'a brilliant book . . .it is difficult to think that the exposition of Dawkins' writings and their religious implications, will ever be better stated, explored and criticised.'

*Times Higher Education Supplement*

ALISTER MCGRATH

# DAWKINS' GOD

## From The Selfish Gene to The God Delusion

SECOND EDITION

WILEY Blackwell

# Dawkins' God

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# Dawkins' God

## From *The Selfish Gene* to *The God Delusion*

Second Edition

Alister E. McGrath

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*"More attention to the History of Science is needed, as much by scientists as by historians, and especially by biologists, and this should mean a deliberate attempt to understand the thoughts of the great masters of the past, to see in what circumstances or intellectual* milieu *their ideas were formed, where they took the wrong turning or stopped short on the right track."*

*R. A. Fisher, speaking at a symposium held in Canberra marking the centenary of the publication of Charles Darwin's* Origin of Species. *"Natural Selection from the Genetical Standpoint."* Australian Journal of Science *22 (1959): 16–17.*

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# Introduction

I first came across Richard Dawkins in 1977 when I read his *Selfish Gene* (1976). I was completing my doctoral research in Oxford University's department of biochemistry, under the genial supervision of Professor Sir George Radda, who went on to become Chief Executive of the Medical Research Council. I was trying to figure out how biological membranes work so successfully by developing new physical methods to study their behavior.

Although it would be some years before *The Selfish Gene* achieved the cult status it subsequently enjoyed, it was obviously a marvelous book. I admired Dawkins' wonderful way with words, and his ability to explain crucial – yet often difficult – scientific ideas so clearly. It was popular scientific writing at its best. No surprise, then, that the *New York Times* commented that it was "the sort of popular science writing that makes the reader feel like a genius."

By any standards, *The Selfish Gene* was a great read – stimulating, controversial, and informative. Dawkins had that rare ability to make complex things understandable, without talking down to his audience. Yet Dawkins did more than just make evolutionary theory intelligible. He was willing to set out its implications for every aspect of life, in effect presenting Darwinism as a universal philosophy of life, rather than a mere scientific theory. It was heady stuff – far better, in my view, than Jacques Monod's earlier work *Chance and Necessity* (1971), which explored similar themes, but in a rather dull way. And, like all provocative writers, Dawkins opened up debates which were both important and intrinsically interesting – such as the existence of God, and the meaning of life.

Although Dawkins' atheism was evident in *The Selfish Gene*, it was presented in an interesting and engaging way – the kind of approach that

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provokes a good conversation. I was especially interested in Dawkins' own history, as we had traversed quite different routes – in my case, from atheism to Christianity; in his, from Christianity to atheism. In fact, at that time I was in the process of moving from the study of the natural sciences to Christian theology, combining working in Oxford's research laboratories with taking tutorials in theology. My long-term goal was to explore the relation of Christian thought and the natural sciences, and my mentors had made it clear that I would need research degrees in both disciplines to be taken seriously.

By June 1978, I had gained my doctorate in molecular biophysics and first-class honors in theology, and was preparing to leave Oxford to begin theological research at Cambridge University. To my surprise, I then received an invitation to lunch with a senior editor at Oxford University Press. Oxford is a very small place, and gossip spreads very quickly. The Press had heard about my "interesting career to date," he explained, and had an interesting possibility to discuss with me. Dawkins' *Selfish Gene* had generated a huge amount of interest. Would I like to write a response from a Christian perspective?

It would be a wonderful book to write. Only a fool, I remember thinking at the time, could resist such an invitation. After much thought, I wrote a polite note thanking my colleague for lunch, and explaining that I did not yet feel ready to write such a book. There were many others better qualified, in my view – such as the biochemist and theologian Arthur Peacocke (1924–2008). It would just be a matter of time before someone else wrote a book-length response to Dawkins' ideas. So I headed off to Cambridge to do research into Christian theology, before returning to Oxford to lecture in theology in 1983. Oxford University's excellent library resources meant I was able to keep up and develop my reading in the history and philosophy of science, as well as follow the most recent experimental and theoretical developments in the field.

But I had not forgotten Dawkins. His *Selfish Gene* introduced a new concept and word into the investigation of the history of ideas – the "meme." As the area of research I hoped to pursue was the history of ideas (specifically, Christian theology, but set against the backdrop of intellectual development in general), I had done a substantial amount of background research on existing models of how ideas were developed and received within and across cultures. None of them seemed satisfactory.[1]

[1] The one I initially had greatest hopes for was Pierre Rousselot, "Petit théorie du développement du dogme." *Recherches de science religieuse* 53 (1965): 355–90. For the issues, see Alister E. McGrath, "The Evolution of Doctrine? A Critical Examination of the Theological Validity of Biological Models of Doctrinal Development." In *The Order of Things: Explorations in Scientific Theology*, 117–67. Oxford: Blackwell Publishing, 2006.

But Dawkins' theory of the "meme" – a cultural replicator – seemed to offer a brilliant new theoretical framework for exploring the general question of the origins, development, and reception of ideas, based on rigorous empirical scientific investigation. I recall with great affection a moment of sheer intellectual excitement, sometime late in 1977, when I realized that there might be a credible alternative to the stale and unpersuasive models of doctrinal development I had explored and rejected at that stage. Might this be the future?[2]

As I knew from Darwin's work on the Galapagos finches, it helps to approach evidence with at least a provisional theoretical framework.[3] And so I began to explore using the "meme" as a model for the development of Christian doctrine. I shall report more fully on my twenty-five-year evaluation of both the "meme" concept and its utility in a later chapter. Suffice it to say at this stage that I was perhaps somewhat optimistic concerning both its rigorous empirical grounding and its value as a tool for the critical study of intellectual development.

In the meanwhile, Dawkins went on to produce a series of brilliant and provocative books, each of which I devoured with interest and admiration. Dawkins followed *The Selfish Gene* with *The Extended Phenotype* (1981), *The Blind Watchmaker* (1986), *River out of Eden* (1995), *Climbing Mount Improbable* (1996), *Unweaving the Rainbow* (1998), *A Devil's Chaplain* (2003), and finally the culmination of his career as an atheist apologist in *The God Delusion* (2006). Following *The God Delusion*, Dawkins went on to publish some elegant works of popular science, and an informative memoir of his life, which have informed the analysis in these pages. Yet the tone and focus of Dawkins' writing changed over the years. As philosopher Michael Ruse pointed out in a review of *The Devil's Chaplain*, Dawkins' focus shifted "from writing about science for a popular audience to waging an all-out attack on Christianity."[4] The brilliant scientific popularizer became a tub-thumping anti-religious polemicist, preaching rather than arguing his case (or so it seemed to his critics).

So what is the source of Dawkins' hostility to religion? My reading of his works suggests that this animosity is deep-rooted, and not grounded in

[2] I was not the only one to be so excited in this way by Dawkins' new idea: see Stephen Shennan. *Genes, Memes and Human History: Darwinian Archaeology and Cultural Evolution.* London: Thames & Hudson, 2002, 7.

[3] I later wondered if I had made too much of this incident in Darwin's intellectual development: see Frank J. Sulloway, "Darwin and His Finches: The Evolution of a Legend." *Journal of the History of Biology* 15 (1982): 1–53.

[4] Michael Ruse, "Through a Glass, Darkly." *American Scientist* 91 (2003): 554–6.

one specific concern. Four interconnected yet distinct grounds of criticism may be found throughout his writings. All are found in his *God Delusion* (2006); yet their formulation dates from different stages of his career.

1 A Darwinian worldview makes belief in God unnecessary or impossible. Although hinted at in *The Selfish Gene*, this idea is developed in more detail in *The Blind Watchmaker*.
2 Religion makes assertions which are grounded in faith, a "kind of mental illness" which shies away from a rigorous, evidence-based concern for truth. For Dawkins, truth is grounded in explicit proof; any form of obscurantism or mysticism grounded in faith is to be opposed vigorously. Dawkins' robust insistence on evidence-based thinking is obvious in *The Selfish Gene*, and recurs regularly in his later writings.
3 Religion offers an impoverished and attenuated vision of the world. "The universe presented by organized religion is a poky little medieval universe, and extremely limited."[5] In contrast, science offers a bold and brilliant vision of the universe as grand, beautiful, and awe-inspiring. This aesthetic critique of religion is developed especially in his 1998 work *Unweaving the Rainbow*.
4 Religion leads to evil. It is like a malignant virus, infecting human minds. This is not strictly a scientific judgment, in that, as Dawkins often points out, the sciences cannot establish what is good or evil. "Science has no methods for deciding what is ethical."[6] It is, however, a profoundly moral objection to religion, deeply rooted within western culture and history, which must be taken with the greatest seriousness.

In 2004, I published the first edition of *Dawkins' God*, which aimed to explore and evaluate Dawkins' views on science and religion through a close reading of his publications – in effect, a belated version of the book I was asked to write back in 1978. There were three main reasons for writing that book. First, Dawkins is a fascinating writer, both in terms of the quality of the ideas he develops, and the verbal dexterity with which he defends them. Anyone who is remotely interested in debates about the meaning of life will find Dawkins an important sparring partner. Augustine of Hippo once wrote of the "*eros* of the mind," referring to a

[5] Richard Dawkins, "A Survival Machine." In *The Third Culture*, edited by John Brockman, 75–95. New York: Simon & Schuster, 1996, 85.
[6] *A Devil's Chaplain*, 34. For all Dawkins texts, please see the Select Bibliography for a full reference.

deep longing within the human mind to make sense of things – a passion for understanding and knowledge. Anyone sharing that passion will want to enter into the debate that Dawkins has begun.

And that was my second reason for writing. Yes, Dawkins may occasionally seem to be immensely provocative and aggressive, dismissing alternative positions with indecent haste, or treating criticism of his personal views as an attack on the entire scientific enterprise. Yet this is what makes popular debates *interesting*, and raises them above the tedious drone of normal scholarly discussion, which seems invariably to be accompanied by endless footnotes, citing of weighty but dull authorities, and a cautious understatement heavily laced with qualifications. Dawkins clearly wanted to provoke such a debate and discussion, and it would be churlish not to join in.

I had a third reason, however. I write as a Christian theologian who believes it is essential to listen seriously and carefully to criticism of my discipline, and respond appropriately to it. One of my reasons for taking Dawkins so seriously is that I want to ask what may be learned from him. As any serious historian of Christian thought knows, Christianity is committed to a constant review of its ideas in the light of their moorings in Scripture and tradition, always asking whether any contemporary interpretation of a doctrine is adequate or acceptable. As we shall see, Dawkins offers a powerful, and in my view credible, challenge to one way of thinking about the doctrine of creation, which gained influence in England during the early modern period, and still lingers on in some quarters today. He is a critic who needs to be heard, and taken seriously.

The first edition of this work was well received. Yet even within a few years of its publication, it was clear that it needed major revision. For a start, Dawkins published *The God Delusion* in 2006. It would be unthinkable to discuss his views on science and religion without engaging with this influential work. Secondly, a substantial secondary literature emerged, dealing with a range of issues of direct relevance to the topic of this book. It was clearly essential to distil the importance of this new body of knowledge into the text of a new edition of this work.

In the spring of 2014, I judged that the moment was right for a new edition of this work. I had just been appointed as the Andreas Idreos Professor of Science and Religion at Oxford, and it seemed entirely appropriate to begin this final phase of my career by interacting with Oxford's former Professor of the Public Understanding of Science.

Finally, I must make it clear that, although I disagree with Dawkins over many issues, I regard him as one of the most important scientists of his

age, not least because of his superb ability to communicate scientific ideas to a wider audience. He has helped to create a new cultural interest in the field of science and religion, from which I and many others have benefited. That discussion is certain to continue, and will develop in new directions in the future. Perhaps this book might help that debate move onward and upward.

Alister E. McGrath
Oxford, June 2014

# 1

# Darwinism
## *The Rise of a Scientific Theory*

Why are things the way they are? How did they come to be this way? And what – if anything – might this tell us about the meaning of life? These questions have played a decisive role in shaping western thinking about the world. From the beginning of human civilization, people have wondered what explanation might be offered for the structures of the world – such as the haunting and solemn silence of the stars in the night sky, the beauty of a rainbow, and the mysterious behavior of living beings. Not only do these evoke a sense of awe; they call out for an explanation.

The earliest Greek philosophers – the pre-Socratics – argued endlessly about the nature of the world, and how it came to be as it is. They insisted that the universe was rationally constructed, and that it could therefore be understood through the right use of human reason and argument. Human beings had the ability to make sense of the universe. Socrates took this line of thought further, identifying a link between the way the universe was constructed and the best way for human beings to live. To reflect on the nature of the universe was to gain insights into the nature of the "good life" – the best and most authentic way of living. Reflecting on the clues provided in the structuring of the world thus led to an understanding of our identity and destiny.

For many, the answer lay in the divine origins of the world – the idea that, in some way, the world has been ordered or constructed. Many have found this idea to be spiritually attractive and intellectually satisfying. For Dawkins, however, the advent of Charles Darwin has shown this up as "cosmic sentimentality," "saccharine false purpose," which natural science has a moral mission to purge and debunk. Such naïve beliefs, he argues,

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might have been understandable before Darwin came along. But not now. Darwin has changed everything. Newton would be an atheist if he had been born after Darwin. Before Darwin, atheism was just one among many religious possibilities; now, it is the only serious option for a thinking, honest, and scientifically informed person. Dawkins' robustly positive take on Darwinism and the message that it brings to the world can be seen in a short talk he gave on BBC Radio in 2003, in which he set out his personal creed:

> [We should] rejoice in the amazing privilege we enjoy. We have been born, and we are going to die. But before we die we have time to understand why we were ever born in the first place. Time to understand the universe into which we have been born. And with that understanding, we finally grow up and realise that there is no help for us outside our own efforts.[1]

Dawkins argues that Darwin marks that decisive point of transition, providing us with the only reliable explanation of our origins. Intellectual history is thus divided into two epochs – before Darwin, and after Darwin. As James Watson, the Nobel Prize winner and co-discoverer of the structure of DNA put it, "Charles Darwin will eventually be seen as a far more influential figure in the history of human thought than either Jesus Christ or Mohammed."

But why Darwin? Why not Karl Marx? Or Sigmund Freud? Each of these is regularly proposed as having brought about an intellectual earthquake, shattering prevailing assumptions and ushering in radical new ways of thinking which lead to the bifurcation of human thought. The theories of biological evolution, historical materialism, and psychoanalysis have all been proposed as defining the contours of humanity come of age. All, interestingly, have been linked with atheism, the movement that some Europeans in the eighteenth and nineteenth centuries hoped might prove to be an intellectual and political liberator. So why Darwin? To ask this question is to open up the issues which so deeply concern Dawkins, and which have such wider implications.

To appreciate the contributions of Richard Dawkins to debates about evolutionary theory and the relation of science and religion, we must first contextualize his ideas. This opening chapter is a scene-setter, providing the background against which Dawkins' ideas about the "selfish gene" and "blind watchmaker" are to be seen. Before we can make sense of Dawkins' distinctive approach, we need to set him in his proper context,

[1] Richard Dawkins, "Alternative Thought for the Day." BBC Radio 4, August 14, 2003.

and tell the story of the emergence of the form of evolutionary thought that is often referred to as "Darwinism."

## Natural Selection: Charles Darwin

The publication of Charles Darwin's *Origin of Species* (1859) is rightly regarded as a landmark in nineteenth-century science. On December 27, 1831, HMS *Beagle* set out from the southern English port of Plymouth on a voyage that lasted almost five years. Its mission was to complete a survey of the southern coasts of South America, and afterward to circumnavigate the globe. The small ship's naturalist was Charles Darwin (1809–82). During the voyage, Darwin noted some aspects of the plant and animal life of South America, particularly the Galapagos Islands and Tierra del Fuego, which seemed to him to require explanation, yet which were not satisfactorily accounted for by existing theories. The opening words of the *Origin of Species* set out the riddle that he was determined to solve:

> When on board HMS *Beagle* as naturalist, I was much struck with certain facts in the distribution of the organic beings inhabiting South America, and in the geological relations of the present to the past inhabitants of that continent. These facts, as will be seen in the latter chapters of this volume, seemed to throw some light on the origin of species – that mystery of mysteries, as it has been called by one of our greatest philosophers.[2]

One popular account of the origin of species, widely supported by the religious and academic establishment of the early nineteenth century, held that God had somehow created everything more or less as we now see it. The success of the view owed much to the influence of William Paley (1743–1805), archdeacon of Carlisle, who compared God to one of the mechanical geniuses of the Industrial Revolution. God had directly created the world in all its intricacy. We shall explore the origins and influence of Paley's thinking in the fourth chapter of this work; at this stage, we need merely note that Paley was of the view that God had constructed – Paley prefers the word "contrived" – the world in its finished form, as we

[2] Charles Darwin, *On the Origin of the Species by Means of Natural Selection*. London: John Murray, 1859, 1. Note that all six editions of this work are now easily accessed online: http://darwin-online.org.uk. Accessed August 5, 2014.

now know it. The idea of any kind of development seemed impossible to him. Did a watchmaker leave his work unfinished? Certainly not![3]

Darwin knew of Paley's views, and initially found them persuasive. However, his observations on the *Beagle* raised some questions. On his return, Darwin set out to develop a more satisfying explanation of his own observations and those of others. Although Darwin appears to have hit on the basic idea of evolution through natural selection by 1842, he was not ready to publish. Such a radical theory would require massive observational evidence to be marshalled in its support.

Some earlier works advocating the evolution of species – most notably, Robert Chambers' *Vestiges of the Natural History of Creation* (1844) – were so incompetent scientifically that they threatened to discredit the ideas that they tried to advance.[4] Thomas H. Huxley, who would later champion Darwin's theory, damned the book as a "once attractive and still notorious work of fiction," and its author as one of "those who . . . indulge in science at second-hand and dispense totally with logic."[5] Chambers was a publisher, not a scientist, and was a little naïve at points; for example, in taking seriously a highly improbable report that living creatures had resulted from passing electric currents through potassium ferrocyanate solution.

As a result of Chambers' muddying of the waters, there was now no way that a radical new theory of biological origins could be launched without overwhelming documentation, guaranteed to disarm its critics through its sheer weight of observational data and close evidence-based argument. Darwin's *Origin of Species* provided such a work, offering both evidence of the phenomenon of biological evolution and an explanation of its mechanism.

Philosophers of science draw an important distinction between a "logic of discovery" and a "logic of confirmation." To simplify what is rather a complex discussion, we might suggest that a logic of discovery is about how someone arrives at a scientific hypothesis, and a logic of confirmation about how that hypothesis is shown to be reliable and realistic.[6] Sometimes hypotheses arise from a long period of reflection on observation; sometimes

[3] See further John T. Baldwin, "God and the World: William Paley's Argument from Perfection Tradition – A Continuing Influence." *Harvard Theological Review* 85 (1992): 109–20.

[4] For further details, see James A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation*. Chicago: University of Chicago Press, 2000.

[5] T. H. Huxley, review of "The Vestiges of Creation." *The British and Foreign Medico-Chirurgical Review* 26 (1854): 425–39.

[6] For a good account, see Christiane Chauviré, "Peirce, Popper, Abduction, and the Idea of Logic of Discovery." *Semiotica* 153 (2005): 209–21.

they come about in a flash of inspiration. Yet if the logic of discovery can often be more inspirational than rational, the same is clearly not true of the logic of justification. Here, any hypothesis – however it is derived – is rigorously and thoroughly checked against what may be observed, to determine the degree of empirical fit between theory and observation. There is no reason to suggest that Darwin's notion of natural selection came about in a moment of inspiration, on the Galapagos or anywhere else. His theory began taking shape in 1837 and 1838. In Darwin's case, the logics of discovery and justification both seem to have been based primarily on extensive reflection on often puzzling observations.[7]

Darwin's own account of how he developed his theory of natural selection makes it clear that it was later reflection on observations that brought about his insight. When he boarded the *Beagle* in 1831, he tells us, he was inclined to the view that the flora and fauna of a given region would be determined by their physical environment. His observations caused him to question this belief, and to search for alternative explanations – one of which gradually came to dominate his thinking. Let us listen to Darwin's own account of things:

> During the voyage of the *Beagle* I had been deeply impressed by discovering in the Pampean formation great fossil animals covered with armor like that on the existing Armadillos; secondly, by the manner in which closely allied animals replace one another in proceeding southwards over the Continent; and thirdly, by the South American character of most of the productions of the Galápagos archipelago, and more especially by the manner in which they differ slightly on each island of the group; none of these islands appearing to be very ancient in the geological sense. It was evident that facts such as these, as well as many others, could be explained on the supposition that species gradually become modified; and the subject haunted me.[8]

On his return to England, Darwin set about building up his repository of evidence for evolution. As Darwin reflected on his own observations, and supplemented them with those of others, a number of points emerged as being of particular significance. For Darwin, four features of the natural world in particular seemed to require particularly close attention, in the light of problems and shortcomings with existing explanations, especially the idea of "special creation" offered by religious apologists such as

[7] See the reflections of Scott A. Kleiner, "The Logic of Discovery and Darwin's Pre-Malthusian Researches." *Biology and Philosophy* 3 (1988): 293–315.

[8] Charles Darwin and Nora Barlow, *The Autobiography of Charles Darwin, 1809–1882: With Original Omissions Restored*. New York: Norton, 1993, 118.

William Paley:[9] rudimentary organs, extinction, geographical biodiversity, and adaptation. While Paley's theory – which we shall consider in more detail in Chapter 4 – offered explanations of these observations, they seemed increasingly cumbersome and forced. A better explanation, Darwin believed, had to lie to hand. None of these could be regarded as "proofs" of natural selection; nevertheless, they possessed a cumulative force in suggesting it was the best explanation of what was actually observed.

The point here is that a number of explanations could be offered for what was observed in nature. The debate concerned which of these explanations was the best. Now, the word "best" is difficult to define. Do we mean the simplest theory? The most elegant? The most natural? The great English natural philosopher William Whewell (1794–1866) – much admired by Darwin – used a rich visual image to communicate the capacity of a good theory to make sense of, and weave together, observations. "The facts are known but they are insulated and unconnected ... The pearls are there but they will not hang together until some one provides the string."[10] The "pearls" are the observations and the "string" is a grand vision of reality, a worldview, that *connects* and *unifies* the data. A grand theory, Whewell asserted, allows the "colligation of facts," establishing a new system of relations with each other, unifying what might have otherwise been considered to be disconnected and isolated observations. The "pearls" were the observations that Darwin had accumulated; but what was the best string on which to thread them?

The pearls – to continue with this visual analogy – include four categories of observations which clearly require to be strung together.

1 Many creatures possess "rudimentary structures," which have no apparent or predictable function – such as the nipples of male mammals, the rudiments of a pelvis and hind limbs in snakes, and wings on many flightless birds. How might these be explained on the basis of

[9] Scott A. Kleiner, "Problem Solving and Discovery in the Growth of Darwin's Theories of Evolution." *Synthese* 62 (1981): 119–62, especially 127–9. Note that substantially the same issues can be discerned in Johann Kepler's explanation of the solar system: Scott A. Kleiner, "A New Look at Kepler and Abductive Argument." *Studies in History and Philosophy of Science* 14 (1983): 279–313.

[10] William Whewell, *Philosophy of the Inductive Sciences*. 2 vols. London: John W. Parker, 1847, vol. 2, 36. As has often been pointed out, Whewell's theory of induction is open to criticism: see, for example, Laura J. Snyder, "The Mill–Whewell Debate: Much Ado about Induction." *Perspectives on Science* 5 (1997): 159–98.

Paley's theory, which stressed the importance of the individual design of species? Why should God design redundancies? Darwin's theory accounted for these with ease and elegance.

2 Some species were known to have died out altogether. The phenomenon of extinction had been recognized before Darwin, and was often explained on the basis of catastrophe theories, such as a universal flood, as suggested by the biblical account of Noah. Darwin's theory offered a neater account of the phenomenon.

3 Darwin's research voyage on the *Beagle* had persuaded him of the uneven geographical distribution of life forms throughout the world. In particular, Darwin was impressed by the peculiarities of island populations, such as the finches of the Galapagos Islands. Once more, the doctrine of special creation could account for this, yet in a manner that seemed forced and unpersuasive. Darwin's theory offered a much more plausible account of the emergence of these specific populations.

4 Various forms of certain living creatures seemed to be adapted to their specific needs. Darwin held that these could best be explained by their emergence and selection in response to evolutionary pressures. Paley's theory of special creation proposed that these creatures were individually designed by God with those specific needs in mind.

So what could be inferred from these? What was the best explanation of these observations? The best string to connect them? The challenge facing Darwin was to find a theoretical framework which could accommodate these observations as simply, elegantly, and persuasively as possible. Darwin's method is a textbook case of the method of "inference to the best explanation" which is now widely regarded as lying at the core of the scientific method.[11] Darwin was quite clear that his theory of natural selection was not the only explanation of the biological data which could be adduced. He did, however, believe that it possessed greater explanatory power than its rivals, such as the doctrine of independent acts of special creation, as set out in the writings of William Paley: "Light has been shown on several facts, which on the belief of independent acts of creation are utterly obscure."[12]

Many popular accounts of the scientific method emphasize the importance of prediction. If a theory does not predict, it is not scientific. Darwin

[11] For the best general statement of this method, see Peter Lipton, *Inference to the Best Explanation*. 2nd edn. London: Routledge, 2004.

[12] Charles Darwin, *On the Origin of the Species by Means of Natural Selection*. 6th edn. London: John Murray, 1872, 164.

was quite clear that his theory did not predict, and could not predict. That was just the nature of things.[13] The nature of the scientific phenomena was such that prediction was not possible for Darwin. This point unhappily led some philosophers of science, most notably Karl Popper, to suggest that Darwinism was not really scientific.[14]

This point is no longer taken seriously. More recent studies, especially in the philosophy of biology, have raised interesting questions about whether prediction really is essential to the scientific method. This issue emerged as important in the nineteenth-century debate between William Whewell and John Stuart Mill over the role of induction as a scientific method.[15] Whewell emphasized the importance of predictive novelty as a core element of the scientific method; Mill argued that the difference between prediction of novel observations and theoretical accommodation of existing observations was purely psychological, and had no ultimate epistemological significance. The debate, of course, continues. In a recent discussion of the issue, leading philosophers of biology Christopher Hitchcock and Elliott Sober argue that while prediction can occasionally be superior to accommodation, this is not always the case.[16] Situations can easily be envisaged where accommodation is superior to prediction. Prediction is neither intrinsically nor invariably to be preferred to accommodation. The relevance of this point to the scientific character of Darwin's approach will be obvious.

The *Origin of Species* sets out with great care why the idea of natural selection is the best mechanism to explain how the evolution of species took place, and how it is to be understood. Darwin proposed that a process of "natural selection" had to be proposed as nature's analogue to the process of "artificial selection" in stockbreeding. Darwin was familiar with

[13] See especially the detailed study of Elisabeth Anne Lloyd, "The Nature of Darwin's Support for the Theory of Natural Selection." In *Science, Politics, and Evolution*. Cambridge: Cambridge University Press, 2008, 1–19.

[14] Karl R. Popper, "Natural Selection and the Emergence of Mind." *Dialectica* 32 (1978): 339–55.

[15] Snyder, "The Mill–Whewell Debate." Snyder elsewhere argues that Whewell's views on induction have been misunderstood, and merit closer attention as a distinctive approach: Laura J. Snyder, "Discoverers' Induction." *Philosophy of Science* 64 (1997): 580–604.

[16] Christopher Hitchcock and Elliott Sober, "Prediction vs. Accommodation and the Risk of Overfitting." *British Journal for Philosophy of Science* 55 (2004): 1–34. The "weak predictivism" defended by Hitchcock and Sober has parallels elsewhere: see, for example, the careful assessment of approaches in Marc Lange, "The Apparent Superiority of Prediction to Accommodation as a Side Effect." *British Journal for Philosophy of Science* 52 (2001): 575–88; David Harker, "Accommodation and Prediction: The Case of the Persistent Head." *British Journal for Philosophy of Science* 57 (2006): 309–21.

these issues, especially as they related to the breeding of pigeons.[17] The first chapter of the *Origin of Species* therefore considers "variation under domestication" – that is, the way in which domestic plants and animals are bred by agriculturists. Darwin notes how selective breeding allows farmers to create animals or plants with particularly desirable traits. Variations develop in successive generations through this process of breeding, and these can be exploited to bring about inherited characteristics which are regarded as being of particular value by the breeder. In the second chapter, Darwin introduces the key notions of the "struggle for survival" and "natural selection" to account for what may be observed in both the fossil records and the present natural world.

Darwin argues that this process of "domestic selection" or "artificial selection" offers a model for a mechanism for what happens in nature. "Variation under domestication" is presented as an analogue of "variation under nature." A process of "natural selection" is argued to occur within the natural order which is analogous to a well-known process, familiar to English stockbreeders and horticulturalists: "As man can produce and certainly has produced a great result by his methodical and unconscious means of selection, what may not nature effect?"[18]

Darwin's theory had considerable explanatory force – a point recognized by many at the time, even those who were anxious about the implications of his ideas for the place of humanity within nature. Yet there was a serious problem with the theory. How did nature "remember" and "transmit" these new developments? How could a rising generation "inherit" the traits of its predecessor? What mechanism could be proposed by which these new developments could be passed on to future generations? Darwin's contemporaries generally believed that characteristics of the parents were "blended" when they were passed to the offspring. But if this was the case, how could a single mutation be spread throughout a species? It would be diluted to the point of insignificance, like a drop of ink in a bucket of water. It seemed that Darwin's evolutionary hypothesis was in genetic difficulties. Variation would simply become diluted. A new trait would be like a teaspoon of white paint falling into a vat of black treacle: it would vanish from sight.

Darwin's *Origin of Species* went through six editions, and Darwin worked constantly to improve his text, adding new material, amending existing material, and, above all, responding to criticisms in what can only

[17] On which see James A. Secord, "Nature's Fancy: Charles Darwin and the Breeding of Pigeons." *Isis* 72 (1981): 163–86.

[18] Darwin, *Origin of the Species.* 1st edn. 1859, 83.

be described as a remarkably open manner. Of the 4,000 sentences in the first edition, Darwin had rewritten three in four by the time of the final sixth edition of 1872. Interestingly, some 60% of these modifications took place in the last two editions, which introduced some "improvements" that now seem unwise – for example, his incorporation of Herbert Spencer's potentially misleading phrase "the survival of the fittest."[19]

The contents of these successive editions of the *Origin of Species* make it clear that Darwin's new theory faced considerable opposition on many fronts. Some traditional Christian thinkers saw it as a threat to the way in which they had interpreted their faith; others saw Darwin's theory as offering new ways of understanding and exploring traditional Christian ideas.

Yet Darwin's theory also provoked controversy within the scientific community, with many scientists of his day raising concerns about the scientific foundations of natural selection. If the successive editions of *Origin* are anything to go by, Darwin's theory was criticized by many scientists of the day on evidentiary grounds. Yet this is the norm, not the exception, in scientific advance. Criticism of a theory is the means by which – to use a Darwinian way of speaking – we discover whether it has survival potential. The reception of a scientific theory is a communal affair, in which a "tipping point" is gradually reached through a process of debate and reflection, often linked with additional research programs. Darwin's theory appears to have met more sustained opposition from the scientific community than from its religious counterpart, especially on account of its failure to offer a convincing account of how innovations were transmitted to future generations.

A good example of such scientific criticism can be seen in Henry Charles Fleeming Jenkin's concerns about "blending inheritance."[20] Jenkin (1833–85) was a Scottish engineer, heavily involved in the business of developing underwater telephone cables, who identified what Darwin clearly believed to be a potentially fatal enquiry flaw in his theory. Jenkin pointed out that, on the basis of existing understandings of hereditary transmission, any novelties would be diluted in subsequent generations. Yet Darwin's theory depended on the transmission, not dilution, of such characteristics. In other words, Darwin's theory lacked a viable understanding of genetics. Darwin responded to Jenkin in the fifth edition of

[19] Spencer (1820–1903) used the phrase in his *Principles of Biology* (1864); Darwin incorporated it into the fifth edition of the *Origin*: "This preservation of favourable variations, and the destruction of injurious variations, I call Natural Selection, or the Survival of the Fittest"; Charles Darwin, *Origin of Species.* 5th edn. London: John Murray, 1869, 91–2.

[20] On which see Michael G. Bulmer, "Did Jenkin's Swamping Argument Invalidate Darwin's Theory of Natural Selection?" *British Journal for the History of Science* 37 (2004): 281–97.

the *Origin*. The reply is generally thought to be very weak and unsatisfactory. But how could it be otherwise?

The answer, of course, lay in the writings of the Austrian monk Gregor Mendel (1822–84), which we shall consider in the next section. While the confluence of Mendel's theory of genetics and Darwin's theory of natural selection still lay some years in the future, it can be said that perhaps the greatest of Darwin's difficulties would not remain problematic for much longer.

Darwin himself was fully aware of the need for a comprehensive account of the mechanics of inheritance. The theory he developed (known as "pangenesis") was based on hypothetical "gemmules" – minute particles which somehow determine all characteristics of the organism.[21] These "gemmules" had never been observed; nevertheless, Darwin argued that it was necessary to propose their existence to make sense of the observational data at his disposal. Each and every cell of an organism, and even parts of cells, was understood to produce gemmules of a specific type corresponding to the cell or cell part. These are able to circulate throughout the body and enter the reproductive system. Every sperm and egg contains these hypothetical gemmules, and are thus transmitted to the next generation. It was an ingenious solution; yet it was not right.[22] Darwin's theory of pangenesis actually only involved partial blending, "since the patent elements fuse but the latent elements do not."[23] Darwin's theory faltered, lacking a plausible theory of genetics.

Yet even though Darwin did not believe that he had adequately dealt with all the problems which required resolution – most notably, the question of the transmission of genetic information – he was still confident that his explanation was the best available. A comment added to the sixth edition of the *Origin of Species* makes this point clear.[24]

> It can hardly be supposed that a false theory would explain, in so satisfactory a manner as does the theory of natural selection, the several large classes of facts above specified. It has recently been objected that this is an unsafe method of arguing; but it is a method used in judging the common events of life, and has often been used by the greatest natural philosophers.

[21] The theory is set out in his *The Variation of Animals and Plants under Domestication*. 2 vols. London: John Murray, 1868.

[22] Conway Zirkle, *The Early History of the Idea of the Inheritance of Acquired Characters and of Pangenesis*. Philadelphia, PA: American Philosophical Society, 1946.

[23] A point stressed by Michael G. Bulmer, *Francis Galton: Pioneer of Heredity and Biometry*. Baltimore, MD: Johns Hopkins University Press, 2003.

[24] Darwin, *Origin of Species*. 6th edn. London: John Murray, 1872, 444. This comment is not present in earlier editions of the work.

While recognizing that it lacked rigorous proof, Darwin clearly believed that his theory could be defended on the basis of criteria of acceptance and justification that were already widely used in the natural sciences, and that its explanatory capacity was itself a reliable guide to its truth.

## The Mechanics of Inheritance: Gregor Mendel

Unknown to Darwin, the issues that he was finding so troublesome were being investigated at that time in a quiet monastery garden in central Europe. Gregor Mendel was a monk who entered the Augustinian monastery of St. Thomas in the Austrian town of Brünn (now the Czech town of Brno) during his twenties. His monastic superiors were impressed with his enthusiasm but not his existing levels of education. They sent him to the University of Vienna for further study (1851–3), during which time he specialized in physics, chemistry, zoology, and botany. After returning to the monastery, he taught in a local school, and conducted some experiments in the monastery garden. He had been encouraged by both his teachers at the University of Vienna and the abbot of his monastery to explore his interest in hybridization in plant populations. In effect, Mendel studied the heredity of specific characteristics as they were passed on from parent plants to their offspring. These experiments came to an end when he was elected abbot of the monastery in 1868, and faced new administrative responsibilities.

Mendel's experiments involving growing something like 28,000 pea plants over the period 1856–63 and observing how characteristics were transmitted from one generation to the next. He chose to focus on seven easily determined characteristics of his peas. Two of the best known of these are the color of their flowers (purple or white?) and the color of their seeds (yellow or green?). As he observed the patterns of inheritance of these characteristics, Mendel noticed some significant recurring features. Because he used so many plants and recorded his findings so meticulously, his results could be subjected to detailed statistical analysis which disclosed certain regular, recurring mathematical patterns of immense importance. In cross-pollinating plants that either produce yellow or green peas exclusively, Mendel found that the first offspring generation always has yellow peas. However, the following generation consistently has a 3:1 ratio of yellow to green. Certain characteristics, such as yellow seeds, were found to be "dominant" over other "recessive" characteristics, such as green seeds.

From his research, Mendel was able to formulate three fundamental principles which seemed to govern inheritance:

1 That the inheritance of each trait – such as the color of the flower or seed – seems to be determined by certain units or factors that are passed on to descendants.
2 That an individual plant inherits one such unit from each parent for each of these traits.
3 That traits which do not show up in an individual may nevertheless be passed on to a later generation.

Mendel thus proposed a theory of "particulate inheritance," in which characteristics were determined by discrete units of inheritance that were passed intact from one generation to the next. Adaptive mutations could spread slowly through a species and never be "blended out," as some contemporary theories of genetics held. The evolutionary implications of this were considerable. Darwin's theory of natural selection, building on small mutations over long periods of time, suddenly became much more plausible.

Mendel set out his ideas at the Natural History Society of Brno early in 1865. They were received politely, but not enthusiastically, and were published the following year.[25] It seems that hardly anyone read the *Verhandlungen des naturforschenden Vereins in Brünn*, and the article languished unnoticed, despite having been sent to the libraries of some 120 institutions including the Royal Society and the Linnean Society in London. In 1868, Mendel was elected abbot of his monastery, and found himself overwhelmed with administrative responsibilities. He was unable to undertake further research, or advance his ideas more widely. It was only in 1900 that the significance of Mendel's Laws were fully appreciated, following their "rediscovery" by Carl Correns in Germany (1864–1933), Hugo de Vries in the Netherlands (1848–1935), and Erich von Tschermak-Seysenegg in Austria (1871–1962), and their importance more fully realized.[26]

Questions have been raised about the integrity of Mendel's work. In 1930, the British mathematical biologist Ronald A. Fisher (1890–1962) published a landmark work in Darwinian theory, which argued that Mendel's empirical results could have been predicted by an armchair scientist, armed only with "a few very simple assumptions," concerning

[25] Gregor Johann Mendel, "Versuche über Pflanzen-Hybriden." *Verhandlungen des naturforschenden Vereins in Brünn* 4 (1866): 3–47.

[26] See for example Carl Correns, "G. Mendels Regel über das Verhalten der Nachkommenschaft der Rassenbastarde." *Berichte der deutschen botanischen Gesellschaft* 18 (1900): 158–68.

the Mendelian notion of "factorial inheritance."[27] Fisher also suggested, on mathematical grounds, that Mendel's reported observations were just too good to be true. Mendel's segregation ratios were far higher than the principles of variation statistics would permit. Since such segregation ratios could occur only very seldom, the integrity of Mendel's ideas would have to be reconsidered. This view is still encountered. As recently as 1991, it was argued that Mendel's "account of his experiments is neither truthful nor scientifically likely," and that "most of the experiments described in *Versuche* are to be considered fictitious."[28] However, the basis of such criticisms is now generally regarded as discredited, and there seems to be no real case to answer.[29] Mendel kept detailed notebooks of his observations, and recorded everything – even when the results did not fit neatly with his emerging theories.[30]

Mendel possessed a copy of Darwin's *Origin of Species*, and clearly realized that his own research explained one of the major difficulties facing Darwin's theory.[31] He marked the following passage with double lines in the margin. In Darwin's original English, this reads:[32] "The slight degree of variability in hybrids from the first cross or in the first generation, in contrast with their extreme variability in the succeeding generations, is a curious fact and deserves attention." As Mendel's most distinguished biographer pointed out, this curiosity would not remain mysterious for much longer: "Mendel must have felt some gratification in the thought that his theory was soon to explain this curious fact."[33] Mendel seems to have appreciated the importance of his own ideas to Darwin. Yet Darwin, as far as can be seen, never knew of Mendel's ideas, nor their far-reaching implications for his own theory.

[27] Ronald A. Fisher, *The Genetical Theory of Natural Selection*. Oxford: Clarendon Press, 1930.

[28] Frederico di Trocchio, "Mendel's Experiments: A Reinterpretation." *Journal of the History of Biology* 24 (1991): 485–519. For a response see Franz Weiling, "J. G. Mendel hat in der Darstellung seiner Erbsenversuche nicht gelogen." *Biologie in unserer Zeit* 4 (1995): 49–53.

[29] The best review in English is Daniel J. Fairbanks and Bryce Rytting. "Mendelian Controversies: A Botanical and Historical Review." *American Journal of Botany* 88 (2001): 737–52.

[30] Allan Franklin, *Ending the Mendel–Fisher Controversy*. Pittsburgh, PA: University of Pittsburgh Press, 2008, 6–7.

[31] More specifically, a copy of the second German edition of 1863, based on the third English edition of 1861. Only two passages are double-marked in this way.

[32] Charles Darwin, *On the Origin of Species by Natural Selection*. 3rd edn. London: John Murray, 1861, 296.

[33] Vítezslav Orel, *Gregor Mendel: The First Geneticist*. Oxford: Oxford University Press, 1996, 193.

Dawkins himself points out that things would have been very different if Darwin had had access to these results.[34] He suggests that "Mendel perhaps did not realize the significance of his findings, otherwise he might have written to Darwin."[35] I am inclined to suspect that he did realize the significance of his findings, as the unusually heavy marking of that passage from the *Origin of Species* indicates. Perhaps he felt that he had already done enough to publicize his results. After all, he was a monk, and hence perhaps disinclined to any further self-advertisement. In any case, his treatise was listed in several major British English-language sources by 1881.

Mendel had shown that inheritance seemed to be determined by certain "units" or "factors." But what where these units? This brings us to the discovery of the gene, an important event in its own right, and of fundamental importance to Dawkins' exposition of a Darwinian worldview.

## The Discovery of the Gene: Thomas Hunt Morgan

The significance of Mendel's ideas had been appreciated in the English-speaking world by the Cambridge geneticist William Bateson (1861–1926), who expended considerable effort in attempting to clarify the principles governing inherited characteristics or traits, including inventing the term "genetics" to designate the field of studies. Yet Bateson was strongly opposed to the suggestion that evolution could proceed by the accumulation of the small changes that Mendel's theory seemed to offer, and Darwin's theory seemed to require. Indeed, it is possible to argue that Bateson and his followers significantly impeded the synthesis of Darwinian evolution by natural selection and Mendelian genetics on account of their misgivings concerning its explanatory potency.[36]

By 1905, Bateson had established that certain traits were linked in some manner, although the pattern of coupling (later to be interpreted as "complete" and "incomplete" coupling) was far from clear. Bateson used a series of vague physical analogies – such as "coupling" and "repulsion" – in an ultimately unsuccessful attempt to explain his puzzling observations.[37]

[34] *A Devil's Chaplain*, 67–9.

[35] *The Selfish Gene*, 34.

[36] See the detailed analysis in Peter J. Bowler, *The Eclipse of Darwinism: Anti-Darwinian Evolution Theories in the Decades around 1900*. Baltimore, MD: Johns Hopkins University Press, 1983; Jean Gayon, *Darwinism's Struggle for Survival: Heredity and the Hypothesis of Natural Selection*. Cambridge: Cambridge University Press, 1998.

[37] Recent scholarship has suggested Bateson's ideas were more plausible than realized at the time: see Patrick Bateson, "William Bateson: A Biologist ahead of His Time." *Journal of Genetics* 81, no. 2 (2002): 49–58.

Bateson's writings suggest that he thought in terms of certain forces (analogous to magnetic or electrical forces) which were capable of attracting or repelling factors of genetic significance. In the end, the solution was set out in a seminal paper published by the American geneticist Thomas Hunt Morgan (1866–1945) in 1926.[38] The solution? The gene.

Excited by Mendel's ideas, Morgan had exploited the short reproductive cycle of the fruit fly *Drosophila melanogaster* to explore the transmission of heritable characteristics. Like Mendel, he chose to focus on some well-defined characteristic traits that occurred in pairs. The most famous of these was the color of the eyes. Noting the patterns of distribution of red and white eyes, Morgan modified Mendel's theory in an important respect: he argued that not all genetic traits are passed on independently, as Mendel had supposed. Instead, some genetic traits seemed to be linked, and are thus inherited together, rather than individually.

Morgan's most important conclusion concerned the "units" or "factors" which transmitted these traits, now known as "genes." It had been known for some time that the division of cells was accompanied by the appearance of tiny rod-shaped, threadlike structures, known as "chromosomes." Some had speculated that these chromosomes might be responsible for transmitting hereditary information. Morgan was able to provide overwhelming evidence that this was indeed the case. The "genes" responsible for transmitting this information were physically located on the chromosomes. As microscopes with increasing resolution were developed, it eventually became possible to confirm this visually.

Morgan's fruit flies had four unusually large chromosomes, which made them particularly easy to study microscopically. He discovered that there were four distinct groups of traits that appeared to be inherited together, corresponding exactly with the number of pairs of chromosomes observed in *Drosophila*. He also found that one of the four linkage groups had fewer characteristics than the other three. This seemed to tie in with the fact that one of the *Drosophila* chromosomes was smaller than the other three. While further work on the role in hereditary transmission of the chromosomes in the cell nucleus was still needed, a coherent picture was now beginning to emerge.

Morgan outlined his findings and assessed their significance in two papers published in the journal *Science* in 1910 and 1911. Morgan's chromosomal theory of heredity assumed that each chromosome contains a collection of small units called genes (a term he borrowed from the Danish

[38] The best study is still Garland E. Allen, *Thomas Hunt Morgan: The Man and His Science*. Princeton, NJ: Princeton University Press, 1978.

physiologist Wilhelm Johannsen who had been a colleague at Columbia University in 1909), with different genes having specific locations along specific chromosomes. The Mendelian notion of discrete hereditary factors could now be stated in terms of "genes." What has come to be known as the "neo-Darwinist" synthesis was now possible – Mendelian genetics as the basic explanation of evolutionary change, linked with the process of Darwinian natural selection as determining its outcome.[39]

One of the greatest achievements of the early scientific revolution of the seventeenth century was the "mathematization of nature." The growing realization that the deeper structures of nature could be represented mathematically was both a stimulus to scientific reflection,[40] and the cause of deeper reflection on why mathematics was so "unreasonably effective" in representing reality.[41] Unsurprisingly, many began to wonder if Darwin's basic ideas were capable of expressing mathematically. If Darwin was indeed the "Newton of the grassblade,"[42] might not mathematics prove as effective at uncovering the law governing the biological world as effectively as Newton had uncovered the laws of motion?

