

Article

The Theological Structure of Evolutionary Theory

Cornelius G. Hunter

Biology Department, William Jessup University, Rocklin, CA 95765, USA; chunter@jessup.edu

Abstract: Evolutionary theory has greatly influenced science and technology, but in recent decades contemporary scholarship has demonstrated religious influence in evolutionary thought. Religious premises do not merely provide insight; they underwrite evolutionary theory both by mandating strictly naturalistic origins and by providing key arguments for evolution. These arguments are common in the evolution literature, but what are the theological traditions and doctrines underlying these arguments? This paper presents a survey of the historical context of five theological traditions that have been important in the evolution literature. This is a step toward a better understanding of this highly influential theory.

Keywords: evolution; Darwin; greater god; plenitude; dysteleology; disutility; infra dig

1. Introduction

Charles Darwin proposed his theory of evolution in 1859 (Darwin 1859), and a century later, it was broadly accepted. Darwin's theory of evolution has been not only influential in the natural sciences but also the applied sciences, engineering, and technology, in areas ranging from genetic engineering to computer science. Given this broad acceptance and popularity in science and technology, it is interesting that evolutionary thought has a complex history involving interaction with non-empirical influences (Gillespie 1979; Nelson 1996; Cosans 2005; Waters 2009; Dilley 2012; Hunter 2014). Throughout Charles Darwin's *Origin of Species*, theological premises played an important epistemological role in interpreting observations and in justifying the theory. The scientific mechanisms alone were not sufficient to advance the theory, and in his summary arguments, Darwin continued to rely heavily on theological premises (Hunter 2021b). Darwin's theological framework for interpreting empirical findings became a hallmark of the evolution literature. After Darwin, identifying explanatory mechanisms remained a key problem (Stoltzfus 2021, p. 12; Reznick and Robert 2009, p. 841; Erwin 2000, p. 78), and evolutionists consistently employed similar, and often identical, theological arguments in justifying the theory (Dilley and Nicholas 2019; Hunter 2020, 2021a, 2021b).

Given the fundamental role that theology plays in evolution—one of the most influential theories of modern science and technology—it is important to understand the details of that theology. Exactly what is this theology? Is it based on a single theological premise, or are there multiple premises? Are there underlying theological doctrines or traditions, implicitly or explicitly, at work? What is the historical context, if any, of such doctrines or traditions?

Such questions have received only limited attention. For example, evolutionary theology is sometimes referred to as “God wouldn't do it that way” or “No designer worth his salt” arguments (Sober 2008, p. 126). Such monikers suggest a rather simplistic or naïve underlying theology. Theological premises and arguments, to make matters worse, are typically stated in the evolution literature as bare assertions. No theological doctrine or historical context is given, as the theological assertion is simply presented as immediately obvious and a self-evident logical fact, not resting on any underlying doctrine or tradition.

Unfortunately, these factors encourage a simplistic view and detract from a robust understanding of evolutionary theory. In fact, Darwin and later evolutionists appeal to



Citation: Hunter, Cornelius G. 2022. The Theological Structure of Evolutionary Theory. *Religions* 13: 774. <https://doi.org/10.3390/rel13090774>

Academic Editor: Man Ho Chan

Received: 1 August 2022

Accepted: 20 August 2022

Published: 24 August 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

and employ several distinct theological premises in formulating their strong arguments for evolutionary theory. In my reading, I count a total of 15 such distinct premises that have influenced and mandated evolution. Therefore, while the arguments for the fact of evolution are religious in the sense that they entail theological premises, those premises do not derive from a single religious tradition, but rather they derive more broadly from a web of religious traditions. These traditions are evident in Western Christian thought in the seventeenth and eighteenth centuries, leading up to Darwin, though some can be traced back to antiquity as well.

In order to achieve a robust understanding of evolutionary theory, what is needed is not merely an accounting of the religious premises at work and how they mandate evolution but the history of those premises and their underlying theological influences. This is a substantial scholarly project requiring expertise in relevant science, history, and theology. Importantly, it must avoid the whiggish tendencies of affording evolution a preferred epistemological status from the outset. Unfortunately, these tendencies have been all too common in contemporary scholarship. The result has been to grant evolution a sort of protected status, beyond the reach of any serious criticism, which has not helped the development of a robust understanding of evolutionary thought.

This paper attempts to assist in building a more robust understanding of evolutionary theory by providing an initial survey of the historical context of five of the important theological premises underwriting evolutionary theory. I label these premises and the arguments in which they are used as the principle of plenitude, disutility, dysteleology, greater god, and *infra dignitatem*. The following five sections survey each of these five arguments, respectively, including their historical arcs and important contributors and how they contributed to the mandate for evolutionary theory.

The final section summarizes and draws out the implications of the role of theological traditions in evolutionary theory. This paper focuses on typical, exemplary, theological influences on evolutionary theory and their implications. Theological doctrines with long histories within religious traditions, often with no initial link to origins, have deeply influenced science and technology. The specific causal links and historiographies, however, are beyond the scope of this paper. This paper is a survey, not a historiography. It demonstrates theology's influence on, and mandate of, evolutionary theory but does not explore the specific historical details of these links.

2. Principle of Plenitude

Historian Arthur Lovejoy once pointed out that in the history of thought, there is a long-standing belief that the world exhibits plenitude in its designs. At the extreme, plenitude thinking holds that the world contains or will contain all possible forms of existence. Lovejoy termed this tradition the Principle of Plenitude and traced it back to antiquity (Lovejoy 1936). An example in the modern era is the plurality of worlds and extraterrestrial life ideas held by Bruno, Huygens, Fontenelle, Burnet, and others (Crowe 1997).

In the eighteenth century, an important and powerful plenitude-type argument emerged in theories of the origin of the solar system presented by Bernoulli, Buffon, Kant, and Laplace (Bernoulli [1734] 2009; Buffon [1749] 1781; Kant [1755] 2008; Brush 1996). Each of these thinkers presented different mechanisms that were supposed to have caused the origin of the sun and planets, and each made high truth claims. Their triumphant claims were not a result of experimental evidence demonstrating that their particular mechanism indeed did or could do the job, but rather because of the plenitude argument, as applied to the solar system.

Specifically, the argument held that while the solar system should span the entire design space, in fact, it exhibits arbitrary and non-random design patterns. For example, the planets circle the sun in roughly the same plane (i.e., the ecliptic), the planets spin about their axis in the same direction, the moons circle their respective planets in the same direction, and so forth. As Kant put it, "it is clear that here there is no reason why the

celestial bodies must organize their orbits precisely in one single direction, unless the mechanics of their development had determined the matter" (Kant [1755] 2008, p. 118). If they were arranged by the "immediate hand of God", then we would expect them to reveal deviations and differences.

