, for supposing it then turned out the cult had abducted thousands of people and left everyone with the birthmark alive, then, in fact, the birthmark *would* have a function since it provided a selective advantage within

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[47] Denis Walsh and André Ariew, "A Taxonomy of Functions," *Canadian Journal of Philosophy* 26, no. 4 (1996): 498.

[48] Mossio et. al., "An Organizational," 821.

[49] Garson, *What Biological*, 29.

[50] Walsh, "Function," 203 also lists examples of functional ascriptions in biological literature that do not appeal to selection history, even implicitly.

[51] Garson, *What Biological*, 29.

a population. Our intuitions tell us that we do not need to ask whether other people were abducted by the cult in order to determine that our birthmark does not have a cult-saving function.

As a final objection, it has been noted that certain traits may become fixed within a population and only later become advantageous.[52] In other words, no selection occurred on the trait even though it now provides an advantage to the population. As such, the selected effects theorist must deny that the trait has a function. Garson admits, "Some find that counterintuitive, but I don't. If a single instance of a trait can have a useful effect that isn't a function, why can't a whole population have a trait like that?"[53] Garson's position would shatter much of our confidence in making functional ascriptions, for, in most cases, we simply do not have access to the exact selective history in order to know whether the trait initially spread via drift or selection.

Another common objection has been that the selected effects theory would incorrectly assign functions to vestigial organs. For instance, the appendix was selected for aiding in digestion; however, it would be wrong to assign it this same function today. Yet the selected effects theory is in danger of just such an erroneous functional ascription.[54] To avoid attributing functions to the nonfunctional vestiges of our evolutionary past, certain adherents, such as Paul Griffiths and Peter Godfrey-Smith, have proposed limiting functional attribution to recent periods of selection.[55] Garson has found these responses adequate, claiming the appendix is

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[52] Lewens, *Organisms*, 93ff. Lewens also offers examples of how adaptively neutral traits might earn functional ascriptions in certain cases. Lewens adds that pleiotropic traits might problematize the selected effects account. While this may be true of Neander and Millikan's account, Garson's rendition can likely avoid it.

[53] Garson, *What Biological*, 30.

[54] Millikan's account is particularly susceptible to this challenge. See Robert C. Koons, *Realism Regained: An Exact Theory of Causation, Teleology, and Mind* (Oxford: Oxford University Press, 2000), 147.

[55] Paul Griffiths, "Adaptive Explanation and the Concept of a Vestige," in *Trees of Life: Essays in Philosophy of Biology*, ed. Paul Griffiths (Dordrecht: Kluwer, 1992), 111-31; Peter Godfrey-Smith, "A Modern History Theory of Functions," *Nous* 28 (1994): 344-62. This suggestion is noticeably more acceptable than Millikan's proposal, which suggests traits have a series of functions, moving from historically remote to proximate. See Millikan, *Language*, 32.

nonfunctional since “it hasn’t aided digestion in our species for thousands of years. The selected effects theory, joined with some facts about digestion, implies that the appendix does not have the function of aiding digestion.”[56] Garson must here contradict his assertion that a function “doesn’t have anything to do with a thing’s powers or abilities. It only has to do with history,”[57] for Garson must appeal to the “facts about digestion” (namely, that the appendix does not contribute to digestion) in order to prevent an inaccurate functional attribution.

Even if one overlooks this, it does little to preserve the selected effects theory, for such theorists never specify the temporal range in which it is appropriate to make functional designations. How recent must the selection events be? Garson’s only suggestion is that the trait must have performed the function at some point “in recent memory,” believing it is impossible to give any more specific cutoff.[58] Worse yet, Garson adds the temporal range “will expand or contract, accordion-like, depending on the kind of selection process at issue.”[59]

Again, the selected effects theory fails to align with biological practice. For instance, new evidence suggests a rapid selection for blindness in a certain species of cavefish over the last 20,000 years.[60] Biologists unreservedly label their eyes as examples of vestigial organs. The selected-effects theory, however, entails that these cavefishes’ eyes *do have* a function—namely, of being blind. This contradicts not only biological practice but also intuition.

A similar yet more severe problem emerges with traits that were selected for in the deep past. If we limit functionality to recent history, what about traits that have existed in a population for an extended period of time? For instance, red blood cells have been a universal feature of the vertebrate lineage for millions of years—far, far longer than there have been

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[56] Garson, *What Biological*, 39.
[57] Ibid, 37.
[58] Ibid, 39.
[59] Ibid, 39-40.
[60] Julien Fumey et al., “Evidence for Late Pleistocene Origin of *Astyanax mexicanus* Cavefish,” *BMC Evolutionary Biology* 18, no. 43 (2018): 1-19.

humans or even mammals. Yet given that there has not been any selection for this cell type for eons, does it still bear a function? According to Garson, no, for such traits exist now only by "sheer inertia."[61] Garson's overly restrictive principle for functional ascriptions fails the criteria of biological usage, practice, and, most notably, our intuitions. Biologists freely employ functional language for such traits and rarely need to question the exact timing of a trait's selection when doing so.

Another frequent complaint is the prevalence of obvious counterexamples. Mark Bedau, for instance, observes that clay crystals also undergo selection and would therefore qualify as bearing functional traits.[62] Lewens has likewise noted that any selective sorting process fulfills the criteria for a function, including "selfish" stretches of DNA, yet most biologists "decline to speak of these as purposive or functional traits, instead viewing selfish DNA as a paradigm example of a function*less* item."[63] Lewens notes processes such as these satisfy all three desiderata of a functional ascription.[64] In response, Millikan has adopted the idea that crystals do have functions as well as any item that might match the criteria.[65] But this fails the criteria of biological usage and the intuitional test; most analytic philosophers are unwilling to grant a whole host of nonbiological entities functional ascriptions.

Garson agrees and attempts to circumvent the issue by including an admittedly "arbitrary restriction" to the definition of a function.[66] Garson delimits functions to populations, though he concedes he has no specific definition of a population. Nevertheless, he believes we can acknowledge that natural selection requires a population "without being committed to any

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[61] Garson, *What Biological*, 40.

[62] Mark Bedau, "Can Biological Teleology Be Naturalized?" *Journal of Philosophy* 88, no. 11 (Nov. 1991): 647-55.

[63] Lewens, *Organisms*, 122.

[64] Ibid, 128-9.

[65] Ruth Millikan, *White Queen Psychology and Other Essays for Alice* (Cambridge, MA: MIT Press, 1993), 116.

[66] Garson, *What Biological*, 94.

particular construal of what populations are.”[67] He does, however, suggest that one necessary condition of a population is that its members interact in fitness-relevant ways.[68] Of course, this merely opens the question of how Garson defines fitness. As previously argued, fitness itself is best conceived as teleological. Thus, Garson’s proposal may be in danger of introducing the very teleology it means to extricate.[69]

Even if we overlook this difficulty, there are still numerous troubles with his proposal. For one, Garson’s account does not specifically define what counts as fitness relevant. How much interaction is needed? Certain groups, such as chimpanzees, interact with other groups in bloody bouts, yet this fitness-relevant interaction does not clarify whether we should consider them one population or two competing populations. Additionally, it is not entirely clear that clay crystals do not interact at least somewhat in this manner, and Garson gives no argument for why this is not so.

Garson seems aware of this difficulty and suggests that populations must also include the property of “linkage”.[70] The more fitness-relevant actions a group maintains, the more “population-like” the group becomes. Garson claims this is a nonarbitrary solution for why biological entities are unique. In the examples with inorganic materials, there is very low interaction between entities. Yet the perplexing (and counterintuitive) implication of this position is that if populations come in degrees, so, too, must functions. Moreover, crystals, selfish DNA, and every other instance where “selection” occurs would also produce functional traits—just to a lesser degree. This, again, departs from biological usage, practice, and intuition. A lone lifeform isolated from the rest of its species is not slowly losing its functionality as time passes. It seems obvious that its trait functions do not depend on its continued interaction with

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[67] Ibid, 104.

[68] Ibid, 103-4.

[69] In fact, since Garson argues his concept of a population need not involve reproduction, most definitions of fitness (which nearly universally include a concept of reproduction) are ruled out. See ibid, 105.

[70] Ibid, 106-7.

other members of its population. In fact, certain species, like snow leopards, rarely interact with other members of their species. Yet no biologist considers (or ought to consider) their traits less functional than, say, human traits. As a final note, it is perfectly possible to imagine scenarios where nonbiological entities attain high degrees of linkage. Stones caught in a tornado may impact and degrade one another very rapidly, yet have the harder stones become more functional as a result? These questions remain a daunting obstacle for the selected effects theory.[71]

The last of the commonly offered objections is what I will term the Harvey objection.[72] According to it, functional ascriptions worked perfectly well before Darwin's publication of *The Origin of Species*, such as William Harvey's work on the circulatory system. Thus, knowledge of functions has, historically, not required knowledge of natural selection. Moreover, if the selected effects theory proves true, it would entail pre-Darwinian biologists meant something entirely different when they made identical attributions of functions. Millikan responds to this objection by claiming she no longer regards her project as a form of conceptual analysis—a program she calls "confused" and the "misconceived child of a mistaken view of the nature of language and thought."[73] For her, it simply does not matter what pre-Darwinians meant by the term.

However, the Harvey objection is not merely what *concepts of functionality* are being employed. If it were, one could simply reply that scientific concepts change over time.[74] Instead, the objection concerns what *functions themselves* are. If functions are defined via their role in natural selection, it becomes astonishing that Harvey would be able to recognize them

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[71] For more "science fiction" counterexamples, see Plantinga, *Warrant*, 204; Koons and Pruss, "Must Functionalists," 203.

[72] William J. FitzPatrick, *Teleology and the Norms of Nature* (New York and London: Garland Publishing Inc., 2000), 106-7; Christopher Boorse, "Wright on Functions," *Philosophical Review* 85 (1976): 70-86; Plantinga, *Warrant*, 208; Koons, *Realism Regained*, 148.

[73] Millikan, *White Queen*, 15.

[74] E.g., Garson, *Critical Overview*, 8-9.

without any prior knowledge of Darwinism. How was he able to rightly detect the particular functions of traits if he had no comprehension of what a function was? Neither Millikan nor Garson gives any explanation for his seemingly inexplicable accuracy. One possible response might be to demonstrate how Harvey's Aristotelian-style analyses could independently arrive at the same functional ascriptions, yet such an analysis would only provoke the question of why Aristotelianism was so successful given that it has a false view of functions.

This point naturally leads to the second set of objections. While not as popular, these objections capture what I believe to be the primary fault in the selected effects theory—namely, that the selected effects theory mistakenly inverts the explanatory order and then attempts to derive normativity from it. Selection does not explain functionality; rather, trait functions explain selection via their success in achieving their aims of survival/reproduction. As Denis Walsh summarizes, the selected effects approach "conflate[s] the conditions required for a successful explanation with the content of that explanation."[75] In other words, the selected effects theory risks committing the naturalistic fallacy of deriving an *ought* from an *is*. To say a trait *is* the product of natural selection signifies something different from the claim that it *ought* to perform that function.

While selected effects theorists have attempted to justify this leap from *is* to *ought*, Bence Nanay has presented perhaps the most compelling case that all such attempts must inevitably end in circularity.[76] Nanay writes that the selected effects theory "presupposes that trait types can be individuated in an unproblematic manner. The trait whose function is to be defined and the traits that have been selected for in the past must be of the same type. But how can we individuate trait types? What makes hearts different from nonhearts?"[77] One common

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[75] Walsh, "Function," 205. Walsh further asserts that this confusion explains why, in the biological literature, functional ascriptions do not universally designate adaptive explanations and why (contra the selected effects theory) many ascriptions are applied to individuals rather than to populations.

[76] The objection was, however, foreshadowed in Lewens, *Organisms*, 99-100.

[77] Bence Nanay, "A Modal Theory of Function," *The Journal of Philosophy* 107, no. 8 (Aug. 2010): 415.

strategy is to group traits via their common functionality; the function of a heart (unlike other organs) is to pump blood.[78] However, the explanation immediately runs into circularity here, for in defining a function, one cannot appeal to trait types, which are already defined functionally. In other words, trait types cannot be used to explain functionality because they simply *are* the token trait's common functionality. But this is exactly what the selected effects theory does. My heart "inherits" its functionality by belonging to a category of organs that were selected for pumping blood in the past, yet to belong to this category, my heart must already possess this functionality, for, as we stated, a heart is only a heart if it already has the function of pumping blood. The *explanans* (the selective history of trait types) thus includes the *explanandum* (functionality).

Nanay rejects alternative attempts to define trait types on morphological or homological grounds. The former fails to range across diverse species—my heart is vastly different from a minnow's—and would entail that malformed traits, such as deformed hearts, are not actually hearts since they lack the right morphological properties. The latter suffers from being unable to distinguish the distinct functions of homologous traits. A bird's wing and a toad's front legs are homologous, bearing many similarities due to a common evolutionary heritage, but do not share a function.[79] Thus, Nanay concludes the selected effects account fails since, "It has to rely on an independent account of individuating trait types, and no such account is available for the etiological theory."[80]

Karen Neander and Alex Rosenberg counter that trait tokens are part of lineages that connect them to prior selection pressures.[81] In other words, selection for hearts occurred in

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[78] Karen Neander, "Functions as Selected Effects: The Conceptual Analysts' Defense," *Philosophy of Science* 58, no. 2 (June 1991): 180. This is not to assert that *all* trait types are individuated functionally but only that those with functions frequently are.
[79] Nanay, "Modal Theory," 416-7.
[80] Ibid, 419.
[81] Neander and Rosenberg, "Solving the Circularity." A trait token is a philosophical term for a particular instantiation of a trait rather than the trait treated abstractly or in general (i.e., a trait type).

prior generations, and these effects created a lineage leading to my possession of a heart along with all its functional properties. Thus, the selection pressures upon certain lineages establish both trait-type individuation and functionality. In reply, Nanay points out that lineages themselves presuppose trait-type individuation; to say that two organs, for example, belong to the same lineage is to already identify them as the same type of organ. Hence, functions parse lineages just as much as they do trait types.[82]

Garson claims that Ruth Millikan's concept of "copying" might salvage their case. He writes, "*B* is a copy of *A* if *A* and *B* have some properties in common, *A* causes *B* to have those properties, and, if *A* had differed in certain respects, *B* would have differed in certain respects as well."[83] The response suffers at multiple points, and I will respond to each criterion in turn. Regarding the first, the criterion fails to identify *which* properties must be in common. All traits, at some level, share properties, and unless there is a method for identifying the *essential* properties of a trait, this criterion is wholly unhelpful. Which properties make it the case that a normal functioning heart and a malfunctioning heart belong to the same trait type? Moreover, why do the bird's wing and the frog's leg not also satisfy this condition? As for the second point, it is difficult to know what "cause" means here. Traits (outside of reproductive ones) do not literally *cause* their replication in offspring. Perhaps Garson means merely that they create a selective advantage that allows them to proliferate in a population. Yet this response would apply to *any* advantageous trait an organism has. The possession of a fitter trait results in the replication of *all* the organism's traits, not just the fitter one. Thus, this criterion does nothing to differentiate one trait from any other within the organism. Finally, the third criterion is vague. What counterfactual differences are being picked out by the phrase "in certain respects"?

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[82] Bence Nanay, "Functions Attributions Depend on the Explanatory Context: A Reply to Neander and Rosenberg's Reply to Nanay," *The Journal of Philosophy* 109, no. 10 (Oct. 2012): 623-7. Nanay opts instead for a pragmatist approach to functions. Since this chapter treats functions as both real and explanatory, Nanay's proposal is not attempting the same project.

[83] Garson, *Critical Overview*, 107.

Pleiotropic traits (two or more traits controlled by one gene) provide a perfect counterexample. Suppose eye color and skin color are controlled by the same gene in an organism. In this case, all three criteria would be satisfied for "copying", yet it is obvious that eye and skin color are not the same trait. Thus, the selected effects theory serves as a reminder that, as David Oderberg notes, "Identifying essence with historical descent… confuses the efficient and formal causes both of a substance and of the species to which it belongs."[84] To know something's history does not tell one what that thing is. In the same manner, adaptations are identified by their functions, and this is not reducible to their evolutionary history.

4.1.2 The Weak Etiological Theory and Propensity Theory

A slightly modified version of the selected effects theory has been labeled the weak theory and defended by David Buller.[85] Accordingly, the weak theory asserts a trait bears a function if it has, at some point, contributed to a species' fitness. Unlike the selected effects theory, the weak theory does not rely upon selection and so does not rely on the existence of competition to account for functionality. If any trait increased the fitness of an organism's ancestors, that trait bears the function of that effect.

Again, this theory relies upon a clear definition of fitness—a problem I have dealt with extensively. Given the ATTIF, the weak theory, even if true, either fails to avoid teleology or, conversely, would need to adopt some nonteleological alternative to the ATTIF. Elliott Sober has offered an additional objection, observing that fitness contributions do not merely explain why a certain trait is present (the asserted goal of etiological theories) but also why the whole organism is present. For instance, the white fur of a polar bear's ancestors explains why the

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[84] David Oderberg, *Real Essentialism* (Oxford: Routledge Publishing, 2009), 102.

[85] David Buller, "Etiological Theories of Function: A Geographical Survey," *Biology and Philosophy* 13 (1997): 505-27.

polar bear not only is white but why the polar bear exists at all (with all its properties).[86] Since functional ascriptions are intended to explain *only* the presence of the trait itself, the weak theory suffers from a lack of explanatory specificity. In addition, Lewens notes the problem of pleiotropic traits reappears here since two coextensive traits will share the same "fitness" (here defined as reproductive success) even though only one may be the efficient cause.[87] In fact, many of the problems with the selected effects account reappear with the weak theory; thus, little progress has been made.

A more radical version of the weak theory (one that no longer technically belongs in the set of etiological theories) has been labeled the propensity theory.[88] The theory maintains that fitness and functionality are interwoven; however, Bigelow and Pargetter, the theory's main proponents, suggest history need not play any part in functional ascriptions. As long as a trait *would* confer increased fitness in an organism's natural habitat, it can be said to function towards that end.[89] Thus, in a commendable move, Bigelow and Pargetter affirm that functions explain fitness rather than fitness explaining functions. By ditching the etiological view, the propensity theory avoids the first appearance and the drift objections noted above: neither advantageous drift events nor the initial evolution of a trait presents a counterintuitive threat.

However, the benefits end here. Like the weak theory, the propensity theory demands an account of fitness. Yet if the ATTIF is correct, then fitness cannot be understood without an already established theory of functionality since functionality is embedded within the interpretation of fitness (i.e., as the second-tier aim). Thus, it cannot then explain functionality without becoming circular. Moreover, the threat of teleology looms in another of the theory's

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[86] Elliott Sober, "Natural Selection and Distributive Explanation: A Reply to Neander," *British Journal of the Philosophy of Science* 46 (1995): 388-9.

[87] Lewens, *Organisms*, 99.

[88] This is distinct from the propensity theory of fitness (PIF) discussed in chapter 3.

[89] John Bigelow and Robert Pargetter, "Functions," *The Journal of Philosophy* 84, no. 4 (Apr. 1987): 181-96. A very similar version of this theory was proposed earlier by William Wimsatt, "Teleology and the Logical Structure of Function Statements," *Studies in History and Philosophy of Science* 3 (1972): 1-80.

key principles: a natural or "normal" habitat. Bigelow and Pargetter assure the reader that "this sort of variable parameter is a common feature of many useful scientific concepts."[90] Yet Koons and Pruss have noted that the concept of a "normal environment" in Bigelow and Pargetter's paper is viciously circular.[91] A "normal environment" is defined as the location where the species' organs function properly, yet, simultaneously, proper functionality is defined by the creature's normal habitat.[92]

In addition, the propensity theory faces its own set of counterexamples. For one, the thumping noise of the heart seems to be functionless, yet with the advent of modern medicine, it enables the detection of abnormal heartbeats by doctors. One would have to conclude, then, that hearts now have two equal functions—pumping blood and making a thumping noise. In response, the authors propose that because heartbeat is "automatic," or would result regardless of whether it conferred survival value or not, their theory could, perhaps, be modified to bracket off such cases.[93] Yet what about rare cases where a dysfunctional organ enhances survival, such as when a slower heart rate prevents an artery with elastic holes from hemorrhaging?[94] Bigelow and Pargetter briefly note that the definition of a "normal habitat" should be extended to include the normal bodily functions of the organism.[95] While this reply cuts off one objection, it simultaneously creates another. Reparative systems, such as blood clotting, only function properly when bodily conditions are abnormal. Hence, these systems would, on this account, have no function.[96]

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[90] Bigelow and Pargetter, "Functions," 192.

[91] Koons and Pruss, "Must Functionalists," 201. Cf. Plantinga, *Warrant*, 206.

[92] Lewens, *Organisms*, 103 attempts to rebut this objection by appealing to "the environment in which the trait in question typically finds itself." However, traits would then become functionless if they belonged to species whose natural habitat has become rare/nonexistent (such as during extinction events) or when most of the population lives outside of its natural habitat, such as in cases where zoos contain more individuals of an endangered species than their natural habitat.

[93] Bigelow and Pargetter, "Functions," 195.

[94] Plantinga, *Warrant*, 206.

[95] Bigelow and Pargetter, "Functions," 192.

[96] Plantinga, *Warrant*, 207.

As a final note, McLaughlin has objected that *any* trait can confer a fitness contribution given the right circumstances.[97] A population's preference for a certain food source found only at one location might cause it to avoid a chance catastrophic avalanche nearby; that event, however, would not confer the function of "avalanche avoidance" on their particular set of taste buds. Indeed, one could surmise a near-infinite number of ways any trait might confer survival value. Thus, propensity accounts "turn out to be systematically under-specified."[98]

4.2 Systems-Oriented Theories

Given the problematic nature of etiological and propensity accounts, many theorists have opted for a different approach—one that prioritizes the role traits play within self-perpetuating systems.[99] Rather than looking to the past contribution of traits, this collection of views prioritizes the role traits presently play in interdependent processes.[100] Since certain parts of systems produce effects that serve a useful role in the perpetuation of that system, these effects can be regarded as normative for these parts.[101] Thus, systems-oriented theories do not rely upon evolution, fitness, or natural selection for functional ascriptions.

Christensen and Bickhard, for instance, define functions in just this manner.[102] According to them, functions originate in autonomous systems, which are defined as any system that "interactively generates the conditions required for its existence."[103] Such systems, they assert, interact with an external environment as a "causally integrated whole" and produce

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[97] Peter McLaughlin, *What Functions Explain: Functional Explanation and Self-Reproducing Systems* (Cambridge: Cambridge University Press, 2001), 125-8.

[98] Mossio et. al., "Organizational Account," 819.

[99] The view is typically seen as originating with Cummins, "Functional Analysis". However, since Cummins rejected the set of "canonical" desiderata, his project is not as relevant (or as well received) as later attempts that accept these desiderata.

[100] Wayne D. Christensen and Mark H. Bickhard, "The Process Dynamics of Normative Function," *The Monist* 85, no. 1 (2002): 4.

[101] Ibid, 13-4.

[102] A similar but wholly independent account is found in Mossio et. al., "Organizational Account," 813-41.

[103] Christensen and Bickhard, 17.

at least some of the conditions necessary for its own cohesion and work.[104] Living organisms, as textbook examples of such systems, are causally integrated networks where traits are dependent on one another for their continuity. This, they assert, is all that is required for normativity.[105] Moreover, they add their theory outperforms etiological theories in one crucial aspect: theirs can not only determine *when* dysfunction occurs but also *to what degree*. Etiological theories can merely notice when a trait fails to perform the task it was selected for. Systems-oriented approaches can determine to what degree this dysfunction affects the whole organism, landing anywhere from a mild annoyance to a lethal outcome.[106] Finally, their theory gives some explanatory depth to functional ascriptions; functions tell us what role the trait *currently* plays in a population.

Systems-oriented approaches avoid most of the objections leveled against etiological positions. There are, however, key weaknesses within Christensen and Bickhard's view. For instance, one major criticism that is leveled is the liberality objection. The criteria for functionality would apply to distinctly nonfunctional systems, such as when obesity produces a sedentary lifestyle and thus perpetuates its own persistence[107] or when panic disorders become self-perpetuating.[108] Moreover, the criteria for what counts as an autonomous system is equally liberal and would seem to include weather systems, ecosystems, plate tectonics, and many other processes. To avoid this, Christensen and Bickhard rely on the concept of cohesion which signifies systems that "produce emergent unified dynamical behavior."[109] The molecular bonds of a kite allow it to bear emergent causal properties, such as flight. However, cohesion will be distinct in living organisms; rather than being grounded in structural unity, biological

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[104] Ibid. Causation is here understood only as efficient causation.

[105] Ibid, 20 add resiliency and propagating dysfunction as additional traits. The former concerns the compensation by one part of the system for other, failing parts. The latter denotes the failure of the system if resiliency collapses.

[106] Ibid, 21.

[107] Christopher Boorse, "Wright on Functions," *Philosophical Review* 85 (1976): 75-6.

[108] Garson, *What Biological*, 56-7. This case is a paradigmatic example of a *dysfunctional* trait.

[109] Christensen and Bickhard, "Process Dynamics," 8.

cohesion emerges from interdependence. The parts of lifeforms mutually aid in the construction and preservation of the whole.

Nevertheless, even this addition may not be enough to preserve normativity, as the two authors themselves recognize. While traits' effects might be "useful" for the preservation of a system or a state, one cannot then assert that the traits *ought to* produce such results unless that end state is already deemed good.[110] Moreover, the addition of interdependent cohesion may not be enough to ward off damaging counterexamples. Ecosystems and the water cycle arguably demonstrate this level of interdependence and even a certain level of autonomy, yet few thinkers are willing to grant these systems normative functions. Similar remarks could be made of the aforementioned self-perpetuating states of obesity and panic disorders. Recognizing this, the authors confess, "We don't propose to offer determinate a priori answers to these kinds of questions; instead, what we hope to do is raise the issues and outline ways of meaningfully developing answers."[111]

Even if one overlooks these issues, their account likely cannot satisfy the last desideratum: distinguishing an accident from a function. One need only consider the aforementioned example of the slower heart rate that prevents an artery with elastic holes from hemorrhaging. According to the systems-oriented approach, the heart's slower rate would (counterintuitively) be for the sake of preventing hemorrhaging. In fact, McLaughlin's critique of the propensity theory might work equally well for systems-oriented approaches; any trait could potentially serve some function in helping to maintain the organism.[112] Thus, all traits would have a near-infinite set of dysfunctions at any given moment.

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[110] Ibid, 13-4 concede the weight of this argument, though they assert the etiological position suffers from the same is-ought dilemma. That, however, ought to motivate a rejection of both theories.

[111] Ibid, 25.

[112] Mossio et. al., "Organizational Account," 831ff seemingly admit this in their division between primary and secondary functions. Their claim that contributions are accidental if they occur only rarely is vague and seemingly arbitrary. Moreover, any newly evolved beneficial trait, by this definition, would be functionless.

Moreover, their account may not even serve as an exhaustive theory of functions. For instance, certain developmental processes work *against* stability, such as those controlling insect metamorphosis. While theorists could maintain that the same system is preserved through such changes, this would be difficult to justify without an additional theory of what constitutes the perduring essence. Reproductive organs, as well, fail to contribute to the maintenance of the biological system and therefore would be functionless. Mossio, Saborido, and Moreno have replied by suggesting reproduction maintains a higher-order historical system and thus functions at a populational level, but again, what defines these lineages outside of some historical continuity? When does one historical system evolve (if ever) into a new one? Indeed, we want to say reproduction has a function for a population or, perhaps, a species but not simply for some unbroken line of descent going back to the first organism. Here, again, the concept of some shared essence seems to be needed.

