Science and Religion: Friends or Foes?

by Paul Black

Introduction

My PhD study involved using the techniques of X-ray crystallography to find out how the atoms of iron and aluminium were arranged in crystals which were found in alloys of these two elements. When I had succeeded, and could look at a model of this crystal structure, I could reflect that I was the first one to unlock the secret of this piece of the natural world, thereby sharing the vision of the Creator. This sense of wonder has been expressed by many scientists, and sits oddly alongside the so-called conflict between science and religion, a conflict characterised more by confusions than by genuine differences. My purpose here is to explore some of these confusions.

The meaning of Creation

The concept of a Creator is not an alternative to the scientist's explanation of the universe. Instead, it is an answer to the question that science cannot answer, which is *why* this universe exists at all, rather than nothing. As the philosopher Wittgenstein explained: *Not **how** the world is but that it **is,** is the mystery*.

To understand the full implication of this view, it is important to be clear about the meaning of the term 'Creator'. I might say that I 'created' this article. Yet if I had not committed the ideas to text in a computer it would cease to exist outside my memory, and disappear entirely if my brain ceased to work. Its continued existence depends on the properties of computers, print and paper, which do not depend on my existence. However, all the properties of the universe depend on its Creator for their existence: if He were to cease to hold them in being they would cease to exist, for there would be nothing about them which does not depend on Him.

But there is even more to be taken into account. The Creator of the universe would have to be outside its framework, of space, time and matter, dimensions which He created. The question "Where is God?" cannot have an answer in the language that we use to discuss 'where'. A similar difficulty applies to such questions as "What was God doing before He created our universe?" Part of St. Augustine's answer was that "He was creating hell for people who ask such questions". The question makes no sense because, as the Creator of time, He cannot be measured as if He were located within our time.

Although we can, through science, come to know something about God through his *works*, and wonder at the fact that we are able to take delight in them, it can only give us a limited understanding of the Creator. To go further we have to rely on God's *words*, on His revelation to us. Given this distinction, need there be any conflict between those two sources, His *works* and his *words*? In principle no, but many have believed that the two are in conflict.

One argument was expressed by Richard Dawkins, asserting that religion must be treated as a scientific hypothesis. This pre-empts any serious debate about the relationship between the two, and the poverty of most of Dawkins' arguments reflects this error. It is evident that his problems about creation have their origin in his concern about evolution, and it is in this arena that most of the recent conflicts between scientific beliefs and religious beliefs have arisen. In previous centuries the area of conflict has been in cosmology. For the purpose of this article, I shall develop the

argument in two sections, dealing in turn with cosmology and with evolution.

Cosmology and the Anthropic Principle

Myths in many cultures describe the history of the created universe. For Christianity, Genesis was a source. However, that book contains two different accounts, whilst its authors wrote in the context of their model of the earth, which was of a flat surface under the hemispherical globe of the firmament. The early Church was not concerned with conflict between Genesis and the quite different geocentric models of rotating spheres proposed by Aristotle and Ptolemy. Aristotle's model ruled until the 16th century when Copernicus concluded that the heliocentric model was far more satisfying. However, since it implied that the earth was spinning on its own axis, he could not explain why we were not blown off its moving surface. Galileo was a more public proponent, producing more convincing evidence from observations with his new telescope. Many in the Church saw this model as an attack on the biblical revelation. Galileo made his defence clear as follows:

> *"...it being true that two truths cannot contradict one another, it is the function of wise expositors to seek out the true senses of scriptural texts. These will unquestionably accord with the physical conclusions".*

Such statements worried the Church: he was a layman who added, to his un-diplomatic mockery of opponents, the insolence of pronouncing on interpretation of the Scriptures. This was at a time when the Reformation challenged the Church's sole right to make such interpretations. Yet Galileo's interpretation, that Genesis was not meant to be a science textbook, was correct; sadly the Church took almost three centuries to recognise this finally, in a statement by Leo XIII in 1893.