Thus, God's choice would not have the slightest motive for tying them to one single arrangement, but would reveal itself with a greater freedom in all sorts of deviations and differences (Kant [1755] 2008, p. 118).

Here, Kant made a theological claim involving a divine intent for the fullness of creation. The planets reveal a pattern rather than a full arrangement with "all sorts of deviations and differences". A convenient mathematical model for this is random design. That is, the planetary orbits should appear to be random. Kant and the others used a statistical calculation to demonstrate that the planetary orbits were highly non-random. By the century's end, Laplace calculated that the odds of the solar system's patterns to be 537 million to 1 if they had arisen by chance (Brush 1996, p. 21). Laplace was confident that his Nebular Hypothesis, which called for a cloud of material that rotates and condenses to form the planets and sun, was the "true system of the world" (Brush 1996, p. 22). This plenitude argument advanced by Laplace, Kant, Buffon, and Bernoulli held fast to a simple dichotomy: either the cosmos was randomly arranged, or it evolved by natural processes. Therefore, any non-random patterns were taken to be evidence for such evolution because, otherwise, God would create a randomly arranged cosmos (Hunter 2020).

This theological doctrine was also evident in later biological tests. Whereas Kant found similarities between the planets to be powerful evidence for cosmological evolution, Darwin found similarities between the species to be powerful evidence for biological evolution. There should be no such obvious pattern; instead, these anatomical designs should fill the design space. Just as Kant called for "all sorts of deviations and differences" among the planets under the divine creation hypothesis, so too Darwin called for more variation among the species under divine creation. For Darwin, the fact that anatomical patterns were conserved between species was evidence for his theory of evolution.

We never find, for instance, the bones of the arm and forearm, or of the thigh and leg, transposed. Hence the same names can be given to the homologous bones in widely different animals (Darwin 1859, p. 434).

As with the shared inclination angles of the planetary orbits, these shared features across the species could not be explained on the creation model, for "On the ordinary view of the independent creation of each being, we can only say that so it is;—that it has so pleased the Creator to construct each animal and plant" (Darwin 1859, p. 435). As with Kant, theology supplied the crucial premise in Darwin's argument, allowing him to claim the consistent pattern of arm and forearm, and thigh and leg, observed in the species as strong evidence for his theory of biological evolution. It is a testament to the strength and influence of this plenitude argument that Darwin would seriously suggest the radical restructuring of animal anatomy—transposing arms and forearms—as a reasonable design option. After Darwin, this religious tradition continued. Here is how Mark Ridley explains this biological test, updated to include the universal genetic code.

Homologous similarities between species provide the most widespread class of evidence that living and fossil species have evolved from a common ancestor. The anatomy, biochemistry, and embryonic development of each species contains innumerable characters like the pentadactyl limb and the genetic code: characters that are similar between species, but would not be if the species had independent origins. (Ridley 1993, pp. 48–49).

As Ridley explains, there would be no such similarities across the species under the "separate creation" model. Evolutionists are unable to explain how the genetic code evolved, but they know it would not have been created.

In addition to these qualitative arguments, over the past forty years, a series of quantitative arguments have emerged. In principle, these arguments are similar to the eighteenth-century cosmology arguments discussed above. Just as the cosmology arguments used a statistical calculation to demonstrate that the planetary orbits were highly non-random and so, therefore, must have evolved by natural processes, these biological arguments from recent decades use a statistical calculation to demonstrate that the biological data are highly non-random and so, therefore, the species must have evolved by natural processes (Hunter 2020).

In a large-scale 2016 study, researchers used 28 different computational experiments to quantify the evidential support for common ancestry among the primate species. The researchers calculated the probabilities that the biological data were random. Most of the results were small, and some were so small that the researchers simply reported a value of zero. As in the cosmological works, this gave the researchers great confidence in the veracity of evolution. They concluded that they had “found tremendously strong support for the CA [common ancestry] of all primates” and that common ancestry “is an overwhelmingly well-supported hypothesis” (Baum et al. 2016, pp. 1354–55).

3. Disutility

Religious rationalism was a dominant theme in seventeenth-century England. As Thomas Sprat put it, “The universal Disposition of this Age is bent upon a rational Religion” (Spurr 1988, p. 563). Central to this religious rationalism was the problem of naturalistic salvation. Nature needed to provide the evidence necessary for a saving faith. In addition to evidence of the divine, a system of ethics was needed for instruction on right conduct (Gill 1999). The history of this seventeenth-century ethics work is beyond the scope of this paper, but it set the stage for the later secular systems of ethics, including eighteenth-century utilitarianism, whose chief exponent was Jeremy Bentham. Utilitarianism is a theory of ethics that is concerned with consequences rather than means or motives. For Bentham, those consequences were achieved with his Greatest-Happiness Principle. Right conduct is that which produces the greatest happiness for the greatest number of people, where happiness is determined by pleasure and pain.

Utilitarianism has influenced a wide range of thought, including both natural theology and evolution. In these two traditions, utilitarianism was no longer a secular system of ethics but rather became a theological doctrine. The doctrine was, simply put, that God’s creation exhibits perfect adaptation or, as Darwin put it, “that every detail of structure has been produced for the good of its possessor” (Darwin 1859, p. 199). Moreover, perfect adaptation, it can be argued, maximizes the pleasure and pain ratio of God’s creatures. So, utilitarianism, when associated with the origin and design of the species, took on theological overtones. This development has not always been well understood, and a misconception, not uncommon in contemporary scholarship, holds that this utilitarian doctrine is entailed by natural theology and that evolution merely entails a weak form of utilitarianism (Hunter 2021a). In other words, natural theology incorporates and hinges on the theological doctrine that all things created by God must exhibit perfect adaptation, whereas evolution does not entail this theological doctrine. In fact, it is precisely the opposite. Evolutionary thought entails this theological utilitarian doctrine, and natural theology does not. To explain this misconception, I will briefly review examples from contemporary scholarship before explaining the actual situation.

Regarding the leading natural theologians John Ray and William Paley, at opposite ends of the eighteenth century, John Dillenberger wrote that they were so busy ascribing purpose and usefulness to everything that the agony and disproportionate character of human suffering did not seriously enter their horizon” (Dillenberger 1973, pp. 186–87). Similarly, Peter Bowler has written that Paley’s natural theology centered on adaptation (Bowler 1977, p. 31). John Reiss claimed that British natural theology viewed everything in the universe as adapted to everything else, and because the adaptation “was a result of God’s action, it was necessarily perfect” (Reiss 2009, pp. 129, 144). Similarly, Dov Ospovat

wrote that perfect adaptation was not hypothesized by natural theology but rather taken as a fact (Ospovat 1981, p. 36).

