

The Historical Relationship Between Darwinism and the Biological Design Argument

It is often held that the argument from biological design (ABD) was valid and almost universally accepted before Darwin, that it was the most important rational ground for theism, and that it was invalidated by Darwinism. However, this is wrong. The history of the ABD ran parallel with those of evolutionary theories, with Lamarck having published in 1801 and Paley in 1802. Evolutionary theories and the ABD were alternative responses to empirical evidence that (1) spontaneous generation does not occur, and (2) new species have arisen in geological history. The main reason why evolution was seldom hypothesized before 1796 was probably that materialism was tenable otherwise.



Many parts of the world have witnessed a decline in theistic belief since the nineteenth century. Often this is thought to be associated with science. In particular, an influential school of thought holds that Darwinism has undermined theism by invalidating the argument from biological design (ABD), which is the argument that organisms are so complex (that is, they have “some quality, specifiable in advance, that is highly unlikely to have been acquired by random chance alone”¹) that they must have been designed by a conscious agent, who must be God. There are other forms of the argument from design, applying to the cosmos, for example, but this article is concerned solely with the ABD.

I term the belief that Darwinism has undermined theism the “Dawkins Model” after its most influential current advocate, the evolutionary biologist Richard Dawkins. The main tenets of this model are:

1. Theism and the ABD were almost universally accepted before Darwin.

Almost everybody throughout history, up to the second half of the nineteenth century, has firmly believed in ... the Conscious Designer theory.²

2. Theism was and is accepted primarily because of the ABD (unless for entirely nonrational reasons).

Why do people believe in God? For most people the answer is still some

version of the ancient Argument from Design ... we cannot fail to be struck by the obvious resemblance of living organs to the carefully planned designs of human engineers ... These beautiful, complex, intricate, and obviously purpose-built structures must have had their own designer, their own watchmaker—God.³

The “Argument from [biological] Design” [is] always the most influential of the arguments for the existence of a God.⁴

3. The ABD was valid before Darwin.

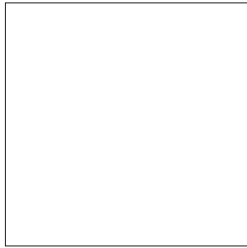
Throughout most of history, it [the ABD] must have seemed utterly convincing, self-evidently true.⁵

4. The ABD was invalidated by Darwin.

And yet, as the result of one of the most astonishing intellectual revolutions in history, we now know that it [the ABD] is wrong, or at least superfluous. We now know that the order and apparent purposefulness of the living world has come about through an entirely different process, a process that works without

Many parts of the world have witnessed a decline in theistic belief since the nineteenth century. Often this is thought to be associated with science.

Richard Thornhill obtained a Ph.D. in biotechnology from Imperial College (London University) in 1994. He has published a number of papers on bacterial phylogenetics and evolutionary theory, although he is personally skeptical about Darwinism. He now works as a scientific translator, as well as carrying out private research into the philosophical and intellectual-historical implications of evolution. He is married with two children and lives in Japan. 4-411 Green Plaza Hibarigaoka-Minami, 1-22 Yato-cho, Nishi-Tokyo-shi, Tokyo 188-0001, Japan, email: r-n-thornhill@aa.bb-east.ne.jp



Even among nonmaterialist beliefs, biological design has not been overwhelmingly accepted outside Judaism and its derivatives. It was often a minority position in Greco-Roman and Indian thought, and always has been unusual in East Asia.

Article

The Historical Relationship Between Darwinism and the Biological Design Argument

the need for any designer and one that is a consequence of basically very simple laws of physics. This is the process of evolution by natural selection.⁶

The aim of this article is to examine the validity of the Dawkins Model. Tenets 1–3 above are discussed in the next three sections. Then the history of evolutionary theories and their relationships with materialism and theism are investigated, covering tenet 4 and related issues.

To help us understand this material, several definitions are required. They are:

Design: The quality pertaining to a structure that is generated in accordance with a conscious plan or concept, and on the basis of conscious volition.

God: An extracosmic conscious agent who is unitary, benevolent toward humans, and chronologically and ontologically ultimate.

Evolution: Biological descent in which intergenerational differences are very much smaller than interspecific ones, except when the direct results of interspecific hybridization.

Lamarckian evolution: Design-free evolution in which the frequency of heritable changes is higher when functionally advantageous.

Darwinian evolution: Non-Lamarckian design-free evolution in which selection is the sole means by which heritable changes are accumulated to form functional structures. This is a wide definition, covering a number of heterodoxies.

Darwinism: The doctrine that all organisms arose from nonliving matter solely by Darwinian evolution.

Paleontological novelty: The doctrine that different fossil-forming species appeared on earth for the first time in different geological eras.

Was the ABD universally accepted before Darwin?

Dawkins states that almost everybody before 1859 firmly believed in the conscious designer as an explanation for the origin of biological structures.⁷ This claim can be broken down into two claims: (1) almost

everyone believed in a conscious designer, and (2) almost everyone believed in a conscious designer because they needed an explanation for biological complexity (i.e., they believed in the conscious designer theory). Let us examine the first claim.

1. Almost Everyone Believed in a Conscious Designer

The statement that there was almost universal belief in biological design before 1859 is transparently false. We never will know how many nonliterate materialists there have been, but literary materialism has arisen at least three times in three areas. They are:

1. *Greece.* Modern Western materialism is derived, via various seventeenth- and eighteenth-century thinkers, from Democritus, Epicurus, and Lucretius.

2. *India.* The Charvakas were one of the three non-Veda-accepting schools in the fifth century BC,⁸ and their thought always has been influential, with the seventh-century philosopher Jayarasi Bhatta having been particularly important.⁹

3. *China.* Hsün Tzu exerted a formative influence on Confucianism.¹⁰ Wang Chung has also had recurrent episodes of popularity.¹¹

Materialism probably seldom has been numerically important. However, even among nonmaterialist beliefs, biological design has not been overwhelmingly accepted outside Judaism and its derivatives. It was often a minority position in Greco-Roman and Indian thought, and always has been unusual in East Asia. Dawkins appears to exclude the Asian civilizations, which is most of the world's population, from his category of "almost everybody."¹²

In conclusion, disbelief in a designer is ancient, common, and widespread. At the very least, therefore, it should be questioned whether the existence of such was always "self-evidently true" before 1859. Now let us examine Dawkins's second claim.

2. Almost Everyone Believed in the Conscious Designer Theory

The ABD has been very far from universally accepted by believers in biological design. Indeed, with a few partial exceptions (see Appendix), the ABD was not formulated until the late seventeenth century. It is noteworthy that it was not formulated by Anselm or

Thomas Aquinas, Maimonides, or ibn Sina, the great intellectual defenders of medieval Catholicism, Judaism, and Islam, respectively.