The first significant attempts to develop a mathematical theory of natural selection took place in the 1920s, predominantly through the formulation of theoretical population genetics by Ronald A. Fisher – whose criticisms of Mendel we noted earlier – although with important contributions from J. B. S. Haldane (1892–1964) and Sewall Wright (1889–1988).[43] It is possible to see Fisher's landmark work *Genetical Theory of Natural Selection* as "a kind of mathematical–Mendelian appendix to *The Origin of Species*."[44] Fisher, Haldane, and Wright developed sophisticated mathematical models of evolution which accounted for the manner in which mutations arise and spread through a population through natural selection. By about 1932, the first phase of the "evolutionary synthesis" was complete; the second phase was catalyzed by Theodosius Dobzhansky

[39] For Morgan's mature statement of this theory, see Thomas H. Morgan, *The Theory of the Gene*. New Haven, CT: Yale University Press, 1938.

[40] Joella G. Yoder, *Unrolling Time: Christiaan Huygens and the Mathematization of Nature*. Cambridge: Cambridge University Press, 1988.

[41] See the classic study of Eugene Wigner, "The Unreasonable Effectiveness of Mathematics." *Communications on Pure and Applied Mathematics* 13 (1960): 1–14.

[42] John F. Cornell, "Newton of the Grassblade? Darwin and the Problem of Organic Teleology." *Isis* 77 (1986): 405–21.

[43] The best studies are Alan Grafen, "Fisher the Evolutionary Biologist." *The Statistician* 52 (2003): 319–29; A. W. F. Edwards, "Mathematizing Darwin." *Behavioral Ecology and Sociobiology* 65, no. 3 (2011): 421–30. Grafen refers to Fisher as "Darwin's mathematician."

[44] A. W. F. Edwards, "The Genetical Theory of Natural Selection." *Genetics* 154 (2000): 1419–26.

(1900–75) on the publication in 1937 of his landmark book, *Genetics and the Origin of Species*, which offered an explanation of how species came into existence.

Yet further clarification was needed concerning the molecular basis of genetics. A decisive step forward was made in the United States during the Second World War – to which we now turn.

## The Role of DNA in Genetics

Morgan's discovery of the critical role of the chromosomes in genetics sparked new interest in their chemical composition. What were these threadlike fibers actually made of? The Swiss biochemist Friedrich Miescher (1844–95) established the chemical composition of cell nuclei in 1868. He determined that they contained two basic components – a nucleic acid (now known as deoxyribose nucleic acid, and universally known by its acronym DNA), and a class of proteins (now known as histones).[45] These nucleic acids were not regarded as particularly important biologically. Chemical studies suggested they were not very diverse and they had only a small number of components.

In 1938, the American biochemist Phoebus Levene (1869–1940), then working at the Rockefeller Institute in New York, discovered that DNA was basically a remarkably long polymer.[46] However, he took the view that this long polymer simply consisted of repeated units of four basic nucleotides: adenine (A), guanine (G), thymine (T), and cytosine (C). For this reason, many (including Levene himself) regarded DNA as highly unlikely to have any major role in the transmission of inherited characteristics. It was too simple chemically to encode genetic information. Many believed that the ultimate key to the molecular basis of genetics would lie in proteins found within the chromosomes.

As is so often the case, the key to solving this riddle came from an unexpected source. In 1928, the English bacteriologist Fred Griffith (1879–1941) was involved in investigating a pneumonia epidemic in London. While investigating the *pneumococcus* responsible for this outbreak, Griffith made the surprising discovery that live *pneumococci* could acquire genetic traits from other, dead *pneumococci* in a process he termed

[45] See Ralf Dahm, "Friedrich Miescher and the Discovery of DNA." *Developmental Biology* 278, no. 2 (2005): 274–88.

[46] For a brief assessment of Levene's significance, see Robert D. Simoni, Robert L. Hill, and Martha Vaughan, "The Structure of Nucleic Acids and Many Other Natural Products: Phoebus Aaron Levene." *Journal of Biological Chemistry* 277, no. 22 (2002): 23–4.

"transformation." But how could this be? All that the dead *pneumococci* could transmit were chemicals: specifically, two types of nucleic acid – ribonucleic acid (RNA) and deoxyribonucleic acid (DNA) – and protein. How could these bring about genetic change in living cells?

The importance of Griffith's work was not appreciated until a research team headed up by Oswald Avery (1877–1955) replicated his findings at the Rockefeller Institute in New York. Avery and his team began detailed studies of how genetic information was transmitted to living *pneumococci*. They conducted a series of experiments which demonstrated that genetic information was not mediated by proteins, or by RNA, but specifically by DNA.[47] This was a momentous discovery, even if it would be some time before its full implications were appreciated. If DNA – and no other substance – was the carrier of hereditary information, it must have a much more complex structure than had previously been appreciated. Yet nobody knew what this structure was, nor how DNA was able to play such a critical genetic role.

This gave new impetus to a remarkable series of studies. Rosalind Franklin (1920–58) undertook pioneering X-ray crystallography work on DNA, which did much to facilitate the ground-breaking work of the English physicist Francis Crick (1916–2004) and the American geneticist James Watson (b. 1928) demonstrating a double-helix structure for DNA.[48] This achievement was a remarkable physical discovery in itself. Yet it also opened the way to understanding how DNA could pass on genetic information. Watson and Crick immediately realized that the pairing of the bases in this double-stranded DNA had to be the key to its function as a replicator and as the transmitter of genetic information. They wrote: "It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material."[49] In other words, a knowledge of the physical structure DNA suggested a mechanism by which it could replicate itself.[50]

On the basis of this research, Crick proposed what he called the "Central Dogma" – namely, that DNA replicates, acting as a template for RNA, which in turn acts as a template for proteins. The long and complex DNA molecule

[47] Oswald Avery, Colin MacLeod, and Maclyn McCarty, "Studies on the Chemical Nature of the Substance Inducing Transformation of Pneumococcal Types: Induction of Transformation by a Desoxyribonucleic Acid Fraction Isolated from Pneumococcus Type III." *Journal of Experimental Medicine* 79 (1944): 137–58.

[48] Francis H. C. Crick and James D. Watson, "Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid." *Nature* 171 (1953): 737–8.

[49] Crick and Watson, "Molecular Structure of Nucleic Acids," 738.

[50] For a good introduction, see C. R. Calladine, *Understanding DNA the Molecule and How It Works.* 3rd edn. San Diego, CA: Elsevier Academic, 2004.

contains the genetic information necessary for transmission "encoded" using the four basic nucleotides: adenine (A), guanine (G), thymine (T), and cytosine (C) arranged in sequences of "base pairs" (in that adenine is always linked to thymine, and guanine to cystosine in the double-helix structure of DNA), attached to a sugar and phosphate spine. It is the sequence of these base pairs which determines the genetic information transmitted.[51]

So why is this so important for an understanding of evolutionary biology? The most important point to emphasize is that Darwin's theory of natural selection required variation to take place *and* to be transmitted, rather than diluted, to following generations. Natural selection would then take place, determining whether or not the genetic code for this variation would survive. The neo-Darwinian synthesis is grounded in the assumption that small random genetic changes (mutations) over long periods of time occasionally have positive survival value. Organisms possessing these favorable mutations should have relative advantage in survival and reproduction, and they will tend to pass their characteristics on to their descendants. Assuming that there are differential rates of survival, it is not difficult to see how a favorable characteristic can become established and transmitted.

The key point is that genetic variation takes place in nature, that the process of natural selection determines whether this variation survives, and that the process of genetic replication ensures that this variation is transmitted. Evolution thus proceeds by fixation of these rare beneficial variations, and the elimination of maladapted variations through the process of natural selection. This, however, still leaves open many of the problems of evolutionary biology. To give an example: at what level does natural selection take place? Is it at the level of genes themselves? Or of individual organisms which contain those genes? Or at the level of kin (closely related individuals) or groups? We shall consider these issues later in this work, as we engage with Dawkins' views on these themes.

## What's in a Name? "Darwinism" or "Evolutionary Theory"?

Many scientific theories are initially known by the names of their originators or chief advocates. A good example is "Copernicanism," a term that is used in a specifically *historical* sense to refer to the way of

[51] For further details see such works as Anthony J. F. Griffiths, *An Introduction to Genetic Analysis.* 7th edn. New York: Freeman, 2000; idem, *Modern Genetic Analysis: Integrating Genes and Genomes.* 2nd edn. New York: Freeman, 2002.

thinking about the solar system developed in the sixteenth century by Nicolaus Copernicus (1473–1543) and his immediate followers.[52] Yet the term "Copernicanism" refers to a theory which incorporates both the *correct* central heliocentric assumption, and the *incorrect* subsidiary assumption that all the planets orbit the sun in perfect circles at constant speeds.[53] The former assumption was subsequently affirmed, just as the second was corrected, by Johannes Kepler (1571–1630).[54] The term "Copernicanism" thus designates a particular model of the solar system, which includes some elements now considered to be correct, and others which are recognized as being wrong. Nobody uses the term "Copernicanism" any more to refer to the solar system. The debate has moved on.

So is the same also true of "Darwinism"? Nobody would deny the historical importance of Charles Darwin, whose works set out the theory of descent with modification through natural selection.[55] But should we continue to use the term "Darwinism" to refer to contemporary theories of biological evolution, when they have moved on so much?

Some writers would defend the continued use of the term in this sense. Jean Gayon argues that the term "Darwinism" acknowledges the manner in which Darwin has "constrained the conceptual and empirical development of evolutionary biology ever after."[56] Others, however, find the use of the term "Darwinism" deeply problematic.[57] Why should contemporary thinking about evolution be described in this manner? Evolutionary thought has moved on since Darwin. Surely "Darwinism" should be used in an essentially historical sense, to refer to the ideas that Darwin himself developed. As is well known, modern evolutionary biology has developed a range of ideas which are decidedly non-Darwinian – that is to say, ideas of which Darwin knew nothing. To speak of Darwinism is thus "grossly misleading," suggesting that Darwin was "the beginning

[52] See Liba Taub, *Ptolemy's Universe: The Natural Philosophical and Ethical Foundations of Ptolemy's Astronomy*. Chicago: University of Chicago Press, 1993.

[53] See Karoly Simonyi, *A Cultural History of Physics*. London: Peters, 181–5.

[54] See Carl D. Murray and Stanley F. Dermott, *Solar System Dynamics*. Cambridge: Cambridge University Press, 2001, 3–4. See further Bruce Stephenson, *The Music of the Heavens: Kepler's Harmonic Astronomy*. Princeton, NJ: Princeton University Press, 1994.

[55] See Peter J. Bowler, *Evolution: The History of an Idea*. 3rd edn. Berkeley, CA: University of California Press, 2003.

[56] Jean Gayon, "From Darwin to Today in Evolutionary Biology." In *The Cambridge Companion to Darwin*, edited by Jonathan Hodge and Gregory Radick, 240–64. Cambridge: Cambridge University Press, 2003, 241.

[57] Note the important concerns expressed in Eugenie Scott and Glenn Branch, "Don't Call It Darwinism." *Evolution: Education and Outreach* 2 (2009): 90–4.

and the end, the alpha and omega, of evolutionary biology," and that the subject changed little since the publication of the *Origin of Species*.[58] Evolutionary thought has moved far beyond the intellectual landscape originally envisaged by Darwin,[59] as a series of non-Darwinian processes – such as autopoiesis, self-organization, epigenetic mechanisms, and symbiosis – are now realized to play a significant role in the evolutionary process, considered as a whole.[60]

The modern approach to evolutionary theory, though grounded in Darwin's theory of natural selection, was initially supplemented with Mendelian genetics in the 1930s and 1940s, and subsequently by the development of mathematical systems allowing the modeling of evolution in populations in the 1940s and 1950s, and the emergence of an understanding of the molecular basis of evolution through the structures and function of RNA and DNA.[61] Continuing to talk about "Darwinism" merely fosters the inaccurate and unfortunate perception that the field stagnated for 150 years after Darwin's own day.

Historians have also raised concerns about the use of the term "Darwinism." For a start, historical research has made it clear that evolutionary thought had developed well before Darwin's time, with other writers having made signal contributions to the science. Using the term "Darwinism" perpetuates the historical myth of Darwin as a solitary genius, and fails to do justice to his intellectual context and dependencies. Without in any way denying Darwin's genius, it is essential to contextualize

[58] Olivia Judson, "Let's Get Rid of Darwinism." *New York Times*, July 15, 2008.

[59] For the continuous evolution of Darwinism, see David Depew and Bruce Weber, *Darwinism Evolving: Systems Dynamics and the Genealogy of Natural Selection*. Cambridge, MA: MIT Press, 1995; Evelyn Fox Keller, *Making Sense of Life: Explaining Biological Development with Models, Metaphors, and Machines*. Cambridge, MA: Harvard University Press, 2002; Timothy Shanahan, *The Evolution of Darwinism: Selection, Adaptation, and Progress in Evolutionary Biology*. Cambridge: Cambridge University Press, 2004, 11–36.

[60] Note the points made in Gregory L. Challis and David A. Hopwood, "Synergy and Contingency as Driving Forces for the Evolution of Multiple Secondary Metabolite Production by Streptomyces Species." *Proceedings of the National Academy of Sciences* 100 (2003): 14555–61.

[61] For an introduction to the core developments see Ted Everson, *The Gene: A Historical Perspective*. Westport, CT: Greenwood, 2007. See further Steven A. Frank, "The Price Equation, Fisher's Fundamental Theorem, Kin Selection, and Causal Analysis." *Evolution* 51 (1997): 1712–29. The importance of information theory should also be noted: Jeffrey S. Wicken, *Evolution, Thermodynamics, and Information: Extending the Darwinian Paradigm*. Oxford: Oxford University Press, 1987; Hubert P. Yockey, *Information Theory, Evolution, and the Origin of Life*. Cambridge: Cambridge University Press, 2005; Steven A. Frank, "Natural Selection Maximizes Fisher Information." *Journal of Evolutionary Biology* 22 (2009): 231–44.

Darwin against the backdrop of evolutionary thought at the time.[62] Critics point out that the predominance and narrow focus of English-language scholarship has led to Darwin being given a position of privilege which marginalizes, often to the point of ignoring, the significant pre-Darwinian discussions in France, Germany, and Italy which helped bring about the revolutionary change in thinking from a static understanding of biological organisms to the dynamic, evolutionary viewpoint that is now taken for granted.[63] Darwin was unquestionably a major influence in bringing about this revolution; he cannot, however, be seen as its sole originator.

And what about Mendel? As we have seen, the work of Fisher and others demonstrated the critical importance of Mendel's ideas as an integral part of evolutionary thought. To use the exclusivist term "Darwinism" is to deny Mendel his fundamental place in the development of the science of evolution.

One possible solution to the dilemma is to use the label "neo-Darwinism," thus indicating both the origins of some core themes of modern evolutionary biology, while at the same time acknowledging their significant modification and amplification through subsequent research. Yet this is only one such way of designating this modification of Darwin's ideas; others which have achieved wider currency – such as the "evolutionary synthesis," "modern synthesis," the "modern evolutionary synthesis," or the "new synthesis" – avoid mentioning Darwin by name.[64] As pressure grows for modification of at least some of the elements of this evolutionary synthesis,[65] the value of the term "neo-Darwinism" seems increasingly fragile.

Modern evolutionary biologists now tend to use the term "Darwinism" rarely, except in a historical sense to designate Darwin's formative ideas.[66] The term "Darwinian" is now often used to refer to the historically

[62] See for example Pietro Corsi, *Evolution before Darwin*. Oxford: Oxford University Press, 2010.

[63] See the important discussion in Pietro Corsi, "Before Darwin: Transformist Concepts in European Natural History." *Journal of the History of Biology* 38 (2005): 67–83.

[64] A work which had an important influence on shaping the vocabulary of the field was Julian S. Huxley, *Evolution: The Modern Synthesis*. London: Allen and Unwin, 1942.

[65] See for example Ulrich Kutschera and Karl J. Niklas, "The Modern Theory of Biological Evolution: An Expanded Synthesis." *Naturwissenschaften* 91 (2004): 255–76; Massimo Pigliucci, "Do We Need an Extended Evolutionary Synthesis?" *Evolution* 61 (2007): 2743–9; Sean B. Carroll, "EvoDevo and an Expanding Evolutionary Synthesis: A Genetic Theory of Morphological Evolution." *Cell* 134 (2008): 25–36.

[66] For comment see David L. Hull, "Darwinism as a Historical Entity: A Historiographic Proposal." In *The Darwinian Heritage*, edited by David Kohn, 773–812. Princeton, NJ: Princeton University Press, 1985.

significant issue of Darwin's personal views, irrespective of the subsequent direction of the discussion about evolution.[67] A survey of the literature suggests that most modern biologists, when speaking about present-day understanding of evolutionary biology, tend to speak about "the theory of evolution" or "evolutionary biology," rather than "Darwinism." It is certainly true that Darwin's three core principles of variation, inheritance, and selection remain significant to modern evolutionary theories; nevertheless, these are now supplemented with additional notions.[68]

Some have therefore drawn the conclusion that the continuing use of the term "Darwinism" to epitomize modern evolutionary biology is as anachronistic as using "Copernicanism" to designate contemporary cosmology. The terms designate important turning points in the history of the disciplines, in the course of which at least some elements of today's thinking were developed. These have, of course, been supplemented (and modified) by many others since then. So why not abandon it, in favor of one of the many superior alternatives? There seems no obvious scientific reason for retaining it. As times passes, it is inevitable that increasing historical distance from Darwin will weaken the links between his specific formulation of the evolutionary process, and contemporary understandings of the field.[69] The use of "Darwinism" to refer to evolutionary biology as this is presently understood would seem at least unnecessary, and probably unwise.

So why retain the use of the term in this book? In part, the answer lies in Dawkins' development of the idea of "Universal Darwinism." One of Dawkins' more important contributions to the public discussion of the significance of evolutionary thought is his argument that what he terms "Universal Darwinism" represents a justified extension of Darwin's approach from the biological to the cultural domain. In developing Darwin in this way, Dawkins and others have initiated an important cultural and historical debate over the cultural authority and character of Darwinism.[70] Is Darwinism to be seen as a provisional scientific theory,

[67] Momme von Sydow, *From Darwinian Metaphysics towards Understanding the Evolution of Evolutionary Mechanisms*. Göttingen: Universitätsverlag Göttingen, 2012, 102–3.

[68] For the question of the whether a unifying narrative may be offered of the development of evolutionary theories, see Vassiliki B. Smocovitis, *Unifying Biology: The Evolutionary Synthesis and Evolutionary Biology*. Princeton, NJ: Princeton University Press, 1996, 97–188.

[69] See for example Jerry A. Fodor and Massimo Piattelli-Palmarini, *What Darwin Got Wrong*. New York: Farrar, Straus and Giroux, 2010, 95–137.

[70] There are important anticipations of this development in the writings of John Dewey: see for example John Dewey, *The Influence of Darwin on Philosophy and Other Essays*. New York: Holt, 1910, 1–26.

which has limited relevance to a broader cultural agenda? Or is it to be seen as a worldview, like Marxism, which, if correct, has major implications for a much broader cultural and social agenda?[71] Is it, as Dawkins asserts, a "universal truth?" Although this debate can be tracked back to the publication of Darwin's *Origin of Species* itself,[72] it remains important today. For some, including Dawkins, the term "Darwinism" designates a worldview, a metanarrative. For this reason, we shall continue to use the term "Darwinism" in this work, despite the concerns noted in this section.

At this point, we have laid the groundwork for a proper engagement with Richard Dawkins' important contributions to evolutionary thought, and the relation of science and faith. In the next chapter, we shall explore the significance of Dawkins' landmark work *The Selfish Gene*.

[71] This has been a major theme in the writings of John C. Greene: see especially his *Darwin and the Modern World View*. Baton Rouge, LA: Louisiana State University Press, 1961.

[72] See for example Ernst Cassirer, "Darwinism as a Dogma and as a Principle of Knowledge." In *The Problem of Knowledge: Philosophy, Science, and History since Hegel*, 160–75. New Haven, CT: Yale University Press, 1950.

# 2

# The Selfish Gene
## *A Darwinian View of the World*

*The Selfish Gene*, published by Oxford University Press in 1976, established Dawkins' reputation both as an original thinker and as a scientific popularizer and communicator. Alongside a series of beautiful analogies and lucid explanations of Darwinian orthodoxy, Dawkins introduced fresh insights, many of which have stood the test of time well. A good example is Dawkins' emphasis on so-called "outlaw" genes, such as segregation-distorters and transposons, which spread despite their negative effects on the host organism's fitness.[1] These "outlaws" or "selfish genetic elements" (SGEs) are now recognized as being more common and significant than was originally realized,[2] and have become one of the strongest arguments for the utility of the "gene's-eye view" advocated by Dawkins in this seminal work.

Is this enough to account for the success of *The Selfish Gene*? Perhaps. Yet some have suggested that the work needs to be viewed against a cultural backdrop, which created an interest in its ideas transcending their scientific significance. Dawkins seemed to some to advocate a view of human beings as collections of "selfish genes," lending moral credibility to individualist political ideologies such as those of Ronald

[1] Dawkins develops this idea primarily in chapter 8 of *The Extended Phenotype*, which can be seen as an extension of the approach set out in *The Selfish Gene*. See Kim Sterelny and Paul Griffiths, *Sex and Death: An Introduction to Philosophy of Biology*. Chicago: University of Chicago Press, 1999, 55–75.

[2] See Gregory D. D. Hurst and John H. Werren, "The Role of Selfish Genetic Elements in Eukaryotic Evolution." *Nature Reviews Genetics* 2 (2001): 597–606; Austin Burt and Robert Trivers, *Genes in Conflict: The Biology of Selfish Genetic Elements*. Cambridge, MA: Belknap, 2006.

*Dawkins' God: From The Selfish Gene to The God Delusion*, Second Edition.
Alister E. McGrath.
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Reagan and Margaret Thatcher who argued that greed was good for society.[3] Frans de Waal famously saw *The Selfish Gene* as lending weight to the neoliberal ideology that pervaded western thought in the final quarter of the twentieth century. "*The Selfish Gene* taught us that since evolution helps those who help themselves, selfishness should be looked at as a driving force for change rather than a flaw that drags us down."[4] Perhaps Dawkins' ideas did chime in with wider cultural concerns and debates; yet for most, the appeal of *The Selfish Gene* lay primarily in its scientific ideas, irrespective of their deeper resonances with the cultural emphases of the late 1970s.

Yet before we begin to explore the ideas of this work in greater detail, we must first introduce its author.

## Introducing Dawkins

Clinton Richard Dawkins was born in Kenya on March 26, 1941, the son of Clinton John and Jean Mary Vyvyan Dawkins.[5] On his return to the United Kingdom from Nyasaland (now Malawi) in 1949, Dawkins attended Chafyn Grove School in the English cathedral city of Salisbury, before moving north to study at Oundle School, near Peterborough, from 1954 to 1959. Dawkins' religious background at this time was traditional Anglicanism, although he hints that he was intrigued in his youth by the ideas of the French Jesuit palaeontologist Pierre Teilhard de Chardin concerning the relation of evolution and spirituality.[6] Dawkins recalls that he "retained a strong belief in some sort of unspecified creator," mainly because he "was impressed by the beauty and apparent design of the living world."[7]

Dawkins attributes his loss of faith to two intellectual developments. The first was his growing realization that "Darwin provided the magnificently powerful alternative to biological design which we now know to be true."[8] This is a recurrent theme in Dawkins' later writings:

[3] See Marek Kohm, "To Rise Above." In *Richard Dawkins: How a Scientist Changed the Way We Think*, edited by Alan Grafen and Mark Ridley, 248–54. Oxford: Oxford University Press, 2006; Mary Midgley, *The Solitary Self: Darwin and the Selfish Gene*. Durham: Acumen, 2010.

[4] Frans de Waal, *Our Inner Ape: The Best and Worst of Human Nature*. London: Granta, 2006, 21.

[5] Dawkins provides details of his early family life in British colonial Africa in *An Appetite for Wonder*, 1–69.

[6] *A Devil's Chaplain*, 196.

[7] *An Appetite for Wonder*, 140–1.

[8] *An Appetite for Wonder*, 141.

Darwinism offers a superior explanation of what is observed in the biological world than a "non-denominational creator god." The second is his belief that there is an "elementary fallacy" within any argument from design, in that "any god capable of designing the universe would have needed a fair bit of designing himself." We shall consider this point later in this book.

After Oundle, Dawkins went up to Balliol College, Oxford University, to study zoology in 1959. He initially applied to read biochemistry, but was offered a place to read zoology instead. After graduating in 1962, Dawkins went on to undertake research with the Animal Behaviour Research Group at 13 Bevington Road, an annex of Oxford University's Department of Zoology, under the supervision of Professor Niko Tinbergen (1907–88), who subsequently won the Nobel Prize in Medicine and Physiology in 1973.[9] Tinbergen and his Austrian colleague Konrad Lorenz (1903–89) pioneered the discipline of ethology – the study of whole patterns of animal behavior in natural environment, stressing the analysis of adaptation and the evolution of patterns. Although Lorenz may be argued to have laid the conceptual foundations for the discipline in the 1930s, Tinbergen's patient and detailed observational work is widely credited with its later conceptual and practical development, especially through his landmark work *The Study of Instinct* (1951).[10] Dawkins' doctoral thesis, entitled "Selective Pecking in the Domestic Chick," stands firmly within this tradition. Its subject was tight and well-defined: what mechanism may be proposed to account for the way in which a chick pecks at the stimuli around it?

Dawkins relates how his research was inspired by a lecture he had heard from Professor N. S. Sutherland (1927–98), who left Oxford in 1964 to establish the Laboratory of Experimental Psychology at the recently founded University of Sussex. His work focused on developing a "Threshold Model" which might account for a detailed series of experimental observations concerning the timing and orientation of chick pecks at small hemispherical spots, presented in pairs. His data was processed using an Eliot 803 machine – an early computer, which relied on punched tape for its data. The thesis was submitted in June 1966, and accepted later that year.

[9] For Dawkins' memories of this period, see *An Appetite for Wonder*, 171–201.

[10] For a critical yet appreciative account of Tinbergen, see Hans Kruuk, *Niko's Nature: The Life of Niko Tinbergen, and His Science of Animal Behaviour*. Oxford: Oxford University Press, 2003. For Dawkins' brief personal reflections on Tinbergen's significance, originally given as the opening remarks to a day conference at Oxford on Tinbergen's legacy on March 20, 1990, see Richard Dawkins, "Introduction." In *The Tinbergen Legacy*, edited by M. S. Dawkins, T. R. Halliday, and R. Dawkins, ix–xii. London: Chapman & Hall, 1991.

Dawkins then spent a further year at Oxford doing postdoctoral research, along with some lecturing in the Department of Zoology. Tinbergen was on sabbatical leave during the academic year 1966–7, and asked Dawkins to cover some of his lectures, while at the same time writing up his thesis for publication.[11] Mike Cullen, one of Dawkins' colleagues in the Animal Behaviour Research Group at Bevington Road, had read W. D. Hamilton's two papers of 1964 setting out his theory of kin selection, including the question of how certain apparently cooperative forms of behavior arise.[12] Hamilton's ideas found a receptive audience within the research group.

Encouraged by Cullen, Dawkins decided to use these lectures to explore some aspects of Hamilton's theory of "kin selection." An individual behaves in such a way that the reproductive capacity of another individual is enhanced, even to own detriment of its own selective capacity. The phenomenon may be observed in aspects of the social, parental, and mating behavior of animals. So how could this have evolved?

Dawkins came to the conclusion that the "most imaginative way of looking at evolution, and the most inspiring way of teaching it" was to see the entire process from the perspective of the gene. In his typewritten lecture notes from 1966, Dawkins set out some core themes of his approach:

> Genes are in a sense immortal. They pass through the generations, reshuffling themselves each time they pass from parent to offspring. The body of an animal is but a temporary resting place for the genes; the further survival of the genes depends on the survival of that body at least until it reproduces and the genes pass into another body. . . To use the terms "selfish" and "altruistic," then, our basic expectation on the basis of the orthodox neo-Darwinian theory of evolution, is that *Genes will be selfish.*[13]

The genes, for their own good, are "manipulating" and directing the bodies that contain them, and carry them about. Throughout his writings, Dawkins has developed the rhetoric of a gene's-eye view of things – not

[11] Richard Dawkins, "The Ontogeny of a Pecking Preference in Domestic Chicks." *Zeitschrift für Tierpsychologie* 25 (1968): 170–86; idem, "A Threshold Model of Choice Behaviour." *Animal Behaviour* 17 (1969): 120–33.

[12] The key paper was published in two parts in 1964: William Hamilton, "The Genetic Evolution of Social Behaviour." *Journal of Theoretical Biology* 7 (1964): 1–16; 17–52. For a helpful account of "Hamilton's Rule," see Alan Grafen, "A Geometric View of Relatedness." In *Oxford Surveys in Evolutionary Biology*, edited by R. Dawkins and M. Ridley, 28–89. Oxford: Oxford University Press, 1985.

[13] Typewritten text of 1966 reproduced in *An Appetite for Wonder*, 200. Emphasis in original.

simply of the individual, but of the entire living world. Organisms can be reduced to genes, and genes to digital (not analogue) information.

> Life is just bytes and bytes of bytes of digital information. Genes are pure information – information that can be encoded, recoded and decoded, without any degradation or change of meaning … We – and that means all living things – are survival machines programmed to propagate the digital database that did the programming. Darwinism is now seen to be the survival of the survivors at the level of pure, digital, code.[14]

In effect, Dawkins was arguing that we should extrapolate from Hamilton's theory of kin selection, and apply it to every aspect of social behavior. Animals were to be seen as "machines carrying their instructions around" with them, using their every aspect as "levers of power to propel the genes into the next generation." Evolution is about the survival of the information in the genes of the individual. Individuals are of relevance to the genes; they are useful containers of the genetic code, but are in the final analysis expendable. Because kin groups share the same genes, the sacrifice of an individual may still increase the likelihood of those genes surviving within the gene group as a whole. Dawkins can be regarded as the first, and perhaps still the most systematic, ethologist of the gene. It is this central theme which has been so decisive to his way of seeing the world, and we shall explore it in much greater detail presently.

From Oxford, Dawkins went on to become Assistant Professor of Zoology at the University of California at Berkeley in 1967, returning to Oxford as Lecturer in Zoology and Fellow of New College in 1970. The return to Oxford was the result of a personal approach by Tinbergen, who wanted Dawkins to apply for a university lectureship in animal behavior, linked to a fellowship at New College. At the last minute, Tinbergen switched his support to another candidate, Colin Beer, who gained the position. However, Tinbergen had research funds at his disposal, and was able to fund Dawkins' return to Oxford. Yet Beer was not happy in Oxford. His wife had held a professorship in the United States, and it became clear that Oxford did not provide her with a satisfactory academic base. A year later, Beer returned to the United States, and the lectureship was re-advertised. Dawkins duly applied, this time with Tinbergen's support, and was appointed to the position. It was during this time that his most influential and creative works were published, including *The Selfish Gene* and *The Blind Watchmaker*.

In 1995, Dawkins was promoted to a new academic position at Oxford University, made possible by the generosity of Charles Simonyi, then one

[14] *River out of Eden*, 19.

of the Microsoft Corporation's foremost software architects, who went on to co-found the Intentional Software Corporation in August 2002. Simonyi had no doubts about who he wanted to occupy this new position in the public understanding of science. Dawkins was duly appointed as the first "Charles Simonyi Reader in the Public Understanding of Science." Oxford University announced this development as follows:

> Dr Charles Simonyi has offered the University a munificent benefaction for the endowment of a Professorship of the Public Understanding of Science. The following statute, and the decree to be made by Council if the statute is approved, formally accept the benefaction on the conditions agreed with Dr Simonyi, establish the Charles Simonyi Professorship of the Public Understanding of Science, and provide in the first instance for the immediate appointment of Dr C. R. Dawkins to a Charles Simonyi Readership in the Public Understanding of Science.[15]

A further advance in his professional standing took place a year later in July 1996 following the 1995–6 Oxford University "Recognition of Distinction" exercise, as a result of which the University conferred on Dawkins the additional *ad hominem* title of "Professor of the Public Understanding of Science."[16] The primary criterion for the award of the title of professor under the "Recognition of Distinction" procedure at that time was that "research must be of outstanding quality, have led to a significant international reputation, and be comparable in distinction with that expected of a professor in other major research universities." In its official publications subsequent to 1996, Oxford referred to Dawkins as the "Simonyi Reader, and Professor of the Public Understanding of Science."[17] He was made a Fellow of the Royal Society – the supreme accolade for a British scientist – in May 2001, and retired from the Simonyi Readership in September 2008, having reached the statutory retirement age of sixty-seven.

Yet alongside his professional career as Oxford's Professor of the Public Understanding of Science, Dawkins pursued a second vocation as an atheist apologist, culminating in his 2006 bestseller, *The God Delusion*. Dawkins' understanding of the natural sciences played a critically important role in

[15] *Oxford University Gazette*, October 12, 1995. Dawkins' appointment to the Simonyi readership was confirmed in the *University Gazette* on January 18, 1996, with effect to the mandatory retiring age of sixty-seven.

[16] *Oxford University Gazette,* Supplement (2) to *Gazette* 4408, July 22 1996.

[17] E.g., see *Oxford University Calendar 2003–4*. Oxford: Oxford University Press, 2003, 77. These details were confirmed by Oxford University on October 26, 2012 in response to a request made under the Freedom of Information Act.

his strident advocacy of atheism.[18] For this reason, we shall be looking at his approach in some detail in the final chapter of this work. For many scholars, including the present writer, Dawkins is the most influential and important advocate of a "scientific atheism," one of the most interesting developments in modern western culture.[19]

But this is to rush ahead of our narrative. We need to begin with the book that propelled Dawkins to international fame – *The Selfish Gene* (1976). In what follows, we shall tell the story of how this landmark book came about, and explore some of its themes.

## Dawkins' Approach: The Selfish Gene

In 1973, Dawkins was settled in Oxford University's Department of Zoology, doing research on the songs of Pacific field crickets.[20] Industrial discontent was widespread in the United Kingdom at this time. On January 1, 1974, the British government implemented the "Three-Day Work Order," introducing a three-day working week, intended to reduce the commercial use of electricity to three consecutive days a week, and thus conserve dwindling coal stocks. This significant reduction in electricity supplies inevitably impacted on scientific research at Oxford. Unable to carry out research throughout the week, Dawkins decided to make good use of this enforced spare time. He would write his first book. The portable typewriters of that day required no electricity, so there was no problem in getting on with this when electricity was not available. Dawkins had already mapped out the leading themes of the work; it was just a question of getting them down on paper.

So what were the key ideas developed in this work? Perhaps Alan Grafen comes closest to capturing the essence of the work: it was a fresh expression of the "fundamental logic of Darwinism" which showed how the gene's-eye approach "brought all the existing theory into coherence with it."[21] For Dawkins, the most satisfying rationale of the evolutionary process is framed in terms of gene lineages. The changes required for

[18] See Alister E. McGrath, "Evidence, Theory, and Interpretation: The 'New Atheism' and the Philosophy of Science." *Midwest Studies in Philosophy* 37 (2013): 179–89.

[19] For its history, see Thomas Dixon, "Scientific Atheism as a Faith Tradition." *Studies in History and Philosophy of Science C 33* (2002): 337–59.

[20] For Dawkins' account of this period, see *An Appetite for Wonder*, 257–84.

[21] Alan Grafen, "The Intellectual Contribution of *The Selfish Gene* to Evolutionary Theory." In *Richard Dawkins: How a Scientist Changed the Way We Think*, edited by Alan Grafen and Mark Ridley, 66–74. Oxford: Oxford University Press, 2006, 73.

evolution to develop take place very slowly. The life of an individual organism, or a group of organisms, is small in comparison with the time required for these changes to come about. This demands a stable and very long-term unit of genetic transmission – and only gene lineages can satisfy this condition. As Richard Alexander pointed out, "genes are the most persistent of all living units, hence on all counts the most likely units of selection."[22] For Dawkins, evolution is therefore the struggle of gene lineages to replicate.

> [The gene] does not grow senile; it is no more likely to die when it is a million years old than when it is only a hundred. It leaps from body to body down the generations, manipulating body after body in its own way and for its own ends, abandoning a succession of mortal bodies before they sink in senility and death. The genes are the immortals, or rather, they are defined as genetic entities that come close to deserving the title.[23]

While individual DNA molecules might survive for little more than months, their ability to replicate themselves means that any given DNA molecule "could theoretically live on in the form of *copies* of itself for a hundred million years."[24] In contrast, the individual organisms or groups of organisms are short-lived, and do not extend over the time-scales necessary to perpetuate the changes that slowly accumulate over extended lengths of time. "Genetically speaking, individuals and groups are like clouds in the sky or dust-storms in the desert. They are temporary aggregations or federations. They are not stable through evolutionary time."[25] Only genes have sufficient permanence to function as units of selection, Dawkins argued; organisms and their phenotypes are merely temporary manifestations or embodiments of something more fundamental. Everything, therefore, depends on the gene.

In the second edition of *The Selfish Gene*, Dawkins acknowledges that a similar idea is "implicit" in the writings of R. A. Fisher.[26] My own reading of Fisher's classic *Genetical Theory of Natural Selection* (1930) leads me to suggest that it is fairly explicit, as the following citation indicates: "To put the matter in another way, each gene is constantly tending to create genetic situations favourable to its own survival, so that an increase in

[22] Richard D. Alexander, *Darwinism and Human Affairs*. London: Pitman, 1980, 38.
[23] *The Selfish Gene*, 34.
[24] *The Selfish Gene*, 35.
[25] *The Selfish Gene*, 34.
[26] *The Selfish Gene*, ix.

numbers due to any cause will in its turn react favourably upon the selective advantage which it enjoys."[27] So how do genetic changes come about? Is there not, on the face of it, an obvious and fatal contradiction between Dawkins' emphasis upon the "high copying-fidelity" of replicators, and the appearance of change? If replicators transmit digital information so accurately, how can change come about? Surely the fidelity of transmission points to a static, not dynamic, situation?

It is an important question, which might seem to raise formidable difficulties. Certain species do indeed seem to have undergone relatively little development over huge periods of time – for example, oysters and the *Ginkgo* tree seem to have changed relatively little over the last 150 million years.[28] Yet changes do occur. Indeed, such "mutations" are the "ultimate raw materials for evolution."[29] In his *Chance and Necessity* (1971), the French Nobel laureate Jacques Monod (1910–76) set out the basic consensus within molecular biology. Monod pointed out that genetic mutations can be observed in the laboratory. Rare, spontaneous mutations are observed in populations of *Drosophila* or other model organisms; others can be induced at random through using mutagens, such as certain chemicals or radiation. Such mutations could also be expected to arise over time in nature itself – accidentally, unpredictably, and for a variety of reasons. But once these (generally small) changes are "incorporated in the DNA structure, the accident – essentially unpredictable because always singular – will be mechanically and faithfully replicated and translated."[30] The outcomes of these genetic mutations are then passed on within the evolutionary process, which acts as a "filter," determining whether they and their genetic codes survive. Most do not. "The replicative system, far from being able to eliminate the microscopic perturbations by which it is inevitably beset, knows only how to register and offer them – almost always in vain – to the teleonomic filter by which their performance is finally judged through natural selection."[31]

Dawkins does not endorse Monod's emphasis on the decisive role of "blind chance." While recognizing that many had indeed drawn the

[27] R. A. Fisher, *The Genetical Theory of Natural Selection*. 2nd edn. New York: Dover, 1958, 102–3. For a rigorous analysis of the material, see A. W. F. Edwards, "R. A. Fisher's Gene-Centred View of Evolution and the Fundamental Theorem of Natural Selection." *Biological Reviews* 89 (2014): 135–47.

[28] See Zhiyan Zhou and Shaolin Zheng. "The Missing Link in Ginkgo Evolution." *Nature* 423 (2003): 821–2.

[29] George Gaylord Simpson, *Life: An Introduction to Biology*. London: Thompson, 1965, 430.

[30] Jacques Monod, *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*. New York: Knopf, 1971, 114.

[31] Monod, *Chance and Necessity*, 118.

conclusion that Darwinism was a "theory of chance," Dawkins insisted that this was a misrepresentation of the situation. "Chance is a minor ingredient in the Darwinian recipe, but the most important ingredient is cumulative selection which is quintessentially *non*-random."[32] Evolution can thus be seen as the outcome of the non-random survival of randomly varying replicators, with the emphasis placed upon the regularity of selection rather than the happenstance of variation. Random changes in DNA give rise to new organisms, which reproduce and are subject to the pressure of natural selection. "Core Darwinism" could thus be defined as the "minimal theory that evolution is guided in adaptively non-random directions by the nonrandom survival of small random hereditary changes."[33]

So what about individual organisms, or groups? Although a hasty reading of Dawkins might suggest that evolution is conceived in purely molecular terms, involving only a silent and invisible competition between genes, it soon becomes clear that he avoids any such absurdity. In that organisms are the "vehicle" by which genes are passed on, the capacity of the organism to survive and reproduce becomes of immense importance. The process of selection is not competition between genes *per se* (how could that happen?), but takes places at the level of intermediaries: namely, the "vehicles" which bear or embody those genes. "A monkey is a machine that preserves genes up trees, a fish is a machine that preserves genes in the water; there is even a small worm that preserves genes in German beer mats."[34] These "gene survival machines" reproduce their genes, and die; it is the *genes* that survive, not the vehicles. Bodies provide "what it takes to propagate genes" and may thus properly be regarded as "engines of gene propagation." This distinction could be formalized in terms of the *replicators* and *vehicles* – that is, between small genetic units ("genes") themselves, and the higher-level entities (typically organisms, but sometimes a family of genetically related organisms) which transmit those genes onward in the evolutionary process.[35]

In *The Selfish Gene*, Dawkins offered what might be called an "ethology of the gene" – although genes cannot really be said to "behave" or "act" – which

[32] *The Blind Watchmaker*, 49.

[33] *A Devil's Chaplain*, 81. This does not, by the way, imply that all evolutionary change is adaptive.

[34] *The Selfish Gene*, 21.

[35] Richard Dawkins, "Replicators and Vehicles." In *Current Problems in Sociobiology*, edited by King's College Sociobiology Group, 45–64. Cambridge: Cambridge University Press, 1982. Other evolutionary biologists use different terminology: for example, David Hull prefers to speak of "interactors" and "replicators." See David L. Hull, *Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science*. Chicago: University of Chicago Press, 1990.

shifted the emphasis away from individual animals, or groups of animals, as the unit of evolution to the nature of the genes themselves. This "gene's-eye view of the world" regards an individual organism as a "survival machine," a "passive receptacle for genes," or a "colony of genes." Dawkins stresses that this is not to suggest that such organisms have no individuality of their own; his point is that these individual characteristics are genetically determined, and hence contribute to whether that lineage of genes will be successful or not. We must "deeply imbibe the fundamental truth that an organism is a tool of DNA rather than the other way round."[36] Evolution thus occurs when genetically caused traits are passed on to the next generation.

So what is a gene? Here, we encounter a number of widely acknowledged difficulties. The term is capable of being defined or visualized in quite different ways.[37] As Dawkins rightly points out, the molecular biologist's "gene" is not the same as the "gene" of the gene's-eye theorist.[38] The former refers to a length of DNA that codes for a protein, the latter for a strand of DNA that survives meiosis intact. In a classic paper, Seymour Benzer offered an essentially molecular definition of the concept,[39] which attempted to bridge the gap between the classic view of the gene as an indivisible unit of genetic information, and the newly discovered physical structure of DNA, which showed that the molecular basis of genetics consisted of a sequence of nucleotides. Dawkins is fully aware of this meaning of the term, but points out that it is perfectly acceptable to conceptualize the "gene" in terms of the unit involved in creating a Darwinian adaptation. His definition, borrowed from George C. Williams, is as follows: "any portion of chromosomal material that potentially lasts for enough generations to serve as a unit of natural selection."[40] It is a functional definition, but is perfectly acceptable, despite the grumblings of population geneticists. However, it does lead to a troubling degree of circularity, in that it makes it almost true by definition that the gene is the unit of selection.

[36] *The Extended Phenotype*, 239.

[37] See André Pichot, *Histoire de la notion de gène*. Paris: Flammarion, 1999; Peter J. Beurton, Raphael Falk, and Hans-Jörg Rheinberger, eds., *The Concept of the Gene in Development and Evolution: Historical and Epistemological Perspectives*. Cambridge: Cambridge University Press, 2000; Helen Pearson, "Genetics: What Is a Gene?" *Nature* 441, no. 7092 (2006): 398–401.

[38] For Dawkins' response to further discussion of this and other points, see Richard Dawkins, "Extended Phenotype—but Not Too Extended. A Reply to Laland, Turner and Jablonka." *Biology and Philosophy* 19 (2004): 377–96.

[39] Seymour Benzer, "The Elementary Units of Heredity." In *The Chemical Basis of Heredity*, edited by W. D. McElroy and B. Glass, 70–93. Baltimore, MD: Johns Hopkins University Press, 1957.

[40] *The Selfish Gene*, 28.

Williams himself wasn't entirely happy about this definition.[41] Dawkins, he argued, defined a replicator in such a way that it had to be conceived "as a physical entity duplicating itself in a reproductive process." While not necessarily disagreeing with this, Williams suggested that Dawkins "was misled by the fact that genes are always identified with DNA." For Williams, it was essential to be clear that the DNA molecule was the medium, not the message: the gene is "a package of information, not an object." Williams himself insisted that not all genes are evolutionary, if one defines an evolutionary gene as "any inherited information for which there is a favorable or unfavorable selection bias equal to several or many times its rate of endogenous change."[42]

How does this work in practice? Perhaps the easiest way is to take a case study. Let's imagine a lion. The faster it can run, the more likely it is to survive – partly because it can outrun its prey, and hence ensure its food supply. Let's imagine that a genetic mutation takes place leading to a lion appearing with superior running skills. The local lion population now has two different kinds of lion: the ones with the new mutation, and the old ones without it. To begin with, they exist side by side. But the lions possessing this mutation have a greater capacity to survive, and hence pass their characteristics on to later generations through the gene – that is, whatever it is that caused this mutation in the first place.[43]

So how are these genetic mutations expressed in living organisms? At this point, we need to draw a distinction between the *gene* (or "genotype") as the "internally coded, inheritable information" carried by all living organisms, used as a "blueprint" or set of instructions for building and maintaining a living creature; and the *phenotype*, as the outward, physical manifestation of the organism – the visible characteristics or behavior which result from the interaction of an organism's genetic blueprint and the environment. Dawkins argues that the gene is the unit of selection, in that it exerts phenotypic effects on the organism – for example, the sharpness of its claws, the nature of its metabolism, or the strength of its leg muscles. Successful genes are those that cause phenotypic effects which promote their survival.

[41] George C. Williams, "A Package of Information." In *The Third Culture*, edited by John Brockman, 38–50. New York: Simon & Schuster, 1995.