These examples illustrate that contemporary scholarship has sometimes characterized natural theology as utilitarian, that is, requiring God's creation to exhibit perfect adaptation. However, this is not an accurate characterization. John Ray's work, for example, focused more on the great range of designs in nature, which, as Bowler put it, "seemed to have been created merely to display the versatility of their Designer" (Bowler 2009, p. 40). More than a hundred pages of Ray's *The Wisdom of God* contain terms such as beauty, elegance, variety, order, and delight, and Marjorie Nicolson has described Ray's natural theology as emphasizing variety and diversity rather than utility.

John Ray might well have called his book not "The Wisdom of God" but "The Goodness of God in the Works of the Creation," for his survey of the world and the universe was a song of praise to the overflowing benignity of a Creator whose nature was to create to profusion: "All the Earth is full of thy Riches" was his theme. Scientist and collector, Ray was familiar with the profusion of Nature shown in plants, in animals, in birds, in insects. Although he made use of every argument familiar to theologians and scientists, his basic emphasis was upon variety and diversity in the richness of the world (Nicolson 1959, p. 260).

Similarly, Paley's *Natural Theology* was certainly not singularly focused on utilitarianism. For example, Paley hypothesized a *principle of beauty*, which he applied to the rare coloration change of the tulip's corolla. Indeed, Paley argued this was not an example of utilitarian design but rather was an example of beauty intended for display:

In plants, especially in the flowers of plants, the *principle of beauty* holds a still more considerable place in their composition; is still more confessed than in animals. Why, for one instance out of a thousand, does the corolla of the tulip, when advanced to its size and maturity, change its colour? . . . *Is it not more probable, that this property, which is independent, as it should seem, of the wants and utilities of the plant, was calculated for beauty, intended for display?* (Paley 1809, pp. 199–200, emphasis added).

Here, Paley explicitly argues against a utilitarian interpretation. Or consider Paley's sometimes maligned "It is a happy world after all . . ." vicarage garden passage. Desmond and Moore characterize it as an ode to adaptation: "It was good, life was happy, because all beings *were adapted* to their surroundings" (Desmond and Moore 1991, p. 90, emphasis added). However, in fact, it was the exact opposite. Not only did the passage not appeal to adaptation, it went out of its way to point out the very lack of use or purpose exhibited in the garden. It was good, and life was happy, not as evidenced by adaptation but the very lack of it. As Paley writes, for newborn flies, it is their "*gratuitous activity*, their continual change of place *without use or purpose*, testify their joy, and the exultation which they feel in their lately discovered faculties" (Paley 1809, pp. 456–57, emphasis added).

This emphasis on non-adaptive features was not limited to leaders such as Ray and Paley. It can be found in the writings of lesser-known eighteenth-century natural theologians as well (Hunter 2021a). Nor did this focus shift toward the end of the movement. In 1850 Adam Sedgwick, responding to Robert Chambers' appeal to abortive and rudimentary organs, argued that such organs might be part of God's greater plan or order.

These general views help us also to explain and rationalize certain well-known phenomena, such as abortive or rudimentary organs. These organs may have a muscular use which in some cases we do not comprehend. However, this may be, they form a part, and an essential part, of a great scheme; and they help us to understand the pattern of nature's workmanship. One use, at least, they have; they tend to complete the order and plan of nature: and this, moreover, we may venture to affirm, that *the Author of Nature manifests, in examples without number, a love of order and harmony and beauty*, which is altogether independent of our conceptions of mere vulgar use (Sedgwick 1850, p. 212 emphasis added).

In other words, abortive or rudimentary organs may be part of a greater order and plan of nature, or perhaps for the purpose of harmony or beauty. The great anatomist Richard Owen made a similar argument regarding the long-debated homologies, such as the pentadactyl pattern, which Owen argued could not be said to serve a utilitarian purpose. Instead, Owen argued that such design patterns represented a plan of creation “as an alternative to the utilitarian view of design” (Bowler 1977, p. 35).

So, while contemporary scholarship has, at times, mischaracterized natural theology as focused and hinging on utilitarianism, in fact, natural theologians consistently focused on non-adaptive design features. This is not to say that natural theologians did not exalt perfect adaptation when they saw it. They did. But their system did not require or hold to the utilitarian doctrine “that every detail of structure has been produced for the good of its possessor”, as Darwin put it (Darwin 1859, p. 199). It would be more accurate to view natural theology as holding to a weak form of utilitarianism.

Next, I turn to evolution. One of Darwin’s most powerful, and most common, arguments for his theory of evolution was from disutility. Structures lacked function or efficient function, so therefore, they must have evolved. It was a powerful argument because it carried the apparently objective criteria of material function. According to Darwin, the immediate inference was a contingency, as in these examples.

Thus, we can hardly believe that the webbed feet of the upland goose or of the frigate-bird are of special use to these birds; we cannot believe that the same bones in the arm of the monkey, in the fore leg of the horse, in the wing of the bat, and in the flipper of the seal, are of special use to these animals. We may safely attribute these structures to inheritance (Darwin 1859, pp. 199–200).

In these examples, Darwin argues that the structures are not well adapted and lack utility and, therefore, must have arisen via descent. Of course, none of these structures lacked utility completely. In fact, it would be difficult to measure any loss of utility at all. The pentadactyl pattern, to which Darwin refers in this passage, apparently worked quite well for the monkey, horse, bat, and seal. The problem was not that there was any observable disutility of these structures. The problem was that common sense dictated that such diverse uses as grasping, walking, flying, and swimming would best be served by very different designs. Even though each of these structures was quite different, nonetheless, there was a discernible common design pattern—the pentadactyl pattern of bones.

So, it seemed safe to assume that in these various species, their bone structures had not been optimally adapted for their specific, peculiar ways of life and functional needs. Instead, it appeared that an overriding pattern or plan was followed in their design. Was God not a good utilitarian but rather a Platonic creator, as Owen and others had argued? This view was gaining traction in the decades before Darwin published *Origin*, and as we have seen, the natural theologians had always promoted nonadaptationist views.

However, for many, including Darwin, utilitarianism ruled. He could not accept the disutility that apparently resulted from species that were independently created and yet unnecessarily forced into a so-called “unity of plan.” Instead, God’s creation would and should exhibit perfect adaptation. Where it failed to do so, this was proof of contingency. The disutility in nature, which Darwin found everywhere he looked, arose not from a misguided creator but from a wise god who designed and created the natural laws that created the species.

With his theory of evolution and common descent, Darwin felt that he solved the disutility problem. However, this problem was a religious, not scientific, one. Darwin’s motivation, and powerful proofs, entailed and hinged on the utilitarian doctrine that God would only create perfectly adapted species. From an empirical perspective, Darwin was hard-pressed to explain how the species actually evolved. Nevertheless, he was certain of it because he felt the alternative was impossible. God would never have created so much disutility.

