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Essay Review

The Crucible of Creation: The Burgess Shale and the Rise of Animals
by Simon Conway Morris (Oxford University Press, 233 pp.
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The history of life is a fascinating topic, not least because we ourselves stand in such a prominent position, arguably at the pinnacle of all living organisms. That much would be attested to by atheists and Christians alike. Differences arise only in interpretations of the significance of our origins. The atheist might say that it is a mere historic accident that humans have evolved the brain-power that enables us to read articles such as this one and to discuss abstract ideas, such as those in this paragraph. The Christian would maintain that humankind is no accident, but that we were created 'in the image of God'¹, as people capable of responding to, and of loving and being loved by our creator God.

In the light of the uniqueness of humans, it is no surprise that there is considerable debate both inside and outside the Christian community as to the significance of the origins of animals and their evolutionary history. Some atheists go as far as claiming that the fact of evolution itself disproves the existence of God. Some Christians, on the other hand, claim that the existence of the creator God of the bible disproves evolution.

Both claims, I would suggest, make the mistake of confusing categories of explanation: scientists make an incomplete and provisional account of *how* matter behaves in the universe, while God's self-revelation in scripture explains *why* we ourselves are here and are in the state in which we find ourselves. Nor do the polarised positions noted above do justice either to the richness of scientific evidence for the inter-relatedness between living organisms and for the very special conditions of the physical universe that enable life to flourish, or to the claims of scripture that God is in control of the world, is active within it, and continually 'sustains all things by his powerful word.'² A far more fruitful stance is to accept the observational evidence for biological evolution as the best scientific description we have of the relationships between living and extinct organisms, and to accept God's revelation in the bible that he made the world and everything in it of his own free-will. We should not be surprised if God chose to work his purposes through evolution or through the mechanisms of genetics that determine much of our make-up. After all, he created the universe and continually upholds it.

1 Gen. 1:26,27.

2 Heb. 1:3.

Nevertheless, evolutionary theory has been the source of much controversy both within and outside the Christian church. Some Christians have perceived evolutionary ideas as a *bête noir* responsible for all kinds of evil. For example, Henry Morris, the president of the Institute for Creation Research, holds that what he calls 'evolutionary philosophy' is responsible for promiscuity, pornography and perversion³. Indeed, he goes further, identifying amongst the 'evil fruit' of evolutionary theory a huge list including fascism, Nazism, communism, anarchism, racism, imperialism, laissez-faire capitalism, secular Humanism, and so on.⁴

Other Christians, in more measured tones, have decried the seemingly 'chance' controls on the evolution of organisms as detracting from the biblical picture of God's controlling, creative activity in his universe. They have sought to portray evolution either as unproven, or as being more a materialistic philosophy than a scientific theory. Though willing to accept the evidence for micro-evolution – the well documented adaptation of organisms to the local environment – they draw the line at evolution being responsible for the generation of new species. They reserve the creation of new species for acts of special creation by God. However, to many, the issue of species may seem a strange point at which to draw a line in the sand. The definition of a species is a population of organisms which interbreed with one another, but not with other organisms. Often, minor changes in morphology can prevent organisms interbreeding. These may arise within a population by small mutations that result in something as trivial as a change in plumage colour, or by geographic isolation by the formation of a new mountain range, or a new ocean that isolates existing populations. The genetic difference between organisms in different species that can no longer interbreed may be less than the degree of genetic diversity which continues to exist within a species. So within the panoply of living organisms, species definitions may be of less significance than we sometimes suppose. Therefore, why make a special point of postulating that God acted differently in the generation of new species than he did, and continues to do, in upholding the great diversity yet inter-relatedness of all living organisms?