[42] George C. Williams, *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought*. Princeton, NJ: Princeton University Press, 1966, 25.

[43] It must be noted at this point that Dawkins' proposal is much more adept at accounting for the modification of the characteristics of existing species than for the generation of new species. See Steven Rose, "The Rise of Neurogenetic Determinism." In *Consciousness and Human Identity*, edited by John Cornwell, 86–100. Oxford: Oxford University Press, 1998.

Dawkins took this a stage further through his ideas of an "extended phenotype."[44] He pointed out that the effects of the gene were not limited to physical characteristics of the individual organism, but extended to their environment. Bower birds construct grass structures within which to mate. Those species of bower birds with especially bright plumage tend to construct less elaborate bowers; those with less attractive plumage compensate for this by fabricating more intricate structures.[45] As Samir Okasha pointed out, this approach raises some questions, especially where the environment plays a major role.

> Thinking in terms of a gene's "interests," as Dawkins and others do, makes good sense where a gene has a relatively context-independent effect on its host organism. The gene's phenotypic effect can then be thought of as a "strategy" it has devised to promote its transmission. But as critics have noted, if a gene's phenotypic effect is highly dependent on context, including genetic context, it is misleading to think this way, since the gene's chances of transmission are not in its own hands—they depend on extraneous factors.[46]

Dawkins is alert to these issues, as the chapter titled "The Selfish Cooperator" in his *Unweaving the Rainbow* (1998) makes clear. A gene must not be seen in isolation, but as embedded in a context, consisting of the other genes in the gene pool of a species. A gene transported into a different "climate" or "context" of other genes can have a completely different expression, and would be subject to completely different selection pressures.

This, then, is a brief sketch of Dawkins' approach, set against its historical background. It has, as might be expected, generated considerable debate and discussion. In what follows, we shall consider some of the more important issues to have emerged in reflection on the work's basic themes.

## The Place of Humanity in a Darwinian Universe

If there was one aspect of his own theory of evolution which left Charles Darwin feeling unsettled, it was its implications for the status and identity of the human race. In every edition of the *Origin of Species*, Darwin consistently stated that his proposed mechanism of natural selection did not

[44] Richard Dawkins, "Replicator Selection and the Extended Phenotype." *Zeitschrift für Tierpsychologie* 47 (1978): 61–76.

[45] *The Extended Phenotype*, 199–200.

[46] Samir Okasha, *Evolution and the Levels of Selection*. Oxford: Oxford University Press, 2006, 167.

entail any fixed or universal law of progressive development. Furthermore, he explicitly rejected the belief of Jean-Baptiste Lamarck (1744–1829) that evolution demonstrated any intrinsic or necessary tendency toward perfection.[47] The inevitable conclusion must therefore be that human beings (now understood to be participants within, rather than merely observers of, the evolutionary process) cannot in any sense be said to be either the "goal" or the "apex" of evolution. It was not an easy conclusion for Darwin, or for his age. The conclusion to the *Descent of Man* speaks of humanity in exalted terms, while insisting upon its "lowly" biological origins:

> Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope for a still higher destiny in the distant future. But we are not here concerned with hopes or fears, only with the truth as far as our reason permits us to discover it; and I have given the evidence to the best of my ability. We must, however, acknowledge, as it seems to me, that man with all his noble qualities . . . still bears in his bodily frame the indelible stamp of his lowly origin.[48]

Using his own version of the image of the "Great Chain of Being," Darwin occasionally seems to suggest that evolution implies progress toward superior creatures, projecting moral (and occasionally even ontological) qualities onto more neutral scientific description.[49]

Dawkins has no hesitations here. We must recognize that we are animals, part of the evolutionary process. He is strongly critical of the absolutist assumptions he discerns behind "speciesism" – a term invented by Richard Ryder, and given wider currency by Peter Singer, currently of Princeton University.[50] Yet Dawkins draws an important – indeed, a remarkable – distinction between humanity and every other living product of genetic mutation and natural selection. *We alone are able to resist our genes.* While some writers – such as Julian Huxley – tried to develop an ethical system based on what they regarded as Darwinian evolution's more progressive aspects, Dawkins regards this

[47] Gregory Radick, "Two Explanations of Evolutionary Progress." *Biology and Philosophy* 15, no. 4 (2000): 475–91.

[48] Charles Darwin, *The Descent of Man*. 2nd edn. London: John Murray, 1882, 619.

[49] For comment, see Maurice Mandelbaum, *History, Man, and Reason: A Study in Nineteenth-Century Thought*. Baltimore, MD: Johns Hopkins University Press, 1971, 77–88; Dov Ospovat, *The Development of Darwin's Theory: Natural History, Natural Theology, and Natural Selection, 1838–1859*. Cambridge: Cambridge University Press, 1995, 229–35.

[50] *A Devil's Chaplain*, 20–5.

as misguided.[51] Natural selection may be the dominant force in biological evolution; this does not for one moment mean that we need to endorse its apparent ethical implications.

It is an important point, as some have argued that Darwinian theory endorses a "survival of the fittest" ethic. A recently discovered letter of Darwin himself seems to lend credibility to this "social Darwinist" approach,[52] although Darwin is elsewhere generally cautious about drawing any such conclusions. Dawkins is adamant: human beings are *not* the prisoner of their genes, but are capable of rebelling against such a genetic tyranny:

> As an academic scientist I am a passionate Darwinian, believing that natural selection is, if not the only driving force in evolution, certainly the only known force capable of producing the illusion of purpose which so strikes all who contemplate nature. But at the same time as I support Darwinism as a scientist, I am a passionate anti-Darwinian when it comes to politics and how we should conduct our human affairs.[53]

Dawkins suggests that the situation can be compared to an oncologist, whose professional specialty is *studying* cancer, and whose professional vocation is *fighting* it.

This same theme emerges in *The Selfish Gene*. Dawkins concluded this work with a passionate defense of human dignity and freedom in the face of genetic determinism. We – that is, his (human) readers – can rebel against our selfish genes:

> We have the power to defy the selfish genes of our birth and, if necessary, the selfish memes of our indoctrination. We can even discuss ways of deliberately cultivating and nurturing pure, disinterested altruism – something that has no place in nature, something that has never existed before in the whole history of the world. We are built as gene machines and cultured as meme machines, but we have the power to turn against our creators. We, alone on earth, can rebel against the tyranny of the selfish replicators.[54]

Human beings alone have evolved to the point at which we are able to rebel against precisely the process that brought us here in the first place.

[51] See here Paul L. Farber, *The Temptations of Evolutionary Ethics*. Berkeley, CA: University of California Press, 1994, 136. Farber comments that Huxley's "ethics was a projection of his values onto the history of man," so that his "naturalism assumed the vision he pretended to discover."

[52] Richard Weikart, "A Recently Discovered Darwin Letter on Social Darwinism." *Isis* 86 (1995): 609–11.

[53] *A Devil's Chaplain*, 10–11.

[54] *The Selfish Gene*, 200–1. The first edition (1976) ended at this point; the second edition (1989) added two additional chapters. Note that Dawkins introduces the term "meme" here, as a "cultural replicator" analogous to the gene, as a genetic replicator. We shall have more to say about this new type of replicator later.

The evolution of the human brain is, as Dawkins points out, central to this unique status. What pressures led to the enlargement of the human brain?[55] And why should this process yield any significant evolutionary advantage? This new development requires that roughly one-quarter of human metabolism is devoted to ensuring brain function. This represents a substantial investment of energy, and a correspondingly high risk for the survival of the species. Nevertheless, whatever its explanation, it happened.[56]

By wise use of this additional resource, humans alone can subvert their "selfish genes" – for example, through using artificial contraception.[57] It's a moot point whether this example can be regarded as a brave act of rebellion by enlightened humans against their genes. It could equally be argued to be an act of collusion. One of the driving arguments for artificial contraception is that it limits the disastrous consequences of population explosion, which would pose a challenge to the continued existence of the human species – and hence the transmission of human genes. But Dawkins' point stands against this criticism: humanity is able to realize the covert influences on actions and reflections, and resist our innate selfish tendencies.

Only we have evolved brains which are capable of, in the first place, understanding how we came to being here, and in the second, subverting the process that might at some very distant point lead to our being displaced, perhaps by some superior primate. Dawkins has, perhaps unsurprisingly, been criticized by primatologists at this point. Frans de Waal, for example, points out that the call to "rise above nature" has nothing to do with Darwin, who rather emphasized that "our humaneness is grounded in the social instincts that we share with other animals."[58]

## Are Genes Really Selfish?

In using the title *The Selfish Gene*, Dawkins saw himself as simply telling the truth about the implications of evolutionary theory for an understanding of human nature:

> The argument of this book is that we, and all other animals, are machines created by our genes . . . I shall argue that a predominant quality to be expected in a successful gene is ruthless selfishness. This gene selfishness

[55] For Dawkins' comments, see *Unweaving the Rainbow*, 286–90; A *Devil's Chaplain*, 74–7.
[56] For some reflections, not dissimilar to Dawkins, see Geoffrey Miller, *The Mating Mind: How Sexual Choice Shaped the Evolution of Human Nature*. London: Vintage, 2001.
[57] *The Selfish Gene*, 109–22.
[58] De Waal, *Our Inner Ape*, 22.

> will usually give rise to selfishness in individual behaviour. However, as we shall see, there are special circumstances in which a gene can achieve its own selfish goals best by fostering a limited form of altruism at the level of individual animals. "Special" and "limited" are important words in the last sentence. Much as we might wish to believe otherwise, universal love and the welfare of the species as a whole are concepts that simply do not make evolutionary sense.[59]

Where some social Darwinists of the 1920s and 1930s in effect argued that evolutionary theory provided a scientific basis for legitimizing certain forms of human behavior,[60] Dawkins argued that one of the most important reasons for understanding such theories was to alert us to the way in which our genetic history predisposes us to act in certain selfish manners *so that we can resist this*. "Let us try to *teach* generosity and altruism, because we are born selfish. Let us understand what our own selfish genes are up to, because we may then at least have the chance to upset their designs."[61] Our genes may "instruct us to be selfish," but we are under no obligation to obey them. There is a sense in which human beings must actively resist their genes if they are "to build a society in which individuals cooperate generously and unselfishly towards a common good."

But can one speak of genes being "selfish"? Many commentators have raised concerns about Dawkins' concept of "the selfish gene." Dawkins' phrase "the selfish gene" was criticized by the philosopher Mary Midgley, partly because of what she regarded as definitional vagueness, but more fundamentally on account of philosophical laziness. "Genes cannot be selfish or unselfish, any more than atoms can be jealous, elephants abstract or biscuits teleological."[62] Midgley argued that the attribution of "selfishness" to genes represented a form of anthropomorphic thinking, by which genes were understood to possess human qualities and vices. Genes themselves, she argued, cannot *be* selfish; the term can really only be applied meaningfully to an organism capable of behavior.[63] It was a reasonable

[59] *The Selfish Gene*, 9–10. Emphasis original.

[60] Gregory Claeys, "The 'Survival of the Fittest' and the Origins of Social Darwinism." *Journal of the History of Ideas* 61 (2000): 223–40. A case in point is the form of Social Darwinism underlying certain Nazi ideas: Richard Weikart, *Hitler's Ethic: The Nazi Pursuit of Evolutionary Progress*. New York: Palgrave Macmillan, 2009.

[61] *The Selfish Gene*, 10.

[62] Mary Midgley, "Gene-Juggling." *Philosophy* 54 (1979): 439–58.

[63] A point made regularly by Dawkins' critics within the evolutionary biology community: see, for example, Steven Rose, "The Rise of Neurogenetic Determinism." In *Consciousness and Human Identity*, edited by John Cornwell, 86–100. Oxford: Oxford University Press, 1998.

point concerning the validity of metaphorical or analogical language. After all, can genes really be said to "behave" in any way, whether "selfish" or not? Genes replicate; they cannot be said to "behave" or "act," even in a pseudo-teleological way. Yet this reasonable point was unfortunately lost in the noise of a scientifically confused piece of polemic which managed to misrepresent Dawkins' views on the gene.[64]

Dawkins was perfectly aware of the issues Midgley noted, and, in my view, deals with them thoroughly in *The Selfish Gene*. It needs to be appreciated that Dawkins was no stranger to the use of analogies in the sciences. In his doctoral thesis, he devoted several pages to exploring the proper use of models or "pictorial aids" in scientific explanation and description, especially in relation to issues of behavior.[65] Dawkins insisted that a clear distinction could be drawn between the subjective and behavioristic senses of the term, and that his definition was unequivocally behavioristic in nature. Genes behave *as if* they are selfish, whatever implications this may be understood to have. As he pointed out in *The Selfish Gene*, "we must not think of genes as conscious, purposeful agents. Blind natural selection, however, makes them behave rather as if they were purposeful, and it has been convenient, as a form of shorthand, to refer to genes in the language of purpose."[66] (Darwin himself, we may note, had earlier remarked that "natural selection" was "shorthand" for a much more complex and nuanced process.)

Dawkins was quite clear that genes are not consciously selfish; yet their dynamics resemble those of consciously selfish agents. Dawkins offers a perfectly defensible account of the term "selfish" in the opening sections of *The Selfish Gene*. The term is being used in a "*behavioural*, not subjective" sense. Dawkins is not "concerned here with the psychology of motives"; the issue is "whether the *effect* of an act" is to "lower or raise the survival prospects" of a given organism[67]. Genes are not to be thought of as having subjective motives; yet it is heuristically or pedagogically helpful to think of them as acting in this way.[68]

If we allow ourselves the license of talking about genes as if they had conscious aims, always reassuring ourselves that we could translate our sloppy language back into respectable terms if we wanted to, we can ask the question, what is a single selfish gene trying to do?

[64] For Dawkins' response, see Richard Dawkins, "In Defence of Selfish Genes." *Philosophy* 56 (1981): 556–73.

[65] Richard Dawkins, "Selective Pecking in the Domestic Chick." D. Phil. Thesis, Oxford University, 1966, 183–5.

[66] *The Selfish Gene*, 196.

[67] *The Selfish Gene*, 11.

[68] *The Selfish Gene*, 88.

Nor does Dawkins see the notion of a "selfish gene" as being inconsistent with the idea of cooperation between genes. Dawkins emphasized this point in a preface to the thirtieth anniversary edition of *The Selfish Gene* (2006), revealing that he considered alternative titles for the work, including *The Eternal Gene* and – significantly – *The Cooperative Gene*. At several points during the work, Dawkins highlights the importance of what could be described as a form of cooperation among self-interested genes. The process of natural selection favors groups of mutually compatible (if not actually cooperating) interacting genes.

This point is difficult for non-biologists to grasp. As might be expected, Dawkins has a good analogy to hand to convey the point at issue. Imagine, he suggests, the Oxford and Cambridge boat race – a collaborative venture, in which the nine crew members work with each other to secure an intended goal. Since a good oarsman in bad company will lose the race, the coach's job is to find the best selection of crew members from the pool available.[69]

A further point at which Dawkins has been criticized needs more careful examination – the tendency to portray genes as active agents. This point has been highlighted by the Oxford systems biologist Denis Noble, who identifies the following passage in *The Selfish Gene* as problematic for two reasons: first, in that it portrays genes as active agents, and second, because it strays beyond the empirically verifiable into what amounts to metaphysical speculation:

> [Genes] swarm in huge colonies, safe inside gigantic lumbering robots, sealed off from the outside world, communicating with it by tortuous indirect routes, manipulating it by remote control. They are in you and me; they created us, body and mind; and their preservation is the ultimate rationale for our existence.[70]

Noting that genes are here depicted as active agents, in control of their own destiny, Noble asks what in this passage can be proved from observation, and what is to be regarded as metaphysical speculation. For Noble, the empirically verified facts are restricted to the statement that genes "are in you and me." The rest is speculative. Noble then playfully rewrites Dawkins's prose, smuggling in a totally different set of metaphysical assumptions, while retaining the single empirically verifiable statement in Dawkins' original piece.

[69] *The Selfish Gene*, 40.
[70] *The Selfish Gene*, 21.

> [Genes] are trapped in huge colonies, locked inside highly intelligent beings, moulded by the outside world, communicating with it by complex processes, through which, blindly, as if by magic, function emerges. They are in you and me; we are the system that allows their code to be read; and their preservation is totally dependent on the joy that we experience in reproducing ourselves. We are the ultimate rationale for their existence.[71]

Here, humans are represented as being in control. We are active; genes are passive.

So what in Noble's passage is observable, and what is speculative? As before, the only thing that can be evidentially confirmed is that genes are "in you and me." The remainder is speculative, and lies beyond empirical investigation. Dawkins and Noble see things in completely different ways. They both cannot be right. Both smuggle in a series of quite different values and beliefs. Yet their statements are "empirically equivalent." In other words, they both have equally good grounding in observation and experimental evidence. So which is right? Which is the more scientific? How could we decide which is to be preferred on scientific grounds? As Noble observes, "no-one seems to be able to think of an experiment that would detect an empirical difference between them."[72]

Noble's critique of Dawkins raises the question of how the "selfish gene" approach is currently regarded within the scientific community – a question we shall consider in the following section.

## What Remains of the "Selfish Gene" Approach?

With the benefit of hindsight, it is perhaps rather difficult to understand the sense of standing on the dawn of a new age which seems to have infected the minds of some evolutionists of the late 1960s, including Williams and Dawkins. The new view of evolution as based entirely on self-interest owed little to Darwin, and was supported as much by an inflated rhetoric as by an appeal to evidence. Dawkins' own dismissal of what he termed a "sloppily unconscious group-selectionism" included both the problematic assertion that the gene's-eye view represented a

[71] See Denis Noble, *The Music of Life: Biology Beyond the Genome*. Oxford: Oxford University Press, 2006, 11–15; quote at p. 13.

[72] Noble would now argue that the cumulative weight of observation would count against Dawkins: Denis Noble, "Neo-Darwinism, the Modern Synthesis and Selfish Genes: Are They of Use in Physiology?" *Journal of Physiology* 589, no. 5 (2011): 1007–15.

recovery of Darwin's position and that its opponents were to be considered as "a Jesuitically sophisticated and dedicated neo-group-selectionist rearguard."[73] Yet Darwin himself articulated the concept of group selection at numerous points in the full corpus of his writings, mainly to explain how natural selection could give rise to altruistic behavior and moral instincts. These could be accommodated by his theory of natural selection, he argued, if they could be shown to be "for the good of the community."[74]

The resurgence of group selection since the 1970s has raised very serious difficulties for Dawkins' gene's-eye approach. *The Selfish Gene* appeared at a point at which most evolutionary biologists rejected the "for the good of the group" explanations of evolution, and insisted that all adaptations were to be explained in terms of individual self-interest.[75] Dawkins' insistence that genes were "the fundamental unit of selection" was taken as an argument against group selection, when it was perhaps better seen as a reaction against what was prematurely seen as a deficient understanding of the process of natural selection.

Dawkins' distaste for "group selection" – which he recently unfairly dismissed as "the poorly defined and incoherent view that evolution is driven by the differential survival of whole groups of organisms"[76] – is seen by his critics as being inattentive to recent developments in the field.[77] Dawkins' advocation of the gene's-eye approach must be set against the "naïve group selectionism" that was highly influential in the first half of the twentieth century. This approach tended to emphasize "between-group selection," which was assumed to outweigh "within-group selection." Yet during the late 1970s and 1980s, it became increasingly clear that that the prevailing tendency to reject "between-group

[73] *The Extended Phenotype*, 6.

[74] Elliott Sober and David Sloan Wilson, *Unto Others: The Evolution and Psychology of Unselfish Behavior*. Cambridge, MA: Harvard University Press, 1998, 4–6. Dawkins is not correct in his belief that Darwin did not teach group selection "with the exception of one anomalous passage in *The Descent of Man*."

[75] David Sloan Wilson and Edward O. Wilson, "Rethinking the Theoretical Foundation of Sociobiology." *Quarterly Review of Biology* 82 (2007): 327–48.

[76] This quote is taken from Dawkins' condescending and misleading review of E. O. Wilson's *Social Conquest of Earth*; "The Descent of Edward Wilson"; *Prospect*, May 24, 2012, www.prospectmagazine.co.uk/science-and-technology/edward-wilson-social-conquest-earth-evolutionary-errors-origin-species, accessed August 7, 2014.

[77] See the robust and highly critical rebuttal of Dawkins by David Sloan Wilson, "Richard Dawkins, Edward O. Wilson, and the Consensus of the Many"; *Huffington Post*, June 11, 2012, www.huffingtonpost.com/david-sloan-wilson/richard-dawkins-edward-o-_b_1588510.html, accessed August 7, 2014.

selection" as a significant evolutionary force was unjustified, and required reconsideration.[78] Dawkins' continuing rejection of group selection is significantly out of line with the contemporary consensus that selection can be understood as operating at a variety of levels. The debate has moved on since the 1970s.

It is important to appreciate that science is progressive, achieving its insights through constant review and revision of existing theories and paradigms in the light of accumulating evidence and observations. A way of looking at things – which is what the Greek term *theoria* really means – that is capable of offering a satisfying synthesis of the evidence at one point in time may find itself overwhelmed by the subsequent accumulation of evidence. What once seemed natural and intuitive seems increasingly cumbersome, forced, and implausible. Has this happened to the gene's-eye view of evolution?

It would be no criticism of Dawkins' approach if this were the case. Science is on a journey, and leaves its past behind it as it moves on. This is perhaps one of the most distinctive differences between the natural sciences and the humanities. Few scientific publications are read more than fifteen years after their appearance, whereas many works in the humanities retain a classic status that ensures they become part of a cultural canon.[79] Dawkins' *Selfish Gene* is still read today, forty years after its publication – a remarkable testimony to its popular appeal, and the quality of its writing and intellectual articulation.

But is this *really* Darwinism? In one sense, the "selfish gene" is not a Darwinian idea, in that Darwin knew nothing about genes. Darwin had a more pluralist approach to the unit of selection (particularly the individual organism), and thought in terms of the transmission of variation, rather than the survival of the gene.[80]

Yet it is important to realize that questions are being raised about Dawkins' approach within the scientific literature, which go far beyond the question of whether it is really "Darwinian," or the popular misunderstandings of the work that cannot really be regarded as serious "criticisms." In what follows, I shall note representative criticisms, and offer a brief assessment of their significance.

[78] Mark E. Borrello, "The Rise, Fall and Resurrection of Group Selection." *Endeavour* 29 (2005): 43–7. As an example of the changed perspective, see Charles J. Goodnight and Lori Stevens, "Experimental Studies of Group Selection: What Do They Tell Us about Group Selection in Nature?" *American Naturalist* 150 (1997): S59–S79.

[79] See the analysis in Italo Calvino, *Why Read the Classics?* New York: Pantheon, 1999.

[80] See the points made by Fern Elsdon-Baker, *The Selfish Genius: How Richard Dawkins Rewrote Darwin's Legacy.* London: Icon, 2009, 103–23.

One initial concern relates to the Darwinian "tree of life" model, implicit in *The Selfish Gene*, and set out explicitly in *The Blind Watchmaker*.[81] This sets out a Darwinian "descent with modification" formula using the idea of "perfect nesting."[82] Evolutionary descent demands a branching structure, similar to a genealogical tree. Yet recent work on genome sequencing of simple organisms, such as bacteria or *archaea*, seems to point to the repeated transfer of genes, or perhaps even clusters of genes, from organism to organism.[83] Most early studies assumed species evolved primarily by vertical inheritance from parent or parents. However, the comparison of microbial gene sequences suggests that horizontal inheritance may be relatively common. The growing evidence for extensive lateral gene transfer among organisms at the lower reaches of the tree of life[84] suggests that the image of a branching "tree of life" may need revision, to take account of this apparent intersection of rings close to its base.

It seems increasingly necessary to speak of a "Darwinian horizon" – a point way back in evolutionary time at which horizontal gene transfer was so common that the traditional Darwinian account becomes problematic. Darwinism, which posits vertical gene transfer as the dominant theme of evolution, can cope with lateral gene transfer as a subtext or sideshow; when it is the main story, however, things are rather more difficult. We shall have to wait and see how things develop here. I do not regard this as forcing a revision of Dawkins' overall approach in *The Selfish Gene*; nevertheless, it alters the detail at points – not least by suggesting that the standard Darwinian account does not embrace the totality of evolutionary history.

This general point being noted, let us consider some more specific criticisms.

Some have expressed concern about the lack of rigorous mathematical analysis in *The Selfish Gene*. One of the great strengths of the work of earlier evolutionary theorists – such as Fisher and Haldane – was their mathematical demonstration of how mutations arise and spread through a population through natural selection. Why did not Dawkins offer such a defense of his model? In part, the answer lies in the fact that *The Selfish*

[81] See the extended discussion in *The Blind Watchmaker*, 255–84.

[82] *The Blind Watchmaker*, 259.

[83] For a survey of the evidence and issues, see Luis Boto, "Horizontal Gene Transfer in Evolution: Facts and Challenges." *Proceedings of the Royal Society B* 277 (2010): 819–27.

[84] See for example K. Henze, C. Schnarrenberger, and W. Martin, "Endosymbiotic Gene Transfer: A Special Case of Horizontal Gene Transfer Germane to Endosymbiosis, the Origins of Organelles and the Origins of Eukaryotes." In *Horizontal Gene Transfer*, edited by M. Syvanen and C. Kado, 343–52. London: Academic, 2001.

*Gene* is a popular work, whose intended audience might struggle with such detail.[85] It is, however, possible to mathematize Dawkins' approach by using optimization theory to explore the analogy of the gene as a "fitness-maximizing agent."[86]

Another point concerns the epistemic status of the gene's-eye approach. We have already noted misgivings expressed about whether genes can really be said to be selfish,[87] whether it is appropriate to use the language of intentionality in relation to genes,[88] and the difficulty of defining genes in the first place.[89] Yet there is still some confusion about whether Dawkins is advocating "an empirical thesis about how evolution happened" or "a heuristic perspective for thinking about evolution."[90] Does the gene's-eye approach designate a *process* or a *perspective*? A helpful distinction can be made between the process of "genic selection" and the perspective of the gene's-eye view.[91] The problems begin to arise when they are confused or conflated. It is easy for a biologist to work with a plurality of perspectives; a plurality of processes is something rather different.

A gene's-eye view can offer helpful perspectives on events which are not necessarily caused by genic selection.[92] For example, Kenneth Waters has argued that a genic perspective can be used to make sense of phenomena that are capable of being interpreted on the basis of a significantly different model: "What appears as a multiple level selection process (e.g., selection of the t-allele) to those who draw the conceptual divide [between environments] at the traditional level, appears to genic selectionists of Williams's style as several selection processes being carried out at the same level within different genetic environments."[93] The gene's-eye view may be capable of accommodating data which others might argue was better

[85] A point made by Grafen, "Intellectual Contribution."

[86] See the discussion in A. Gardner and J. J. Welch, "A Formal Theory of the Selfish Gene." *Journal of Evolutionary Biology* 24 (2011): 1801–13.

[87] Burt and Trivers, *Genes in Conflict*, 1–18.

[88] See further Brian Charlesworth, "Conflicts of Interest." *Current Biology* 16 (2006): R1009–R1011.

[89] Elisabeth Anne Lloyd, "Why the Gene Will Not Return." *Philosophy of Science* 72 (2005): 287–310. See also Beurton, Falk, and Rheinberger, eds., *Concept of the Gene*; Pearson, "Genetics: What Is a Gene?"

[90] See Okasha, *Evolution and the Levels of Selection*, 146–9.

[91] For a defense of "genic selection," see P. Kitcher, K. Sterelny, and C. K. Waters, "The Illusory Riches of Sober's Monism." *The Journal of Philosophy* 87, no. 3 (1990): 158–61.

[92] Okasha, *Evolution and the Levels of Selection*, 148.

[93] C. Kenneth Waters, "Tempered Realism about the Force of Selection." *Philosophy of Science* 58, no. 4 (1991): 553–73. See also his later paper "Why Genic and Multilevel Selection Theories Are Here to Stay." *Philosophy of Science* 72 (2005): 311–33.

explained by a "group selection" approach.[94] Defenders of this approach thus argue that in many cases there are multiple equally adequate accounts of evolutionary events, but that the set of equally adequate representations will always include one operating at the genic level.[95] My own concern about this pluralist perspective is that it seems to me to render the approach incapable of direct empirical falsification.[96]

The idea of the "selfish gene" may live on in the niches of popular culture, where it seems to have achieved the status of a dogma for some. Most researchers now argue for the need for an integrative, multilevel approach to evolutionary theory in which genes and many other components of organisms that are inherited are viewed as cooperating in networks. Perhaps paradoxically, relentless competition thus leads to cooperation. Overall, Dawkins' gene's-eye perspective is seen to remain helpful heuristically, as a way of viewing the complexities of the evolutionary process. Yet it is increasingly been seen as one angle of approach among others, not *the* defining model or theory of evolution.

Thus far, we have sketched the outlines of the "Darwinian" approach advocated by Dawkins. But what are its implications? What difference might it make to our broader view of reality, including that realm of human life and thought which is often, though somewhat misleadingly, called "religion"? In Chapter 4, we shall explore some of the features of the Darwinian view of reality developed and so ably communicated by Dawkins, and consider what he believes to be its religious implications. To explore this important question, we will consider one of Dawkins' most important works, in which he explicitly engages such questions – *The Blind Watchmaker*. Yet we must first look at a more general question, which underlies Dawkins' analysis in that book. How does science establish its beliefs? And what are the implications of this for religion? We shall consider some aspects of this broader question in the next chapter.

[94] For the debate about the levels of selection, see Edward O. Wilson, "One Giant Leap: How Insects Achieved Altruism and Colonial Life." *BioScience* 58 (2008): 17–25. More generally, see the discussion of Wilson and Wilson, "Rethinking the Theoretical Foundation of Sociobiology."

[95] For a criticism of this approach, see the important paper of R. N. Brandon and H. F. Nijhout, "The Empirical Nonequivalence of Genic and Genotypic Models of Selection: A (Decisive) Refutation of Genic Selectionism and Pluralistic Genic Selectionism." *Philosophy of Science* 73, no. 3 (2006): 277–97.

[96] A point stressed by Noble, "Neo-Darwinism."

# 3

# Blind Faith?

## *Evidence, Proof, and Rationality in Science and Religion*

One of the central themes of the human quest for knowledge is the need to be able to distinguish mere "opinion" from "knowledge." How can we distinguish a belief that is warranted and rigorously reasoned from mere unsubstantiated opinion? The debate goes back to Plato, and continues today. The key question – whether in the natural sciences, philosophy or theology – is this: What conditions must be fulfilled before we can conclude that a given belief is justified? For Dawkins, the only reliable knowledge we may hope to have of the world is scientific. Philosophers, lawyers, theologians, and others may make spurious claims to secure knowledge. In the end, however, it is only the natural sciences that can provide a true understanding of the world.

Although Dawkins and I diverge at points in our views about the cultural authority and intellectual implications of the natural sciences, we both take delight in the sense of wonder that so often accompanies the scientific investigation of nature. Science is the great success story of human intellectual exploration. It is widely regarded as the most secure and reliable form of human knowledge, and has gained this enviable reputation by the modesty of its ambition. Scientists know that they don't have to comment on everything – just what can be shown to be true by rigorous and testable investigation.

In one sense, the cultural authority of science rests on its principled refusal to comment on matters that lie beyond its domain of competency. Questions of value and meaning, for example, are non-empirical, and are widely regarded as lying beyond its scope. The cultural and intellectual authority of science depends upon its absolute neutrality in ethical,

*Dawkins' God: From The Selfish Gene to The God Delusion*, Second Edition.
Alister E. McGrath.
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political, and religious debates. This point was made by Darwin's great supporter Thomas H. Huxley (1825–95), who declared that science "commits suicide when it adopts a creed."[1] Huxley made this dramatic statement toward the end of a remarkable speech of April 1880 at the Royal Institution, London, celebrating the "coming of age" of *The Origin of Species*. He was right. If science is hijacked by fundamentalists, whether religious or anti-religious, its intellectual integrity is subverted and its cultural authority compromised.

Science is a never-ending quest for the best understanding of things. The way things seem today will not be the way they are seen a century from now. (A hundred years ago, scientists thought that the universe had existed forever; that belief has now been replaced with the radically different notion that the universe came into being in a primordial fireball known as the Big Bang.[2]) The chemist and noted philosopher of science Michael Polanyi (1891–1976) once shrewdly observed that scientists believed many things to be true, but knew that some of those would eventually be shown to be wrong. The problem was that they didn't know which they were.

Today, most scientists believe that Darwin's theory of natural selection is the best explanation of what we see in the world around us. But as Dawkins himself rightly points out, Darwinism itself may eventually turn out to need revision, perhaps even rejection: "We must acknowledge the possibility that new facts may come to light which will force our successors of the twenty-first century to abandon Darwinism or modify it beyond recognition."[3] This statement has caused concern to some, but Dawkins was absolutely right in making it. Science is driven by the accumulation of evidence and theoretical reflection on that evidence, which will from time to time lead to the abandoning of what was previously thought to be right.

Such a recognition of the provisionality of scientific theories is *not* the same as embracing a free-floating relativism, with each individual or generation arbitrarily choosing what it wants to believe. Theoretical judgments are driven by evidence, which builds up over time, gradually leading to what the historian Thomas Kuhn called "paradigm shifts" – radical changes in the way in which we see things, forced upon us by the accumulation of evidence.[4]

[1] Thomas H. Huxley, *Darwiniana*. London: Macmillan, 1893, 252.

[2] Helge S. Kragh, *Conceptions of Cosmos: From Myths to the Accelerating Universe. A History of Cosmology*. Oxford: Oxford University Press, 2006.

[3] *A Devil's Chaplain*, 81.

[4] Paul Hoyningen-Huene, *Reconstructing Scientific Revolutions: Thomas S. Kuhn's Philosophy of Science*. Chicago: University of Chicago Press, 1993, 197–265.

The importance of evidence-based thinking for the scientific enterprise cannot be overstated. Science has learned to conform its thinking to the distinct and idiosyncratic nature of the universe, rather than trying to lay down in advance what form this ought to take. The fact that the strangeness of the physical universe is not something we could possibly have predicted makes it clear that rationality is a matter of discovery, rather than foresight. The question a scientist will ask is not: "Is this reasonable?" but "What are the reasons for thinking this is true?" Science is about evidence-based thinking.

Dawkins' emphasis on evidence-based reasoning leads him to adopt a strongly critical attitude toward any beliefs that are inadequately grounded in the observable. "As a lover of truth, I am suspicious of strongly held beliefs that are unsupported by evidence."[5] One of his core beliefs, frequently repeated in his writings, is that religious faith is "blind trust, in the absence of evidence, even in the teeth of evidence."[6]

The debate over how we generate and justify our beliefs is immensely important, and Dawkins' contribution to this debate must be welcomed, and – along with its rivals – taken seriously. Considerable attention has been paid to the way in which people sustain their belief systems. Cognitive psychological research has demonstrated repeatedly that people "tend to seek out, recall and interpret evidence in a manner that sustains beliefs."[7] The interpretation of data is often deeply shaped by implicit beliefs that they affect the way in which people process information and arrive at judgments. Both religious and anti-religious belief systems are often resistant to anything that threatens to undermine, challenge, qualify, or disconfirm them. Deeply held assumptions often render these implicit theories "almost impervious to data."[8] Observations are foregrounded and emphasized in ways that render them consistent with existing belief systems.

One of the more puzzling aspects of Dawkins' critique of religion is his insistence that it represents a form of "blind faith," which refuses to reflect on observation and experience in a reasoned manner. Doubtless some religious people adopt such an approach; it is, however, clearly not in any way typical or representative. The observational inaccuracy of this belief has generated widespread criticism of Dawkins, within both religious and atheist circles.

[5] *A Devil's Chaplain*, 117.

[6] *The Selfish Gene*, 198.

[7] Richard E. Nisbett and Lee D. Ross, *Human Inference: Strategies and Shortcomings of Social Judgment*. Englewood Cliffs, NJ: Prentice-Hall, 1980, 192.

[8] Nisbett and Ross, *Human Inference*, 169.

Thus the Oxford theologian Keith Ward has criticized Dawkins' "systematic mockery and demonizing of competing views, which are always presented in the most naïve light."[9] Dawkins' habit of misrepresenting the views of his opponents is probably the least attractive aspect of his writings, and simply reinforces the perception that he inhabits a hermetically sealed conceptual world, impervious to a genuine engagement with its alternatives, including religion.

We may open our discussion of the place of evidence in Dawkins' worldview by exploring his approach to the idea of "faith."

## Faith as Blind Trust?

Faith "means blind trust, in the absence of evidence, even in the teeth of evidence."[10] This view, set out for the first time in 1976, is an expression of one of the "core beliefs" that determine Dawkins' attitude to religion. In 1989, he hardened his views: faith now qualified "as a kind of mental illness."[11] This non-negotiable core conviction surfaces again in 1992, when Dawkins delivered a lecture at the Edinburgh International Science Festival, in which he set out his views on the relation of faith and evidence. Dawkins was scathing over the intellectual irresponsibility of faith: "Faith is the great cop-out, the great excuse to evade the need to think and evaluate evidence. Faith is belief in spite of, even perhaps because of, the lack of evidence … Faith is not allowed to justify itself by argument."[12] Four years later, Dawkins was named "Humanist of the Year." In his acceptance speech, published the following year in the journal *The Humanist*, Dawkins set out his agenda for the eradication of what he regarded as the greatest evil of our age.

> It is fashionable to wax apocalyptic about the threat to humanity posed by the AIDS virus, "mad cow" disease, and many others, but I think a case can be made that *faith* is one of the world's great evils, comparable to the smallpox virus but harder to eradicate. Faith, being belief that isn't based on evidence, is the principal vice of any religion.

[9] Keith Ward, *God, Chance and Necessity*. Oxford: One World, 1996, 99–100.

[10] *The Selfish Gene*, 198.

[11] *The Selfish Gene*, 330 (this passage added in the second edition).

[12] The lecture had no agreed title, and was published under the title "Lions 10, Christians Nil" in vol. 1, no. 8 (December 1994) of an electronic journal entitled "The Nullafidian," which describes itself as "The E-Zine of Atheistic Secular Humanism and Freethought," formerly known as "Lucifer's Echo." There is no pagination. The journal appears to have ceased publication in March 1996.

This is to be contrasted with the natural sciences, which offer an evidence-based approach to the world. "As a lover of truth, I am suspicious of strongly held beliefs that are unsupported by evidence."[13]

Dawkins here opens up the whole question of the place of proof, evidence, and faith in both science and religion. It is a fascinating topic, and we must be grateful to him for so doing. In this chapter, we shall explore some of the issues raised by the history and philosophy of science for this debate, and ask if it really is quite as simple as Dawkins suggests. I certainly thought so during my atheist phase, and would have regarded Dawkins' arguments – if I then had access to them – as entirely plausible and evidentially compelling. But not now.

Dawkins is absolutely right to insist upon evidential foundations for belief, no matter what that belief may be. In many ways, his approach is similar to that of the English mathematician William K. Clifford (1845–79). In his influential essay *The Ethics of Belief* (1877), Clifford argued that "it is wrong always, everywhere, and for anyone, to believe anything upon insufficient evidence."[14] This was, he argued, not simply an intellectual responsibility; it was a fundamentally *moral* duty. Nobody should be allowed to believe something which was argumentatively or evidentially underdetermined. I would, of course, agree with Clifford, although I think it is fair to point out that Clifford's use of the phrase "insufficient evidence" is more than a little vague, not least when he comes to deal with that cornerstone of the scientific explanation – the question of justified inference.

Happily, Clifford – who was a mathematician – knew enough about the more empirical sciences to be aware that the scientific method relies upon inference. Yet, even so, his account of the scientific method is clearly deeply problematic. It seems quite incapable, for example, for dealing with the troublesome issue of the "underdetermination of theory by evidence,"[15] one of the persistent difficulties that cloud the horizons of those who prefer to keep their science simple and untroubled by philosophical and historical inconveniences. If Clifford's unrealistic account of the scientific method were to be applied to Darwin's *Origin of Species*, we should have to reject either Darwin's work as unscientific and even unethical, or Clifford's account of the place of belief in science. Fortunately, this matter is easily resolved, and it is Clifford who is to be judged as unsatisfactory.

[13] *A Devil's Chaplain*, 117.

[14] William Kingdon Clifford, *The Ethics of Belief and Other Essays*. Amherst, NY: Prometheus, 1999, 70–96.

[15] See for example Laurie Calhoun, "The Underdetermination of Theory by Data, 'Inference to the Best Explanation', and the Impotence of Argumentation." *Philosophical Forum* 27 (1996): 146–60.

Darwin himself was quite clear that his doctrine of natural selection could not be proved, and praised the perspicuity of the naturalist F. W. Hutton (1836–1905) for pointing this out: "He is one of the very few who see that the change of species cannot be directly proved, and that the doctrine must sink or swim according as it groups and explains phenomena. It is really curious how few judge it in this way, which is clearly the right way."[16] Darwin believed that the case for his doctrine of natural selection lay in its ability to "group and explain" the observations he had accumulated. Yet even though Darwin did not believe that he had sorted out all the problems with his theory, he was confident that his explanation was the best available.[17]

The inadequacies of Clifford's approach are the subject of the famous 1897 essay "The Will to Believe" (1897), in which the psychologist William James (1842–1910) argued that human beings find themselves in a position where they have to choose between intellectual options which are, in James's words, "forced, living, and momentous."[18] We all, James argues, need what he terms "working hypotheses" to make sense of our experience of the world. These "working hypotheses" often lie beyond total proof, yet are accepted and acted upon because they are found to offer reliable and satisfying standpoints from which to engage the real world. For James, faith is a particular form of belief, which is pervasive in everyday life. James defined faith as follows: "Faith means belief in something concerning which doubt is still theoretically possible." This leads James to declare that: "Faith is synonymous with working hypothesis." Although James is sometimes accused of lending intellectual weight to what is merely wishful thinking – a charge, for example, made by the American scientist and pragmatist philosopher Charles S. Peirce (1839–1914) – James himself did not see things this way. As Gerald E. Myers observed in his study of James: "He always advocated a faith sensitive to reason, experimental in nature, and therefore susceptible to revision."[19]

[16] *The Life and Letters of Charles Darwin*, edited by F. Darwin. 3 vols. London: John Murray, 1887, vol. 2, 155. Hutton deserves much greater attention as a perceptive interpreter of Darwin: see for example John Stenhouse, "Darwin's Captain: F. W. Hutton and the Nineteenth-Century Darwinian Debates." *Journal of the History of Biology* 23 (1990): 411–42.

[17] Charles Darwin, *Origin of Species*. 6th edn. London: John Murray, 1872, 444. This comment is not present in earlier editions of the work.

[18] William James, "The Will to Believe." In *The Will to Believe and Other Essays in Popular Philosophy*. New York: Longmans, 1897, 1–31, 3.

[19] Gerald E. Myers, *William James, His Life and Thought*. New Haven, CT: Yale University Press, 1986, 460.

So what of Dawkins? Let's begin by looking at that definition of faith, and ask where it comes from. Faith "means blind trust, in the absence of evidence, even in the teeth of evidence." But why should anyone accept this puzzling and totally unrepresentative definition? In his "Prayer for my Daughter," Dawkins makes an important point, which is clearly relevant here: "Next time somebody tells you that something is true, why not say to them: 'What kind of evidence is there for that?' And if they can't give you a good answer, I hope you'll think very carefully before you believe a word they say."[20] So what is the evidence that religious people define or understand "faith" in this absurd way? I don't. And what's more, I don't know anyone else who does either.

Sadly, Dawkins offers no defense of this definition. He offers no evidence that it is representative of religious opinion. He cites no authority in its support. I don't accept this idea of faith, and I have yet to meet a theologian who takes it seriously. It cannot be defended from any official declaration of faith from any Christian denomination. It is Dawkins' own definition, constructed with his own agenda in mind, being represented as if it were characteristic of those he wishes to criticize.

What is really worrying is that Dawkins genuinely seems to believe that faith actually is "blind trust," despite the fact that no major Christian writer adopts such a definition. This is a core belief for Dawkins, which determines more or less every aspect of his attitude to religion and religious people. Yet core beliefs often need to be challenged. This may be what Dawkins thinks; it is not what Christians think. Let me provide a definition of faith offered by W. H. Griffith-Thomas (1861–1924), a noted Anglican theologian whose definition of faith is typical of most Christian writers: "[Faith] affects the whole of man's nature. It commences with the conviction of the mind based on adequate evidence; it continues in the confidence of the heart or emotions based on conviction, and it is crowned in the consent of the will, by means of which the conviction and confidence are expressed in conduct."[21] It is a good and reliable definition, synthesizing the core elements of the characteristic Christian understanding of faith. And this faith "commences with the conviction of the mind based on adequate evidence." I see no point in wearying readers with other quotations from Christian writers down the ages in support of this point. In any case, it is Dawkins' responsibility to demonstrate that his skewed and nonsensical definition of "faith" is characteristic of Christianity through evidence-based argument.

[20] *A Devil's Chaplain*, 248.

[21] W. H. Griffith-Thomas, *The Principles of Theology*. London: Longmans, 1930, xviii. Faith thus includes "the certainty of evidence" and the "certainty of adherence"; it is "not blind, but intelligent" (xviii–xix).

Having set up his straw man, Dawkins knocks it down. It is not an unduly difficult or demanding intellectual feat. Faith is infantile, we are told – just fine for cramming into the minds of impressionable young children, but outrageously immoral and intellectually risible in the case of adults. We've grown up now, and need to move on. Why should we believe things that can't be scientifically proved? Faith in God, Dawkins argues, is just like believing in Santa Claus and the Tooth Fairy. When you grow up, you grow out of it.

This would seem to be a schoolboy argument that has accidentally found its way into a grown-up discussion. It is as amateurish as it is unconvincing. There is no serious empirical evidence that people regard God, Santa Claus, and the Tooth Fairy as being in the same category. I stopped believing in Santa Claus and the Tooth Fairy when I was about six years old. After being an atheist for some years, I discovered God when I was eighteen, and have never regarded this as some kind of infantile regression.

If Dawkins' rather simplistic argument has any plausibility, it requires a real analogy between God and Santa Claus to exist – which it clearly does not. Everyone knows that people do not regard belief in God as belonging to the same category as these childish beliefs. Dawkins, of course, argues that they both represent belief in non-existent entities. But this represents a very elementary confusion over which is the conclusion and which the presupposition of an argument.

In any case, Santa Claus and the Tooth Fairy are not ideas invented by children; these myths are forced upon them by adults, even if the children themselves often collude with them. Dawkins takes the view that belief in God is something forced upon children by tyrannical adults, and is to be rejected for that reason. Yet it is impossible to study the development of atheism in the twentieth century without noting how precisely this pattern of the imposition of ideas was also found in the Soviet Union and other atheist states.[22] Having failed to persuade people that atheism was right, the Soviet authorities ended up imposing it.