In formulating this powerful argument, Darwin was well aware that he had made a significant theological commitment to the utilitarian doctrine that God would design a

world of perfect adaptation. If this doctrine were not true, it would deal a fatal blow to his theory.

The foregoing remarks lead me to say a few words on the protest lately made by some naturalists, against the utilitarian doctrine that every detail of structure has been produced for the good of its possessor. They believe that very many structures have been created for beauty in the eyes of man, or for mere variety. This doctrine, if true, would be absolutely fatal to my theory (Darwin 1859, p. 199).

Here, Darwin makes it clear that he requires a strictly utilitarian, adaptive design doctrine. The non-adaptive explanations that natural theologians had advanced—such as that structures have been created for beauty in the eyes of man, for mere variety, or to delight man or the Creator (this last item was added in the sixth edition)—would be “absolutely fatal” to Darwin’s theory. In this passage, Darwin makes clear that his theory is contingent on a theological claim about the mode of creation. After Darwin, the pentadactyl pattern soon became textbook orthodoxy (Dilley and Nicholas 2019), and the disutility argument remained a fundamental proof of evolution. As Stephen Jay Gould observed, “Odd arrangements and funny solutions are the proof of evolution—paths that a sensible God would never tread but that a natural process, constrained by history, follows perforce (Gould 1980, p. 20). Although this often is misunderstood in contemporary scholarship, the utilitarian doctrine is entailed by evolutionary thought, but not natural theology.

4. Dysteleology

The utilitarian and the dysteleology arguments for evolution use similar reasoning. Both argue that structures in the natural world must have arisen naturalistically. However, whereas the utilitarian argument focuses on the lack of function as the premise, the dysteleology argument focuses on the lack of design attributes, regardless of function. In fact, structures may exhibit exquisite function and utility without forfeiting their dysteleology status. This makes the dysteleology argument powerful, but it raises the question of how one is to determine a structure’s dysteleology status. Whereas function or utility can be difficult to measure, the lack of design attributes is even more subjective, as we shall see in this section.

An early and influential example of the dysteleology argument comes from the seventeenth-century Anglican cleric Thomas Burnet in his 1681 cosmogony *The Sacred Theory of the Earth*. In describing the origin of the earth, Burnet devised and elaborated on his seven phases of planetary evolution. Burnet aligned these different phases with certain biblical events, such as the Genesis Flood. One of Burnet’s chief arguments for his naturalistic origin of the earth was from dysteleology.

In the summer of 1671, Burnet toured Europe and crossed the Alps and Apennines mountain ranges. He had the experience of majesty and grandeur not uncommon for those visiting a great mountain range for the first time. However, Burnet’s wonder was often interrupted by the “incredible confusion” and lack of symmetry and proportion. From a distance, the mountains were awe-inspiring, but up close, there were irregular rocks, moraines, and valleys. Maps and atlases portrayed well-ordered and symmetrical mountains, but Burnet found them to be “shapeless and ill-figured.” Mountains were not the only confusing feature of earth’s geography for Burnet. Other problems included the jagged coastlines and lack of symmetry in the continents.

There is nothing in Nature more shapeless and ill-figur’d than an old Rock or Mountain, and all that Variety that is among them, is but the many various Modes of Irregularity; so as you can not make a better Character of them, in short, than to say they are of all Forms and Figures except regular (Nicolson 1959, p. 210).

In addition to the earth’s features, Burnet also found a lack of design in the cosmos. Telescopes increasingly revealed the unseemly details of the Moon’s pock-marked surface that Galileo had seen early in the century. Moreover, with its jagged and unsymmetric coastlines and mountains, the earth no doubt would also appear from afar “rude and

ragged,” as Burnet put it. For Burnet, all of this dysteleology was proof of a naturalistic origin.

Burnet’s cosmogony was immensely popular and controversial. The initial Latin version of *The Sacred Theory of the Earth* was in such demand that, at the request of the King, Burnet produced an English translation in 1684. Both versions expanded into two volumes as Burnet continued to make additions (Nicolson 1959, p. 187). As Nicolson explains, “In England the list of those who expressed themselves on Burnet’s theories is an imposing one, including in the period from 1685 to 1715 the names of nearly all men now remembered in the history of science and theology” (Nicolson 1959, p. 235). Toward the end of the century, Edmund Halley and William Whiston elaborated on Burnet’s idea of a naturalistic history of the Earth. Halley, one of the greatest astronomers in the world, theorized that a comet was the cause of the flood. Whiston, Isaac Newton’s successor at Cambridge, elaborated on Halley’s idea.

Burnet’s work continued to be popular well into the eighteenth century (Nicolson 1959, p. 187). In later years, the English Romantics William Wordsworth and Samuel Taylor Coleridge highly regarded Burnet. Meanwhile, on the continent, the French Encyclopedists held Burnet in high esteem, placing him in the company of Descartes and Newton. Moreover, Buffon and Leibniz referred approvingly to Burnet’s ideas.

However, not all readers approved, and Burnet received multiple lines of criticism from figures such as Richard Bentley, John Keill, and John Ray. Nonetheless, while his theory of earth’s origins did not endure, Burnet’s theological argument from dysteleology did anticipate later arguments for biological evolution. Perhaps there is a direct causal influence (though this is beyond the scope of this paper), but the dysteleology argument was a motivation in the emerging theories of biological evolution. Charles Darwin argued that the biological patterns he observed contradicted design and creation. For example, various islands possessed species of bats peculiar to them (Darwin 1872, p. 351). Why would this be so? Serial homologies (similarities within a species, rather than across different species) also made no sense, according to Darwin. For example, the skulls of vertebrate species are composed of numerous “extraordinarily shaped pieces of bone” (Darwin 1872, p. 384). Or again, a species of bird has similarities to the woodpecker yet preyed “on insects on the ground” (Darwin 1872, p. 414).

Such observations were, according to Darwin, strange and inexplicable to the conventional view of creation. However, in none of Darwin’s dysteleology arguments did he provide justification or rationale for his theological claims. Nor, aside from vague references to natural selection, could Darwin explain how such structures could have evolved. Indeed, after discussing serial homologies, Darwin retreated behind a hypothetical epistemological barrier, thus protecting his theory from the explanatory burden:

We need not here consider how the bodies of some animals first became divided into a series of segments, or how they became divided into right and left sides, with corresponding organs, for such questions are almost beyond investigation (Darwin 1872, p. 384).