The first full-blown formulation of the ABD was probably that of the theologian John Wilkins in 1672:

And the failing in any one of these [Members], would cause an irregularity of the Body, and in many of them, such as would be very notorious ... Now to imagine, that all these things, according to their several kinds, could be brought into this regular Frame and Order, to which such an infinite number of Intentions are required, without the Contrivance of some wise Agent, must needs be irrational in the highest degree.¹³

The Puritan minister and natural historian John Ray greatly expanded Wilkins' argument over the next few decades,¹⁴ and the ABD had a certain amount of influence in the early eighteenth century, being accepted by thinkers such as the *philosophe* and *encyclopédiste* Denis Diderot.¹⁵ However, even then it was not very common, and was rarely formulated in detail before its most famous exposition by William Paley in 1802.¹⁶

The historical unimportance of the ABD is exemplified by two eighteenth-century works. In David Hume's *Dialogues Concerning Natural Religion*, a long-winded refutation of the argument from cosmological design, only a single paragraph is concerned with the ABD.¹⁷ In Moreau de Maupertuis' *Essay de cosmologie*, one of the most detailed versions of the argument from cosmological design ever, the ABD is only suggested in order to be rejected.¹⁸

Was the ABD the only rational ground for theism before Darwin?

Philosopher Daniel Dennett, one of Dawkins' strongest intellectual allies, maintains that no rational arguments for theism were presented before the seventeenth century.¹⁹ This is perhaps because he is aware that the ABD was not formulated before that era, and wishes to explain this without acknowledging the fact that it was because it was invalid before then. He suggests, rather vaguely, that the dawn of modern science was responsible for attempts to offer rational arguments for theism. However, this claim is simply false. Alternative arguments for theism formulated before 1600 include the following:

- (a) *The argument from cosmological design.* This was formulated by innumerable thinkers, with Thomas Aquinas' fifth "proof" being the best known example.²⁰
- (b) *Various forms of the first-cause and prime-mover arguments.* These were very popular with thinkers influenced by Aristotle, and the first four "proofs" of Aquinas are the best known examples.²¹

(c) *Anselm's ontological argument.*²²

(d) *Pascal's wager.* This was formulated centuries before Pascal, by the Muslim philosopher Abu Hamid al Ghazali.²³

No suggestion is intended that any of these arguments are valid, but they do show that theism did not exist in a purely nonrational sphere until early modern times.

Was the ABD Valid Before Darwin?

The ABD has two components: (1) the complexity-to-design argument, i.e., the complexity of biological structures is evidence that they were designed; and (2) the design-to-God argument, i.e., their designer must have been God. Let us examine the first component.

Dawkins says that he could not imagine having been an atheist before 1859, and that "Darwin made it possible to be an intellectually fulfilled atheist."²⁴ Yet, there is no evidence that atheists living before 1859 felt themselves unfulfilled. If Darwinism were disproved today, there would be almost no alternative to accepting biological design. However, it is anachronistic to suppose that this was so before Darwin, as the two non-evolutionary, non-design-based explanations for biological complexity below had wide currency.

1. Spontaneous generation

Aristotle taught that many plants and invertebrates, and also some fishes, are generated spontaneously from various organic materials, and also from mud, sand, dew, snow, and fire.²⁵ The Roman poets Lucretius²⁶ and Ovid²⁷ considered this to be stimulated by the rain and sun, whereas Aquinas, in the thirteenth century, thought it due to the influence of the stars.²⁸ Belief in spontaneous generation seems preposterous to the modern mind, and is not supported by the Bible or the Koran, yet it was unquestioned throughout medieval Christendom and Islam. It was also universally accepted in pre-modern China²⁹ and India.³⁰

Many people accepted the spontaneous generation of small quadrupeds, in addition to Aristotle's examples. For example, Ovid³¹ and Augustine³² believed that frogs were so generated; Pliny believed that salamanders were;³³ and in 1600, Jan-Baptista van Helmont, one of the fathers of modern medicine, published a recipe for generating mice. Furthermore, Aristotle left open the possibility of the spontaneous generation of humans and large quadrupeds in the distant past.³⁴ Lucretius accepted this possibility as fact, entirely eliminating the problem of the origin of biological complexity, and maintained that when the earth and ether were young, birds' eggs had been generated spontaneously and wombs containing humans and animals had grown on stalks, with the earth producing milk for the babies after birth.³⁵ This looks very much like a

Article

The Historical Relationship Between Darwinism and the Biological Design Argument

religious belief in Mother Earth, but Lucretius expressly denied that the earth is conscious.³⁶ Thus, his was not a belief in design. Chu Hsi, the great twelfth-century neo-Confucian systematizer, also explained human origins in terms of spontaneous generation.³⁷

John Farley's definition of spontaneous generation as organisms arising "suddenly by chance"³⁸ is misleading, as generation was seen as a nonrandom, inherent property of matter. For example, Aristotle wrote that "all things are full of soul,"³⁹ and the eighteenth-century scientist and philosopher Maupertuis wrote: "One can concede to matter a certain level of intelligence, desire, aversion and memory."⁴⁰ As spontaneous generation was seen as due to vital forces rather than chance, modern creationists' identification of spontaneous generation with the Darwinian origin-of-life hypotheses is mistaken.

The first time spontaneous generation was tested empirically was in 1668, by Francesco Redi. It was shown that maggots are not generated spontaneously by rotting meat. However, it was only finally refuted with respect to microorganisms in 1861 by Louis Pasteur.⁴¹

After 1668, Marcello Malpighi and other scientists extended Redi's refutation to various other insects and plants,⁴² and the spontaneous generation of all organisms was increasingly rejected by the educated.⁴³ It was at this time that Wilkins formulated the first full-blown formulation of the ABD (see p. 251). Ray, the expositor of Wilkins' argument, knew that the spontaneous generation of insects had been refuted,⁴⁴ and it is illuminating to see the increase in the forcefulness of his argument between 1691 and his death in 1705, as the non-occurrence of spontaneous generation became generally accepted. This acceptance resulted in a great deal of space being given to this theme in the posthumous seventh edition of his *Wisdom of God*.⁴⁵ Ray went much further than Redi and Malpighi, arguing that no plants or microorganisms are spontaneously generated.⁴⁶ The centrality of this to his argument cannot be overemphasized:

For if this Point be but cleared, and it be demonstrated that all Creatures are generated univocally by Parents of their own Kind, and that there is no such

thing as Spontaneous Generation in the World, one main Prop and Support of Atheism is taken away, and their strongest Hold demolished: they cannot then exemplify their foolish Hypothesis of the Generation of Man and other Animals at first, by the Like of Frogs and Insects at this present Day.⁴⁷

However, in the 1740s, the spontaneous generation hypothesis regained popularity, as a result of its vigorous sponsorship by the Count of Buffon, France's most influential scientist.⁴⁸ This popularity culminated in the hypothesis being experimentally "proven" with respect to microorganisms by John Needham in 1748. The spontaneous generation of microorganisms was considered an established fact until well into the nineteenth century. Furthermore, in the 1760s, renewed attention was given to the possible spontaneous generation of macroorganisms,⁴⁹ only for this to be firmly rejected again in the late eighteenth century.

2. Infinite age

Stephen J. Gould maintains that "deep time" was one of history's three most important scientific discoveries.⁵⁰ As Augustine pointed out, however, time's finitude is more crucial than its immensity, and the nonrecognition of this by Westerners is a cultural artefact due to the recent rejection of Genesis.⁵¹ The infinite age of the earth was taught by Aristotle.⁵² Furthermore, even the medieval theologians Boethius⁵³ and Aquinas⁵⁴ defended its logical possibility, rejecting it solely on the basis of revelation. Thus, it was always possible for design disbelievers to argue that life or species always had existed.

