

Darwin, evolution and God's action in the world

Michael Reiss

May the words of my lips ...

This year 2009 is the 200th anniversary of the birth of Charles Darwin on 12 February 1809. For this reason a programme of events, known as Darwin200, honouring Darwin's scientific ideas and their impact, is being held across the UK and beyond. Furthermore today is the 150th anniversary of the publication of Darwin's magnum opus – *On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life* (to give it its full title) – on 24 November 1859ⁱ.

As is often the case with famous intellectuals, Darwin's ideas were seized upon both during his life and subsequently, and many who have read or understood little of his writing have not been slow to write about the implications of his thinking for religious belief. My purpose is not to present an historical account of these developments – both then and now Darwin can be used to castigate or bolster religious faith. Rather, my interest is in the possibility of a contemporary theological response that both accepts evolutionary biology as valid science and seeks to examine this within a coherent religious worldview.

Let me say a bit about **Creationism and intelligent design**, the first of five sections of this lecture.

For reasons that delight some and appall others, creationism is growing in extent and influence, both in the UK and elsewhere. Definitions of creationism vary but about 40% of adults in the USA and at least 10% in the UK believe that the Earth is only some 10,000 years old, that it came

into existence as described in the early parts of the Bible or the Qu'ran and that the most that evolution has done is to change species into closely related species^{ii iii iv}. This understanding of creationism is best described as young-Earth creationism as other versions (including old-Earth creationism and progressive creationism) exist. However, although hard data are in short supply, it seems clear that the creationism movement is clearly currently dominated by young-Earth creationists. For most creationists it is possible that the various species of zebra had a common ancestor but this is not the case for zebras, bears and antelopes – still less for monkeys and Bishops, for birds and reptiles or for fish and fir trees.

Those who advocate intelligent design, a theory that has only really been around since the 1990s but has grown hugely in political influence since then, generally make no reference to the scriptures or a deity in their arguments but maintain that the intricacy of the order we see in the natural world, including at the level inside cells, provides strong evidence for the existence of an intelligence behind this. In other words, there is said to be evidence that some aspects of life are 'irreducibly complex'. An undirected process, such as natural selection, is held to be inadequate^{v vi}.

By and large, creationism has received short shrift from those who accept the theory of evolution. In a fairly early study the philosopher of science Philip Kitcher argued that "in attacking the methods of evolutionary biology, Creationists are actually criticizing methods that are used throughout science"^{vii}. He concluded that flat-earth theory, the chemistry of the four elements and mediaeval astrology have as much claim to rival current scientific views as creationism does to challenge evolutionary biology. A possibly even more trenchant attack on creationism is provided by geologist Ian Plimmer whose book title *Telling Lies for God: Reason vs Creationism*^{viii} sums up the line he takes.

2. An evolutionary view of life on earth

To an evolutionist, the Earth is some 4600 million years old and all organisms share a common ancestor. Indeed, if you go back far enough, life had its ancestry in inorganic molecules. Furthermore, an evolutionary understanding of the world is held to be fundamental to biology and many other aspects of science. For an evolutionist, for us to understand ourselves, the other organisms and the world about us requires an evolutionary perspective^{ix}.

Creationism, Darwinian evolution and intelligent design can be contrasted by means of a classic example: the mammalian eye. For the creationist, there is, of course, nothing to explain. God can create the human eye, indeed a whole universe, out of nothing and in no time at all. Darwin, though, was well aware that the mammalian eye, with its fine adaptations and its wonderful fitness for purpose, was a problem for his theory. Darwin was unable to point to a fossil history of eyes. Instead he appealed to a variety of organisms alive today that have light-detecting structures that differ hugely in complexity. He reasoned that we could *imagine* an eye evolving from a simple predecessor to its present mammalian complexity. For intelligent designers, though, this still leaves open the question of how even a 'simple' light-detecting structure came into being. Intelligent designers maintain that when we look at the biochemistry of the simplest such structures, there is a wealth of intricate detail that argues for intelligent design.