In other words, while creationist explanations could be rejected on the serial homology evidence, evolution was not vulnerable to such evaluation and instead could be free to speculate:

It is, however, probable that some serial structures are the result of cells multiplying by division, entailing the multiplication of the parts developed from such cells. It must suffice for our purpose to bear in mind that an indefinite repetition of the same part or organ is the common characteristic, as Owen has remarked, of all low or little specialised forms; therefore the unknown progenitor of the Vertebrata probably possessed many vertebræ; the unknown progenitor of the Articulata, many segments; and the unknown progenitor of flowering plants, many leaves arranged in one or more spires. We have also formerly seen that parts many times repeated are eminently liable to vary, not only in number, but in

form. Consequently such parts, being already present in considerable numbers, and being highly variable, would naturally afford the materials for adaptation to the most different purposes; yet they would generally retain, through the force of inheritance, plain traces of their original or fundamental resemblance. They would retain this resemblance all the more, as the variations, which afforded the basis for their subsequent modification through natural selection, would tend from the first to be similar; the parts being at an early stage of growth alike, and being subjected to nearly the same conditions. Such parts, whether more or less modified, unless their common origin became wholly obscure, would be serially homologous (Darwin 1872, pp. 384–85).

Here, Darwin assumes only a small burden. With the dysteleology argument ruling out creation, he merely needed to provide a vague explanation for an evolutionary origin. After Darwin, the dysteleology argument has remained popular, and new examples have been triumphantly presented as proofs of evolution. Two examples will suffice: the recurrent laryngeal nerve in the giraffe and the orientation of photoreceptor cells in the mammalian retina. Regarding the former, Jerry Coyne explains:

One of nature’s worst designs is shown by the recurrent laryngeal nerve of mammals. Running from the brain to the larynx, this nerve helps us speak and swallow. The curious thing is that it is much longer than it needs to be. Rather than taking a direct route from the brain to the larynx, a distance of about a foot in humans, the nerve runs down into our chest, loops around the aorta and a ligament derived from an artery, and then travels back up to connect to the larynx. It winds up being three feet long. In giraffes the nerve takes a similar path, but one that runs all the way down the long neck and back up again: a distance fifteen feet longer than a direct route! (Coyne 2009, p. 82).

For evolutionists such as Coyne, it is plainly obvious that this arrangement was not designed and so must be the product of evolution. It “can be understood *only* as a product of our evolution” (Coyne 2009, pp. 82–83, emphasis added). According to Mark Pallen, the nerve is “the ultimate in undesigned biology!” (Pallen 2009, p. 99). In his evolution textbook, Mark Ridley rhetorically asks, “why giraffes should have such a nerve if they originated independently . . . well, we can leave that to others to try to explain” (Ridley 1993, p. 50, ellipses in original). Regarding the photoreceptor orientation, Richard Dawkins explains:

“Each [vertebrate] photocell is, in effect, wired in backwards, . . . This means that the light, instead of being granted an unrestricted passage to the photocells, has to pass through a forest of connecting wires, presumably suffering at least some attenuation and distortion (actually probably not much but, still, it is the principle of the thing that would offend any tidy-minded engineer!)” (Dawkins 1986, p. 93).

George Williams agrees and calls this a “functionally stupid upside-down orientation” (Williams 1997, p. 10). Steve Jones adds that “The feeblest of designer could improve it” (Jones 2000, pp. 130–31). According to Nathan Lents, this arrangement has the photoreceptor cells “facing the wrong way” and is “one of the all-time most famous examples of quirky designs in nature” (Lents 2015). There are other such examples, leading Williams to conclude that “organisms can have sophisticated adaptations and at the same time show design features that would not be there if intelligent planning had played a role” (Williams 1997, p. 2).

This dysteleology argument entails and requires a judgment on a transcendental property of nature, namely, what constitutes acceptable and unacceptable design. It is without regard to material properties such as efficiency or utility. As Dawkins states above, “but, still, it is the principle of the thing.” Indeed, even given discoveries of remarkable utility (Labin et al. 2014; Ball et al. 2022), the photoreceptor cell arrangement remains “backward” and does not forfeit its status of a bad design.

5. Greater God

As with the dysteleology argument, the greater god argument also traces back at least to the seventeenth-century Anglican cleric Thomas Burnet. Burnet illustrated this argument with a clockmaker analogy.

We think him a better Artist that makes a Clock that strikes regularly at every hour from the Springs and Wheels which he puts in the work, than he that hath so made his Clock that he must put his finger to it every hour to make it strike (Gould 1973, p. 144).

So just as the greater clockmaker makes a clock that works automatically, so too the greater god is the god who makes a universe that works by itself rather than having to apply a divine finger at different times and places. This argument that the earth evolved by natural means is separate and distinct from Burnet's dysteleology argument. This highlights a theme of evolutionary thought, namely, that it is motivated by a range of different theological premises.

The greater god argument had several important adherents, but Isaac Newton was an exception. The solar system, with its planets and comets orbiting the Sun was, for Newton, a "most beautiful system" that "could only proceed from the counsel and dominion of an intelligent and powerful Being" (Newton [1687] 1995, p. 440). Newton's laws of motion explained the motion of the planets and comets. However, Newton believed that these laws had their limits. Not only could the laws not be responsible for the origin of the system, but due to rare planetary alignments, orbital instabilities could grow until the system required an adjustment. According to Newton, the system on its own was not stable. The solar system would occasionally require, perhaps divine, intervention (Burt 1954, p. 296ff).

Others objected that this made God out to be a tinkerer and an unskilled creator. For in this view, he would have created a machine that did not function properly (Ashworth 2003, pp. 83–84; Broman 2003, pp. 91–92). One objection came from the wide-ranging mathematician and philosopher Gottfried Leibniz. Leibniz was a devout Lutheran, and he accused Newton of disrespect for God in proposing the idea that God was not sufficiently skilled to create a self-sufficient clockwork universe (Brush 1996, p. 17).

After Leibniz, the early eighteenth-century Lutheran philosopher Christian Wolff argued forcefully against miracles and for natural processes in the creation of the world. For once the universe was created, subsequent divine intervention would demonstrate power, but would undermine wisdom, as it would be a sign that a blemish needed removal, and thus there was a lack of wisdom in the initial creation act. In God's creation acts, Wolff argued that creation by natural law and natural processes required more power (and therefore was indicative of a greater god) than creation by miracle. Therefore, it was not possible that God would use a miracle when a natural process could do the job. Wolff concluded that "The natural way, as the superior way, must always be preferred over the way of miracles, and therefore miracles cannot occur except where God cannot achieve his goal in the natural way." Moreover, the only such instance requiring a miracle was creation *ex nihilo*. From then on, natural law must have reigned (Saine 1987, pp. 110–11).