Fossil evidence for the earth's great age was recognized by Xenophanes⁵⁵ and arguably several other Greeks, widely accepted in China⁵⁶ and the Islamic world,⁵⁷ and debated during the Italian Renaissance.⁵⁸ However, until the eighteenth century, the empirical evidence was very limited. In 1795, James Hutton was the first modern European to popularize an empirically-based belief in great age.⁵⁹ Hutton actually believed in great but finite age, but his observations, necessitating rejection of a literal understanding of Genesis, offered support for the almost forgotten possibility of infinite age. Hume — perhaps after talking to Hutton, his fellow Edinburgh intellectual — used the fos-

As spontaneous generation was seen as due to vital forces rather than chance, modern creationists' identification of spontaneous generation with the Darwinian origin-of-life hypotheses is mistaken.

sil evidence of repeated inundations as far as the mountaintops to defend the possible infinite age of the earth, as it meant that civilizations, and even species (over parts of their ranges), could have been repeatedly wiped out.⁶⁰ Hume's celebrated argument that extrapolation from order to design is no more valid than from order to animal-like or plant-like reproductive processes seems overrated,⁶¹ as it is little more than an extension of his defense of the possibility of the infinite age of the universe.⁶²

To summarize, the dawn of modern geology offered support for a nondesign-based explanation that had lain dormant for centuries. However, the further development of science gradually ruled out this explanation. This involved the elimination of two separate possibilities:

1. *Infinite age of all species.* Hutton argued for paleontological non-novelty. However, during the following decades, it became clear that many fossil species are no longer extant in their present ranges. Furthermore, as a result of global exploration, it became increasingly unlikely that they were present in unexplored areas. Most early nineteenth-century geologists, therefore, accepted paleontological novelty, regardless of whether they explained it in terms of evolution or progressive extinction and re-creation. However, Charles Lyell, the "father of modern geology," rejected this doctrine from 1830 until 1853,⁶³ and did not finally accept it until 1862.⁶⁴

2. *Infinite age of simple organisms.* The infinite age of life on earth is ruled out by theories of planetogenesis, which were formulated in the eighteenth century by Buffon and Laplace, among others, and were increasingly accepted in the nineteenth century. After acceptance of planetogenesis, it remained possible to argue that life is infinitely old and arrived on earth from elsewhere in the universe. This was put forward several times in the late nineteenth and early twentieth centuries, most persuasively by Svante Arrhenius,⁶⁵ but was rarely given serious consideration. The arrival of life from space was most recently defended by the maverick physicists Fred Hoyle and Chandra Wickramasinghe.⁶⁶ However, the possibility of infinite age now has been eliminated by the almost universal acceptance of the Big Bang theory.

The above discussion only takes into account empirical evidence. There have been attempts to prove the finite age of the universe on abstract grounds. Such attempts were popular in the seventeenth century, and Ray believed infinite age to be philosophically untenable,⁶⁷ which was no doubt one reason why he felt free to formulate an ABD. However, he was not entirely honest in according John Tillotson's⁶⁸ and Wilkins'⁶⁹ arguments the status of proof, when these theologians themselves saw them only as demonstrations of probability. Furthermore, these arguments were given little credence at earlier and later dates.

One may object that pre-modern philosophers did formulate the arguments from first cause and cosmological design, both of which depend on the assumption of finite age, so the possibility of infinite age cannot have been one of the reasons they did not formulate the ABD. However, before Jean d'Alembert in the 1750s, it was assumed that God has to hold the planets in position. The argument from cosmological design was, therefore, more accurately the argument from cosmological order, with a ruler needed to prevent the universe from falling into chaos. Furthermore, Aquinas, in his first three "proofs,"⁷⁰ did not distinguish fully between chronological and ontological arguments, and saw the first cause as being both before all other causes and outside the chronological series,⁷¹ as did Aristotle.⁷²

For most of history, a theory of evolution was not required for rejection of biological design, except among those people in the late seventeenth and early eighteenth centuries who accepted the philosophical disproof of infinite age.

In response to the previous paragraph, one could object that some thinkers have referred to God to explain not only the origin of organisms but their continuing existence and action, and, therefore, would have been free to formulate an argument from biological order, analogous to the pre-Alembertian argument from cosmological order, and that, in this case, the possibility of infinite age cannot have been one of the reasons they did not formulate such an argument. Ray exemplified such thinkers,⁷³ although it was not God but a subordinate "intelligent plastic Nature" to which he referred.⁷⁴ However, Ray's ideas were not simply archaic but were an aspect of the thought of the Cambridge Platonists, especially Ralph Cudworth,⁷⁵ with its fashion for the late-classical neo-Platonists Plotinus and Porphyry, and its rejection of both Cartesianism and Aristotelianism. The possibility of formulating an argument from biological order did not exist, therefore, before the mid-seventeenth century.

Thus, even leaving aside the possibility of spontaneous generation, for most of history, a theory of evolution was not required for the rejection of biological design, except among those people in the late seventeenth and early eighteenth centuries who accepted the philosophical disproof of infinite age.

Let us now examine the second component of the ABD argument: the design-to-God argument. It is very weak.

Article

The Historical Relationship Between Darwinism and the Biological Design Argument

In 1748, Needham's "proof" of spontaneous generation inhibited the further development of proto-Darwinian ideas by reclaiming for intellectual respectability the possibility that the spontaneous generation of macro-organisms could occur under certain conditions, and thus making it easier to disbelieve in biological design without recourse to proto-Darwinism.

Were one to accept biological design, there would still be no compelling reason to suppose the designer(s) to be God, as he/she/they could be non-unitary or unconcerned about or malevolent toward humans. Furthermore, he/she/they could be non-ultimate, being contingent, within his/her/their ontologically higher existence, upon yet ontologically higher being(s), which in turn could be either conscious or unconscious. There would not even be any reason to suppose a finite upper limit to the ontological ladder. Hume made these points with respect to the nature of the designer(s)⁷⁶ and the possibility of an infinite ontological regress.⁷⁷ He was far from original in this, however, as the Manichees believed the earth to have been designed by a malevolent agent in rebellion against God, and classical Zoroastrians believed it to have had two designers, one malevolent and one benevolent.

Acceptance of the complexity-to-design argument thus does not necessitate acceptance of theism, and neither does it necessitate rejection of materialism, as the designer(s) could have been intracosmic. In the most recent sophisticated formulation of the ABD, Michael Behe admits that the designer(s) could have been extraterrestrials or time-travelers.⁷⁸ Furthermore, Dennett says that materialists could accept intervention by extraterrestrials, were there demonstrated to be a case of biological complexity which is inaccessible by Darwinian evolution.⁷⁹

History of Evolutionary Theories

Before 1668

The widespread belief that theories of evolution were current in Greco-Roman times is not entirely true. Lucretius' scheme was one of spontaneous generation, and did not involve the transmutation of species.⁸⁰ Empedocles envisaged body parts wandering about separately until they joined to form whole animals and humans.⁸¹ Aristotle briefly considered but rejected (for unclear reasons) a proto-Darwinian hypothesis:

Whenever then all the parts came about just what they would have been if they had come to be for an end, such things survived, being organized spontaneously in a fitting way; whereas those which grew otherwise perished and continue to perish.⁸²

Anaximander taught that the first humans were "born from animals of another species" and were "like another animal, namely a fish."⁸³ However, his other ideas, about humans arising inside fishes, and animals originally having had a prickly bark, sound less like evolution.