Most of the literature on creationism (and/or intelligent design) and evolutionary theory puts them in stark opposition. (Evolutionary theory here and from now on is understood as outlined above; everyone is comfortable with the notion that natural selection and possibly other mechanisms are responsible for small-scale evolutionary change.) From the creationist camp, there are a huge number of books and a number of journals devoted to extolling creationism and execrating evolution. It is easy for scientists and others, perhaps especially those with no religious faith, to ignore or dismiss such views as worthless but it is important to recognise the vigour with which they are held. After all, imagine you (assuming you are not a creationist) genuinely believed that the theory of evolution was

not only factually incorrect but led to increased immorality and the loss of eternal salvation for anyone who believed it, wouldn't you fight passionately against it? The psychologist Margaret Evans provides an analysis of why creationism is here to stay^x.

Evolution is consistently presented in creationist books^{xi xii xiii} and articles too many to mention in the journals and other publications of the Biblical Creation Society, the Creation Science Movement and other like-minded organisations as illogical (natural selection cannot, on account of the second law of thermodynamics, create order out of disorder; mutations cannot lead to improvements); contradicted by the scientific evidence (e.g. the fossil record shows human footprints alongside animals supposed by evolutionists to be long extinct); the product of special pleading (the early history of life would require life to arise from inorganic matter – a form of spontaneous generation; radioactive dating makes huge assumptions about the constancy of natural processes over aeons of time); and the product of those (e.g. Richard Dawkins, Steve Jones) who ridicule the word of God, and a cause of a number of social evils (eugenics, Marxism, Nazism, racism).

Many scientists and others have defended evolutionary biology from creationism and there are a number of agreed statements by scientists on the teaching of evolution^{xiv}. The main points that are frequently made are that evolutionary biology is good science in that not all science consists of controlled experiments where the results can be collected within a short period of time; that creationism (including 'scientific creationism') isn't really a science in that its ultimate authority is scriptural and theological rather than the evidence obtained from the natural world; and that an acceptance of evolution is fully compatible with a religious faith, an assertion most often made in relation to Christianity since it is more obviously true of many other religions – including Hinduism, Buddhism and Judaism – and rather less true of Islam^{xv xvi}.

3. Science and God's action in the world

How does God act in the world? The first, rather major, question is whether God chooses to act only in a way that can be understood through science. I belong to the mainstream Christian position that has always held that God can act in any way so long as this is true to 'himself'. (I accept the limitations of our language which mean that we need either to avoid the use of any gendered pronouns when speaking of God, to adopt new rolds such as 'Godself', to speak or write somewhat clumsily ('himself/herself'), to parade a feminism/pro-feminism ('herself') or run the risk of appearing insensitive or triumphalist ('himself').)

Science is above all about objectivity and repeated testing. Certain things clearly fall under the domain of science – the nature of electricity, human physiology and the arrangement of atoms into molecules, to give three examples. However, what about the origin of the universe, the behaviour of people in society, decisions about whether we should build nuclear power plants or go for wind power, the appreciation of music and the nature of love, for example? Do these fall under the domain of science? Although a small proportion of people, including a few prominent scientists, would not only argue 'yes' but maintain that all meaningful questions fall within the domain of science, most people hold that science is but one form of knowledge and that other forms of knowledge complement science.

This way of thinking means that the origin of the universe is also a philosophical or religious question – or simply unknowable; the behaviour of people in society requires knowledge of the social sciences (including psychology and sociology) rather than only of the natural sciences; whether we should go for nuclear or wind power is partly a scientific issue but also requires an understanding of economics, risk and politics; the appreciation of music and the nature of love, while clearly having something to do with our perceptual apparatuses and our evolutionary history, cannot be reduced to science^{xvii}.