An interesting proposal has been made by McShea that systems-oriented approaches ought to be regarded as upper-directed.[113] Goal-directed systems are always couched within a higher system that constrains their choices of an end state without determining it. A predator seeking food is constrained by the food sources available to it within its ecosystem. However, McShea recognizes that certain non-goal-directed systems also satisfy his conditions; thus, he suggests the only true difference is that "goal-directed systems are more mysterious, perhaps more complex."[114] His position seems implausible given that despite our increasing knowledge of biological systems, biologist's usage of functional language has only increased, and we have little reason to believe that biologist's centuries from now will cease to regard the bird's wing as having the function of flying, no matter how much its mysteries give way to discovery. Yet McShea's central point is likely true: teleological systems are grounded in a higher system that

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[113] Daniel W. McShea, "Upper-Directed Systems: A New Approach to Teleology in Biology," *Biology & Philosophy* 27 (2012): 663-684.

[114] Ibid, 680.

constrains lower-order entities. It is a conclusion that harkens back to the ATTIF (in chapter 3) and Turner's proposals (in chapter 4).

The final account I will examine is Peter McLaughlin's, who represents a departure from the standard teleonaturalistic presuppositions. McLaughlin's approach can be broadly subsumed under the systems-oriented category, though, unlike his compatriots, McLaughlin recognizes the need to embrace some account of organismal goods. He writes, "If we ascribe the function of pumping the blood to the heart of an animal, we assume that the animal has a good…. Function bearers are parts of wholes that have a good."[115] McLaughlin defines a good trait as one contributing to the self-reproduction of a system. However, replicating crystals cannot be said to satisfy these conditions since they are not beneficiaries of their own replication.[116] Garson has objected to his position, asking, "If values are objective, then how do they fit into the natural world?"[117] His worry stems from the fact that the introduction of values would be a denial of naturalism—the fundamental assumption of teleonaturalists.[118] Yet if one simply denies that naturalism ought to retain its status as the unquestioned presupposition of the field, then this objection loses its weight.

Garson's dissatisfaction can also be traced to the fact that, "McLaughlin says very little about what goods are, or about the kinds of things that get to have them."[119] Admittedly, McLaughlin's account is simplistic, yet it suggests that an acknowledgment of organismal values might be required to satisfy the three desiderata while avoiding counterintuitive counterexamples. Indeed, if organisms have Aristotelian-style goods, then functions, which are those traits that regularly bring about certain good effects, would be explanatory, normative,

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[115] McLaughlin, *What Functions*, 191.
[116] Ibid, 181-2.
[117] Garson, *Critical Overview*, 105.
[118] Garson, *What Biological*, 55. Garson does, however, question this assumption, remarking that although naturalism is the default and a preferable position given his aversion to excessive ontological commitments, other positions ought to be on the table.
[119] Ibid.

and differentiated from accidental goods. In fact, functions would explain not only a trait's causal role in the preservation of the system (as with the systems-oriented approach) but also its presence within populations (as is achieved by etiological theories). However, in the latter case, the right functioning of traits explains selection rather than selection explaining functionality. Such explanations thus reverse the explanatory scheme of etiological theories; functional traits bring about good effects, which, in turn, allow their possessors to thrive and reproduce. Additionally, the presence of values allows for objective normative assessments of traits, and the acknowledgement of a creaturely essence grants the capacity to differentiate accidental goods from natural ones. Finally, this approach appears far more impervious to the problem of liberality and false functional ascriptions.

5. Defining Functionality

How, then, ought functionality be defined? I will offer the seemingly simplistic definition that *functionality denotes the goal-directedness of a trait towards a good end.*[120] To say the function of a heart is to circulate blood is to assert that hearts are directed towards this end. Its fulfillment of this end can simultaneously explain why hearts exist in certain organisms, both etiologically (through the selection of such beneficial effects) and systemically (by contributing to a process that is itself good for the organism). In other words, blood circulation is vital for many creatures' survival, and since survival represents the end towards which most functional traits are aimed, blood circulation acts as an instrumental good towards this goal. Thus, this account explains both a trait's present contribution and the past selection events that retained it within a population and therefore satisfies the aims of both the etiological and systems-oriented approach. Trait functionality, then, simply denotes the teleological nature of the parts in relation

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[120] Good ends are determined by both beneficiaries of the ATTIF (organisms and populations/species). See chapter 3 for more details.

to the whole of the organism/species.[121] This definition allows functionality to fit neatly within the structure of the ATTIF outlined in chapter three and the whole theological system described under the metaphysical notion of goodness in chapter one (i.e., biological goodness as metaphysically grounded in Goodness itself). However, this deceptively simple solution entails a complicated web of implications.

6. Reciprocal Poiesis

I group these implications under the label reciprocal poiesis for reasons that will be developed below.[122] The discoveries and perspectives that have been broadly grouped within the extended evolutionary synthesis are central to this section.[123] The section's aim will be to demonstrate that, in overly simplified form, the relationship of development to functionality corresponds to the relationship of efficient causality to final causality. Development is *for the sake of* producing functional traits and processes as noted earlier by the ATTIF. However, I will additionally indicate why this relationship is complicated by the fact that each aspect reciprocally constitutes the other. This connection is complicated further by the reciprocally constitutive relationship between the organism and its ecological context. Before dissecting this dense topic, however, I begin with a critique of the adaptationist model, which has been the primary metaphor behind contemporary functional theories, based upon the discoveries of the extended synthesis.

6.1 A Better Metaphor

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[121] For reproductive organs, the part-whole relationship is trait-to-species whereas for (most) nonreproductive traits it is trait-to-organism.

[122] This account shares many similarities with (and draws heavily from) Denis Walsh's Situated Darwinism (see below). Due to the differing goals of our projects, I have chosen a distinct label. See D. M. Walsh, *Organisms, Agency, and Evolution*, (Cambridge: Cambridge University Press, 2015), 163ff.

[123] Kevin Laland et al., "Does Evolutionary Theory Need a Rethink? Yes, urgently," *Nature* 514 (Oct. 2014): 164 argue that such discoveries, "demonstrate that development is a direct cause of why and how adaptation and speciation occur."

One of the fundamental theses of the extended synthesis is that the activities of organisms are factors in evolution. In other words, while the modern synthesis views natural selection as the sole source of adaptations, newer discoveries have shown that organismal development (defined here as any process involved in the formation, transformation, or maintenance of an organism's form, function, or behavior) is responsive to ecological context and therefore is another factor in the production of trait adaptations.[124] This challenges the thesis that trait variation is a product of pure random events, positing instead that development is often biased towards certain outcomes. While the modern synthesis often acknowledged development as a constraining factor, the extended synthesis goes further by embracing the notion of "developmental processes as a creative element."[125] In short, development and selection cooperate in the creation and evolution of life. Stochasticity, while still a factor, is increasingly being recognized as a means utilized by developmental processes for the production of phenotypic novelty.[126]

Yet if treating adaptations as mere byproducts of environmental causes is misguided, then so must the usage of the artifact model. This model treats adaptations *as if* they were designed to solve a certain environmental problem and hence is often used as justification for teleological language.[127] The strength of this model lies in the fact that regarding certain traits as purposefully designed has, indeed, proved a valuable heuristic. Thus, attacking the value of adaptationism's usage of teleological thinking, as many of its critics have done, is misguided. For instance, Michael Ghiselin has argued that such language "is bad because it asks the wrong question, namely, What is good?... The alternative is to reject such teleology altogether. Instead

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[124] Ibid, 162.
[125] Ibid, 164.
[126] Lenny Moss, "From Representational Preformationism to the Epigenesis of Openness to the World?: Reflections on a New Vision of the Organism," *Annals of the New York Academy of Sciences* 981 (Dec. 2002): 221 compares this to the immune system's response to foreign invaders. While the generation of variable regions of antibodies to counteract antigens is often random, it nevertheless has a clear goal.
[127] Lewens, *Organisms*, 39.

of asking, What is good? We ask, What has happened?"[128] Ghiselin here disregards the fact that asking, "What is good?" *reveals* what likely led to the retention of a given trait; without the assumption of some *good* effect being preserved by the evolving population, the retention of certain traits (i.e., "What has happened") would prove mysterious.[129]

The fundamental issue with adaptationism (overlooked by many critics) is *not* its teleological thinking but that, like an artifact, organisms are regarded as passive, atomized products of external agents. Often, each trait is explained independently of the organism it belongs to, yet as Gould and Lewontin remind us, organisms are "integrated entities".[130] Treating organisms like artifacts is the legacy of early modern science—specifically Descartes' mechanistic understanding of living organisms.[131] Despite adaptationism's long history and heuristic value, Gould and Lewontin rightly note its failure to capture the essence of lifeforms. Thus, functional theories (specifically the selected effects approach) err by addressing the problem as if selection was merely a surrogate for an intelligent artisan. Yet, as Fodor's critique reveals, this externalist conception of natural selection fails to relieve itself of its theistic baggage.

Is there, then, a better metaphor that preserves the heuristic value of the artifact model? The reason the artifact model proves valuable is that it treats certain ends as goods that are then pursued by an agent. In other words, it is the teleological nature of the metaphor that grants it value. While artifacts might seem the most obvious parallel, a more immediate (and overlooked) analogue is agential action. Agents seek certain goals perceived as goods, and it is

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[128] Michael Ghiselin, "Lloyd Morgan's Canon in Evolutionary Context," *Behavioral and Brain Sciences* 6, no. 3 (1983): 363.

[129] Other critics have targeted "panadaptationism" and the supposed treatment of all biological traits as adaptations of some sort. This critique, however, does not attack adaptationism itself but merely its application.

[130] Stephen Jay Gould and Richard Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme," *Proceedings of the Royal Society of London B* 205, no. 1161 (Sept. 1979), 585.

[131] This idea originated after Descartes' encounter with complex automata on his visit to the Francini brothers in Saint-Germain-en-Laye in 1614. See Richard G. Olson, *Science and Religion: 1450-1900* (Baltimore: The Johns Hopkins Press, 2004), 74-6.

perhaps encouraging that certain adaptationists have sought to employ this metaphor instead in order to preserve an ontology of organisms as integrated entities.[132] Moreover, the metaphor better captures the extended synthesis's emphasis on the organism as active and creative in its own development and evolution. Given this, I will now analyze each aspect (development and functionality) and explain how this understanding illuminates their respective reciprocally formative nature.

6.2 Development

While developmental factors have always played some role in evolutionary explanations, this role has normally been restricted to morphological restraints imposed by developmental limitations.[133] Indeed, the canalization represented by epigenetic landscapes conveys this fact. Given this exclusively restrictive role, many biologists conclude, "natural selection explanations must take priority, whereas development is an explanatory redoubt of last resort."[134] Natural selection creates whereas development merely inhibits. Yet this competitive explanatory regime, which treats development as ontologically independent of selection, has come under increasing attack in recent years, especially given the fact that, as noted by the ATTIF, selection only occurs *as a result of* developmental processes. Some, like Walsh, have even argued, "Adaptive evolution *just is* development."[135] Minimally, however, it would be incorrect to oppose the two processes (an error that has apparently led to a biological "turf war" between conflicting sides).[136]

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[132] Okasha, *Agents and Goals*, 34.
[133] As Lewens, *Organisms*, 79 notes, the environment underdetermines which traits are selected. There are always multiple solutions to any given environmental stressor. If we wish to account for why one solution was selected over others, constraints will play an explanatory role.
[134] Walsh, *Organisms*, 137.
[135] Ibid, 143. Walsh attributes this confusion to the widespread mechanistic mischaracterization of both processes as competing forces.
[136] Ibid, 183. For a recent attempted rapprochement, see Rose Novick, *Structure and Function* (Cambridge: Cambridge University Press, 2023).

The extended synthesis has striven to overcome this competitive model. In an article for *Nature*, a team of their leading advocates writes that their alternative vision of evolution regards "The processes by which organisms grow and develop… as causes of evolution," and that, "Living things do not evolve to fit into pre-existing environments, but co-construct and coevolve with their environments, in the process changing the structure of ecosystems."[137] While they contend that the evidence for their position grows daily, the greater biological community has shown staunch resistance due to, as they believe, the "spectre of intelligent design."[138] They continue, "This is no storm in an academic tearoom, it is a struggle for the very soul of the discipline."[139]

If the extended synthesis is correct in asserting that development is integral to natural selection, it is apt to ask, "At what level?" To answer this, we must return to the three conditions needed for selection: trait variation, heritability, and fitness differentiation—or, as Walsh phrases it, sources of novelty, constancy of form, and adaptively biased changes.[140] Chapter three focused on the last of these elements. Utilizing the novel discoveries within the extended synthesis, I will now demonstrate that the other two aspects are not only intimately tied to development but also exhibit organismal purposiveness. This will be achieved by analyzing two major concepts within the extended synthesis, developmental plasticity and the DNA damage repair system.

6.2.1 Developmental Plasticity

Philosopher Lenny Moss has characterized the Modern Synthesis's view of the gene as "representational preformationism"—a term that denotes the supposed representation a gene

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[137] Laland et. al., "Evolutionary Theory," 162.

[138] Ibid.

[139] Ibid.

[140] Denis Walsh, "Chance Caught on the Wing: Metaphysical Commitment or Methodological Artifact?" in *Challenging the Modern Synthesis: Adaptation, Development, and Inheritance*, ed. Philippe Huneman and Denis Walsh (Oxford: Oxford University Press, 2017), 254-5; cf. Richard Lewontin, "The Units of Selection," *Annual Review of Ecology and Systematics* 1 (Nov. 1970), 1-18.

carries of some future functional phenotypic trait.[141] On this view, since the genes themselves are merely the byproducts of stochastic mutations, the origin of functional traits would be explained by a more basic random process. However, if the expression of genes[142] is mediated by purposive epigenetic factors, then the origin of adaptive traits cannot be reduced to chance events. And, in fact, such regulation, known as phenotypic plasticity, is an integral part of development and, consequently, evolution. The term signifies an organism's ability to react adaptively to new phenotypic and ecological inputs "with a change in form, state, movement or activity."[143] For instance, if one new phenotype is introduced, the whole organism must accommodate this novelty, yet if such accommodation required its own fortuitous mutation, "the waiting time… can be prohibitively long and the probability of subsequent loss through drift can be high."[144] Thankfully for the organism, the various interconnected systems can respond adaptively to changes in circumstances.[145] In other words, genes are not deterministic; organisms can respond to perturbations by altering their phenotype in a purposive and flexible manner. In fact, in one extreme example, *Oxytrichia trifallax* is capable of rewriting 90 percent of its somatic genome.[146] This plasticity by the organism has been labeled robustness by Andreas Wagner, who believes it represents "a ubiquitous, and probably primal phenomenon of life."[147]

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[141] Moss, "From Representational," 222.

[142] As ibid 223ff notes, the term "gene" has two equivocal meanings: 1.) A genetic sequence that expresses the same phenotype (e.g., any gene that results in cystic fibrosis), and 2.) A particular genetic sequence. If genes had a one-to-one correlation with traits, this equivocity would not be problematic, yet (as noted below) this assumption has faced withering critiques. Thus, the gene-centric view can no longer "pack" functional traits (as representations) into certain genetic sequences.

[143] Mary Jane West-Eberhard, *Developmental Plasticity and Evolution* (Oxford: Oxford University Press, 2003), 37.

[144] D. W. Pfennig et al., "Phenotypic Plasticity's Impact on Diversification and Speciation," *Trends in Ecology and Evolution* 25, no. 8 (2010): 460.

[145] Walsh, "Chance," 252-3.

[146] Xiao Chen et al., "The Architecture of a Scrambled Genome Reveals Massive Levels of Genomic Rearrangement during Development," *Cell* 158, no. 5 (Aug. 2014): 1187-98.

[147] Andreas Wagner, *The Origins of Evolutionary Innovation: A Theory of Transformative Change in Living Systems* (Oxford: Oxford University Press, 2011), 216.

While robustness might appear to be fundamentally conservative and thus antithetical to evolution, it plays a significant role in the production of novelties. In fact, adaptive phenotypic change without an accompanying genotypic mutation has been argued to be the primary source of novelty.[148] In some cases, phenotypic changes might precede *and induce* genotypic changes that will help to preserve the novel phenotype.[149] As Walsh summarizes, "The capacity of organisms to respond to changes and perturbations in ways that preserve their viability is required to *explain* the origin and maintenance of novel phenotypic characters in evolution. Evolution is adaptive, because organisms are adaptive, goal-directed systems."[150] Genes do not "represent" a precise phenotype but rather co-create the organism in conversation with environmental and developmental factors. While a conserved core of processes is maintained across all multicellular species, these combine with an array of highly plastic, variable features that produce "facilitated variations" which maximize phenotypic options while minimizing their inherent lethality.[151] In sum, "adaptive evolution is not ineluctably chancy. It is inherent in the purposiveness of organisms."[152]

6.2.2 The DNA Damage Repair System

One of the foundational presuppositions of the Modern Synthesis has been the static nature of an organism's genome. However, a growing body of empirical evidence has revealed that the integrity of this code only results from adaptive responses by the organism. The DNA damage repair system (DDR) is an intricate series of mechanisms designed to restore or alter the structure of damaged DNA.[153] For humans, DNA lesions occur tens or even hundreds of

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[148] West-Eberhard, *Developmental*, 503; Andreas Wagner, "The Role of Robustness in Phenotypic Adaptation and Innovation," *Proceedings of the Royal Society B: Biological Sciences* 279, no. 1732 (2012): 1249-58.
[149] Stuart Newman, "Complexity in Organismal Evolution," in *Philosophy of Complex Systems*, ed. Cliff Hooker (London: Elsevier, 2011), 335-54.
[150] Walsh, "Function," 202.
[151] Marc Kirschner and John Gerhart, "Facilitated Variation," in *Evolution: The Extended Synthesis*, eds. Massimo Pigliucci and Gerd Müller (Cambridge MA: The MIT Press, 2010), 262.
[152] Walsh, "Chance," 257.
[153] Ibid, 253-4.

thousands of times per cell per day,[154] and any lesions left unrepaired may result in severe repercussions. As such, the responses of the cell are multivarious and specified to the unique attributes of the damaged DNA structure.[155] Thus, the efficient causal asymmetry often presumed by the Modern Synthesis (immutable genes giving rise to functional traits) reveals itself to be too simplistic;[156] genes not only generate functional traits but are themselves preserved by a complex functional system adapted to respond to the specific needs of DNA maintenance. In other words, to explain the stability of DNA structure, one needs to invoke the goals of the DDR (just as in the case of other functional traits).[157]

6.2.3 Reciprocity of Functions and Development

Consequently, phenotypic plasticity produces the variation needed for natural selection, and the DDR preserves the stability of genomes, allowing for heritability. Hence, all three aspects of natural selection—trait variation, heritability, and fitness—depend, to some degree, upon functional traits and, therefore, upon teleology. It might seem, however, that I have contradicted the ATTIF at this moment, for it treats development as causally prior (with respect to efficient cause) to functionality, yet in this section, I have argued that developmental processes (namely, phenotypic plasticity and the DDR) *are themselves already functional*. This paradox is fundamental to the first pillar of what I have called reciprocal poiesis: functionality and development reciprocally constitute one another. Developmental processes produce functional traits, yet development itself is driven by functional traits. The causal arrow is cyclical.[158] As such, it is best to regard the ATTIF as a simplified model for understanding natural selection.

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[154] Alberto Ciccia and Stephen J. Elledge, "The DNA Damage Response: Making It Safe to Play with Knives," *Molecular Cell* 40, no. 2 (2010): 179-204.

[155] Walsh, "Function," 210.

[156] A famed example is Jacques Monod, *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, trans. Austryn Wainhouse (New York: Schopf, 1971).

[157] Walsh, *Organisms*, 204.

[158] Cyclical causation within organisms was noted by Immanuel Kant. See his *The Critique of Judgment*, trans. James Creed Meredith, ed. Nicholas Walker (Oxford: Oxford University Press, 2007), §65.

Ontologically, functionality and development are intricately linked and co-constitutive; moreover, each is *for the sake of* the other, and each has the more distal aim of survival/reproduction. Nevertheless, it may still be heuristically and didactically valuable for the purposes of defining fitness to simply regard the causal arrow as leading from development (efficient cause) to functional traits (final cause). It is also important to note that not all trait functions are for the sake of development. As such, I will consider these traits next.

6.3 Functionality

Many trait functions, such as sense organs, are not *directly* related to development.[159] Nevertheless, they are not freed from a co-constitutive relationship, though, in this case, the reciprocity emerges between the environment and the purposive aspects of organisms. I will expand upon the reciprocalist model of natural selection discussed in chapters 3 and 4 and argue that organisms constitute their relevant ecological contexts which in turn causally impact their evolutionary development. Here again, the causal arrow is cyclical.[160] While Lewontin's concept of niche construction has formed the foundation for these ideas, I will focus on Denis Walsh's more recent (and radical) Situated Darwinism in this section.

Denis Walsh classifies his approach as "neo-Aristotelian," contrasting it to the "neo-Democritean" hegemony of the modern synthesis.[161] By treating organisms as products of purposive processes, neo-Aristotelianism "relieves biology of the obligation to accord an ineliminable role to chance."[162] Citing Aristotle, Walsh notes that the same event can be interpreted as either a chance event or purposive depending upon the metaphysical prejudices of the observer. To illustrate, one can describe the activities of a farmer purely mechanistically

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[159] While sense organs emerge from development and their contributions assist developmental processes *indirectly*, they are not themselves *directly* involved in the formation and maintenance of the organism.

[160] However, this is only true of efficient causation. The ecological effects on species do not happen *for the sake of* that particular evolutionary result.

[161] Walsh, "Chance," 241ff. In Walsh, *Organisms*, 207, Walsh labels neo-Democritean views "bargain-basement metaphysics."

[162] Walsh, "Chance," 241.

(the firing of neurons, contractions of her muscles, etc.), yet such explanations would, on their own, be incomplete. It would overlook the final cause that explains the whole series of events—namely, the desire to harvest crops. Because of the modern synthesis's metaphysical biases, it only allows for mechanistic explanations and is, therefore, blind to purposive events.[163]

Yet, as Walsh notices, one can distinguish between a chance event and a purposive one in that only the latter is counterfactually robust (i.e., an effect is invariant across a range of nearby possible worlds). Chance events, by contrast, are highly sensitive to initial conditions. If one slightly adjusted the initial conditions of the farmer, the same goal would likely still result (i.e., the harvesting of crops) because this end-state directs the means to achieving it. Thus, purposive events can be explained in two different ways—either mechanistically or teleologically—while chance events permit only a mechanistic explanation.[164] The counterfactual dependence is summarized thus: if the goal is not present, neither is the means, and if the goal is present, then the means will obtain.[165] Indeed, as noted in chapter 1, Aristotle claimed teleological motion is characterized by its consistency, occurring "always or usually" (*Phys.* II.8).

Walsh adds that a complete teleological explanation will also fulfill the "description dependent" nature of explanations. In other words, explanations must describe *why* such relations occur and not merely point them out.[166] Thus, Walsh characterizes the difference between final causal explanations and "productive" (efficient) causal explanations as the distinction between "conducing" and "producing". Conducing an end simply means an end occurs "robustly and reliably… *ceteris paribus*, across a range of counterfactual

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[163] Ibid, 243-7.

[164] Ibid, 244. The term "mechanistic" is preferred by Walsh. I retain it here only for consistency and not as a commitment to any metaphysical system.

[165] Walsh, "Function," 207.

[166] Walsh, *Organisms*, 198-9.

circumstances."[167] He therefore concludes that mechanistic and teleological explanations are "complementary and noncompeting."[168] Each has its own explanatory domain. "One explains the *how* it happened; the other the *why*."[169]

Unfortunately, the goodness of ends is noticeably absent from Walsh's account. Indeed, he writes, "To say that system *S* did *x* in order to achieve *y*, is just to say that under the circumstances, *x* was conducive to *y*. It does not require that *y* is objectively good or valuable."[170] This, however, opens Walsh up to the liberality objection. As Mark Bedau notices, a stick in a river can get pinned against a rock, creating a backwash that keeps it pinned even through minor disturbances.[171] Why ought this not also be considered a means-goal relation? Walsh defines a goal-directed process only as a process that "bring[s] about and maintain[s] stable end-states."[172] Supposing the stick remains pinned across a range of counterfactual circumstances, Bedau's example would satisfy the conditions of a goal-directed process. The "goal" (the stable end-state of the pinned stick) conduces its means, yet this example is clearly not a case of a goal-directed process. Not all counterfactually robust end-states are goals, and Walsh's account cannot differentiate the two.

To solve this issue, I contend that goals are not reducible to an explanatory relation involving counterfactual robustness; instead, goals derive from the definition of what it is to be a particular instance of something (i.e., a thing's essence). To be an instance of *x* entails a list of properties that define *x* as a certain kind of thing. Thus, to be a token *x* means one ought to obtain this set of properties simply by virtue of the kind of thing *x* is. It is these essential properties that define a goal for an organism regardless of whether or not the organism can,

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[167] Ibid, 199.
[168] Ibid.
[169] Ibid.
[170] Ibid, 201.
[171] Mark Bedau, "Where's the Good in Teleology?" *Philosophy and Phenomenological Research* 54, 4 (Dec. 1992): 786.
[172] Walsh, *Organisms*, 194.

indeed, obtain them. For example, to be a pigeon means to be a kind of organism that flies; thus, the power of flight would be a goal for all instances of pigeons. In addition, since obtaining these properties is synonymous with the perfection of a creature's form, these properties constitute the goods of a creature. This alternative conception avoids the problems of dysfunctional traits and liberality noted above; it likewise explains *why* certain ends conduce their means; such ends constitute a thing's good and thus are the final cause towards which its natural motion is directed. Consequently, functionality, as per the definition above, requires an account of the goodness of an end. Goals explain first by identifying a good end and only then by how they conduce the means for their own actualization. As Aristotle and Aquinas observed, the formal and final causes cannot be segregated in a causal explanation.

Fortunately, Walsh is no stranger to invoking Aristotelian essences despite their widespread unpopularity in biology.[173] In fact, Walsh's account of evolution relies heavily on James Lennox's interpretation of what Aristotle called a creature's "way of life" (βίος or *Bios*).[174] According to Lennox, an organism's βίος constitutes the integration of its many activities and parts.[175] For instance, nocturnality demands a certain coordinated set of traits and behaviors that allow an organism to thrive in low light. Nocturnality combines with a set of other features (e.g., arboreality, predatory, sexually reproducing, etc.) to form the unique mode of living for a species that differentiates it from other types of organisms. This concept then defines the good of a species, and value judgements on the goodness of traits and behaviors must make reference to an organism's βίος.[176] Moreover, an organism's adaptations are teleologically explained via their role within the greater βίος.[177] In other words, the βίος is the

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[173] E.g., Denis Walsh, "Evolutionary Essentialism," *British Journal of the Philosophy of Science* 57, no. 2 (2006): 425-48.

[174] Walsh, *Organisms*, 5.

[175] James G. Lennox, "*Bios* and Explanatory Unity in Aristotle's Biology," in *Definition in Greek Philosophy*, ed. David Charles (Oxford: Oxford University Press, 2010), 334ff.

[176] Ibid, 342.

[177] Ibid, 345. Cf. Aristotle's *PA* I, 645b15-20.

principle of unity over the organism's traits and behaviors and thus has explanatory and conceptual priority; one cannot understand the parts until one grasps the whole. Lennox asserts, "In virtually all passages in which an animal's way of life plays an explanatory role, it is explanation of the type … [*De partibus animalium*] 640a33–34: 'since this is what it is to be X, on account of (*dia*) this it has these things'."[178] As such, while Walsh employs the concept of βίος in his attempted retrieval of Aristotelianism, his approach would be improved by recognizing how a βίος grounds both organismal goals *and* evaluative statements about the goodness of traits.