Later in the century in 1794, the greater god argument entered early evolutionary thinking in the writings of Charles Darwin's grandfather, Erasmus Darwin:

The world itself might have been generated, rather than created; that is, it might have been gradually produced from very small beginnings, increasing by the activity of its inherent principles, rather than by a sudden evolution by the whole by the Almighty fiat. What a magnificent idea of the infinite power of the great architect! The Cause of Causes! Parent of Parents! *Ens Entium!* For if we may compare infinities, it would seem to require a greater infinity of power to cause the causes of effects, than to cause the effects themselves (Darwin [1794] 1999, p. 1355).

Erasmus' writings influenced the young Darwin, and, more generally, this religious sentiment was becoming popular with scientists, theologians, and popularizers. In the

nineteenth century, minister and professor John Playfair contended that James Hutton's uniformitarianism was far more conducive to reverent contemplation and a "properly worshipful attitude" (Gillispie 1951, p. 76). Likewise, Charles Lyell thought it more worthy of God to have designed interdependency to ensure balance and uniformity (Gillespie 1979, p. 59). Charles Darwin also expressed the greater god theology in an early notebook entry:

Astronomers might formerly have said that God ordered each planet to move in its particular destiny. In same manner God orders each animal created with certain form in certain country, but how much more simple and sublime powers let attraction act according to certain law such are inevitable consequences. Let animals be created, then by the fixed laws of generation, such will be their successors (Darwin 1838a, p. 263).

Michael Ruse has explained the role of greater god sentiment in Darwin's beliefs:

Darwin rejected miracles . . . his theological commitment was to deism rather than to theism. He grew to accept an Unmoved Mover who works through unbroken law, rather than a God of intervention who works through miracles that break physical laws. . . . the greatness of God lay in his ability to plan everything beforehand and then just step back and watch it all unfurl as he intended. This was the God that Charles Darwin accepted (Ruse 2003, pp. 95–96).

This sentiment was consistent with Darwin's social circles where, as Desmond and Moore put it, the "lawful" approach was carrying the day. For example, Charles Babbage, reformer, polymath, and creator of the "Difference Engine," wrote the unauthorized Ninth Bridgewater Treatise, countering the authorized volumes, which critics such as Babbage saw as suggesting a Creator with both a lack of foresight and a lack of dignity. In Babbage's narrative, God created the laws which created the species, thus displaying "a degree of power and of knowledge of a far higher order." Charles Lyell agreed and saw Babbage's "estimate of the Creator's attributes much higher" than those proposing an interventionist Creator (Desmond and Moore 1991, pp. 212–20).

So, it is not too surprising that Darwin's new theory of evolution would be approved on the basis of greater god theology. One of Darwin's early clerical supporters, the Anglican Charles Kingsley, wrote that "We knew of old that God was so wise that He could make all things but behold, He is so much wiser than even that, that He can make all things make themselves" (Murphy 2003, p. 119).

6. *Infra Dignitatem*

Whereas Thomas Burnet was concerned with large-scale geological structures of the earth and moon, the seventeenth-century Anglican theologian and philosopher Ralph Cudworth was concerned with the minutia. "That God himself doth all Immediately, and as it were with his own Hands, Form the Body of every Gnat and Fly, Insect and Mite" was, according to Cudworth, unbecoming of God (Allen 2013, p. 341). Following Cudworth, the botanist John Ray believed that God would not "set his own hand as it were to every work, and immediately do all the meanest and trifling'st things himself drudgingly, without making use of any inferior or subordinate Minister" (Ray 1735, Part I, p. 51). Simply put, the minutia of creation was beneath the dignity of the creator.

This is the *infra dignitatem* argument. The facts that both Cudworth and Ray opposed the Epicurean's chance creation story, that Ray opposed Burnet's naturalistic cosmogony, and that Ray was at the forefront of the eighteenth-century natural theology movement, which argued that the creation revealed the creator, served to illustrate the multiple facets of evolutionary theology. The *infra dignitatem* argument argues for precisely the more distant creator that the dysteleology and greater god arguments envision. This was especially true in the hands of later thinkers.

One of those thinkers was the eighteenth-century leading French scientist Buffon who opposed the "indignity of involving God in trivial anatomical details" (Burbridge 1998,

p. 57). Another such thinker was Charles Darwin, who made occasional *infra dignitatem* arguments to himself in his notebooks, such as this one.

How far grander than idea from cramped imagination that God created . . . a long succession of vile molluscous animals. How beneath the dignity of him, who is supposed to have said let there be light & there was light.—whom it has been declared “he said let there be light & there was light”—bad taste. (Darwin 1838b, pp. 36–37).

Darwin continued to use the *infra dignitatem* argument in his 1844 essay.

It is derogatory that the Creator of countless Universes should have made by individual acts of His will the myriads of creeping parasites and worms, which since the earliest dawn of life have swarmed over the land and in the depths of the ocean (Darwin 1909, p. 254).

In that same year, the *infra dignitatem* argument was made by Robert Chambers in his popular and controversial 1844 pseudonymous work, *Vestiges of the Natural History of Creation*. Chambers argued that it was ridiculous to expect a Deity to interfere personally and specially on every occasion when a new shellfish or reptile was to be ushered into existence. His point was that it was beneath God’s dignity, as Chambers made clear:

How can we suppose an immediate exertion of this creative power at one time to produce the zoophytes, another time to add a few marine mollusks, another to bring in one or two crustacea, again to crustaceous fishes, again perfect fishes, and so on to the end. This would surely be to take a very mean view of the Creative Power (Bosanquet 1845, p. 20).

In 1850, this conviction that God must be properly separated from the lower things of the world emerged in the arts with the exhibition at the Royal Academy of *Christ in the house of his parents* by pre-Raphaelite painter John Millais. In the painting, the boy Jesus had injured his hand in his father’s carpentry shop. Mother Mary attended to the boy while Joseph continued with his work. But the scene was altogether too realistic, with wood scraps lying all about and workers going about their duties. The scriptures said that God became flesh and dwelt among us. He knew sorrow, pain, temptation, and joy. However, the *infra dignitatem* argument emphasized God’s wisdom, power, and transcendence. Could He really have bruised his hand in a messy carpenter’s shop? *The Times* complained that the painting was revolting for its “attempt to associate the holy family with the meanest details of a carpenter’s shop, with no conceivable omission of misery, of dirt, even of disease, all finished with the same loathsome meticulousness, is disgusting . . .” *Blackwood’s Magazine* said, “We can hardly imagine anything more ugly, graceless and unpleasant,” and Charles Dickens called the painting “mean, odious, revolting and repulsive” (Wilson 1999, pp. 129–30). The reactions to Millais’ painting reveal the degree to which the *infra dignitatem* sentiment had penetrated English culture.