While historians tell us that what scientists study changes over time, there are reasonable consistencies. For a start, science is concerned with the natural world and with certain elements of the manufactured world – so

that, for example, the laws of gravity apply as much to artificial satellites as they do to planets and stars. And then science is concerned with how things are rather than with how they should be. So there is a science of gunpowder and *in vitro* fertilisation without science telling us whether warfare and test-tube births are good or bad.

Lakatos^{xviii} argued that scientists work within research programmes. A research programme consists of a set of core beliefs surrounded by layers of less central beliefs. Scientists are willing to accept changes to these more peripheral beliefs so long as the core beliefs can be defended. So, in biology, we might see in contemporary genetics a core belief in the notion that development proceeds via a set of interactions between the actions of genes and the influences of the environment. At one point, it was thought that the passage from DNA, deoxyribonucleic acid, to RNA, ribonucleic acid, was unidirectional. Now we know (reverse transcriptase, etc.) that this is not always the case. The core belief (that development proceeds via a set of interactions between the actions of genes and the influences of the environment) remains unchanged but the less central belief (that the passage from DNA to RNA is unidirectional) is modified.

The post-Newtonian advent in the early twentieth century of quantum theory and, later in the same century, of chaos theory has led many to wonder whether within either or both of these two frameworks there might lie a space for divine action in a way that does not contradict the scientific worldview in the way that miracles seem to. For almost anyone who does not work professionally within quantum physics, it is exceptionally difficult to understand what is going on that is relevant to the science/religion issue but a core concept is that of determinism, which results from the issue of the relationship of measurement to reality^{xix}.

As is well known, in 1927 Heisenberg argued that key physical variables (e.g. the position and momentum of an object) are linked. Measuring the one to a very high degree of precision necessarily means that the other cannot be so precisely determined. Thus far there is not a great deal that is of interest to the non-physicist. However, as Osborne writes:

Heisenberg himself took a more radical view – he saw this limitation as a property of nature rather than an artefact of experimentalism. This radical interpretation of uncertainty as an ontological principle of indeterminism implies that quantum mechanics is inherently statistical – it deals with probabilities rather than well-defined classical trajectories. Such a view is clearly inimical to classical determinism.^{xx}

Put somewhat loosely, a number of people have tried to find room for divine action in this indeterminacy. No consensus yet exists as to the validity of this search though, on balance, the current view seems to be that such a search is mistaken for reasons both of theology and of physics. A particularly helpful, though demanding, analysis of both the theology and the physics is provided by Saunders^{xxi}. Beginning with the theology, Saunders draws on the widespread distinction between general and special forms of divine action. In the words of Michael Langford general divine action is “the government of the universe through the universal laws that control or influence nature, man, and history, without the need for specific or ad hoc acts of divine will”^{xxii}. On the other hand, special divine action is characterised by:

Those actions of God that pertain to a *particular* time and place in creation as distinct from another. This is a broad category and includes the traditional understanding of ‘miracles’, the notion of particular providence, responses to intercessory prayer, God’s personal actions, and some forms of religious experience^{xxiii}.

Oversimplifying considerably, and eliding over a thousand years of theology in the Buddhist, Christian, Jewish, Hindu, Islamic and Sikh traditions, all religions are comfortable with the notion of general divine action but they differ both among and within themselves considerably in their understanding of specific divine action. In particular, many leading theologians are uncomfortable with the notion of specific divine action so defined for a number of reasons including the particular problems for the occurrence of suffering that it raises (if suffering can sometimes be averted

miraculously, why isn't it always, or at least more often?) and the apparent shortcomings, including capriciousness, suggested by a deity who relies on occasional exercises of supernatural activity to keep things moving along.

Going onto the physics, Saunders is sceptical of attempts to locate the possibility of specific divine action in quantum or chaos theory. The argument here becomes even more technical and depends, in respect of quantum theory, on whether one accepts the standard (Copenhagen) interpretation of reality (in which Schrödinger's cat is either dead or alive before the box is opened) or the more radical interpretation (in which the cat is both dead and alive). In both cases, though, and in the case of chaos theory (sometimes termed 'complexity theory' on the grounds that it deals with systems that are deterministic but unpredictable because of their exquisite sensitivity to small changes in their initial conditions) Saunders rejects attempts to find opportunities for specific divine activity in the science.