How, though, does the βίος of organisms affect evolutionary change? It may be remembered that Walsh is a statisticalist regarding natural selection. As such, Walsh argues that individual-level causes, driven by development and an organism's βίος, result in the higher-level statistical phenomenon of natural selection.[179] Selection, then, merely measures the distributional changes within populations undergoing a host of evolutionary effects (migration, drift, fitness differentiation, etc.). This, Walsh explains, results in the ontological dependence of selection on development.[180] While selection might allow for predictions of populational change, these explanations are grounded upon lower-level processes.

Walsh's critique of the Modern Synthesis goes further; extending Lewontin's concept of niche construction, Walsh argues that organisms establish a set of "affordances",[181] which he defines as, "Opportunities for, or impediments to, the pursuit of a system's goals."[182] The organism's goals, derived from its βίος, necessitate a certain relationship with its conditions: certain items have more significance for the organism than others. These affordances, in turn,

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[178] Ibid, 349.
[179] Walsh, *Organisms*, 146-7.
[180] Ibid, 148.
[181] This term derives from James J. Gibson, *The Ecological Approach to Visual Perception* (Boston: Houghton Mifflin, 1979).
[182] Walsh, *Organisms*, 163.

become the means by which an organism purposefully operates within the world.[183] Thus, by creating and then responding to affordances, organisms act as agents in their own evolutionary fate.[184]

Walsh further asserts this conclusion entails the denial of two sacrosanct aspects of the Modern Synthesis: environmental autonomy and explanatory externalism. Regarding the former, Walsh states that traits can no longer be regarded as responses to environmental stressors and fixed ecological niches. The supposed shared "selective environment"[185] that imposes the same pressures on a host of organisms is, he asserts, a "construct… [and] a pragmatic or heuristic device."[186] The environment underdetermines adaptations, for the same environment may result in distinct evolutionary responses. Thus, it is not the environment *per se* that determines form but only the environment *as experienced and responded to* by the organism (i.e., the environment as a series of affordances).[187] For instance, paramecium and porpoises occupy the same environment (the ocean), yet due to their size, water viscosity is greater for the paramecium, thus requiring a different method of locomotion.[188] Therefore, treating an environment as an abstract external entity commits a "metaphysical error."[189] While explanatory externalism cleanly divides between the contributions of development and external selection pressures—a dichotomy that allows for biologists to treat organisms as mere objects—Walsh's approach, what he calls Situated Darwinism and I have elsewhere labeled reciprocalism (see chapters 3-4), recognizes the agential role organisms play in crafting both domains.[190]

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[183] Ibid, 174.
[184] Ibid, 209.
[185] Kim Sterelny and Paul E. Griffith, *Sex and Death: An Introduction to Philosophy of Biology* (Chicago: Chicago University Press, 1999), 269 call the selective environment, "The critical notion for evolutionary theory."
[186] Walsh, *Organisms*, 225.
[187] Ibid, 223.
[188] Ibid, 171.
[189] Ibid, 237.
[190] Ibid, 172 claims Waddington was "ahead of his time" in recognizing this "participatory" role.

Consequently, Walsh rejects adaptationism in favor of more “participatory” terminology, opting for words such as “intimacy” and “commingling”—words that fit within the agential metaphor suggested above.[191] These terms better capture the co-constitution of biological form and affordances. In other words, form determines affordances and affordances shape form. Similarly, a shift in one results in a reciprocal shift in the other. This, Walsh argues, distinguishes his “constitutive” interpretation of niche construction from “causal” ones which, in theory, still firmly distinguish between a separate environment and the organism.[192] This “dialectical” relationship results in reciprocal changes to organismal βίοι and morphologies,[193] and a clear example of this, according to Walsh, is the evolution of human appendages in response to tool use.[194] By “enacting evolution,” evolution becomes not a “chancy” process but a teleological one—one enacted by agents.[195] Functional traits (what Walsh calls an organism’s “repertoire”) are then the teleological products of a teleological process: “The capacities of organisms to succeed in the struggle for existence are both the phenomenon to be explained, and the principles that explain them.”[196]

How, then, does Walsh intend to reconcile Situated Darwinism with the success of the Modern Synthesis? He proposes introducing the term “theoretical population” to population dynamics in order to avoid the allusion of a shared environment. While the latter concept still has heuristic value, environments should not be “hypostatize[d] as autonomous causal entities.”[197] Thus, compatibility lies in recognizing the Modern Synthesis as an abstraction and Situated Darwinism as a metaphysic. Walsh concludes by noting (in reminiscence to conclusions from chapter 4) the deviation of the Modern Synthesis from Darwin’s original

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[191] Ibid, 173. Walsh mentions John Haugeland, Heidegger, and Merleau-Ponty as partial inspirations.
[192] Ibid, 179-81.
[193] Ibid, 175.
[194] Campbell Rolian, Daniel E. Lieberman, and Benedikt Hallgrìmsson, “The Co-Evolution of Hands and Feet,” *Evolution* 64, no. 6 (2010): 1558–1568.
[195] Walsh, *Organisms*, 209.
[196] Ibid, 214.
[197] Ibid, 227.

conception and how, by reintroducing the struggle for life, Situated Darwinism positions itself as a truer heir to Darwinism.[198]

By way of analysis, caution should be taken at Walsh's assertion regarding the objectivity of a shared environment, for given that a common essence is shared by a population, a common set of ecologically relevant factors can be derived. This might be correctly described as an abstraction but one not far removed from the underlying ontology of organisms themselves. Thus, there is a sense in which it is still possible to speak of a *natural* habitat in an objective sense as those set of affordances common among a population, and one can still map environmental parameters for a given species (as is performed in establishing Hutchinsonian niches). Walsh's point, though, is well taken: these parameters exist *because of* the organism. As a final note, Walsh, as a statisticalist, asserts Situated Darwinism denies the objective distinction between "genuinely evolutionary" changes and episodes such as drift.[199] However, given the ATTIF, a (final) causal distinction can be made as Chapter 3 makes clear.

Despite these minor issues, Situated Darwinism nevertheless reveals the reciprocity between an organism and a set of ecologically relevant factors. To summarize, one can rightly say that biological functionality, defined as the goal-directedness of traits toward a good end, arises from the complex relationship between an experienced environment and an organism's development. One can equally claim that functional traits determine a set of affordances, which, in turn, impact development. One could continue by similarly asserting that functional traits regulate development which then establishes a set of affordances, that affordances impact development which then determines an adaptive response, etc. The relationship can be construed in any manner since all three exist in a single reciprocally constitutive relationship. Each remains conceptually distinct yet co-constitutive and ontologically grounded by the

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[198] Ibid, 230ff.

[199] Ibid, 241.

organism's βίος.[200] The βίος is the unifying principle that explains an organism's development, functional traits, and affordances as well as their teleological relationship to one another.

The initial goal of this chapter was to demonstrate the teleological nature of functionality; the result has been to expose the complicated web of relations that form functional traits. I have therefore chosen to title this perspective reciprocal poiesis—a phrase that references both the reciprocalist explanatory model of selection and the terminology of Aristotle.[201] I turn now to theologically reflect upon these conclusions.

7. Philosophical and Theological Reflection

The foregoing analysis has shown that biological functionality is grounded in an organism's βίος. Life, then, is nothing outside of its teleological nature. A βίος defines not only the norm for a particular organism but also structures the subsidiary functional traits towards that unified goal. An organism simply *is* its telos. What implications might this have for the ATTIF and, more broadly, the theological framework I have tied to it? To answer, I analyze the work of Andreas Wagner and the implications of the facts presented in this chapter on the question of life's creativity.

While evolution might be called purposive under reciprocal poiesis, is it appropriate to also suggest it is creative? Such a proposal might appear extreme, yet Wagner, whose work features prominently in the extended synthesis, has recommended just such terminology.[202] In a series of studies, Wagner and his team concluded that of the 10^{130} possible proteins with just

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[200] It is the organism's "way of life" that determines how it develops, what its particular ends are, and thus establishes a set of affordances *as affordances*.

[201] See, for instance, *NE* VI.5, 1140b1-5.

[202] Wagner cites Donald Campbell, "Blind Variation and Selective Retention in Creative Thought as in Other Knowledge Processes," *Psychological Review* 67 (1960): 380-400 as sparking the conversation on this topic. Cf. Dean Keith Simonton, "Picasso's Guernica Creativity as a Darwinian Process: Definitions, Clarifications, Misconceptions, and Applications," *Creativity Research Journal* 19 (2007): 381-94.

one hundred amino acids,[203] only about 1 in 10,000 are functional. Yet, in order to evolve, each mutation must be functional; the theory of Darwinian evolution risks falsification if the evolution of one functional protein to the next is separated by thousands of nonfunctional intermediates. Remarkably, when this "library of protein forms" was catalogued, the "genotype network" of all viable forms was shown to be interwoven in a series of "neutral networks".[204] In other words, genotypes coding for the same functional form produced networks that allowed access to other functional forms. Rather than a cluster of isolated islands of functionality, these networks form "bridges" that allow populations to explore genotypic space without losing phenotypic viability until they "arrive" at a new functional protein through a single mutational jump. In fact, some identical protein folds discovered by Wagner's team shared no amino acids in common.

Because of this, evolution only needed to investigate a minuscule portion of the full space—indeed, only $10^{-100\text{th}}$ of the total space—to discover all possible functional forms. Even more remarkably, Wagner's team discovered similar setups for both metabolism and gene regulation.[205] He writes, "Starting from anywhere in the library—*anywhere*—you need not walk very far, only fifteen steps away from a genotype network, before finding the genotype network of *any* other circuit."[206] The canalization first proposed by Conrad Waddington (see chapter 4) proved to not only preserve form but innovate form, as well.

Wagner draws two conclusions from his research. First, he parallels evolutionary creativity to human creativity. Both operate through trial and error, resource old solutions in new ways, and can even be mapped algorithmically.[207] Wagner has even recently devoted an

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[203] Some proteins, like *titin*, are 30,000 amino acids in length. Thus, the number arrived at by Wagner's team (10^{130}), as astronomical as it already is, pales next to the actual, as-yet-incalculable number of possible proteins.

[204] Wagner, *The Origins*, 15.

[205] These discoveries are helpfully summarized in Andreas Wagner, *Arrival of the Fittest: How Nature Innovates* (New York: Current, 2014).

[206] Ibid, 183.

[207] Ibid, ch. 7.

entire work comparing the processes of evolution to human ingenuity, citing research on how eminent creators generate a profusion of ideas before selecting the one that best fits their intentions.[208] This, he maintains, perfectly parallels the processes occurring on the adaptive landscape. The greatest creators are, statistically, those that also generate the most failures, yet even these failures are not without "purpose". Similarly, selection and drift are, according to Wagner, utilized by populations to explore the adaptive landscape and find higher peaks. Moreover, creative individuals are surprisingly incapable of predicting the success of their novelties. Like evolving populations, novelty emerges seemingly sporadically in search of success. In other words, the process of variability and selection seems to be the universal creative method at the anthropological, biological, chemical, and perhaps even the molecular level.[209] Wagner's conclusions map well with the concept of reciprocal poiesis. If the teleological activities of organisms drive evolutionary change, the analogy between human creativity and natural selection is unsurprising. Creative mental activity is merely a special case of a process that is fundamental to life itself—namely, the production of novelty in a groping search towards the ever-greater attainment of the Good in itself.

In other words, it is as if the cosmos was conditioned to be creative, and the power of creativity, Wagner asserts, lies in metaphor and analogy.[210] Both biological and human creativity relies upon bringing together disparate items to form something completely novel, and only metaphor captures the convergence of two worlds in this manner. In fact, Wagner cites scientific research demonstrating the power of metaphor to reveal new meanings not contained in the parts alone.[211] Wagner provocatively concludes his work proclaiming, "The thirteenth-

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[208] Andreas Wagner, *Life Finds a Way: What Evolution Teaches Us About Creativity* (New York: Basic Books, 2019).

[209] In ibid, ch. 5, Wagner parallels adaptive landscapes to the creation of molecules known as "bucky-balls", which trade selection and drift for molecular stability and heat as the primary motors for traversing their own (molecular) evolutionary landscape.

[210] Ibid, ch. 8.

[211] Roger Tourangeau and Lance Rips, "Interpreting and Evaluating Metaphors," *Journal of Memory and Language* 30, no. 4 (Aug. 1991): 452-72.

century theologian Thomas Aquinas was onto something when he wrote that God created the world in play."[212]

Wagner's second conclusion is that the "library of forms" that make this innovation possible ought to be interpreted in a Platonic fashion, writing, "Life's creativity draws from a source that is older than life, and perhaps older than time."[213] These libraries "exist in a world of concepts" that we nevertheless ought to interpret as real.[214] He therefore concludes that lifeforms as they exist "are just faint shadows of this Platonic realm of the possible."[215] As such, Wagner's proposals not only support the concept of reciprocal poiesis but also help to place it within the broader context of this work.

Assuming both of Wagner's points, evolution must then be interpreted as fundamentally non-stochastic, even at the level of drift. While individual instances of variation might not be conducive to the organism/species, variation itself is utilized by organisms for creative purposes in an analogous manner to human creativity. However, this creativity is possible only via the prior structuring of evolutionary potentialities in a manner conducive to the realization of functional forms. While Wagner does not explore the radical implications of his gesture towards Platonism, it is, as chapter 1 argued, a position that teleologically orders all evolutionary change towards the Good. As noted in the last chapter's discussion of adaptive landscapes, life itself stretches toward the transcendent in its ascent toward evolutionary peaks. Coupled with reciprocal poiesis, evolution might be interpreted, by its very creative activity, as the *reditus* movement of creation back to its divine source.

8. Conclusion

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[212] Wagner, *Life*, 222.
[213] Wagner, *Arrival*, 221.
[214] Andreas Wagner, "Possible Creatures," *Aeon*, March 16, 2015. https://aeon.co/essays/without-a-library-of-platonic-forms-evolution-couldn-t-work?fbclid=IwAR02tZp0lrTRj40Q_hLz4bSPF_CUKobIx4Vf4O27j363pcca8SFp9iBv570.
[215] Ibid.

In this chapter, I have set out to accomplish two primary tasks: 1.) offer a definition of functionality that overcomes the difficulties of teleonaturalistic positions, and 2.) evaluate how functionality emerges and operates within the organism. The first task concluded that functionality signifies the goal-directedness of a trait towards a good end. The second task elaborated on the implications of this definition with a position I labeled reciprocal poiesis, which asserts individual trait functions emerge from an organism's particular and unified way of life (βίος) and exist in a reciprocally constitutive relationship with development and a set of affordances. The βίος provides a conceptual and teleological unity for all three elements of reciprocal poiesis.

I have used the concept of the Good as a bridge for theological speculation, and similar projects have often moved likewise from biological teleology to a theological conclusion.[216] However, a skeptic of this move might quite rightly challenge if such a move is necessary or warranted. Even if one grants the reality of biological teleology, why adopt theism, as well? While this issue was dealt with tangentially in the first chapter's evaluation of classical/medieval thought, I have mostly relegated this question until now for logical reasons. One must first establish the warrant for belief in teleology before assessing its implications. As Étienne Gilson justifiably contends, "When the moment arrives… to search out whether final causes have as their origin divine thoughts and intentions, the philosopher of nature will have decided long ago about their existence on the basis of fact drawn from the observation of nature herself."[217] Another concern with the project thus far is an oft-cited criticism of any attempted rapprochement between essentialism and evolutionary theory, claiming that the former contradicts the latter. As such, the next chapter will consider whether this pivot to theological

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[216] E.g., Plantinga, *Warrant*, 195-215; Richard Taylor, *Metaphysics*, 4th ed. (Englewood Cliffs, NJ: Prentice Hall, 1992), 109-16; E. V. R. Kojonen, *The Compatibility of Evolution and Design* (London: Palgrave MacMillan, 2021). Kojonen's project, while distinct from my own, likewise utilizes Wagner's research.

[217] Gilson, *From Aristotle*, 120-1.

conclusions is justified as well as the concern that essentialism is fundamentally incompatible with biological evolution.

CHAPTER SIX: RESPONSES TO TWO OBJECTIONS

*You see I am determined to baptize [*The Origin of Species*],* nolens volens*, which will be its salvation. But if you won't have it done, it will be damned, I fear.*[1]

-Asa Gray, letter to Charles Darwin-

1. Introduction

This chapter addresses two assumptions from the previous chapters that are most likely to garner critique: 1.) The move from biological teleology to classical theism, and 2.) The compatibility between Aristotelian essences and biological evolution. Therefore, the chapter will contain two parts. First, I will argue that two of the most popular alternative explanations for natural teleology (panpsychism/neutral monism and emergentism) suffer from severe problems that classical theism does not. Second, I will defend a version of essentialism compatible with Darwinian evolution.

2. Nontheistic Alternatives

I begin by analyzing two of the most popular nontheistic explanations for the origins of biological teleology.[2] In other words, there are positions that deny reductive teleonaturalistic attempts and accept the reality of biological teleology; however, they also reject that this position implies any theistic commitments. One such position is panpsychism or neutral monism, a stance that asserts that all material reality contains a mental aspect, as well. Though mind is a ubiquitous feature of reality, the position does not necessarily maintain that this results in a unified cosmic consciousness (an *anima mundi*). This position has recently seen a growth in popularity due to the works of Thomas Nagel and Philip Goff. The second position is emergentism, which asserts that final causes emerge from nonteleological material processes

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[1] Asa Gray, *Letters of Asa Gray*, ed. J. L. Gray (Boston: Houghton Mifflin, 1894), 2:479-80.

[2] I prefer the term "nontheistic" over "atheistic" as the former denotes attempts to explain the world without appealing to God without necessarily denying God's reality.

bearing a certain organization and complexity. While various thinkers have held to this position, within theology, its most prominent advocates have been the religious naturalists.

2.1 Panpsychism/Neutral Monism

Panpsychism (or neutral monism) has recently become increasingly popular as an alternative to theism. If mental properties are a fundamental feature of the world, then teleology would, it is argued, no longer be a mysterious element of reality. Having goals or ends are properties of mental agents; thus, if physical reality is coextensive with mental reality, then the cosmos itself would be suffused with final causes.

The most famous contemporary argument for this view has been Thomas Nagel's *Mind and Cosmos*. The work triggered a horde of scathing reviews from intellectuals like Steven Pinker, Daniel Dennett, and Jerry Coyne—the latter summarily dismissing Nagel as a mere "teleologist" and, consequently, "anti-science."[3] Indeed, as one reviewer aptly summarized, Nagel's view is reminiscent of the "Greek conception of a rationally intelligible cosmos with mind at its centre."[4] However, unlike the Greeks, Nagel refuses to ground his teleological vision of the cosmos on a theistic foundation. Instead, Nagel maintains that the emergence of consciousness, cognition, and ethical values is best explained through a purely immanent account of reality, or an "intelligibility from within."[5] More recently, philosopher Philip Goff has defended the view in a series of articles and his book *Why? The Purpose of the Universe*. Goff is particularly concerned to show how his conception explains the finetuning of the cosmos for intelligent life without invoking divine design. According to him, the best explanation is a form of panpsychism called teleological cosmopsychism: the view that a

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[3] Michael Chorost, "Where Thomas Nagel Went Wrong," *The Chronicle of Higher Education*, May 13, 2013, https://www.chronicle.com/article/Where-Thomas-Nagel-Went-Wrong/139129 (accessed 8 May 2019).

[4] James DiFrisco, "Nature Rendered 'Intelligible': On Thomas Nagel's Mind and Cosmos," *Journal of the British Society for Phenomenology* 46, no. 1 (2015): 79.

[5] Thomas Nagel, *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly False* (Oxford: Oxford University Press, 2012), 26.

fundamental mind is coextensive with the cosmos itself and guiding it towards certain good ends.[6] As is evident, the attraction of nontheistic forms of panpsychism derives from its supposed power in explaining certain features of the world (consciousness, teleology, finetuning, etc.) that seem inexplicable on naturalism while being free of theistic commitments.

Why not simply opt for theism? According to Nagel, any appeal to the divine would prove detrimental to his attempt to offer a unified, explanatorily complete conception of nature since any intervention by God would be from outside nature and thus deny him a purely immanent account of reality.[7] He writes, "Theism pushes the quest for intelligibility outside the world."[8] One could, of course, challenge this motivation as simply begging the question in favor of nontheistic options, and it is a fact that Nagel seemingly admits, writing that he holds an "ungrounded assumption" that theistic alternatives are not true options.[9] Referencing Plantinga's reformed epistemology, Nagel claims he lacks the *sensus divinitatis* that enables the bulk of humanity to see the divine operating behind the world of nature. However, a more pressing issue with Nagel's dismissal of theism is his conflation of one form of theism—namely, the "interventionist" kind he has apparently learned from the Intelligent Design community—with theism in general. Classical forms of theism do not push intelligibility outside the world; rather, the very intelligibility of the world is said to demonstrate its transcendent foundation, such as in Aquinas's famous *De Ente* argument.[10] While space restricts defending this and other such arguments, they are sufficient to critique Nagel's narrow understanding of theism.

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[6] Philip Goff, *Why? The Purpose of the Universe* (Oxford: Oxford University Press, 2023).
[7] Ibid, 8.
[8] Nagel, *Mind and Cosmos*, 26.
[9] Ibid, 12.
[10] See, for example, a sophisticated defense of this argument in Gavin Kerr, *Aquinas's Ways to God: The Proof in* De Ente et Essentia (Oxford: Oxford University Press, 2015).

Nagel also claims that theism offers only a "partial explanation" since it has nothing to say, "about how [the divine] intention operates except what is found in the results to be explained."[11] In other words, Nagel asserts that theism can, on its own, predict any given outcome and does not specifically isolate our world as one that God would prefer. Yet, given classical theism, a world with cognitive, value-sensitive agents would be preferable given the fact that they embody higher perfections and thus constitute a better world than one without them. Nagel, apparently foreseeing a similar response, admits that any intentional explanation must include "some interpretive assumptions, even about God." Thus, God's "aims cannot be arbitrary" and that some worlds would be more valuable to God.[12]

However, Nagel cautions, this response "poses the famous problem of evil."[13] Nagel does not defend the problem of evil by attempting any demonstration of the incompatibility of God with evil. Indeed, beyond this comment, the subject is dropped. As such, it is impossible to tell how seriously he takes this as an objection to theism. Goff, however, provides a more thorough argument, and the problem of evil acts as his primary weapon against the possibility of theism, focusing primarily on the theodicy of Richard Swinburne and the work of skeptical theists.[14] Given the mountain of literature on the topic, I will avoid any attempt at a defense and merely note that it has not been conclusively shown that evil poses a logical threat to the existence of God.[15] Indeed, Goff's analysis does little to advance the problem of evil, recycling many past objections while overlooking some recent advances in the arguments for skeptical theism.[16] As such, both author's case against theism remains notably undeveloped.

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[11] Nagel, *Mind and Cosmos*, 25.
[12] Ibid.
[13] Ibid.
[14] Goff, *Why?*, ch. 4.
[15] See Alvin Plantinga, *God, Freedom, and Evil* (Grand Rapids: MI: William B. Eerdmans Publishing Company, 1974).
[16] E.g., Perry Hendricks, *Skeptical Theism* (London: Palgrave Macmillan, 2023).

Moreover, it is highly objectionable whether *nontheistic* panpsychism is a fully intelligible alternative to theism regarding questions of natural teleology, for although panpsychism might, in theory, explain why consciousness, finetuning, and other peculiar aspects of the cosmos emerged, it fails to give an account of why the cosmos is teleologically ordered *in this particular manner*. What is it about consciousness, cognition, values, etc. that determines them as the ends that direct cosmological evolution? We need some reason for why these traits serve as ends if we are to have a complete picture of the cosmos. Yet an explanation of this sort would appeal to the value of a world with these features. However, this would contradict Nagel's assertions within his own work that values coemerged only with the first lifeforms.[17] How, then, could the universe "value" life and thus be teleologically ordered to its production if values did not exist prior to life's emergence?

Goff at the very least recognizes the problem and suggests at one point that the cosmos could be thought of as one enormous "Aristotelian organism" with a set of intrinsic goods determined by its nature.[18] This suggestion only pushes the problem back one step, for one could simply ask why the universe has this particular set of goods. Appealing to the work of John Leslie, Goff's response seems to be that these goods might simply be a brute fact with no further explanation. Goff's only defense for this is, "Explanations have to end somewhere."[19] While obviously true, this principle ought not be used arbitrarily, especially in cases where one seems justified in seeking a deeper explanation. It is perfectly intelligible to ask why the cosmos has the goals it has, and any system that can account for these goals (such as theism) ought to be preferred over one that does not. Indeed, the principle of sufficient reason demands one account for these facts—something Goff seems unwilling to do. This problem of arbitrariness plagues any explanation of natural teleology that denies the reality of the Good-in-itself. For

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[17] Nagel, *Mind and Cosmos*, 119.
[18] Goff, *Why?*, 117.
[19] Ibid.

classical theists, by contrast, God is identical with the Good, and creatures that bear the traits of consciousness and cognition participate in these higher perfections. Thus, God himself establishes these ends as ends simply by virtue of their relationship to the divine nature. In short, Nagel and Goff's systems work best if one is a theist.

Even if one grants to the nontheist that certain biological features are, indeed, intrinsically good properties, one can still ask how the universe "recognizes" these ends as goods. These panpsychist thinkers have seemingly invested the world with some level of "desire" towards these goods. Yet if nature has something analogous to desire, this seems to entail a certain psychologizing of the cosmos. Goff fully embraces this implication, suggesting that a "field-based picture of the universe" might imply a "universe-wide" field and the existence of a cosmic mind.[20] Thus, natural laws merely delimit the scope of possibility, yet it is the universe itself, driven by a desire for certain goods, that propels the cosmos in certain directions. Nagel's particular views on this topic are vague, though it is possible he entertains the existence of some unified cosmic mind. If this is the case, Nagel can account for why certain ends are recognized as ends: the *anima mundi* has its own set of goods and directs itself toward their actualization (namely, the evolution of creatures like ourselves).[21] Indeed, at least one reviewer of Nagel's work has noted the awkwardness of any proposal of natural teleology that does not imply a directing mind, cosmic or otherwise.[22]

Yet, even if one grants the possibility of an *anima mundi*, one is still left wondering why fundamental reality is a composite of the mental and physical. Why does this type of

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[20] Ibid, 130.

[21] William Jaworski, Review of *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly Fa*lse by Thomas Nagel, *Faith and Philosophy* 31, no. 2 (April 2014): 240 interprets Nagel as implying this conclusion. Thus, he concludes Nagel is closer to Platonism than Aristotelianism. As I argue in chapter 1, though, Aristotle may have also been committed to the concept of a world soul.

[22] Jim Slagle, Review of *Mind and Cosmos: Why the Materialist Neo-Darwinian Conception of Nature Is Almost Certainly False* by Thomas Nagel. *Philosophy in Review* 33, no. 5 (2013): 401, "The introduction of teleology into the universe as a whole suggests an overarching mind to the universe that is strikingly similar to the theism Nagel decries."

world, rather than, say, a purely physical or purely mental one, exist? This seems to be a contingent fact and thus also in need of some form of explanation. Moreover, as Richard Swinburne points out in his review of Goff's work, Goff's suggestion fails to not only account for the teleological nature of the cosmos but also for its material nature, as well. Why do the laws of nature limit the world in just the sort of way that they do? Ironically, a universe with this particular set of laws (not to mention a teleological impulse towards life) is one that would seemingly require its own finetuning.[23] Thus, Goff does not explain the finetuning of the cosmos; he merely pushes it back one step.