Modern commentators, both Chinese and Western, tend to read evolutionary ideas into Taoist thought, especially the *Chuang Tzu*.⁸⁴ However, rather than evolution, this describes spontaneous generation,⁸⁵ and some Ovidian transformations, such as fish turning into birds⁸⁶ and insects giving birth to horses, which then give birth to humans.⁸⁷

1668 to 1861

After 1691, the increasingly widespread acceptance that spontaneous generation does not occur bolstered Ray's complexity-to-design argument, and he therefore started to give serious (hostile) consideration to the alternative possibility: a proto-Darwinism hypothesis based on the ideas of Aristotle.⁸⁸ This supports the suggestion that it was the availability of nondesign-based alternatives that previously had rendered unnecessary the energetic defense of proto-Darwinian hypotheses. Ray referred to proto-Darwinist ideas as the "Atheists usual Flam," suggesting their, at least, moderate popularity.⁸⁹

In the eighteenth century, Diderot, Maupertuis, and La Mettrie toyed with more sophisticated proto-Darwinian ideas.⁹⁰ These were little more than musings, but one wonders whether Darwinism would have been accepted more than a century earlier if spontaneous generation had remained out of favor. It should be noted that Maupertuis' "*Mécanique aveugle*"⁹¹ pre-dated Dawkins' *Blind Watchmaker* by 241 years.

In 1748, Needham's "proof" of spontaneous generation inhibited the further development of proto-Darwinian ideas by reclaiming for intellectual respectability the possibility that the spontaneous generation of macro-organisms could occur under certain conditions, thus making it easier to disbelieve in biological design without recourse to proto-Darwinism. It is essential to note that Needham's "proof" also inhibited the development of the ABD, as is illustrated by the case of Diderot. Before Needham, Diderot accepted the ABD, and

made it clear that it hinged on the refutation of spontaneous generation:

The great blows that atheism has received have not been at the hand of the metaphysician. The sublime meditations of Malebranche and Descartes were less appropriate for the weakening of materialism than a single observation by Malpighi.⁹²

However, in his *Rêve de d'Alembert*, written in the 1760s (although published much later), he espoused materialism.⁹³ There were proto-evolutionary strains in his thought, and one tends to assume that his deism-to-materialism trajectory was connected with an increasing acceptance of evolution.⁹⁴ This is anachronistic, however, and his post-Needham acceptance of spontaneous generation was probably responsible for both his conversion to materialism and his failure to develop his nascent Darwinism.⁹⁵

At the end of the eighteenth century, ... biological origins once again started to present difficulties for design disbelievers.

At the end of the eighteenth century, spontaneous generation's post-Needham Indian summer drew to a close, and biological origins once again started to present difficulties for design disbelievers. This led to an era of popularity for the ABD, typified by the writings of Paley,⁹⁶ and, at the same time, to the formulation of the first detailed theories of design-free evolution by Erasmus Darwin⁹⁷ and Jean-Baptiste de Lamarck.⁹⁸ The theories of Lamarck and Erasmus Darwin were genuinely novel, being based on the principle that organisms struggle to improve. This struggle was not necessarily conscious, and the belief that Lamarck's theory was nonmaterialist⁹⁹ is a misunderstanding due to the translation of *besoin* as "want," which meant "need" or "lack" in 1801 but had shifted to its modern meaning by 1859.¹⁰⁰

Lamarck and Erasmus Darwin believed that microorganisms are generated spontaneously whereas macroorganisms are not.¹⁰¹ This ruled out non-evolutionary nondesign-based origins for higher organisms, and therefore made evolution necessary for rejection of biological design (leaving aside the possibility of infinite age). It also made Lamarckian evolution possible, by providing the initial organisms (no Lamarckian mechanism for the origin of microorganisms has ever been suggested). Lamarck was clear about this motivation, stating that it had recently been shown that only the simplest organisms are spontaneously generated, but that design-free evolution is a form of indirect spontaneous generation.¹⁰²

During the early nineteenth century, there was growing skepticism about the spontaneous generation of microorganisms, presenting design-disbelievers with increasing difficulties. Lamarckian evolution was widely accepted during this era, but it provided no succor, as it required simple initial organisms (the possibility of arrival from space was largely ignored).¹⁰³ Therefore, in formulating his theory, Charles Darwin turned back to the older Empedoclean-Aristotelian tradition.¹⁰⁴ His ideas, published just before Pasteur applied the *coup de grace* to spontaneous generation, led to his suggestion that microorganisms arose by chance rather than spontaneous generation.¹⁰⁵

The discovery of paleontological novelty probably had a much less important role in the development of evolutionary hypotheses, as few atheists defended their beliefs on the grounds of the infinite age of species, preferring spontaneous generation. This was perhaps a simple failure of imagination, as exemplified by Paley's dismissal, without explanation, of the possibility that a watch on a heath may have always lain there.¹⁰⁶ However, the 1830s to 1860s, when Lyell was clinging stubbornly to his belief in paleontological non-novelty, were also the decades when the final rejection of spontaneous generation was underway. One therefore may argue that it was the acceptance of paleontological novelty that prevented design-disbelievers using infinite age as a last-resort explanation, and thus led to their acceptance of evolution.

Since 1861

After Pasteur, explanations for the origin of simple organisms were limited to design, Darwinism, and arrival from space, with the last being largely disregarded.

The insufficiency of purely Lamarckian evolution as an explanation for higher organisms meant that Occam's razor favored the acceptance of Darwinism. In addition, Lamarckian evolution was largely refuted experimentally in the early twentieth century, and Dawkins rejects it, probably validly, on purely theoretical grounds.¹⁰⁷ "Lamarckism" has recently been defended on the grounds of interspecific gene transfer, the endosymbiotic origins of chloroplasts and mitochondria, and various forms of nongenetic and epinucleic inheritance.¹⁰⁸ However, this is due to an imprecise definition. The expansion of the concept of germ-line to include nongenetic inheritance, and extra- and epinuclear genetic inheritance, brings these phenomena fully within the Darwinian fold.¹⁰⁹

Finally, acceptance of the Big Bang has ruled out the possibility of the infinite age of microorganisms.

Conclusions

The Dawkins Model is utterly false, as (1) theism was widely rejected before Darwin, (2) several arguments for

Article

The Historical Relationship Between Darwinism and the Biological Design Argument

theism other than the ABD were in widespread use before Darwin, (3) the ABD was almost never used before the late seventeenth century, and had little influence before Paley, (4) two nondesign-based non-evolutionary explanations for biological complexity were available until the mid-nineteenth century, and (5) even if it were accepted that organisms must have been designed, this would not offer a convincing case for theism. The ABD and evolutionary theories have parallel histories, and were alternative responses to the same sets of new data. Both became important in the 1790s, when geological, paleontological, and microbiological evidence started to increase both the plausibility of the ABD and design disbelievers' logical requirement for the evolutionary theories. The logical necessity for design-disbelievers to believe in Darwinism continued to increase, and had become almost absolute by the 1860s. This is very different from the textbook picture, according to which the ABD was accepted throughout history, with evolution often being suggested but making little headway, until Darwin proposed a workable mechanism, after which evolution was rapidly accepted, resulting in a decline in theistic belief.