In July 1954, the Communist Party of the Soviet Union ordered an increased explicit commitment to atheism in its schools. Belief in God had not yet been eliminated by argument or force. The only option seemed to be an aggressive program of indoctrination of its children. Soviet schoolbooks repeatedly asserted the malevolence of religion through slogans such as "Religion is a fanatical and perverse reflection of the world" or "Religion has become the medium for the spiritual enslavement of the masses." Alarmed at the persistence of religion, the Party decreed that

[22] See for example Dimitry V. Pospielovsky, *A History of Marxist-Leninist Atheism and Soviet Anti-Religious Policies.* New York: St. Martin's Press, 1987.

"the teaching of school subjects (history, literature, natural sciences, physics, chemistry, etc.) should be saturated with atheism." In the end, all that the program did was to lay the foundations for the massive rebirth of belief in God after the collapse of the Soviet Union in the 1990s.

So, if Dawkins' argument carries weight, are we to conclude that atheism is evil, immoral, and incredible – the sort of nonsense that one has to force on children, because otherwise they would never believe it? No. The institutional abuse of an idea does not discredit it, whether we are talking about atheism, theism, or democracy.

At times, Dawkins seems to get carried away with his anti-religious rhetoric by sliding from "this cannot be proved" to "this is false" with alarming ease, apparently unaware of the lapses in reasoning along the way. Consider, for example, his response in a 1999 debate on "Whether Science is Killing the Soul" to a question from the audience: can science offer consolation in the way that religion does – for example, after the death of a close friend or relative: "The fact that religion may console you doesn't of course make it true. It's a moot point whether one wishes to be consoled by a falsehood."[23] Dawkins slides effortlessly from "consolation does not make religion true" to "religion is false." Now perhaps this is an entirely natural inference for Dawkins himself, given his deeply ingrained and entrenched anti-religious feelings. But it is not a logically valid conclusion. It not follow that, since *A* has not been proven, *A* is false. As we shall see when reflecting on Dawkins' idea of the "meme," these hypothetical entities have never been proved to exist, and give every indication of being purely hypothetical notions. Yet Dawkins clearly believes in the meme.

As the core belief that faith is "blind trust" permeates Dawkins' many criticisms of religion, it clearly needs careful examination. Let's examine one of his statements on the nature of faith in a little more detail. In the second edition of *The Selfish Gene*, Dawkins proposes an absolute dichotomy between "blind faith" and "overwhelming, publicly available evidence": "But what, after all, is faith? It is a state of mind that leads people to believe something – it doesn't matter what – in the total absence of supporting evidence. If there were good supporting evidence, then faith would be superfluous, for the evidence would compel us to believe it anyway."[24] This is an unsustainable view of the relation of evidence and belief in the natural sciences, chiefly because it fails to make the critical distinction between the "total absence of supporting evidence" and the "absence of totally supporting evidence."

[23] Debate between Richard Dawkins and Steve Pinker at Westminster Central Hall, London, on February 19, 1999, chaired by Tim Radford, science correspondent of *The Guardian*.
[24] *The Selfish Gene*, 330.

For example, consider the current debate within cosmology over whether the Big Bang gave rise to a single universe, or a series of universes (the so-called "multiverse").[25] I have many distinguished scientific colleagues who support the former approach, and equally distinguished scientific colleagues who support the latter. Both are real options for thinking and informed scientists, who make their decisions on the basis of their judgments of how best to interpret the evidence and believe – but cannot prove – that their interpretation is correct. This process, rather inconveniently, doesn't fit at all with Dawkins' bold declaration that "if there were good supporting evidence, then faith would be superfluous, for the evidence would compel us to believe it anyway." Science just isn't like that.[26]

In its rigorous sense, "proof" applies only to logic and mathematics. We can prove that $2 + 2 = 4$, just as we can prove that "the whole is greater than the part."

John Polkinghorne – a theoretical physicist turned theologian – insists that the real issue in both science and religion is whether a belief can be regarded as warranted or justified.[27]

> Neither science nor religion can entertain the hope of establishing logically coercive proof of the kind that only a fool could deny. No one can avoid some degree of intellectual precariousness, and there is a consequent need for a degree of cautious daring in the quest for truth. Experience and interpretation intertwine in an inescapable circularity. Even science cannot wholly escape this dilemma (theory interprets experiments; experiments confirm or disconfirm theories).

Good reasons can be given for believing that a scientific theory (or religious belief) are justified, even if these fall short of the rigorous proof that we expect in logic or mathematics. Yet on further reflection, we realize that this form of rigorous proof is actually *limited to* the somewhat narrow worlds of logic and mathematics.

It is important to avoid confusing "provability" with "truth." In science, as we make a series of observations, we are forced to address the question: what must be true if we are to explain what is observed? What "big picture" of reality offers the best fit? Charles Peirce used the term

[25] For a collection of essays from leading thinkers exploring the options, see Bernard Carr, ed., *Universe or Multiverse?* Cambridge: Cambridge University Press, 2007.

[26] See the important discussion of the relation between "evidence" and "warrant" in Susan Haack, *Evidence and Inquiry*. Oxford: Blackwell, 1993, 158–81.

[27] For the context of this remark, see John Polkinghorne, *Theology in the Context of Science*. London: SPCK, 2008, 84–6.

"abduction" to refer to the way in which scientists generate theories that might offer the best explanation of things. The method is now more often referred to as "inference to the best explanation."

A classic example of this can be found in Darwin's *Origin of Species*, a work that both Dawkins and I admire enormously. Both of us regard it as a model of the scientific method. As we noted earlier in this chapter, Darwin believed that his theory of "natural selection," set out in this work, provided the most elegant and persuasive explanation of biological life forms. *But he knew he could not prove it.*[28] The problems were obvious.

To begin with, there was no "smoking gun" – no knock-down, unambiguous evidence which would conclusively and incontrovertibly compel people to accept his theory. Everything that was then known about the natural world could be accommodated by rival evolutionary theories, such as transformism.[29] Furthermore, there were serious scientific objections and difficulties to his theory, which led many scientists of his day to believe it was vulnerable.[30]

Yet despite some formidable difficulties, Darwin believed that his theory was right, and would one day be shown to be right. How, he asked, could a theory be wrong when it made so much sense of what he observed? Yes, there were loose ends everywhere, and a large number of problems. But his core idea seemed to him to be correct – despite the fact it could not be proved: "A crowd of difficulties will have occurred to the reader. Some of them are so grave that to this day I can never reflect on them without being staggered; but, to the best of my judgment, the greater number are only apparent, and those that are real are not, I think, fatal to my theory."[31]

So does science *prove* its theories? There are certainly some things that science (as opposed to logic and mathematics) *can* prove, and *has* proved – for example, that the chemical formula for water is $H_2O$,[32] or that the average distance of the moon from the earth is about 384,500 km. But these are basically facts about our world. The big scientific questions concern notions about the origins of the universe, the nature of force and

[28] See his famous comments on F. W. Hutton's concerns about his theory: *The Life and Letters of Charles Darwin*, edited by F. Darwin. 3 vols. London: John Murray, 1887, vol. 2, 155.

[29] Pietro Corsi, "Before Darwin: Transformist Concepts in European Natural History." *Journal of the History of Biology* 38 (2005): 67–83.

[30] For a discussion of these difficulties, see Abigail J. Lustig, "Darwin's Difficulties." In *The Cambridge Companion to the "Origin of Species,"* edited by Michael Ruse and Robert J. Richards, 109–28. Cambridge: Cambridge University Press, 2009.

[31] Charles Darwin, *Origin of Species.* 1st edn. London: John Murray, 1859, 171.

[32] Though there is a lot more that needs to be said about this: see Barbara Abbott, "Water = $H_2O$." *Mind* 108 (1999): 145–8.

matter, and perhaps the biggest question of them all: Is there a "Grand Unified Theory" that can explain everything? We can give good answers to these questions, which we believe can be justified from the best evidence we have at our disposal. But we can't give a *final* answer, because we know that what scientists believe today may not be what scientists believe in the future. No wonder that so many standard scientific textbooks rightly emphasize that "science rests on faith."[33]

Most people do not have a problem with this. Faith is just part of human life, and plays an important role in science as it does everywhere else. However, Dawkins seems to have an aversion to using the word "faith," believing it denotes some kind of intellectual perversity reserved for deluded religious fools. Faith is invariably *blind* faith. Well, it's not. Faith – whether religious or secular – is just a normal human way of making sense of a complex world. As the philosopher Julia Kristeva observed, "whether I belong to a religion, whether I be agnostic or atheist, when I say 'I believe', I mean 'I hold as true'."[34] Or as the cultural commentator Terry Eagleton put it: "We hold many beliefs that have no unimpeachably rational justification, but are nonetheless reasonable to entertain."[35] Dawkins seems to think that faith is confined to religion, when in fact it saturates the realities of human life.

## Is Atheism Itself a Faith?

Is science a religion? Dawkins is often asked this question, and has a standard answer: No. The sciences, he argues, have all the good points of religious belief, and none of their bad points. They evoke a sense of wonder at reality, and offer humanity uplift and inspiration. And they are immune from the problems of faith. Atheism is the only option for today's thinking person, whose ideas are grounded in the only valid mode of encounter with reality – that of the natural sciences. It's a splendidly simple account of things.

[33] Hugh G. Gauch, *Scientific Method in Practice*. New York: Cambridge University Press, 2003, 152.

[34] Julia Kristeva, *The Incredible Need to Believe*. New York: Columbia University Press, 2009, 3. Her general point is widely accepted within contemporary philosophy: see for example Slavoj Žižek, *How to Read Lacan*. London: Granta, 2007, 93–4; John Cottingham, *Why Believe?* London: Continuum, 2009.

[35] Terry Eagleton, "Lunging, Flailing, Mispunching." Review of *The God Delusion*. October 19, 2006. *London Review of Books*, www.lrb.co.uk/v28/n20/terry-eagleton/lunging-flailing-mispunching, accessed August 7, 2014.

It all starts to unravel very quickly, however. We have already noted Dawkins' belief that religious faith is "blind trust, in the absence of evidence, even in the teeth of evidence."[36] This arbitrary and idiosyncratic definition simply does not stand up to serious investigation. In fact, it is itself an excellent example of a false belief tenaciously held and defended "in the absence of evidence, even in the teeth of evidence." Dawkins doggedly holds on to his own dogmatic idea of what "faith" is, despite being repeatedly challenged and contradicted on this point. But what of atheism itself?

Dawkins presents agnosticism as an intellectual soft option, offering a rhetorical dismissal of the notion. In his Edinburgh Lecture of 1992 he argued that agnosticism is a "cop-out" – an argument that can be applied to anything. "There is an infinite number of hypothetical beliefs we could hold which we can't positively disprove." Now there is unquestionably some truth in this. But the real difficulty is that Dawkins' biological arguments – to the extent that they *are* genuine arguments, rather than blunt dogmatic assertions – lead only to religious agnosticism. He is obliged to supplement them with additional arguments of a non-scientific nature to get to his intended conceptual destination of atheism. And these are often rhetorical, rather than analytical, in nature. In the end, Dawkins' atheism does not really rest on his science at all, but on an unstated and largely unexamined cluster of hidden non-scientific values and beliefs. As this point is so important, we shall explore it further.

The debate between atheism and religious belief has gone on for centuries, and just about every aspect of it has been explored to the point where even philosophers seem bored with it. The outcome is a stalemate. Nobody can prove God's existence, and nobody can disprove it. This does not suit Dawkins at all.

One of the most striking things about Dawkins' atheism is the confidence with which he asserts both its inevitability, and its scientific foundations. It is a curious confidence, which seems curiously out of place – perhaps even out of order – to those familiar with the philosophy of science. As Richard Feynman (1918–88), who won the Nobel Prize for physics in 1965 for his work of quantum electrodynamics, often pointed out, scientific knowledge is a body of statements of varying degree of certainty – some most unsure, some nearly sure, but none absolutely certain.[37] Yet Dawkins seems to deduce atheism from the "book of nature" as if it were a pure matter of logic. Atheism is asserted as if it was the only conclusion possible from a series of axioms.

[36] *The Selfish Gene*, 198.

[37] See especially Richard P. Feynman, *What Do You Care What Other People Think?* London: Unwin Hyman, 1989; Richard P. Feynman, *The Meaning of It All*. London: Penguin, 1999.

Many of a more philosophical inclination will want to ask a question at this point: given that the natural sciences proceed by inference from observational data, how can Dawkins be so sure about atheism? At times, he speaks with the conviction of a believer about the certainties of a godless world. It is as if atheism was the secure and inevitable result of a seamless logical argument. But how can he achieve such certainty, when the natural sciences are not deductive in their methods?

This difficulty has puzzled me throughout my reading of Dawkins' works. Inference is, by definition, an uncertain matter, in which one must take enormous trouble not to reach premature conclusions. So how come Dawkins is so sure about his science-based atheism? Others have examined the same evidence, and come to quite different conclusions. As will be clear from what has been said thus far, Dawkins' insistence that atheism is the only legitimate worldview for a natural scientist is an unsafe and unreliable judgment. Yet my anxiety is not limited to the flawed intellectual case that Dawkins' makes for his convictions; I am troubled by the ferocity with which he asserts his atheism. One obvious potential answer is that the grounds of Dawkins' atheism lie elsewhere than his science, so that there is perhaps a strongly emotive aspect to his beliefs at this point. Yet I have not come across anything that forces me to this conclusion. The answer has to lie elsewhere.

I began to find an answer to my question while reading Timothy Shanahan's careful analysis of Dawkins' distinctive style of reasoning.[38] This study compared Dawkins' approach to biological data with that of Stephen Jay Gould. Shanahan pointed out that Dawkins' conclusions are actually determined by a set of logical premises, which are ultimately – yet *indirectly* – grounded in the empirical data. "The very nature of a valid deductive argument is such that, given certain premises, a given conclusion follows of logical necessity quite irrespective of whether the premises used are true."[39] In effect, Dawkins uses an essentially inductive approach to defend a Darwinian worldview – yet then extracts from this worldview a set of premises from which secure conclusions may be deduced.

Although Shanahan limits his analysis to exploring how Gould and Dawkins arrive at such antithetically opposed conclusions on the issue of evolutionary progress, his analysis is clearly capable of extension to his

[38] Timothy Shanahan, "Methodological and Contextual Factors in the Dawkins/Gould Dispute over Evolutionary Progress." *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 32 (2001): 127–51.

[39] Shanahan, "Methodological and Contextual Factors," 140.

religious views. Having inferred that Darwinism is the best explanation of observation, Dawkins proceeds to transmute a provisional scientific theory into a totalizing ideological worldview. Atheism is thus presented as the logical conclusion of a series of axiomatic premises, having the certainty of a deduced belief, even though its ultimate basis is actually inferential.

I have no doubt that Dawkins himself is persuaded of the case for atheism. Yet the case made is not *publicly* persuasive. Dawkins is obliged to make a "leap of faith" from agnosticism to atheism, corresponding to those who make a similar leap in the opposite direction. The idea that atheism is a form of faith is unproblematic. It amounts to little more than asserting what everyone knows to be true: that the things that really matter in life often lie beyond demonstrative proof. Nobody is going to be able to settle the question of the existence of God with complete certainty. It's simply not in the same category as whether the earth is flat, or whether DNA takes the form of a double helix. It's more like the question of whether democracy is better than totalitarianism. This cannot be settled by scientific means – but this does not present people from reaching their own conclusions on this matter. Nor does it entail that their decisions on such matters are irrational – a matter which we may explore a little further in the next section.

## Is Christian Faith Irrational?

As we have seen Dawkins' analysis of faith is highly simplistic, and takes no account of the way in which words are used in religious contexts. The Austrian philosopher Ludwig Wittgenstein (1889–1951) made the uncontestable point that words are used with different meanings in different contexts. For Wittgenstein, the *Lebensform* ("form of living") within which a word was used was of decisive importance in establishing its meaning. As Wittgenstein pointed out, precisely the same word can be used in a large number of contexts, with different meanings in each. One way of getting round this problem might be to invent a totally new vocabulary, in which the meaning of each word was tightly and unequivocally defined. But this is not a real option. Languages are living entities, and cannot be forced to behave in such an artificial way.

A perfectly acceptable approach, according to Wittgenstein, is to take trouble to define the particular sense in which a word should be understood, in order to avoid confusion with its many other senses. This involves a careful study of its associations and its use in the "form of living" to

which it relates.[40] Instead of blindly and naïvely assuming that a word which means one thing in one situation means precisely the same in another, it is universally agreed that we need to take great care in establishing how words are used in each context, and the meanings that they bear.

This point ought to be familiar to any working scientist, who is perfectly used to using words in one sense in everyday life, and a more precise, restricted sense within a laboratory culture. I worked for several years during the late 1970s in Professor Sir George Radda's research group in Oxford University's Department of Biochemistry. Every weekday morning at 11.00, we gathered for communal coffee around an ancient gas ring. When someone asked a neighbor to "Pass the sugar!," what they were actually asking for was the chemical known as "sucrose" or, more precisely, α-D-glucopyranosyl-β-D-fructofuranoside. Now in the natural sciences, the term "sugar" represents a very broad class of chemicals, which includes the specific sugars found in sugar cane (sucrose), milk (lactose), and various fruits (fructose). These vary greatly in sweetness. Lactose, for example, has only 16% of the sweetness of sucrose.

The "sugar" of the everyday world is thus actually one very specific form of the more general scientific category of sugar – specifically, a 1, 2-glycoside. This simple difference of vocabulary can cause immense confusion, especially in relation to health problems arising from excessive sucrose consumption.[41] It might also have led to someone putting lactose in their coffee. We would have needed to pile six times the amount of lactose into our coffee to achieve the same degree of sweetness as sucrose. But this confusion just didn't arise. Everyone who gathered for coffee knew that words were being used with different meanings in different contexts, and could tell the difference between them.

Now there isn't a problem here. You just get used to living in different worlds, and becoming sensitive to their subtle linguistic differences. You realize that words mean different things within different communities. Outsiders find these subtle differences troubling, and often fail to understand why the distinctive languages of different communities come into being. There is no question of dishonesty involved, as if anyone was trying to deceive people by using these specific forms of language. They evolve naturally, in response to the professional needs and distinctive tasks of the

[40] Ludwig Wittgenstein, *Lectures and Conversations on Aesthetics, Psychology and Religious Belief*. Oxford: Blackwell, 1966, "If I had to say what is the main mistake made by philosophers … I would say that it is that when language is looked at, what is looked at is a form of words and not the use made of the form of words."

[41] Madeleine Sigman-Grant and Jaime Morita, "Defining and Interpreting Intakes of Sugars." *American Journal of Clinical Nutrition* 78 (2003): 815S–626S.

communities involved. It just involves becoming bilingual, and sensitive to the different meanings of words in different contexts. It means being prepared to ask people "What do *you* mean when you use that word?," and being prepared to accept that *their* use of that word may not be identical with *your* use of the word – and that this doesn't mean that they are wrong, and you are right. Otherwise, communication across disciplinary boundaries becomes impossible. Scientists use language in a way that differs from ordinary usage; so do theologians. The first stage in any attempt to engage with a discipline is to understand its use of language.

Dawkins knows this perfectly well. He famously ridiculed philosopher Mary Midgley for criticizing his "selfish gene" hypothesis for her apparent lack of awareness of how scientists used language. His words deserve to be cited – against him:

> [Midgley] seems not to understand biology or the way biologists use language. No doubt *my* ignorance would be just as obvious if I rushed headlong into *her* field of expertise, but I would then adopt a more diffident tone. As it is we are both in my corner, and it is hard for me not to regard the gloves as off.[42]

So this is the same Richard Dawkins who, knowing nothing about Christian theology, rushes headlong into the field, and tells theologians what they really mean when they use their own language? Or that they really mean "blind trust" when they speak of "faith"? There is a total failure on Dawkins' part even to begin to understand what Christian theology means by its language. It really does make it very difficult to take his judgments concerning its alleged failures with any degree of seriousness.

Let's try and get things straight here. As a professional theologian, I have no hesitation in asserting that the classic Christian tradition has always valued rationality, and does not hold that faith involves the complete abandonment of reason or believing in the teeth of the evidence. Indeed, the Christian tradition is so consistent on this matter that it is difficult to understand where Dawkins has got the idea of faith as "blind trust" from. Even a superficial reading of the works of leading Christian philosophers such as Richard Swinburne (Oxford University), Nicolas Wolterstorff (Yale University), and Alvin Plantinga (University of Notre Dame), or even

[42] Richard Dawkins, "In Defence of Selfish Genes." *Philosophy* 56 (1981): 556–73. For Midgley's original article, see Mary Midgley, "Gene-Juggling." *Philosophy* 54 (1979): 439–58. For her response to Dawkins' criticisms, see Mary Midgley, "Selfish Genes and Social Darwinism." *Philosophy* 58 (1983): 365–77. Emphases original.

popular writers such as C. S. Lewis,[43] would reveal their passionate commitment to the question of how one can make "warranted," "evidenced," or "coherent" statements concerning God.[44] There is no question of "blind trust." The issue is how one can make an informed, rational, and defensible judgment on the God-question, when the evidence is open to multiple readings.

Now perhaps Dawkins is too busy writing books against religion to allow him time to read works of religion. On the rare occasions when he cites classic theologians, he tends to do so at second hand, often with alarming results. For example, Dawkins singles out the early Christian writer Tertullian (c. 160–c. 225) for particularly acerbic comment, on account of two quotations from his writings: "It is certain because it is impossible"; and "it is by all means to be believed because it is absurd."[45] Dawkins has little time for such nonsense. "That way madness lies."

In his view, Tertullian's approach – as evidenced by these two isolated citations – is just like that of the White Queen in Lewis Carroll's *Through the Looking-Glass*, who insisted on believing six impossible things before breakfast. As this dismissive account of Tertullian is one of the very few occasions on which Dawkins engages with serious representatives of the Christian theological tradition, I propose to take his comments with seriousness, and see where they take us. They might tell us something about Tertullian. Or even about Christianity. Or, then again, about Dawkins himself.

Tertullian, a Roman theologian based in the North African city of Carthage, never wrote the words "it is by all means to be believed because it is absurd." This garbled misquotation is often attributed to him in secondary writings. But it is a misreading, and has been known to be such for some time.[46] So at least we can reasonably assume that Dawkins has not read Tertullian himself, but has taken this citation from an unreliable secondary source.

Tertullian really did, however, write the words "it is certain because it is impossible." The context, however, makes it clear that he is not for one

[43] Alister E. McGrath, "An Enhanced Vision of Rationality: C. S. Lewis on the Reasonableness of Christian Faith." *Theology* 116, no. 6 (2013): 410–17.

[44] I have in mind such works as Richard Swinburne, *The Coherence of Theism*. Oxford: Clarendon Press, 1977; Nicholas Wolterstorff, *Reason within the Bounds of Religion*. Grand Rapids, MI: Eerdmans, 1984; Alvin Plantinga, *Warranted Christian Belief*. Oxford: Oxford University Press, 2000.

[45] *A Devil's Chaplain,* 139.

[46] For details, see Robert D. Sider, "Credo Quia Absurdum?" *Classical World* 73 (1978): 417–19.

moment arguing for a "blind faith."[47] Tertullian is not discussing the relation of faith and reason, or the evidential basis of Christianity. Reading the passage in context immediately eliminates any such idea. It has been known since 1916 that Tertullian is parodying some ideas from Aristotle in this passage. "The phrase is often misquoted, and more often it is supposed to crystallize an irrational prejudice in his mind, as if he scorned and spurned the intelligence in religion – a supposition which will not survive any first-hand acquaintance with [his] writings."[48]

What is the point that Tertullian is making? He is simply pointing out that the Christian gospel is profoundly counter-cultural and counterintuitive on the importance of Christ's death. So why would anyone want to make it up, when it is so obviously implausible by those standards of wisdom? Tertullian then parodies a passage from Aristotle's *Rhetoric*, which argues that an extraordinary claim may well be true, precisely because it is so out of the ordinary. It was probably meant to be a rhetorical joke, for those who knew their Aristotle.

It is grossly inaccurate and unfair to determine Tertullian's rich understanding of the rationality of faith on the basis of a single, isolated phrase. If any phrase sums up Tertullian's attitude to reason, it is the following: "For reason is a property of God's, since there is nothing which God, the creator of all things, has not foreseen, arranged and determined by reason. Furthermore, there is nothing God does not wish to be investigated and understood by reason."[49] The bottom line is that there are no limits to what may be "investigated and understood by reason." The same God who created humanity with the capacity to reason expects that reason to be used in the exploration and representation of the world. And that's where the vast majority of Christian theologians stand today, and have stood in the past. Sure, there are exceptions. But Dawkins seems to prefer to treat exceptions as if they were the rule, offering no evidence in support of this highly questionable conclusion.

Christian theologians regard their faith as intellectually warranted for many reasons – perhaps most notably because of the coherent account of reality it offers. A good example of this is found in the writings of C. S. Lewis (1898–1963), who abandoned his earlier "glib and shallow rationalism" on account of the more satisfying vision of reality he

[47] Tertullian, *De paenitentia*, v.4.

[48] James Moffat, "Tertullian and Aristotle." *Journal of Theological Studies* 17 (1916): 170–1. For a more recent study, see Robert D. Sider, *Ancient Rhetoric and the Art of Tertullian*. London: Oxford University Press, 1971, 56–9.

[49] Tertullian, *de poenitentia* i, 2. "Quippe res dei ratio quia deus omnium conditor nihil non ratione providit disposuit ordinavit, nihil enim non ratione tractari intellegique voluit."

encountered in Christianity. Lewis declared that he was an "empirical theist," who arrived at belief in God by "induction."[50] His views on the rational foundations of his faith are summarized in this pithy sentence, now inscribed on his memorial stone in Poet's Corner, Westminster Abbey: "I believe in Christianity as I believe that the Sun has risen, not only because I see it, but because by it I see everything else."[51]

Lewis may well have found this way of thinking already expressed in the writings G. K. Chesterton. After his initial agnosticism, Chesterton's spiritual journey took a decisive new turn in 1903. He published a newspaper article explaining why he and many others now regarded Christianity with intense intellectual seriousness. "We have returned to it because it is an intelligible picture of the world." Chesterton realized that testing a theory meant checking it out against observation: "The best way to see if a coat fits a man is not to measure both of them, but to try it on." Let Chesterton himself explain what he has in mind:

> Numbers of us have returned to this belief; and we have returned to it, not because of this argument or that argument, but because the theory, when it is adopted, works out everywhere; because the coat, when it is tried on, fits in every crease … We put on the theory, like a magic hat, and history becomes translucent like a house of glass.[52]

Chesterton's argument is that it is the Christian vision of reality as a whole – rather than any of its individual components – that proves so compelling. Individual observations of nature do not "prove" Christianity to be true; rather, Christianity validates itself by its ability to make sense of those observations. Chesterton puts this in a sentence rich with inductive insight: "The phenomenon does not prove religion, but religion explains the phenomenon." For Chesterton, a good theory – whether scientific or religious – is to be judged by the amount of illumination it offers, and its capacity to accommodate what we see in the world around us and experience within us.

We find a similar view in the writings of Dorothy L. Sayers, who became convinced that Christianity seemed to offer "the only explanation of the

[50] These phrases are found in a manuscript known as "Early Prose Joy," held at the Wade Center, Wheaton College, Illinois. I explore the contours of Lewis's conversion (or "re-conversion") in Alister E. McGrath, *C. S. Lewis – A Life. Eccentric Genius, Reluctant Prophet*. London: Hodder & Stoughton, 2013, 135–51.

[51] C. S. Lewis, "Is Theology Poetry?" In *C. S. Lewis: Essay Collection*. London: Collins, 2000, 21.

[52] G. K. Chesterton, "The Return of the Angels." *Daily News,* March 14, 1903.

universe that is intellectually satisfactory."[53] For Christians, faith goes beyond what is logically demonstrable, yet is nevertheless capable of rational motivation and foundation. It is a form of motivated or warranted belief – not a blind leap into the dark, but a joyful discovery of a bigger picture of things, of which we are part.

But my concern here is not to show that Christianity is right; it is simply to point out two things. First, that its adherents believe it to be rational, and believe that they are justified in believing it to be rational. And second, that Dawkins does not really know what he is talking about here.

## The Problem of Radical Theory Change in Science

When I was learning physics at high school, I gradually became aware of an awkward contradiction within what I was being taught. On the one hand, I was being assured that the theories of modern physics were completely reliable, the most secure form of knowledge that humanity could ever hope to possess. Yet every now and then, we would venture into a strange, twilight region, in which it would be explained to us, in hushed, conspiratorial tones, that "physicists once used to believe this, but they don't believe this now." Most of these had to do with the nature of light – something that was reasonably simple for a sixteen-year-old to understand. Once, it was thought that light required a medium to travel – but now, in the enlightened 1960s, nobody believed that any more. Once, people thought that light was made up purely of waves – but now we knew that it consists of photons. At first, I thought that these old-fashioned views dated back to the sixteenth century. But the awful truth soon became clear. The acceptance of these new ideas dated from about forty years earlier. "Once" turned out to mean "quite recently."

The problem of "radical theory change" in science cannot be overlooked in any responsible account of the scope of the scientific method. It is impossible to assume that today's scientific knowledge determines how things will be seen in future, or that today's scientific theories will continue to retain the confidence of future generations. There is no doubt that such confident attitudes were held in the late nineteenth century.[54]

[53] Letter to L. T. Duff, May 10, 1943; *The Letters of Dorothy L. Sayers* vol. 2: *1937 to 1943*, edited by Barbara Reynolds. New York: St. Martin's Press, 1996, 401.

[54] See the excellent study of Lawrence Badash, "The Completeness of Nineteenth-Century Science." *Isis* 63 (1973): 48–58.

Theoretical stability had been assumed to be a sign of theoretical truth. Yet this simply turned out to be complacency.

Many noted nineteenth-century scientists held that everything worth knowing was now known. In 1871, James Clerk Maxwell (1831–79) expressed his irritation with the then prevailing idea that physics had uncovered all that could be known, so that all that remained was to establish measurements to the next place of decimals.[55] Max Planck (1858–1947) relates how he found himself uncertain what subject to study at the University of Munich in 1875. His inclination to study the natural sciences was rubbished by the Professor of Physics at the university, who declared that nothing worthwhile remained to be discovered.[56] Robert A. Millikan (1868–1953) – whose investigations of the electron broke new ground – recalls how physics was widely regarded as a "dead subject" in American academic circles during the early 1890s.[57] Such views were widespread, and can be found in many scientific writings of the period. The leading American astronomer Simon Newcomb (1835–1909) felt able to assert in 1888 that more or less everything of importance had been seen and measured; what remained was to consolidate this body of knowledge.[58] Sure, a few more comets would be discovered. But the "big picture" was settled. It just remained for some more detail to be filled in.

Yet by 1920, a revolution was under way within physics. The great age of "classical physics" was over, and a new age dominated by quantum mechanics, the theory of relativity, and a Big Bang cosmology was dawning. There was no hint in the final decades of the nineteenth century of the tidal wave of change that was about to sweep over the natural sciences in the twentieth. Nobody in the nineteenth century seemed to have any idea of the massive upheavals that would take place, overturning many of the scientific certainties of the age. The theories seemed settled, assured, and constant. A century later, however, new theoretical paradigms had taken over.

Historians and philosophers of science have produced long lists of scientific theories, each of which was believed by one generation to be the best possible representation of reality, yet which were abandoned by

[55] W. D. Niven, ed., *The Scientific Papers of James Clerk Maxwell*. 2 vols. Cambridge: Cambridge University Press, 1980, vol. 2, 244.

[56] Max Planck, *A Scientific Autobiography*. New York: Philosophical Library, 1949, 8.

[57] Robert A. Millikan, *The Autobiography of Robert A. Millikan*. New York: Houghton, Mifflin, 1950, 23–4. On Millikan, see Robert Hugh Pargon, *The Rise of Robert Millikan: Portrait of a Life in American Science*. Ithaca, NY: Cornell University Press, 1982.

[58] Simon Newcomb, "The Place of Astronomy among the Sciences." *The Sidereal Messenger* 7 (1888): 69–70.

later generations, in the light of new discoveries and increasingly precise measurements of what was already known. Some theories have proved remarkably stable; many have been radically modified, and others abandoned altogether.[59]

As Michael Polanyi pointed out, natural scientists find themselves having to believe some things that they know will later be shown to be wrong – but not being sure *which* of their present beliefs would turn out to be erroneous. How can Dawkins be so sure that his current beliefs are true, when history shows a persistent pattern of abandoning of scientific theories as better approaches emerge? What historian of science can fail to note that what was once regarded as secure knowledge was eroded through the passage of time?

Scientific theorizing is thus *provisional*. In other words, it offers what is believed to be the best account of the experimental observations currently available. Radical theory change takes place either when it is believed that there is a better explanation of what is currently known, or when new information comes to light which forces us to see what is presently known in a new light. Unless we know the future, it is impossible to take an absolute position on the question of whether any given theory is "right." What can be said – and, indeed, must be said – is that this is believed to be the best explanation currently available. History simply makes fools of those who argue that every aspect of the current theoretical situation is true for all time. The problem is that we don't know which of today's theories will be discarded as interesting failures by future generations, and which will be retained.

If theories are thus subject to erosion, what of worldviews that are based upon them? What happens to a worldview, if its theoretical foundations collapse? Once more, history provides us with ample warnings of what happens when a scientific theory underpinning a worldview collapses. Like a house of cards, the worldview follows suit.

It is absolutely correct to say that "evolutionary biologists currently believe that Darwinism is the best theoretical explanation of earth's life-forms." But this does not mean that future evolutionary biologists will share this judgment. We may *believe* that Darwinism is right, but we do not *know* that this is so. To do this, we need to stand in a hypothetical position, which allows us to see the evidence of the future. On the basis of what we currently know, we may hold this theoretical position; however, the history of science makes it clear that new evidence has a

[59] For the biological sciences, see the points raised by Sylvia Culp and Philip Kitcher, "Theory Structure and Theory Change in Contemporary Molecular Biology." *British Journal for the Philosophy of Science* 40 (1989): 459–83.

habit of arising, causing radical revision – perhaps even abandonment – of many long-held theories. Will Darwinism be one of them? As we noted earlier, Dawkins rightly recognizes that future generations may abandon Darwinism, or revise it radically. And what then will happen to any worldviews, whether atheist or theist, which are founded on this same Darwinism? The only honest answer is that we don't know. Darwinism, like any other scientific theory, is best seen as a temporary resting place, not a final destination.

## The Limits of Science

The natural sciences are empirical in their approach – in other words, they rely on the application of observation and experiment in investigating the world. Yet empiricism refuses *as a matter of principle* to speculate about any realities beyond the observable world. Bas van Fraasen, a leading philosopher of science, makes this point clearly:

> To be an empiricist is to withhold belief in anything that goes beyond the actual, observable phenomena, and to recognize no objective modality in nature. To develop an empiricist account of science is to depict it as involving a search for truth only about the empirical world, about what is actual and observable … it must invoke throughout a resolute rejection of the demand for an explanation of the regularities in the observable course of nature by means of truths concerning a reality beyond what is actual and observable.[60]

This emphasis on what is "actual and observable" gives the sciences their distinct identity. But it also defines their limits.

The clumsy word "scientism" – often glossed as "scientific imperialism"[61] – is now used to refer to the view that science can solve all our problems, explain human nature, or tell us what is morally good.[62] It claims that all that is known, or can be known, is capable of verification or falsification using the scientific method. Anything that cannot be verified

[60] Bas C. van Fraassen, *The Scientific Image*. Oxford: Oxford University Press, 1980, 202–3.
[61] John Dupré, "Against Scientific Imperialism." *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association* 2 (1994): 374–81.
[62] For critiques, see Frederick A. Olafson, *Naturalism and the Human Condition: Against Scientism*. London: Routledge, 2001; Mikael Stenmark, *Scientism: Science, Ethics and Religion*. Aldershot: Ashgate, 2001. For helpful nuancing of the issues, see Susan Haack, *Defending Science – Within Reason: Between Scientism and Cynicism*. Amherst, NY: Prometheus, 2003.

or falsified in this manner is to be regarded as at best mere private opinion or belief, and at worst delusion or fantasy. Yet very few natural scientists embrace scientific imperialism, which appears to appeal to a handful of philosophers on the one hand, and a much larger cohort of adherents of popular "scientific atheism" on the other.

Two areas of thought that clearly lie beyond the legitimate scope of the natural sciences are the non-empirical notions of value and meaning. These cannot be read off the world, or measured as if they were constants of nature. As the philosopher Hilary Putnam rightly notes, while there is such a thing as "correctness in ethics," it is important not to model our ethical thinking "on the ways in which we get things right in physics."[63] It has been known since the eighteenth century that there are formidable intellectual obstacles in the way of anyone wanting to argue that science can generate moral values, most notably the impossibility of arguing from observed facts to moral values.

Religion engages with questions that lie beyond the scope of the scientific method – such as the existence of God, the meaning of life, and the nature of values. These are all open to rational debate; it is very doubtful that they are open to scientific analysis in that they are not empirical notions. Sir Peter Medawar (1915–97), who won the Nobel Prize in medicine for his work on immunology, drew what seems to me to be an important and entirely defensible distinction between "transcendent" questions, which he thought were best left to religion and metaphysics, and questions about the organization and structure of the material universe, which were the bread and butter of the natural sciences. Medawar insisted that it is "very likely" that there are limits to science, given "the existence of questions that science cannot answer, and that no conceivable advance of science would empower it to answer."[64]

So what sort of questions did Medawar have in mind? These turn out to be questions such as "What are we all here for? What is the point of living?" These are real questions, and we are right to seek answers to them. But science – if applied legitimately – isn't going to help us here. We need to look elsewhere for answers. Karl Popper noted the importance of such "ultimate questions," both in terms of their intrinsic importance, and their transcendence of the scientific method.

[63] Hilary Putnam, "Was Wittgenstein Really an Anti-Realist about Mathematics?" In *Wittgenstein in America*, edited by Timothy McCarthy and Sean C. Stidd. Oxford: Oxford University Press, 2001, 140–94, 185–6.

[64] Peter B. Medawar, *The Limits of Science*. Oxford: Oxford University Press, 1985, 66.

> It is important to realize that science does not make assertions about ultimate questions — about the riddles of existence, or about man's task in this world. This has often been well understood. But some great scientists, and many lesser ones, have misunderstood the situation. The fact that science cannot make any pronouncement about ethical principles has been misinterpreted as indicating that there are no such principles.[65]

## Mystery, Insanity, and Nonsense

Dawkins is a splendid representative of the no-nonsense "one rationality fits all" approach of the Enlightenment. Perhaps this is most obvious in his discussion of "mystery" – a category which he cheerfully, if a little prematurely, reduces to "plain insanity or surrealist nonsense."[66] We can make sense of things – or, if we can't make sense of things right now, the relentless advance of science will make this possible sooner or later. Given enough time, anything can happen. Religious people who talk about "mystery" are just irrational mystics who are too lazy or frightened to use their minds properly.

It is a recognizable caricature of the idea of "mystery." But it's still a caricature. Here is what a theologian means when using the word "mystery": something which is true and possesses its own rationality – yet which the human mind finds it impossible to grasp fully. Some years ago, I started learning Japanese. I didn't get very far. The language uses three syllabaries, has a vocabulary which bears little relation to any of the languages that I knew, and a syntax that seemed completely illogical to my western way of thinking. In short: I couldn't make sense of it. But my failure to grasp the Japanese language represented a failure on my part. Those who know the language assure me that it is rational and intelligible; it is just that I wasn't able to get my mind around it.

There is no way that the concept of "mystery" means "an irrationality," except in the sense that it may be counterintuitive. It may lie beyond the present capacity of human reason to grasp; that does not mean it is contrary to reason, as Thomas Aquinas emphasized. The human mind is just too limited to grasp the totality of such a reality, and we must therefore do what we can, while recognizing our limits. We are not God, and hence find what John Donne called "the immense weight of divine glory" difficult to cope with.

[65] Karl R. Popper, "Natural Selection and the Emergence of Mind." *Dialectica* 32 (1978): 339–55, 342.

[66] *A Devil's Chaplain*, 139.

And it is not just an issue in the area of theology. Any attempt to engage with the immensity of nature – such as the seemingly vast time-scale of Darwinian evolution – faces the same problems, and makes the use of both the word and the idea of "mystery" entirely appropriate in the natural science. Dawkins himself knows this, as is clear from his derisive comment on postmodern critics of the sciences:

> Modern physics teaches us that there is more to truth than meets the eye; or than meets the all too limited human mind, evolved as it was to cope with medium-sized objects moving at medium speeds through medium distances in Africa. In the face of these profound and sublime mysteries, the low-grade intellectual poodling of pseudo-philosophical poseurs seems unworthy of adult attention.[67]

My point precisely.

Quantum mechanics is an excellent example of an area of science where the category of "mystery" seems entirely appropriate. It is something that we believe to be true, and to possess a deep rationality of its own – but which it often seems impossible to get our minds around. I certainly found my mathematics pressed to its limits when specializing in this discipline at Oxford in the academic year 1972–3. Dawkins concurs, noting in particular how its conclusions "can be disturbingly counter-intuitive."[68]

The point here is that both the scientific and religious communities can be thought of as attempting to wrestle with the ambiguities of experience, and offering the "best possible explanations" for what is observed, while accepting the intellectual difficulties that may arise if we think in this way. The analysis of experience can lead to the generation of conceptualities which are often very complex, and occasionally quite counterintuitive. Many more unreflective natural scientists hostile to religion deride the complexity of its conceptualities. Science, they argue, deals with simple ideas, and avoids such extravagant ventures into such realms. Others, however, who have given more careful thought to the matter are not so sure.

The Princeton philosopher of science Bas van Fraassen is intensely skeptical of those who suggest that science is justifiably simple whereas religion is unjustifiably complex; once more, quantum theory is cited as an example: "Do the concepts of the Trinity, the soul, haecceity, universals, prime matter, and potentiality baffle you? They pale beside the unimaginable

[67] *A Devil's Chaplain*, 19.

[68] *A Devil's Chaplain*, 18–19. He cites in support Lewis Wolpert's excellent study *The Unnatural Nature of Science*. London: Faber & Faber, 1992.

otherness of closed space-times, event-horizons, EPR correlations and bootstrap models."[69] Fraassen clearly considers that the conceptual and imaginative demands of some areas of modern physics exceed those traditionally associated with even the most labyrinthine theological and philosophical systems of the Middle Ages. His point is that an empirical engagement with the world of experience and phenomena throws up theoretical concepts which are far from simple, yet which appear to be inevitable if the phenomena are to be preserved.

For an orthodox Christian theologian, the doctrine of the Trinity is the inevitable outcome of intellectual engagement with the Christian experience of God; for the physicist, equally abstract and bewildering concepts emerge from wrestling with the world of quantum phenomena. But both are committed to sustained intellectual engagement with those phenomena, in order to derive and develop theories or doctrines which can be said to do justice to them, preserving rather than reducing them.

Dawkins' most reflective account of "mystery" is found in *Unweaving the Rainbow*, which explores the place of wonder in an understanding of the sciences. While maintaining Dawkins' core hostility to religion, the work acknowledges the importance of a sense of awe and wonder in driving people to want to understand reality. Dawkins singles out the poet William Blake as an obscurant mystic, who illustrates why religious approaches to mystery are pointless and sterile. Dawkins locates Blake's many failings in an understandable – but misdirected – longing to delight in a mystery:

> The impulses to awe, reverence and wonder which led Blake to mysticism … are precisely those that lead others of us to science. Our interpretation is different but what excites us is the same. The mystic is content to bask in the wonder and revel in a mystery that we were not "meant" to understand. The scientist feels the same wonder, but is restless, not content; recognizes the mystery as profound, then adds, "But we're working on it."[70]

So there isn't actually a problem with the word or the category of "mystery." The question is whether we choose to wrestle with it, or take the lazy and complacent view that this is conveniently off-limits.

[69] Bas van Fraassen, "Empiricism in the Philosophy of Science." In *Images of Science: Essays on Realism and Empiricism*, edited by P. Churchland and C. Hooker, 245–308. Chicago: University of Chicago Press, 1985, 258.

[70] *Unweaving the Rainbow*, 17.

In this chapter, we have considered some aspects of Dawkins' understanding of the role of the sciences in leading us to form reliable judgments and opinions. The importance of the issue is obvious. Yet our reflections have focused on the sciences in general. So what of evolutionary biology in particular? What is its relevance to religion, and the deeper questions of life? In the next chapter, we shall consider *The Blind Watchmaker* (1983), in which Dawkins explicitly engages the religious implications of a Darwinian worldview.

# 4

# The Blind Watchmaker
## *Evolution and the Elimination of God?*

Although Dawkins had sketched his views on the implications of a Darwinian worldview for religion in earlier writings, his first systematic treatment of this issue is found in his important work *The Blind Watchmaker* (1986). The subtitle emphasizes one of the work's core themes: "Why the evidence of evolution reveals a universe without design." *The Blind Watchmaker* is regarded as one of Dawkins' most important publications, and reveals both his skills as a communicator and his commitment to a Darwinian worldview. His aim in writing the book, he declared, was not only to persuade his readers "that the Darwinian world-view happens to be true" but that this is "the only known theory that could, in principle, solve the mystery of our existence."[1] Darwinism, Dawkins suggested, is true, not merely on this planet, but throughout the universe wherever life may be found.

## The Contours of a Darwinian Worldview

The title *The Blind Watchmaker* represents a critique of the image of God as a "watchmaker," which began to be used in the late seventeenth century, and played a prominent role in William Paley's landmark work *Natural Theology* (1802).[2] Paley argued that the complexities of the biological world were to be compared to the machinery of a clockwork watch, forcing

[1] *The Blind Watchmaker*, ix–x.
[2] *The Blind Watchmaker*, 4–6.

*Dawkins' God: From The Selfish Gene to The God Delusion*, Second Edition.
Alister E. McGrath.
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any intelligent observer to draw the conclusion that the biological realm had been designed and constructed by God.

Dawkins' decision to engage Paley is entirely appropriate, given that Charles Darwin himself was initially persuaded by Paley's arguments, before beginning to realize that they were inadequate at points. Indeed, Darwin's growing realization that his own theory of evolution made more sense of his detailed observations than Paley's was of no small importance in persuading him of the need to publish his findings, and explain the appeal of his new approach.[3] In effect, Dawkins sets out to offer an updated version of Darwin's own engagement with Paley, extending Darwin's critique of Paley to include his modern interpreters and followers.

Two themes dominate *The Blind Watchmaker*. First, that the complexities of the biological world which seem to point toward a divine designer are to be seen as mere "appearances of design"; they are, in fact, the outcome of the blind process of evolution. Living organisms evolve by means of the process of natural selection, which "does not see ahead, does not plan consequences, [and] has no purpose in view."[4] And second, the Darwinian worldview effectively eliminates God as a redundancy, offering a superior and simpler explanation of what we observe in the world around us.