Moreover, the primary motivation for panpsychism is the failure of materialism to explain consciousness, yet if a lack of explanatory power is enough to abandon materialism, why is not the same principle used to abandon nontheistic forms of panpsychism? In short, a higher principle above the cosmos must be invoked if a panpsychist account is to attain the full intelligibility its adherents seek to achieve. Despite their best efforts, panpsychists must appeal to the transcendent.[24]

2.2 Emergentism

While panpsychism and neutral monism have gained a level of support, many still find the view too extravagant and removed from the presumptive truth of naturalism that is so dominant in many philosophical circles. As such, emergentism, a view that accepts the reality of natural teleology without departing from naturalism, has garnered significant attention. Emergentism asserts that a particular material organization of sufficient complexity is capable of generating

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[23] Richard Swinburne, "Design for Living: The Improbability of Intelligent Life in the Universe," *The TLS Magazine* 6296 (Dec. 2023), https://www.the-tls.co.uk/articles/why-philip-goff-book-review-richard-swinburne/.

[24] Cf. Joanna Leidenhag, "Why a Panpsychist Should Adopt Theism: God, Galileo and Goff," *Journal of Consciousness Studies* 28, no. 9-10 (2021): 250-61, who argues a similar point utilizing the cosmological argument.

genuine final causes.[25] As such, emergentists limit final causes to lifeforms and, perhaps, a select few other material processes, such as certain self-perpetuating behaviors within complex dissipative systems. Prominent supporters of this position are a group known as the religious naturalists, whose ranks include Ursula Goodenough, Stuart Kauffman, and George Santayana. Religious naturalists deny the truth claims of all established religions and theism in general, though they maintain that a religious stance towards the natural world is still possible and, indeed, desirable. Since emergentism represents a vast field of thought, I will limit myself to this particular set of thinkers as representative of much of the field.

Donald Crosby, whose work has proved foundational in developing the metaphysics of the movement, has argued that properties such as consciousness, teleology, and freedom can emerge from lower-level substrata despite not being present within nor reducible to these substrata. As such, physics alone cannot account for the nature of matter, especially at these higher levels.[26] According to Scot Yoder, the reliance on emergentism forms the foundation for their belief: "On the one hand, emergentism offers religious naturalists a way to be scientific without adopting reductionism and the meaninglessness it seems to imply. On the other, it allows them to be religious without appealing to supernaturalism."[27] Concerning the former claim, Yoder clarifies that their version of emergentism maintains that while physical entities are all that exist, they have the capacity to generate unpredictable, irreducible properties when the material aggregates are arranged in the right manner. Meaning, freedom, and purpose can

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[25] Another prominent supporter of this position not examined directly in the chapter is Richard Cameron, "How to be a Realist About *Sui Generis* Teleology Yet Feel at Home in the 21st Century," *The Monist* 87, no. 1 (2004): 72-95.

[26] See Donald A. Crosby, *Nature as Sacred Ground: A Metaphysics for Religious Naturalism* (Albany, NY: SUNY Press, 2015).

[27] Scot D. Yoder, "Emergence and Religious Naturalism: The Promise and Peril," *American Journal of Theology & Philosophy* 35, no. 2 (May 2014): 154.

then be regarded as real aspects of a fully material universe. Thus, minds (or "spirits") are mere "functions or traits of matter," though, admittedly, their emergence is still a complete mystery.[28]

However, emergentism's claims have come under severe criticism. For instance, Mikael Leidenhag levels an objection he calls the placement problem.[29] This critique can be summed up with one question: How can the emergentist coherently claim that teleological properties are *purely* natural when it is not possible to provide tractable specifications for the emergence of such properties?[30] If emergent properties, such as teleology, are unpredictable—an assertion religious naturalists use to safeguard against reduction—what certainty do we have that these properties are the effects of purely material forces? Indeed, if we cannot predict from the matter alone when this phenomenon will arise, teleology is rendered inexplicable at the physical level, leaving it open to possible explanations from other, non-naturalistic metaphysics. Accordingly, Leidenhag asserts, "In order to avoid the problem of competing ontologies, the naturalist has to demonstrate that higher-level properties are purely natural."[31] Indeed, Mariusz Tabaczek, in his extensive analysis of emergentism, declares, "In my opinion, the very concept of [nonreductive physicalism, a position comparable to Crosby's]—metaphysically speaking—is self-contradictory. Why? Simply because physicalism, by definition, assumes either reductionism or eliminativism, or both."[32]

But perhaps the most devastating and rehearsed objection to emergentism is Jaegwon Kim's causal exclusion argument.[33] Emergentists claim emergent phenomena must be regarded as more than mere aggregate effects reducible to their physical substrata, and their justification

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[28] Crosby, *Nature as Sacred*, 91.

[29] Mikael Leidenhag, "Does Naturalism Make Room for Teleology? The Case of Donald Crosby and Thomas Nagel," *American Journal of Theology & Philosophy* 40, no. 1 (Jan. 2019): 12ff.

[30] Ibid, 13.

[31] Ibid.

[32] Mariusz Tabaczek, *Emergence: Towards a New Metaphysics and Philosophy of Science* (Notre Dame, IN: University of Notre Dame Press, 2019), 69.

[33] See Jaegwon Kim, "Making Sense of Emergence," *Philosophical Studies* 95 (1999): 3-36.

for this claim often comes from the unique causal powers exercised by these emergent entities. The goal-directed behavior of free agents, for instance, demonstrates the exercise of unique powers that cannot be accounted for by simply appealing to the lower-level causes; indeed, the agent imposes a top-down causal influence that determines its choice among possibilities. Kim, however, doubts that this form of downward causation is anything more than epiphenomenal, asking, "If an emergent, *M*, emerges from basal condition *P*, why can't *P* displace *M* as a cause of any putative effect of *M*? Why can't *P* do all the work in explaining why any alleged effect of *M* occurred?"[34] Thus, the lower-level entities seem to be capable of doing all the work on their own, and positing the causal contributions of higher-level emergent entities is redundant.

One might note that Kim's argument may also undermine my own account, as it would seem to suggest that ends, functions, and *bioi* are also reducible to the activities of lower-level entities. However, Tabaczek has responded that Kim's argument "collapses once we assert that [downward causation] is not an efficient cause and cannot be understood in terms of this type of causality."[35] Tabaczek appeals to the "anti-Humean turn in philosophy of causation and the revival of teleology in the philosophy of evolutionary biology"[36] in order to argue that an account of emergence "explained in terms of formal and final causation is still possible."[37] William Simpson has recently offered a similar proposal, claiming that forms of Aristotelian hylomorphism can overcome Kim's causal exclusion objection.[38] While space restricts outlining their proposals in detail, it is sufficient here to suggest that far from offering a competitive explanation for the origin of biological teleology, emergentism might work best under the Aristotelian metaphysics suggested by my project.

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[34] Ibid, 32.
[35] Tabaczek, *Emergence*, 91.
[36] Ibid.
[37] Ibid, 97.
[38] William M. R. Simpson, *Cambridge Elements: Hylomorphism* (Cambridge: Cambridge University Press, 2023).

Moreover, the same criticism leveled against panpsychism reappears for emergentism—namely, that emergentism leaves unexplained why organisms have the particular aims that they do. As noted in chapter 1, there must be some explanation of why certain ends act as aims for the organism in question. In other words, why do certain ends act as goods for a creature rather than, say, their contrary? Emergentists will often leave this point unaddressed, taking for granted that certain ends are obvious goods (such as survival or reproduction). Hence, some emergentists, such as Jeremy Sherman and Terrance Deacon (both religious naturalists), have argued that by simply demonstrating the hypothetical formation of systems with apparent goal-directedness, such as theoretical entities they deem "autocells", one has fully explained biological teleology.[39] No further explanation is needed of *why* certain self-perpetuating systems have goods and others do not; it simply seems intuitively obvious when such normative judgments are warranted.

However, to say that a certain fact is *obvious* is not to *explain* it. If the goal is a fully intelligible account of goods, there must be some account concerning why certain ends are objectively preferable to others. Simply put, there cannot be an account of finite goods without the Good-in-itself, for without the latter, there exists no ultimate measure of finite goods. This seems to be the implication of any ordered series of goods (such as the ATTIF). As noted in chapter 3, proximal goods are ordered by their relationship to more distal goods and their capacity to achieve them. However, unless this series of goods continues *ad infinitum*, there must be some ultimate good that orders all subsidiary goods. This ultimate aim cannot be any particular instance of a good, for one could simply ask, "What makes x good?" For instance, reproduction is the fourth aim of the ATTIF, yet it cannot be the *ultimate* aim, for one is free to question why reproduction is, itself, good. It certainly is not part of the definition of

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[39] Jeremy Sherman and Terrence W. Deacon, "Teleology for the Perplexed: How Matter Began to Matter," *Zygon* 42, no. 4 (Dec. 2007): 873-901.

reproduction that it is good. Rather, if it is good, it must, as Aristotle argued, point beyond itself to some other good; it must be instrumental in achieving some higher aim.[40] The only intelligible way to end this sequence of goods is with something that is definitionally good (i.e., the Good-in-itself). In other words, the explorations of ancient and medieval thought in chapter 1 prove as relevant as ever.

As a final note, Aristotelians will object to any account, including emergentism, that gives ontological priority to chance over teleology. According to emergentism, natural teleology emerges from chance chemical events that are both ontologically and chronologically prior. Yet chance events *cannot* be said to be the source of teleology, for chance events presuppose teleological causes. In *Phys.* II.5, Aristotle gives the illustration of a moneylender who accidentally encounters a man who has borrowed money from him at a marketplace. The lender thus recovers the sum owed to him. Aristotle describes this encounter as being a result of "chance" rather than "nature" since neither the borrower nor lender had the aim of meeting each other in mind when they went to the marketplace. Hence, it was not *qua* lender that the man encountered the individual who owed him money and was, therefore, merely the result of chance.

However, this chance encounter comes about only through the activity of end-directed agents.[41] As John Dudley notes, "Chance is not a substance or a *per se* cause, since it does not exist in the strong sense. For every event, including chance events, there is a *per se* cause, which is either nature… or intellect."[42] In other words, chance cannot explain events on its own since it derives from *per se* causes. In the example given, it was the decision of both men to go

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[40] See *DA* II.4, 215b2-7.

[41] I ignore here Aristotle's distinction between chance and spontaneity, the only significant difference being that the former derives from deliberating agents (such as in the example; see *Phys.* II.4-8) whereas the latter does not. This distinction, while important, is unnecessary for my point.

[42] John Dudley, *Aristotle's Concept of Chance: Accidents, Cause, Necessity, and Determinism* (Albany, NY: SUNY Press, 2012), 368.

to the marketplace (*per se* causes) that led to the chance encounter (accidental cause). To explain why the moneylender encountered his borrower, one need only appeal to these intrinsic, *per se* causes that led each individual to their chance encounter. The meeting itself has no intrinsic cause and, therefore, requires no further explanation. As Sauvé Meyer states, "To insist on an explanation of the meeting in addition to this account of its sufficient conditions reflects mere superstition, the conviction that the meeting was not an accident."[43] Thus, all chance events derive from teleological *per se* causes—namely, nature or intellect. Dudley therefore concludes, "One of Aristotle's more profound observations is that intelligibility and purpose go together."[44] This truth applies to the causes behind chance events just as much as it does to events one considers to be purposeful.

Therefore, emergentism cannot account for natural teleology by appealing to chance events. Much more could (and ought to) be said regarding both panpsychism and emergentism, and, indeed, a positive case arguing from biological teleology to theism can certainly be given. However, given the problems with the primary nontheistic alternatives noted by the foregoing material, I conclude that it is, at minimum, wholly within one's rational rights to accept classical theism as the ontological basis for natural teleology.

3. Essentialism

One of the other challenges for any project incorporating Thomistic thought into evolutionary theory is the question of whether essentialism can survive in a post-Darwinian era. According to Stephen Boulter, there are various distinct propositions that define an essentialist; however, I believe these can be summarized in the following two statements. First, essentialists hold to the existence of mind-independent substances belonging to distinct natural kinds with their

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[43] Susan Sauvé Meyer, "Aristotle, Teleology, and Reduction," *The Philosophical Review* 101, no. 4 (Oct. 1992): 825.

[44] Ibid, 370.

own unique set of essential properties. Second, essentialists maintain these essential properties serve both to define the substance and to explain why a particular instantiation of a given substance has the properties it does.[45] Essentialism has served as the ontological foundation for this project since essences define the sort of creature a particular substance is and thus serve to ground its unique set of goods.

However, essentialism has become unpopular within both biology and the philosophy of biology due to its perceived threat to the logic of Darwinian evolution.[46] Indeed, until recently, Neo-Scholastic philosophers had largely left the issue of Darwinism unaddressed.[47] Nevertheless, a quiet coup has been forming within the philosophy of biology by a revival of Aristotelian thought. Examples include the aforementioned publications of Denis Walsh and James Lennox as well as recent work by Christopher Austin.[48] The reasons for this revival are multiple, though three arguments are particularly noteworthy. These are the argument from species realism, the argument from explanatory power, and the argument from teleology.

3.1 Arguments for Essentialism

The species realism argument, proposed by Scholastic thinkers such as Boulter and Travis Dumsday, contends that if biological species are real and actually come into existence and later become extinct, then some form of essentialism must be maintained. As Boulter argues, to say that a speciation event occurs presumes that some identity conditions are being met for the first time in such organisms. Similarly, to say a species has become extinct is to say that these identity conditions are no longer being instantiated by any existing organisms. Since these

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[45] Stephen Boulter, *Metaphysics from a Biological Point of View* (London: Palgrave MacMillan, 2013), 101.

[46] See, for instance, Elliott Sober, "Evolution, Population Thinking, and Essentialism," *Philosophy of Science* 47 (1980): 350-83.

[47] Some previous Scholastic thinkers, such as Mortimer Adler and Etienne Gilson, did engage with Darwinian thought, though, as Travis Dumsday, "Is There Still Hope for a Scholastic Ontology of Biological Species?" *The Thomist: A Speculative Quarterly Review* 76, no. 3 (July 2012): 372 notes, their work is "in need of supplementation and further development in the face of new challenges."

[48] Christopher J. Austin, *Essence in the Age of Evolution: A New Theory of Natural Kinds* (New York and London: Routledge, 2019).

identity conditions simply *are* a creature's essence, then the concepts of speciation and extinction entail essentialism. In other words, while the evolution of one species into another is often thought to undermine belief in real essences, it actually presupposes it.

Dumsday similarly maintains that belonging to the kind "organism" requires certain identity conditions. Since all agree that organisms, the basic biological unit, exist and that organisms can be subdivided into various discrete, mind-independent classes, these classes must be distinguished by their own unique and objective identity conditions. Dumsday writes, "The argument simply draws attention to the fact that to belong to a biological taxon is also to be an organism, and that to be an organism is necessarily to have a certain set of intrinsic properties."[49] Thus, the various biological taxa are differentiated by their set of essential properties. All creatures defined as an organism will bear certain common properties (metabolism, reproduction, etc.) even though they differ in the specifics of how these properties are maintained. While most biologists maintain that an organism is identified as a particular species via certain relational properties only (such as its reproductive viability with other organisms or its lineal descent), Dumsday's argument seems to suggest that certain identity conditions intrinsic to the organism must also be considered if two biological taxa are to be considered distinct classes of organisms.[50]

The second argument for essentialism is the argument from explanatory power. Essences are said to be explanatory, and, as Mohan Matthen notes, biologists often assume that "something is striped *because* it is a tiger."[51] The essence of an organism offers some explanation for the traits it possesses. Michael Devitt adds, "The same underlying properties that make the organism a tiger cause it to be striped…. The intrinsic nature of a taxon explains

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[49] Dumsday, "Is There Still Hope," 391.

[50] Ibid, 393-4 also notes that the ecological definition of species, which differentiates species via their occupation of distinct ecological niches, must also be incorrect. He instead suggests that such niches *cause* speciation events but do not themselves *constitute* unique species.

[51] Mohan Matthen, "Biological Universals and the Nature of Fear," *Journal of Philosophy* 95 (1998): 114-5.

both the truth of generalizations about its members and why being in the taxon is explanatory."[52] Thus, essences have a role to play in scientific explanations and therefore ought to be treated as real theoretical entities.[53]

A third argument that could be given is an argument from teleology. The argument moves from the reality of objective biological teleology to essentialism as the best ontological option for understanding biological goals and ends. In other words, many of the arguments presented in the previous chapters have motivated a renewed interest in biological essentialism. Indeed, a reevaluation of biological history seems to support the case that biological teleology has always been implicit in the thought of evolution's greatest theorists, as will be examined in the next chapter. As Mariusz Tabaczek argues, "Far from being antithetical to ancient philosophy, Darwin seems to develop it."[54] However, since such arguments and their implications have been the focus of much of this project, I will not rehearse them here.[55]

3.2 Arguments Against Essentialism

Against these two arguments for essentialism stands a host of counterarguments in favor of its denial. Due to the prevalence of these objections within philosophical literature, I will devote a more extended word in response. These arguments can roughly be broken down into three main groups: 1.) Essentialism posits invariant natures which are incompatible with an evolutionary account of origins, 2.) Lineage relations, not essences, are the basis for classifications in Darwinism, and 3.) The identity conditions between two species have no clear boundary.[56]

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[52] Michael Devitt, "Defending Intrinsic Biological Essentialism," *Philosophy of Science* 88 (Jan. 2021): 70.

[53] I have made a similar claim for the *bios* in a previous chapter, and I consider these concepts to be closely related.

[54] Mariusz Tabaczek, "Thomistic Response to the Theory of Evolution: Aquinas on Natural Selection and the Perfection of the Universe," *Theology and Science* 13, no. 3 (2015): 332.

[55] For a more detailed version of this argument, see Boulter, *Metaphysics*, 109ff.

[56] A common fourth objection is that biologists define the term "species" differently than essentialists. Indeed, even within biology, there are different definitions of species, leading some to adopt the view of species pluralism. See, for instance, Marc Ereshefsky, "Eliminative Pluralism," *Philosophy of Biology* 59, no. 4 (Dec. 1992): 671-

3.2.1 Invariance of Natures

The first and most common objection to biological essentialism is that it contradicts Darwinian evolution by entailing that stable essences are the ontological foundation of biological organisms. Variation, for the essentialist, is often regarded as non-fundamental, yet Darwinism would seem to entail that all of an organism's traits are subject to variation and selection. There is no fixed set of traits that provides perduring identity conditions for a species. Without this stability, it is difficult to see how the essence can serve to define a biological kind. As Christopher Austin summarizes, "[Essentialism's] claim of metaphysical priority—a declaration of the 'dominance' of the unchanging over the changing—has… long been viewed as one of the most serious errors of biological essentialism."[57] Similarly, Stephen J. Gould has written, "Variation… represents the fundamental reality of nature…. Variation is primary; essences are illusory."[58] Natural selection is only sensitive to variations within a population; thus, it is argued that variation, not stable essences, provides the explanation for organismal ontogenesis.

The problem is exaggerated by the discovery of phenotypic plasticity, which, as previous chapters note, allows organisms to modify their own development in response to environmental influences. Given this fact, how are we to assess which environmentally dependent phenotypic state is the *natural* one? Moreover, given that these phenotypic features are determined by *external* factors, it becomes difficult to label these traits as *intrinsic*

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90. One solution is to maintain the heuristic value of such definitions without denying that, ontologically, there is only one correct demarcation of the various species based on their shared essence. This latter position would sharply distinguish between the explanatory objectives of biologists and metaphysicians.

[57] Austin, *Essence in the Age*, 119.

[58] Stephen Jay Gould, *Flamingo's Smile: Reflections in Natural History* (New York and London: W. W. Norton & Company, 1985), 160.

properties—a term used by many essentialists to distinguish essential properties from relational properties.[59]

As a final note, evolution seems to violate the principle of proportionate causation—a key tenet of Aristotelian and Scholastic philosophy—which argues that lower causes cannot give rise to higher causes.[60] No one gives what he does not possess (*nemo dat quod non habet*). Here, again, biological essences seem to be incompatible with the history of evolutionary change.

Yet, as noted previously, to say that one species changes into another presupposes a form of essentialism. Change *cannot* be ontologically primary since the concept of biological change presupposes some prior identity conditions that are no longer met. In other words, if A changes into B, there must be some essential traits missing from B that make it distinct from A. Moreover, the claim that essentialism cannot accommodate speciation is questionable. As Devitt has noted, to say that one species evolves into another may assume a shift in the set of properties constituting each species' essence, but there is no reason, *prima facie*, to assume that this picture of evolutionary change is incompatible with Darwinian gradualism.[61] Tabaczek has further suggested that a Thomistic account might say that new species arise through the operations of biological organisms acting as secondary, instrumental causes of God, who infuses a new form into primary matter possessing the right potency for reception (discussed further below).[62]

Indeed, while neither Aristotle nor Aquinas entertained the possibility of biological evolution, there are some hints in their existing writings to suggest how they might have

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[59] See, for instance, Dumsday, "Is There Still Hope," 390, "…to be an organism is necessarily to have a certain set of intrinsic properties."

[60] *Metaphys*. VII.8, 1033b30; cf. *ST* I-II.63.3. Tabaczek, "Thomistic Response," 330 raises this as one possible objection to essentialism. Tabaczek further notes the confusion that occurs between how Thomists use the term causation and how natural selection is regarded as a single, unified cause.

[61] Michael Devitt, "Resurrecting Biological Essentialism," *Philosophy of Science* 75 (July 2008): 372.

[62] Tabaczek, "Thomistic Response," 335.

reconciled it with their framework, though, as I will note, it may be necessary to go beyond them. For Aristotle, the most relevant work in this discussion is *De Generatione et Corruptione*. Aristotle maintained that primary matter can, if sufficiently altered, undergo corruption and receive a new substantial form in the process.[63] While Aristotelian species are "fixed" to the extent that their substantial form causes a predictable set of traits to develop within the organism, this does not entail that such organisms cannot produce wholly novel species. As Tabaczek states, "Even though the essential intrinsic traits of species are immutable, their existential realization in nature is not."[64] Evolution, then, merely requires a "tendency [of matter] to be in-formed by more perfect forms."[65] Tabaczek theorizes that accidental changes within the DNA ultimately result in the matter of the sperm and egg being disposed to the reception of a wholly new substantial form. In other words, accidental changes precede and ultimately dispose the matter to the instantiation of a wholly new species. Thus, in a single instant, a new species is formed. While Tabaczek unfortunately relies too heavily on DNA as the source of phenotypic novelty, the suggestion can likely be updated to accommodate the other developmental factors central to the extended synthesis. However, the adaptation of Aristotelianism to conform with biological evolution, while seemingly possible, must admittedly go beyond what Aristotle himself surmised.

The same must be said for Thomas Aquinas. While many have argued that Thomas can likewise be interpreted in a manner that allows for evolution, the sections often cited are questionable in their evidential support. For instance, in *ST* I.103.6, Thomas argues that it is better for a thing not only to be good in itself but also to be the source of goodness in something else. Indeed, Nicanor Pier Giorgio Austriaco has even cited this passage as evidence for the "fittingness" of evolutionary creationism since it bestows to creation a perfection—namely, a

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[63] See *GC* I.4, 319b10-18.

[64] Tabaczek, "Thomistic Response," 328.

[65] Ibid, 327. "Perfect" here is defined in the Aristotelian sense noted in chapter 1.

causality to create—that it would otherwise lack.[66] While contextually, the statement is not addressing the creation of new substances, Austriaco is likely correct that such hints within the Thomistic system might provide the resources for developing a theological account of evolution, though one that strays from what Thomas himself would have believed.

Early in his life, Thomas did, in fact, entertain the philosophical possibility that creatures might be instrumental causes through which God creates other organisms.[67] However, like the previous passage, the context of Thomas's argument is distantly removed from contemporary discussions of biological evolution. When Thomas contemplated such possibilities, the context concerned emanationism, a view where more perfect beings created lesser beings below them on the metaphysical chain. Within biological evolution, though, the causal chain is regularly inverted; lesser beings often give rise to more perfect beings.[68] Thus, it is perhaps a stretch to say early Thomas would have been more accommodating to contemporary evolutionary theory. Moreover, even in this early period, Thomas ultimately denied the possibility that creatures had the power to create other creatures due to his reading of the Genesis text. Later, he would retract his earlier stance and deem it philosophically as well as theologically objectionable.[69] God alone immediately created all creatures, and this power cannot be communicated to creaturely beings since it requires infinite power (*De pot.* 3.4). Additionally, a being can only cause an effect that is commensurate to its essence, but since no created being has existence as part of its essence, it cannot be the instrumental cause of being in another (*ST* 1.45.5).

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[66] Nicanor Pier Giorgio Austriaco, "The Fittingness of Evolutionary Creation," in *Thomistic Evolution: A Catholic Approach to Understanding Evolution in the Light of Faith*, ed. Nicanor Pier Giorgio Austriaco et al. (Tacoma: Cluny Media, 2016), 186-7.

[67] As Steven E. Baldner and William E. Carroll, *Aquinas on Creation: Writings on the "Sentences" of Peter Lombard, Book 2, Distinction 1, Question 1* (Toronto: Pontifical Institute of Mediaeval Studies, 1997), 46-7 note, this idea appears in both *In Sent.* and *De verit.*

[68] Perfection here is defined in a Thomistic sense (see chapter 1).

[69] Ibid, 47 list *SCG*, *De pot.*, *ST*, and the *Quodlibetum Tertium* as sources for this later rejection.

Similar passages from Thomas, such as the possibility of imperfect animals arising from putrefaction (*ST* I.73.1), suffer from similar contextual issues. Indeed, despite some suggestive passages, Thomas simply did not allow for the possibility of biological evolution—an unsurprising conclusion given the empirical data of his day. Provided this fact, it is perhaps preferable to heed the advice of James Hofmann, who states that any reconciliation with biological evolution "requires Thomism to be practiced as an exploratory application of scholastic method rather than as a rigid preservation of all Aquinas' doctrines."[70] This is, perhaps, more in keeping with Thomas's methodology if not his conclusions, for, as Hofmann later remarks, "Aquinas was a scholastic thinker receptive to good empirical arguments."[71]

Thus, if we are to entertain the possibility that creative causation has been communicated to creatures, our theology may need to expand beyond a rigid adherence to Thomas's original thoughts. One example of this is John Milbank who has combined the works of Nicholas of Cusa, Giambattista Vico, and later Romantic figures to arrive at a theology where human making mirrors the intra-Trinitarian relationship and continuously extends the creative activity of God.[72] One might expand this creative capacity to nonhuman animals and thus understand the history of evolution in the same light.

This might be seen as one end of the theological spectrum, representing a more novel approach that gives priority of place to creaturely creation. If this is the case, then Austriaco's defense of his "Thomistic" theological account—one that declares it "fitting for God" to grant creatures a causality to create—might actually be more at home in the fifteenth or eighteenth century rather than the thirteenth.[73] Yet Milbank represents only one figure among many who

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[70] James R. Hofmann, "Some Thomistic Encounters with Evolution," *Theology and Science* 18, no. 2 (2020): 327.
[71] Ibid, 341.
[72] Peter J. Leithart, "Making and Mis-Making: *Poiesis* in Exodus 25-40." *International Journal of Systematic Theology* 2, no. 3 (Nov. 2000): 308-9.
[73] Austriaco, "The Fittingness," 186-7.

have written on the co-creative capacities of creatures. Indeed, the concept is one that remains popular within Protestant circles[74] and has even been adopted by two recent popes.[75]

At the other end of the spectrum are accounts that attempt to leave Thomism relatively preserved and God's unique power for creation untouched. For Tabaczek, this preservation may be possible by distinguishing the modes of creative activity. Creaturely creation pertains solely to the order of becoming (*causa fiendi*); In other words, the generation of a new substance occurs through the educing of a substantial form via the production of matter with an appropriate potency to receive said form. By contrast, God's creative activity pertains to the *causa essendi*—the order of being that bestows existence to the substantial form.[76] This model allows for creation to become a cooperative, participatory enterprise. The motivation for thinkers like Tabaczek is to prevent the collapse between the divine mode of causation and the creaturely. Only God can infuse being since only God is the source of absolute *esse*. For such Thomists, to create simply *is* to infuse being, and thus, only God can create.