The primary significance of this conclusion is its weakening of materialist propaganda. The Dawkins Model is widely assumed in such propaganda, because science has more popular prestige than philosophy, so most people are more liable to be convinced by an argument based on science, and because it enables materialism to be characterized as *modern*, so opponents can be dismissed as reactionaries.

The second significance depends on one's metaphysical position. For convinced materialists, the recognition that evolution is a philosophical red-herring (regardless of whether it is true), and that materialism must be defended on other grounds, should encourage skepticism about Darwinism-derived extra-scientific positions. The importance of this should not be underrated. Social Darwinism is very much alive and slithering, as shown by the popularity of *The Bell Curve*.¹¹⁰ However, even apart from wickedness of that ilk, the political-cultural agendas of many prominent Darwinists are profoundly illiberal, being hostile to all non-science-based decision making, and are,

indeed, oddly analogous to those of the Religious Right.

For everyone else, the above conclusion should encourage a reassessment of the truth of Darwinism. The scientific claims of biblical (or Koranic, etc.) literalists are treated with extreme skepticism, not primarily because of the weakness of their supporting evidence, but because they are derived from metaphysical assumptions. Twenty-first-century materialists are sometimes criticized as being in an analogous situation, as they have little choice but to explain biological complexity in Darwinian terms. However, this criticism involves the confusion of grounds and consequents, as materialism may be derived—although perhaps not validly—from Darwinism, rather than *vice versa*. This article suggests that Darwinism was an effect rather than a cause of materialism. An effect is not the same as a consequent, and Darwinism therefore should not be regarded as directly analogous to literalist creationism. However, if it could be shown that the only ground for Darwinism is as an alternative to design, it would be legitimate to regard it as directly analogous.

Appendix: Pre-1668 history of the ABD

That the ABD was sometimes formulated before 1668 is a weakness of this thesis. Pre-1668 formulations are therefore examined here. Further investigation is needed to show whether these genuinely militate against this thesis.

Aristotle and Galen formulated arguments resembling the ABD, but it is not certain whether they envisaged a conscious designer. Aristotle frequently made statements about the motives of "nature" (*physis*), such as that it "makes nothing in vain,"¹¹¹ but it is not clear whether this should be regarded as other than a figure of speech. Although Aristotle seems to have held quasi-theistic beliefs,¹¹² the idea that his biological teleology referred to the aims of the designer is now generally rejected.¹¹³ Galen, on the other hand, kept switching between "nature" and "the creator" (*demiourgos*), with no apparent change in thinking, and it therefore appears that the latter was merely a figure of speech.¹¹⁴ He was explicit in his

The ABD and evolutionary theories have parallel histories, and were alternative responses to the same sets of new data. Both became important in the 1790s, when geological, paleontological, and microbiological evidence started to increase both the plausibility of the ABD and design disbelievers' logical requirement for the evolutionary theories.

rejection of the Judaic beliefs in miracles and creation *ex nihilo*.¹¹⁵ Design is, in any case, the less central of his two theses, the other being a defense of Aristotle's teaching that all parts of the body are optimal,¹¹⁶ in opposition to Plato's belief in their imperfection.¹¹⁷ The question whether biological structures are optimal is independent of that of whether they are designed.

The arguments of the Stoics are more clearly arguments from design, although the designer was probably envisaged as the consciousness of the universe, rather than God. A brief such argument is that of Epictetus.¹¹⁸ A second is that of Balbus, in Cicero's *De Natura Deorum*. Balbus described beautifully how awe at the living world leads one to appreciate the consciousness of the universe,¹¹⁹ and at points, his description amounts almost to an argument from biological complexity. It is possible (although admittedly improbable) that Cicero was skeptical about spontaneous generation, as he did not mention it, despite being familiar with Aristotle's biological writings.¹²⁰ Furthermore, he wrote that "trees and all such things" reproduce by seeds, all animals reproduce sexually, and fishes produce eggs.¹²¹

The most unambiguous pre-Christian formulation of the ABD was that of Socrates, as he clearly contrasted design with chance.¹²² However, it is not certain that Socrates had considered the possibility of infinite age, because it is often stated that Aristotle was the first Greek to teach this doctrine. Furthermore, although one tends to assume that Aristotle took his ideas about spontaneous generation from universally accepted folk-belief, one factor suggesting that this might not be the case is that Homer seems not to have believed in it.¹²³ If these suggestions are correct, Socrates, at the beginning of Western intellectual history would have been, oddly, in the same situation with respect to design as we have been since the 1860s.

Probably the only Christian (or Jew or Muslim) before 1668 to formulate the ABD was Henry More, in 1653.¹²⁴ His argument was largely based on the utility of plants and animals to humans, rather than their complexity, but the latter type of argument does appear, and he made it clear that he was arguing against organisms arising by chance, commenting that it is no more likely that they could arise without God than that Greek inscriptions could do so. More believed in spontaneous generation, even considering Lucretius' bizarre stalked-womb ideas to be credible, but he was clearly troubled by this possibility, and argued that it must have been providential for both males and females to have been generated while the earth was fecund.¹²⁵ His argument is difficult to follow, but he was a Cambridge Platonist, holding that the continued operation of organisms requires conscious intervention¹²⁶ (see p. 253). Therefore, his argument may perhaps be looked upon as an argument from biological order rather than design. Furthermore, the possibility of infinite age was widely rejected in the late seventeenth century. ★