4. The nature of the Creator

The evolutionary view of life, often characterised when it arose in the 19th century as Darwinism but shared with many others in the UK, on the Continent, in the USA and elsewhere, led to two main theological responses. The minority approach was the one that eventually gave rise to today's creationism. Perhaps the most ingenious and infamous of these was that of Philip Henry Gosse^{xxiv}. Gosse, somewhat sadly, is perhaps best known today for his son's superbly written but deeply critical biography *Father and Son*. In addition, though, to being an outstanding naturalist (he was elected an FRS in 1856) Gosse, the father, had a deep religious faith and coined what has become known as the Omphalos hypothesis when he published *Omphalos: an Attempt to Untie the Geological Knot* in 1857, just two year's before Darwin's *Origin*.

The Omphalos hypothesis is an attempt to combine a serious reading of the fossil record – which suggests ages before the Garden of Eden – and a literal reading of the Bible. *Omphalosis* is Greek for navel and Gosse began by wondering, apparently innocuously, whether Adam had a navel (despite his having not been attached by an umbilical cord to a placenta). Gosse supposed that he did – just as the trees in the Garden of Eden were presumably created with tree rings. Extrapolating considerably, the whole of the fossil record could have been created during the biblical days of creation. The critics reacted badly and the book bombed. Most of the first edition was eventually sold as waste paper. Charles Kingsley (of *The Water-Babies* fame) wrote that he could not believe that God had “written on the rocks one enormous and superfluous lie for all mankind”^{xxv}.

The majority approach to evolutionary thinking only arose after the publication of Darwin’s *The Origin of Species*. The mass of evidence, the rigour of its argument and the care Darwin took to avoid both theological confrontation and the issue of human evolution were crucial in the quite rapid Victorian acceptance of evolutionary thinking. Charles Kingsley read a pre-publication copy and wrote to Darwin:

I have gradually learnt to see that it is just as noble a conception of Deity, to believe that he created primal forms capable of self development into all forms needful pro tempore & pro loco, as to believe that He required a fresh act of intervention to supply the lacunas w^h. he himself had made^{xxvi}.

However, two major objections immediately raise themselves to this view of the world. First, doesn’t this reduce God to the one who winds up a clock and sets it in motion? Secondly, doesn’t this mean that scripture can no longer be read as the word of God?

The second objection – scripture can no longer be read as the word of God – is the easier to address. Long before Darwin and the other evolutionists and the geologists of the nineteenth century came, through extensive fieldwork and careful observation, to realise both that the Earth was far older than a literal reading of scripture allowed and that species did indeed

seem to have evolved considerably over time, some of the Church's greatest theologians had cautioned against a literal reading of all parts of scripture. In his *The Literal Meaning of Genesis* Augustine wrote:

Usually even a non-Christian knows something about the earth, the heavens, and the other elements of this world, about the motion and orbit of the stars ... and this knowledge he holds to as being certain from reason and experience. Now it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking nonsense on these topics; and we should take all means to prevent such an embarrassing situation, in which people show up vast ignorance in a Christian and laugh it to scorn. ... how are they going to believe those books in matters concerning the resurrection of the dead, the hope of eternal life, and the kingdom of heaven, when they think their pages are full of falsehoods on facts which they themselves have learnt from experience and the light of reason?^{xxvii}

For most of us, simply the regular practice of reading the scriptures attentively and with devotion causes us to realise that to read everything in them 'literally' is to read in a particular way that was foreign to both the authors and much of their audience. And this is not to make the familiar point about the different genres of scripture. Rather, the slight differences between the multiple accounts of singular events (whether in the historical books of the Jewish Bible, the synoptics or *Acts*) causes most of us to reject this way of understanding scripture^{xxviii} without, of course, believing that scripture isn't trustworthy or inspired.