Despite this restrictive terminology, one can likely still regard this as a genuine account of creaturely co-creation—one that sharply avoids collapsing the distinction between primary and secondary causation. In fact, such an account can likely overcome the aforementioned difficulties of reconciling biological evolution with Thomism. Citing *ST* I.66.1, Tabaczek notes that it is possible to read Thomas's account of the "production" of the plants on day three of creation as an account of their formation from already in-formed matter.[77] Unlike "creation", the "production" of creatures was, for Thomas, characterized by the substantial transformation

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[74] This has largely been through the impact of Philip Hefner, *The Human Factor: Evolution, Culture, and Religion* (Minneapolis, MN: Augsburg Fortress Press, 1993).

[75] Pope Francis, *Let Us Dream: The Path to a Better Future* (New York: Simon and Schuster, 2020), 4, "We're protagonists, we're—if I can stretch the word—*co-creators.*" Cf. Pope John Paul II, "Address of John Paul II to the Participants in the Plenary Session of the Pontifical Academy of Sciences," November 8, 2004, Dicastery for Communication—Vatican Publishing House, https://www.vatican.va/content/john-paul-ii/en/speeches/2004/november/documents/hf_jp-ii_spe_20041108_academy-sciences.html, "In [a] real way, [humans] are meant to be 'co-creators' with God."

[76] Tabaczek, "Thomistic Response," 334-5.

[77] Ibid, 333ff.

of in-formed matter. In other words, by educing matter for the reception of a certain form (even, in certain cases, more perfect forms), creatures participate in the generation of new species, though it is only God who grants being to the creaturely essence and all its concomitant perfections.

This account can also avoid the supposed invariance of essences without straying too far from Thomas's original understanding. If God's creative activity is an ongoing process involving creaturely instrumental causes, then while the essences of particular species may provide stable identity conditions, creatures with these essences would still have the capacity to generate, in cooperation with God, the conditions for the production of a new species. This is very much in keeping with Thomas, for, as he argues, creaturely participation in the production of natural effects demonstrates "the immensity of His goodness," in that God has "communicated His likeness to things, not only so that they might exist but also that they might be causes for other things" (*SCG* III.70.7). Thus, no contradiction would exist between Thomistic essentialism and a Darwinian evolutionary account.

Regarding phenotypic plasticity, one solution that has become popular among Aristotelians and Thomists is an appeal to the discoveries of evolutionary-developmental biology (evo-devo) that underpins many cases of phenotypic plasticity. As Austin summarizes:

> Evo-devo is thus a science of dispositions: it posits that the central participants in the process of evolution are systems whose intrinsic dynamical structure both delivers and delimits its possible directions, thereby actively undergirding the regularities which non-accidentally pattern its actual paths.[78]

This dispositional model is fully compatible with essentialism, though it would need to interpret the developmental control genes that determine phenotypic expression as the locus for understanding an organism's form. In other words, it is not the developmental control genes themselves that constitute an organism's form but rather the particular range of phenotypic

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[78] Austin, *Essence in the Age, 127.*

expressions they bias development toward. The genes themselves, being material parts, cannot be the formal cause, yet such genes provide valuable information regarding the stable, perduring *teloi* of development.

If correct, determining whether two organisms possess the same form could potentially become a question of scientific (and not just metaphysical) evaluation. According to Boulter, "On this suggestion two organisms belong to the same species and have the same essence if they share the same developmental programme regardless of how else they might differ."[79] Indeed, Boulter considers these programs as "serious candidates for biological essences" due to their "great explanatory potential, an essential feature of Aristotelian essences."[80] Hofmann concurs, praising these newer models of essentialism for their ability to account for the discoveries of phenotypic plasticity.[81] Given the range of phenotypic options available to an organism during development, isolating any one specimen as a greater expression of a species' essence appears arbitrary, yet if one determines the organism's essence via these control genes, one bypasses this seeming arbitrariness and locates a structure that perdures across time and between populations. Yet whether one agrees with this assessment or not, it shows that, at least in principle, phenotypic plasticity is not incompatible with essentialism. What ultimately matters for essentialism is not whether this model has truly located a means for determining a stable essence but if models such as these show an in-principle compatibility between phenotypic plasticity and stable essences, which, indeed, they do.

Finally, there is the contention that, under essentialism, no one can give what he does not possess (*nemo dat quod non habet*). The above account of creaturely participation in the creative act can likewise address this concern, for one can simply argue that the novel powers

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[79] Boulter, *Metaphysics*, 111.
[80] Ibid, 112.
[81] Hofmann, "Some Thomistic," 335.

that appear in evolutionary lineages derive from their form, which, in turn, is directly given being by God. The ancestral species merely educes the form from the potency of matter; God makes it exist.[82]

3.2.2 Lineage Relations as Basis for Classification

After a prolonged treatment of the most common objection, I turn now to consider a second rebuttal against essentialism. According to it, classifications in biology are determined not by intrinsic properties but rather via an organism's place within a biological lineage. In other words, an organism can differ in any given property from the other members of its species just as long as it belongs to the same phylogenetic lineage. Line of descent, not common traits, demarcates which species any given organism belongs to. In response, David B. Kitts and David J. Kitts remark that while no one denies that organisms of the same species produce one another, "The fact that all horses are begot [*sic*] by horses is something to be explained. To suppose that an explanation is possible and to suppose further that the explanation is the same for all horses is to suppose that horses have some property in common which they do not share with the members of any other species."[83]

Indeed, descent cannot solely determine which taxon an organism falls under, for, as Gerry Webster and Brian Goodwin note, the same question can then be asked of that organism's ancestor and then again *ad infinitum*. Unless we have some method for differentiating lineages (such as with the intrinsic properties of their members), appeals to ancestry alone will result in an infinite explanatory regress.[84] Moreover, descent itself seemingly presupposes a shared essence between offspring and parent. Robert Koons and Alexander Pruss have pressed this

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[82] Tabaczek, "Thomistic Response," 334-5.

[83] David B. Kitts and David J. Kitts, "Biological Species as Natural Kinds," *Philosophy of Science* 46, no. 4 (Dec. 1979): 618.

[84] Gerry Webster and Brian Goodwin, *Form and Transformation: Generative and Relational Principles in Biology* (Cambridge: Cambridge University Press, 1996), 46.

point, stating, "Complex organisms (especially ones that reproduce sexually) never produce exact physical duplicates of themselves. Conversely, since everything is similar to everything else in some respects, every cause could be said to be 'reproducing' itself in each of its effects."[85] Dumsday concurs, remarking, "Reproduction, lineage-making, is a biological process that presupposes repeatable kind-essences on the part of individual organisms…. Put simply: descent requires qualitative similarity, which implies kind-membership. Therefore descent implies prior kind-membership."[86] In other words, there is a vicious circularity to the claim that biological classifications are determined by lineage since to belong to a lineage presupposes one has already identified the organism as a token of a certain type.

3.2.3 Vagueness of Identity Conditions

If organisms have definable essences, one might expect these essences to be reasonably obvious to the biological researcher. However, delineating the identity conditions of a species has proven almost impossible given the sheer genotypic and phenotypic variety within existing species. Indeed, Marc Ereshefsky has noticed that "Biologists have been hard-pressed to find traits that occur among all and only the members of a particular species."[87] Rather than a series of clear boundaries, species will mix and blend at the extremities of their populations. This, it is argued, suggests that essences are mere illusions.

Yet, taken at face value, the argument is weak. It moves from epistemic uncertainty to an ontological conclusion. But why should our lack of precision regarding where one essence ends and another begins determine whether or not such essences are real? Very little is often said to justify this logical jump. It simply does not follow from the vagueness surrounding the

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[85] Robert C. Koons and Alexander Pruss, "Must Functionalists Be Aristotelians?" in *Causal Powers,* ed. Jonathan D. Jacobs (Oxford: Oxford University Press, 2017), 201.

[86] Dumsday, "Is There Still Hope," 382.

[87] Marc Ereshefsky, *The Poverty of the Linnaean Hierarchy: A Philosophical Study of Biological Taxonomy* (Cambridge: Cambridge University Press, 2001), 98; cf. John Dupré, "Natural Kinds and Biological Taxa," *Philosophical Review* 90 (1981): 84 and Sober, "Evolution, Population Thinking," 372.

boundaries of essences that they do not exist. Perhaps a more generous but less powerful version of the argument could frame it as an undercutting defeater for essentialism; it could be that without clear boundaries, we lack sufficient warrant for concluding the truth of essentialism. An even more restrained version of the argument might assert that the lack of definite boundaries between species makes essences unknowable. Thus, the argument could be framed as either saying that essences are unreal, unjustified, or unknowable.

Since I have noted that the first version is a non sequitur, I will only focus on the latter two versions. Both arguments rely on the ambiguity of determining species' genotypic and phenotypic ranges. For example, it might be impossible to know when one species of horse becomes another, suggesting that we do not, in fact, know the intrinsic properties that determine each species. However, an essentialist could respond that while such cases are vital and important, they should not distract us from the fact that horses are easily distinguishable from human beings. The vagueness only appears in the regions surrounding a speciation event, and such vagueness is not uncommon in nearly all domains. The transition between a planet's atmosphere and the greater cosmos is somewhat vague, and any firm demarcation risks being labeled arbitrary, yet this does not detract from our confidence in the distinction between a planet and its surrounding space. The list of objects that can be rendered as a Sorites paradox regarding their boundaries or essential properties is endless, yet our certainty that such objects exist is normally unshaken. Indeed, as Devitt notes, indeterminacy about when speciation occurs is a problem for *all* species realists, not just essentialists.[88] Thus, it seems arbitrary to single out biological species in general and essentialism in particular as specifically problematic.

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[88] Devitt, "Resurrecting Biological," 373.

Travis Dumsday arrives at a similar conclusion, noting how the more complex the entity, the more it is capable of undergoing change in its parts without a loss of identity.[89] A fundamental particle has a much stricter set of criteria for kind identity than a cup of water, which often contains trace molecules other than just H_20. Similarly, the kind "horse" will have an even more diverse set of traits among its members. He concludes, "The underlying mistake… is a common one in philosophy of science, namely, the mistake of taking some fact or standard that obtains within physics and assuming that it holds just the same across all sciences."[90]

3.3 Relational Essentialism

While the previous section has attempted to defend an essentialism grounded upon the intrinsic properties of organisms, it should not be interpreted as defending the view that essences are defined *purely* by intrinsic properties. For instance, while Dumsday's arguments have featured prominently thus far, he is careful to limit his argument to the claim that the identity conditions of organisms are made "*at least in part* of intrinsic properties."[91] Thus, Dumsday does not rule out here that some identity conditions are, indeed, relational.

The Christian philosopher Robin Collins has advanced this notion.[92] Collins begins with a phenomenological argument from one's subjective experience of selfhood. According to him, personal connections to other persons and beings constitute part of what one perceives as her "self". Further, Collins adopts a view that human subjectivity and agency emerge from the fabric of the cosmos itself rather than being directly created by God in each new person—a view that seems most compatible with panpsychism. In other words, human freedom arises

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[89] Dumsday, "Is There Still Hope," 384-6.
[90] Ibid, 386.
[91] Dumsday, "Is There Still Hope," 392. Emphasis mine.
[92] Robin Collins, "Divine Action and Evolution," in *The Oxford Handbook of Philosophical Theology*, ed. Thomas P. Flint and Michael C. Rea (Oxford: Oxford University Press, 2009), 241-61.

from the more fundamental indeterministic properties of the universe through the process of evolution. In this manner, humanity's interconnection to the rest of the cosmos is stronger than it would be under dualism.[93] Therefore, Collins maintains that this evolutionary origin forces us to conceive of the relational self as defined, at least in part, by our relationship to our evolutionary lineage and thus to all life. It is a conclusion shared by biologists like Joan Roughgarden and theologians like Conor Cunningham.[94]

That some essential properties of lifeforms are relationally defined is nearly incontrovertible. While Collins appeals only to our phenomenological experience of selfhood, there are clearer examples from biology itself. Perhaps the most obvious are lichens, which, though defined as one organism, arise only via the symbiotic relationship of algae/cyanobacteria and fungi. In other words, one cannot even *define* a lichen except via the relationship between two subordinate organisms cooperating towards a common goal. Symbiosis generally complicates (though by no means eradicates) the project of defining a biological individual, yet even in instances where such complications are not the case, these mutually beneficial relationships form integral parts of creaturely essences. The coloration of distinct species of flowers is only understood via their relationship to insect pollinators, for instance. Indeed, all organisms abide within a system of relationships that allows for the existence and flourishing of all others, and the traits and powers that are often considered most essential (such as human digestion) are possible only via the participation of other independently existing organisms (such as the gut microbiota). Ecology, not just morphology and physiology, is integral for understanding the essence of the individual organism.

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[93] Ibid, 248. Collins further speculates that through our (and, more specifically, Christ's) interconnection to all lifeforms, our salvation effects the salvation of the world.

[94] Joan Roughgarden, *Evolution and the Christian Faith: Reflections of an Evolutionary Biologist* (Washington: Island, 2006), 18; Conor Cunningham, D*arwin's Pious Idea: Why the Ultra-Darwinists and Creationists Both Get It Wrong* (Grand Rapids, MI: William B. Eerdmans Publishing Company, 2010), 158ff.

This fact pairs well with the concept of reciprocal poiesis discussed in the previous chapter. Organismal functions and developmental traits are only fully actualized in conversation with a background environment that is experienced and utilized differently by each creature (i.e., a set of affordances). In other words, affordances are determined by organisms and reciprocally shape the development and evolution of organisms. The two *cocreate* one another in perpetual conversation. Reciprocal poiesis thus adds another layer to the relational nature of living organisms. While it may be possible to argue that a species' essential traits can be defined without reference to a system of affordances, such definitions are often not truly independent of implicit references. To give just one example, a whale is a type of organism defined by its power to swim, yet this power only arises through the relationship of the hydrodynamic qualities of the tail fluke and fins to the surrounding ocean. In short, a whale is only a "swimming-creature" because of the nature of water.

To repeat, to accept that such essential traits are partially defined via their relationships is not a denial of essentialism; rather, it is to open essentialism to the fact that relational properties constitute at least part of what defines certain organisms. As such, my contention contrasts with other projects that attempt a more radically revisionist ontology, such as Francis Heylighen's relational agency.[95] Heylighen contends that "at all levels, from particles to stars, change ('Becoming') is more fundamental than permanence ('Being')."[96] However, one cannot coherently give ontological priority to becoming since becoming is always the becoming *of something*. Heylighen's suggestion that "processes and relations" are more fundamental than perduring substances meets with a similar problem, for relations are always relations *between things*.[97] Relations, like change, are always ontologically grounded in something more

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[95] Francis Heylighen, "Relational Agency: A New Ontology for Coevolving Systems," in *Evolution "On Purpose": Teleonomy in Living Systems*, ed. Peter A. Corning et. al. (Cambridge, MA: The MIT Press, 2023).

[96] Ibid, 87.

[97] Ibid, 82.

primordial; the relation of X to Y persists only as long as X and Y do. Indeed, Heylighen's attempt to reconceive of lifeforms as agents rather than passive objects (a position I have sympathies with) seemingly presupposes this conclusion, for to be an agent entails being a discrete, independent entity with the capacity to act on separate objects. In short, while relations are integral to creaturely essences, they are grounded upon intrinsic properties. Thus, while my position understands essences as often being *more than* intrinsic properties, it does not exclude their reality.

4. Conclusion

In this chapter, I explored two possible complaints regarding my argument thus far: the theological foundation for the good and the compatibility of essentialism with biological evolution. I have shown that the two most common nontheistic alternative explanations of natural teleology, panpsychism/neutral monism and emergentism, fall short of providing a competing account to classical theism. I then demonstrated that objections to the compatibility of essentialism and biological evolution proved insufficient, further arguing for a position I deem relational essentialism. In the final chapter, I draw the various points of my argument together and examine how it compares to prior interpretations of evolution and Darwinism. The goal will be to place the argument within the greater scientific and theological traditions that include, I will show, some of the most well-respected names in both fields. This will demonstrate how my argument expands upon prior theological and philosophical reflections at the intersection of Darwinism and theism.

CHAPTER SEVEN: A THEOLOGY OF EVOLUTION

Evolution, then, is the creation myth of our age. By telling us our origins it shapes our views of what we are. It influences not just our thought, but our feelings and actions too, in a way which goes far beyond its official function as a biological theory.[1]

-Mary Midgley-

1. Introduction

In this chapter, I develop a more robust theology of evolution using the conclusions of prior chapters as a basis. I begin by outlining the various competing historical conceptions of evolutionary teleology. The goal of this exercise is to properly place my argument within a greater intellectual tradition in order to extract and examine the theological ramifications developed by these prior thinkers. Drawing from the works of Aubrey Moore, Henri Bergson, and 20th century Catholic theologians, I will argue for a model—a model I label Moorean conatist teleology—that I believe provides the best theological interpretation of biological evolution. Moreover, I will maintain that it is one that boasts strong continuity with the history of teleological speculation by some of biology's most prominent figures. I conclude by integrating this model with recent work by Nathan Lyons on Nicholas of Cusa's theology of art. I suggest that my model offers a way of interpreting evolution as a creative, artistic process that both creature and Creator participate in.

2. Two Types of Evolutionary Teleology

Given that Darwinism implies the reality of teleology (see chapter 3), one may additionally inquire what *sort* of teleology it entails. Throughout the history of Darwinism, many scientific figures have speculated on the teleological implications of Darwinian theory, yet little effort has been taken to systematize and analyze these various attempts.[2] I will broadly separate such

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[1] Mary Midgley, *Evolution as a Religion: Strange Hopes and Stranger Fears*, rev. ed. (London and New York: Routledge, 2002), 33.

[2] One exception is the Intelligent Design proponent Michael A. Flannery, "Strong and Weak Teleology in the Life Sciences Post-Darwin," *Religions* 11, no. 298 (2020): 1-22, whose distinction between strong and weak teleology is problematic in multiple ways. For instance, strong teleology receives multiple, distinct definitions throughout

attempts into two categories: Darwinian and eschatological. Darwinian teleology is broadly defined as the concept that organisms possess real goals and ends and that these ends play a causal role in selection. In other words, if a scholar embraces a teleological understanding of some part of the ATTIF, they minimally qualify as affirming Darwinian teleology.[3] I label this view "Darwinian" because, as I will show, it is consistently implicit and occasionally explicit in Darwin's own writings. The more grandiose claims of evolutionary teleology come from those ascribing to eschatological teleology. This view asserts that evolution, *in toto*, is directed towards certain ends, such as freedom, cognition, or even humanity specifically. After providing a general outline of these traditions, I will argue for certain streams within each tradition—namely, what I will deem Moorean and conatist teleology—and against others—what I term Paleyan and finalist teleology.

2.1 Darwinian Teleology

Darwinian teleology is the concept that various traits of biological organisms possess objective teleological ends and that the evolution of populations is, in some way, determined by the pursuit and achievement of such ends. In short, advocates of this position accept that teleology has a causal impact on evolutionary change, normally through the utilization of functional traits. Philosopher Lenn Goodman summarizes this position as follows, "Function, a teleological concept, remains critical…. To purge such assumptions robs evolution of its dynamic…. There is no evolution unless there's value in survival."[4] While many figures within biology have historically embraced Darwinian teleology, there have been few efforts to systematize it in the way the ATTIF has done.

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the paper, leading to a confusing hybrid of different ideas. Additionally, teleological realists like Denis Walsh and James Lennox do not fit into either category.

[3] The four aims are briefly summarized as 1.) development, 2.) functionality, 3.) survival, and 4.) reproductive success.

[4] Lenn E. Goodman, *Creation and Evolution* (London and New York: Routledge, 2010), 141.

Yet what the biological tradition lacks in systematization, it compensates for in the sheer wealth of thinkers who have speculated about biological teleology and its theological ramifications. Indeed, a survey of Darwinism's most prestigious figures reveals that the claim of Darwinism's general hostility to teleology is, at the very least, historically biased. Thus, the aim of this section will be to briefly outline the pervasiveness of Darwinian teleology while also critically analyzing what I believe to be two separate streams within it. I begin by sketching Darwin's original relationship to teleology, arguing that, while often ambiguous on the topic, Darwin was the originator of the tradition I label under his name. I then distinguish between two forms of Darwinian teleology, Paleyan and Moorean, that offered competing theological interpretations of biological teleology. Moorean teleology, I will assert, provides a superior theological model.

2.1.1 Darwin's Ambiguous Relationship with Teleology

Chapter 3 briefly sketched James Lennox's assertions that Darwin utilized final causation when describing how natural selection operated, noting that Darwin believed, "Natural selection acts for the good of each being, and that its products are present for various functions, purposes and ends."[5] Phillip Sloan connects these thoughts with Darwin's affinity for Alexander von Humboldt's conception of an immanent creative power operating within the natural world.[6] Marjorie Grene and David Depew have catalogued the often contradictory language Darwin employs regarding final causality; however, they conclude that Darwin's adoption of Cuvier's phrase "conditions of existence" retained "something of its original teleological intent." They add that Darwin changed the principle "from a static to a historical principle, so that for Darwin

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[5] James G. Lennox, "Darwin *was* a Teleologist," *Biology and Philosophy* 8 (1993): 411. Emphasis in original.

[6] Phillip R. Sloan, "'The Sense of Sublimity': Darwin on Nature and Divinity," *Osiris* 16 (2001): 251-69.

it was the 'good' of this individual or of its progenitors that was involved, whereas for Cuvier, it was only this organism… whose 'conditions of existence' were in question."[7]

This evidence is corroborated by Darwin's son, Francis. A notable biologist in his own right, Francis writes, "One of the greatest services rendered by my father to the study of Natural History is the revival of Teleology. The evolutionist studies the purpose or meaning of organs with the zeal of the older Teleologist, but with far wider and more coherent purpose."[8] Thus, one may classify Darwin as a cautious advocate of teleology, recognizing the explanatory role it played in natural selection. However, his deeper thoughts on the issue are vague, and one is left to speculate on his beliefs regarding the nature and extent of biological teleology, especially as it concerns theological issues. Yet if it is in fact correct that Darwin was a cautious realist, it may explain why Darwin felt comfortable with teleological language despite the antagonism it inevitably produced from fellow biologists.[9]

Indeed, just prior to the birth of the Modern Synthesis, Erik Nordenskiöld's famed *History of Biology: A Survey* chastised Darwinians for their overt reliance upon teleological explanations rather than purely mechanistic ones. Asking why a cat has claws, Nordenskiöld asserts, is as absurd as asking why stones fall.[10] This complaint was echoed by the historian of

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[7] Marjorie Grene and David Depew, *The Philosophy of Biology: An Episodic History* (Cambridge: Cambridge University Press, 2004), 211.

[8] Francis Darwin, *The Life and Letters of Charles Darwin*, vol. 2, ed. Francis Darwin (New York: D. Appleton and Company, 1896), 430.

[9] Michael T. Ghiselin, "Darwin's Language May Seem Teleological, but His Thinking Is Another Matter," *Biology and Philosophy* 9 (1994): 489-92 claims Darwin's supposed teleological thinking is a "myth". His article defending this stance is littered with many issues, such as admitting not to understand any form of teleology outside of design as well as basic misunderstandings of Darwin's original writings. For instance, Ghiselin cites a letter from Darwin to John Murray as evidence for the claim that Darwin sought to attack natural theology, yet a perusal of the original letter reveals the opposite. Instead, Darwin compares his work on orchids to the *Bridgewater Treatises*, a work of natural theology. Ghiselin further cites a letter to Asa Gray where Darwin admitted the work was a "flank movement" on his enemy. Ghiselin apparently believes the enemy to be natural theology, but when reviewing the original letter, one finds the opponent is George Bentham and that the "flank movement" was a term Darwin borrowed from Gray in praise of Darwin's work. Obviously, Gray would not have praised the work if it was an attack on natural theology since Gray himself was a major advocate for natural theology. For these and many other reasons, Ghiselin's short article does little to derail the conclusion that Darwin did, indeed, utilized teleological reasoning.

[10] Erik Nordenskiöld, *History of Biology: A Survey* (London: Kegan Paul, Trench and Trubner, 1929), 482.

biology Charles Singer as well as by Thomas Hunt Morgen, a father of modern genetics.[11] Yet it was not just anti-Darwinians who immediately noticed an implicit form of teleology within Darwin's theories. Indeed, historian James Moore has argued that early acceptance of Darwinism by orthodox Christians was driven largely by the fact that it was grounded upon prior Christian teleological reasoning.[12] Moreover, Stephen Jay Gould has noted the similarity in adaptationist thinking between Darwin and Robert Boyle's more overt theological research.[13] According to Richard England, these theological relics "not only acted to help Darwin produce scientific knowledge; they also contributed to the popularity and strength" of his position in later years.[14] It is perhaps ironic, then, that it was partially *because* of its teleological implications and the support from theistic communities that Darwinism gained early popularity.

2.1.2 Asa Gray and Thomas Huxley's Paleyan Darwinism

Undoubtedly, this popularity was aided by the fact that one of Darwin's chief supporters, the Harvard botanist Asa Gray, was an orthodox evangelical Christian. Gray found Darwin's ideas beneficial to the case for teleology and, thus, for theology, as well. In fact, Gray honored Darwin by claiming that his "great service to Natural Science [was] in bringing back to it Teleology: so that, instead of Morphology *versus* Teleology, we shall have Morphology wedded to Teleology."[15] Darwin had shown how biological functions explain the morphology of adapted traits. Rather than appealing to "laws of form" as some of Darwin's contemporaries

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[11] Goodman, *Creation and Evolution*, 138-9.

[12] James Moore, *The Post-Darwinian Controversies* (Cambridge: Cambridge University Press, 1979), 332-3; cf. ibid, 344-5.

[13] Stephen Jay Gould, "On Transmuting Boyle's Law to Darwin's Revolution," in *Evolution: Society, Science, and the Universe*, ed. A. C. Fabian (Cambridge: Cambridge University Press, 1998), 25. Richard England, "Natural Selection, Teleology, and the Logos: From Darwin to the Oxford Neo-Darwinists, 1859-1909," *Osiris* 16 (2001): 270-87 argues that a relic of natural theological thinking existed in much of Darwin's early writings, including his commitment to panadaptationism and the so-called "Newtonian metaphysical tradition" that regarded the world as the result of divine ordering.

[14] England, "Natural Selection," 285.

[15] Asa Gray, "Scientific Worthies: Charles Darwin," *Nature* 10 (June 1874): 81. Emphasis in original.

did to explain the morphology of organisms (e.g., Richard Owen), Gray praised Darwin for making the teleological nature of organismal traits more apparent and their causal role in the formation of species evident. Darwin himself was apparently pleased by Gray's remarks, writing, "What you say about Teleology pleases me especially, and I do not think any one else has ever noticed the point. I have always said you were the man to hit the nail on the head."[16]

However, in contrast to my own approach, Gray argued that the bridge from Darwinian teleology to theology is constructed via a Paleyan design inference. Darwinian teleology was not enough on its own to arrive at a theological conclusion; rather, one needs to insert a premise regarding the apparent design of the evolutionary process and its products. Thus, Gray maintained Paley's argument was unharmed by Darwin's proposal, stating that "gradualness is in nowise incompatible with design."[17] For Gray, the slowness of the process and the fact that chance and selection were involved does not lessen the wonder of the ingenious designs developed by nature over time. Consequently, Gray ultimately adopted both Darwinian teleology and eschatological teleology; he affirmed organismal purposes as objective features of lifeforms yet further believed that these creatures evolved via the production of beneficial mutations by the directing hand of God.[18] Consequently, Gray contrasts with the approach taken by my project by arguing that divine causation in evolutionary history occurs not via the selection process but via actively generating trait variation. This production of biological novelty becomes a central premise in Gray's Paleyan-style design inference.[19] By contrast, my project relies upon the metaphysical notion of goodness and thus regards God's causal activity in selection as more immediate, acting as the principle by which all selection events can be

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[16] Charles Darwin, Letter to Asa Gray, June 5, 1874, in *The Life and Letters of Charles Darwin,* vol. 2, ed. Francis Darwin (New York: D. Appleton and Company), 367.