By the twentieth century, the point had become moot and needed only a rhetorical reminder. Geneticist and leading evolutionist J. B. S. Haldane pointed out that the creator must have an inordinate fondness for beetles to have created over 250,000 different species (Berra 1990, p. 142). Douglas Futuyma rhetorically asked, “What could have possessed the Creator to bestow two horns on the African rhinoceroses and only one on the Indian species?” (Futuyma 1983, p. 127). Moreover, regarding the elephant-like fossil species, Ken Miller rhetorically stated that “This designer has been busy! And what a stickler for repetitive work!” (Miller 1999, p. 97).

7. Conclusions

The theory of evolution has been widely influential in science and technology, yet evolution itself is inextricably linked to the deep theological themes that motivate and justify it. The structure and history of the religious influence on evolution are complex,

involving multiple theological traditions and doctrines—traditions and doctrines that did not necessarily have today's theory of evolution in view.

This paper explores five such doctrines that have been fundamental in evolutionary thought: the principle of plenitude, disutility, dysteleology, greater god, and infra dignitatem. This brief survey illustrates the diversity of religious thinking that has contributed to the wide acceptance of evolution. This survey also illustrates the complexity of the relationship between religion and science. In particular, I note three important features of religion's role in evolutionary thought.

First, the various religious arguments surveyed in this paper allow for scientific thinking to proceed in the absence of a detailed mechanism. Historically, both cosmological and biological theories of origin proceeded as high-level, phenomenological hypotheses. They lacked the level of detail required to test and confirm their sufficiency. Religion relieved the science of the requirement of specificity, allowing for broad freedom of thought and speculation without concern of rejection.

Second, the religious arguments underwrite the scientific theories, making them more robust to empirical failure and resistant to falsification. With the religious mandates in place, the science can sustain contradictory evidence, as it is relieved of scrutiny that otherwise might be felt. Lakatos urged a protective belt of scientific subhypotheses to protect the core theory, but here it appears that theological doctrines can serve in that role as well.

Third, the religious arguments provide significant confidence in the evolutionary theories. In spite of the lack of sufficient scientific mechanisms, the theories can be held to be facts. For both cosmological and biological theories, there has been little or no demonstration that the proposed mechanisms actually could create the structures in question. Nonetheless, those theories are generally held to be factual accounts.

These important features of evolutionary thought are not available from science alone, and this paper illustrates the importance of religion in scientific theory development and the justification and complexity of the science-religion interaction.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

References

- Allen, Keith. 2013. Cudworth on Mind, Body, and Plastic Nature. *Philosophy Compass* 8: 337–47. [\[CrossRef\]](#)
- Ashworth, William. 2003. Christianity and the Mechanistic Universe. In *When Science & Christianity Meet*. Edited by David C. Lindberg and Ronald L. Numbers. Chicago: University of Chicago Press.
- Ball, John M., Shan Chen, and Wei Li. 2022. Mitochondria in cone photoreceptors act as microlenses to enhance photon delivery and confer directional sensitivity to light. *Science Advances* 8: eabn2070. [\[CrossRef\]](#) [\[PubMed\]](#)
- Baum, David, Cécile Ané, Bret Larget, Claudia Solís-Lemus, Lam Si Tung Ho, Peggy Boone, Chloe P. Drummond, Martin Bontrager, Steven J. Hunter, and William Saucier. 2016. Statistical evidence for common ancestry: Application to primates. *Evolution* 70: 1354–63. [\[CrossRef\]](#) [\[PubMed\]](#)
- Bernoulli, Daniel. 2009. Physical and astronomical researches on the problem proposed for the second time by the Academie Royale des Sciences de Paris. In *Recueil des Pièces qui ont Remporté les Prix de l'Académie Royale des Sciences*. Translated by Richard J. Pulskamp. Paris: Jombert, vol. 3. First published 1734.
- Berra, Tim. 1990. *Evolution and the Myth of Creationism*. Stanford: Stanford University Press.
- Bosanquet, Samuel Richard. 1845. *Vestiges of the Natural History of Creation: Its Argument Examined and Exposed*, 2nd ed. London: John Hatchard & Son.
- Bowler, Peter J. 1977. Darwinism and the Argument from Design: Suggestions for a Reevaluation. *Journal of the History of Biology* 10: 29–43. [\[CrossRef\]](#) [\[PubMed\]](#)
- Bowler, Peter J. 2009. *Evolution: The History of an Idea, 25th Anniversary ed. with a New Preface*. Berkeley: University of California Press.
- Broman, Thomas H. 2003. Matter, Force, and the Christian Worldview in the Enlightenment. In *When Science & Christianity Meet*. Edited by David C. Lindberg and Ronald L. Numbers. Chicago: University of Chicago Press.