The first objection – that evolutionary biology reduces God to one who, having wound up a clock and set it in motion, then leaves – deserves more attention. One response, as old in the Christian tradition as the scriptures themselves, is to appreciate that God continually upholds all of creation, while, of course, the incarnation gives the lie to the notion that God leaves.

A second response looks carefully at what the point of this world might be. John Hick famously argued that we live in a vale of soulmaking: that the

imperfections of this world enable us to become better, more virtuous people^{xxix}. More recent developments of this idea, notably Christopher Southgate's^{xxx}, explore the 'no other way' hypothesis. That if one wants to end up in a world with beauty (as well as ugliness), goodness (as well as evil), pleasure and joy (as well as pain and suffering), a world in which evolution occurs in the way that it has and does may be the only (or best) possibility. This argument is close to that of Richard Dawkins and other evolutionary biologists when they argue that Darwinian natural selection is logically necessary.

There are many who will not find this argument convincing. For a start, couldn't God have ensured there was rather less suffering? Let me move onto my fifth section by arguing two points: first, that susceptibility to pain and suffering are a product of evolution as much as any other biological feature is; secondly, that the amount of suffering in the world – and I realise that by even raising this as a possibility I risk hurting people and calling down opprobrium on myself – is sometimes overstated.

5. Pain and suffering

Suffering involves susceptibility to pain and an awareness of being, having been or being about to be in pain. Pain here is used in its widest sense and includes stress, discomfort, anxiety and fear. So, to an evolutionary biologist, the question is, what contribution does suffering make to the interests of an organism?^{xxxi}

A startling illustration of the function of suffering is provided by Paul Brand, a surgeon, in his book *Pain: The Gift Nobody Wants*:

Tanya was a four-year-old patient with dark, flashing eyes, curly hair, and an impish smile. ... She sat on the edge of the padded table and watched impassively as I began to remove blood-soiled bandages from her feet.

Testing her swollen left ankle, I found that the foot rotated freely, the sign of a fully dislocated ankle. I winced at the unnatural movement, but Tanya did not. ...

When I unwrapped the last bandage, I found grossly infected ulcers on the soles of both feet. Ever so gently I probed the wounds, glancing at Tanya's face for some reaction. She showed none. The probe pushed easily through soft, necrotic tissue, and I could even see the white gleam of bare bone. Still no reaction from Tanya.^{xxxii}

Tanya was one of more than a hundred cases of congenital painlessness that have been written up in the medical literature. By the time she was 11 years old, I am afraid Tanya had lost both her legs to amputation and most of her fingers. Her elbows were constantly dislocated and she suffered the effects of chronic sepsis from ulcers on her hands and amputation stumps. Most people with congenital painlessness die before the age of 20, leaving no children behind. Their lack of pain eventually kills them.

The evolutionary function of physical pain is to prevent the body from getting so damaged that it reduces the chance of survival and reproduction. Plants almost certainly suffer no pain. Not only do they lack the necessary mechanisms for them to detect pain but, being rooted for most of their life cycle to the ground, they wouldn't be able to do a great deal in response to painful stimuli. For the response of an organism to physical pain is simply to avoid the source of the pain. Suppose I cut my finger. The pain I feel prevents me from using my finger much until it has healed, thus reducing the likelihood of my damaging it further.

The argument outlined here for the evolutionary function of human suffering holds in precisely the same way for non-human suffering. In other words, animal suffering is, broadly speaking, natural. In more theological language, God has given creation a certain freedom and, through natural selection, part of the animal portion of creation has 'chosen' (i.e. evolved) to have the capacity to suffer. Over countless generations and in certain species, individual animals incapable of suffering did less well than those that could and did.