[17] Asa Gray, "Natural Selection and Natural Theology," *Nature* 27 (1883): 291.

[18] England, "Natural Selection," 277.

[19] Asa Gray, "Natural Selection Not Inconsistent with Natural Theology," in *Darwiniana: Essays and Reviews Pertaining to Darwinism*, ed. A. Hunter Dupree (Cambridge, MA and London: Harvard University Press, 1963), 72-145 argues the fine-tuned initial conditions allowing for life adds further evidence for theism.

understood.[20] Selection itself is already a teleological concept; one does not need to insert direct divine intervention into Darwin's theory to see God's role within it.

Gray's famed contemporary, Thomas Huxley, was seemingly convinced by his reasoning, asserting that while Darwinism abolished "commoner and coarser forms of Teleology," it nevertheless "is the reconciliation of Teleology and Morphology."[21] This "wider teleology… is actually based upon the fundamental proposition of Evolution."[22] However, despite paralleling Gray's language, Huxley's meaning is noticeably different. Huxley does not intend to convey that Darwinism allows for organismal purposes to remain intact; rather, he suggests that this "wider teleology" denotes the possibility that the laws of nature were precisely constructed to generate the production of intelligent living organisms. It was the cosmos's mechanical preconditioning, not the inherent end-directed nature of organisms, that bespoke biological teleology. Thus, despite his agnosticism, Huxley was more open to a Paleyan-style teleology (a concept that regarded teleology as extrinsically imposed upon organisms by a designer) than the Aristotelian-style teleology defended in chapter 1. Indeed, Huxley even defended Paley's famed watchmaker argument, arguing that it was consistent with Darwin's theory.[23] Huxley's form of teleology is therefore more at home in the eschatological category, yet it appears in this section for one reason: its impact on the thought of Anglo-Catholic priest Aubrey Moore.

2.1.3 Aubrey Moore and the Later Tradition

While Gray and, to a lesser extent, Huxley's work attempted to justify the continued relevance of Paleyan teleology, Moore's work represents one far closer to the Aristotelian-Thomistic tradition—a tradition independent of design-style arguments. As Aristotle notes, if the art of

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[20] For a definition of the metaphysical notion of goodness, see chapter 3.

[21] Thomas Henry Huxley, *Critiques and Addresses* (New York: D. Appleton and Company, 1873), 272.

[22] Ibid.

[23] Ibid, 272ff.

shipbuilding belonged to the wood of a tree itself, it would automatically produce ships (*Phys.* II.8, 199b27-29). This, he continues, is analogous to natural beings like organisms. He is herein contrasting the intrinsic teleology of natural beings with the extrinsic teleology of shipmakers imposing a design upon the wood. While Gray's theological project sought a teleology in an extrinsic "shipbuilder", Moore, following Aristotle, utilized the teleology *within* the organism and the process of evolution itself for his theological conclusions. It is perhaps ironic, then, that Moore was originally inspired by Huxley's suggestion of a "wider teleology". For Moore, organismal teleology was one aspect of natural law through which God operated. As Richard England summarizes, "Moore believed that the strictly natural phenomenon of Darwinian teleology suggested a more Christian theology of nature than had Paley's somewhat deistic claim that nature was designed by an external Creator."[24]

In his contribution to *Lux Mundi*, entitled "The Christian Doctrine of God," Moore contrasts two visions of reality: the Anaxagorean and the Aristotelian. Anaxagoras regarded reason and rationality as alien to matter; thus, it must be imposed upon matter by a transcendental source. By contrast, Aristotle made reason immanent to the world—an intrinsic aspect of substances. The two views could likewise be characterized as, "The mechanical and the organic view of nature. Both were teleological, but to the one, reason was an extra-mundane cause, to the other, an internal principle."[25] According to Moore, the former view is the one held by Paley whereas the latter, "wider teleology" is one implicit in Darwin and (as Moore interprets him) defended by Huxley. But rather than prefer one stance over the other, Moore asserts that, "The Christian doctrine of God brings [both] together."[26] Moore maintains that the doctrine of the Trinity was what allowed early Christian apologists to synthesize the

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[24] England, "Natural Selection," 279.
[25] Aubrey Moore, "The Christian Doctrine of God," in *Lux Mundi*, 12th ed., ed. Charles Gore (London: John Murray, 1891), 69.
[26] Ibid.

transcendence of God (prioritized by ancient Judaism) with the immanence of God (maintained by the philosophical pantheists of the Greek tradition). This synthesis, he continues, was the single "unsolved problem" plaguing Plotinus, the later Neoplatonists, and even the non-Christian philosophies of Moore's day.[27]

How does the Trinity resolve this issue? Moore believes that, against the "motionless simplicity of Being" embraced by the Greeks, Trinitarians assert the omnipresence of the divine Word within the world.[28] While somewhat unclear, it seems Moore is asserting that by claiming the Logos was divine and consubstantial with the Father, the Son became the means through which early Christians understood how God could simultaneously be present with and distinct from the world. Thus, the Logos is the method by which the church must understand God's causal activity within creation.

In other words, while Paley saw the markers of divine causality only in objects bearing the imprints of design, a truly Christian view of the world sees the divine working in all rationally operating processes. Moore therefore concludes, "In nature everything must be His work or nothing. We must frankly return to the Christian view of direct Divine agency, the immanence of Divine power in nature from end to end."[29] As such, Darwinism offers a serendipitous gift to the church, reminding her to return to a more original conception of the God-world relationship.[30]

Moore cautions against regarding his claims as a "proof" for God's existence since, "Reason has for its subject-matter the problem of essence, not of existence."[31] Nevertheless, for those of faith, "The evolution which was at first supposed to have destroyed teleology is

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[27] Ibid, 70.
[28] Ibid, 71.
[29] Ibid, 74.
[30] England, "Natural Selection," 280 notes that for Moore, it did not matter if such adaptations were perfect so long as natural selection continued to produce functional traits fitted for changing environments.
[31] Moore, "Christian Doctrine," 76.

found to be more saturated with teleology than the view which it superseded."[32] This, he concludes, acts as a "confirmation," though not a proof, of one's Christian faith. In other words, the various arguments for God, teleological arguments included, provide justification for faith but not an overwhelming demonstration. Moore compares it to our beliefs in an external, objective world. Both a belief in an external world and in God can be argued against and denied on philosophical grounds, yet both "persist in the consciousness of mankind," demonstrating that reason always begins with prior assumptions about reality.[33]

Consequently, Moore represents a break with the Paleyan tradition that was inherent in the thought of both Gray and Huxley. For Moore, the purposive nature of both organisms and natural selection bespoke a more powerful—and more Christian—apologetic. England summarizes, "The apologetic value of his work lay in the fact that it described a reasonable religious interpretation of natural selection. Its status as a natural process was in no way threatened by the belief that natural laws were the direct result of divine action."[34]

While Moore's thesis is not identical to my own argument, it anticipates it in many significant ways. First, it is teleological without being Paleyan. Second, it draws inspiration from the "immanent" teleology of Aristotle without denying the transcendent ground for biological teleology—a position also reminiscent of Aristotle. In this manner, Moore's view of teleology strongly resembled Thomas Aquinas's, which equally regarded natural teleology as both immanent to the creature and extrinsically imposed. Indeed, Moore can be regarded as an early attempt to synthesize Thomas's concept of an infused teleology with Darwinism. Third, it affirms that the intrinsic teleological features of organisms are part of the causal explanation of selection events. Finally, it argues that biological teleology provides some form of

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[32] Ibid, 78.

[33] Ibid.

[34] England, "Natural Selection," 281.

justification for theism. There is, however, one noticeable difference between our approaches. Moore's argument relies upon the Christian theological framework to reconcile two competing philosophical approaches to teleology (Aristotelian and Anaxagorean) and then to interpret Darwinism from this stance. By contrast, my project begins by extracting the implicit metaphysical concepts within Darwinism in order to demonstrate their congruence with and, perhaps, implication of classical theism. In short, whereas Moore's argument *ends* with an interpretation of Darwinism from a theological stance, mine *begins* with an analysis of Darwinism in order to extract its already implicit philosophical/theological assumptions. Despite these methodological differences, my own project can be seen as an extension and, perhaps, revival of this competing, minority stream that existed separately from the Paleyan tradition.

While a marginal position, Moorean teleology survived in a few later thinkers, most notably the figure of Frederick Dixey, an Oxford entomologist near the turn of the century.[35] During the supposed "eclipse of Darwinism" that was said to have lasted from the 1880s to around 1920, Dixey represented a prominent defender of Darwin with his repeated publications in *Nature*. While competing theories of evolution, such as mutationism, had begun to downplay the role of adaptations, Dixey insisted on their reality, though he did admit that pursuits to find purposes for all traits had hampered the Darwinian project. He writes, "[Too] much exuberance may have been shown in the pursuit of what Aubrey Moore called 'the new teleology.'"[36] Despite this warning, Dixey continuously stressed the importance of adaptationist thinking to the Darwinian project.[37] Indeed, he asserted that by replacing Paley's "deism" with the concept of "organic growth," one arrives at a universe with "a purpose which may be called moral."[38]

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[35] A second major advocate for Moorean teleology is Edward Poulton, another Anglican Oxonian entomologist.

[36] Frederick Dixey, "Section D-Presidential Address," *Nature* 104 (1919): 126.

[37] England, "Natural Selection," 283.

[38] Frederick Dixey, "Intelligence as the Soul of the Universe," *Nature* 64 (1901): 422.

Thus, as England concludes, “Dixey's neo-Darwinism, then, was more than a strictly scientific enterprise: in discovering adaptation in nature he uncovered the working of natural selection, which he could interpret as the presence of God.”[39]

Advocates for Darwinian teleology continued to appear throughout the twentieth century, though with the advent of the modern synthesis, the theological strands of the tradition, in both their Paleyan and Moorean forms, began to disappear. Thus, while such thinkers as George Gaylord Simpson and Ernst Mayr, two founders of the modern synthesis, advocated for the reality of Darwinian teleology, they attempted to free it of all metaphysical and theological baggage, maintaining the independence of the concept from any philosophical implications.[40] Thus, while their thought is important historically for demonstrating the continued acceptance of biological teleology, their often-trivial dismissal of metaphysics and theology proves largely irrelevant for this thesis.

To summarize, rather than evacuating biology of teleology, Darwinism was recognized by both its opponents and its advocates as providing a fruitful locus for teleological (and, in many cases, theological) speculation. Indeed, building off Darwin’s own ambiguous and sometimes welcoming attitude towards teleology, advocates of Darwinian teleology provided two theological interpretations of God’s role within the evolutionary process. The first was a renewal of Paleyan design inferences updated to accommodate evolutionary theory. The second, which I have deemed Moorean teleology, denied such design inferences and instead posited a teleology implicit within the process of natural selection itself. Due to the similarity of this latter project with my own, I consider my arguments to be an extension and attempted revival of Moorean teleology—one that sees God’s activity as ubiquitous across evolutionary

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[39] England, “Natural Selection,” 284. England further cites a letter from Dixey to C. W. Formby wherein Dixey asserts the certainty of finding teleology in evolution, referencing Aristotelian philosophy in support. Dixey further claims that his conclusions demanded Christian acceptance.

[40] George Gaylord Simpson, “On Eschewing Teleology,” *Science* 129, no. 3349 (1959): 672-5; Ernst Mayr, “The Idea of Teleology,” *Journal of the History of Ideas* 53 (1992): 117-35.

history. It is a view that harmonizes well with Thomas Aquinas. According to Thomas, all natural motion is determined in its orientation *by* God and *towards* God; thus, God, under a Thomistic interpretation of evolution, is understood not merely as the efficient cause of a creature's being (as with some versions of Paleyan teleology) but also as the directing agent guiding evolution towards certain ends. The diversification and alteration of populations can be thus interpreted not as stochastic flux but as a rational and intelligible process—the motion of life striving towards its Creator.

Moreover, since my project derives from the very logic of Darwinism itself, its vision of how God interacts causally in the evolutionary process need not appeal to any additional premises to support its claims. Paleyan teleology, by contrast, usually invokes additional evidence to arrive at its conclusion (such as the laws of nature as in the case of Gray and Huxley). While such projects are not technically incompatible with Moorean teleology (and, indeed, some interesting contemporary arguments have been made in favor of Paleyan teleology within evolution), their case builds off a more foundational teleology already imbedded within Darwinism itself.[41] As such, these arguments, no matter what their evidence, may prove superfluous.

Yet an acceptance of Darwinian teleology does not address the further (and perhaps more interesting) question of whether evolution *in toto* is teleologically oriented towards certain goals. While Darwinian teleology might bias a population towards the production of certain traits (i.e., a higher frequency of better-adapted features), most of its advocates would caution against advancing any notion that would deny the radically contingent nature of evolutionary history. Evolution might be teleological, they assert, but it is not eschatological; there are no predetermined ends in evolution. However, a few prominent figures have suggested

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[41] See, for instance, the intriguing argument in E. V. R. Kojonen, *The Compatibility of Evolution and Design* (London: Palgrave MacMillan, 2021).

otherwise, and some have even proposed that humanity is the apex of the long evolutionary journey. I turn now to consider this more radical view of evolutionary teleology.

2.2 Eschatological Teleology

Certain overall directional patterns within evolution have tremendous empirical evidence. One of the most famous is Cope's Rule, named after the famed paleontologist Edward Drinker Cope. It asserts that as organisms evolve over time, body mass will tend to increase. And, indeed, by one study, newly emerging mammalian species are on average 9.1% larger than prior species of the same genus. The author of the study states that this result is only predicted by "the most narrow and deterministic interpretation of Cope's rule."[42] Yet while such general trends maintain a place within mainstream biology, claims about an overall directionality to evolution are generally met with skepticism by most biologists.

Nevertheless, there have been many high-profile advocates for the view that life's history has been highly constrained towards certain ends. I have labeled this view eschatological teleology and have divided it into two general categories of interpretation. The first, which I label finalism, regards evolution as a highly constrained upward climb, normally said to culminate in humanity—the peak of lifeforms.[43] Accordingly, this account holds that evolution is compelled towards a certain, predestined endpoint. As such, finalism is typically anthropocentric. The second type will be called conatism; the neologism derives from Spinoza's usage of *conatus* to define the general striving of the natural world.[44] This view allows for more contingency, unpredictability, and openness in evolution, though it still

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[42] John Alroy, "Cope's Rule and the Dynamics of Body Mass Evolution in North American Mammals," *Science* 280 (1998): 734.

[43] Unlike Asa Gray's view, finalism asserts that evolution, *in se* and without direct divine intervention, is ordered to specific ends.

[44] The conceptual dependence upon Spinoza for members of this group is normally either limited or unclear, however.

maintains that the process has various tendencies and *teloi*.[45] In other words, rather than being *compelled* towards some future particular state, evolution is *propelled* from behind by certain inclinations and, thus, towards certain ends. However, the manner and means by which these ends are met is often less rigid than in a finalist conception of evolution.

2.2.1 Alfred Russel Wallace's Theological Vision of Finalism

Finalism first appears near the advent of Darwinism itself—namely, with Alfred Russel Wallace, the co-discoverer of natural selection. While Darwin's spiritual journey is often erroneously portrayed as one from theism to agnosticism by way of natural selection, Wallace presents a near-perfect inversion of this narrative. Though never religious, Wallace became fascinated by spiritualism in his later life and willingly sacrificed his reputation in pursuit of an integration of his science with his supernatural interests. His views have been labeled "intelligent evolution" since they incorporated the doctrine of natural selection—acting as a mere filtering principle—with the creative activities of unseen intelligent agents.[46] In other words, God (through spiritual intermediaries) creates new beneficial traits, and selection subsequently filters out the now less fit organisms.

As such, Wallace preferred Herbert Spencer's phrase "survival of the fittest" over Darwin's "natural selection" since the latter suggested intelligent agency, and for Wallace, the intelligent agency's work had already been accomplished prior to the process of selection.[47] Foreshadowing the objections of Fodor and Piattelli-Palmarini (see chapter 2), Wallace derided the term "selection" for its failure to recognize that nature itself bears no preferences. Summarizing Wallace's opinions, Michael Flannery writes, "Darwin, it seems, was trying to

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[45] This view is *not* a denial of divine providence, no more than the affirmation of human freedom has traditionally been assumed to deny God's providence. Conatism merely asserts that evolution, *in se*, has no predetermined endpoint.

[46] Michael A. Flannery, *Nature's Prophet: Alfred Russel Wallace and His Evolution from Natural Selection to Natural Theology* (Tuscaloosa, AL: The University of Alabama Press, 2018), 34.

[47] C. Lloyd Morgan, a follower of Wallace, suggested instead the phrase "natural elimination." See C. Lloyd Morgan, "Elimination and Selection," *Bristol Naturalists Society Proceedings* 5 (1888): 273-85.

have it both ways: a Creator-free nature transmutated into a *selecting* Nature governed by *chance*."[48] In other words, Wallace's teleological model of evolution, contra Darwinian teleology, regarded ends and goals as additions to natural selection rather than inherent to it. Evolution was teleological *in spite of* natural selection, not because of it. Thus, Wallace's views, like Gray's, can be summarized as Paleyan with respect to the source of biological novelty. While natural selection explains the *elimination* of variety, the external agency of spiritual forces explains the *origin* of variety—namely, through the "build up [of] that infinitely complex machine, the living organism."[49]

The goal of these spiritual agents was, accordingly, the "preparation of the earth for man."[50] Indeed, Wallace believed that all of history had one end in mind: humanity's arrival and spiritual training. Even seemingly trivial features, such as the beautiful colorations of butterflies, serve a purpose, leading one to see "some supreme mind" directing the whole chorus of creation.[51] As such, Wallace's finalism was grounded upon his acceptance of Paleyan teleology; because spiritual agents were acting towards the production of humanity, evolution was a predetermined route leading unwaveringly towards our arrival. This was not a mere theological gloss for Wallace; rather, it was a conclusion Wallace believed one could derive from the empirical evidence itself. [52]

Wallace therefore offers a theological vision of evolution that, while accepting of natural selection, seems to have little place for it. Indeed, Wallace's speculative model presents a history where every facet of evolution is teleological and theological *except for* natural selection. Natural selection is not, *in se*, teleological; rather, it merely clears out the relic

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[48] Flannery, *Nature's Prophet*, 38. Emphasis in original.

[49] Alfred Russel Wallace, *The World of Life: A Manifestation of Creative Power, Directive Mind and Ultimate Purpose* (London: Chapman and Hall, Limited, 1914), 337-8. The usage of mechanistic imagery likely reveals an implicit Paleyanism.

[50] Ibid, 315.

[51] Ibid, 323.

[52] ibid, 354.

populations no longer needed in the grand spiritual plan.[53] As such, Wallace's model is one where teleology is *extrinsically* imposed upon a fundamentally ateleological process; despite being nonreligious, Darwin's (apparent) view of biological teleology was far closer to the theological model I defend than Wallace's more bold speculations. Moreover, since my project offers little justification for Paleyanism, it likewise grants no support for finalism since the latter is grounded upon the former.

While it might be easy to dismiss Wallace's views as an antiquated relic of history, they have retained a persistent presence through the decades. For instance, Pierre Lecomte du Noüy, a notable French biophysicist, popularized a similar model during the mid-twentieth century under the title of teleofinalism. According to it, evolution is guided by a divinely crafted governing principle that acts "as a distant directing force tending to develop a being endowed with a conscience, a spiritually and morally perfect being."[54] By ordering inorganic matter, this "force" coordinates all aspects of the world "in the same direction" in order to arrive at humanity.[55] Like Wallace, du Noüy is also anthropocentric, claiming that outside of humans, "all the creatures actually living on our planet are forms which have been left behind [by evolution]."[56] Only in humanity does evolution continue. This restrictive, anthropocentric view sharply contrasts with the otherwise similar themes within his contemporary, Pierre Teilhard de Chardin.[57]

Robert Broom represents an even closer analogy to Wallace's views. Writing during the same period as du Noüy, Broom was one of the most accomplished biologists in South African history. However, his greatest fame came from his resurrection of the view that spiritual beings

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[53] Wallace did, of course, believe there was *some* purpose to natural selection and the clearing out of less fit populations. However, unlike the ATTIF, this is a teleology imposed extrinsically upon natural selection.
[54] Pierre Lecomte du Noüy, *Human Destiny* (New York: Longmans, Green and Co., 1947), 87.
[55] Ibid.
[56] Ibid.
[57] Flannery, "Strong and Weak," 12.

were the active agents of mutagenesis, directing evolution towards humanity and subsequently promoting our spiritual development. Like Wallace, Broom was interested in the Theosophical Society and their esoteric teachings and freely incorporated them into his work. As such, both Broom and Wallace ultimately wed their speculative angelic hierarchies to their vision of the evolutionary process.[58] Broom's impact was considerable, though it was most notably felt on Julian Huxley, the inventor of the term "modern synthesis." Huxley, though an atheist, continued in the tradition of Wallace by regarding evolution as culminating in humanity through a progressive and highly constrained process. Huxley also maintained the thesis that evolution is currently only occurring in humanity.[59]

This summary, while brief, demonstrates that finalism's vision of biological teleology is not one that emerges *from* natural selection but *in addition* to it. This addition is made to constrain evolution in a manner counter to what available evidence seems to suggest. In other words, some other mechanism, be it a spiritual hierarchy or proposed laws internal to evolution itself (as in the case of Huxley), is claimed to direct natural selection towards certain ends—namely, humanity. Such mechanisms are, at best, speculative and, at worst, merely a reintroduction of Paleyan extrinsic teleology (as in the case of Bloom and Wallace). As such, while my argument does not necessarily rule out such mechanisms, it does not support them in any way and, indeed, suggests that biological teleology must be thought of in a radically different (i.e., non-Paleyan) manner.

2.2.2 Bergson's Conatism

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[58] For a summary of Broom's beliefs, see Goran Štrkalj, "Robert Broom's Theory of Evolution," *Transactions of the Royal Society of South Africa* 58, no. 1 (2003): 35-39; cf. Robert Broom, "Evolution—Is There Intelligence Behind It?" *South African Journal of Science* 30 (Oct. 1933): 1-19.

[59] For a summary of Huxley's beliefs, see Marc Swetlitz, "Julian Huxley and the End of Evolution," *Journal of the History of Biology* 28, no. 2 (1995): 181-217.

A distinct stream of eschatological teleology emerged near the turn of the twentieth century and began with the work of Henri Bergson. While largely overlooked today, Bergson was the most celebrated philosopher of his era. In 1913, the popularity of his lectures was said to have caused one of the worst traffic jams in the history of New York City. Quasi-pilgrimages were performed to his summer home in Switzerland in order to obtain locks of his hair from city barbers.[60] His popularity extended to academia, as well, with over two hundred articles on his work appearing from 1909 to 1911 in just British presses alone. He additionally garnered comparisons to philosophical titans like Plato, Kant, and Descartes.[61] Even the highly renowned Emmanuel Levinas would declare Bergson's *Time and Free Will* as one of the "four or five… finest books in the history of philosophy."[62]

While Bergson's philosophy covered many areas, perhaps the two most important concepts to his philosophy of biology were *durée* and *élan vital*. While space restricts an adequate treatment, I will briefly define each term. *Durée*, or duration, is Bergson's attempt to reconceptualize time as a process of ceaseless becoming. While his contemporaries routinely conceived of time in a spatial manner (most notably with the concept of a timeline), Bergson warned that this misconception resulted in a view of time that is static and fixed; in other words, it is a model that removes the very essence of time—namely, temporal flow. For Bergson, time is known only through our inner conscious experience of a world in constant flux, changing and moving in unpredictable and novel manners. Our subjective experience of time is the gateway to discovering the nature of reality. Hence, it becomes the connecting point for absolute metaphysical knowledge of the world. Reality itself is a state of perpetual becoming.

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[60] Robert C. Grogin, *The Bergsonian Controversy in France: 1900–1914* (Calgary: University of Calgary Press, 1988), ix.

[61] William G. Barnard, *Living Consciousness: The Metaphysical Vision of Henri Bergson* (Albany, NY: SUNY Press, 2011), xviii.

[62] Emmanuel Levinas, *Ethics and Infinity*, trans. Richard A. Cohen (Pittsburgh: Duquesne University Press, 1985), 37.

Duration is therefore the immeasurable, purely qualitative nature of the world, and our measures of it are a product of a rational imposition on a fundamentally nonquantitative reality. Duration is also the realm of freedom. By conceiving of time linearly, we come to regard it as fixed and determined. When we return to our perception of time, however, we recognize it as proceeding via free, spontaneous, and creative choice.

The second term, *élan vital*, is occasionally translated as "vital force" but is, more often than not, simply left untranslated due to the lack of any perfect English equivalent. The term rose to prominence after the 1907 publication of Bergson's most recognized work, *L'évolution créatrice*, or *Creative Evolution*, and denotes the fundamental, distinguishing feature of life. Life, for Bergson, is "consciousness launched into matter."[63] Yet while this implies that all life is conscious, Bergson believed consciousness manifests in a greater capacity in certain organisms, such as higher vertebrates. Consequently, since consciousness involves freedom, all life, not just higher lifeforms, are free to some degree. Thus, life must be regarded as acting freely, unpredictably, and, perhaps most importantly of all, creatively. Evolutionary history, with its "continual creation of new forms," is the product of free, conscious agents, not the outcome of a mechanistic process.[64] Bergson therefore distinguishes his perspective from the twin fallacies of mechanism and finalism (defined here similarly to its usage earlier in the chapter). While seemingly contrasting positions, both regard the future as determinable from the beginning. Thus, no space is given for novelty, creativity, freedom, and unpredictability—all essential features of duration and the *élan vital.*

How do Bergson's positions compare to Darwin's? While the two positions are often contrasted, the actual relationship is more nuanced. Bergson retains the idea that variations take root in the germ, though he does dispense with Darwinism's reliance upon accidental,

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[63] Henri Bergson, *Creative Evolution,* trans. Arthur Mitchell (New York: Random House, 1911), 199.
[64] Bergson, *Creative Evolution*, 96.

individual-level changes as the driving mechanism of evolution.[65] The multiple instances of convergent evolution (such as the independent evolution of the eyeball in distinct species) is, according to Bergson, simply beyond the capacity of random variation.[66] As such, Bergson finds Darwinism to be incomplete on these grounds or, at the very least, in need of "some good genius"[67] behind the process.

For Bergson, the "motive principle of evolution" is consciousness.[68] Since consciousness implies "at least a rudiment of choice," life itself, as consciousness in matter, drives evolutionary change and determines its orientation.[69] The convergent evolution of the eye, then, is not the result of the mechanical processes of matter. Rather, an "original impetus of life"[70] lies behind this phenomenon—namely, an impetus toward vision. Life, as consciousness, has the drive to act upon matter, yet matter resists the drive of life for self-transcendence.[71] Thus, matter, whose essence is necessity and identical repetition, works to resist the creative activities of life, whose essence is indeterminacy, choice, and contingency.[72] With this explanation in hand, one can now recognize the cause behind the convergent evolution of the eye. Since vision allows for greater possible actions upon matter, it allows for a greater degree of freedom. Thus, life has striven to arrive at an organ capable of this function; the eye then becomes the shared result of this shared impulse.