But in one important sense the detractors of the prevalence of evolutionary thinking have a good point to make. Evolutionary theory deals with biological inter-relatedness. Yet in both academic and in popular thinking, evolutionary ideas have spilled over into all kinds of areas in which they are not relevant, and in which they have no competence. One reviewer of books on evolution commented recently that evolutionary 'selectionist thinking is extending its tendrils into every aspect of human life, from medicine to morality.'⁵ For

3 Quoted by Philip Kitcher (1983) in *Abusing Science*, Open University Press, p. 187.

4 Quoted by R.L. Ecker (1990) in *Dictionary of Science and Creationism*, Buffalo, New York: Prometheus, p. 177.

5 Comment by Laurence Hurst, Professor of Evolutionary Genetics at the University of Bath, in *The darling of the masse*, *New Scientist*, 6 June 1998, no. 2137, pp. 50–51.

example, some sociobiologists have claimed that all of human existence lies within the purview of evolution, and some have attempted to explain contemporary complex human behaviours using adaptationist arguments based on evolutionary pressures supposedly operating during human evolution hundreds of thousands of years ago (albeit without convincing many people). Others, including Christians such as Teilhard de Chardin, have used evolutionary ideas to claim that humankind is getting better and more perfect as time goes by, and that eventually humankind will evolve to a state of sinless perfection⁶. Neither approach is in accord with the biblical perspective of humankind as fallen and sinful⁷, yet responsible for their own actions and redeemable only by God's loving intervention. Nor do the optimistic views of humankind getting ever better match the reality of life about us. All the evidence is that humans have behaved in much the same way as they do now, throughout all of recorded history, with the only changes being in the technology people use to assert their will.

A related problem in our society is that the language of DNA has become so common in popular culture that people now talk and think of genes as being solely responsible for a huge range of human characteristics and responses. Thus genes have been suggested to 'explain' criminality, shyness, intelligence, political leanings, and preferred styles of dressing. As it happens the evidence for a genetic contribution to *any* complex human behaviour remains remarkably thin. But despite this current lack of evidence, the media promotes the idea that there are selfish genes, pleasure-seeking genes, violence genes, celebrity genes, gay genes, couch-potato genes, depression genes, genes for genius, genes for saving, and even genes for sinning.⁸ This mechanical view of humans which is being promoted in popular culture is demeaning and falls far short of the biblical view that we were created in God's image, enabling a relationship with God as our father. The idea of genetic determinism in popular culture also has the practical effect of removing from people a sense of personal responsibility for their actions.

The secular world also has its fill of controversy over evolutionary interpretations, with some vicious turf wars between those who believe in different scenarios for evolutionary theories. One group, including people like Richard Dawkins, Daniel Dennett, Jared Diamond and Edward O. Wilson believes that natural selection can explain everything, and that we are all products of blind but deterministic forces acting on our genes. Opposed to them are those like Michael Behe, Niles Eldredge, Stephen Jay Gould and Steven Rose, who believe that natural selection is vastly over-rated and that our current model of evolution is missing some major facets (such as claims by Michael Behe that

6 Pierre Teilhard de Chardin (1959). *The Phenomenon of Man*. London: Collins.

7 Scripture is clear that it is out of the hearts of people that evil comes (e.g. Matt. 15:19), and that 'all have sinned and fall short of the glory of God' (Rom. 3:23).

8 D. Nelkin and M.S. Lindee (1995). *The DNA Mystique*, New York: W.H. Freeman and Company, 276pp.

some features of living organisms display what he calls irreducible complexity, which he says could not have evolved and so must be attributed to design by God; or contingency, the unpredictability of future stability, in the case of Stephen Jay Gould⁹). The tempo of evolutionary change is also bitterly disputed. Some believe that most changes were gradual and accumulative; others, like Eldredge and Gould, that evolution occurred in abrupt spasms separated by long intervals of stasis, or little change. Some, like Conway Morris in this book, show that all the basic body plans were in existence very early in the history of animal life, and that subsequent evolution has been the history of a relatively restricted number of basic morphologies being re-used by different species as the environment changed. As he comments (p. 13), 'For all its exuberance, the forms of life are restricted and channelled'. Others, like Stephen Jay Gould, maintain that if the history of life were to be re-run again and again, the outcome would be completely different each time, and it would be extremely unlikely that humans would ever appear again.¹⁰