The extent of suffering in the non-human part of the creation is difficult to determine but may sometimes be overstated. Darwin wrote in his autobiography:

A being so powerful and full of knowledge as a God who could create the universe, is to our finite minds omnipotent and omniscient, and it revolts our understanding to suppose that his benevolence is not unbounded, for what advantage can there be in the sufferings of millions of the lower animals throughout almost endless time?^{xxxiii}

And, as is well known, in a letter to the Harvard botanist Asa Gray written on 22 May 1860, Darwin wrote:

There seems to me too much misery in the world. I cannot persuade myself that a beneficent & omnipotent God would have designedly created the Ichneumonidæ with the express intention of their feeding within the living bodies of caterpillars, or that a cat should play with mice.^{xxxiv}

Well, it is, as philosophers occasionally remind us, very difficult – some would argue logically impossible – for any of us to know what is going on in another human's mind, let alone the mind of a non-human animal. Nevertheless, the consensus among a number of experts on animal behaviour and pain is that while there is virtually no doubt that adult vertebrates, and probably certain invertebrates such as octopuses and large crustacea, can suffer, it is far less certain that other animals can^{xxxv}. It is very likely that caterpillars do not suffer when consumed by ichneumonids. Darwin may have worried unnecessarily about the 'sufferings of millions of the lower animals throughout almost endless time'.

The cat and mouse example would take me rather longer to address but it is worth noting that it is the element of play that seems to have troubled Darwin. Now, for us to play in such a way would be cruel but for a cat it may be a natural way of improving its ability to hunt. Indeed, a Panglossian view of the world might even conclude that such play reduces the overall amount of suffering in the world (as cats that didn't play would more often,

when hunting, fail quickly to kill their prey). Furthermore, it is difficult to be sure about what is going on in the mouse's mind. Soldiers in the heat of battle sometimes feel little pain from their wounds and something similar may happen in mice.

Let me **conclude** very briefly. We do not have to choose between creation and evolution. I am confident that both are correct. Furthermore, an acceptance of the theory of evolutionary biology can help illuminate the issue of evil, contributing towards a theodicy. The evolutionary view of life is one in which suffering and happiness have both arisen naturally. A theological response may be that if we want a world with joy we must have sorrow too.

Notes

- ⁱ Charles Darwin, *On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859).
- ⁱⁱ J. D. Miller, E. C. Scott & S. Okamoto, 'Public acceptance of evolution', *Science*, vol. 313, pp. 765-766, 2006.
- ⁱⁱⁱ Michael J. Reiss, 'Should science educators deal with the science/religion issue?', *Studies in Science Education*, vol. 44, pp. 157-186, 2008.
- ^{iv} Caroline Lawes, *Faith and Darwin: Harmony, Conflict, or Confusion?* (London: Theos, 2009).
- ^v Phillip E Johnson, 'The wedge: breaking the modernist monopoly on science', *Touchstone*, vol. 12(4), pp. 18-24, 1999.
- ^{vi} Michael Behe, 'The modern intelligent design hypothesis: breaking rules' in: *God and Design: The teleological argument and modern science*, Neil A. Manson (Ed.) (London: Routledge, 2003), pp. 277-291.
- ^{vii} Philip Kitcher, *Abusing Science: The case against creationism* (Milton Keynes: Open University Press, 1983), pp. 4-5.
- ^{viii} Ian Plimmer, *Telling Lies for God: Reason vs creationism* (Miltons Point, NSW: Random House Australia, 1994).