Already, one can see resonances between Bergson and the conclusions of previous chapters. For instance, the analogy between a deliberating, volitional agent and natural

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[65] Ibid, 85.
[66] Ibid, 70ff.
[67] Ibid, 77.
[68] Ibid, 200.
[69] Ibid, 107.
[70] Ibid.
[71] ibid, 113.
[72] In Henri Bergson, "Introduction to Metaphysics," in *The Creative Mind*, trans. Mabelle L. Andison (Mineola, NY: Dover Publications, Inc., 2007), 158, Bergson notes that "intuition" (his term for a unique form of knowing that bridges the divide between subject and object) must hover between the repetition of matter and the eternity of life: "Between these two extreme limits moves intuition, and this movement is metaphysics itself."

selection as modeled on an evolutionary landscape (discussed in chapter 4) no longer seems so mysterious. The "personification of natural selection," as Samir Okasha describes it, would, for a Bergsonian, not be a mere heuristic but a natural recognition of two features of reality (rational agents and natural selection) that derive from a common source (consciousness).[73] Moreover, the concept of affordances (as discussed in chapter 5) likewise corresponds to Bergson's ideas; organisms constitute affordances *as affordances* through their deliberate response to them. These, in turn, recursively affect evolutionary change. Here, again, life itself determines its evolutionary path, and if life is coterminous with freedom and consciousness, one could equally assert that consciousness determines evolution through its free acts.

Moreover, Bergson affirms both the reality of internal and external teleology. He describes the body of cells as "living each for itself at the same time as for the others."[74] In other words, the primal tendencies present in all living organisms act as an *external* finality, guiding and directing evolution into unpredictable and novel territories. Nevertheless, the individual manifestations of these tendencies at the cellular, organic, systemic, organismic, populational, and ecospheric levels are self-referential (i.e., directed towards intrinsic goods) and are therefore states of *internal* finality. Hence, while life is teleological in the sense that it is always striving *toward* some end—namely, greater degrees of consciousness and freedom)—the particular means for achieving this end and the exact form it will take cannot be foreknown with certainty.[75] Thus, Bergsonism, as a species of conatism, differs from finalism in one major

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[73] Samir Okasha, *Agents and Goals in Evolution* (Oxford: Oxford University Press, 2018), 15-16.

[74] Bergson, *Creative Evolution*, 183. Contra Tano S. Posteraro, *Bergson's Philosophy of Biology: Virtuality, Tendency and Time* (Edinburgh: Edinburgh University Press, 2022), 45ff, who asserts that Bergson defended only an external teleology since, Posteraro claims, Bergson denied the reality of individual organisms (i.e., there can be no "internal" when there is no individuality). However, if Bergson truly denied individuality (a contentious notion), then there cannot be an external teleology, either, since the latter term equally requires an individual to be external to.

[75] As such, David Kreps, *Bergson, Complexity and Creative Emergence* (New York: Palgrave Macmillan, 2015), 17 errs when he declares that the *élan vital* "belies *any* teleology" (emphasis my own). More pronounced is the error of Étienne Gilson, *From Aristotle to Darwin and Back Again: A Journey in Final Causality, Species, and Evolution*, trans. John Lyon (Notre Dame: University of Notre Dame Press, 1984), 102, who writes that in Bergson's work, "Intelligence, dragging finality with it, is condemned to dwell in the house of geometry and evil."

respect; it does not regard evolution as a directionally fixed process, lest it lose the very power of freedom that is its motive principle. As such, it does not consider humanity the inevitable *telos* of evolutionary change.

One possible objection at this point is Bergson's supposed denial of Darwinism.[76] However, this is a caricature of Bergson's actual position. As noted, Bergson merely denied the role of *chance* mutations with no higher intentionality. The ATTIF concerns the teleological nature of natural selection and leaves open the possibility of further teleology in the generation of novelty. Moreover, as chapter 5 argues, phenotypic expression of genes is not based on chance. Additionally, chapter 4 has suggested that even chance mutations play an essential role in a higher teleological process—namely, the exploration of evolutionary landscapes. Finally, as discussed below, one can challenge the assertion that mutations are purely the product of chance. As such, Bergsonism and the ATTIF, as well as other key aspects defended in preceding chapters, are compatible, though, admittedly, one does not entail the other. My thesis does not depend on the truth of Bergson's ideas; nonetheless, they naturally correspond in many areas, especially as they relate to the individual elements within the ATTIF that are discussed in chapters 4 and 5.

A more concerning criticism of Bergsonism is that recent discoveries have undermined key aspects of Bergson's critique of Darwinism. Given the discoveries of evolutionary developmental biology, such as the PAX6 gene, evolutionary convergences even as complex as the eye have been rendered more probable, and the identical paths taken by various lineages can be explained by the shared usage of the same gene toolkits. Thus, Bergson's arguments seem to have been undercut by advances in evolutionary biology, especially within the field of

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This mistake, along with his misunderstanding that Bergson denied substantial forms, resulted in Gilson's rejection of Bergsonian thought.

[76] See Bergson, *Creative Evolution*, ch. 1.

evolutionary development, rendering even some of Bergson's defenders suspicious of this particular point.[77]

Nevertheless, one can still defend Bergson at this point.[78] Biologists now know that the evolution of the camera eye has occurred *seven* times.[79] Even assuming that the common genetic toolkit was available, an explanation must still be given for why evolution tended in *this* direction rather than any other. It is difficult to provide an adequate reply without appealing to something analogous to an impulse toward vision. In other words, a toolkit constructs nothing without an active agent making the necessary changes, and the fact that the toolkit continually constructs the same result implies the need for some form of explanation.

Yet even assuming that Bergson's example is outdated, numerous other instances are not so easily dispensed. For instance, one of the more incredible cases of convergent evolution is a phenomenon deserving of its own name: carcinization. At least five times in evolutionary history, the major bodily features of a crab have independently evolved.[80] Not only is the crab's external form present, but other features, such as neurological resemblances and a shared circulatory system, likewise make an appearance.[81] Simon Conway Morris has exhaustively treated the topic of convergent evolution, observing the thousands of instances of evolutionary convergence in features as incidental as animal songs.[82] However, Conway Morris concludes from these facts that the evolution of life is remarkably predictable, an observation seemingly

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[77] E.g., Kreps, *Bergson, Complexity*, 92, "The claim that cases of convergent evolution are to be explained in terms of an initial impulsion of life that has persisted across divergent lines can only remain highly speculative."

[78] For a sustained defense of Bergson's biology, see Posteraro, *Bergson's Philosophy*.

[79] Simon Conway Morris, "Introduction," in *The Deep Structures of Biology: Is Convergence Sufficiently Ubiquitous to Give a Directional Signal?*, ed. Simon Conway Morris (West Conshohocken, PA: Templeton Foundation Press, 2008), viii.

[80] These include true crabs, king crabs, porcelain crabs, hairy stone crabs, and hermit crabs.

[81] Jonas Keiler, Christian S. Wirkner, and Stefan Richter, "One Hundred Years of Carcinization – The Evolution of the Crab-Like Habitus in Anomura (Arthropoda: Crustacea)," *Biological Journal of the Linnean Society* 121, no. 1 (May 2017): 200-222. It should be noted that because numerous differences have emerged between these groups, the authors deny that this phenomenon confirms the reality of "evolutionary tendencies." However, such novelties are not unexpected given a Bergsonian framework.

[82] Simon Conway Morris, *The Runes of Evolution: How the Universe Became Self-Aware* (West Conshohocken, PA: Templeton, 2015), 295.

at odds with Bergsonism which regards the flow of duration as fundamentally unpredictable. Jonathan Losos has challenged this inference by Conway Morris, though, noting that while common selection pressures often do lead to common results, this is, by no means, a perfectly predictable process. Appealing to the bacteriological experiments performed by Richard Lenski, Losos notes that while eleven of his twelve lines of bacteria displayed evidence of convergent evolution, one line developed a unique adaptation—namely, the ability to feed on citrate—that none of the other lines were able to replicate despite repeated trials.[83] Similarly, while New Zealand has, until human arrival, lacked any terrestrial mammals, the indigenous birds failed to evolve into mammal "surrogates".[84] As such, it seems that current biological evidence appears to support Bergson's conclusions; evolution has a certain degree of unpredictability even while it proceeds through many episodes of repetition.

Further redemption for Bergson comes from the many discoveries of the extended evolutionary synthesis; the active role of organisms in evolution is a feature common to both the extended synthesis and Bergson. For instance, epigenetic markers introduce the active role of the organism in response to its environment that is missing from a purely Darwinian account of adaptations. Examples of this phenomenon include alterations in DNA methylation as a reaction to certain stressors or as compensation for low genetic variety.[85] This effect has even been witnessed in humans such as in the case of Dutch Hunger Winter Syndrome. Children born during the Dutch famine of 1944-5 were on average smaller than those of previous years and had higher rates of glucose intolerance. These traits persisted even in the grandchildren of

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[83] Jonathan B. Losos, *Improbable Destinies: Fate, Chance, and the Future of Evolution* (New York: Riverhead Books, 2017), ch. 9.

[84] Ibid, ch. 3.

[85] Aaron W. Schrey et. al., "The Role of Epigenetics in Evolution: The Extend Synthesis," *Genetics Research International* (2012): 1-3.

the affected individuals.[86] Here, again, it is difficult to account for *why* such mechanisms emerge without resorting to teleological language highly analogous to Bergson's own.

Another instance of the active role life plays in its own evolution has been the discovery that mutations are not, in fact, completely random. As Eva Jablonka and Marion Lamb note, until recently, "The idea that mutations might be formed specifically when and where needed was rarely even considered. It was simply assumed that all mutations are blind mistakes, the outcome of faults in the system."[87] Now, however, this idea has been abandoned by many geneticists, leading them to coin the term "directed mutation". While space restricts treating this topic in full, it is important to stress that their research has evidenced the presence of mechanisms that actively alter DNA in response to cellular signals or the environment.[88] In addition, organisms are now known not only to actively induce mutations but also to resist their effects, as well. As noted in chapter 5, the research of Andreas Wagner has led to the discovery of what has become known as "robustness", or the organism's ability to withstand phenotypic effects by mutations to specific genes.[89] An additional byproduct of robustness is its capacity to create cryptic genetic variations, which are neutral variations that might prove helpful in future circumstances. This further supports Wagner's contention of life's creativity detailed in chapter 5. Thus, when evolutionary biologists map fitness landscapes, these are not heuristic fictions. They demonstrate the real, unpredictable, and creative paths life may take.[90] Taken together, directed mutations and robustness grant a novel perspective on life—namely, one that

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[86] Yanchang Wei, Heide Schatten, and Qing-Yuan Sun, "Environmental Epigenetic Inheritance through Gametes and Implications for Human Reproduction," *Human Reproduction Update* 21, no. 2 (March/April 2015): 194–208. While traits obtained via epigenetic markers are sometimes compared to Lamarckism, many epigenetic markers, such as in the case of Dutch famine, seem to first emerge in the offspring rather than the parent organisms.

[87] Eva Jablonka and Marion J. Lamb, *Evolution in Four Dimensions* (Cambridge, MA: The MIT Press, 2005), 87.

[88] Ibid, 88.

[89] Andreas Wagner, *Robustness and Evolvability in Living Systems* (Princeton, NJ: Princeton University Press, 2005).

[90] While one might argue that this is still a spatialization of duration, because these models fall within the realm of science rather than metaphysics, they would likely be seen as perfectly appropriate by Bergson so long as one does not confuse them with the real flow of duration.

sees life as actively directing, correcting, and resisting evolutionary change. These traits, coupled with a rebirth of mainstream interest in self-organization, have proven wholly compatible with Bergson's *élan vital* (though, of course, by no means empirically demonstrating it).[91] In short, the many facets I have drawn from the ATTIF in previous chapters converge well with Bergson's model of evolution.[92]

2.2.3 A Critique of Bergsonism

However, one major difference exists between the ATTIF and Bergsonism—namely, the role of the transcendent. While Aristotle and Thomas Aquinas grounded natural motion in God as the ultimate aim and source of all final causes, Bergson's writings are far more cryptic on the possibility of such an ontological hierarchy. Does Bergson leave room for the transcendent? Certain passages seem to allude to this possibility. The most direct statement comes in the closing remarks of an essay entitled "The Perception of Change." Bergson comments, "The more we immerse ourselves in [duration], the more we set ourselves back in the direction of the principle, though it be *transcendent*, in which we participate and whose eternity is not to be an eternity of immutability, but an eternity of life: how, otherwise, could we live and move

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[91] While Stuart Kauffman and Brian Goodwin have maintained this position for many years, it has received more attention with its inclusion in the extended synthesis by Massimo Pigliucci. Cf. Massimo Pigliucci, "Do We Need an Extended Evolutionary Synthesis?" *Evolution* 61, no. 12 (2007): 2747, "There is little doubt that certain kinds of complex physical systems—of which biological ones are an obvious example—do show a tendency for self-organization and spontaneously complex behavior." This, in effect, demonstrates "a new organizing principle to aid in the quest to explain the evolution of biological form." For a detailed conversation on self-organization and Bergsonism, see Kreps, *Bergson, Complexity*, 195ff.

[92] One might wonder how Bergsonism can be reconciled with the last chapter's defense of essentialism given that Bergson is often cited as an anti-essentialist. For instance, in Bergson, *Creative Evolution*, 328, he writes, "There is no form, since form is immobile and the reality is movement." However, in his later writings, such as Bergson, "Introduction to Metaphysics," 222, he is careful to distance himself from the "doctrine of Heraclites." He emphatically denies the accusation that his philosophy abandons the concept of substances, writing, "Let me insist I am thereby in no way setting aside *substance*. On the contrary, I affirm the persistence of existences. And I believe I have facilitated their representation" (ibid, emphasis original). Therefore, one must read Bergson as grounding substances in becoming rather than in static, timeless forms independent of their temporal expressions. It is a view of forms that tries to make room for evolution, creativity, and freedom. This reading is supported by Henri Bergson, "Philosophical Intuition," in *The Creative Mind*, trans. Mabelle L. Andison (Mineola, NY: Dover Publications, Inc., 2007), 105, where Bergson declares becoming to be "itself substantial." I therefore believe that Bergsonism may be most compatible with the relational essentialism defended last chapter.

in it? *In ea vivimus et movemur et sumus*."[93] Thus, Bergson positions theology at the end of metaphysics; it is the final product of durational immersion. Bergson makes no secret of this, stating that philosophy ought to "turn us back… in the direction of the divine."[94] In fact, Bergson himself defines God as "unceasing life, action, freedom."[95] Divine creation, then, occurs in and through creaturely participation.[96] By reentering the *élan vital*, the individual performs something "quasi divine"[97] in their free acts and, now freed of necessities, "stand[s] erect, masters associated with a greater Master."[98] God, then, becomes synonymous with pure duration, yet, simultaneously, God is, for Bergson, transcendent. These subtle hints of his theology leave much to the imagination. Duration, it seems, is a force wholly immanent. How, then, can God be called transcendent? Thus, a failure to fully define the role of the transcendent plagues his work.

Moreover, there is a need to transcendentally affix many of the essential terms in Bergsonism in order to ground them. For instance, if "movement is reality itself," as Bergson declares, then matter, which Bergson regards as bearing a tendency toward immobility, can only be a deviation away from the real.[99] In other words, Bergson seems to establish an ontological hierarchy where the material is a privation of being. Bergson's vision, then, begins to resemble the very Neoplatonic metaphysic he often distanced himself from.[100] Indeed, this

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[93] Henri Bergson, "The Perception of Change," in *The Creative Mind*, trans. Mabelle L. Andison (Mineola, NY: Dover Publications, Inc., 2007), 132. Emphasis mine. The final line is a direct allusion to Acts 17:28, except here, Bergson replaces the masculine personal pronoun for the neuter. Another instance of this allusion can be found in his *Creative Evolution*, 75, where "God" is replaced with the "Absolute".

[94] Henri Bergson, "Introduction II," in *The Creative Mind*, trans. Mabelle L. Andison (Mineola, NY: Dover Publications, Inc., 2007), 46.

[95] Bergson, *Creative Evolution*, 217.

[96] While Bergson is primarily concerned with the creation of natural beings, he acknowledges that humanity, as *Homo faber*, is defined by the creation of artificial tools, as well. Unfortunately, it seems that, for Bergson, the act of concept creation for natural beings is purely alien to their being. It is partitive rather than constitutive and expansive.

[97] Ibid.

[98] Henri Bergson, "The Possible and the Real," in *The Creative Mind*, trans. Mabelle L. Andison (Mineola, NY: Dover Publications, Inc., 2007), 86.

[99] Bergson, *Creative Evolution*, 171.

[100] John Milbank, "Stanton Lecture 2: Immanence and Life," http://theologyphilosophycentre.co.uk/papers/Milbank_Stanton Lecture2.pdf, 20-1. Keith Ansell Pearson, *Philosophy and the Adventure of the*

similarity to Platonic thought was not lost on at least one of Bergson's more prominent students, Étienne Gilson.[101]

Bergson's concept of life (i.e., consciousness) as the motive force of evolution is further evidence of his need for the transcendent. Life is the initial unity that living organisms imperfectly embody and strive to further emulate, and each organism possesses some of the impulses driving the evolution of life forward more fully than others.[102] Yet while Bergson declares that a harmony of these impulses (now divided among the various species) existed in some primordial state, no organisms, not even the first lifeforms in earth's history, actually possessed this original harmony.[103] If such a unity existed, it is not materially instantiated. What, then, can this initial harmony of life be if not a transcendent reality that all individual lifeforms participate in? Thus, life is both immanent to the living beings yet necessarily transcendent of all organisms, since even all biological life collectively fails to fully actualize the perfected unity of this initial force. Hence, one must place life as the transcendent origin from which individual biological lifeforms derive their unique tendencies.

2.2.4 Theistic Conatism

It is for these reasons that Catholic thinkers have had the most success in providing the needed refinements to Bergson's thought. Ironically, the very church that placed his works on the *Index Librorum Prohibitorum* prevailed in modifying Bergsonism in a manner that not only

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Virtual (London and New York: Routledge, 2002), 94 calls this objection "legitimate and trenchant." However, he believes the objection ultimately fails; the *élan vital*, being a purely immanent reality, exists as a unity since "there are no things" to divide it. Thus, there can be no ontological hierarchy. This, however, fails to resolve the problem. Either the *élan vital* is a term convertible with reality itself or it is not. If the former, matter cannot then act as an opposing force to the *élan vital* since the *élan vital* is coextensive with all reality. If the latter, then one has reintroduced an ontological dualism.

[101] Gilson, *From Aristotle*,100. David Grumett, *Teilhard de Chardin: Theology, Humanity, and Cosmos* (Leuven: Peeters, 2005), 225 makes a similar note but adds that Bergson failed to distinguish between πρᾶξις and ποίησις, leading to his inability to see how "the transcendent absolute recapitulates its creative, unifying act in human action." For this mistake, he credits Teilhard de Chardin with a more authentic Plotinian cosmology.

[102] Bergson, *Creative Evolution*, 115.

[103] Ibid, "[This] harmony is not in front, but behind."

comported with the Catholic faith but also addressed the greatest challenge plaguing the philosophy.[104] The two most prominent figures in this regard are the writer and poet Charles Péguy and the paleontologist and priest Pierre Teilhard de Chardin. The former made no illusion of his dependence upon Bergson, considering him the greatest contemporary ally against the spiritual barrenness wrought by modernity. He did, however, wish to proceed beyond where Bergson himself would go, speaking "as a Christian and a Catholic" within the Bergsonian debate of his era.[105] Teilhard also borrowed heavily from Bergsonism in his sweeping application of its principles to earth's paleontological history. Even central aspects of Teilhard's "Omega Point Theology", often assumed as original to Teilhard, are prefigured in Bergson's work.[106] Yet, like Péguy, Teilhard wrote primarily as a Catholic; thus, his writings all culminate in a vision of the God behind reality, pushing it onward, and in front of it, drawing into unity with himself. This, for Teilhard, was God-Omega, in whom we find "eternal discovery and eternal growth."[107] I will, therefore, briefly touch on each thinker and how their development of the transcendent corrected and enhanced Bergsonism.

From the divine side of transcendence, the role of grace is made prominent by both thinkers. For Teilhard, grace provides the very means for creative creaturely activity. God acts

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[104] While the relationship between Bergson and the Catholic Church might seem antagonistic, the truth is more nuanced. The prohibition of his works was largely the success of Jacques Maritain, who initially credited Bergson with saving him from a life of skeptical relativism and setting his path toward an eventual conversion to Catholicism. Another factor in this prohibition was the embrace of Bergsonism by Catholic Modernists. Nevertheless, near the end of his life, Bergson confirmed he had drawn close to converting to Catholicism, which he declared to be the "completion of Judaism," but ultimately refused conversion due to a desire to remain in solidarity with the Jewish people as antisemitism advanced throughout Europe. Regardless, upon his will's request, he was buried in a Catholic cemetery.

[105] Charles Péguy, "Note on Bergson and the Bergsonian Philosophy," in *Notes on Bergson and Descartes: Philosophy, Christianity, and Modernity in Contestation*, trans. Bruce K. Ward (Eugene, OR: Cascade Books, 2019), 49.

[106] For instance, the cycle of divergence and convergence is anticipated in Bergson, *Creative Evolution*, 282, "A part is no sooner detached than it tends to reunite itself, if not to all the rest, at least to what is nearest to it. Hence, throughout the whole realm of life, a balancing between individuation and association."

[107] Pierre Teilhard de Chardin, *The Divine Milieu* (New York: Harper & Brothers, 1960), 119.

as the divine "lure" at the end of history, drawing life into himself and providing the transcendent foundation lacking in Bergson's own treatment. He writes:

> Whereas the Kosmos, in Bergson's creative evolution is seen as a radiation that spreads out from a central source, the picture of the universe we are introduced to by 'Creative Union' is that of a concentration, a convergence, a centripetal confluence that originates in some infinitely distended sphere.[108]

Thus, Teilhard considered his cosmology the "converse" of Bergson's.[109] Grace, as its transcendent source, provides both the motive and means for the vital impulse. Péguy's doctrine of grace shares much in common. Grace is, for Péguy, what draws creation from a death in habitude by "moistening" even the most perverse souls.[110] The sterility of habit, rather than sin, is therefore the contrast to grace. Moreover, Péguy's doctrine of grace provides a "teleology that is eschatologized" and thus bridges any sharp divide between the immanent and the transcendent—the natural and the supernatural.[111]

From the human side, each thinker offers their own perspective on which of the theological virtues acted as the primary agent of transformation. For Péguy, hope is "the source of life, for she is that which constantly dis-habituates. She is the seed. Of every spiritual birth. She is the source and the splashing up of grace, for she is that which constantly unclads that mortal cladding of habit."[112] As such, it is hope in the ever-present arrival of grace that opens the path toward God and away from the death of habitude. Hope can therefore receive various labels, such as "the principle of re-creation" and "the most direct, the most present agent of God."[113] Teilhard, by contrast, offers love as the principal motive force behind the cosmos. In

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[108] Pierre Teilhard de Chardin, "Creative Union," in *Writings in Time of War*, trans. René Hague (New York: Harper & Brothers, 1965), 157. Cf. Bergson, *Creative Evolution,* 115, "[unity] is given at the start as an impulsion, not placed at the end as an attraction."

[109] Ibid.

[110] Charles Péguy, "Conjoined Note on Descartes and the Cartesian Philosophy," in *Notes on Bergson and Descartes: Philosophy, Christianity, and Modernity in Contestation*, trans. Bruce K. Ward (Eugene, OR: Cascade Books, 2019), 82-6.

[111] John Milbank, "Forward," in *Notes on Bergson and Descartes: Philosophy, Christianity, and Modernity in Contestation*, trans. Bruce K. Ward (Eugene, OR: Cascade Books, 2019), xx.

[112] Péguy, "Conjoined Note," 101.

[113] Ibid.

an early poetic work entitled "The Eternal Feminine," love, personified as a woman, comes forth from God as the first created work alongside the world. She is the one through whom "all things have their movement and are made to work as one."[114] In later works, he reiterates this position, declaring love to be the motive force behind the conscious ascent of matter.[115] Thus, in both thinkers, the bridge between the transcendent and the immanent is breached by grace working through the theological virtues. Péguy and Teilhard therefore offer a perspective that retains the heart of Bergsonism while correcting his underdeveloped treatment of the transcendent.

Moreover, Teilhard and Péguy provide a bridge between the classical thinkers analyzed in chapter 1 and the ATTIF introduced in chapter 2. While the ATTIF ends its analysis of aims with reproduction (as any account of biological fitness ought to), it does not assert that this is, indeed, the *ultimate* aim. Indeed, as chapters 1 and 6 have argued, no account of goods is intelligible outside of the Good-in-itself. Like Aristotle and Aquinas, Péguy and Teilhard provide an account of biological life that links the organism with the divine; however, they accomplish this in conversation with the intriguing insights of Bergson, assimilating and correcting elements of his thought through the lens of these classical thinkers.

2.2.5 Is Teilhardian Biology Still Viable?

Referencing Teilhard in either biological or theological circles will often draw criticism. Indeed, one common objection is that Teilhard's thought is outdated or irrelevant. On the biological side, however, Teilhard's conclusions were independently supported, at least in part, by many accomplished figures. One could cite the important works of Yale's Edmund Ware Sinnott, who argued that a "Power… creates organized living systems and sets up in them the

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[114] Pierre Teilhard de Chardin, "The Eternal Feminine," in *Writings in Time of War*, trans. René Hague (New York: Harper & Brothers, 1965), 192.

[115] Pierre Teilhard de Chardin, *The Phenomenon of Man* (New York: Harper and Brothers, 1955), 264-5.

goals toward which they move and which culminate in the aspirations of the spirit."[116] One could similarly note the renowned work of Pierre-Paul Grassé, who, seemingly prophetic of the ATTIF, declared, "The selective act is inseparable from an end, whether directed by man in the case of artificial selection, or in the case of natural selection by death" and opted for a theory of orthogenesis.[117] However, these figures, despite their acknowledged contributions to biology, are also often dismissed as outside the scientific mainstream. One figure who cannot be is Theodosius Dobzhansky, who is famous for his admiration of Teilhardian thought.

Indeed, one reviewer of his work claims Dobzhansky was "driven to re-examine and to agree, at least in its essentials, with the evolutionary 'credo' of Teilhard de Chardin."[118] Even Dobzhansky's most famous quotation about the "light of evolution" was inspired by a line from Teilhard.[119] As such, it is perhaps no surprise that Dobzhansky regarded the progress and rise of life through history as an unavoidable fact.[120] Indeed, over a decade after Teilhard's death, Dobzhansky published an article in praise of Teilhard's efforts.[121] In it, Dobzhansky contrasts the vision of finalists like Lecomte du Nouy, who believe evolution proceeds via a "predetermined direction," with Teilhard's view of a "groping (*tatonnement*)" process.[122] The latter allows us to understand evolutionary dead ends without a denial of a general directionality to the process. Moreover, Dobzhansky also agreed that humans have, in some sense, taken evolution to a new psychical stage.[123] In humanity, the universe begins to question

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[116] Edmund Ware Sinnott, *The Biology of the Spirit* (New York: The Viking Press, 1955), 172.

[117] Pierre-Paul Grassé, *Evolution of Living Organisms: Evidence for a New Theory of Transformation* (New York: Academic Press, 1977), 129.

[118] Edgar Taschdjian, Review of *The Biology of Ultimate Concern* by Theodosius Dobzhansky, *CrossCurrents* 17, no. 3 (Summer 1967): 361.

[119] Dobzhansky's original quotation, which was the title of his 1973 essay in *American Biology Teacher*, is, "Nothing in Biology Makes Sense Except in the Light of Evolution." This line was inspired by Teilhard de Chardin, *Phenomenon*, 219, "Evolution is a light which illuminates all facts, a curve that all lines must follow."