Notes

- ¹Richard Dawkins, *The Blind Watchmaker*, 2d ed. (London: Penguin, 1991), 9.
- ²*Ibid.*, 3-4.
- ³—, "The Improbability of God," *Free Inquiry* 18, no. 3 (1998): 6-9.
- ⁴—, *The Blind Watchmaker*, 4.
- ⁵—, "The Improbability of God."
- ⁶*Ibid.*
- ⁷—, *The Blind Watchmaker*.
- ⁸Debiprasad Chattopadhyaya, *Lokayata: A Study in Ancient Indian Materialism*, 4th ed. (Delhi: People's Publishing House, 1978).
- ⁹K. N. Jayatilleke, *Early Buddhist Theory of Knowledge* (London: George Allen and Unwin, 1963), 69-107.
- ¹⁰Hsün Tzu, *The Works of Hsüntze*, trans. and ed. Homer H. Dubs (London: Probsthain, 1928), chap. XVII.
- ¹¹Wang Chung, *Lun-Heng*, trans. and ed. Alfred Forke (New York: Paragon, 1962).
- ¹²Dawkins, *The Blind Watchmaker*.
- ¹³John Wilkins, *Of the Principles and Duties of Natural Religion*, ed. John Tillotson (London: J. Walthoe and Co., 1734), I:VI.
- ¹⁴John Ray, *The Wisdom of God Manifested in the Works of Creation* (New York: Garland, 1979); —, *The Wisdom of God Manifested in the Works of Creation*, 7th ed. (on website of John Ray Initiative, Bucks., UK, http://www.jri.org.uk/wisdom/wisd_fr.htm).
- ¹⁵Denis Diderot, *Pensées philosophiques* (1746), 1-49, in *Diderot: Oeuvres philosophiques*, ed. Paul Vernière (Paris: Garnier Frères, 1964), chap. XVIII.
- ¹⁶William Paley, *Natural Theology, or Evidences of the Existence and Attributes of the Deity Collected from the Appearances of Nature* (1802), excerpted chaps. I-III, V-VI, XXIII-XXVII in *Natural Theology: Selections*, ed. Frederick Ferré (Indianapolis: Bobbs-Merrill, 1963).
- ¹⁷David Hume, *Dialogues Concerning Natural Religion*, 2d ed. (London, 1779), 227-9.
- ¹⁸P. L. Moreau de Maupertuis, *Essay de cosmologie* (1750), 3-54 in *Les oeuvres de Mr. de Maupertuis* (Dresde: George Conrad Walther, 1752), 6-9.
- ¹⁹Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon and Schuster, 1995), 28.
- ²⁰Thomas Aquinas, *Summa Theologica*, trans. Fathers of the English Dominican Province (1273), in *Great Books of the Western World*, vols. 19-20, ed. Robert M. Hutchins (Chicago: William Benton, 1952), I:II:3.
- ²¹*Ibid.*
- ²²Anselm, *Proslogion* in *L'oeuvre de S. Anselme de Cantorbery*, vol. 1, ed. and trans. Michel Corbin (Paris: Cerf, 1986), chap. III.
- ²³A. Hamid M. al Ghazali, *The Alchemy of Happiness*, trans. Claud Field (on website of Canadian Society of Muslims, <http://muslim-canada.org/sufi/ghacontents.html>, 2001), chap. IV.
- ²⁴Dawkins, *The Blind Watchmaker*, 5-6.
- ²⁵Aristotle, *History of Animals*, trans. D'Arcy W. Thompson, in *Great Books of the Western World*, vol. 9, V:1, 15-6, 19, 31-2; VI:15; and —, *On the Generation of Animals*, trans. Arthur Platt, in *Great Books of the Western World*, vol. 9, I:1, 16; II:1; III:9-11.
- ²⁶T. Lucretius Carus, *De Rerum Natura* (Cambridge, MA: Harvard University Press, 1997), 5:797-8.
- ²⁷P. Ovidius Naso, *Metamorphoses* in *Ovid*, vols. III-IV (Cambridge, MA: Harvard University Press, 1994), I:416-37.
- ²⁸Aquinas, *Summa Theologica*, I:LXXI-LXXII.
- ²⁹Joseph Needham, *Science and Civilisation in China*, vol. 2 (Cambridge: Cambridge University Press, 1956), 78-9, 421-2, 481, 487.
- ³⁰*Vajracchedika Prajnaparamita Sutra* in *The Diamond that Cuts Through Illusion: Commentaries on the Prajnaparamita Diamond Sutra*, ed. & trans. Thich Nhat Hanh, (Berkeley, CA: Parallax Press, 1992), chap. 3; and *Akaranga Sutra*, trans. Hermann Jacobi, in *Sacred Books of the East*, vol. 22, ed. F. Max Müller (Delhi: Motilal Banarsidass, 1968), 1:6.
- ³¹Ovidius, *Metamorphoses*, XV:375-8.
- ³²Aurelius Augustinus, *De Civitate Dei Contra Paganos*, trans. George E. McCracken, et al. (London: William Heinemann, 1965), XVI:VII.