One lesson from this variety of interpretations is that we simply do not have the data at present to distinguish between the different scenarios: as I discuss below, the fossil history is relatively sparse, and anyway only records a limited number of organisms, and then mainly those with hard parts that are easily preserved in the rock record. This does not mean to say that the evolutionary relationships themselves are completely suspect: just that we do not have all the answers at present. As Conway Morris writes in this book (p. 3), 'For biology it has been famously observed that nothing makes sense unless considered in the context of evolution. The fact of organic evolution in itself is not disputed.' In the future, new information from molecular genetics will be likely to add a whole new dimension to our understanding of genetic relationships between individual organisms, and groups of organisms: those studies are still in their infancy, but already open up new arenas of evidence that were completely unavailable to Charles Darwin when he formulated his theory of descent with modification. Another lesson is that it is foolish to try to derive philosophical positions from fossil remains. It is well known that Stephen Jay Gould has Marxist inclinations, and some have commented that his predilection for punctuated (sporadic) evolution owes more to Marxist revolutionary ideas of the sudden overthrow of moribund, static societies, than it does to hard fossil data¹¹. That may or may not be true, but it makes clear the fact that science deals with observable relationships between matter, be it organic or inorganic, but has rather little to say that is of religious significance, or that deals with ultimate questions of purpose. Even a professional evolutionary geneticist was moved to complain

9 Stephen Jay Gould (1992). *Life in a punctuation*. *Natural History*, Vol. 101, pp. 10–21.

10 Stephen Jay Gould (1989). *Wonderful Life: The Burgess Shale and the Nature of History*, New York: Norton.

11 See Conway Morris' discussion of the influence of Stephen Jay Gould's political views on his scientific views on p. 11 of this book, and Daniel C. Dennett's discussion on pp. 309ff. in his book *Darwin's Dangerous Idea*, London: The Penguin Press (1995).

in print that 'The biggest problem is that Darwinism is too often used polemically.'¹²

Conway Morris' book is therefore one which deals with issues of great relevance to each of us as we seek to work out our God-given command to subdue the world and to be good stewards of it. How should we relate to the animals in the world around us? His book deals with the remarkable fossils preserved soon after the time when animals first appeared on Earth some 600 million years ago. They come primarily from a 530 million year old outcrop of rock in the Yoho National Park in the Canadian Rockies known as the Burgess Shale that was discovered in 1909. More recently, similar fossil preservations known as the Sirius Passet fauna have been found in the high Arctic of Greenland, and the Chengjiang fauna, again of similar age have been discovered in the Yunnan province of China. These faunas are remarkable for both the number and the diversity of fossils they contain, and for the exquisite details of soft-body tissue that have been preserved. Though they date from close to the first appearance of animals on earth, their quality of preservation is almost unmatched in more than 500 million years of subsequent geological history.

As a sort of 'time capsule' at the dawn of animal life, these faunas are of huge interest and importance. Professor Simon Conway Morris is arguably *the* world expert on them, having worked on them since he first started his PhD research in Cambridge. He writes elegantly and entertainingly, and as he takes us along with him on some of his collecting expeditions to remote mountainsides, and through the trials and errors of his analysis and interpretation of the fossil evidence back in the laboratory, we absorb a sense of his enthusiasm and sheer awe in the face of these astonishing fossils. The book is beautifully illustrated, including such strange animals as *Hallucigenia*, a worm-like animal covered in long, protruding spikes and so-named by the author because of its weird, dream-like appearance.

The central part of the book is devoted to a description of many of the animals found in the Burgess Shale and, more briefly, in the similar preservations of approximately the same age found in Greenland and China. It is a fascinating tale of how their mode of life can be inferred from their remains. There are organisms thought to have burrowed through the sediment, perhaps in search of food. Others lived on the seabed itself, some attached or rooted to the seafloor, while others walked or crawled across it. Many of them left distinctive tracks and trails known as trace fossils when they were preserved in the rock. In the water column itself, some actively swam around, others floated or drifted passively as plankton. There is also clear evidence of predation, with many of the fossils, and particularly those known as trilobites, bearing the scars of boring and even of frequent bite marks.

The collection of animals now found in the Burgess Shales was buried rapidly by a catastrophic mudflow. Evidently the conditions of burial were toxic.

12 Laurence Hurst (1998). The darling of the masses, *New Scientist*, 6 June 1998, no. 2137, pp. 50-51.

because remarkably little rotting of the bodies has occurred. This extremely unusual preservation of an entire community enables a proper census to be made of the living community from the fossil remains, with some sobering implications for those who use the fossil record elsewhere to investigate evolutionary links.