This second point brings us to an important aspect of Dawkins' understanding of science, especially as it relates to religion. In his landmark essay "Darwin Triumphant: Darwinism as Universal Truth," Richard Dawkins sets out his conviction that Darwin's theory of evolution is more than just a scientific theory, on the same epistemological level as other such provisional theories. Darwinism is to be seen as a worldview, a total account of reality, a "universal and timeless" principle, capable of being applied throughout the universe. In comparison, rival worldviews such as Marxism are to be seen as "parochial and ephemeral,"[5] lacking the grounding in a scientific understanding of reality that is so characteristic of Darwin's theory of natural selection, and the understandings of the world and human nature that emerge from it. Darwinism is not being presented as a representative element of the scientific enterprise, with a legitimate place at the round table of ethical and social debate. It is clearly understood as *the* defining account of reality.

[3] See William Sweet, "Paley, Whately, and 'Enlightenment Evidentialism'." *International Journal for Philosophy of Religion* 45 (1999): 143–66; Matthew D. Eddy, "The Rhetoric and Science of William Paley's Natural Theology." *Theology and Literature* 18 (2004): 1–22.

[4] *The Blind Watchmaker*, 21.

[5] "Darwin Triumphant: Darwinism as Universal Truth." In *A Devil's Chaplain,* 78–90.

Where most evolutionary biologists would agree that Darwinism offers a *description* of reality, Dawkins and some others go further, holding that it is to be seen as an *explanation* of things. Darwinism is a worldview, a *grand récit*, a metanarrative[6] – that is to say, a totalizing framework, by which the great questions of life are to be evaluated and answered. Dawkins' advocacy of Darwinism as a "worldview" has provoked criticism from postmodern writers, for whom any metanarrative – whether Marxist, Freudian, or Darwinian – is to be resisted as a matter of principle.[7] Although this criticism of Dawkins is often portrayed as postmodern critique of science, it is clearly a critique of a worldview alleged to be based upon science.

One of Dawkins' main concerns in *The Blind Watchmaker* is to challenge the "appearance of design" within the natural world, especially at the biological level. Surely the intricate structure of aspect of the biological world – such as the human eye – points to something that cannot be explained by random natural forces, and which obliges us to invoke a divine creator by way of explanation? How otherwise may we explain the vast and complex structures that we observe in nature?[8]

Dawkins' answer is set out primarily in *The Blind Watchmaker*, with important amplification of some points in the later work *Climbing Mount Improbable*. The fundamental argument common to both works is that complex things evolve from simple beginnings, over long periods of time:

> Living things are too improbable and too beautifully "designed" to have come into existence by chance. How, then, did they come into existence? The answer, Darwin's answer, is by gradual, step-by-step transformations from simple beginnings, from primordial entities sufficiently simple to have come into existence by chance. Each successful change in the gradual evolutionary process was simple enough, *relative to its predecessor*, to have arisen by chance. But the whole sequence of cumulative steps constitutes anything but a chance process.[9]

[6] For the legitimacy of this term in this context, see Dena Pedynowski, "Science(s): Which, When and Whose? Probing the Metanarrative of Scientific Knowledge in the Social Construction of Nature." *Progress in Human Geography* 27 (2003): 735–52.

[7] For an illuminating example, see Luke Davidson, "Fragilities of Scientism: Richard Dawkins and the Paranoid Idealization of Science." *Science as Culture* 9 (2000): 167–99. For a more general postmodern response to scientific criticism of cultural accounts of science, see Brian Martin, "Social Construction of an 'Attack on Science'." *Social Studies of Science* 26 (1996): 161–73.

[8] An excellent study of this issue may be found in Michael Ruse, *Darwin and Design: Does Evolution Have a Purpose?* Cambridge, MA: Harvard University Press, 2003.

[9] *The Blind Watchmaker*, 43.

What might seem to be a highly improbable development needs to be set against the backdrop of the huge periods of time envisaged by the evolutionary process. Dawkins explores this point using the image of a metaphorical "Mount Improbable." Seen from one angle, its "towering, vertical cliffs" seem impossible to climb. Yet seen from another angle, the mountain turns out to have "gently inclined grassy meadows, graded steadily and easily towards the distant uplands."[10]

The "illusion of design," Dawkins argues, arises because we intuitively regard structures as being too complex to have arisen by chance. An excellent example is provided by the human eye, cited by some advocates of the divine design and direct special creation of the world as a confirmation of God's existence. In one of the most detailed and argumentative chapters of *Climbing Mount Improbable*, Dawkins conducts a mental experiment to show how, given enough time, even such a complex organ could have evolved from something much simpler.[11]

It's all standard Darwinism. What's new is the lucidity of the presentation, and the detailed illustration and defense of these ideas through judiciously selected case studies and carefully crafted analogies. In that Dawkins sees Darwinism as a worldview, rather than a biological theory, he has no hesitation in taking his arguments far beyond the bounds of the purely biological. The evolutionary process leaves no conceptual space for God. What an earlier generation explained by an appeal to a divine creator can be accommodated within a Darwinian framework. There is no need to believe in God after Darwin.

Some might draw the conclusion that Darwinism merely encourages agnosticism. Far from it: for Dawkins, Darwin impels us to atheism. It is not merely that evolution erodes the explanatory potency of God; it eliminates God altogether. In an important essay of 1996, Dawkins argues that there are at present only three possible ways of seeing the world: Darwinism, Lamarckism, or God.[12] The last two fail to explain the world; the only option is therefore Darwinism: "I'm a Darwinist because I believe the only alternatives are Lamarckism or God, neither of which does the job as an explanatory principle. Life in the universe is either Darwinian or something else not yet thought of."[13] Now the rhetoric of his argument demands that Darwinism, Lamarckism, and belief in God are three

[10] *Climbing Mount Improbable*, 64.

[11] *Climbing Mount Improbable*, 126–79.

[12] Richard Dawkins, "A Survival Machine." In *The Third Culture*, edited by John Brockman, 75–95. New York: Simon & Schuster, 1996.

[13] Dawkins, "A Survival Machine," 85–6.

mutually exclusive views, so that commitment to one necessarily entails rejection of the others. Yet it is well known that many Darwinians believe that there is a convergence between Darwinism and theism. The extent of that overlap is most certainly open to discussion, and it is far from being a settled issue. Yet Dawkins' conclusion depends upon proposing an absolute dichotomy – *either* Darwinism *or* God – when the theories themselves do not require such absolutist ways of thinking (though they certainly permit it).[14] This absolutism does not (and could not) follow from the legitimate application of the methods of the natural sciences, but rather arises from an ideological precommitment which informs and controls his way of thinking at this point.

Dawkins also presupposes the total irreconcilability of Darwinism and Lamarckism as overall accounts of evolution. Perhaps this was how things were seen back in the 1980s; it is certainly not how they are seen now. Our deepening understanding of human evolution, for example, does not fit easily within a purely Darwinian paradigm, and has led some to suggest that there are Lamarckian elements in human evolution, or that at least some aspects of human evolution are best explained by a Lamarckian paradigm.[15] Some would now argue that humans are able to subvert the biological evolutionary process due to their unique capacity for cognition and cultural adaptation. The growing importance of anthropology and neurology as evolution-related disciplines has led to qualifications of purely biological accounts of evolution.[16]

Yet our concern here is with Dawkins' understanding of the implications of evolution for belief in God. We may agree that Dawkins has certainly demonstrated that a purely natural *description* may be offered of what is currently known of the history and present state of living organisms. But why does this lead to the more radical conclusion that there is no God? Dawkins' arguments lead to the conclusion that God need not be invoked as a direct explanatory agent within the evolutionary process. This is consistent with various atheist, agnostic, and Christian understandings of the world, but it necessitates none of them.

[14] Michael Ruse, "Darwinism and Atheism: A Marriage Made in Heaven?" *Think* 2, no. 6 (2004): 51–62.

[15] See for example Eugene V. Koonin and Yuri I. Wolf, "Is Evolution Darwinian or/and Lamarckian?" *Biology Direct* (November 11, 2009): 4:42. doi: 10.1186/1745-6150-4-42; Guy Barry, "Lamarckian Evolution Explains Human Brain Evolution and Psychiatric Disorders." *Frontiers in Neuroscience* (November 26, 2013): doi: 10.3389/fnins.2013.00224.

[16] The development of odor sensitivity is a good example of a phenomenon that can be interpreted plausibly within a Lamarckian paradigm: Moshe Szyf, "Lamarck Revisited: Epigenetic Inheritance of Ancestral Odor Fear Conditioning." *Nature Neuroscience* 17 (2014): 2–4.

## Is Darwinism a Complete Explanation?

One of the leading themes of *The Blind Watchmaker* is that Darwinism offers the ultimate explanation of human origins – the only one that makes any sense, and stands up to critical evidential judgment. But a critic might reasonably respond by pointing out that Darwinism does not – and, indeed, cannot – offer a complete explanation of the origins of life, of the origins of species in general, or of humanity in particular. At best, it offers a partial explanation – an explanation that depends on other supplementary explanations, each of which has at least some claim to be considered the "master" explanation.

Let's set out the issues. First, we need to note the importance of a "Darwinian horizon" – a point at which the development of life had reached a point of sufficient complexity for Darwinian processes to come into play. As Dawkins himself rightly points out, DNA is an integral component of the Darwinian paradigm, providing the means by which genetic information may be transmitted with astonishing fidelity. Yet it is now widely agreed that both DNA itself, and the associated DNA replication mechanisms, appeared at a relatively late stage in early life history.[17] Darwinian mechanisms kicked in only at a relatively late stage in the history of the planet earth. Other processes led up to the point at which this evolutionary mechanism could begin.

Nor does Darwinism explain the origins of life.[18] Darwin himself was careful not to discuss the question of how life began in the *Origin of Species*, although the assumption that purely natural processes might account for the origins of life seems implicit in many of his writings.[19] Although some believed that his failure to account for the origins of life represented a significant failure on his part, Darwin was quite clear that his theories explained the transformations of species, not the origins of life. Darwin's theory offered an explanation of how life developed; it was not an explanation of how life came into being, which he saw as lying outside the scope of his theory.

Yet we must return to the critical role played by DNA in biological evolution to make a final point. The ability of DNA to encode genetic

[17] See, for example, Patrick Forterre, Jonathan Filée, and Hannu Myllykallio, "Origin and Evolution of DNA and DNA Replication Machineries." In *The Genetic Code and the Origin of Life*, edited by Lluis Ribas de Pouplana, 145–68. New York: Kluwer Academic, 2004.

[18] Liane M. Gabora, "Self–Other Organization: Why Early Life Did Not Evolve through Natural Selection." *Journal of Theoretical Biology* 241 (2006): 443–50.

[19] Juli Peretó, Jeffrey L. Bada, and Antonio Lazcano, "Charles Darwin and the Origin of Life." *Origins of Life and Evolution of the Biosphere* 39, no. 5 (2009): 395–406.

information is critically dependent on the chemistry of carbon – above all, its ability to form long chains. Is there a global chemical basis for evolution throughout the universe?[20] If so, it is not difficult to see why life might be carbon-based. Yet most biologists would argue that the evolutionary process is dependent on what is available, making it questionable whether, if biological evolution is universal throughout the universe (as Dawkins clearly believes it is), it necessarily uses the same chemical mechanisms and agents in every situation. Evolution on earth makes extensive use of phosphates;[21] evolution elsewhere might not.

Finally, it is simply impossible to discuss evolution without considering the processes which led to the synthesis of three chemical elements that are essential for the mechanisms of evolutionary process on earth – carbon, nitrogen, and oxygen. The recognition of the chemical dependence of biological evolution is nothing new. The Harvard chemist Josiah Parsons Cooke (1827–94) argued that the chemistry of the universe was of vital importance in shaping its development. The fundamental properties of the chemical elements determined both biological constraints and possibilities:

> Before the first organic cell could exist, and before Mr. Darwin's principle of natural selection could begin that work of unnumbered ages which was to end in developing a perfect man, nay, even before the solid globe itself could be condensed from Laplace's nebula, the chemical elements must have been created, and endowed with those properties by which alone the existence of that cell is rendered possible.[22]

Yet biochemically critical elements such as carbon, nitrogen, and oxygen did not form, and could not have formed, in the early history of the universe. Their existence is the consequence of the "clumping" or "accretion" of material into stars, with the subsequent initiation of nuclear fusion reactions.[23] The ratio of the gravitational binding force to rest-mass energy (widely regarded as a classic example of "fine tuning") is such that it

[20] Steven A. Benner, Alonso Ricardo, and Matthew A. Carrigan, "Is There a Common Chemical Model for Life in the Universe?" *Current Opinion in Chemical Biology* 8 (2004): 672–89.

[21] See the classic study of Frank H. Westheimer, "Why Nature Chose Phosphates." *Science* 235 (1987): 1173–8.

[22] Josiah Parsons Cooke, *Religion and Chemistry.* New York: Scribner's Sons, 1880, 265.

[23] Donald D. Clayton, *Principles of Stellar Evolution and Nucleosynthesis.* New York: McGraw-Hill, 1968, 70–2. For a detailed consideration of the question of "fine tuning," see Alister E. McGrath, *A Fine-Tuned Universe: The Quest for God in Science and Theology.* Louisville, KY: Westminster John Knox Press, 2009.

permitted the gradual "clumping" of material into larger bodies – the stars. Stars form as a result of turbulence in giant clouds of matter within the tenuous interstellar medium.[24] Without the formation of stars, the universe would have been limited to hydrogen and helium, with only a tiny percentage of other elements, such as lithium and beryllium.

So where do these reflections leave us? The issues we have raised provide the deep context for biological evolution, making it clear that this process is only part of the answer to the question of human origins. It also raises some issues about whether Darwinism can be seen as a universal process in terms of its mechanisms, given the importance of local factors in determining the chemical resources available for evolutionary mechanisms and agents. Evolution is part of the answer to the question of how we came to be here. Yet that process is ultimately dependent on other processes, lying beyond its reach.

Let's move on, and look at another aspect of the debate over the theological implications of Darwinism.

## God as an Explanatory Hypothesis?

Do we need God to explain anything? William Paley argued that God was an explanation for the "contrivances" observed in nature – that is to say, natural structures that showed evidence of design and execution. For Dawkins, Darwin marks the parting of the ways. Before Darwin, Dawkins argues, it was possible to see the world as something designed by God; after Darwin, we can speak only of the "illusion of design." A Darwinian world has no purpose, and we delude ourselves if we think otherwise. "The universe we observe had precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind pitiless indifference."[25]

Dawkins thus argues that God is redundant as an explanatory hypothesis. God has no discernible "utility function" in scientific explanation. In support of this idea, he offers a number of arguments, of which the most interesting is his "biomorph programme."[26] This analogy is intended to help us appreciate that the *appearance* of design can arise from random developments. Imagine, he suggests, a monkey (or equivalent) with a typewriter

[24] For an excellent summary of present theories of stellar formation, see Michael D. Smith, *The Origin of Stars*. London: Imperial College Press, 2004, especially 31–136.

[25] *River out of Eden*, 133.

[26] *The Blind Watchmaker,* 46–51.

equipped with twenty-six capital letters and a space bar. Dawkins selects a twenty-eight character phrase from Shakespeare's *Hamlet*, as follows:

METHINKS IT IS LIKE A WEASEL

This is the "target phrase." Now a computer generates, at random, a phrase of twenty-eight characters – the equivalent of the proverbial monkey trying to type out the works of Shakespeare. Needless to say, it bears no relation to the target phrase.

But now something happens. The computer has been instructed to examine the phrase, and select the one "which, *however slightly*, most resembles the target phrase."[27] The process now continues. After a mere thirty iterations, something recognizably like the target phrase has developed:

METHINGS IT IS LIKE I WEASEL

Just a dozen or so iterations later, the target phrase had been reached. Dawkins concludes that the process of evolution is capable of bringing about the appearance of order rather more quickly and effectively than might be expected.

The analogy, however, is flawed, glossing over some fundamental issues as if they were unproblematic. Indeed, it represents an excellent example of what Friedrich Waismann termed the "conjuring away of philosophical problems" through carefully controlled and selected analogies.[28] The most obvious problem is that the analogy presupposes a teleology which Dawkins believes to be absent in nature. There is no "target phrase" toward which evolution may proceed. Dawkins concedes this point in the same work, but does not regard it as being critical to his analogy.[29] This is clearly incorrect.

Yet there is another problem, which Dawkins does not properly address. The idea of design or purposeful selection has been eliminated only at the *verbal* level. While the analogy allows us to avoid the vocabulary of "design," the notion of design is implicit in the computer program, which was constructed to control the development in a certain specific way. An unacknowledged anthropomorphism underlies the analogy, and lends it plausibility for the intended readership. Remove the (designed) computer

[27] *The Blind Watchmaker*, 47.
[28] Friedrich Waismann, *The Principles of Linguistic Philosophy*. London: Macmillan, 1965, 60.
[29] *The Blind Watchmaker*, 50.

program and the analogy loses its much of its plausibility. It is best seen simply and solely as an indication of how small random mutations can accumulate to yield substantial changes *provided that they are selected non-randomly.*[30]

Setting to one side the plausibility of the analogy, let us focus on the point that Dawkins wants to make. A "theory of random mutation plus nonrandom cumulative selection" can explain the appearance of design in the world. There is no need to posit a God as an explanatory mechanism. Suppose we concede this point; what are its implications? Dawkins infers that, since God may be ignored as an improbable irrelevance, the only meaningful position is atheism. Yet he does not actually make the logical moves required to reach such a conclusion, apparently assuming that they are so self-evident that they do not require demonstration. But it is not so. To illustrate this point, we may explore the view of the world set out by the leading Christian theologian Thomas Aquinas (1225–74) in the thirteenth century.

Aquinas constructed a framework for understanding God's relation to the world which weaves together the fundamental themes of the Christian creeds.[31] The basic ideas that Aquinas developed can be set out very simply, as follows. God is the cause of all things. Yet God's causality operates in a number of ways. While God must be considered capable of doing certain things directly, God delegates causal efficacy to the created order. For Aquinas, this notion of secondary causality must be considered as an extension of, not an alternative to, the primary causality of God himself. Events within the created order can exist in complex causal relationships, without in any way denying their ultimate dependency upon God as final cause.

The critical point to appreciate is that the created order thus demonstrates causal relationships which can be investigated by the natural sciences.[32] Those causal relationships can be investigated and correlated – for example, in the form of the "laws of nature" – without in any way implying, still less necessitating, an atheist worldview. To put this as simply as possible: God creates a world with its own ordering and processes.

This classic approach had its strengths and weaknesses. The most obvious of its strengths is that it laid the conceptual foundations for

[30] *Climbing Mount Improbable*, 75.

[31] For what follows, see Etienne Gilson, *The Christian Philosophy of St. Thomas Aquinas.* Notre Dame, IN: University of Notre Dame Press, 1994.

[32] See the important studies of William E. Carroll, "Aquinas on Creation and the Metaphysical Foundations of Science." *Sapientia* 54 (1999): 69–91; idem, "Creation, Evolution, and Thomas Aquinas." *Revue des questions scientifiques* 171 (2000): 319–47.

the development of the natural sciences in the later Middle Ages, by encouraging the investigation of natural processes and events. It is, by the way, important to note that this Christian view of the world was set out long before Darwin. As a result, there is no way that Aquinas' approach can be described as a *post hoc* attempt to defend Christianity in response to a perceived threat from the new science of evolutionary biology.

## The Elimination of Purpose: Dawkins on Teleology in Nature

Let's recall one of Dawkins' more quotable statements, noted earlier: "The universe we observe had precisely the properties we should expect if there is, at bottom, no design, no purpose, no evil and no good, nothing but blind pitiless indifference."[33] For Dawkins, Darwinism eliminates any notion of purpose within the natural world. There may be appearances of design, or semblances of purpose; but that is all they are. The idea of teleology is destroyed by Darwin's insights. Dawkins here seems to find support from Thomas H. Huxley, who remarked that what struck him most forcibly on his first reading of Darwin's *Origin of Species* was "that teleology, as commonly understood, had received its deathblow at Mr Darwin's hands."[34]

Yet there are two points that need to be made here. First, Huxley was clear that only one version – the "commonly understood" form – of teleology was discredited by Darwin; others were not. Second, the idea of teleology has re-emerged as helpful and appropriate in certain respects within evolutionary biology since about 2000. Let's look at both of these points briefly.

First, Huxley was critical of those who suggested that Darwin's theory of natural selection tended to "abolish Teleology, and eviscerate the argument from design."[35] While Huxley rightly held that Darwin's approach destroyed the popular understanding of teleology set out by William Paley, he was clear that Darwin's theory of evolution bore witness to a "wider teleology," rooted in the deeper structure of the universe. It is also important to note Asa Gray's remark in an article in *Nature*: "let us recognize Darwin's great service to Natural Science in bringing back to it

[33] *River out of Eden*, 133.

[34] Thomas H. Huxley, *Lay Sermons, Addresses, and Reviews*. London: Macmillan, 1870, 301.

[35] See Francis Darwin, ed., *The Life and Letters of Charles Darwin*. 3 vols. London: John Murray, 1887, vol. 2, 201.

Teleology; so that instead of Morphology versus Teleology, we shall have Morphology wedded to Teleology."[36]

Second, the biologist Francisco J. Ayala and others have insisted upon the legitimacy and importance of the use of teleological language in biological explanation.[37] The adaptations of organisms can be considered to be explained teleologically when their existence can be accounted for in terms of their contribution to the reproductive fitness of the population. Such adaptations – such as organs, homeostatic mechanisms, or patterns of behavior – are observed to have had a beneficial impact on the survival or reproductive capacities of organisms, which can be considered as the phenomenological "goal" toward which they tend.

It is important to note that the concept of "teleology" is open to multiple interpretations – some theistic, others not.[38] The philosopher of biology Ernst Mayr rightly noted that many biologists resist teleological statements or explanations, partly out of suspicion that these smuggle unverifiable theological or metaphysical doctrines into supposedly objective scientific accounts of reality.[39] Yet what, Mayr asked, if some kind of teleology is discerned within, not imposed upon, the biological process? "The use of so-called 'teleological' language by biologists is legitimate; it neither implies a rejection of physicochemical explanation nor does it imply non-causal explanation."[40] In support of his suggestion, Mayr noted that examples of goal-directed behavior are widespread in the natural world. Indeed, "the occurrence of goal-directed processes is perhaps the most characteristic feature of the world of living systems."[41]

We need now to turn to consider the writer and the image which play a central role in Dawkins' *Blind Watchmaker*. In the major section which follows, we shall consider the image of God as the divine watchmaker, and its application to the living world by the early nineteenth-century theologian William Paley.

[36] Asa Gray, "Scientific Worthies: Charles Robert Darwin." *Nature* 10, no. 240 (1874): 79–81, 81.

[37] Francisco J. Ayala, "Teleological Explanations in Evolutionary Biology." *Philosophy of Science* 37 (1970): 1–15; idem, "Teleological Explanations vs. Teleology." *History and Philosophy of the Life Sciences* 20 (1998): 41–50.

[38] See Martin Mahner and Mario Bunge, *Foundations of Biophilosophy*. Berlin: Springer, 1997, 367–76; Ernst Mayr, "The Multiple Meanings of 'Teleological'." *History and Philosophy of the Life Sciences* 20 (1998): 35–40.

[39] Ernst Mayr, *Toward a New Philosophy of Biology: Observations of an Evolutionist*. Cambridge, MA: Harvard University Press, 1988, 38–66, especially 39–41; idem, *What Makes Biology Unique? Considerations on the Autonomy of a Scientific Discipline*. Cambridge: Cambridge University Press, 2004, 39–66, especially 46–7.

[40] Mayr, *Toward a New Philosophy of Biology*, 59.

[41] Mayr, *Toward a New Philosophy of Biology*, 44–5.

## The Divine Watchmaker: Paley's Grand (but Correctable) Mistake

The concept of God as "watchmaker," which Dawkins spends so much time demolishing, was developed by Robert Boyle (1627–91) during the late seventeenth century. Boyle compared the regularities and complexities of the world to the Great Clock of Strasbourg. It was a somewhat hasty response to the intellectual challenge of what is usually known as "the mechanical philosophy."[42] Initially applied to the physical world, the "watchmaker" analogy was transposed to the biological sphere in the late eighteenth century, with results that some found reassuring, and others deeply unsatisfying.

*The Blind Watchmaker* represents a significant and highly successful attack on this eighteenth-century concept of God as a watchmaker. But what are the implications of this? What Dawkins actually demonstrates is that a very specific understanding of the doctrine of creation, which came into being in response to the historical circumstances of eighteenth-century England, is completely undermined by a Darwinian account of evolution. This theory, associated with William Paley, had already been rejected as inadequate by many leading theologians of the day – such as John Henry Newman (1801–90) – before Darwin undermined it still further. In view of the importance of this point, we shall examine Paley's theory in some detail.

The background to William Paley's emphasis on the apparent "contrivance" of the biological world is a peculiarly English affair, arising through complex interaction of politics and religion in England in the early eighteenth century. This development is fascinating historically, as well as being of no small importance to Dawkins' thesis of the "blind watchmaker."[43]

In the late seventeenth century, a series of events within both the British state and society at large forced the Church of England onto the defensive.[44] One of these is of particular relevance for our purposes: the emergence of Deism, a view of God which recognizes the divine creatorship, yet which rejects any continuing divine involvement with the world. The rise of Deism caused some problems for the established church, especially in

[42] For background, see Margaret J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World*. Cambridge: Cambridge University Press, 1994.

[43] *The Blind Watchmaker*, 4–6.

[44] Lisa M. Zeitz, "Natural Theology, Rhetoric, and Revolution: John Ray's *Wisdom of God*, 1691–1704." *Eighteenth Century Life* 18 (1994): 120–33; Scott Mandelbrote, "The Uses of Natural Theology in Seventeenth-Century England." *Science in Context* 20 (2007): 451–80.

relation to how the Bible and doctrinal tradition of the church were to be interpreted. Impressed by Isaac Newton's demonstration of the mechanical regularity of the world, many within the church began to explore the idea that an appeal to the natural world might be the basis for a new defense of Christian ideas.[45]

Now an interest in the natural world has always been part of the Christian intellectual tradition. However, in the past, this generally took the form of interpreting the world from a Christian perspective, appealing to the wonder and beauty of the natural world as a way of appreciating the beauty of God.[46] It is well known that one of the most fundamental impulses leading to the development of the natural sciences in the sixteenth and seventeenth centuries was the belief that to study nature at close quarters was to gain a deeper appreciation of the wisdom of God.[47] As the great naturalist John Ray (1628–1705) – author of the celebrated work *The Wisdom of God Manifested in the Works of Creation* (1691) – put it in 1660: "There is for a free man no occupation more worthy and delightful than to contemplate the beauteous works of nature and honour the infinite wisdom and goodness of God."[48]

Yet all this changed in the early eighteenth century. A new approach to doing theology developed, which would be variously known as "natural theology" or "physical theology" (from the Greek word *physis*, "nature"). The existence and attributes of God, it was argued, could be inferred from nature itself. As rationalism gained a growing hold on English intellectual life, the established church responded by shifting emphasis from traditional sources of authority (such as the Bible) to the natural world. The existence and wisdom of God could be proved to an increasingly skeptical world by an appeal to the ordering of nature.

Initially, this "natural theology" made its appeal to the ordering of the physical world – and above all, to the regularity of the "celestial mechanics" demonstrated by Isaac Newton (1642–1727). Suddenly, Newton was seen as having mapped out a new approach to defending Christianity and doing theology. "Physical theology" became all the rage in the early 1700s. Yet it was not long before what had seemed to be a promising alliance between

[45] James R. Jacob and Margaret C. Jacob, "The Anglican Origins of Modern Science: The Metaphysical Foundations of the Whig Constitution." *Isis* 71 (1980): 251–67.

[46] See for example Umberto Eco, *The Aesthetics of Thomas Aquinas*. London: Radius, 1988; Patrick Sherry, *Spirit and Beauty: An Introduction to Theological Aesthetics*. Oxford: Clarendon Press, 1992.

[47] For some reflections, see John Hedley Brooke, *Science and Religion: Some Historical Perspectives*. Cambridge: Cambridge University Press, 1991.

[48] See Charles Raven, *John Ray, Naturalist*. Cambridge: Cambridge University Press, 1950, 83.

science and religion led to a growing and potentially irreversible estrangement.[49] An approach once advocated by the leading scientists of the day passed into the decidedly less competent hands of bishops and archdeacons, who often repeated at second hand ideas they had not properly understood, and whose implications they were prone to exaggerate. The Newtonian system seemed to suggest that the world was a self-sustaining mechanism which had no need for divine governance or sustenance for its day-to-day operation.[50] Far from encouraging belief in God, it declared this to be quite unnecessary.

By the end of the eighteenth century, many in Britain's cultural elite had concluded that Newton's system was more likely to lead to atheism or agnosticism than to faith. Newton's synthesis of the physical sciences and religion had failed. When Percy Bysshe Shelley (1792–1822) remarked that "the consistent Newtonian is necessarily an atheist,"[51] he was expressing the emerging consensus of the age that there was little to be gained by defending Christianity by an appeal to physics.

So if physics was a dead end, what about biology? Might it be possible to construct arguments for God's existence based on an appeal to the living world of nature, rather than the regular orbits of the planets? Paley could see a way of injecting new life into the approach. It would live to fight another day. As it happened, Paley's approach achieved a popular success beyond anything he could have imagined. Yet it created the utterly false impression that the intellectual credibility of Christianity somehow depended upon the approach he adopted. The approach? God as the watchmaker.

Paley's *Natural Theology; or Evidences of the Existence and Attributes of the Deity, Collected from the Appearances of Nature* (1802) had a profound influence on popular English religious thought in the first half of the nineteenth century, and is known to have been read appreciatively by the young Charles Darwin. Paley was deeply impressed by Newton's discovery of the regularity of nature, especially in relation to the area usually known as "celestial mechanics." It was clear that the entire universe could be thought of as a complex mechanism, operating according to regular and understandable principles.

[49] See the careful study of H. H. Odom, "The Estrangement of Celestial Mechanics and Religion." *Journal of the History of Ideas* 27 (1966): 533–58.

[50] James E. Force, "The Breakdown of the Newtonian Synthesis of Science and Religion: Hume, Newton and the Royal Society." In *Essays on the Context, Nature and Influence of Isaac Newton's Theology*, edited by R. H. Popkin and J. E. Force, 143–63. Dordrecht: Kluwer, 1990.

[51] John Gascoigne, "From Bentley to the Victorians: The Rise and Fall of British Newtonian Natural Theology." *Science in Context* 2 (1988): 219–56.

For Paley, the analogy of God as a watchmaker needed to be transferred from the physical to the biological domain. Nature was to be seen as a "contrivance." This important word implies the ideas of *design* and *construction* – both of which Paley held to be evident in the biological world. Paley argues that only someone who is mad would suggest that complex mechanical technology came into being by purposeless chance. Mechanism presupposes contrivance – that is to say, both a sense of purpose and an ability to design and fabricate. Both the human body in particular, and the world in general, could be seen as mechanisms which had been designed and constructed, perfectly adapted to their needs and specific situations.

The opening paragraphs of Paley's *Natural Theology* set out the analogy for which Paley became famous, and which is the subject of many gracious, yet ultimately critical, references within Dawkins' *Blind Watchmaker*:

> In crossing a heath, suppose I pitched my foot against a *stone*, and were asked how the stone came to be there. I might possibly answer, that for any thing I knew to the contrary it had lain there for ever; nor would it, perhaps, be very easy to show the absurdity of this answer. But suppose I had found a *watch* upon the ground, and it should be inquired how the watch happened to be in that place. I should hardly think of the answer which I had before given, that for any thing I knew the watch might have always been there. Yet why should this answer not serve for the watch as well as for the stone; why is it not admissible in the second case as in the first?[52]

Paley then offers a detailed description of the watch, noting in particular its container, coiled cylindrical spring, many interlocking wheels, and glass face. Having carried his readers along with this careful analysis, Paley turns to draw his critically important conclusion:

> This mechanism being observed – it requires indeed an examination of the instrument, and perhaps some previous knowledge of the subject, to perceive and understand it; but being once, as we have said, observed and understood, the inference we think is inevitable, that the watch must have had a maker – that there must have existed, at some time and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer, who comprehended its construction and designed its use.[53]

[52] William Paley, *Works*. London: Wm. Orr & Co., 1849, 25.
[53] Paley, *Works*, 25.

The analogy, like most of Paley's work, was borrowed, and the scholarship decidedly second-rate. Paley had ruthlessly plagiarized John Ray's writings in his quest for a new natural theology. Though a derivative and old-fashioned thinker, Paley was nevertheless an excellent communicator. What he communicated so effectively was nevertheless an outmoded way of thinking. Ways of thinking, dating from the late seventeenth and early eighteenth century, already regarded as outdated and unhelpful by most Christian academics, were given a new lease of life through Paley's populist writing.[54]

Nature, Paley argued, shows signs of "contrivance" – that is, purposeful design and fabrication. Nature bears witness to a series of biological structures which are "contrived" – that is, constructed with a clear purpose in mind. "Every indication of contrivance, every manifestation of design, which existed in the watch, exists in the works of nature." Indeed, Paley argues, nature shows an even greater degree of contrivance than the watch. He is at his best when dealing with the immensely complex structures of the human eye and heart, each of which can be described in mechanical terms. Anyone using a telescope, he points out, can see that this complex instrument was designed and manufactured by someone. Who, he wonders, can look at the human eye, and fail to see that it also has a designer?

Paley's argument is that creation is static. Once God has made things, they don't develop. They were cast in their final form, and needed to undergo no development. For Paley, the notion of development implied imperfection of an original form. And how could a perfect God create an imperfect creature? Since there is no sense of development within Paley's account of creation, the mere demonstration of evolution within nature is sufficient to undermine his entire thesis.

Darwin's theory accounted much more naturally and elegantly for two features of the biological world, which Paley's doctrine of "special creation" could accommodate only in a somewhat forced and clumsy manner. First, during his voyages on the *Beagle,* Darwin had been impressed by the highly individual animal populations of islands, such as the Galapagos. These could easily be accounted for in terms of evolution within a local environment. Paley's theory struggled to make sense of this. Second, Darwin realized that his theory could explain vestigial organs, which had no apparent purpose. Paley had problems explaining why God would equip human beings with appendixes, when they served no useful

[54] For a detailed account, see Alister E. McGrath, *Darwinism and the Divine: Evolutionary Thought and Natural Theology.* Oxford: Wiley-Blackwell, 2011, 85–142.

purpose. Yet for Darwin, these were remnants of an evolutionary past. Darwin believed that his theory of natural selection possessed greater explanatory power than Paley's doctrine of independent acts of special creation. "Light has been shown on several facts, which on the belief of independent acts of creation are utterly obscure."[55]

Like Darwin before him, Dawkins is eloquent and generous in his account of Paley's achievement, noting with appreciation his "beautiful and reverent descriptions of the dissected machinery of life."[56] Without in any way belittling the wonder of the mechanical "watches" that so fascinated and impressed Paley, Dawkins argued that his case for God – though made with "passionate sincerity" and "informed by the best biological scholarship of his day" – is "gloriously and utterly wrong." The "only watchmaker in nature is the blind forces of physics."

Dawkins is right to criticize Paley. Most Christian academics – whether scientists or theologians – of the early Victorian age did the same thing, seeing Paley as representing an outdated way of looking at things that failed to do justice to either the scientific developments of the age, or the basic themes of an informed Christian theology. The great Victorian theologian John Henry Newman declared that Paley's approach was as likely to lead to atheism as to belief in God. Newman rejected Paley's argument from design, in effect proposing an inductive approach to the interpretation of the natural world: "I believe in design because I believe in God; not in God because I see design."[57]

In 1852, Newman was invited to give a series of lectures in Dublin on "the idea of a university." This allowed him to explore the relation between Christianity and the sciences, and especially the "physical theology" of Paley. Newman was scathing about Paley's approach, lambasting it as "a false gospel." Far from being an advance on the more modest approaches adopted by the early church, it represented a degeneration from those views.

The nub of Newman's criticism of Paley's approach can be summarized in a sentence: "it has been taken out of its place, has been put too prominently forward, and thereby has almost been used as an instrument against

[55] Charles Darwin, *Origin of the Species*. 6th edn. London: John Murray, 1872, 164.

[56] *The Blind Watchmaker*, 5.

[57] Newman, letter to William Robert Brownlow, April 13, 1870; in *The Letters and Diaries of John Henry Newman*, vol. 25, 97. For further comment on Newman and arguments from design, see Noel K. Roberts, "Newman on the Argument from Design." *New Blackfriars* 88 (2007): 56–66; Kevin Mongrain, "The Eyes of Faith: Newman's Critique of Arguments from Design." *Newman Studies Journal* 6 (2009): 68–86.

Christianity."[58] Paley's "physical theology" was a liability, and Newman believed that it ought to be abandoned before it discredited Christianity:

> Physical Theology cannot, from the nature of the case, tell us one word about Christianity proper; it cannot be Christian, in any true sense, at all … Nay, more than this; I do not hesitate to say that, taking men as they are, this so-called science tends, if it occupies the mind, to dispose it against Christianity.[59]

Seven years before Darwin had subverted Paley's approach on scientific grounds, Newman – widely regarded as the most important English theologian of the nineteenth century – had repudiated Paley as an outdated theological liability.

What is interesting is that there is no awareness on Newman's part of a new crisis of faith about to be precipitated by Darwin's work. His argument, which predates Darwin's *Origin of Species*, rests solely on his belief that Paley's approach fails in what it sought to deliver, and traps Christian theology in an apologetic which can only go disastrously wrong. It was not the first time Christian apologetics had taken a disastrous wrong turn; an immediate correction was, in Newman's view, long overdue.

Some later Victorian writers took the view that Darwin's theory of evolution allowed Paley to be developed in more helpful directions. As James Moore has shown in his massive and definitive account of Christian responses to Darwin, there were many who believed that the obvious deficiencies in Paley's account of biological life – most notably, the notion of "perfect adaptation" – were corrected by Darwin's notion of natural selection.[60]

More importantly, a series of writers discarded Paley's interest in specific adaptations (to use a Darwinian term unknown to him), and preferred to focus on the fact that evolution appeared to be governed by certain quite definite laws – a clear application to biology of the general approach developed in the Middle Ages by Aquinas, reflected in Baden Powell's influential *Essays on the Spirit of the Inductive Philosophy* (1855).[61]

[58] John Henry Newman, *The Idea of a University*. London: Longmans, Green & Co, 1907, 450–1. For the background, see Fergal McGrath, *The Consecration of Learning; Lectures on Newman's Idea of a University*. Dublin: Gill, 1962.

[59] Newman, *Idea of a University*, 454.

[60] James R. Moore, *The Post-Darwinian Controversies: A Study of the Protestant Struggle to Come to Terms with Darwin in Great Britain and America, 1870–1900*. Cambridge: Cambridge University Press, 1979.

[61] R. S. S. Baden Powell, *Essays on the Spirit of the Inductive Philosophy*. London: Longman, Brown, Green and Longmans, 1855. For an excellent analysis of this thinker, see Pietro Corsi, *Science and Religion: Baden-Powell and the Anglican Debate*. Cambridge: Cambridge University Press, 1988.

The essential point here is that Paley represents the late and final flowering of a movement that came into being in the aftermath of the great Newtonian revolution of the late seventeenth century, and which had completely lost its way by the middle of the eighteenth century. Paley reworked older ideas, unaware that their already tenuous credibility was about to expire. Darwin's *Origin of Species* and later writings are to be seen as a late nineteenth-century refutation of an early eighteenth-century idea regarded with suspicion by leading Christian writers of the early nineteenth century.

So why did Paley work with the idea of a static natural order, established once and for all by God in a primordial act of creation? By locking himself into this static view of things, Paley painted himself into a corner. Neither he nor his later followers could cope with the geological evidence of the world being older than had hitherto been imagined,[62] or with the growing awareness of changes in the biological population over time. Yet these were the assumptions of the late seventeenth century, which was locked into the static way of thinking characteristic of the science of that earlier age. Paley's theology was shaped by the scientific worldview of the early modern period, which led him to think of creation in static terms.[63]

Christianity is not a static entity; rather, it is like a growing plant.[64] Although grounded in the Bible, the Christian theological tradition has always been mindful of the need to interpret its foundational text in the most authentic way possible. This has led to debates within the church over how best to interpret certain passages. In the first 500 years of Christianity, a number of basic principles emerged. One of these was to interpret the Bible in such a way that allowed a creative interaction with the best natural science of the day.

The most influential theologian of this era was Augustine of Hippo (354–430), who is of especial importance in relation to the exploration of the relationship between biblical interpretation and the sciences. Augustine stressed the importance of respecting the conclusions of the sciences in relation to biblical exegesis. As Augustine observed in his commentary on Genesis, certain of its passages were genuinely open to diverse interpretations. It was therefore important to allow further scientific research to

[62] See Stephen Baxter, *Ages in Chaos: James Hutton and the Discovery of Deep Time*. New York: Forge, 2004.

[63] See McGrath, *Darwinism and the Divine*, 219–22.

[64] See here Aidan Nichols, *From Newman to Congar: The Idea of Doctrinal Development from the Victorians to the Second Vatican Council*. Edinburgh: Clark, 1990.

assist in the determination of which was the most appropriate mode of interpretation for a given passage:

> In matters that are so obscure and far beyond our vision, we find in Holy Scripture passages which can be interpreted in very different ways without prejudice to the faith we have received. In such cases, we should not rush in headlong and so firmly take our stand on one side that, if further progress in the search for truth justly undermines our position, we too fall with it. We should not battle for our own interpretation but for the teaching of the Holy Scripture. We should not wish to conform the meaning of Holy Scripture to our interpretation, but our interpretation to the meaning of Holy Scripture.[65]

Augustine therefore urged that biblical interpretation should take due account of what could reasonably be regarded as established facts. This approach to biblical interpretation aimed to ensure that Christian theology never became trapped in a pre-scientific worldview. This has always been the dominant theme in western biblical interpretation. Yet it does not preclude debates over what is the best approach. And these debates often involved trial and error, determining the best way of interpreting a biblical passage by an extended period of discussion and exploration.

And one of those explorations was due to William Paley. It does not matter that history regards it as one of the less successful pieces of theological adventurism. We cannot adopt a "Whig view of history," which lauds those explorations which succeeded, and excoriates those which failed. To use Arnold Toynbee's famous phrase, the whole enterprise of Christian theology, like human civilization itself, is "a movement and not a condition, a voyage and not a harbour."[66] Precisely the same is true of the scientific method. Exploration is essential.

As we have already emphasized, evaluation of Paley's approach to Christian apologetics was underway from 1800, and was essentially complete by 1850, before the publication of Darwin's theory. The verdict? It was an experiment that had failed. It was time to rediscover older approaches to apologetics, and develop new ones, untainted by the failures of Paley. Yet such was Paley's impact that his ideas lingered within Victorian culture – and with them, an essentially static understanding of the biological world, which was improperly assumed to be *the* Christian view of things. No wonder that so many theologians wanted to get back to an earlier, more authentic way of doing theology, and set Paley's adventurism to one side.

[65] On this, see Tarsicius van Bavel, "The Creator and the Integrity of Creation in the Fathers of the Church." *Augustinian Studies* 21 (1990): 1–33.

[66] Arnold J. Toynbee, *Civilization on Trial*. London: Oxford University Press, 1948, 55.

Dawkins' assessment of the theological implications of Darwinism is excessively dependent on the assumption that Paley (or Paleyesque) approaches to the biosphere are typical or normative for Christianity. He also seems to assume that the intellectual case for Christianity rests largely, if not totally, upon an "argument for design" akin to that proposed by Paley. Yet Christian theology does not hold that Christian belief is irrational or lacking positive epistemic status without an appeal to the kind of arguments that Paley develops. Dawkins makes a superb case for abandoning Paley. However, he seems to think this also entails abandoning God.

So what if we were to forget about Paley, and return to the biblical interpretation and theological methods of the early church? Sadly, this is an historical experiment which simply cannot be undertaken. History, like the evolutionary process described by Darwin and Dawkins, is irreversible, and prone to contingencies which lie beyond experimental control. Happenstance is as important in cultural as it is in biological evolution. But what can be said, and needs to be said is this: if the Darwinian debate had taken place in the Greek-speaking church of the fourth century, things would have worked out very differently.[67] *Dawkins' strongly negative assessment of the religious implications of Darwinism depends on depicting a local historical contingency as a universal theological necessity.* Even allowing for the cultural importance of Britain in the nineteenth century, the local and specific conditions of Victorian England cannot be treated as if they were determinant of the Christian faith down the ages.

We need to realize that earlier Christian writers had developed dynamic conceptions of creation – as opposed to Paley's flat and static notion – which were highly amendable to an evolutionary view. In what follows, we shall consider one of the best-known examples.

## Dynamic Conceptions of Creation: Augustine of Hippo

In the early fifth century, Augustine of Hippo – widely regarded as one of Christianity's most perceptive and influential theologians – published his reflections on the first three chapters of Genesis. *De Genesi ad litteram* ("On the Literal Meaning of Genesis") was written between 401 and 415.[68] One of the most important ideas developed in this commentary is

[67] See Frances M. Young, "Adam and Anthropos: A Study of the Interaction of Science and the Bible in Two Anthropological Treatises of the Fourth Century." *Vigiliae Christianae* 37 (1983): 110–40.

[68] It is important to distinguish the complete mature work *De Genesi ad litteram libri duodecim* (401–15) from the incomplete earlier work *De Genesi ad litteram imperfectus liber* (393–4). All references in this chapter are to the complete mature work.

that God's act of creation was not limited to an act of origination, but extended to include subsequent unfolding and development of the original creation. The world was created with the capacity for further development, under God's providential direction. Where some thought of creation in terms of God's insertion of new kinds of plants and animals ready-made, as it were, into an already existing world, Augustine rejects this as inconsistent with the overall witness of the Bible. Rather, God must be thought of as creating in that very first moment the potencies (Augustine uses the image of a "seed") for all the kinds of living things that would come later, including humanity.

Augustine thus argued that God created the world with the capacity to develop from the "seedlike principles" that were present from the beginning, each of which contained the potential for the later development of a specific living kind.[69] Augustine suggests that the earth has received from God the power or capacity to produce things by itself.[70] The notion of the "seed" is best understood as heuristic, providing an inexact, though helpful, means of visualization for the theologically difficult yet important notion of God continuing to act within nature to actualize the potentialities embedded within the created order at the moment of its creation.[71] The image of the seed implies that the original creation contained within it the potentialities for all the living kinds that would subsequently emerge.