Article

The Historical Relationship Between Darwinism and the Biological Design Argument

- ³³Plinius Secundus, G., *Naturalis historia*, trans. H. Rackham (Cambridge, MA: Harvard University Press, 1950–1953), X:LXXXVI.
- ³⁴Aristotle, *On the Generation of Animals*, III:11.
- ³⁵Lucretius, *De Rerum Natura*, 5:783–836.
- ³⁶*Ibid.*, 2:652–60.
- ³⁷Chu Hsi, *Chu Hsi Wen Shu*, excerpts from 46:26, 58:5 in *Shu Shi Kenkyu*, Kazutsugu Akizuki (Tokyo: Kyobunsha, 1927), 245–6.
- ³⁸John Farley, *The Spontaneous Generation Controversy from Descartes to Oparin* (Baltimore, MD: Johns Hopkins University Press, 1977), 1.
- ³⁹Aristotle, *On the Generation of Animals*, III:11.
- ⁴⁰Maupertuis, *Système de la nature* (1751), 135–184, in P. L. Moreau de Maupertuis: *Oeuvres*, vol. II (Hildesheim, Germany: Georg Olms, 1965), XXVIII, my translation.
- ⁴¹Louis Pasteur, “Mémoire sur les corpuscules organisés qui existent dans l’atmosphère,” in *Oeuvres de Pasteur*, vol. II, ed. Pasteur Vallery-Radot (Paris: M. M. Masson, 1922).
- ⁴²Marcello Malpighi, *Anatomie Plantarum*, part II (Brussels: Culture et Civilisation, 1968), 22–50.
- ⁴³Farley, *The Spontaneous Generation Controversy from Descartes to Oparin*, 8–30.
- ⁴⁴Ray, *The Wisdom of God*, 1st ed. (1691), 221–3.
- ⁴⁵Ray, *The Wisdom of God*, 7th ed. (1717), 123–5, 298–326.
- ⁴⁶*Ibid.*, 320.
- ⁴⁷*Ibid.*, 322.
- ⁴⁸Jean Piveteau, Commentary in *Corpus Général des Philosophes Français* XLI (Paris: Presses Universitaires de France, 1954), 1:XXII–XXIII.
- ⁴⁹Diderot, *Le rêve de d’Alembert* (1830), 285–371 in *Diderot: Oeuvres philosophiques*, ed. Paul Vernière (Paris: Garnier Frères, 1964), 299–303.
- ⁵⁰Stephen J. Gould, *Time’s Arrow, Time’s Cycle* (London: Penguin, 1988), 1–3.
- ⁵¹Augustinus, *De Civitate Dei Contra Paganos*, XII:12.
- ⁵²Aristotle, *Meteorology*, trans. E. W. Webster, in *Great Books of the Western World*, vol. 8, I:4; —, *On the Heavens*, trans. J. L. Stocks, in *Great Books of the Western World* 8, I:3, 9–12; and —, *Physics*, trans. R. P. Hardie and R. K. Gaye, in *Great Books of the Western World* 8, VIII:1–2.
- ⁵³A. M. Severinus Boethius, *The Consolation of Philosophy*, trans. H. F. Stewart, in *Boethius* (London: William Heinemann, 1962), V:VI:31–40.
- ⁵⁴Aquinas, *On the Eternity of the World*, trans. Robert T. Miller in *Internet Medieval Sourcebook*, New York: Fordham University, www.fordham.edu/halsall/basis/aquinas-eternity.html, 1997; and —, *Summa Theologica*, I:XLVI:2.
- ⁵⁵Hippolytus, *The Refutation of All Heresies*, trans. J. H. MacMahon, in *The Ante-Nicene Fathers*, vol. V, ed. Alexander Roberts and James Donaldson (Grand Rapids, MI: W. B. Eerdmans, 1956), I:XII.
- ⁵⁶Needham, *Science and Civilisation in China*, vol. 3 (Cambridge: Cambridge University Press, 1959), 611–23.
- ⁵⁷Seyyed H. Nasr, *Islamic Science: An Illustrated Study* (London: World of Islam Festival Publishing, 1976), 52.
- ⁵⁸Stephen J. Gould, “Deconstructing the ‘Science Wars’ by Reconstructing an Old Mold,” *Science* 287 (2000): 253–61.
- ⁵⁹James Hutton, *Theory of the Earth with Proofs and Illustrations* (Weinheim, Germany: J. Cramer, 1960).
- ⁶⁰Hume, *Dialogues Concerning Natural Religion*, 123–4.
- ⁶¹*Ibid.*, 115–43.
- ⁶²*Ibid.*, 120–3.
- ⁶³Charles Lyell, *Principles of Geology*, vol. I (Lehre, Germany: J. Cramer, 1970), 145–56; and —, “Anniversary Address of the President,” *Quarterly Journal of the Geological Society of London* 7 (1851): xxv–lxxvi.
- ⁶⁴ —, *Principles of Geology*, vol. 1, 11th ed. (London: John Murray, 1872), 143–71; and Gould, *Time’s Arrow, Time’s Cycle*, 167–73.
- ⁶⁵Svante Arrhenius, *Worlds in the Making: The Evolution of the Universe*, trans. H. Borns (New York: Harper and Row, 1908).
- ⁶⁶Fred Hoyle and Chandra Wickramasinghe, *Lifecloud: The Origin of Life in the Universe* (New York: Harper and Row, 1978).
- ⁶⁷Ray, *The Wisdom of God*, 1st ed., 13.
- ⁶⁸John Tillotson, *The Wisdom of Being Religious*, in *Three Restoration Divines: Barrow, South, Tillotson*, II:ii, ed. Irène Simon (Paris: Société d’Éditions “Les Belles Lettres,” 1976), 375–84.
- ⁶⁹John Wilkins, *Of the Principles and Duties of Natural Religion*, I:V.
- ⁷⁰Aquinas, *Summa Theologica*, I:II:3.
- ⁷¹Étienne Gilson, *Le Thomisme*, 6th ed. (Paris: Librairie Philosophique J. Vrin, 1986), 74.
- ⁷²Aristotle, *Physics*, VII:1.
- ⁷³Ray, *The Wisdom of God*, 1st ed., 20–37, 59–60, 74–6.
- ⁷⁴*Ibid.*, 74.
- ⁷⁵Ralph Cudworth, *The True Intellectual System of the Universe* (New York: Garland, 1978), 146–72, 672–90.
- ⁷⁶Hume, *Dialogues Concerning Natural Religion*, 104–12.
- ⁷⁷*Ibid.*, 93–4.
- ⁷⁸Michael J. Behe, *Darwin’s Black Box: The Biochemical Challenge to Evolution* (New York: Free Press, 1996), 248–9.
- ⁷⁹Dennett, *Darwin’s Dangerous Idea*, 318–19.
- ⁸⁰Lucretius, *De Rerum Natura*, 5:783–836.
- ⁸¹Empedocles, (fragments, arranged by Hermann Diels, trans. John Burnet), in *Early Greek Philosophy*, 4th ed., John Burnet (London: Adam and Charles Black, 1948), 204–26, fragment 57–62.
- ⁸²Aristotle, *Physics*, II:8.
- ⁸³John Burnet, *Early Greek Philosophy*, 4th ed. (London: Adam and Charles Black, 1948), 70–1.
- ⁸⁴Needham, *Science and Civilisation in China*, vol. 2, 78–83, 485–9.
- ⁸⁵Chuang Tzu, *Chuang Tzu*, in *Shinshaku Kanbun Taikei*, vols. 7–8, ed. Tetsuo Endo and Yasushi Ichikawa (Tokyo: Meiji Shoin, 1966), chap. XVIII.
- ⁸⁶*Ibid.*, chap. I.
- ⁸⁷*Ibid.*, chap. XVIII.
- ⁸⁸Ray, *The Wisdom of God Manifested in the Works of Creation*, 7th ed., 158, 337–8, 357–65.
- ⁸⁹*Ibid.*, 158.
- ⁹⁰Diderot, *Lettre sur les aveugles, à l’usage de ceux qui voient* (1749), 75–146 in *Diderot: Oeuvres philosophiques*, ed. Paul Vernière (Paris: Garnier Frères, 1964), 121–2; Maupertuis, *Essay de cosmologie*, 7–8; and Julian O. de La Mettrie, *Système d’Épicure*, 253–96 in *Oeuvres philosophiques de Mr. de La Mettrie* (Berlin, 1775), XIII–XIV.
- ⁹¹Maupertuis, *Essay de cosmologie*, 8.
- ⁹²Diderot, *Pensées philosophiques*, XVIII–XX; and *Ibid.*, XVIII, my translation.
- ⁹³ —, *Le rêve de d’Alembert*.
- ⁹⁴ —, *Lettre sur les aveugles*, 121–2; —, *De l’interprétation de la nature* (1753), 177–244 in *Diderot: Oeuvres philosophiques*, ed. Paul Vernière (Paris: Garnier Frères, 1964), XII; and —, *Le rêve de d’Alembert*, 308, 326.
- ⁹⁵*Ibid.*, 299–303.
- ⁹⁶William Paley, *Natural Theology, or Evidences of the Existence and Attributes of the Deity Collected from the Appearances of Nature* (1802), excerpted chaps. I–III, V–VI, XXIII–XXVII in *Natural Theology: Selections*, ed. Frederick Ferré (Indianapolis: Bobbs-Merrill, 1963).
- ⁹⁷Erasmus Darwin, *Zoonomia* (1796), II:233–45 excerpted in *The Essential Writings of Erasmus Darwin*, Desmond King-Hele (London: MacGibbon and Kee, 1968), 83–9; and —, *The Temple of Nature* (1803), in *The Poetical Works of Erasmus Darwin*, vol. III (Tokyo: Hon-no-Tomosha, 1997).
- ⁹⁸Jean-Baptiste de Lamarck, *Système des animaux sans vertèbres* (Brussels: Culture et Civilisation, 1969), 12–9; and —, *Philosophie zoologique*, vol. I, (Brussels: Culture et Civilisation, 1970), 53–81.
- ⁹⁹Dawkins, *The Blind Watchmaker*, 289.
- ¹⁰⁰Lamarck, *Système des animaux sans vertèbres*, 13; and —, *Philosophie zoologique* I, 221–2.
- ¹⁰¹Erasmus Darwin, *The Temple of Nature*, note I.
- ¹⁰²Lamarck, *Philosophie zoologique*, vol. II, 62–70.
- ¹⁰³For example, Robert Chambers, *Vestiges of the Natural History of Creation* (Leicester, UK: Leicester University Press, 1969).
- ¹⁰⁴Charles R. Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (Brussels: Culture et Civilisation, 1969).