[120] Theodosius Dobzhansky, "Chance and Creativity in Evolution," in *Studies in the Philosophy of Biology: Reduction and Related Problems*, eds. Francisco Ayala and Theodosius Dobzhansky (Berkeley: University of California Press, 1974), 310-1.

[121] Theodosius Dobzhansky, "Teilhard de Chardin and the Orientation of Evolution: A Critical Essay," *Zygon* 3, no. 3 (Sept. 1968): 242-58.

[122] Ibid, 248-50.

[123] Ibid.

its place and meaning. He writes, "These eons [prior to humanity] are, to us, inevitably preparatory for the entrance of mankind on the cosmic scene. Teilhard has forcefully and eloquently made this clear."[124] This is not to say that Dobzhansky agreed with Teilhard at all points. Indeed, Dobzhansky admits to splitting with Teilhard on multiple fronts, such as Dobzhansky's acceptance of process theology, his denial of orthogenesis, and his dismissal of other speculative aspects of Teilhard's system.[125] Nevertheless, Dobzhansky defends Teilhard's value and compatibility with contemporary science.[126] In sum, Dobzhansky represents a prominent attempt to "tame" Teilhard's thought, reducing it to a more palatable form during the height of the modern synthesis. Yet even despite these "taming" efforts, Dobzhansky demonstrates that the integration of Teilhardian thought was being performed even at the highest levels of biological thought during the mid-century.

Moreover, the impact of Teilhard on biology has not definitively faded. David Sloan Wilson, a major proponent of the extended synthesis, has argued, "*The Phenomenon of Man* was scientifically prophetic in many ways."[127] Indeed, Wilson considers his title *This View of Life* to be an "updated version" of Teilhard's book.[128] Simon Conway Morris, Chair of Evolutionary Paleontology at Cambridge, represents another prominent example. While the subtitle to his work *Life's Solution: Inevitable Humans in a Lonely Universe* may suggest a proclivity towards finalism, his work on convergent evolution, briefly noted above, indicates a different conclusion. Conway Morris's thesis is not that humanity, as it currently exists, was the destiny of evolution; rather, he suggests that evolution tends towards the production of

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[124] Ibid, 254.

[125] Ibid, 255-6. Both Dobzhansky and George Gaylord Simpson sometimes portrayed as an ardent critic of Teilhard) attributed this to Teilhard's mystical side. Simpson is complimentary, though measured, in his comments on Teilhard's system. E.g., George Gaylord Simpson, *The View of Life: The World of an Evolutionist* (New York: Harcourt, Brace & World, Inc., 1964), 224ff.

[126] Ibid, 257-8.

[127] David Sloan Wilson, *This View of Life: Completing the Darwinian Revolution* (New York: Pantheon Books, 2019), xiii.

[128] Ibid.

creatures with the same cognitive capacities as humanity. Indeed, he even suggests that mind could operate as an "attractor" in evolutionary change.[129] Conway Morris has also repeatedly praised and defended Teilhard's writings, and a comparison of their respective works shows considerable conceptional overlap.[130] As such, it would not be a stretch to list Conway Morris as a prestigious contemporary biologist who operates within the Teilhardian tradition.

Thus, a minority tradition of key figures exists as a living testament to the continued presence and compatibility of Teilhard with contemporary biology. In fact, a recent article in the prestigious *Proceedings of the National Academy of Sciences* (PNAS) by a team from the Carnegie Institution for Science, Caltech, and Cornell argues for a missing natural law that biases all evolving systems, both living and nonliving, towards ever increasing states of functional complexity and diversity.[131] In other words, selection for functionality is a fundamental trait of reality; existence itself is teleologically oriented towards higher states of being. There are striking similarities between the proposal of this article and the radiation and convergence that underly Teilhard's conception of cosmic evolution. While not fully arriving at Teilhard's system, the article represents another example in a growing litany that is breathing new life into his old framework.

Yet, as a final disclaimer, I am not claiming that one needs to embrace every element of Teilhard's theology/science to acknowledge this growing contemporary relevance of his thought. Indeed, my thesis can be regarded as a limited retrieval of his thought—namely, those aspects that correct the inadequate theology of Bergonism while retaining his conatist teleological vision of evolution that has proven harmonious with the ATTIF.

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[129] Conway Morris, *Runes of Evolution*, 260.

[130] Seth P. Hart, "A Convergence of Minds: Teilhard de Chardin and Conway Morris," *Theology and Science* 19, no. 3 (2021): 272-86.

[131] Michael L. Wong et al., "On the Roles of Function and Selection in Evolving Systems," *Proceedings of the National Academy of Sciences* 120, no. 43 (2023): 1-11.

2.3 Moorean, Conatist, and Thomistic Teleology

In this chapter, I have argued for both Moorean and conatist teleology. How do these positions align with the aspects of Thomistic thought defended in prior chapters? To begin, it may be remembered that Moore emphasized both the need to regard God's causal activity as ubiquitous and the need to reconcile Anaxagorean and Aristotelian teleology—both intrinsic and extrinsic teleology. This was, in many ways, a return to Thomas Aquinas's thought, for, as Thomas himself emphasized, the nature of creatures is a "divine art" impressed upon them, providing them with their particular *telos*. Expanding upon Aristotle's shipbuilding metaphor, Thomas argues that the divine work is analogous to a shipbuilder granting the wood the capacity to form itself into a ship (*In Phys.* II.14.268). Moreover, Thomas regarded the "principal good" for created things to be the "perfection of the universe" (*ST* I.22.4.c). Elsewhere in one of his earlier works, Thomas notes that the goodness of the cosmic parts is measured by their capacity to achieve their end—namely, similitude to divine goodness, which is the "end of all things" (*In I Sent.* d.44, q.1, a.2, co.)—and the addition of novel creatures might enhance the cosmos' capacity to achieve this end.[132] As such, the more creatures are able to attain their own perfections and assist in the development and perfection of other substances and the cosmos as a whole (such as through evolution), the closer the cosmos is to attaining its *telos*. This, for Thomas, is the manner in which God providentially acts within the world to order it towards the good, for (as noted in chapter 1) Thomas compares the workings of the cosmos to the ordering of an army to a commander's good (*SCG* III.64.2).[133] In other words, the virtues Moore saw in Darwinism were already in place within Thomism. God's causal activity is, for Thomas, ubiquitous within creation and intrinsic to it.

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[132] Thomas would later retract this position, stating that the addition of a new species would not enhance the perfection of the cosmos (*ST* I.118.3).

[133] A more contemporary defense is found in Ernan McMullin, "Evolution and Special Creation," *Zygon* 28, no. 1 (1993): 328. McMullin believes evolution demonstrates that "the universe has in itself the capacity to become what God destined it to be."

Moreover, if the necessary modifications are made to allow for a Thomism compatible with evolution (as noted in the previous chapter), one begins to see how certain aspects of conatism become a welcome theological addition. The intrinsic goods of organisms constantly shift as a result of their interactions with a perpetually changing set of environmental affordances, fueling the exploration of new avenues on evolutionary landscapes and generating phenotypic novelties. Form, then, becomes not a barrier to evolutionary change but the very means by which speciation occurs. As Goodman summarizes:

> We can judge the emergence of intrinsic values as an achievement of evolution. Just as Genesis reports the goods God saw, we see in nature an openness to emergent goods of many kinds, as natural selection sculpts living species, interpreting and letting them interpret their good dynamically and interactively. Teilhard sees consciousness as evolution's goal. Its rise guides us, like Ariadne's thread, through the taxonomic labyrinth.[134]

In other words, because creatures have forms, they have goods, and because they have particular goods, they seek these out, fueling the upward ascent towards higher fitness peaks. While certain aspects of (Bergsonian and Teilhardian) conatism remain speculative, especially the claim that consciousness is the goal of evolution, there have been recent scientific defenses even of these more brazen claims.[135] Yet even if one is skeptical of these rather audacious contentions, the central thesis of conatism seems to rest on solid scientific grounds and aligns well with both Moorean teleology and the metaphysical notion of the Good.[136] Thus, as Goodman concludes, “Darwin, like the neoplatonists, sees all natural kinds as existing for their own sakes. It's because the good is sought in so many ways that we can read the vast history of evolution as a series of experiments, groping for the light, finding all sorts of self-definition.”[137]

3. Evolution, Creativity, and Art

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[134] Goodman, *Creation and Evolution*, 155.

[135] E.g., Conway Morris, *Runes of Evolution*.

[136] For a definition of the metaphysical notion of the Good, see chapter 3.

[137] Goodman, *Creation and Evolution*, 155-6.

My project is not the first to suggest this view of evolution. Indeed, a recent work from Nathan Lyons has added further theological depth to many of the positions defended in this thesis, yet whereas this chapter has argued for the congruence of Bergsonism with the extended synthesis, Lyons has argued a similar claim with Félix Ravaisson, whose philosophy of habit proved foundational for Bergson's thought.[138] For Ravaisson, habit was a "second nature". In other words, Ravaisson held that the consistent activities of creatures eventually proved formative and supplemental to their nature. This view would become a core feature of Bergsonian duration.

Lyons supports Ravaisson's thesis by citing work on phenotypic plasticity, robustness, and niche construction—three biological concepts explored in previous chapters. These three concepts demonstrate three facets of life: the self-formative capacity of organisms, the effects of self-formation on heritability, and (consequently) the role of habit in evolution.[139] Lyons therefore concludes that these aspects of the extended synthesis "can be understood as the action of Ravaissonian habit, through which the ideas of organisms 'become being'… in their own bodies and their surrounding environment."[140]

But Lyons does not merely echo the thoughts of this thesis from a Ravaissonian perspective. Lyons further suggests that these conclusions can be wedded to Nicholas of Cusa's theology of art. For Cusa, human artistry adds to the range of sensible forms in the world; the spoon-maker, in making the spoon, brings something truly novel into the world with their creations (*De mente* 2.62-3). Lyons suggests we extend this creative capacity to organisms, arguing, "Biological evolution can be understood as a sort of art."[141] While the products of beavers, higher apes, and other tool-making organisms might be seen as obvious examples,

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[138] Nathan Lyons, *Signs in the Dust: A Theory of Natural Culture and Cultural Nature* (Oxford: Oxford University Press, 2019), ch. 6.
[139] Ibid, 132ff.
[140] Ibid, 143.
[141] Ibid, 144.

Lyons argues that habit-formation ought to be regarded as a type of art—a making visible in the body the "ideas" of organisms. In other words, just as tools are ideas made substantial, so, too, do the habits of organisms form their morphologies and behaviors. Art, defined as making one's ideas visible, is a ubiquitous feature of life.

Lyons resonates with the conclusions of chapter 5. It may be recalled that in that chapter, I noted that Andreas Wagner likewise argues for the creativity of life in evolution. As noted, Wagner surmises that this creativity derives from a library of forms and that existing lifeforms "are just faint shadows of this Platonic realm of the possible."[142] Moreover, the concept of reciprocal poiesis, defended in the same chapter, further adds credence to Lyons notion. Indeed, it provides a model detailing how the intentional ideas of organisms artistically form novel items in the world shaped around their interests (i.e., affordances) as well as how these creations reciprocally form the organisms who generate them. In their interaction with environments, organisms evoke affordances from their environment. While affordances are, in some sense, already virtually contained in the environment, they are brought forth only once an organism recognizes them as a good. In other words, organisms generate affordances in participation with their environment, and this activity reciprocally affects the evolutionary trajectory of the species.[143] Herein, one sees the creativity of life—a creativity that affects both environment and organism. Art in evolution, understood thus, is always a mutual activity. As organisms shape their external environment, they are shaped by it; the artist is always simultaneously the art.

Lyons argues that the generation of affordances is an instance of biosemiosis and links this with Cusa's notion of vertical participation, whereby creatures, in their act of sign-making,

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[142] Andreas Wagner, "Possible Creatures," *Aeon*, March 16, 2015. https://aeon.co/essays/without-a-library-of-platonic-forms-evolution-couldn-t-work?fbclid=IwAR02tZp0lrTRj40Q_hLz4bSPF_CUKobIx4Vf4O27j363pcca8SFp9iBv570.

[143] Lyons, *Signs in the Dust*, 92.

bring forth meanings latent within the divine art of creation. Cusa argues that since each creature perceives the world differently (i.e., has a different set of affordances), it brings forth distinct signs that each form a partial meaning of the same object (*Comp.* 6.16). Lyons concludes, "It follows that the Cusan act of vertical participation through horizontal sign-making is not restricted to humans but in fact has a history as long as life itself."[144]

Thus, two forms of artistry are performed in evolution: sign-making through the generation of latent affordances and evolutionary change through effects of the organism-affordance interaction. Organisms are, therefore, "art of themselves."[145] Against the mechanistic world-picture of Intelligent Design, Lyons suggests we see organisms not as artifacts but as art. In other words, human culture, with its continuous generation of new concepts and tools, is merely an extension of what nature has always performed.

Lyons's proposal also aligns with the theological stance of this project, citing Aquinas's shipbuilding analogy (referenced earlier in the chapter) as an illustration of how divine and creaturely art can be understood through participation and the distinction between primary and secondary causation.[146] Moreover, while Lyons does not cite him, his suggestions parallel Teilhard's concept of the noosphere. Teilhard maintained that the conceptual world of humanity, with its evolution in thought and technology, was merely the highest expression of the evolutionary process that had been continuously occurring in the world. God, as the Good-in-itself, was the motive force behind this evolutionary ascent, drawing all things together in the unity of the divine life. It is a picture of the cosmos that resonates deeply with the themes of this work, and it offers a framework for understanding how life itself participates in the ongoing artistic creation, the *creatio continua*, of the world.

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[144] Ibid, 147.
[145] Ibid, 151.
[146] Ibid, 152.

4. Conclusion

In this chapter, I have argued for what I have labeled a Moorean, conatist teleological interpretation of evolutionary theory. I have maintained that Aubrey Moore provided a theological and metaphysical framework for understanding Darwinism that comported with the ATTIF in a manner that Paleyan teleology (adapted to fit Darwinism) did not. Moreover, I have resourced the work of Henri Bergson, Charles Péguy, and Pierre Teilhard de Chardin and argued against a deterministic interpretation of evolution that I have called finalism. Instead, the picture of the cosmos I have explored is one where the striving of organisms toward particular goods is contingent upon the particular activities in determining which end is actualized. The evolutionary process is not a restrictive, constrained progression but rather a cooperation of creature and Creator in true freedom in the ongoing perfection of the cosmos.[147] Finally, I have suggested Nathan Lyons's Cusan interpretation of evolution resonates with this thesis, providing a theological framework for understanding evolution as an artistic participation in divine creation. I will conclude with some final thoughts and reflections on the thesis and its implications.

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[147] Again, this not a denial of divine providence, no more than any acceptance of creaturely freedom is.

CONCLUSION

1. A Brief Summary

This thesis has argued that natural selection, understood as a real and distinct cause of evolution, is not only compatible with teleology but may be unintelligible without it. I have argued that teleology (and, therefore, a concept of the Good) is required for understanding the concept of biological fitness, and this, in turn, is defined by four distinct and hierarchical aims: development, functionality, survival, and reproductive success. Each one of these aims is itself teleological and understood via the distinct aims that determine their motion. Given this, I propose that classical theism offers a metaphysic for grounding natural teleology that at least equals, if not surpasses, naturalistic and nontheistic alternatives. I conclude by suggesting that a Moorean, conatist interpretation of this teleology offers a fruitful path for future theological speculation and integration with contemporary biology and that the first fruits of this work have appeared in Nathan Lyons's Cusan interpretation of evolution as a creative, artistic, and meaning-making enterprise.

2. Suggestions for Future Work

Outside of Lyons, this project finds consilience with recent works emerging from other contemporary theologians. Such projects are ripe for integration with my own, particularly in the field of theological anthropology. For instance, Michael Burdett has attempted integrating a functional model of the Image of God with niche construction—a topic briefly touched upon but in need of much deeper theological integration.[1] Burdett concludes that the divine mandate on humanity to bring about the flourishing of creation must be read as the development of a world where the mutual flourishing of all organisms within their respective niche occurs. In

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[1] For more on niche construction, see John Odling-Smee, Kevin Laland, and Marcus Feldman, *Niche Construction: The Neglected Process in Evolution* (Princeton, NJ: Princeton University Press, 2003).

other words, the construction of our own human niche must not come at the expense of other creatures given our divine mandate; indeed, our role is to enhance the niche spaces of other species.[2] Burdett's suggestion parallels the theological interpretation I attempt with niche construction, though with a greater emphasis on particularly human niches.

John Milbank has likewise emphasized the creative capacity of humanity, though in a manner that criticizes one of the main protagonists of this thesis. Embracing the role of humanity as co-creative agents of the divine, Milbank critiques Thomas Aquinas for confining "human transitive causation to the level of form/matter, rather than the level of *esse/essentia*" and failing to observe that creaturely activity is the means for "a *continuous* emergence *ex nihilo.*"[3] Thus, to quote Peter Leithart, humanity, when in cooperation with God, embodies "a creative performance of the Word."[4] Here, again, contemporary work in theological anthropology merges with some of the themes of this project, though a synthesis of our conclusions, though potentially fruitful, might require adjustments or refinements to our understanding of creaturely participation in the creative act.

Outside of theology, this thesis parallels emerging conversations in biology and the philosophy of science. By prioritizing the role of individual organisms in their own evolution, the ATTIF follows the same increasing trend within biology at large (the so-called "return to the organism" noted in the introduction).[5] This trend has motivated a recent rise in interest concerning the philosophical implications of biological teleology, and this ensures that theological work will continue to prove vital if it wishes to remain in conversation with this positive trend in biology. These suggestions represent only a few places where the conclusions

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[2] Michael Burdett, "Niche Construction and the Functional Model of the Image of God," *Philosophy, Theology and the Sciences* 7, no. 2 (2020): 158-180.

[3] John Milbank, qtd. in Peter J. Leithart, "Making and Mis-Making: *Poiesis* in Exodus 25-40," *International Journal of Systematic Theology* 2, no. 3 (Nov. 2000): 311.

[4] Ibid, 316.

[5] David J. Depew and Bruce H. Weber, "The Fate of Darwinism: Evolution After the Modern Synthesis," *Biological Theory* 6 (2011): 98.

of this thesis might prove beneficial in these arenas, and, undoubtedly, much more could be said in this regard.

3. The Place of Apologetics

Undoubtedly, there are holes one could find in this thesis's general aim of discovering a theology of evolution from the very logic of natural selection itself. For instance, I have consistently had to qualify that I am interpreting natural selection in a causalist sense, yet, simultaneously, I could not ignore the emergence of statisticalism as an alternative interpretation of natural selection. Similarly, one could simply deny any theory of natural selection altogether, as Jerry Fodor and Massimo Piattelli-Palmarini have done. While statisticalists generally still accept the reality of vernacular (i.e., individual) fitness and thus may still be beholden to teleology (as Denis Walsh has defended), Fodor and Piattelli-Palmarini's position is harder to rebut. For this reason alone, I have emphasized that my thesis ought not be considered an apologetic project. While the much weaker claim that only theists can hold to a traditional concept of natural selection can still be made and might still hold some rhetorical power, I do not believe much more can be said to evidence theism. Even chapter six's rebuttals to certain nontheistic positions can only succeed if one already assumes the reality of natural teleology, and a simple denial of natural selection (or perhaps even just a causalist interpretation of it) would render these rebuttals irrelevant.

This is not to suggest, however, that an apologetic cannot be made. Indeed, teleological arguments are common in philosophical history. An early version appears in Cicero's *De Natura Deorum* II.V.15, where he attributes the ordering of the universe to its various ends as evidence for their intelligent origin. The Abrahamic traditions would adopt and develop this line of argumentation, such as with the Christian theologian Theodoret, the Muslim savant Al-

Jahiz, and the Jewish philosopher Judah Halevi.[6] If a successful argument can be made for the truth of natural selection and causalism, this project can then be used as another example of a teleological argument for theism. As noted in the introduction, James Dominic Rooney has attempted to make such an argument.[7] Rooney parallels this thesis in his assertion that biological fitness is a teleological concept; thus, it can be used in support of Thomas Aquinas's Fifth Way. However, Rooney fails to engage in the lengthy literature on fitness and the nature of selection; hence, his project merely assumes the truth of causalism.[8]

A completely different approach is taken by David Bentley Hart, whose phenomenological argument focuses primarily on one instantiation of biological teleology: human rationality. According to Hart, the rational faculty's desire not for any particular truth but for Truth in itself demonstrates the transcendental foundation of all rational inquiry.[9] However, Hart's argument is not offered as a piece of evidence for God's existence. Thus, it would be incorrect to read his assertions as stating that the structure of rationality either proves or even evidences theism. Rather, Hart is claiming that rational thought, when turned on itself, recognizes its own teleological structure and its commitment to transcendental values. God, who is identified with these transcendentals, thus serves as a necessary *Grenzbegriff* [limit

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[6] For a deeper analysis of these thinkers, see Herbert A. Davidson, *Proofs of Eternity, Creation and the Existence of God in Medieval Islamic and Jewish Philosophy* (Oxford: Oxford University Press, 1987), 216ff.

[7] James Dominic Rooney, "Evolutionary Biology and Classical Teleological Arguments for God's Existence," *The Heythrop Journal* 54, no. 4 (2013): 617-30.

[8] Edward Feser, "Between Aristotle and William Paley: Aquinas's Fifth Way," *Nova et Vetera* 11, no. 3 (Summer 2013): 707-49 has offered a similar argument. However, the strength of Feser's arguments stems from its being a metaphysical argument from the nature of causation rather than from any particular causal process (like evolution). Rooney's project might be seen as a mere application of it to natural selection. For an earlier version of Feser's argument, see Edward Feser, "Teleology: A Shopper's Guide," *Philosophia Christi* 12, no. 1 (2010): 142-58. This earlier version lacked a connection between finality and the Good. Feser has been rightly critiqued for this by Marie George, "An Aristotelian-Thomist Responds to Edward Feser's 'Teleology'," *Philosophia Christi* 12, no. 2 (2010): 443-5. Feser has more recently corrected this absence in his argument. See, for instance, Feser, "Between Aristotle," 730.

[9] In David Bentley Hart, *The Experience of God: Being, Consciousness, Bliss* (New Haven and London: Yale University Press, 2013). Cf. David Bentley Hart, "The Treasure of Delight: Nicholas of Cusa on Infinite Desire," in *You Are Gods: On Nature and Supernature* (Notre Dame, IN: University of Notre Dame Press, 2022), 21-34; David Bentley Hart, "Waking the Gods: *Theosis* as Reason's Natural End," in *You Are Gods: On Nature and Supernature* (Notre Dame, IN: University of Notre Dame Press, 2022), 1-20.

concept] for logical thought without which our understanding of our own cognitive capacities disappears into incoherence. While Hart will occasionally make stronger claims than this, this rendering of his argument is the more common in his writings and, notably, is more defensible.[10] This thesis, while not directly supportive of Hart's contentions, are nevertheless parallel to them in many respects. If an attempt is made to form an apologetic argument from my conclusions, Hart's thesis might prove a helpful conversation partner.

But perhaps the best apologetic is the humblest and easiest to defend. I will, therefore, suggest what I believe to be the best method forward for an apologetic argument from biological teleology: a Bayesian approach. I have not, to this point, found the following version of the argument in any academic literature. The suggested proposal is somewhat technical, so I will keep this section relatively brief and provisional, given that it is offered purely as a proposal for future research. In short, one might assert that biological teleology raises the posterior probability of theism.

To begin, assuming the principle of indifference, one assumes that classical theism and atheistic materialism exhaust the metaphysical options and are each equiprobable.[11] Thus, each is given a prior probability of .5.[12] However, when we turn to the likelihood ratio, what level of credence ought we assign to the two competing hypotheses? On classical theism, natural teleology is predicted and, perhaps, entailed by the very logic of the causal system adopted by its greatest adherents. By contrast, on atheistic materialism, natural teleology is not predicted and, indeed, requires a conjunctive hypothesis to explain its reality; thus, its conditional probability will likely be lower than what we assigned to classical theism. As such, the posterior

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[10] For an example of Hart's stronger claims, see Hart, "Waking the Gods," 18, where he asserts theism is "the only possible explanation for the reality of rational existence."

[11] There are, of course, possible mediating positions (such as theistic personalism or atheistic panpsychism), but I disregard them for now for simplicity.

[12] I am committing myself to objective Bayesianism since I consider the principle of indifference a rational method for assigning priors.

probability of classical theism given natural teleology will be higher than atheistic materialism. This meets the minimal Bayesian definition of what it means to count as evidence for a hypothesis, which, in this case, is classical theism.[13]

Indeed, because classical theism so strongly predicts natural teleology, its reality could present a strong case for the existence of God. As an imprecise demonstration of this fact, suppose one assigns a probability of .5 to the reality of natural teleology given atheistic materialism (arguably an extremely generous assignment). One might additionally assign a probability of .95 to the reality of natural teleology given classical theism—a number that, as noted, might be too low given that the position might metaphysically entail natural teleology. If we again assume the principle of indifference and that these positions are metaphysically exhaustive, one ends up with a posterior probability of around .66 for classical theism. In other words, on its own, natural teleology turns classical theism from a coinflip to a hypothesis that is twice as likely as its contrary. If we reassign the conditional probabilities to more realistic numbers (lower for materialism; higher for theism), the posteriors will increasingly tilt towards classical theism.

Again, I offer these proposals as mere suggestions for future research. I do not consider any of them developed enough to defend in any rigorous way, including my own Bayesian proposal. That is not, however, to suggest that such arguments might not be fruitful arenas waiting to be developed.

4. Evolution as Doxology

In this thesis, I have attempted to construct a picture of biological evolution as an artistic, creative process of participation between God and creature. It is a journey marked by genuine

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[13] In other words, where P is the probability, E is the evidence, and H is the hypothesis: If $P(E/H) > P(E/{\sim}H)$, then E counts as evidence in favor of H. This is the standard Bayesian definition of evidence.

creaturely freedom, though a freedom that is always striving towards higher and higher perfections as each creature attempts to emulate God's goodness in its own distinct manner. This portrait of *natural* history is one that strikingly mirrors the one painted by St. Paul concerning *human* history in his famed Areopagus address.

Taking some paraphrastic liberties with the speech, biological evolution is the account of a God who has crafted a world so that all beings would seek after him and perhaps reach out and find him in ever greater ways, though, fundamentally he is not far from any of us. Indeed, he is not just the aim towards which all creatures seek but the very ground of being that allows for all seeking and finding. Put simply, he is the one in whom we live and move and have our being. This is the gift of creation; creation, gifted with being, gives back to God in its very motion and imitation of him. It is "a gift of a gift to a gift."[14] Yet in this imitation of God, creation most fully becomes itself. Thus, "All creatures… are fundamentally themselves in the praise of God."[15] Evolution, then, becomes nothing less than a grand, unending chorus of worship of all life in praise of its creator.

This project has been an attempt to bring together vastly different fields of study—theology, philosophy, and biology—in order to proffer a coherent teleological conception of evolution and the divine's role within it. I have maintained not merely the compatibility of Darwinism and classical theism, as so many have so urgently attempted, but the conceptual complementarity of the two beliefs. Undoubtedly, the questions that emerge and the answers I offer can and must be explored further, yet it is hoped that these first few probing attempts at an answer motivate further explorations of a theology of evolution—one that seeks not merely compatibility but a constructive synthesis that might mutually benefit our understanding of

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[14] Simon Oliver, "Every Good and Perfect Gift Is from Above: Creation *Ex Nihilo* before Nature and Culture," in *Knowing Creation: Perspectives from Theology, Philosophy, and Science*, vol. 1, eds. Andrew B. Torrance and Thomas H. McCall (Grand Rapids, MI: Zondervan, 2018), 39.

[15] Ibid, 40.

both biology and theology. If this thesis motivates such projects, even those that might disagree with my ultimate conclusions, I will consider my work a success.

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