Augustine thus taught that there were two "moments" in creation, corresponding to a primary act of origination, and a continuing process of providential guidance.[72] While conceding that there is a natural tendency to think of creation as a past event, Augustine insists that God must be recognized to be working even now, in the present, sustaining and directing the unfolding of the "generations that he laid up in creation when it was first established."[73]

Augustine insists that this does not mean that God created the world incomplete or imperfect, in that "what God originally established in causes, he subsequently fulfilled in effects."[74] The world was created with an inbuilt potentiality to become what God intended it to be over time, which was bestowed in the primordial act of origination.[75] This process of

[69] See further Michael J. McKeough, *The Meaning of the Rationes Seminales in St Augustine*. Washington: Catholic University of America Press, 1926.
[70] Augustine, *De Genesi ad litteram*, V.iv.11.
[71] Augustine, *De Genesi ad litteram*, VI.vi.10–11; IV.xvi.27.
[72] Augustine, *De Genesi ad litteram*, V.iv.11.
[73] Augustine, *De Genesi ad litteram*, V.xx.41–2.
[74] Augustine, *De Genesi ad litteram*, VI.xi.19.
[75] Augustine, *De Genesi ad litteram*, VI.xi.18.

development, Augustine declares, is governed by fundamental laws, which reflect the will of their creator: "God has established fixed laws governing the production of kinds and qualities of beings, and bringing them out of concealment into full view, so that God's will might be over all."[76]

We see here an explicit affirmation of the role of divine providence in guiding the emergence of the natural world by "fixed laws" [*certas leges*]. This notion would play an important role in guiding later thinking on the "laws of nature" or "scientific laws."[77] Augustine uses the idea of a providentially directed process of emergence to articulate a two-fold notion of creation, both as a primordial event with embedded possibilities, and the subsequent actualization of those possibilities over time.

Even this very brief account of Augustine's theology of creation will make it clear that it offers a helpful framework within which to set a Christian account of biological evolution. Implicit within Augustine's account of creation is the notion that creation entails the origination of a potentially multilevel reality, whose properties *emerge* under certain conditions which either did not exist, or were not considered appropriate for development, at the origins of the universe. Augustine argues that the universe was brought into being with the intrinsic capacities to develop into its full form, subject to God's guidance. This contrasts sharply with the views of Paley, who believed that that any idea that nature possessed vital powers or inherent forces sufficient to create its own order was tantamount to atheism.[78]

We need to set Augustine's approach alongside the celebrated remark by Charles Kingsley (1819–75), arising from his reflections on Darwin's *Origin of Species*: "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."[79] Why, it may reasonably be asked, did Kingsley not develop this idea from his reading of Augustine, rather than of Darwin? Why was he not able to bring this theological framework to his reading of Darwin, and realize its potential resonance with what he found in the *Origin of Species*? After all, the English Catholic biologist St. George Mivart (1827–1900) knew about Augustine's approach, and

[76] Augustine, *De Genesi ad litteram,* VI.xiii.23.

[77] For the subsequent use of significant phrases such as "quasdam certas leges," see Jane E. Ruby, "The Origins of Scientific 'Law'." *Journal of the History of Ideas* 47 (1986): 341–59.

[78] William Paley, *Natural Theology: or, Evidences of the Existence and Attributes of the Deity.* 12th edn. London: Faulder, 1809, 427–34.

[79] Charles Kingsley, "The Natural Theology of the Future." In *Westminster Sermons.* London: Macmillan, 1874, v–xxxiii, xxv. Like Augustine, Kingsley saw this process as being directed by divine providence (xxiv–xxv).

appreciated the importance of the framework it offered for accommodation evolutionary perspectives. "St. Augustine insists in a very remarkable manner on the merely derivative sense in which God's creation of organic forms is to be understood; that is, that God created them by conferring on the material world the power to evolve them under suitable conditions."[80] And Frederick Temple (1821–1902), later to become archbishop of Canterbury, saw such an approach as the obvious way ahead for Christian theology. In some influential lectures of 1884, Temple suggested that God had endowed the creation with "such inherent powers that in the ordinary course of time living creatures such as the present were developed … He did not make the things, we may say; no, but He made them make themselves."[81]

Paley's approach, and others like it, are a contingency of history, the outcome of the prevailing scientific consensus of the early eighteenth century (which some unwisely assumed to be permanently valid), and an ecclesiastical establishment which wanted to emphasize the importance of stability, order, and regularity, and was perfectly happy to go along with Paley's approach and its predecessors as a means to that end – not because they knew (or even believed) it was wrong, but simply because they appear to have lacked an awareness of viable and authentic alternatives from the first great period of Christian theological reflection.

If Paley and his colleagues can be said to have taken a wrong turn, we must thank Dawkins for pointing this out – although noting that many in the Victorian age had already drawn the same conclusion. It is not Christianity as such that Dawkins has discredited, but a decidedly English theological fashion of the eighteenth century, which had long been abandoned by Christian academics. The Catholic philosopher of religion Christopher F. J. Martin gets it right when he remarks: "The Being whose existence is revealed to us by the argument from design is not God but the Great Architect of the Deists and Freemasons, an impostor disguised as God, a stern, kindly, and immensely clever old English gentleman, equipped with apron, trowel, square and compasses."[82] Yet Paley's vivid analogy lingers on in popular accounts of faith, particularly within North American Protestantism. Perhaps this was the real target of Dawkins' criticism.

[80] St. George Mivart, *On the Genesis of Species*. New York: Appleton & Co., 1871, 281. For discussion see Don O'Leary, *Roman Catholicism and Modern Science: A History*. New York: Continuum, 2006, 78–93.

[81] Frederick Temple, *The Relations between Religion and Science*. London: Macmillan, 1885, 115.

[82] Christopher F. J. Martin, *Thomas Aquinas: God and Explanations*. Edinburgh: Edinburgh University Press, 1997, 181.

## Natural Selection and Religious Beliefs: Darwin's Views

So what of Darwin's own religious faith? Did his theory of evolution turn him into an atheist crusader against religious belief, as some seem to suggest? Unfortunately, Darwin's authority and example are continually invoked to justify metaphysical and theological claims that go far beyond anything that he himself expressed in, or associated with, his evolutionary biology. Happily, the fundamentally *historical* question of Darwin's religious views is relatively easy to answer, thanks to the intensive scholarly study of Darwin and his Victorian context in the last few decades.[83] The excellent online Darwin Project has a section which brings together the most important historical evidence in a way that is both historically objective and trustworthy.[84]

There are two related questions that need to be considered. First, what were Darwin's own religious views? It seems that Darwin abandoned what we might call "conventional Christian beliefs" at some point in the 1840s, although the dating of this must probably remain elusive. Yet there is a substantial theoretical gap between "abandoning an orthodox Christian faith" and "becoming an atheist." Christianity involves a highly specific conception of God; it is perfectly possible to believe in a god other than that of Christianity, or to believe in God and reject certain other aspects of the Christian faith. Indeed, the "Victorian crisis of faith" – within which Darwin is widely seen as having been both spectator and participant – can be understood as a shift away from the specifics of Christianity toward a more generic concept of God, largely determined by the ethical values of the day.[85] Darwin, like many others, appears to have moved toward what might reasonably be described as a Deist conception of God, rather than the more specific divinity of the Christian faith.[86] It is not difficult to

[83] See for example John Hedley Brooke, "The Relations between Darwin's Science and His Religion." In *Darwinism and Divinity*, edited by John Durant. Oxford: Blackwell, 1985, 40–75; Frank Burch Brown, *The Evolution of Darwin's Religious Views*. Macon, GA: Mercer University Press, 1986; John Hedley Brooke, "Darwin and Victorian Christianity." In *The Cambridge Companion to Darwin*, edited by Jonathan Hodge and Gregory Radick, 192–213. Cambridge: Cambridge University Press, 2003.

[84] See www.darwinproject.ac.uk, accessed August 8, 2014.

[85] Perhaps too much has been made of this "crisis of faith": see Timothy Larsen, *Crisis of Doubt: Honest Faith in Nineteenth-Century England*. Oxford: Oxford University Press, 2006.

[86] See Frank Burch Brown, "The Evolution of Darwin's Theism." *Journal of the History of Biology* 19 (1986): 1–45. It is interesting to compare Darwin's views with the idea of "generic divinity" found in the writings of Benjamin Franklin: David T. Morgan, "Benjamin Franklin: Champion of Generic Religion." *Historian* 62 (2000): 723–9. While having difficulties with the Christian idea of God, Franklin was no atheist.

discern a more or less continuous trajectory from the Christian orthodoxy of his Cambridge years to a non-biblical Deism at the time of the publication of the *Origin of Species*, and subsequently to a more agnostic position in later life (although Darwin was not entirely consistent in his leanings at this time).[87]

While Darwin's religious beliefs unquestionably veered away from what we might loosely call "Christian orthodoxy," they are not replaced with anything even remotely resembling the aggressive and ridiculing form of atheism we unfortunately find in some of those who have presented themselves as his champions in more recent times. There is little in Darwin's writings to point to any such conclusion. In 1879, while working on his autobiography, Darwin commented on his personal religious confusion: "My judgement *often fluctuates* … In my most extreme fluctuations I have never been an Atheist in the sense of denying God. I think that generally (and more and more as I grow older), *but not always*, that an Agnostic would be the more correct description of my state of mind."[88]

Two factors are known to have been a particular concern for Darwin, with negative implications for his attitude toward traditional Christianity. First, Darwin found the existence of pain and suffering in the world to be an unbearable intellectual and moral burden. It is widely agreed that what C. S. Lewis termed "the problem of pain" is one of the most significant obstacles to Christian belief, and it is entirely understandable that one as sensitive as Darwin should feel the weight of this matter, particularly in the light of his own protracted (and still unexplained) illness.[89] The death of his daughter Annie at the tender age of ten unquestionably deepened his feeling of moral outrage over this issue.[90]

In 1961, Donald Fleming put forward the important thesis that Darwin's experience of suffering was an integral element of his own loss of faith. Fleming held that Darwin came to believe that "modern man would rather have senseless suffering than suffering warranted to be intelligible because willed from on high."[91] Pain and suffering were to be accepted as

[87] It is interesting to note how many scientists have held religious views that were heterodox, at least to some degree. See the important studies gathered together in John Hedley Brooke and Ian McLean, eds., *Heterodoxy in Early Modern Science and Religion*. Oxford: Oxford University Press, 2006.

[88] *Life and Letters of Darwin*, vol. 1, 304.

[89] For a study of the causes of Darwin's illness, characterized by intermittent "excitement, violent shivering and vomiting attacks," see Ralph E. Colp, *To Be an Invalid: The Illness of Charles Darwin*. Chicago: University of Chicago Press, 1977.

[90] This has been beautifully documented by Randal Keynes, *Annie's Box: Charles Darwin, His Daughter and Human Evolution*. London: Fourth Estate, 2001.

[91] Donald Fleming, "Charles Darwin, the Anaesthetic Man." *Victorian Studies* 4 (1961): 219–36.

the meaningless outcome of the evolutionary process; this, however disagreeable, seemed preferable to the alternative – namely, that God either inflicted suffering himself, or permitted it to be inflicted by others.

The idea that evolution took place according to certain general principles or laws, with the precise details left to chance, never entirely satisfied Darwin, seeming to leave many intellectual loose ends and open up difficult moral issues – not least, the immense wastage of life attending the process of natural selection. But it seemed to Darwin to be less troubling than the alternative – that "a beneficent and omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of caterpillars."[92] At least this could be put down to an accident of nature, rather than purposeful divine design.

Second, Darwin shared the moral outrage of the mid-Victorian period over some aspects of Christian doctrine especially associated with the increasingly influential evangelical movement. Like George Eliot (1819–80) and many others at the time,[93] Darwin reacted with repugnance to ideas such as the damnation to everlasting Hell of those who did not explicitly believe the Christian gospel.[94] Darwin felt this outrage with particular force, on account of his father's somewhat unorthodox religious beliefs. As he wrote in his *Autobiography*: "I can indeed hardly see how anyone ought to wish Christianity to be true; for if so the plain language of the text seems to show that the men who do not believe, and this would include my Father, Brother and almost all of my friends, will be everlastingly punished. And this is a damnable doctrine."[95] In October 1882, six months after Darwin's death, his widow asked that this particular passage should not be published. She wrote the following in the margins of her husband's manuscript at this point: "I should dislike the passage in brackets to be published. It seems to me raw. Nothing can be said too severe upon the doctrine of everlasting punishment for disbelief – but very few now wd. call that 'Christianity.'"[96] We can see here something of the spirit of this remarkable period in English cultural history, in which some aspects of evangelical Christianity were subjected to an unprecedented level of

[92] Letter to Asa Gray, May 22, 1860, *Life and Letters of Darwin*, vol. 2, 310–12.

[93] U. C. Knoepflmacher, *Religious Humanism and the Victorian Novel: George Eliot, Walter Pater, and Samuel Butler*. Princeton, NJ: Princeton University Press, 1970.

[94] For an excellent overview of this moral revulsion, see Geoffrey Rowell, *Hell and the Victorians: A Study of the Nineteenth-Century Theological Controversies Concerning Eternal Punishment and the Future Life*. Oxford: Clarendon Press, 1974.

[95] *The Autobiography of Charles Darwin 1809–1882*, edited by Nora Barlow. London: Collins, 1958, 87.

[96] *Autobiography of Charles Darwin*, 87, n. 1.

criticism, reflecting a growing belief that these accounts of the nature and purposes of God were deficient and unacceptable within an increasingly sophisticated culture.[97] Darwin here speaks with the voice of his age, and does not add anything of a specifically evolutionary character.

But it is the second question that is the more important for our purposes in this section. What did Darwin believe to be the relationship between his theory of natural selection and Christianity, *irrespective of whether Darwin himself is to be regarded as an orthodox or conventional Christian believer*? In other words, setting Darwin's personal religious views to one side, did he think that a Christian could accept his approach to evolution, as set out in the successive editions of the *Origin of Species*? Once more, Darwin discusses this matter explicitly in his works, making it clear that he considered his approach to evolution as causing no mental discomfort for orthodox Christian belief. This is perhaps the most striking difference between Darwin and Dawkins, and has not received the attention that it deserves.

Many have praised the prescience and cool neutrality of Darwin's *Origin of Species*, noting its Olympian social and political detachment and scrupulous religious neutrality. It is in Darwin's letters that we must turn for illumination of both the fluctuations of his religious beliefs over time, as well as his reluctance to comment on religious matters, including his own personal beliefs. Yet when the context demanded it, Darwin seems to have been willing, not merely to go on record concerning, but to emphasize, the consilience of religious faith and the theory of natural selection.

A representative example lies to hand in his reference to "laws impressed on matter by the Creator," which is given a higher profile in the second edition of the *Origin* than in the first.[98] Darwin's emphasis upon the role of natural laws in governing evolutionary processes prompted some to suggest that Darwin had achieved for biology what Newton had achieved for physics. Ernst Haeckel, for example, wrote of Darwin as the "new Newton," who had uncovered the natural laws governing the biological domain.[99] Darwin's theory of natural selection was comparable to Newton's law of gravity. Taken together, they offered a unitary vision of the natural

[97] See here works such as Howard R. Murphy, "The Ethical Revolt against Christian Orthodoxy in Early Victorian England." *American Historical Review* 60 (1955): 800–17.

[98] See the analysis in John Hedley Brooke, "'Laws Impressed on Matter by the Creator'? The *Origins* and the Question of Religion." In *The Cambridge Companion to the "Origin of Species,"* edited by Michael Ruse and Robert J. Richards, 256–74. Cambridge: Cambridge University Press, 2009.

[99] See John F. Cornell, "Newton of the Grassblade? Darwin and the Problem of Organic Teleology." *Isis* 77 (1986): 405–21.

world.[100] As Newtonian physics had led to the emergence of a new style of natural theology, might not Darwinian biology have a similar outcome? Newton had uncovered the laws of physics; Darwin those of biology.

Such lines of reflection might well end up leading to a Deistic conception of God, rather than a Trinitarian God. But there is not even the whiff of a personal atheism here. While some might argue that Darwin may have made it possible to be an intellectually fulfilled atheist, Darwin did not himself draw that conclusion. It is difficult to believe that his references to a Creator in the *Origin of Species* were simply contrived to mollify his audience, representing crude deceptions aimed at masking a private atheism which Darwin feared might discredit his theory in the eyes of the religious public. As Darwin himself commented to Asa Gray (1810–88) in May 1860, concerning his *Origin of Species*, he had no intention of writing "atheistically," and did not believe that his views on natural selection entailed atheism: "I can see no reason, why a man, or other animal, may not have been aboriginally produced by other laws; and that all these laws may have been expressly designed by an omniscient Creator, who foresaw every future event and consequence."[101] While Darwin saw his doctrine of natural selection as consistent with belief in a creator God, he did not see this as *entailing* a creator God, and often expressed his own personal uncertainty about this matter. But the point is this: whatever Darwin's own religious views may have been, he was clear both that others who did believe in a creator God ought not to have intellectual difficulty with his theory, and that his theory itself was not a challenge to their beliefs. Dawkins is not good at doing history, and his failure to engage adequately with Darwin's views at this crucial point is difficult to understand – especially when Darwin so clearly contradicts Dawkins at this juncture.

Darwin's enemy was not God, nor even the Church of England, but a specific view of God which limited the act of creation to a series of specific past divine actions, leading to a fixed, static biological realm. Yet it is not necessary to determine Darwin's personal religious views to evaluate is impact upon natural theology in the Victorian age. Thomas H. Huxley, who was rather inclined to emphasize the anti-religious aspects of Darwin's thought, was quite clear that "the doctrine of Evolution is neither Anti-theistic nor Theistic."[102] Darwin's theory denied direct divine creation of

[100] See Bernard Kleeberg, "God-Nature Progressing: Natural Theology in German Monism." *Science in Context* 20 (2007): 537–69.

[101] *Life and Letters of Darwin*, vol. 2, 312.

[102] Thomas H. Huxley, "On the Reception of the *Origin of Species*." In *Life and Letters of Darwin*, vol. 2, 202.

biological organisms. The question that remained open was whether it also denied indirect involvement, such as action through secondary causes.

In this section, I expressed concern that Dawkins has not adequately engaged with Darwin's own views on the compatibility of natural selection and belief in God. We must now turn to another historical question, which raises further doubts concerning whether Dawkins has adequately justified his atheist reading of Darwinism. In what follows, we shall reflect on the views of leading Christian biologists and theologians around the time of Darwin himself to the new theory of natural section.

## The Christian Reaction to Darwin

Within thirty years of the publication of Darwin's *Origin of Species*, many within the establishment of the Church of England had swung behind the new ideas, and pronounced them to be perfectly consistent with Christian theology. This positive new attitude within the established church was noticed by most, including Huxley. In November 1887, he penned an essay in the journal *Nineteenth Century*, summarizing and evaluating three recent sermons by senior bishops of the Church of England. These were preached in Manchester Cathedral on Sunday, September 4, 1887, during the meeting of the British Association for the Advancement of Science, by the bishops of Carlisle, Bedford, and Manchester.[103] "These excellent discourses," Huxley wrote with evident enthusiasm, "signalize a new departure in the course adopted by theology towards science, and to indicate the possibility of bringing about an honourable *modus vivendi* between the two." Huxley welcomed this genuine attempt to achieve a rapprochement – no, more than that: a genuine convergence – of the natural sciences and theology. Perhaps his greatest enthusiasm was reserved for the firm rejection of any notion of demanding isolated intellectual compartments of the human mind for dealing with both. Huxley singled out one comment by the bishop of Bedford for especial praise, in which the bishop repudiated any idea that science and religion

> occupy wholly different spheres, and need in no way intermeddle with each other. They revolve, as it were, in different planes, and so never meet. Thus we may pursue scientific studies with the utmost freedom and, at the same time, may pay the most reverent regard to theology, having no fears of collision, because allowing no points of contact.[104]

[103] Text in Thomas H. Huxley, "An Episcopal Trilogy." In *Science and Christian Tradition: Essays*, 126–59. London: Macmillan, 1894.

[104] Huxley, "An Episcopal Trilogy," 129.

Why bother with such historical details? Because they make it clear that it is deeply problematic to suggest that Darwinism *necessitates* atheism. As a matter of historical fact, Darwinism was not *perceived* to entail atheism by the best-informed judges of the time. Huxley's personal view was that it led to a principled agnosticism. However, his comments on these sermons indicates that he did not regard this as a completed closed question. While there was opposition, particularly from some popular preachers, to Darwin's ideas, the vast scholarly endeavor to understand both popular and academic reaction to them has demonstrated a far greater level of religious support for Darwin than was previously supposed.[105]

This support for Darwin was not restricted to the Church of England. A growing interest in Darwin is evident in North America around this time, even in those more conservative religious groups from which opposition might be expected. An excellent example of this positive assessment of Darwin can be found in Benjamin B. Warfield (1851–1921), widely regarded as the most important American theologian of the late nineteenth century. Although characterized by a conservative Protestant religious outlook, Warfield made clear his support for the concept of biological evolution.[106] Where Darwin regarded the evolutionary process as resting upon chance variations, whose subsequent fate was determined by general principles, Warfield argued that it was entirely proper to see the evolutionary process as guided by divine providence.

In fact, the theory was surprisingly widely accepted within early North American fundamentalism. This movement derives its name from a series of short publications entitled *The Fundamentals*, which appeared over the period from 1912 to 1917.[107] One of those fundamentalist essays was by James Orr, who argued that evolution "is coming to be recognized as but a new name for 'creation', only that the creative power now works from *within*, instead of, as in the old conception, in an *external*, plastic fashion."[108] Although hostile to Darwin's notion of random variations,

[105] See for example David N. Livingstone, *Darwin's Forgotten Defenders: The Encounter between Evangelical Theology and Evolutionary Thought*. Grand Rapids, MI: Eerdmans, 1987.

[106] See David N. Livingstone, "B. B. Warfield, the Theory of Evolution and Early Fundamentalism." *Evangelical Quarterly* 58 (1986): 69–83; David N. Livingstone and Mark A. Noll, "B. B. Warfield (1851–1921): A Biblical Inerrantist as Evolutionist." *Isis* 91 (2000): 283–304; Alister E. McGrath, "Evangelicalism and Science." In *The Oxford Handbook of Evangelical Theology*, edited by Gerald McDermott, 434–48. New York: Oxford University Press, 2010.

[107] For details, see George Marsden, *Fundamentalism and American Culture: The Shaping of Twentieth Century Evangelicalism 1870–1925*. New York: Oxford University Press, 1980.

[108] James Orr, "Science and Christian Faith." In *The Fundamentals*. 4 vols. Los Angeles: Bible Institute of Los Angeles, 1917, vol. 1, 334–47. Emphases original.

Orr was clear that the process of natural selection could easily be viewed in terms consistent with Christian theism.

We might also pause here to note the views of Sir Ronald A. Fisher, one of the most important evolutionary biologists of the twentieth century.[109] Fisher, whose many theoretical achievements are noted by Dawkins, is often cited as the father of the neo-Darwinian synthesis. Although a rather private man, Fisher was perfectly prepared to get involved in controversy whenever he believed scientific truth was being compromised. That he did not regard neo-Darwinism as entailing atheism (or even agnosticism) is perfectly clear from a sermon he preached in the chapel of Gonville and Caius College, Cambridge, in 1947:

> To the traditionally religious man, the essential novelty introduced by the theory of the evolution of organic life, is that creation was not all finished a long while ago, but is still in progress, in the midst of its incredible duration. In the language of Genesis we are living in the sixth day, probably rather early in the morning, and the Divine artist has not yet stood back from his work, and declared it to be "very good." Perhaps that can only be when God's very imperfect image has become more competent to manage the affairs of the planet of which he is in control.[110]

Fisher retired to Australia in 1959, and is buried in Adelaide Cathedral, South Australia.

Stephen Jay Gould rightly pointed out that many leading Darwinians self-defined religiously, and saw no problem about doing so.[111] As Gould observes, any suggestion that Darwinian theory of evolution is *necessarily* atheistic goes way beyond the competency of the natural sciences, and strays into territory where the scientific method cannot be applied. If it is applied, it is *mis*applied. Thus Gould argues that Charles Darwin was agnostic (having lost his religious beliefs upon the tragic death of his favorite daughter), whereas the great American botanist Asa Gray, who advocated natural selection and wrote a book entitled *Darwiniana*, was a devout Christian.

More recently, Gould continues, Charles D. Walcott (1850–1927), the discoverer of the Burgess Shale fossils, was a convinced Darwinian and an equally firm Christian, who believed that God had ordained natural

[109] See the excellent biography by his daughter, Joan Fisher Box, *R. A. Fisher: The Life of a Scientist*. New York: Wiley, 1978.

[110] R. A. Fisher, "The Renaissance of Darwinism." *The Listener* 37 (1947): 1001.

[111] Stephen Jay Gould, "Impeaching a Self-Appointed Judge." *Scientific American* 267, no. 1 (1992): 118–21.

selection to construct a history of life according to His plans and purposes. More recently still, the "two greatest evolutionists of our generation" show radically different attitudes to the existence of God: George Gaylord Simpson (1902–84) was a humanist agnostic, Theodosius Dobzhansky a believing Russian Orthodox. As Gould concludes: "Either half my colleagues are enormously stupid, or else the science of Darwinism is fully compatible with conventional religious beliefs – and equally compatible with atheism."[112] And that, in a nutshell, seems to be where the debate has ended. Darwinism can be held to be consistent with conventional religious beliefs, agnosticism, and atheism. It all depends on how these terms are defined. The debate itself is fascinating, and opens up many important questions about the limits of the scientific method, the interpretation of the Bible, the evidential basis of faith, the transition from scientific theories to worldviews, and the history of biology. It is impossible to study, or become involved in, such debates without being challenged and stimulated to think through some of life's great issues.

But the debate, though immensely worthwhile and intellectually fascinating, is religiously inconclusive. Dawkins presents Darwinism as an intellectual superhighway to atheism. In reality, the intellectual trajectory mapped out by Dawkins seems to get stuck in a rut at agnosticism. And having stalled, it stays there. There is a substantial logical gap between Darwinism and atheism, which Dawkins seems to prefer to bridge by rhetoric, rather than evidence. If firm conclusions are to be reached, they must be reached on other grounds. And those who earnestly tell us otherwise have rather a lot of explaining to do.

[112] Gould, "Impeaching a Self-Appointed Judge," 119–20.

# 5

# Cultural Darwinism?
## *The Invention of the Meme*

Darwinism, Dawkins believes, is too big a theory to be limited to the field of biology. Why restrict Darwinism to the world of the gene, when it is laden with significance for every aspect of human life and thought? In *The Selfish Gene*, Dawkins explains that he had long been interested in the analogy between cultural and genetic information. Might not Darwinian theory also be applied to human culture, rather than being limited to the world of biology? This intellectual move lays the ground for converting Darwinism from a scientific theory to a worldview – a metanarrative, an overarching view of reality.

## Universal Darwinism: The Evolution of Culture

Dawkins stands in a long tradition of those who have attempted to apply Darwin's theory of evolution to human culture.[1] It is, however, a challenging and deeply problematic suggestion, not least because the shaping of human culture involves active agency on the part of human beings. Not all cultural developments are the result of forethought and deliberate planning; but many are – and are often planned on the basis

[1] For a defense of this approach, see Alex Mesoudi, *Cultural Evolution: How Darwinian Theory Can Explain Human Culture and Synthesize the Social Sciences.* Chicago: University of Chicago Press, 2011. An often-overlooked example is Peter Medawar's analysis of tradition in terms of selection pressures: see Peter Medawar, "Tradition: The Evidence of Biology." In *The Uniqueness of the Individual.* New York: Basic Books, 1958, 134–42.

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Alister E. McGrath.
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of understandings (such as those of Antonio Gramsci) of how the process of cultural evolution can be manipulated and directed.[2] "Human agents act intentionally to produce anticipated cultural outcomes. They are not 'blind watchmakers'."[3] Although the application of any biological model of evolution to cultural development is fraught with difficulties, the intentionality of at least some aspects of cultural development would seem to point to a Lamarckian, rather than a Darwinian, model as having superior explanatory potential.[4]

The move, however, requires a cultural equivalent to the gene – a "cultural replicator," which ensures the transmission of information across time and space. If this concept of a cultural replicator could be established on a firm scientific basis, Darwinism would be transformed into a universal method, reaching beyond the specific domain of biological evolution to include the world of culture.[5]

The evolutionary psychologist Donald T. Campbell (1916–96) developed the idea of a "cultural replicator" as early as 1960 as part of his "blind variation and selective retention" model of cultural evolution,[6] and introduced the term "mnemone" to describe this.[7] The related idea of the "culturgen" has found particular acceptance within North

[2] E.g., see Anne Showstack Sassoon, *Gramsci and Contemporary Politics: Beyond Pessimism of the Intellect*. London: Routledge, 2000, 15–42.

[3] Ted Benton, "Social Causes and Natural Relations." In *Alas, Poor Darwin: Arguments against Evolutionary Psychology*, edited by Hilary Rose and Steven Rose, 206–24. London: Harmony, 2000, 216. For similar concerns, see Joseph M. Bryant, "An Evolutionary Social Science? A Skeptic's Brief, Theoretical and Substantive." *Philosophy of the Social Sciences* 34 (2004): 451–92.

[4] The situation is much more complex than it might at first seem, as pointed out by Maria E. Kronfeldner, "Is Cultural Evolution Lamarckian?" *Biology and Philosophy* 22 (2007): 493–512.

[5] See Joseph Poulshock, "Universal Darwinism and the Potential of Memetics." *Quarterly Review of Biology* 77 (2002): 174–5.

[6] Donald T. Campbell, "Blind Variation and Selective Retention in Creative Thought as in Other Knowledge Processes." *Psychological Review* 67 (1960): 380–400; idem, "Variation, Selection and Retention in Sociocultural Evolution." In *Social Change in Developing Areas: A Reinterpretation of Evolutionary Theory*, edited by H. R. Barringer, G. I. Blanksten, and R. W. Mack, 19–49. Cambridge, MA: Schenkman, 1965. For an evaluation of the approach, see Dean Keith Simonton, "Creative Thought as Blind-Variation and Selective-Retention: Combinatorial Models of Exceptional Creativity." *Physics of Life Reviews* 7 (2010): 156–79.

[7] Donald T. Campbell, "A General 'Selection Theory' as Implemented in Biological Evolution and in Social Belief-Transmission-with-Modification in Science." *Biology and Philosophy* 3 (1988): 413–63. The term was first introduced by Campbell in 1974; this article sets out a later exposition of the notion.

American sociobiology.[8] Yet such clumsy terms failed to capture the popular imagination. In marked contrast, Dawkins developed an approach that got noticed.

## Introducing the Meme

In *The Selfish Gene*, Dawkins introduced the term which has come to dominate popular discussion of the issue of cultural evolution: the "meme." Dawkins recalls how he wanted a word for a "cultural replicator" that sounded like "gene" – thus stressing the analogy between cultural and genetic transmission – and came up with "meme,"[9] an abbreviation of the term "mimeme," which he derived from the Greek *mimesis* ("imitation"). The meme was proposed as a hypothetical replicator – "a unit of cultural transmission, or a unit of *imitation*"[10] – to explain the process of the development of culture within a Darwinian framework.

Although the notion of a cultural replicator had been developed earlier, Dawkins popularized the concept, and made it accessible to a wider audience through his simple terminology and illustrations. In part, the greater success of this term can be put down to the neater and more memorable terminology Dawkins developed. Yet another factor was the greater popular reach of his writings, which allowed a much wider reading public to become aware of the potential of essentially biological analogues for cultural development. As a result, Dawkins' work has generated considerable popular discussion.[11] In this chapter, we shall explore Dawkins' central contribution to a Darwinian account of the evolution of human culture.

[8] A "culturgen" is to be understood as "a relatively homogenous set of artifacts, behaviours, or mentifacts"; Charles J. Lumsden and Edward O. Wilson, *Genes, Mind, and Culture: The Coevolutionary Process*. Cambridge, MA: Harvard University Press, 1981, 27. For an assessment of this concept, see Brian Baxter, *A Darwinian Worldview: Sociobiology, Environmental Ethics and the Work of Edward O. Wilson*. Aldershot: Ashgate, 2007, 59–76.

[9] *The Selfish Gene*, 192. Similarly, the word "memetic" was coined, paralleling "genetic"; once more, the intention was to stress that both biological and cultural evolution could be accounted for by "units of replication" or "units of transmission."

[10] *The Selfish Gene*, 192. Emphasis original. On the "imitation" theme, see Lee Alan Dugatkin, *The Imitation Factor: Evolution beyond the Gene*. New York: Free Press, 2000, 115–35.

[11] See for example Susan J. Blackmore, *The Meme Machine*. Oxford: Oxford University Press, 1999. This is best seen as a somewhat ambitious extension of Dawkins' approach, which goes beyond his own formulation of the notion.

So what is a meme? Dawkins answers this question clearly in *The Selfish* Gene, even though he is a little vague about the mechanism by which memes transfer information:

> Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches. Just as genes propagate themselves in the gene pool by leaping from body to body via sperm or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain by a process which, in the broad sense of the term, can be called imitation.[12]

For Dawkins, one of the best examples of a meme is believing in God – an idea that has come to feature prominently in recent popular atheist polemical writings. But how reliable is this idea?

The "memetic" approach is unquestionably helpful in formulating research questions in the field of intellectual history and cultural development. The three core elements of evolutionary theory – selection, variation, and replication – can all be seen at work in cultural contexts. In her analysis of the concept of the meme, Kate Distin has shown how all three elements can be seen in the phenomenon of cultural evolution.[13] For example, a meme may mutate, and be transmitted in a different form – which is then subject to the selection process.[14] This is unquestionably part of the picture of cultural evolution. But it is only part of the picture. Yes, memes may mutate – but they may equally be deliberately changed by humans with agendas, and access to the mechanisms which influence the cultural reception of ideas and values. The sociological issues of human agency, control, and power simply cannot be avoided here. We may concede that certain aspects or elements of cultural evolution may be analogous to biological evolution. Yet the overall picture is much more complex.[15]

A further point needs clarification. In *The Selfish Gene*, Dawkins identifies tunes, ideas, catch-phrases, fashions, aspects of architecture, songs, and believing in God, as examples of memes. Yet there is a problem with this definition of the meme. In Dawkins' account of the neo-Darwinian synthesis, it is the *gene* that is the unit of selection, even though it is the

[12] *The Selfish Gene*, 173.

[13] Kate Distin, *The Selfish Meme: A Critical Reassessment*. Cambridge: Cambridge University Press, 2005.

[14] Distin develops these themes more fully in Kate Distin, *Cultural Evolution*. Cambridge: Cambridge University Press, 2011, 49–62.

[15] For example, see the points made by Peter Godfrey-Smith, "Darwinism and Cultural Change." *Philosophical Transactions of the Royal Society B* 367 (2012): 2160–70.

*phenotype* which is actually subject to the process of selection. The gene is the replicator, or the set of instructions; the phenotype is the physical manifestation of the organism, the visible characteristics or behavior resulting from that set of instructions. Yet all the examples of memes that Dawkins offers in *The Selfish Gene* are the *result* of such instructions, not the instructions themselves. While Dawkins proposed an analogy between meme and gene, he actually illustrated this by appealing to the cultural equivalent of phenotypes, not genes. Dawkins' suggestion of a parallel between the propagation of genes in the gene pool and memes in a (hypothetical) meme pool was thus not entirely warranted.

We can grasp the importance of this point by considering an earlier attempt to account for cultural evolution in terms of an essentially Darwinian mechanism. In an important article of 1968, expanded in 1975, the anthropologist F. T. Cloak proposed that culture evolved along Darwinian lines, and set out how ethological methods might be applied to culture-specific behavior.[16] Cloak drew a distinction between "i-culture" (the set of cultural instructions that are contained in the nervous system) and "m-culture" (relationships in material structures which are maintained by such instructions, or changes in material structures which come about as a result of these instructions). All the examples of memes that Dawkins provides in *The Selfish Gene* are actually cases of what Cloak terms "m-culture," where the reader might reasonably have expected to be provided with examples of "i-culture" (again, using Cloak's terms).

Dawkins recognized this problem, and modified his ideas in his next major work – *The Extended Phenotype* (1982). His original account of the meme, he conceded, was defective; it required correction:

> I was insufficiently clear about the distinction between the meme itself, as replicator, and its "phenotypic effects" or "meme products" on the other. A meme should be regarded as a unit of information residing in a brain (Cloak's "i-culture"). It has a definite structure, realised in whatever medium the brain uses for storing information … This is to distinguish it from phenotypic effects, which are its consequences in the outside world (Cloak's m-culture).[17]

[16] F. T. Cloak, "Is a Cultural Ethology Possible?" *Human Ecology* 3 (1975): 161–81. An earlier version of this article appeared in *Research Previews* 15 (1968): 37–47. For another perspective, see L. L. Cavalli-Sforza, "Cultural Evolution." *American Zoologist* 26 (1986): 845–55.

[17] *The Extended Phenotype*, 109. As this citation suggests, *The Extended Phenotype* was not conceived as a popular book (unlike *The Selfish Gene*).

This clarification removed one fundamental difficulty with the concept of the meme. On any standard neo-Darwinian account, genes give rise to phenotypes. There is no question of phenotypical causation of genetic traits. To put it in a nutshell: genes are *selected, not instructed*.[18] Dawkins, who vigorously defends this "central dogma" of Darwinian orthodoxy, had put himself in a potentially indefensible position, in that he appeared to imply that it was phenotypes that were inherited.

This new definition of the meme identifies it as the fundamental unit of information or instruction which gives rise to cultural artifacts and ideas. It is the set of instructions, the blueprint, not the product. What Dawkins originally defined as memes – things like "catchy tunes" – are now to be regarded as "meme products." At a popular level, however, Dawkins' meme concept continues to be discussed in terms of his 1976 definition, set out in *The Selfish Gene*, rather than its 1982 revision, as presented in the somewhat less widely read *Extended Phenotype*.

## Introducing the "God-Meme"

So what is the relevance of this hypothetical meme for belief in God? From the outset, Dawkins associated his idea of the meme with issues of religious belief, declaring that religions were "the prime examples of memes."[19] A series of writers – including Karl Marx (1818–83) and Sigmund Freud (1856–1939) – argued that, since there is no God to believe in, human religious belief is essentially an invention designed to provide "metaphysical comfort" to an existentially beleaguered humanity.[20] Dawkins develops this approach in a new direction, arguing that religions are basically "mind parasites." Belief in God is to be seen as "self-replicating information" that "leaps infectiously from mind to mind."

Dawkins is an atheist, and believes (though in my view incorrectly on both points) first, that there is no God, and second, that religious faith is "blind trust," which refuses to take account of evidence. So it is natural for him to raise this question: Why do people believe in God, when there is no God to believe in? Dawkins' answer lies in the ability

[18] For an excellent presentation of this point, see Gary Cziko, *Without Miracles: Universal Selection Theory and the Second Darwinian Revolution*. Cambridge, MA: MIT Press, 1995.

[19] *A Devil's Chaplain*, 117.

[20] Friedrich Nietzsche, *The Birth of Tragedy*. Cambridge: Cambridge University Press, 2007, 12. See William Lloyd Newell, *The Secular Magi: Marx, Freud, and Nietzsche on Religion*. New York: Pilgrim, 1986.

of a God-meme to replicate itself in the human mind. The God-meme performs particularly well because it has "high survival value, or infective power, in the environment provided by human culture."[21] People do not believe in God because they have given long and careful thought to the matter; they do so because they have been infected by a powerful meme. In both cases, the intent and outcome is a subversion of the intellectual legitimacy of belief in God. Belief in God is not something that is intellectually compelling; it is just that the God-meme is good at infecting people.

The same, of course, would also be true of an "atheism"-meme, although Dawkins somehow manages to overlook this point. Dawkins does not deal with how atheism spreads on the basis of his memetic approach, presumably on account of his core belief that atheism is scientifically correct. Others would argue that it is a belief, which requires explanation. Dawkins' model actually requires that both atheism and belief in God should be seen as memetic effects. They are therefore equally valid – or equally invalid, for that matter.

The problem with this approach is immediately obvious. If all ideas are memes, or the effects of memes,[22] Dawkins is left in the decidedly uncomfortable position of having to accept that his own ideas must also be recognized as the effects of memes. Scientific ideas would then become yet another example of memes replicating within the human mind. This would not suit Dawkins' purposes at all, and he excludes the notion in an intriguing manner: "Scientific ideas, like all memes, are subject to a kind of natural selection, and this might look superficially virus-like. But the selective forces that scrutinize scientific ideas are not arbitrary or capricious. They are exacting, well-honed rules, and they do not favour pointless self-serving behaviour."[23] This represents a case of special pleading, in which Dawkins makes an unsuccessful attempt to evade the trap of self-referentiality. Anyone familiar with intellectual history will spot the pattern immediately. Everyone's dogma is wrong except mine. My ideas are exempt from the general patterns I identify for other ideas, which allows me to explain them away, leaving my own to dominate the field.

[21] *The Selfish Gene*, 193. Dawkins clearly assumes a link between religion, biology, and culture, but fails to deal with this in any depth. For a (non-memetic) attempt to engage this question, see Walter Burkert, *Creation of the Sacred: Tracks of Biology in Early Religions.* Cambridge, MA: Harvard University Press, 1996.

[22] On which see John A. Ball, "Memes as Replicators." *Ethology and Sociology* 5 (1984): 145–61.

[23] *A Devil's Chaplain*, 145.

But why should conformity to scientific criteria be allowed to determine whether a meme is "good" or "useful"? On any conventional reading of things, a good or useful meme would be one that promoted harmony, gave someone a sense of belonging, or increased life expectancy. These would seem far more natural and obvious criteria for "good" memes. But on further reflection, the truth dawns on us. There are no "natural" criteria involved at all. We decide whether we like them or not, and then label the memes accordingly. If you like religion, it's a "good" meme; if not, it's "bad." In the end, all that Dawkins does here is to construct an entirely circular argument, reflecting his own subjective system of values.[24] Ideas of which Dawkins disapproves – such as belief in God – are labeled as "viral," whereas those of which he approves are treated as non-viral. The apparent lack of objectivity of judgment is a real concern – all the more so because Dawkins appears blissfully unaware of his own covert intellectual commitments, and their covert impact on his assessment of things.

We shall return to explore the idea of "God as a virus" later in the present chapter. But first, we need to consider some concerns which have led most to abandon the meme as a serious tool of scientific research. In what follows, I shall explore the origins of Dawkins' concept of the meme in more detail, and address some critical difficulties that confront this specific idea, before moving on to consider Dawkins' later idea that God as a parasitic "virus of the mind." These difficulties – which are not restricted to any putative God-meme – may be summarized as follows:

1 There is no reason to suppose that cultural evolution is Darwinian, or indeed that evolutionary biology has any particular value in accounting for the development of ideas.
2 There is no direct evidence for the existence of memes themselves. The idea is best understood in an instrumentalist sense, as a heuristic device offering a helpful way of viewing things, without any commitment to the meme being a "real" entity.
3 The case for the existence of the meme rests on the questionable assumption of a direct analogy with the gene, which proves incapable of bearing the theoretical weight that is placed upon it.
4 There is no necessary reason to propose the existence of a meme as an explanatory construct. The observational data can be accounted for perfectly well by other models and mechanisms.

[24] See the analysis in Distin, *The Selfish Meme*, 72–7.

## Is Cultural Development Darwinian?

My own interest in intellectual history developed at more or less the same time at which Dawkins first set out the meme theory. When I first encountered the idea of the meme in 1977, I found it immensely exciting. Here was something which was potentially open to rigorous evidence-based investigation, offering new possibilities for the study of intellectual and cultural development.[25] Why was I so optimistic about the idea? I was in the process of beginning what would be one of my lifetime concerns – the history of ideas. My particular interest lay in how religious ideas develop over time, and the factors that lead to their development, modification, acceptance, or rejection, and – at least in some cases – their slow decline into oblivion.

The meme, I thought at the time, would allow me to create and validate robust and reliable models for intellectual and cultural development, firmly grounded in observational evidence. Yet as I began my research, I found myself coming up against serious obstacles in practically every area of intellectual activity I investigated.

Most important of these was my growing realization that Darwinism itself seemed very poorly adapted to account for the development of culture, or the overall shape of intellectual history. When I researched the rise of atheism during its "Golden Age" (1789–1989), I was struck by the purposefulness of the contemporary retrieval of the older atheisms of writers such as Xenophanes (c. 570–c. 475 BC) or Lucretius (c. 99–c. 55 BC). These ideas were deliberately reappropriated. Their revival did not just happen; it was *made to happen* in order to achieve a specific goal. The process was strongly teleological, driven by precisely the purpose and intentionality that Darwinian orthodoxy excludes from the evolutionary process.

The same point can be seen in the emergence of the Renaissance, widely regarded as one of the most remarkable developments in the history of western culture. Its origins lie in Italy during the thirteenth century, although its full blossoming would take place in the following two centuries.[26] The movement expanded from Italy into northern Europe, causing significant changes wherever it took hold. The cultural impact of

[25] For my reflections, see my extended essay: Alister E. McGrath, "The Evolution of Doctrine? A Critical Examination of the Theological Validity of Biological Models of Doctrinal Development." In *The Order of Things: Explorations in Scientific Theology*. Oxford: Blackwell, 2006, 117–67.

[26] There is a huge literature. For a useful introduction see Charles G. Nauert, *Humanism and the Culture of Renaissance Europe*. Cambridge: Cambridge University Press, 1995.

the movement was immense – for example, the Gothic style of architecture gave way to the classical style, impacting significantly on western European urban landscapes.[27]

So why did this happen? What explanation may be given for this radical and highly creative redirection of European culture at this time? Since the origins and development of the movement are so well understood, it represents an ideal – indeed, even a critical – case for the application of mimetic theory.

Since the pioneering work of P. O. Kristeller (1905–99), the fundamental basis of the Renaissance is widely accepted to be the critical reappropriation of the culture of ancient Rome (and, to a lesser extent, Athens).[28] Perhaps stimulated by the presence of the remains of classical civilization in Italy, Renaissance theorists advocated the recovery of the rich cultural heritage of the past – the elegant Latin of Cicero; the eloquence of classical rhetoric; the splendor of classical architecture; the philosophies of Plato and Aristotle; the republican political ideals which inspired the Roman constitution.[29] Renaissance writers set about deliberately and systematically adopting these principles, and applying them to their own situation.

It is a fascinating and complex picture, which continues to delight a new generation of scholars. But it does raise some serious difficulties for Dawkins' theory. The origins, development, and transmission of Renaissance humanism – while subject to the inevitable happenstance of history – was *deliberate*, *intentional*, and *planned*. If Darwinism is about copying the instructions (genotype), Lamarckism is about copying the product (phenotype). It would thus seem that Lamarck, rather than Darwin, offers the better account of cultural evolution in the case of the Renaissance.