- ¹⁰⁵_____, letter (1871), excerpted in Melvin Calvin, "The Origin of Life on Earth and Elsewhere," *Annals of Internal Medicine* 54 (1961): 956.
- ¹⁰⁶Paley, *Natural Theology*, I.
- ¹⁰⁷Dawkins, *The Blind Watchmaker*, 2d ed., 287–312.
- ¹⁰⁸Otto E. Landman, "The Inheritance of Acquired Characteristics," *Annual Review of Genetics* 25 (1991): 1–20.
- ¹⁰⁹Dawkins, *The Extended Phenotype*, 2d ed. (Oxford: Oxford University Press, 1999), 164–78.
- ¹¹⁰Richard J. Herrnstein and Charles Murray, *The Bell Curve: Intelligence and Class Structure in American Life* (New York: Free Press, 1994).
- ¹¹¹Aristotle, *On the Gait of Animals*, trans. A.S.L. Farquharson, in *Great Books of the Western World*, vol. 9: 2, 12; _____, *On the Generation of Animals*, II:5–6; V:8; and _____, *On the Parts of Animals*, trans. William Ogle, in *Great Books of the Western World*, vol. 9: II:13; III:1; IV:12.
- ¹¹²_____, *Metaphysics*, trans. W.D. Ross, in *Great Books of the Western World*, vol. 8, ed. I:2; II:2; XII:7–10; _____, *On the Motion of Animals*, trans. A.S.L. Farquharson, in *Great Books of the Western World*, vol. 9, 1–6; _____, *Physics*, VIII:5–10; and _____, *On Prophesying by Dreams*, trans. J. I. Beare, in *Great Books of the Western World*, vol. 8: 2.
- ¹¹³Allan Gotthelf, "Aristotle's Conception of Final Causality," in *Philosophical Issues in Aristotle's Biology*, ed. Allan Gotthelf and James G. Lennox (Cambridge: Cambridge University Press, 1987), 204–42; and D. M. Balme, "Teleology and Necessity," in *Philosophical Issues in Aristotle's Biology*, ed. Allan Gotthelf and James G. Lennox (Cambridge: Cambridge University Press, 1987), 277.
- ¹¹⁴Claudius Galenus, *On the Usefulness of the Parts of the Body*, trans. and ed. Margaret T. May (Ithaca, NY: Cornell University Press, 1968).
- ¹¹⁵*Ibid.*, II:159–60.
- ¹¹⁶Aristotle, *On the Gait of Animals*, 2, 12; and _____, *On the Generation of Animals*, I:4.
- ¹¹⁷Plato, *Timaeus*, trans. Benjamin Jowett, in *Great Books of the Western World*, vol. 7: 76; and Galenus, *On the Usefulness of the Parts of the Body*, I:12.
- ¹¹⁸Epictetus, *Discourses*, trans. George Long in *Great Books of the Western World*, vol. 12, I:6.
- ¹¹⁹M. Tullius Cicero, *De Natura Deorum*, trans. H. Rackham in *Cicero*, vol. XIX (Cambridge, MA: Harvard University Press, 1994), II:120–50.
- ¹²⁰Cicero, II:125.
- ¹²¹*Ibid.*, II:127, my translation, 128, 129.
- ¹²²Xenophon, *Memorabilia*, trans. E. C. Marchant in *Xenophon: Memorabilia and Oeconomicus* (London: William Heinemann, 1959), I:IV:4–7.
- ¹²³Homer, *The Iliad*, trans. Samuel Butler in *Great Books of the Western World*, vol. 4, XIX:12–39.
- ¹²⁴Henry More, *An Antidote Against Atheism, or an Appeal to the Natural Faculties of the Minde of Man, Whether There Be Not a God* (1653) in *The Cambridge Platonists*, ed. C. A. Patrides (Cambridge: Cambridge University Press, 1980), II:V–XII excerpts on pp. 213–87.
- ¹²⁵*Ibid.*, II:IX–XII.
- ¹²⁶Cudworth, *The True Intellectual System*, 148–9, 690.

Books Received and Available for Review

Contact the book review editor if you would like to review one of these books. Please choose alternate selections. Richard Ruble, Book Review Editor, *Perspectives on Science and Christian Faith*, 212 Western Hills Drive, Siloam Springs, AR 72761. richard@tcaineternet.com

- Wolfgang Achtner, Stefan Kunz & Thomas Walter, *Dimensions of Time: The Structure of the Time of Humans, of World, and of God*, Eerdmans, 196 pages, 2002
- Connie Barlow, *The Ghosts of Evolution: Nonsensical Fruit, Missing Partners, and Other Ecological Anachronisms*, Basic Books, 220 pages, 2001
- Frans B. M. de Waal, ed., *Tree of Origin: What Primate Behavior Can Tell Us About Human Social Evolution*, Harvard University Press, 310 pages, 2001
- Donald Fernie, *Setting Sail for the Universe: Astronomers and Their Discoveries*, 200 pages, 2002
- Wayne Frair, *Science and Creation: An Introduction to Some Tough Issues*, Creation Research Society, 75 pages, 2002
- Wayne Frair, *Biology and Creation: An Introduction Regarding Life and Its Origins*, Creation Research Society, 85 pages, 2002
- M. L. Greenhut & J. G. Greenhut, *Science and God: Our Amazing Physical and Economic Universe ... Accidental or God Created*, University Press of America, 180 pages, 2002
- Thomas Heinze, *How Life Began: Answers to My Evolutionist Friends*, Chick Publications, 160 pages, 2002
- Edwin Hui, *At the Beginning of Life: Dilemmas in Theological Bioethics*, IVP, 400 pages, 2002
- Phillip Johnson, *The Right Questions: Truth, Meaning and Public Debate*, IVP, 190 pages, 2002
- Stephen Kellert & Timothy Farnham, *The Good in Nature and Humanity: Connecting Science, Religion, and Spirituality with the Natural World*, Island Press, 280 pages, 2002
- Clif Matthews, *When Worlds Converge: What Science and Religion Tell Us*, Open Court, 400 pages, 2002
- William Nesbitt, *Illusion of Time: Seeing Scripture Through Science*, Black Forest Press, 180 pages, 2002
- W. E. Phipps, *Darwin's Religious Odyssey*, Trinity Press, 200 pages, 2002
- Susan Quinn, *Human Trials: Scientists, Investors, and Patients in the Quest for a Cure*, Perseus Publishing, 295 pages, 2001
- W. M. Richardson, ed., *Science and the Spiritual Quest: New Essays by Leading Scientists*, Routledge, 265 pages, 2002
- J. S. Sachs, *Corpse: Nature, Forensics, and the Struggle to Pinpoint the Time of Death*, Perseus Publishing, 270 pages, 2001
- Richard Schlagel, *The Vanquished Gods: Science, Religion, and the Nature of Belief*, Prometheus Books, 349 pages, 2001
- David, Toolan, *At Home in the Cosmos*, Orbis, 250 pages, 2001
- Mary Stewart Van Leeuwen, *My Brother's Keeper: What the Social Sciences Do (and Don't) Tell Us About Masculinity*, IVP, 254 pages, 2002
- David Wilkinson, *The Message of Creation*, IVP, 300 pages, 2002
- Benjamin Wiker, *Moral Darwinism: How We Became Hedonists*, IVP, 326 pages, 2002
- Kurt Wise, *Faith, Form, and Time: What the Bible Teaches and Science Confirms About Creation and the Age of the Universe*, Broadman & Holman, 287 pages, 2002