Out of about 70,000 specimens recovered from the Burgess Shales, 95% were soft-bodied or had only thin skeletons that probably would not normally have been preserved in the rock record. The normal record of fossils that are found elsewhere in rocks of the same age (Cambrian), without the benefit of the atypical preservation conditions of the Burgess Shale, are mostly those organisms with thick shells or carapaces, and by analogy with the Burgess Shales they probably represent no more than 5% of the then-living range of organisms. Furthermore, not one in a million living organisms is normally preserved in the rock record after its death. So if there was a chain of descent of, say, ten different species over half a million years, the chance of now finding specimens from more than one or two of the intermediate species is rather unlikely. The fossil record is extremely incomplete, and we should be wary of using the absence of intermediate fossils along particular lineages to claim that those intermediate organisms never existed, and that such an evolutionary lineage is therefore impossible.

Throughout the book there is an underlying thread which goes far deeper than a simple description of these fascinating fossils. Conway Morris uses them as a platform for discussing evolutionary theory itself, and the way in which both morphological studies of fossils and the recently available molecular studies of DNA and genetic information makes it possible to reconstruct the inter-relationships between organisms and the way that they have changed through geological time.

The new molecular information that is becoming available is likely to have a marked impact on the understanding of evolutionary links. After all, it is genetic information that is passed from parent to offspring, and not skeletal remains. Yet the bulk of the fossil record consists solely of skeletal remains, and then mostly only from those organisms that had hard parts, so were more likely to have been preserved. Although molecular studies are still in their infancy, it is already clear that major changes in the morphology of organisms can result from extremely minor genetic changes. Conversely, remarkably similar looking organisms can arise from lineages with very different genetic compositions, a phenomenon known as convergent evolution. So we ought to be very careful in deducing evolutionary genetic lineages from morphology alone, and still more wary when all we have is a highly incomplete collection of fossils of the skeletons or carapaces of the more robust organisms.

Those knowledgeable about current debates over the philosophy and mechanisms of evolution will appreciate Conway Morris' discussions of the different approaches of both Richard Dawkins and Stephen Jay Gould. Apart from anything else, as Conway Morris remarks, theirs are 'arid manifestos', which

hardly seem to explain the human condition. But 'special creationists' will not find solace in Conway Morris' views. He notes that there are probably of the order of twenty million extant species, though the exact number is uncertain, and that somewhere in the order of two billion species have become extinct during the history of the earth. Nearly all the species that have ever lived are now extinct. So although (p. 3) 'separate and special creation of each and every species is a logical alternative, and in itself need not be beyond reason', 'nevertheless, the study of comparative anatomy, behaviour, molecular biology, and the fossil record give no support to any such model of recurrent creation.'

Though this book is not written from a specifically Christian perspective, those interested in the science-faith debate would do well to listen to what Conway Morris has to say. He writes with a deep humanity as well as with an extensive knowledge and expertise in palaeontology. That humankind represents a unique species comes over clearly in his writing. Few would disagree with his assertion that we have special responsibilities for stewardship of Earth, though our present behaviour, as he puts it (p. 223), 'is little short of reckless' as we 'behave like unwelcome guests' on our planet.

One of the most striking points Conway Morris makes is that there is a major difference between the normal history of life on this planet and that of the history of humankind. This is what he calls (p. 205) 'the catastrophic failure in human values and decency.' It has led to an almost endless list of atrocities, such as the sacking of Constantinople in 1204, the destruction of Baghdad in 1258, the expulsion of Jews from Spain in 1492, and the Nazi Holocaust, and as he remarks, 'no scientific analysis can even remotely answer or account for past and present horrors of human behaviour.' He goes on to comment (p. 205) that 'human history can make no sense unless evil doings are recognized for what they are, and are only bearable if somehow they may be redeemed.' This is where Conway Morris ends his analysis, concluding (p. 223) that we have a duty 'to leave the world a little better than we found it.'

Christians will agree with Conway Morris' astute and perceptive analysis of the place and nature of humankind in the rich tapestry of the history of life. And they will go on to proclaim the good news that there is indeed a Redeemer, and that he longs to make himself known to us, if only we are prepared to listen.

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13 I am grateful for references to several quotations provided by Sam and Andrew Berry, and for advice from Denis Alexander.



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