The patterns of development I found in the history of the Renaissance – and, I must add, in most of the other intellectual and cultural phenomena I have studied – is that of the blending of memes, and a clear pattern of intellectual causality which forces us to use a Lamarckian, rather than neo-Darwinian, understanding of the evolutionary process; assuming, of course, that evolutionary biology has any relevance to the development of culture, or to the history of ideas. The use of such terms as "Darwinian" and "Lamarckian" to describe cultural development may just be downright

[27] See for example Norbert Huse, Wolfgang Wolters, and Edmund Jephcott. *The Art of Renaissance Venice: Architecture, Sculpture, and Painting, 1460–1590*. Chicago: University of Chicago Press, 1990; James S. Ackerman, *Distance Points: Essays in Theory and Renaissance Art and Architecture*. Cambridge, MA: MIT Press, 1991.

[28] See for example Paul Oskar Kristeller, *Renaissance Thought: The Classic, Scholastic, and Humanistic Strains*. New York: Harper & Row, 1961.

[29] For the general issue, see Ronald G. Witt, *In the Footsteps of the Ancients: The Origins of Humanism from Lovato to Bruni*. Leiden: Brill, 2000.

misleading, implying a fundamental analogy where none – other than the passage of time and the observation of change – really exists.

Dawkins seems to be aware of these problems. Consider these cautionary comments of 1982:

> Memes may partially blend with each other in a way that genes do not. New "mutations" may be "directed" rather than random with respect to evolutionary trends. The equivalent of Weismannism is less rigid for memes than for genes; there may be Lamarckian causal arrows leading from phenotype to replicator, as well as the other way round. These differences may prove sufficient to render the analogy with genetic selection worthless, or positively misleading.[30]

I think this is a fair judgment. If the observational evidence compelled us to conclude that cultural evolution or the development of ideas took place in a Darwinian manner, then that would be the end of the debate. Yet the model is inappropriate. Biological and cultural evolution may have their points of similarity; they seem, however, to proceed by quite different mechanisms.

The question of whether cultural evolution can be described or illuminated by biological analogies remains disputed. In recent years, four viewpoints have emerged. It remains to be seen how the debate will continue in the future:

1 Cultural evolution is best considered as a Lamarckian process.[31]
2 Any viable theory of cultural evolution must contain Lamarckian elements.[32]
3 If a Darwinian paradigm is held to offer the best explanation of the evolution of cultural entities, it requires considerable expansion or modification to accommodate the observational evidence.[33]

[30] *The Extended Phenotype*, 112.

[31] See Arthur J. Robson, "The Evolution of Strategic Behaviour." *Canadian Journal of Economics* 28 (1995): 17–41; Stephen Jay Gould, *Life's Grandeur: The Spread of Excellence from Plato to Darwin*. London: Jonathan Cape, 1996, 217–30; Richard Nelson, "Evolutionary Social Science and Universal Darwinism." *Journal of Evolutionary Economics* 16 (2006): 491–510.

[32] See Thorbjørn Knudsen, "Nesting Lamarckism within Darwinian Explanations: Necessity in Economics and Possibility in Biology?" In *Darwinism and Evolutionary Economics*, edited by John Nightingale and John Laurent, 121–59. Cheltenham: Edward Elgar, 2001.

[33] See Thorbjørn Knudsen and Geoffrey M. Hodgson, "Why We Need a Generalized Darwinism: And Why Generalized Darwinism Is Not Enough." *Journal of Economic Behavior and Organization* 61 (2006): 1–19; Kronfeldner, "Is Cultural Evolution Lamarckian?"; Yoshihisa Kashima, "Globalization, Diversity and Universal Darwinism." *Culture and Psychology* 13 (2007): 129–39.

4 Cultural evolution is best described using models drawn from other sources, such as disease epidemiology,[34] learning theory,[35] or cognitive psychology.[36]

## Do Memes Actually Exist?

The second difficulty with the meme idea is that it is inadequately grounded in the evidence. In his preface to Susan Blackmore's *Meme Machine* (1999), Dawkins points out the problems that the meme faces if it is to be taken seriously within the scientific community:

> Another objection is that we don't know what memes are made of, or where they reside. Memes have not yet found their Watson and Crick; they even lack their Mendel. Whereas genes are to be found in precise locations on chromosomes, memes presumably exist in brains, and we have even less chance of seeing one than of seeing a gene (though the neurobiologist Juan Delius has pictured his conjecture of what a meme might look like).[37]

These are intriguing comments, indicating an awareness of the evidential vulnerability of the memetic hypothesis. To his critics, Dawkins talking about memes is like believers talking about God – an invisible, unverifiable postulate, which helps explain some things about experience, but ultimately lies beyond empirical investigation. It is far from clear how Dawkins' views on evidence and beliefs allows him to continue believing in memes, when he is so critical of others for believing in God.

And just what are we to make of the point that "the neurobiologist Juan Delius has pictured his conjecture of what a meme might look like"? I've seen countless pictures of God in many visits to art galleries. And that verifies the concept? Or makes it scientifically plausible? Delius' proposal that a meme will have a single locatable and observable structure as "a constellation of activated neuronal synapses" is purely conjectural, and

[34] See L. L. Cavalli-Sforza and M. W. Feldman, *Cultural Transmission and Evolution: A Quantitative Approach*. Princeton, NJ: Princeton University Press, 1981, 46–53.

[35] See Robert D. Boyd and Peter J. Richerson, *Culture and the Evolutionary Process*. Chicago: University of Chicago Press, 1985, 81–131. Boyd and Richerson later emphasized that the evolution of human culture was a landmark in human development, marking a transition away from purely biological accounts of human evolution: Peter J. Richerson and Robert Boyd, *Not by Genes Alone: How Culture Transformed Human Evolution*. Chicago: University of Chicago Press, 2005.

[36] See Lumsden and Wilson, *Genes, Mind, and Culture*.

[37] *A Devil's Chaplain*, 124.

has yet to be subjected to rigorous empirical investigation.[38] It is one thing to speculate about what something might look like; the real question is whether it is there at all.

In 1993, Dawkins laid down the essence of what constituted a "scientific" approach: "testability, evidential support, precision, quantifiability, consistency, intersubjectivity, repeatability, universality, progressiveness, independence of cultural milieu, and so on."[39] So where is the evidential support for memes? The quantitative analysis? The formulation of criteria by which the meme may be confirmed or eliminated as a useful construct? We await clarification here.

The glaring contrast with the gene will be obvious. Genes can be "seen," and their transmission patterns studied under rigorous empirical conditions. What started off as hypothetical constructs inferred from systematic experiment and observation ended up being observed themselves. The gene was initially seen as a theoretical necessity, in that no other mechanism could explain the relevant observations, before being accepted as a real entity on account of the sheer weight of evidence. But what about memes? The simple fact is that they are, in the first place, *hypothetical constructs*, inferred from observation rather than observed in themselves; in the second place, *unobservable*; and in the third place, more or less *useless* at the explanatory level. This makes their rigorous investigation intensely problematic, and their fruitful application somewhat improbable.

A gene is an observable entity that is well defined at the biological, chemical, and physical levels. Biologically, the gene is a distinct portion of a chromosome; chemically, it consists of DNA; physically, it consists of a double-helix, with a sequence of nucleotides which represent a "genetic code" that can be read and interpreted. Even if genes were never observed, they would continue to be considered a superb theoretical explanation of what can be observed.

The situation with memes is quite different. What are memes? Where are they located? How are they to be described biologically, chemically, and physically? There is no operational definition of a meme, allowing its alleged characteristics and function to be investigated. Our understanding of cultural development and the history of ideas would not be in the least disadvantaged if the idea of the meme is forgotten. The meme is simply an

[38] Juan D. Delius, "The Nature of Culture." In *The Tinbergen Legacy*, edited by M. S. Dawkins, T. R. Halliday, and R. Dawkins, 75–99. London: Chapman & Hall, 1991. See also the earlier essay Juan D. Delius, "On Mind Memes and Brain Bugs: A Natural History of Culture." In *The Nature of Culture*, edited by Walter A. Koch, 26–79. Bochum: Brockmeyer, 1989. More than twenty years later, this idea remains as tenuous and unevidenced as before.

[39] *A Devil's Chaplain*, 145.

optional extra, an unnecessary addition to the range of theoretical mechanisms proposed to explain the development of culture. It can be abandoned without difficulty by cultural theorists.[40]

And what about the mechanism by which memes are allegedly transmitted? One of the most important implications of the discovery of the structure of DNA was that it opened the way to an understanding of the mechanism of replication. So what physical mechanism is proposed in the case of the meme? How does a meme cause a memetic effect? Or, to put the question in a more pointed way: How could we even begin to set up experiments to identify and establish the structure of memes, let alone to explore their relation to alleged memetic effects? Unsurprisingly, the plausibility of the meme as a serious scientific hypothesis now seems to be on the wane.

And since the meme is not warranted scientifically, are we to conclude that there is a meme for belief in memes themselves?[41] The meme concept then dies the slow death of self-referentiality, in that, if taken seriously, the idea explains itself as much as anything else. And as the qualifications mount up, the concept loses its plausibility. It's like adding more and more epicycles to the Ptolemaic model of the solar system. What was once a bright, neat idea becomes immensely cumbersome, its initial brilliance fading with every additional qualification added in its defense.

## The Flawed Analogy between Gene and Meme

Dawkins' argument for both the existence and function of the meme is based on a proposed analogy between biological and cultural evolution. His implicit assumption seems to be that, since the transmission of culture and the transmission of genes are analogical processes, the well-developed concepts and methods of neo-Darwinism can account for them both. The argument can be set out as follows:

> Biological evolution requires a replicator, now known to actually exist, namely the *gene*.
> So, by analogy:
> Cultural evolution also requires a replicator, which is hypothesized to be the *meme*.

[40] Note the comments of Maurice Bloch, "A Well-Disposed Social Anthropologist's Problem with Memes." In *Darwinizing Culture: The Status of Memetics as a Science*, edited by Robert Aunger, 189–203. Oxford: Oxford University Press, 2000.

[41] Alan Costall, "The 'Meme' Meme." *Cultural Dynamics* 4 (1991): 321–35.

It is a brave and bold move. But is it right? Does this analogy actually work? And what is the hard, observational evidence for memes, that demands that we accept this hypothetical concept as a necessary and fruitful means of explaining cultural development?

As has often been demonstrated, analogical argumentation is an essential element of scientific reasoning.[42] The perception of an analogy between *A* and *B* is often the starting point for new lines of enquiry, opening up new and exhilarating frontiers. Yet that same perception has often led to scientific dead ends, including the long-abandoned ideas of "calorific" and "phlogiston." As Mario Bunge points out, analogies have a marked propensity to mislead in the sciences.[43] So is this posited analogy between gene and meme in the first place *real*, and in the second *helpful*?

Let's begin by exploring whether the analogy has any basis in fact. The exploration and testing of the limits of scientific analogies is an important and legitimate aspect of the scientific method. In *The Blind Watchmaker*, Dawkins provides an eloquent discussion of how science has often advanced by exploring whether a possible analogy may point to something deeper: "Some of the greatest advances in science have come about because some clever person spotted an analogy between a subject that was already understood, and another still mysterious subject. The trick is to strike a balance between too much indiscriminate analogizing on the one hand, and a sterile blindness to fruitful analogies on the other."[44] Analogies don't always mislead. The problem is working out which ones are fruitful, and which are dead ends. In proposing the meme, Dawkins was exploring a potentially significant analogy between biological and cultural evolution, proposing an analogical process or mechanism to account for this. He was not the first to do so, but he communicated it with particular skill.

Exactly the same process of exploring analogies can be seen at work in Darwin's *Origin of Species*. Darwin spotted what seemed to be an analogy between the way animals were bred to improve certain desirable characteristics, and the way nature seemed to bring about changes. He proposed the idea of "natural selection" as a mechanism within the natural order, analogous to the "artificial selection" of the animal-breeding industry.[45] This analogy has turned out to be highly fruitful, but as the

[42] Daniel Rothbart, "The Semantics of Metaphor and the Structure of Science." *Philosophy of Science* 51 (1984): 595–615.

[43] Mario Bunge, *Method, Model, and Matter*. Dordrecht: Reidel, 1973, 125–6.

[44] *The Blind Watchmaker*, 195.

[45] See Robert M. Young, "Darwin's Metaphor and the Philosophy of Science." *Science as Culture* 16 (1993): 375–403.

history of science demonstrates, there are significant limits to analogical argumentation of this kind.

Remember the ether? Sound and light seemed analogous to many physicists in the nineteenth century. They seemed to behave so similarly. Both were known to be forms of waves, whose speed and wavelength could be determined with a high degree of accuracy. And since the propagation of sound required a medium – such as air or water – then the same had to be true of light as well. The term "ether" was used to designate this mysterious medium, through which light and other electromagnetic radiation travelled.

The Michelson–Morley experiment of 1887 set out to explore the properties of the "luminiferous ether" – that is, the medium through which light was believed to travel. As a result of their experiment, Albert A. Michelson (1852–1931) and Edward W. Morley (1838–1923) came to the remarkable conclusion that "the ether is at rest with regard to the earth's surface."[46] This puzzling result had a number of possible implications. One of these was that there was no "luminiferous ether" in the first place. The analogy with sound had just been pressed too far.

By the 1920s, the scientific world had finally come round to the conclusion that light was not the same as sound. There were unquestionably similarities, parallels, and convergences – but these had been overinterpreted, and allowed to create the impression that two different entities were analogous. Even though light and sound did indeed behave in very similar ways in very many contexts, they were completely different things. Light needed no medium; it would travel in a vacuum.

It is a well-known story, and its moral is perfectly clear: analogies can be dangerously misleading. The argument from analogy was seen to have misled here – as it had misled in so many other cases. Quantum theory is an excellent example of a scientific discipline bedeviled by problems arising from the bad use of analogies.[47] And when we move outside the relatively well defined world of physics into the chaos of human culture, analogies often develop a life of their own, unchecked by the rigid demands of evidence-based argument.

The early case for some physical factor for the transmission of hereditary information – now known as the "gene" – was based on the Mendelian demonstration of the precision of such transmission, and the self-evident fact that there was no other means by which such information could be

[46] A. A. Michelson and E. W. Morley, "On the Relative Motion of the Earth and Luminiferous Ether." *American Journal of Science* 34 (1887): 333–45.

[47] Mario Bunge, "Analogy in Quantum Theory: From Insight to Nonsense." *British Journal for the Philosophy of Science* 18 (1967): 265–86.

stored, transmitted, and retrieved. The case of cultural evolution is completely different. All human cultures possess means by which information may be transmitted within existing populations and to subsequent generations – such as books, rituals, institutions, and oral traditions.[48] The notion of a "meme" is functionally redundant, forcing its defenders to make a case by analogy with the gene – yet to downplay the empirically determined biological, chemical, and physical parameters of the gene, which are now an essential aspect of molecular genetics. The plausibility of the meme is thus grounded in a questionable analogical argument, not in overwhelming evidence and observation.[49]

We clearly need the memetic equivalent of the Michelson–Morley experiment – something which will determine, by empirical investigation rather than questionable analogical argumentation, whether memes exist. The present state of research overwhelmingly suggests that memes are the new ether – a redundant hypothesis just waiting to be finally eliminated.[50] The "meme for memes" may have a high capacity for survival and transmission – but it names nothing in the real world. In fact, in both respects, it seems to be inconveniently similar to Dawkins' God-meme.

## The Redundancy of the Meme

Perhaps the most significant criticism of the meme concept is that the study of cultural and intellectual development proceeds perfectly well without it. Economic and physical models – especially information transfer – have proved their worth in this context. The contrast between meme and gene is, once more, painfully obvious: the gene *had* to be postulated, as there was simply no other way of explaining the observational evidence concerning the patterns of transmission of inherited traits. The meme is explanatorily redundant.

[48] There is a huge literature, including works such as Niklas Luhmann, *Love as Passion: The Codification of Intimacy*. Stanford, CA: Stanford University Press, 1998; Vera Schwarcz, *Bridge across Broken Time: Chinese and Jewish Cultural Memory*. New Haven, CT: Yale University Press, 1998; John Lowney, *The American Avant-Garde Tradition: William Carlos Williams, Postmodern Poetry, and the Politics of Cultural Memory*. Lewisburg, PA: Bucknell University Press, 1997.

[49] See further the discussion in Mark Jeffreys, "The Meme Metaphor." *Perspectives in Biology and Medicine* 43 (2000): 227–42.

[50] There are some very interesting alternative proposals for the interaction of genes and culture set out in William H. Durham, *Coevolution: Genes, Culture, and Human Diversity*. Stanford, CA: Stanford University Press, 1991, 1–41.

Economic models, which treat ideas as "information cascades" or consumer durables are rather more persuasive and helpful than the unverified meme concept.[51] These models incorporate the "competition" and "extinction" motifs of Darwinian theory, without necessarily endorsing its theories on the origins of innovations. For example, an economic "theory of fads" is considerably more convincing as an explanation of patterns of thought adoption and dispersal than Dawkins' meme.[52] Cultural evolution and intellectual development can often be better understood in terms of a physical, rather than a biological analogue – such the transmission of information on random networks.[53] Yet Dawkins does not consider these significant theoretical alternatives in evaluating his meme hypothesis.

To its supporters, the meme has not yet been definitively pronounced dead. Dawkins' idea of the meme has been upheld by two of his colleagues – Daniel Dennett, especially in his *Darwin's Dangerous Idea* (1995), and Susan Blackmore, especially in her *The Meme Machine* (1999). Significantly, Dennett and Blackmore understand the meme in strikingly different ways[54] – which is perhaps inevitable, given the meme's questionable empirical credentials. Yet the concept of the meme remains so vague and so empirically indeterminate that there seems to be no means by which it can be verified or falsified.

In any case, what it proposes to "explain" can easily be accounted for by other models. Exactly what otherwise puzzling phenomena are accounted for by memes? Dawkins is coy about specifics here, exposing all the more clearly the glaring contrast between this and his brilliant evidence-based defense of his concept of the "selfish gene."

Although now a quarter of a century old, the "science" of memetics has failed to generate a productive research program in mainstream cognitive

[51] See for example S. Bikhchandani, D. Hirshleifer, and I. Welch, "Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades." *Journal of Economic Perspectives* 12 (1998): 151–70.

[52] Sushil Bikhchandani, David Hirshleifer, and Ivo Welch, "A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades." *Journal of Political Economy* 100 (1992): 992–1026. Dawkins fails to explore this issue in his account of "crazes," which he analyses very superficially using an epidemiological model: *A Devil's Chaplain*, 136–7.

[53] See for example D. J. Watts, "A Simple Model of Information Cascades on Random Networks." *Proceedings of the National Academy of Sciences* 99 (2002): 5766–71. The implications of this as an analogue for the transmission of ideas in a cultural system will be obvious.

[54] As noted by Distin, *The Selfish Meme*.

science, sociology, or intellectual history. On the basis of the evidence available, I can only agree with Martin Gardner's withering criticism of the notion:

> A meme is so broadly defined by its proponents as to be a useless concept, creating more confusion than light, and I predict that the concept will soon be forgotten as a curious linguistic quirk of little value. To critics, who at the moment far outnumber true believers, memetics is no more than a cumbersome terminology for saying what everybody knows and that can be more usefully said in the dull terminology of information transfer.[55]

Gardner's concerns are echoed in an article reflecting on the closure of the online *Journal of Memetics*, which was launched in 1997, arguably at the zenith of the cultural plausibility of the meme.[56] The journal folded in 2005. Why? The answer can be found in a devastating critique of the notion of the meme, published in the final issue of this ill-fated journal.[57] Dr. Bruce Edmonds made two fundamental criticisms of the notion of memetics, which he believes have undermined its claims to plausibility in the scientific community:

1 The underlying reason why memetics has failed is that it "has not provided any extra explanatory or predictive power beyond that available without the gene-meme analogy." In other words, it has not provided any "added value" in terms of providing *new* understanding of phenomena.
2 The study of memetics has been characterized by "theoretical discussion of extreme abstraction and over ambition." Edmonds singles out for special criticism unrealistic and over-ambitious attempts, often developed in advance of evidence, "to 'explain' some immensely complex phenomena such as religion." Yet for many of its more uncritical and enthusiastic advocates, this is precisely the reason why the meme was invented – to explain away belief in God.[58]

Edmonds ends his dismissal of the meme with what in effect amounts to its obituary: Memetics "has been a short-lived fad whose effect has been

[55] Martin Gardner, "Kilroy Was Here." *Los Angeles Times*, March 5, 2000.
[56] Website at http://jom-emit.cfpm.org, accessed August 8, 2014.
[57] Bruce Edmonds, "The Revealed Poverty of the Gene–Meme Analogy – Why Memetics per se Has Failed to Produce Substantive Results." January 2005. http://cfpm.org/jom-emit/2005/vol9/edmonds_b.html, accessed August 8, 2014.
[58] Edmonds, "Revealed Poverty."

to obscure more than it has been to enlighten. I am afraid that memetics, as an identifiable discipline, will not be widely missed."

Not surprisingly, Dawkins himself has moved on, distancing himself from any suggestion that he offered the meme concept as an explanation of human culture in general.[59] As Daniel Dennett puts it, Dawkins has recently "drawn in his horns slightly."[60] He has retreated from his early optimism, and hinted that the meme hypothesis was simply a useful analogy. Others have taken a similar view, suggesting that the meme is best seen as a useful theoretical construct, which plays a valuable heuristic role in explaining observational evidence. "For us, the pertinent question is not whether memes exist … but whether they are a useful theoretical expedient."[61] Dennett suggests that Dawkins was forced to back off here because he was seen as having become a sociobiologist.[62] I think it rests more on a growing realization of the chronic evidential underdetermination of the notion. While discussion about whether the meme has any explanatory or predictive value continues,[63] there has been a perceptible loss of interest in the idea since about 2010.

## God as a Virus of the Mind?

Yet there are other ways of visualizing or conceptualizing the transmission of ideas in culture which draw on biological analogies. During the 1990s, Dawkins developed his meme concept in another direction, using the image of a "virus of the mind." "Memes," Dawkins tells us, can be transmitted

[59] *A Devil's Chaplain*, 127.

[60] Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and the Meaning of Life*. New York: Simon & Schuster, 1995, 361. Dennett himself developed a highly speculative notion of the meme, with little empirical evidence to support it. It is important not to judge Dawkins' more modest notion against this inflated version. It is worth noting that the meme hypothesis is still advocated by Dawkins in *Unweaving the Rainbow*, 304–10, and *The God Delusion*, 191–201.

[61] Kevin Laland and John Odling-Smee, "The Evolution of the Meme." In *Darwinizing Culture: The Status of Memetics as a Science*, edited by Robert Aunger, 121–42. Oxford: Oxford University Press, 2000, 121.

[62] Dennett, *Darwin's Dangerous Idea*, 361–2.

[63] See Susan Blackmore, "Memetics Does Provide a Useful Way of Understanding Cultural Evolution." In *Contemporary Debates in Philosophy of Biology,* edited by Francisco J. Ayala and Robert Arp, 255–72. Oxford: Blackwell, 2010; William C. Wimsatt, "Memetics Does Not Provide a Useful Way of Understanding Cultural Evolution." In *Contemporary Debates in Philosophy of Biology,* edited by Francisco J. Ayala and Robert Arp, 273–91. Oxford: Blackwell, 2010.

"like viruses in an epidemic."[64] Although the connection between a "meme" and a "virus of the mind" is not clarified with the precision we might expect, it is clear that, for Dawkins, the key theme in each case is *replication*. For a virus to be effective, it must possess two qualities: the ability to replicate information accurately, and to obey the instructions which are encoded in the information replicated in this way.[65]

Yet there is a problem here. Mary Midgley argues that, while human beings can be considered to act as passive carriers of biological viruses, they cannot be regarded as mere passive "vehicles" or "carriers" of ideas and beliefs.[66] As psychologists have pointed out from the time of William James (1842–1910) onward, individuals actively interpret the information they receive in the light of their existing knowledge and values, and on the basis of that may decide to reject, accept, or modify the information that is communicated to them.[67]

Yet there is also a most regrettable verbal sleight of hand at work here, a rhetorical device apparently being presented as if it were good science. As everyone knows, viruses are *bad* things; they are contagious, parasitic entities, which exploit their hosts.[68] A computer "virus" causes degradation of the system's capacity to function. The rhetorically freighted "argument" that God is a virus amounts to little more than thinly veiled insinuation, rather than rigorous evidence-based reasoning. Belief in God is proposed as a malignant infection contaminating otherwise pure minds. Yet the whole idea founders on the rocks of the absence of experimental evidence, the subjectivity of Dawkins' personal value judgments implicated in assessing what is "good" and "bad," and the circularity of self-referentiality.

The importance of this point can be seen from Susan Blackmore's recent change of heart on whether God can be seen as a "virus of the mind."[69]

[64] *A Devil's Chaplain*, 121.

[65] *A Devil's Chaplain*, 135.

[66] Mary Midgley, "Why Memes?" In *Alas, Poor Darwin: Arguments against Evolutionary Psychology*, edited by Hilary Rose and Steven Rose, 67–84. London: Jonathan Cape, 2001. From a religious perspective, see the concerns noted in John W. Bowker, *Is God a Virus?: Genes, Culture and Religion*. London: SPCK, 1995.

[67] See especially Sperber's complaint about the marginalization of human psychology in this discussion: Dan Sperber, "Why a Deep Understanding of Cultural Evolution Is Incompatible with Shallow Psychology." In *Roots of Human Sociality: Culture, Cognition and Interaction*, edited by Nick Enfield and Stephen Levinson, 431–49. Oxford: Berg, 2006.

[68] Some might argue that bacteriophages are examples of good viruses, in that they infect and destroy bacteria that are potentially damaging for humans. From the bacterium's perspective, of course, things look rather different.

[69] Susan Blackmore, "Why I No Longer Believe Religion Is a Virus of the Mind." *The Guardian*, September 16, 2010. www.theguardian.com/commentisfree/belief/2010/sep/16/why-no-longer-believe-religion-virus-mind, accessed August 8, 2014.

"The idea of religions as 'viruses of the mind' may have had its day," she remarked, given the clear evidence that religion can sometimes – though not always – be "something helpful and adaptive to its host." Perhaps the phrase "bacteria of the mind" might be more helpful? After all, "bacteria can be helpful as well as harmful; they can be symbiotic as well as parasitic."

So just what is the experimental evidence that God is bad for you? Dawkins presumes that it is publicly accepted within the scientific community that religion debilitates people, reducing their potential for survival and health. Yet a substantial body of recent empirical research points to a generally positive interaction of religion and health. That there are pathological types of religious belief and behavior is well known; yet this in no way invalidates the generally positive estimation of religion's impact on mental health to emerge from evidence-based studies.

Dawkins appears to assume that his readers will rather uncritically share his own subjective views on the malignancy of religion, and thus accept his conclusions without demur. But they are not grounded in the rigorously evidence-based analysis, based on objective observation of the impact of religion on individuals, which is typical of the scientific enterprise that both Dawkins and I admire.

The implications of this emerging consensus for the "God as virus" hypothesis is unambiguous. An already tenuous analogy becomes completely unsustainable. If religion is reported as having a positive impact on human wellbeing by 79% of recent studies in the field,[70] and neutral or mixed in a further 20%, how can it conceivably be regarded as analogous to a virus? Viruses are meant to be bad for you. So just how many viruses have such a positive impact on their hosts? Far from being something which reduces the survival value of its host, belief in God is an additional resource that enhances psychic survival.[71] I have no doubt that, within the faith-based worldview which shapes Dawkins' account of reality – atheism – God ought to have such a negative, detrimental impact on human wellbeing. But he does not. The evidence just doesn't fit the theory.

Furthermore, what is the actual experimental evidence for such hypothetical "viruses of the mind"? In the real world, viruses are not known

[70] Harold G. Koenig and Harvey J. Cohen, *The Link between Religion and Health: Psychoneuroimmunology and the Faith Factor*. Oxford: Oxford University Press, 2002, 101.

[71] Kenneth I. Pargament, *The Psychology of Religion and Coping: Theory, Research, Practice*. New York: Guilford, 1997.

solely by their symptoms; they can be detected, subjected to rigorous empirical investigation, and their genetic structure characterized minutely. In contrast, the "virus of the mind" is hypothetical; posited by a questionable analogical argument, not direct observation; and is totally unwarranted conceptually on the basis of the behavior that Dawkins proposes for it. Can we observe these viruses? What is their structure? Their "genetic code"? Their location within the human body? And, most importantly of all, given Dawkins' interest in their spread, what is their mode of transmission?

There is no experimental evidence that ideas are viruses. Ideas may seem to "behave" in certain respects *as if* they are viruses. But there is a massive gap between analogy and identity – and, as the history of science illustrates only too painfully, most false trails in science are about analogies which were mistakenly assumed to be identities. The "God as virus" slogan, to the extent that it has any scientific validity, might be shorthand for something like "the patterns of diffusion of religious ideas seem to be analogous to those of the spread of certain diseases."

Unfortunately, Dawkins does not give any evidence-based arguments for this, and prefers to conjecture as to the impact of such a hypothetical virus on the human mind. The science just isn't there. In any case, each and every argument that Dawkins adduces for his idea of "God as virus of the mind" can be countered by proposing its counterpart for "atheism as a virus of the mind." Both ideas are equally unsubstantiated and meaningless.

The "thought contagion" metaphor has been developed most thoroughly by Aaron Lynch,[72] who makes the crucially important point that the way in which ideas spread has no necessary relation to their validity or "goodness." As Lynch puts it:

> The term "thought contagion" is neutral with respect to truth or falsity, as well as good or bad. False beliefs can spread as thought contagions, but so too can true beliefs. Similarly, harmful ideas can spread as thought contagions, but so too can beneficial ideas … Thought contagion analysis concerns itself primarily with the mechanism by which ideas spread through a population. Whether an idea is true, false, helpful or harmful are considered mainly for the effects they have on transmission rates.[73]

[72] Aaron Lynch, *Thought Contagion: How Belief Spreads through Society*. New York: Basic Books, 1996.

[73] Aaron Lynch, "An Introduction to the Evolutionary Epidemiology of Ideas." *Biological Physicist* 3, no. 2 (2003): 7–14.

## Moving On…

The invention of the Internet gave a new meaning to the "meme," far removed from Dawkins' original intentions back in 1976. The idea of the meme has been "co-opted by the marketing and advertising industry as a way of getting their messages into your head."[74] A "meme" now designates words, images, or actions which are designed to be liked and thus to spread, generally with the intention of influencing people – often to buy something. It is nothing like what Dawkins proposed. But at least the word "meme" has survived, even if it now means something quite different.

But what about the original concept of the meme? It now finds few supporters. Neither the developed forms of Dawkins' concepts of the meme or the "virus of the mind" – whatever their relationship – really help us validate or negate ideas, or understand or explain patterns of cultural development. As most working in the area of cultural development have concluded, it is perfectly possible to postulate and study cultural evolution while remaining agnostic to its mechanism. "All we need to do is recognize that cultural inheritance exists, and that its routes are different from the genetic ones."[75]

And what does this have to do with the idea of God? Well, not very much, really. A "memetic" approach to the diffusion of ideas may allow some insights about how beliefs – such as belief in God or belief in memes – spread within a culture. But it can't tell us anything about whether this belief itself is right or wrong, good or bad. This won't stop people drawing such conclusions – but they are not *valid* conclusions. And they are most certainly not *scientific* conclusions.

[74] Dominic Basulto, "Have Internet Memes Lost Their Meaning?" *Washington Post*, July 5, 2013.

[75] Stephen Shennan, *Genes, Memes and Human History: Darwinian Archaeology and Cultural Evolution*. London: Thames & Hudson, 2002, 63. For a more positive (but problematic) assessment of the meme see Kim Sterelny, "Memes Revisited." *British Journal for Philosophy of Science* 57 (2006): 145–65.

# 6

# The God Delusion

## *Dawkins on Atheism, Science, and Religion*

In 2006, Dawkins published a popular work of atheist polemics, with a teasing title that helped ensure it became a bestseller: *The God Delusion*. The work confirmed his profile as one of the world's best-known atheists, and as a leading figure in the "New Atheist" movement which attracted much attention in the five years between 2006 and 2010, before fading away. The work is chiefly notable for its dogmatic and trenchant assertion that God is a delusion – a "psychotic delinquent" invented by mad, deluded people.[1] For Dawkins, science sorts out this nonsense, in that it shows why there cannot be a God in the first place, and explains why credulous people arrive at such a ridiculous conclusion in the second.

*The God Delusion* was a "feel-good" book aimed at atheists, anxious at the persistence, and even resurgence, of religious belief they saw around them. It reassured them that they were not on their own, and flattered them by proclaiming the intellectual superiority of atheists over deluded religious believers. The latter was an unwise move. Terms such as "arrogant" and "dogmatic" began to be used to refer to the "New Atheism" – even from those sympathetic to its aims and ideas.

*The God Delusion* develops some themes that Dawkins set out in two television programs, entitled "Root of All Evil?," first broadcast in the United Kingdom in January 2006 by Channel 4. Unlike *The Selfish Gene*, which is a popular work rigorously informed by the best scientific scholarship, presented by a writer who clearly understands and appreciates the issues, *The God Delusion* seemed to its critics to be little more than an anti-religious rant lacking any serious scholarly foundation.

[1] *The God Delusion*, 38.

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To give one trivial but unfortunately representative example, Dawkins provides a few decontextualized quotes, lifted from an Internet site, from the sixteenth-century German Protestant writer Martin Luther, which Dawkins treats as representative of Luther's irrationalism – here taken to mirror that of religion in general.[2] No attempt is made to check the accuracy of the translation of the quotes, to clarify what Luther means by "reason," and how it differs from what Dawkins takes to be the self-evident meaning of the word. Having written a book on Luther's complex attitude to reason, I was somewhat disappointed at Dawkins' cavalier approach to truth.[3] I admire the simplicities of popular writing – but not when they become simplifications and misrepresentations. Yet the populist tone of *The God Delusion*, seen by scholars as a weakness, did much to ensure the work's success. It remains one of the most widely read popular manifestos for atheism.

Up to this point, we have explored the development of Dawkins' ideas up to about 2003. So how are these refined and nuanced in this major work of popular atheist apologetics? *The God Delusion* is a rather disorganized collage of arguments and pastiche of assertions which cannot be said to advance those ideas or enhance their critical edge, but rather harnesses them in the service of the advocacy of atheism. It makes use of some themes we have already considered – such as the idea of a "God-meme," or God as a "virus of the mind" – but does not develop them further. Since one of the central themes of *The God Delusion* is the inevitability of the triumph of science over religion, it is clearly essential to consider this late work in our study. We begin by locating *The God Delusion* within its cultural context.

## The Cultural Location of *The God Delusion*

On September 11, 2001, four commercial jet passenger airliners were hijacked by Islamic terrorists in a series of coordinated suicide attacks against targets in the United States of America. This event, now invariably referred to simply as "9/11," changed the public perception of religion within secular western liberalism. Where once it was seen as merely a

[2] *The God Delusion*, 190.

[3] Alister E. McGrath, *Luther's Theology of the Cross: Martin Luther's Theological Breakthrough*. Oxford: Blackwell, 1985.

puzzling relic from the past, it was now seen as dangerous, encouraging fanaticism, violence, and intolerance.[4]

Dawkins would play a central role in this change in cultural mood in western liberal circles. 9/11 confirmed everything he had always believed: religion was dangerous precisely because it was irrational, and when it failed to win arguments, it resorted to terror instead. Four days after the attack, Dawkins declared that "to fill a world with religion, or religions of the Abrahamic kind, is like littering the streets with loaded guns. Do not be surprised if they are used."[5] Five years later, Dawkins' definitive response to 9/11 appeared, in the form of *The God Delusion*.

The cultural backdrop to this work, and the New Atheism in general, is complex. Dawkins' book is in part an exasperated defense of some core assumptions of modernity in the midst of a world that he believes to have embraced a postmodern irrationalism.[6] The unexpected rebound of religion was one such factor. The humanist Michael Shermer, director of the Skeptics Society and publisher of *Skeptic* magazine, made this point in the closing year of the twentieth century, when he observed that never in history had so many people, and such a high percentage of the American population, believed in God.[7]

The resurgence of religion throughout most parts of the world – western Europe being a conspicuous exception – demanded a response, grounded in the two core legitimating resources of the Enlightenment: reason and science. Of all the works to emerge from the New Atheism, Dawkins' *God Delusion* is by far the most interesting and intellectually robust of these responses, notable for its harnessing of the core methods and assumptions of science – especially biology – as a key ally in the war against religion.[8]

[4] For some excellent studies and critiques, see Amarnath Amarasingam, ed., *Religion and the New Atheism: A Critical Appraisal*. Leiden: Brill, 2010; Tina Beattie, *The New Atheists: The Twilight of Reason and the War on Religion*. London: Darton, Longman and Todd, 2007; Terry Eagleton, *Reason, Faith, and Revolution: Reflections on the God Debate*. New Haven, CT: Yale University Press, 2009; David Bentley Hart, *Atheist Delusions: The Christian Revolution and Its Fashionable Enemies*. New Haven, CT: Yale University Press, 2009.

[5] Richard Dawkins, "Religion's Misguided Missiles." *The Guardian*, September 15, 2001.

[6] Note the analysis in Terry Eagleton, *Culture and the Death of God*. New Haven, CT: Yale University Press, 2014.

[7] Michael Shermer, *How We Believe: Science, Skepticism, and the Search for God*. New York: Freeman, 2000, 16–31.

[8] For the recent use of Darwinism in atheist apologetics, see Abigail J. Lustig, "Natural Atheology." In *Darwinian Heresies*, edited by Abigail J. Lustig, Robert J. Richards, and Michael Ruse, 69–83. Cambridge: Cambridge University Press, 2004; Alister E. McGrath, "The Ideological Uses of Evolutionary Biology in Recent Atheist Apologetics." In *Biology and Ideology: From Descartes to Dawkins*, edited by Denis R. Alexander and Ronald Numbers, 329–51. Chicago: University of Chicago Press, 2010.

The cultural lineage of Dawkins' approach in this work can be discerned in a number of its themes, including its implicit collusion with the impoverished mechanistic metaphysics of the Newtonian worldview, and a somewhat condescending assumption that all cultures that do not fall in line with the Enlightenment's limited account of reality are backward and irrational. Dawkins' rather naïve account of theory and evidence, already obvious in earlier works, now seems uncomfortably close to some kind of "Enlightenment rationalist fundamentalism,"[9] which failed to recognize either the limits of reason, or its potential abuse in the service of oppression.

There is also a clear alignment with the individualist voluntarism characteristic of late capitalist consumerism. It is not difficult to see the philosopher Immanuel Kant's notion of the sovereign individual who freely chooses her own destiny hovering over *The God Delusion*, although never quite brought to conscious articulation. Dawkins tends to present religion as something imposed (and hence oppressive and evil), and atheism as something freely chosen (and hence liberating and good) – a culturally and socially located account of the relation of faith and atheism, which is worryingly inattentive to the social realities of state-imposed atheism, such as that associated with the Soviet Union for most of its history.[10] Perhaps more importantly, Dawkins' dislike of "group selection" generally leads him to avoid discussing the social functions of religion, and to focus instead on the impact of faith on individuals. Needless to say, that impact is presented in purely negative terms, without any attempt to engage the substantial literature on the matter. The cultural critic Terry Eagleton, exasperated at Dawkins' laughable caricatures of religion in *The God Delusion*, summarized its pseudo-scientific dogmatism at this point admirably: "Such is Dawkins's unruffled scientific impartiality that in a book of almost four hundred pages, he can scarcely bring himself to concede that a single human benefit has flowed from religious faith, a view which is as *a priori* improbable as it is empirically false."[11]

[9] I take this interesting phrase from the perceptive account of Ernest Gellner, *Postmodernism, Reason and Religion*. London: Routledge, 1992, 80. For the argument that the New Atheism is itself a new form of fundamentalism, see Chris Hedges, *When Atheism Becomes Religion: America's New Fundamentalists*. New York: Free Press, 2008.

[10] For an account of how his experience of Soviet atheism led him to religious faith, see Peter Hitchens, *The Rage against God: How Atheism Led Me to Faith*. Grand Rapids, MI: Zondervan, 2010.

[11] Eagleton, "Lunging, Flailing, Mispunching." For Eagleton's own perceptive and critical comments on this important issue, see Terry Eagleton, *Holy Terror*. New York: Oxford University Press, 2005.

For our purposes in this book, the most important theme in *The God Delusion* is the epistemological privileging of the natural sciences, even if Dawkins is highly selective in what he chooses to note.[12] Dawkins had earlier explored and set out his ideas on this theme in *Unweaving the Rainbow*. This is a triumphalist manifesto for the cultural independence of the sciences, offering a robust defense of the core values of the Enlightenment. Two issues stand out as being of major significance:

1 Dawkins argues that the sciences lead to a model of the universe which is "not a superstitious, small-minded, parochial model filled with spirits and hobgoblins, astrology and magic, glittering with fake crocks of gold at where the rainbow ends."[13] In contrast, the religious view of nature is presented as being so ugly that it could not lead anyone to aesthetically pleasing conclusions. Religion is said to be aesthetically deficient, leading to the impoverishment of nature, and a diminution of the natural human sense of wonder and mystery evoked by the universe, and its scientific investigation.
2 Dawkins rejects any transcendent dimension to nature as aesthetically redundant and intellectually untenable. Science is said to get rid of such meaningless notions as "purpose," "God," and so forth. Nothing is lost by their elimination, Dawkins declares, except the deviousness that keeps the psychics, astrologers, and other peddlers of dishonest nonsense in business.

*Unweaving the Rainbow* offers a somewhat simplistic account of the scope of the natural sciences, which seems untroubled by the less appealing aspects of the scientific enterprise – such as the links between scientific research and military applications – in the face of what Dawkins sees as outbursts of irrationality in western culture. Nor does Dawkins note the darker side of the Enlightenment, which has so troubled many thinkers of the late twentieth century – such as its demand for the enforcement of uniformity, and its intolerance for deviation from what is declared to be "rational."[14] Dawkins' robust defense of modernism in the face of what he

[12] This view is often designated "scientism," although I have misgivings about both the term and its connotations. See Mikael Stenmark, *Scientism: Science, Ethics and Religion*. Aldershot: Ashgate, 2001.

[13] *Unweaving the Rainbow*, 312.

[14] See for example John Gray, *Straw Dogs: Thoughts on Humans and Other Animals*. London: Granta, 2002. For a balanced account of the Enlightenment, see Anthony Pagden, *The Enlightenment and Why It Still Matters*. Oxford: Oxford University Press, 2013.

regarded as postmodern irrationalism is curiously inattentive to the historical roots and fundamental motivations of the postmodern enterprise – namely, the realization that modernity in effect amounted to a totalization of reality within a single unitary framework, resistance to which was to be seen as a sign of irrationality or madness.

To understand the ferocity of Dawkins' attack on religion in *The God Delusion*, we must try to step into a worldview that is unfamiliar to most of us – namely, that science and religion are fighting to the death for the soul of humanity, and no quarter must be given to ensure the triumph of reason over superstition, or of science over religion. So where does this idea, now widely debunked by historians, come from?

## The "Warfare" of Science and Religion

The narrative of the New Atheism is that of the cultural triumph and intellectual totalization of science. Science eliminates God, having gobbled up the explanatory space he once occupied. Science is the only reliable tool that we possess to understand the world. It has no limits. Science may not know something now – but it will in the future. It is just a matter of time before science displaces religion completely. Real scientists must therefore be atheists. It is simply unthinkable that a genuine scientist would be a religious believer. Science and religion, for Dawkins, represent logically and ideologically exclusive domains. If you're a real scientist, you can't believe in God. If you believe in God, you can't be a real scientist.

This doctrinaire attitude has done much to undermine the intellectual credibility of Dawkins' arguments in *The God Delusion*. One of the more unpleasant parts of the book is his personal attack on the eminent physicist Freeman Dyson. Dyson was awarded the Templeton Prize for Religion in 2000, and gave an acceptance speech in which he lauded the achievements of religion, while highlighting and criticizing its downside. He was also clear about the downside of atheism, noting that "the two individuals who epitomized the evils of our century, Adolf Hitler and Joseph Stalin, were both avowed atheists." Dawkins was outraged by this "endorsement of religion by one of the world's most distinguished physicists."[15] When Dyson commented that he was a Christian who wasn't particularly interested in the doctrine of the Trinity, Dawkins interpreted this to mean that Dyson wasn't really a Christian at all, but was actually an atheist simulating

[15] *The God Delusion*, 152.

a Christian identity. "Isn't that just what any atheistic scientist *would* say, if he wanted to sound Christian?"[16]

Dawkins' outrage here reflects a challenge to his absolutist commitment to the malignancy of religion, regularly cited as one of the greatest weaknesses of *The God Delusion*. Sure, religion can be held accountable for some bad things; but it's also responsible for a lot of good things. As the leading skeptic Michael Shermer pointed out, "religion, like all social institutions of such historical depth and cultural impact, cannot be reduced to an unambiguous good or evil."[17]

Yet the problem is not so much that a controlling anti-religious outlook distorts and determines Dawkins' views on religion. It is that this worldview is shaped by the notion of a permanent warfare between science and religion, so that any scientist who is supportive of religion is a traitor or an appeaser – someone who represents the "Neville Chamberlain" school.[18] For those who do not recognize this slightly dated and parochial allusion, Dawkins is referring to the (unsuccessful) policy of appeasement adopted by the British Prime Minister, Neville Chamberlain, toward Adolf Hitler in 1938, in the hope of avoiding a damaging and destructive total war in Europe. This unpleasant analogy seems to imply that scientists who affirm the importance of religion are "appeasers," and that religious people are to be compared to either Hitler or the Nazis. It is a natural assumption, given Dawkins' dogmatic controlling worldview, which shapes how he sees things. But it's not one shared by many others.

Dawkins then proceeds to single out Michael Ruse – a distinguished atheist philosopher who describes himself as a "hard-line Darwinian," who has done much to clarify the philosophical roots and consequences of Darwinism, and challenge religious fundamentalism – as an example of such an appeaser.[19] Why? Might it possibly have been Ruse's criticism of Dawkins for his intellectually sloppy and personally dogmatic response to Pope John Paul II's 1996 statement to the Pontifical Academy of Sciences supporting the notion of biological evolution, while criticizing certain materialist interpretations of the idea? Here's what Ruse had to say: "When John Paul II wrote a letter endorsing Darwinism, Richard Dawkins' response was simply that the pope was a hypocrite, that he could not be

[16] *The God Delusion*, 152.

[17] Shermer, *How We Believe*, 71.

[18] *The God Delusion*, 66–9. For a criticism of Dawkins' rhetoric at this point, see Fern Elsdon-Baker, *The Selfish Genius: How Richard Dawkins Rewrote Darwin's Legacy*. London: Icon, 2009, 225–55, especially 229.

[19] His best work, in my view, is *Monad to Man: The Concept of Progress in Evolutionary Biology*. Cambridge, MA: Harvard University Press, 1996.

genuine about science and that Dawkins himself simply preferred an honest fundamentalist."[20] For Ruse, Dawkins was so locked into a controlling "religious people must be anti-evolution" mindset that he simply could not comprehend this development – and therefore concluded that the pope could not conceivably be telling the truth.