- Brush, Stephen. 1996. *Nebulous Earth: The Origin of the Solar System and the Core of the Earth from Laplace to Jeffreys*. Cambridge: Cambridge University Press.
- Buffon, George Louis Comte de. 1781. Of the formation of planets. In *Natural History: General and Particular*. Translated by William Smellie. Edinburgh: Creech, vol. 1, art. 1. First published 1749.
- Burbridge, David. 1998. William Paley Confronts Erasmus Darwin: Natural Theology and Evolutionism in the Eighteenth Century. *Science & Christian Belief* 10: 49–71.
- Burt, Edwin. 1954. *The Metaphysical Foundations of Modern Science*. Garden City: Doubleday Anchor Books.
- Cosans, Chris. 2005. Was Darwin a Creationist? *Perspectives in Biology and Medicine* 48: 362–71. [CrossRef] [PubMed]
- Coyne, Jerry. 2009. *Why Evolution Is True*. New York: Viking.
- Crowe, Michael J. 1997. A History of the Extraterrestrial Life Debate. *Zygon* 32: 147–62. [CrossRef]
- Darwin, Charles. 1838a. "Notebook B: Transmutation of Species." Barrett, P. H. ed. 1960. "A Transcription of Darwin's First Notebook [B] on 'Transmutation of Species.'" *Bulletin of the Museum of Comparative Zoology* 122: 245–96, and Corrected against the Microfilm. Deletions, Punctuation and Page Numbers Were Added. Corrections by John van Wyhe. Available online: <http://darwin-online.org.uk/content/frameset?itemID=CUL-DAR121.-&viewtype=text&pageseq=1/> (accessed on 30 July 2022).
- Darwin, Charles. 1838b. Notebook D: [Transmutation of Species (7-10.1838)]. CUL-DAR123. Transcribed by Kees Rookmaaker. Available online: <http://darwin-online.org.uk/> (accessed on 26 August 2021).
- Darwin, Charles. 1859. *The Origin of Species*, 1st ed. London: John Murray.
- Darwin, Charles. 1872. *The Origin of Species*, 6th ed. London: John Murray.
- Darwin, Charles. 1909. *The Foundations of the Origin of Species. Two Essays Written in 1842 and 1844*. Edited by Francis Darwin. Cambridge: Cambridge University Press.
- Darwin, Erasmus. 1999. *Zoonomia, or The Laws of Organic Life*. London: J. Johnson, vol. 1, p. 509. First published 1794; quoted in George B. Dyan. 1999. Darwin in Kansas. *Science* 285: 1355.
- Dawkins, Richard. 1986. *The Blind Watchmaker*. New York: Norton.
- Desmond, Adrian, and James Moore. 1991. *Darwin: The Life of a Tormented Evolutionist*. New York: WW Norton.
- Dillenberger, John. 1973. The Apologetic Defence of Christianity. In *Science and Religious Belief: A Selection of Recent Historical Studies*. Edited by Colin Archibald Russell. Kent: Hodder and Stoughton.
- Dilley, Stephen. 2012. Charles Darwin's use of theology in the Origin of Species. *The British Journal for the History of Science* 45: 29–56. [CrossRef] [PubMed]
- Dilley, Stephen, and Tafacory Nicholas. 2019. Damned if You Do and Damned if You Don't: The Problem of God-talk in Biology Textbooks. *Communications of the Blyth Institute* 1: 37–70. [CrossRef]
- Erwin, Douglas. 2000. Macroevolution is more than repeated rounds of microevolution. *Evolution and Development* 2: 78–84. [CrossRef] [PubMed]
- Futuyma, Douglas. 1983. *Science on Trial*. New York: Pantheon Books.
- Gill, Michael B. 1999. The Religious Rationalism of Benjamin Whichcote. *Journal of the History of Philosophy* 37: 271–300. [CrossRef]
- Gillispie, Charles. 1951. *Genesis and Geology*. Cambridge: Harvard University Press.
- Gillespie, Neal. 1979. *Charles Darwin and the Problem of Creation*. Chicago: Univ Chicago Press.
- Gould, Stephen Jay. 1973. The Reverend Thomas' Dirty Little Planet. In *Ever Since Darwin*. New York: W. W. Norton and Company.
- Gould, Stephen Jay. 1980. The Panda's Thumb. In *The Panda's Thumb*. New York: W. W. Norton and Company.
- Hunter, Cornelius. 2014. Darwin's Principle: The Use of Contrastive Reasoning in the Confirmation of Evolution. *History of the Philosophy of Science* 4: 106–49. [CrossRef]
- Hunter, Cornelius. 2020. On the Influence of Religious Assumptions in Statistical Methods Used in Science. *Religions* 11: 656. [CrossRef]
- Hunter, Cornelius. 2021a. The Role of Non-Adaptive Design Doctrine in Evolutionary Thought. *Religions* 12: 282. [CrossRef]
- Hunter, Cornelius. 2021b. Evolution as a Theological Research Program. *Religions* 12: 694. [CrossRef]
- Jones, Steve. 2000. *Darwin's Ghost*. New York: Random House.
- Kant, Immanuel. 2008. *Allgemeine Naturgeschichte und Theorie Des Himmels [Universal Natural History and Theory of Heaven]*. Translated by Ian Johnston. Arlington: Richer Resources. First published 1755.
- Labin, Amichai M., Shadi K. Safuri, Erez N. Ribak, and Ido Perlman. 2014. Müller cells separate between wavelengths to improve day vision with minimal effect upon night vision. *Nature Communications* 5: 4319. [CrossRef] [PubMed]
- Lents, Nathan. 2015. The Poor Design of the Human Eye. *The Human Evolution Blog*, January 12.
- Lovejoy, Arthur. 1936. *The Great Chain of Being*. Cambridge: Harvard University Press.
- Miller, Kenneth. 1999. *Finding Darwin's God*. New York: Cliff Street Books.
- Murphy, George. 2003. *The Cosmos in the Light of the Cross*. Harrisburg: Trinity Press International.
- Nelson, Paul. 1996. The Role of Theology in Current Evolutionary Reasoning. *Biology and Philosophy* 11: 493–17. [CrossRef]
- Newton, Isaac. 1995. *The Principia*. Translated by Andrew Motte. Amherst: Prometheus Books. First published 1687.
- Nicolson, Marjorie. 1959. *Mountain Gloom and Mountain Glory: The Development of the Aesthetics of the Infinite*. Seattle: University Washington Press.
- Ospovat, Dov. 1981. *The Development of Darwin's Theory: Natural History, Natural Theology, and Natural Selection, 1838–1859*. Cambridge: Cambridge University Press.
- Paley, William. 1809. *Natural Theology: Or, Evidences of the Existence and Attributes of the Deity*, 12th ed. London: J. Faulder.

- Pallen, Mark. 2009. *The Rough Guide to Evolution*. London: Penguin Books.
- Ray, John. 1735. *The Wisdom of God Manifested in the Works of the Creation*, 10th ed. Corrected. London: William Innys and Richard Manby.
- Reiss, John O. 2009. *Not By Design: Retiring Darwin's Watchmaker*. Berkeley: University of California Press.
- Reznick, David, and Ricklefs Robert. 2009. Darwin's bridge between microevolution and macroevolution. *Nature* 457: 837–42. [[CrossRef](#)] [[PubMed](#)]
- Ridley, Mark. 1993. *Evolution*. Boston: Blackwell Scientific.
- Ruse, Michael. 2003. *Darwin and Design: Does Evolution Have a Purpose*. Cambridge: Harvard University Press.
- Saine, Thomas. 1987. Who's Afraid of Christian Wolff? In *Anticipations of the Enlightenment in England, France and Germany*. Edited by Alan Charles Kors and Paul J. Korshin. Philadelphia: University of Pennsylvania Press.
- Sedgwick, Adam. 1850. *A Discourse on the Studies of the University*, 5th ed. London: John W. Parker.
- Sober, Elliott. 2008. *Evidence and Evolution: The Logic Behind the Science*. Cambridge: Cambridge University Press.
- Spurr, John. 1988. 'Rational Religion' in Restoration England. *Journal of the History of Ideas* 49: 563–85. [[CrossRef](#)]
- Stoltzfus, Arlin. 2021. *Mutation, Randomness, and Evolution*. Oxford: Oxford University Press.
- Waters, C. Kenneth. 2009. The arguments in the Origins of Species. In *The Cambridge Companion to Darwin*, 2nd ed. Edited by Jonathan Hodge and Gregory Radick. Cambridge: Cambridge University Press.
- Williams, George C. 1997. *The Pony Fish's Glow: And Other Clues to Plan and Purpose in Nature*. New York: Basic Books.
- Wilson, Andrew Norman. 1999. *God's Funeral*. New York: W. W. Norton and Company.