-
- ix Francisco J. Ayala, *Darwin and Intelligent Design* (Minneapolis: Fortress Press, 2006).
- x E. M. Evans, 'Beyond Scopes: why creationism is here to stay' in *Imagining the Impossible: Magical, scientific, and religious thinking in children*, K. S. Rosengren, C. N. Johnson & P. L. Harris (Eds) (Cambridge: Cambridge University Press, 2000), pp. 305-333.
- xi A. Hayward, *Creation and Evolution: The facts and fallacies* (London: Triangle, 1985).
- xii Sylvia Baker, *Bone of Contention: Is evolution true?*, 3rd edn (Rugby: Biblical Creation Society, 2003).
- xiii David Rosevear, *Has Darwin Had His Day?: What the scientific journals say* (Portsmouth: Creation Science Movement, 2007).
- xiv Interacademy Panel on International Issues, *IAP Statement on the Teaching of Evolution*. Published 2006; available at <http://www.interacademies.net/Object.File/Master/6/150/Evolution%20statement.pdf> (last accessed 8 March 2009).
- xv Shaikh Abdul Mabud, *Theory of Evolution: An assessment from the Islamic point of view* (Cambridge; The Islamic Academy, 1991).
- xvi M. R. Negus, 'Islam and science' in *God, Humanity and the Cosmos*, 2nd edn revised and expanded as *A Companion to the Science-Religion Debate*, Christopher Southgate (Ed.) (London: T & T Clark, 2005), pp. 321-339.
- xvii Michael Reiss, 'The nature of science' in: *Learning to Teach Science in the Secondary School: A Companion to School Experience*, 2nd edn, Jenny Frost & Tony Turner (Eds) (RoutledgeFalmer, London, 2005), pp. 44-53.
- xviii Imre Lakatos, *The Methodology of Scientific Research Programmes* (Cambridge: Cambridge University Press, 1978).
- xix L. Osborn, 'Theology and the new physics' in *God, Humanity and the Cosmos*, 2nd edn revised and expanded as *A Companion to the Science-Religion Debate*, Christopher Southgate (Ed.) (London: T & T Clark, 2005), pp. 119-153.
- xx Osborn, p. 132.
- xxi Nicholas Saunders, *Divine Action and Modern Science* (Cambridge: Cambridge University Press, 2002).
- xxii Michael Langford, *Providence* (London: SCM, 1981), p. 11.
- xxiii Saunders, p. 20.

-
- ^{xxiv} Ann Thwaite, *Glimpses of the Wonderful: The Life of Philip Henry Gosse, 1810-1888* (London: Faber & Faber, 2002).
- ^{xxv} Thwaite, pp. 222-223.
- ^{xxvi} Letter from Charles Kingsley to Charles Darwin 18 November 1859. <http://www.darwinproject.ac.uk/content/view/25/38/> (last accessed 7 March 2009).
- ^{xxvii} Augustine, *The Literal Meaning of Genesis* trans. John Hammond Taylor (New York: Newman Press, 1982), 42-3; 19:39.
- ^{xxviii} James Barr, *Escaping From Fundamentalism* (London: SCM, 1984).
- ^{xxix} John Hick, *Evil and the God of Love* (Basingstoke: Macmillan, 1966).
- ^{xxx} Christopher Southgate, *The Groaning of Creation: God, evolution and the problem of evil* (Louisville, Kentucky: Westminster John Knox Press, 2008).
- ^{xxxi} Michael J. Reiss, 'On suffering and meaning: an evolutionary perspective', *Modern Believing*, vol. 41(2), pp. 39-46 (2000).
- ^{xxxii} Paul Brand with Philip Yancey, *Pain: The gift nobody wants* (London: Marshall Pickering, 1993), p. 4.
- ^{xxxiii} Gavin de Beer, *Charles Darwin; Thomas Henry Huxley – Autobiographies* (Oxford: Oxford University Press, 1983), p. 52. Charles Darwin's autobiography was written in 1876.
- ^{xxxiv} <http://www.darwinproject.ac.uk/darwinletters/calendar/entry-2814.html> (last accessed 13 April 2009).
- ^{xxxv} House of Lords Select Committee on Animals in Scientific Procedures, *Volume 1 – Report* (London: Stationery Office, 2002). Available at <http://www.publications.parliament.uk/pa/ld/ldanimal.htm> (last accessed 13 April 2009).