Dawkins' espousal of the "warfare" model between science and religion is simply unwise; his use of it as a normative worldview is simply ridiculous. For Dawkins, any talk about an "alleged convergence" between religion and science can only be "a shallow, empty, hollow, spin-doctored sham."[21] Yet Dawkins offers his readers no engagement with history or recent historical scholarship – a failing which many consider to be the Achilles' heel of Dawkins' simplistic positivist approach to the natural sciences. It is why the many critics of the New Atheism accuse it of developing "vacuous arguments afloat on oceans of historical ignorance."[22] And it is not difficult to figure out why Dawkins steers clear of both history, and recent historical scholarship.

In the last two decades, the scholarly understanding of the historical relationship of science and religion has undergone an intellectual revolution no less than that occasioned by Darwin's *Origin of Species*. Intensive historical scholarly research has demonstrated that the popular notion of a protracted war between church and science which continues to this day is a piece of Victorian propaganda, completely at odds with the facts.[23] There were certainly individual conflicts, often reflecting institutional politics and personal agendas – such as the Galileo affair – or simply misunderstandings on either or both sides of the debate. But these conflicts are neither typical nor defining.

Dawkins takes a strongly positivist view of science, and links this with the idea that science and religion are necessarily at war with each other. To do this, he has to adopt an "essentialist" view of both science and religion, which holds that both are be defined by core beliefs or methods, and disregards both their changing ideas and approaches over time, and the

[20] Cited in *God Delusion*, 67. For Ruse's own assessment of this papal statement, see Michael Ruse, "John Paul II and Evolution." *Quarterly Review of Biology* 72 (1997): 391–5.

[21] *A Devil's Chaplain*, 151.

[22] Hart, *Atheist Delusions*, 4.

[23] Two earlier publications were especially important in forcing this radical review of the popular viewpoint: David C. Lindberg, and Ronald L. Numbers, *God and Nature: Historical Essays on the Encounter between Christianity and Science*. Berkeley: University of California Press, 1986; Edward Grant, *The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional and Intellectual Contexts*. Cambridge: Cambridge University Press, 1996.

extent of social construction in shaping these.[24] The "warfare" model rests on "essentialist" accounts of the interaction of science and religion, which assumes that each of these terms designates something fixed, permanent, and essential, so that their mutual relationship is determined by something fundamental to each of the disciplines, unaffected by the specifics of time, place, or culture. But it is simply not so. The relation of science and religion is historically conditioned, bound to the social and intellectual conditions of the age.[25]

Most historians who stand outside the groupthink of the New Atheist movement regard religion as having had a generally benign and constructive relationship with the natural sciences in the west.[26] Tensions and conflicts, such as the Galileo controversy, often turned out on closer examination to have more to do with papal politics, ecclesiastical power struggles, and personality issues than with any fundamental tensions between faith and science.[27] Leading historians of science regularly point out that the interaction of science and religion is determined primarily by the specifics of their historical circumstances, and only secondarily by their respective subject matters. There is no universal paradigm for the relation of science and religion, either theoretically or historically. The case of Christian attitudes to evolutionary theory in the late nineteenth century makes this point particularly evident. As the Irish geographer and intellectual historian David Livingstone makes clear in a ground-breaking study of the reception of Darwinism in two very different contexts – Belfast and Princeton – local issues and personalities were often of decisive importance in determining the outcome.[28]

In the eighteenth century, a remarkable synergy developed between religion and the sciences in England. Newton's "celestial mechanics" was widely regarded as at worst consistent with, and at best a glorious confirmation of, the Christian view of God as creator of a harmonious universe. Many members of the Royal Society of London – founded to advance

[24] For the point at issue, see Stephan Fuchs, *Against Essentialism: A Theory of Culture and Society*. Cambridge, MA: Harvard University Press, 2001, especially 12–70.

[25] For a sustained critique of this position, richly illustrated with historical case studies, see John Brooke, and Geoffrey Cantor, *Reconstructing Nature: The Engagement of Science and Religion*. Edinburgh: Clarke, 1998.

[26] See, for example, Ronald L. Numbers, ed. *Galileo Goes to Jail: And Other Myths about Science and Religion*. Cambridge, MA: Harvard University Press, 2009.

[27] Mario Biagioli, *Galileo, Courtier: The Practice of Science in the Culture of Absolutism*. Chicago: University of Chicago Press, 1993.

[28] David N. Livingstone, "Darwinism and Calvinism: The Belfast–Princeton Connection." *Isis* 83 (1992): 408–28.

scientific understanding and research – were strongly religious in their outlooks, and saw this as enhancing their commitment to scientific advancement.

All this changed in the second half of the nineteenth century. The general tone of the later nineteenth-century encounter between religion (especially Christianity) and the natural sciences was set by two works – John William Draper's *History of the Conflict between Religion and Science* (1874) and Andrew Dickson White's *The Warfare of Science with Theology in Christendom* (1896). The crystallization of the "warfare" metaphor in the popular mind was unquestionably catalyzed by such vigorously polemical writings.[29]

Yet the notion of an endemic conflict between science and religion, so aggressively advocated by White and Draper, is itself socially determined, created in the lengthening shadows of hostility toward individual clergy and church institutions. The interaction of science and religion has been influenced more by their social circumstances than by their specific ideas.[30] The Victorian period itself gave rise to the social pressures and tensions which engendered the myth of permanent warfare between science and religion. The "conflict" model has its origins in the specific conditions of the Victorian era, in which an emerging professional intellectual group sought to displace a group which had hitherto occupied the place of honor.

The "conflict" model of science and religion thus came to prominence at a time when professional scientists wished to distance themselves from their amateur colleagues, and when changing patterns in academic culture necessitated demonstrating its independence from the church and other bastions of the establishment. Academic freedom demanded a break with the church; it was a small step toward depicting the church as the opponent of learning and scientific advance in the late nineteenth century, and the natural sciences as its strongest advocates.

Today, the idea that the natural sciences and religion have been permanently at war with each other is no longer taken seriously by any historian of science. It is understandable that it should still linger in some works of popular science and journalism – after all, serious academic historical scholarship takes a long time to filter down to this lower level. If it is read at all, that is.

[29] For their impact, see James R. Moore, *The Post-Darwinian Controversies: A Study of the Protestant Struggle to Come to Terms with Darwin in Great Britain and America, 1870–1900.* New York: Cambridge University Press, 1979, 29–49.

[30] See for example Frank M. Turner, "The Victorian Conflict between Science and Religion: A Professional Dimension." *Isis* 69 (1978): 356–76; Colin A. Russell, "The Conflict Metaphor and Its Social Origins." *Science and Christian Faith* 1 (1989): 3–26.

And it is not just historians who regard the "warfare" model as outdated and discredited. Most scientists don't see things this way either. After surveying the views of contemporary scientists, Rice University sociologist Elaine Howard Ecklund concluded that "the 'insurmountable hostility' between science and faith is a caricature, a thought-cliché, perhaps useful as a satire on groupthink, but hardly representative of reality."[31]

The twentieth century has witnessed a vast revision of the simplistic views of the nineteenth century on the nature and limits of the scientific method, and the relation of faith and science. The huge scholarly process of subjecting these traditional views to minute examination has forged a new awareness of possibilities for positive and constructive dialogue and engagement, at a time in the history of western culture which is showing a new interest in spirituality at every level.

I do wish Dawkins would join in this dialogue, instead of firing off inaccurate, wildly rhetorical salvoes, and lampooning those who disagree with him.[32] Why? One of the defining characteristics of western culture is the perception of a growing – possibly accelerating – alienation between the humanities and natural sciences, and an increasing cultural unease about where science is taking us. Back in 1959, C. P. Snow observed that the gulf between the arts and sciences had become so pronounced that it was necessary to speak of two distinct and non-interactive cultures in western society: "The intellectual life of the whole of western society is increasingly being split into two polar groups … Literary intellectuals at one pole … at the other scientists, and as the most representative, the physical scientists. Between the two a gulf of mutual incomprehension."[33] If anything, things seem to have got worse since then. The once relatively civilized disagreements between the natural sciences and the humanities seem to have given way to something approaching a shooting war.

Recent works dealing with the cultural impact of science show a growing polarization between the natural sciences and the humanities. The possibility of reconciliation – or even a constructive dialogue – seems to diminish year by year. And Dawkins is one of those who some accuse of

[31] Elaine Howard Ecklund, *Science vs. Religion: What Scientists Really Think*. New York: Oxford University Press, 2010, 5.

[32] For reflections on this disagreeable aspect of Dawkins' writing, see Gary Keogh, *Reading Richard Dawkins: A Theological Dialogue with New Atheism*. Minneapolis, MN: Fortress Press, 2014.

[33] C. P. Snow, *The Two Cultures and the Scientific Revolution*. Cambridge: Cambridge University Press, 1959, 3.

making things worse.[34] It doesn't need to be like this. We might turn to Sir Peter Medawar's 1968 Romanes Lecture at Oxford University, entitled "Science and Literature," in which this distinguished biologist and scientific popularizer sought to hold together what seemed to be drifting apart. To remedy this, Medawar suggested, required that people on both sides should "work their way towards an understanding – not just of each other's accomplishments … nor just of each other's purposes … but of each other's methods and energizing concepts, and the quality and pattern of movement of each other's thought."[35] Medawar gets my vote anytime.

## Natural Science Leads to Neither Atheism Nor Christianity

Dawkins' emphasis on science as the ultimate adjudicator of life's great questions faces a significant difficulty, in that the scientific method is incapable of delivering a decisive adjudication of the God question. Those who believe that it proves or disproves the existence of God press that method beyond its legitimate limits, and run the risk of abusing or discrediting it. Some distinguished biologists (such as Francis S. Collins, director of the Human Genome Project) argue that the natural sciences create a positive presumption of faith;[36] others (such as the evolutionary biologist Stephen Jay Gould) that they have negative implications for theistic belief. But they *prove* nothing, either way. If the God question is to be settled, it must be settled on other grounds.

This is not a new idea. Indeed, the recognition of the religious limits of the scientific method was well understood around the time of Darwin himself. As none other than "Darwin's Bulldog," T. H. Huxley, wrote in 1880: "Some twenty years ago, or thereabouts, I invented the word 'Agnostic' to denote people who, like myself, confess themselves to be hopelessly ignorant concerning a variety of matters, about which metaphysicians and theologians, both orthodox and heterodox, dogmatise

[34] See for example Hugh Aldersley-Williams, "The Misappliance of Science." *New Statesman*, September 13, 1999.

[35] Peter Medawar, "Science and Literature." *Encounter*. January 1969, 15–23, 16. On Medawar's achievement, see Neil Calver, "Sir Peter Medawar: Science, Creativity and the Popularization of Karl Popper." *Notes and Records of the Royal Society* 67 (2013): 301–14. Interestingly, Dawkins included extracts from this lecture in his edited collection *The Oxford Book of Modern Science Writing*. Oxford: Oxford University Press, 2009, 178–9.

[36] Francis S. Collins, "Faith and the Human Genome." *Perspectives on Science and Christian Faith* 55 (2003): 142–53.

with utmost confidence."[37] Fed up with both theists and atheists making hopelessly dogmatic statements on the basis of inadequate empirical evidence, Huxley declared that the God question could not be settled on the basis of the scientific method: "Agnosticism is of the essence of science, whether ancient or modern. It simply means that a man shall not say he knows or believes that which he has no scientific grounds for professing to know or believe… Consequently Agnosticism puts aside not only the greater part of popular theology, but also the greater part of anti-theology."[38] Huxley's arguments are as valid today as they were in the late nineteenth century, despite the protestations of those on both sides of the great debate about God.

In a 1992 critique of an anti-evolutionary work which posited that Darwinism was *necessarily* atheistic,[39] Stephen Jay Gould invoked the memory of Mrs. McInerney, his third-grade teacher, who was in the habit of rapping young knuckles when their owners said or did particularly stupid things:

> To say it for all my colleagues and for the umpteenth million time (from college bull sessions to learned treatises): science simply cannot (by its legitimate methods) adjudicate the issue of God's possible superintendence of nature. We neither affirm nor deny it; we simply can't comment on it as scientists. If some of our crowd have made untoward statements claiming that Darwinism disproves God, then I will find Mrs. McInerney and have their knuckles rapped for it (as long as she can equally treat those members of our crowd who have argued that Darwinism must be God's method of action).

Gould rightly insists that science can work only with naturalistic explanations; it can neither affirm nor deny the existence of God. The bottom line for Gould is that Darwinism actually has no bearing on the existence or nature of God. If Darwinians choose to dogmatize on matters of religion, they stray beyond the straight and narrow way of the scientific method, and end up in the philosophical badlands. Either a conclusion cannot be reached at all on such matters, or it is to be reached on other grounds.

[37] See his 1883 letter to Charles A. Watts, publisher of the *Agnostic Annual*.; *Life and Letters of Thomas Henry Huxley*. London: Macmillan, 1913, vol. 3, 97. For further comment, see Alan Willard Brown, *The Metaphysical Society: Victorian Minds in Crisis, 1869–1880*. London: Oxford University Press, 1947.

[38] Huxley, *Life and Letters*, vol. 3, 97.

[39] Gould, "Impeaching a Self-Appointed Judge."

Now Dawkins knows perfectly well that "science has no way to disprove the existence of a supreme being."[40] This, he argues, cannot be allowed to lead to the conclusion that "belief (or disbelief) in a supreme being is a matter of pure individual inclination." But who said anything about "pure individual inclination"? Where does this idea come from? Dawkins seems to imply that, where the scientific method cannot be properly applied, there is only epistemological anarchy, in which we are reduced to the pure subjectivity of individual opinion.

But it's nothing like that. This misleading gloss on a perfectly serious and legitimate debate about the limits of the scientific method allows Dawkins to evade the point at issue. If the scientific method cannot settle an issue, it does not mean that all answers have to be regarded as equally valid, or that we abandon rationality in order to deal with them. It simply means that the discussion shifts to another level, using different criteria of evidence and argumentation. Everyone knows that, if the scientific method can neither prove nor disprove the existence or nature of God, then either we abandon the question as unanswerable, or we answer it on other grounds. And that is precisely what Dawkins himself does – develop arguments for atheism which are ultimately non-scientific in character. We shall return to consider how successful these are in due course. The key point for the moment is simply this: the scientific method *alone* cannot ultimately determine the God question, even though it has some important contributions to make to the debate.

## Science, Faith, and Evidence

One of the central assertions of Dawkins' *God Delusion* is that beliefs should be proved with reference to evidence. As we noted earlier, Dawkins regards religious belief as an evidence-free zone, meriting the accolade of "blind faith" or a "kind of mental illness." I have no doubt that some religious people have some very strange views about the relation of faith and reason. But the fact remains that the mainstream of religious thought – especially within Christianity – has celebrated, affirmed, and explored the rationality of faith, and eschewed any notion of "blind faith" or a "God of the gaps."

So what is meant by "evidence"? Dawkins does not appear to appreciate that an observation only becomes evidence when placed within, and assessed against, a theoretical framework. An observation can thus function

[40] *A Devil's Chaplain*, 149.

as evidence for several possible theories, being interpreted in different manners within these theoretical frameworks.[41] A core assumption of Dawkins's polemic against theism is that observations can be treated as "brute," in that they ultimately have only one proper, unequivocal meaning.

This assumption, deeply embedded within the Enlightenment,[42] is problematic. Unsurprisingly, the work of Thomas Kuhn does not feature prominently in Dawkins' writings. On the relatively few occasions when Dawkins does refer to Kuhn, it is as a "truth-heckler," someone who resists Dawkins' scientific positivism in the name of covert sociological agendas.[43] Kuhn rightly observed, however, that any supposedly "univocal" observations in science were perceived as such because they were interpreted solely within the dominant hermeneutical paradigm of that time.[44] A "paradigm shift" resulted in that same observation now being located and interpreted within another hermeneutical framework – that is to say, an observation once regarded as evidence for one theory came to be treated as evidence for something else. It is not difficult to understand this failure to engage seriously with the issues raised by Kuhn. The epistemological simplicity of Dawkins' "evidential univocality" is seriously undermined by Kuhn's historical and philosophical analysis.

Perhaps related to this weakness, Dawkins fails to make the significant and necessary distinction between a "logic of discovery" and a "logic of verification." The manner in which a scientific theory or hypothesis is derived often turns out to have little bearing on its truth. As the American philosopher and scientist Charles S. Pierce pointed out, a theory might emerge through intuition or inspiration, as much as through rational reflection. Yet once formulated, a theory must be tested against observation.[45]

[41] As noted by John Earman, "Underdetermination, Realism, and Reason." *Midwest Studies in Philosophy* 18 (1994): 19–38. For a criticism of this position, see Igor Deuven and Leon Horsten, "Earman on Underdetermination and Empirical Indistinguishability." *Erkenntnis* 49 (1998): 303–20.

[42] For the development of this paradigm in the eighteenth century, see Mark E. Blum, "The European Metahistorical Narrative and Its Changing 'Metaparadigms' in the Modern Age." In *Political Economy, Linguistics and Culture: Crossing Bridges*, edited by Jürgen G. Backhaus, 101–62. Heidelberg: Springer, 2008.

[43] *A Devil's Chaplain*, 16.

[44] Thomas S. Kuhn, *The Structure of Scientific Revolutions*. 2nd edn. Chicago: University of Chicago Press, 1970. See further José Díez, "Falsificationism and the Structure of Theories: The Popper–Kuhn Controversy about the Rationality of Normal Science." *Studies in History and Philosophy of Science* 38 (2007): 543–54.

[45] Christiane Chauviré, "Peirce, Popper, Abduction, and the Idea of Logic of Discovery." *Semiotica* 153 (2005), 209–21.

A classic example of this is August Kekulé's hypothesis that the chemical benzene possessed a cyclical structure. Kekulé (1829–96) first set out this idea in a French article of 1865, and then a German article of 1866. Kekulé did not explain the "logic of discovery" which led to the formulation of this innovative idea at that time, although his subsequent work provided an extensive "logic of justification" for the ring structure of benzene. But in 1890, at a celebration marking the twenty-fifth anniversary of this suggestion – by then widely accepted – Kekulé spoke of how this idea came to him. Perhaps because his reputation was by then beyond reproach, Kekulé was able to tell his astonished audience of the unorthodox manner by which he developed the idea in the first place.[46] He had a dream of a snake chasing its own tail. But while the origins of this idea might indeed be somewhat speculative, even mystical, the fact remains that, when it was checked out against the evidence, it seemed to work. The manner of its derivation might be opaque; the manner of its verification, however, was perfectly clear – and ultimately persuasive.

So how do these reflections relate to Dawkins' arguments in *The God Delusion*? Dawkins tends to treat God as an additional object within the universe – like a teapot orbiting between the earth and Mars[47] – which leads him to draw two conclusions. First, the existence of this additional object ought to be demonstrable. Second, that religious belief is less parsimonious than atheism, in that it involves believing in one additional entity.

These are both interesting points. Dawkins has been heavily criticized by philosophers and theologians on the first of them, in that Christianity does not regard God as an object within the world, capable of the same kind of empirical verification as a new planet within the solar system. As the Catholic theologian Herbert McCabe once remarked, "God is not an inhabitant of the universe; he is the reason why there is a universe at all."[48]

Dawkins' demand that God should be provable or observable is deeply problematic. Proof, in the proper sense of the term, is limited to the rather small worlds of mathematics and logic. The natural sciences invite us to think more in terms of the identification of reasons for believing that something may be true, mindful of the provisionality of our conclusions.

Yet the rather outdated form of scientific positivism to which Dawkins is wedded demands that the existence of proposed entities ought to be

[46] August Kekulé, "Benzolfest Rede." *Berichte der deutschen chemischen Gesellschaft zu Berlin* 23 (1890): 1302–11.

[47] *The God Delusion*, 51–2. Dawkins takes this analogy from the writings of Bertrand Russell.

[48] Herbert McCabe, *God Still Matters*. London: Continuum, 2002, 37.

proved – for example, by observing them. In this, he echoes some themes of "logical positivism," which gained intellectual traction in Oxford through the influence of A. J. Ayer (1910–89) and others. Dawkins' approach to the existence of God is perhaps more akin to the common-sense approach of earlier empiricists – such as David Hume (1711–76) – than to Ayer's metaphysically deflationary agenda. It is difficult not to see the intellectual affinity between Dawkins and Hume: "If we take in our hand any volume, of divinity or school metaphysics for instance, let us ask, Does it contain any abstract reasoning concerning quantity or number? No. Does it contain any experimental reasoning concerning matter of fact and existence? No. Commit it then to the flames, for it can contain nothing but sophistry and illusion."[49] But things are not quite this simple. A realist philosophy of science – which I assume underlies Dawkins' approach – distinguishes between observable and unobservable entities, while recognizing that this distinction rests on human sensory capabilities, rather than the reality that is being observed. Subatomic particles cannot strictly be "observed," yet cannot be regarded as "non-existent" for that reason. The distinction between what can be observed and what cannot be observed reflects limitations on the unaided human capacity to observe, which can be enhanced through technology, and extended through theoretical interpretation.[50] The best scientific theories offer explanations of both observable and unobservable aspects of the world.[51] The theoretical importance of "dark matter" (which cannot be observed) in contemporary cosmology is a luminous and representative reminder of the importance of this point. It is hypothesized to account for effects that are believed to be the result of mass, where no such mass can actually be seen.[52]

Science is absolutely right in demanding that we provide justification of our beliefs, on the basis of the best knowledge and methods at our disposal.

[49] David Hume, *Enquiries concerning Human Understanding and concerning the Principles of Morals*. 3rd edn. Oxford: Clarendon Press, 1975, 165. For the problems with this approach, see Colin Howson, *Hume's Problem: Induction and the Justification of Belief*. Oxford: Oxford University Press, 2000, 168–220.

[50] For the issues, see Dudley Shapere, "The Concept of Observation in Science and Philosophy." *Philosophy of Science* 49 (1982): 485–525; Paul Dicken and Peter Lipton, "What Can Bas Believe? Musgrave and van Fraassen on Observability." *Analysis* 66 (2006): 226–33; Anjan Chakravartty, *A Metaphysics for Scientific Realism: Knowing the Unobservable*. Cambridge: Cambridge University Press, 2007.

[51] See Stathos Psillos, *Knowing the Structure of Nature: Essays on Realism and Explanation*, London: Palgrave Macmillan, 2009.

[52] For an excellent review, see Gianfranco Bertone, Dan Hooper, and Joseph Silk, "Particle Dark Matter: Evidence, Candidates and Constraints." *Physics Reports* 405, nos. 5–6 (2005): 279–390.

However, as Stanley Fish pointed out, those methods of enquiry and bodies of knowledge change over time:

> [A defence of objective truth] will not proceed by citing unmediated and unchallengeable evidence, but by citing evidence that appears to me to be conclusive given the features of the world as I see it and the force of arguments I unproblematically affirm, at least for now. In short, I rely on the world that has been delivered to me by the traditions of inquiry and demonstration I currently have faith in. That is what objectivity means, going with the best arguments and bodies of evidence one has at the moment.[53]

Fish's point merits close consideration: methods of investigation and normative assumptions are embedded within social and professional contexts, and thus change over time. The same "evidence" (that is, observation) is thus open to being interpreted in different ways in different socio-cultural locations.

But Dawkins has a third point to make. In a rather patchy and derisory account of the "anthropic principle," lacking even the semblance of objectivity of judgment, Dawkins argues that the idea of a creator God is nonsensical, in that such a God would have to be "complex," and hence "improbable."[54] While conceding that this does not amount to a disproof of God's existence, Dawkins clearly believes that it renders the idea implausible. This, it must be said, is a puzzling argument, which has left his critics struggling to grasp the point at issue.[55] Dawkins appears to confuse statistical improbability with the rather different notion of epistemic improbability. Let me give an argument which descends to Dawkins' level of naïveté at this point. The possibility of a specific individual called "Richard Dawkins" existing is vanishingly small. Therefore he is so improbable that he doesn't exist. It's nonsense.

Dawkins also develops a fourth critique of the doctrine of creation. God designed the world, then who designed God? "Any God capable of designing anything would have to be complex enough to demand the same kind of explanation in his own right. God presents an infinite regress from which he cannot help us to escape."[56] If that process of regression is terminated, he argues, this constitutes an improper and

[53] Stanley Fish, "Evidence in Science and Religion, Part Two." *New York Times,* April 9, 2012.

[54] *The God Delusion,* 111–24.

[55] See for example Alvin Plantinga, *Where the Conflict Really Lies: Science, Religion, and Naturalism*. New York: Oxford University Press, 2011, 25–30.

[56] *The God Delusion*, 109.

premature foreclosure, based on "the dubious luxury of arbitrarily conjuring up a terminator to an infinite regress."[57] Anything that explains something itself has to be explained – and *that* explanation in turn needs to be explained. There is no justifiable way of ending this infinite regression of explanations. What explains the explanation? Who designed the designer?

Yet many note that the holy grail of the natural sciences is the quest for the "Grand Unified Theory" – the "theory of everything." Why is such a theory regarded as being so important? Because it can explain everything, without itself requiring or demanding an explanation.[58] The explanatory buck stops right there. There is no infinite regress in the quest for explanation. If Dawkins' brash and simplistic arguments carried weight, this great scientific quest could be dismissed with a seemingly profound, yet in fact trivial, question: What explains the explainer?

Now maybe there is no such ultimate theory. Maybe the "theory of everything" will turn out to be a "theory of nothing." However, there is no reason to suppose that this quest is a failure from the outset, simply because it represents the termination of an explanatory process. Yet an analogous quest for an irreducible explanation lies at the heart of the scientific quest. There is no logical inconsistency, no conceptual flaw, no self-contradiction involved. A "theory of everything" may well be more complex than the lesser theories that it explains – but what has that to do with its improbability?

## A Darwinian Explanation of Belief in God?

Perhaps the most interesting section of *The God Delusion* deals with the question of whether belief in God is conditioned by our evolutionary past. Potentially, this could have been one of the most important and interesting aspects of the work, exploring whether belief in God can be explained persuasively in purely naturalist terms as an evolutionary outcome. But the discussion is skewed and unpersuasive. Dawkins writes as an atheist polemicist, not as a disinterested scientist.

[57] *The God Delusion*, 77.

[58] Among the best introductions are David Deutsch, *The Fabric of Reality*. London: Allen Lane, 1997; Brian Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. London: Vintage, 2000.

A serious reflection on the issue would have considered at least four possible views on whether religion is adaptive, and in what manner (and to what extent) this might help account for its origins:

1 Religious beliefs have no adaptive functions, so that their presence and success in human populations is to be explained by other means. The notion of the "meme," which we considered earlier, is an example of such a reductive evolutionary explanation of belief in God.
2 Religious beliefs can be considered as by-products of more fundamental and essentially adaptive features of human cognition.
3 Religious beliefs are to be considered as adaptations which play a positive role in enabling humanity to deal with environmental complexity.
4 Religious beliefs are essentially cultural adaptations that co-evolve and interact with natural adaptations.

The difficulty here is that it is still far from clear whether religious belief is adaptive or not. Some argue that there is no obvious adaptive function to religious belief,[59] where others hold that religion can clearly be interpreted in adaptationist terms.[60] There is simply no consensus on this matter at present.[61]

Dawkins is thus obliged to offer a highly selective review of the literature on the topic, peppered with his own somewhat trenchant views on the nature and value of religion, which seem to function as the dogmatic presupposition of his argument, rather than as its evidenced conclusion. Whatever the situation may have been in our evolutionary past, Dawkins declares, religion is now non-adaptive, damaging people. If religious beliefs can be described as adaptive in any sense, it is only in that these beliefs themselves prove successful as cultural parasites within their human hosts. His analysis is conspicuously lacking in empirical engagement of any kind, and is best seen as armchair theorizing, without any scholarly or

[59] For example, see Pascal Boyer, *Religion Explained: The Evolutionary Origins of Religious Thought*. New York: Basic Books, 2001, 4–33; Scott Atran, *In Gods We Trust: The Evolutionary Landscape of Religion*. Oxford: Oxford University Press, 2002, 12–13.

[60] As argued by Candace S. Alcorta and Richard Sosis, "Ritual, Emotion, and Sacred Symbols: The Evolution of Religion as an Adaptive Complex." *Human Nature* 16 (2005): 323–59.

[61] Peter J. Richerson and Lesley Newson, "Is Religion Adaptive? Yes, No, Neutral. But Mostly We Don't Know." In *The Believing Primate: Scientific, Philosophical and Theological Reflections on the Origin of Religion*, edited by Jeffrey Schloss and Michael Murray, 100–17. Oxford: Oxford University Press, 2009.

empirical merit. As the leading evolutionary biologist David Sloan Wilson argued, *The God Delusion* suggests that Dawkins "is just another angry atheist, trading on his reputation as an evolutionist and spokesperson for science to vent his personal opinions about religion."[62]

There is little point in reading *The God Delusion* as a serious contribution to our understanding of the origins of religion. It is deeply regrettable that Dawkins' evolutionary account depends on the "general principles" of religion[63] he finds in *The Golden Bough* by Sir James Frazer (1854–1941) – a highly impressionistic early work of anthropology, first published in 1890.[64] It is a highly puzzling strategy. Why does Dawkins depend so heavily here on the core assumptions of a work which is well over a century old, and now largely discredited? Many would argue that the rise of modern anthropology was a direct reaction to the obvious inadequacies of Frazer's *Golden Bough*, which lacked any serious basis in systematic empirical study.

So why might Dawkins want to follow Frazer in reducing religion to some single universal trait, neglecting (if, indeed, he is aware of it) the mass of research that suggests it is much more complex and diverse, incapable of being forced into a simple set of universal beliefs or attitudes? The only persuasive answer is that, by making this move, Dawkins can accommodate the origins of religion within his "universal Darwinism." "Universal features of a species demand a Darwinian explanation."[65] Yet religion does *not* exhibit the "universal features" that Dawkins' approach demands. It is one of the many points at which *The God Delusion* depends on discarded nineteenth-century assumptions to make a twenty-first-century case against religion.

Dawkins asserts that religion is an unintended by-product of the evolutionary process.[66] One of the best-written passages in *The God Delusion* describes how moths use light sources in the night sky – such as the moon – to orient their flight path. This, Dawkins points out, is to be seen as an adaptation in evolutionary terms. But with the invention of artificial light, this adaptation goes wrong. Through a "misfiring by-product of a normally useful compass," moths are attracted to artificial lighting – including the flame of candles.[67] The moth that flies into a candle flame and burns

[62] David Sloan Wilson, "Beyond Demonic Memes: Why Richard Dawkins is Wrong about Religion." *eSkeptic*. July 4, 2007, www.skeptic.com/eskeptic/07–07–04, accessed August 8, 2014.

[63] *The God Delusion*, 188.

[64] See Eric Csapo, *Theories of Mythology*. Oxford: Blackwell, 2005, 36–43.

[65] *The God Delusion*, 166.

[66] *The God Delusion*, 172–9.

[67] *The God Delusion*, 172–3.

up, Dawkins rightly notes, had no intention of committing suicide. It had simply fallen victim to what was once a useful adaptation.

Dawkins suggests (without offering much in the way of evidence) that religion is also to be understood in terms of the misfiring of some once useful instinct. "Religious behaviour may be a misfiring, an unfortunate by-product of an underlying psychological propensity which in other circumstances is, or once was, useful."[68] It is "a by-product of something else," a "primitively advantageous trait" that now "sometimes misfires to generate religion." It is a puzzling statement. How can one speak of the "by-product" of the evolutionary process? After all, as Dawkins points out, natural selection "does not see ahead, does not plan consequences, [and] has no purpose in view."[69] How can one meaningfully speak of the intended goal of the process (and hence distinguish this from an unintended "by-product") without adopting a teleological account of evolution? How can Dawkins speak of religion as distinctively "accidental," when his understanding of the evolutionary process precludes any theoretical framework that allows him to suggest that some outcomes are "intentional" and others "accidental"?

Dawkins follows this decidedly unpersuasive evolutionary explanation of religion with an amateurish reflection on whether human beings are predisposed to believe in God. There are major problems in offering a psychological account of the origins of religion, which Dawkins overlooks. It is certainly possible to argue that some aspects of human cognitive processes may help explain how religious ideas are generated or sustained. But as the psychologist Fraser Watts points out, it is necessary to recognize a multiplicity of causes in such areas. Some scientists have fallen into the habit of asking: "What caused A? Was it X or Y?" But in the human sciences, multiple causes are the norm. For example, consider the question "Is depression caused by physical *or* social factors?" The answer is that it is caused by both. As Watts points out, the history of such research "ought to make us wary of asking whether an apparent revelation of God really is such, or whether it has some other natural explanation, in terms of people's thought processes or brain processes."[70] To put it crudely, God, human brain processes, and psychological processes could all be causal factors in human religious experience.

[68] *The God Delusion*, 174.

[69] *The Blind Watchmaker*, 21.

[70] Fraser Watts, "Cognitive Neuroscience and Religious Consciousness." In *Neuroscience and the Person*, edited by R. J. Russell, N. C. Murphy, and C. J. Isham, 327–46. Vatican City: Vatican Observatory, 1999.

## Awe, Wonder, and Religion

In the opening sections of *The God Delusion,* Dawkins speaks of a sense of "transcendent wonder" at the beauty and complexity of nature, which "religion monopolized in past centuries."[71] Dawkins argues – rightly, in my view – that it is perfectly possible to have a sense of "awe" or reverence for nature without being religious. Indeed, at points he suggests that a religious commitment actually *diminishes* this sense of awe, by positing an aesthetically deficient view of the universe: "The universe is genuinely mysterious, grand, beautiful, awe-inspiring. The kinds of views of the universe which religious people have traditionally embraced have been puny, pathetic, and measly in comparison to the way the universe actually is. The universe presented by organized religions is a poky little medieval universe, and extremely limited."[72] The logic of this bold assertion is rather hard to follow, and its factual basis astonishingly slight. The "medieval" view of the universe may indeed have been more limited and restricted than modern conceptions. This has nothing to do with religion, however, either as cause or effect. It reflected the science of the day, largely based upon Aristotle's treatise *De caelo* ("On Heaven"). If the universe of religious people in the Middle Ages was indeed "poky," it was because they trusted the best cosmologists of the day to tell them what it was like. This, they were assured, was scientific truth, and they accepted it. They took it on trust. They were naïve enough to assume that what their science textbooks told them was right. Precisely that trust in science and scientists which Dawkins commends so uncritically led them to weave their theology around someone else's view of the universe. They didn't know about such things as "radical theory change in science," which causes twenty-first century people to be cautious about investing too heavily in the latest scientific theories, and much more critical of those who base worldviews upon them.

Medieval conceptions of the universe were largely based on a Ptolemaic model of the planetary system, which located the earth at the center of a vast, ordered cosmic mechanism.[73] This is vividly depicted in *Nuremberg Chronicle* (1493) by Hartmann Schedel (1440–1514), one of the most popular and technologically advanced printed books of the

[71] *The God Delusion*, 12.

[72] Richard Dawkins, "A Survival Machine." In *The Third Culture*, edited by John Brockman, 75–95. New York: Simon & Schuster, 1996, 85.

[73] By far the best study is Edward Grant, *Planets, Stars and Orbs: The Medieval Cosmos, 1200–1687*. Cambridge: Cambridge University Press, 1996.

late Middle Ages. On this grand view of the universe, the earth stood at the center of a series of concentric spheres, each of which rotates round the earth according to its own predetermined rhythms. Beyond them lies the "empyrean" – a vast, eternal, infinite, and formless void. Christian theologians assumed that this was where paradise was located, often on the basis of questionable traditional arguments.[74] Popular depictions of this vision of the universe, such as the *Nuremberg Chronicle*, depict God and the saints as dwelling in this region. It is not today's model of the solar system, and is wrong at just about every point. It's certainly "medieval," but it's hardly a "poky little universe." Most medieval writers that I have read on the topic found the thought of cosmic vastness to be really rather awesome – even on the basis of a Ptolemaic model of the heavens.

The implication of Dawkins' unsubstantiated criticism is that a religious view of reality is deficient and impoverished in comparison with his own. There is no doubt that this consideration is an important factor in generating and maintaining his atheism. Yet his analysis of this issue is disappointingly thin and unpersuasive. The very slight historical evidence that Dawkins brings forward in support of his extravagant and unsubstantiated excoriation of religious visions of reality, whether in *Unweaving the Rainbow* or elsewhere, amounts to little more than an observation that our understanding of the vastness and complexity of the universe has increased in recent years.

A Christian approach to nature identifies three ways in which a sense of awe comes about in response to what we observe:

1 An immediate sense of wonder at the beauty of nature. This is evoked *immediately*. This "leap of the heart" that William Wordsworth described on seeing a rainbow in the sky occurs *before* any conscious theoretical reflection on what it might imply. To use psychological categories, this is about *perception*, rather than *cognition*. I can see no good reason for suggesting that believing in God in any way diminishes this sense of wonder. Dawkins' argument at this point is so underdetermined by evidence and so utterly implausible that I fear I must have misunderstood it.
2 A derived sense of wonder at the mathematical or theoretical representation of reality which arises from this. Dawkins also knows and approves of this second source of "awed wonder," but seems to imply

[74] Grant, *Planets, Stars and Orbs*, 169–85; 371–89.

that religious people "revel in mystery and feel cheated when it is explained."[75] They don't; a new sense of wonder emerges, which I will explain in a moment.

3 A further derived sense of wonder at what the natural world points to. One of the central themes of Christian theology is that the creation bears witness to its creator, "The heavens declare the glory of the Lord!" (Psalm 19:1). For Christians, to experience the beauty of creation is a sign or pointer to the glory of God, and is to be particularly cherished for this reason. Dawkins excludes any such transcendent reference from within the natural world.

In a ground-breaking study, the psychologists Dacher Keltner and Jonathan Haidt developed a prototype approach to the experience of awe, which has at its heart two distinctive features – *vastness* and *accommodation*.[76] Vastness, they argue, refers to "anything that is experienced as being much larger than the self, or the self's ordinary level of experience or frame of reference." It may refer simply to physical size, or to more subtle markers of vastness, such as social signs or symbolic markers. Accommodation refers to what was identified by Jean Piaget (1896–1980), Professor of Genetic and Experimental Psychology at the University of Geneva from 1940 to 1971, as the process by which human mental structures undergo an adjustment in the face of the challenge posed by new experiences. Thus it would be possible to experience a sense of awe through realization of the "breadth and scope of a grand theory," such as evolutionary theory – or the Christian vision of reality:

> We propose that prototypical awe involves a challenge to or negation of mental structures when they fail to make sense of an experience of something vast. Such experiences can be disorientating and even frightening … They also often involve feelings of enlightenment and even rebirth, when mental structures expand to accommodate truths never before known. We stress that awe involves a *need* for accommodation, which may or not be satisfied. The success of one's attempt at accommodation may partially explain why awe can be both terrifying (when one fails to understand) and enlightening (when one succeeds).[77]

[75] *Unweaving the Rainbow*, xiii. See also his extended discussion, ranging from traditional religions to New Age movements, at 114–79.

[76] Dacher Keltner and Jonathan Haidt, "Approaching Awe, a Moral, Spiritual and Aesthetic Emotion." *Cognition and Emotion* 17 (2003): 297–314.

[77] Keltner and Haidt, "Approaching Awe," 304.

On the basis of this approach, the human sense of awe at the vastness of the universe, or the dramatic beauty of a natural landscape or feature (such as a rainbow) could be enhanced by grasping the theoretical foundations or implications of what was being observed. This resonates with Dawkins' belief – which is also mine – that the theoretical representations of reality are in themselves beautiful, and capable of evoking awe on account of their complexity or their capacity to invoke a "big picture" view of things. This is unquestionably the case with theories which propose a larger vision of things – a list of theories which includes, but is not limited to, Darwinism, Marxism, and Christian theology.

Dawkins suggests that a religious approach to the world misses out on something.[78] Having read *Unweaving the Rainbow* and *The God Delusion*, I still haven't worked out what this is. A Christian reading of the world denies nothing of what the natural sciences tell us, except the trenchant naturalist dogma that reality is limited to what may be known through the natural sciences. If anything, a Christian engagement with the natural world adds a richness which I find quite absent from Dawkins' account of things, offering a new motivation for the study of nature. Perhaps the greatest difference between science and religion thus lies not in how they begin, nor even in how they proceed, but in how they end.

As a populist manifesto, *The God Delusion* works magnificently. Its swashbuckling rhetoric leaves its readers in no doubt of what is right and wrong. The future of the planet depends on the elimination of superstition, and the reinstatement of reason! Science is the only reliable source of knowledge, and must triumph over primitive ways of thought – most notably, religion. But the price paid for this argumentative simplicity is unacceptably high. The work relies excessively on gross oversimplifications, misunderstandings, and misrepresentations. It is best seen as a work of atheist polemic, not of scientific popularization. If Dawkins has made any contributions to the serious debate about science and religion, these are to be found in his earlier writings, not this unfortunate diatribe.

[78] *Unweaving the Rainbow*, xii.

# Conclusion

This book has barely scratched the surface of a series of fascinating questions raised by the writings of Richard Dawkins. Some of these are directly, others indirectly, religious in nature. I am conscious that I have failed to deal with any of them in the detail that they rightly demand. I have opened up some questions for further discussion, and have not settled anything – except that the issues raised in this book are important and interesting, and that further discussion is clearly needed. Dawkins raises all the right questions, and gives some interesting answers. They're not particularly reliable answers, admittedly, unless you happen to believe that religious people are science-hating fools who are into "blind faith" and other unmentionable things in a big way.

So why this failure to understand religion? Nobody is asking Dawkins to agree with religion; if he wishes to engage with it, however, we have every right to expect an attempt to understand it. Perhaps the philosopher Ludwig Wittgenstein helps us understand the issue. "A *picture* held us captive. And we could not get outside it, for it lay in our language and language seemed to repeat it to us inexorably."[1] Wittgenstein here puts into words what I believe undergirds Dawkins' attitude toward science and religion – a self-imposed captivity to a controlling "picture of reality" or "worldview," which seems to render him incapable of stepping outside this rigid way of thinking. This worldview is cultural, rather than scientific. It reflects a *cultural interpretation* of the scientific project, rather than being itself scientific in its character. Science articulates no worldview, and

[1] Ludwig Wittgenstein, *Philosophical Investigations.* 3rd edn. Oxford: Blackwell, 1968, 48.

*Dawkins' God: From The Selfish Gene to The God Delusion*, Second Edition.
Alister E. McGrath.
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degenerates into an ideology if it chooses to adopt one. That is precisely why Thomas H. Huxley's wise aphorism is to be celebrated and cherished: science "commits suicide when it adopts a creed." Dawkins' misplaced certainties about religion are ultimately not scientific, but ideological.

This book aims to move the discussion about the relation of science and religion on, and draw a line under the often unreliable account that Dawkins offers. An evidence-based approach to this question is much more complex and much more *interesting* than Dawkins' so-called "path of simplicity and straight thinking," which all too often proves to involve the forcing of a complex reality into the intellectual straitjacket of a dogmatic atheism.

A good example of this reductionist "straight thinking" is found in Dawkins' answers to the great "why" questions of life. Consider the following conversation with a six-year-old girl, which Dawkins recounted in the first of his 1991 Royal Institution Christmas Lectures: "I asked her what she thought flowers were for? She gave a very thoughtful answer. 'Two things,' she said; 'to make the world pretty and to help the bees make honey for us.' Well, I thought that was a very nice answer and I was very sorry I had to tell her that it wasn't true."[2] Dawkins' own answer to this question is chilling in its utter failure to appreciate the complexity of life, and the need to engage questions at multiple levels. "Simplicity and straight thinking" lead to a simplistic biological reductionism, which is totally inattentive to the deeper questions of meaning: "We are machines built by DNA whose purpose is to make more copies of the same DNA Flowers are for the same thing as everything else in the living kingdoms, for spreading 'copy-me' programmes about, written in DNA language." As Dawkins saw things, the question of the "meaning of life" was simple. "We are machines for propagating DNA, and the propagation of DNA is a self-sustaining process. It is every living object's sole reason for living."[3]

This is simply nonsense. It may well be an element of a *biological* account of the significance of life. But as any "critical realist" philosophy of science makes clear, reality is complex, and requires engagement and analysis at multiple levels.[4] Only someone with chronic biological tunnel vision would suggest that the "sole reason for living" is "the propagation of DNA." Other answers may be added, complementing and extending this

[2] Lecture transcript, in Michael Poole, "A Critique of Aspects of the Philosophy and Theology of Richard Dawkins." *Science and Christian Belief* 6, no. 1 (1994): 41–59, 51.

[3] Richard Dawkins, *Growing Up in the Universe*. London: BBC Education 1991, 21. This short work is a study guide to Dawkins' 1991 Royal Institution Christmas Lectures.

[4] For exploration and documentation of this theme, see Alister E. McGrath, *A Scientific Theology, vol. 2: Reality*. London: Continuum, 2002, 195–244.

existentially impoverished account of the meaning of life. To be human is ultimately to transcend any physical or biological account of human identity. It is to move on and away from the belief that, because we are biological (or chemical or physical) entities, our significance is therefore to be reduced to that level.[5] Yes, we have a biological function, and that is part of the answer to the question of what we are, and why we are here. But it is only *part* of the answer, not the "sole" answer.

As Dawkins rightly points out, there are areas of tension between science and religion, which must be acknowledged and confronted; yet alongside them, sadly unacknowledged by Dawkins, there is an immense potential for intellectual synergy and the discovery of fresh perspectives on reality. The question of whether there is a God, and what that God might be like, has not – despite the predictions of overconfident Darwinians – gone away since Darwin, and remains of major intellectual and personal importance. On this matter, we have perhaps more to learn from Darwin himself than from his more dogmatic recent interpreters. New Atheist writers in general, and Dawkins in particular, have raised some fascinating questions about the relation of science and religion, yet have conspicuously failed to provide intellectually satisfactory answers.

The conversation continues. Some minds on both sides of the argument may be closed; the evidence and the debate, however, most certainly are not. Scientists and theologians have so much to learn from each other. Listening to each other, we might – to use an elegant phrase from Dawkins himself – "hear the galaxies sing."[6] Or even the heavens declaring the glory of the Lord (Psalm 19:1).

[5] The issue of emergent properties represents one obvious difficulty for such a reductionist perspective: see for example Michael Silberstein, "Reduction, Emergence, and Explanation." In *Blackwell Guide to the Philosophy of Science*, edited by Peter Machamer and Michael Silberstein, 80–107. Oxford: Blackwell, 2002; Margaret Morrison, "Emergence, Reduction, and Theoretical Principles: Rethinking Fundamentalism." *Philosophy of Science* 73 (2006): 876–87.

[6] *Unweaving the Rainbow*, 313.

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