However, Galileo differed fundamentally from his predecessors. They were proposing purely geometric descriptions of planetary motion. He was interested in causal mechanisms. His studies of the physics of motion and of the force of gravity opened a quite new phase in the study of cosmology. A central feature of gravity is that it is a force of equal mutual interaction: it is easy to understand that the earth pulls the falling apple down, far less obvious that the apple is at the same time pulling the earth towards it. Yet the details of the motion of the moon around the earth could only be understood in terms of such interaction, and the scope of the theory expanded subsequently to include all of matter in this interaction

This realization led to a puzzle: if there is a universal mutual attraction, why isn't all of matter being pulled closer together? This puzzle became even more challenging when astronomers studied the light from the stars. The waves emitted by any source of light (or of sound) are stretched out if the source is moving away from us as it emits them, and compressed if it is moving towards us. The astronomers' analyses revealed that, far from moving together, all the stars were moving apart from one another and that the distances between them are unimaginable. For example, the sun is 93 million miles from the earth so light from the sun takes 8 minutes to reach us. This distance can be expressed as '8 light-minutes'. Measured in this way the nearest galaxy to our own, Andromeda, is two million light years away – i.e. we are now looking at light that it emitted two million years ago.

These puzzles led to the hypothesis of the Big Bang. If all matter were originally compressed together and then exploded, it would fly apart as the force of the

explosion overcame gravitational attraction. There are then two questions – what caused the explosion, and will gravity eventually pull the exploded pieces together? The first question was answered by the study of nuclear physics. If an enormous mass of matter is compressed, the gravity will so compress atoms that nuclear fusion reactions occur, reactions which release huge amounts of energy, raising the temperature so that everything flies apart – i.e. a nuclear explosion.

The second question is more fascinating. The gravity force between any two objects decreases rapidly as the distance between them increases. So if the initial explosion had been powerful enough the attractions would be overcome and the universe would expand so quickly that within a few years any 'spectator' would see an apparently dark and empty universe. However, if the force of the explosion had been relatively small, gravity would soon slow down the exploded matter and pull it back together.

Between these two extremes, there could be a delicate balance between gravity's effect in slowing things down and the decrease of its effect as things move apart. Theoretical calculations have shown that this last scenario, which is the one in which we live, is a very delicate balance indeed. Thus, the Big Bang was not too big, and not too small, but just right. This is one example of the so-called Goldilocks Effects, leading us to wonder why it is 'just right'. This view is taken further by the Anthropic Principle, by which it is assumed that the design was made 'just right' to serve human evolution.

It is tempting to conclude that the Big Bang was the moment of God's creation. Stephen Hawking describes an incident in the Vatican observatory at a scientific conference in the early stages of Big Bang theory. At the end of the conference, Pope John Paul II gave a farewell address, welcoming the theory, but saying, according to Hawking, that "we should not enquire into the Big Bang itself because that was the moment of Creation and therefore the work of God". The pope was thereby repeating the mistake of his predecessor in the Galileo case – using religious beliefs to constrain scientific enquiry. Hawking was intrigued, because he had already presented a paper in the conference engaging in such enquiry.

Hawking has also stated that as he, with others, developed models to account for the Big Bang, with the possible emergence of matter and energy through fluctuations in empty space, he decided that a Creator was not a necessary hypothesis – the universe could emerge from this empty space, i.e. from nothing. The problem with this view is that the 'empty space' of Hawking and others is a space in which the laws of gravity, of matter and of energy all operate; the creation of this space with these properties still calls for explanation. The trap is to use the term 'nothing' in such statements as "Why this universe rather than nothing?", for the term 'nothing' can represent a real entity with (created) properties: the question ought to be re-phrased as "Why this universe rather than not anything?"

As matter flew apart after the Big Bang, there would be many local fluctuations, so some pieces would clump together, on a small scale forming stars, on a larger scale forming galaxies. Many varieties of stars are observed: some may explode quickly – overcoming gravity, some will compress and form black holes. Our own Sun is 'just right', and is relatively stable in using up its own nuclear fuel slowly, with enough supplies left for about 5,000 million years. As it initially collapsed, lumps of matter collected around it and formed the planets. For life as we know it to have

developed on earth, its distance from the Sun had to be such that the temperature made biological development possible, and the mix of the elements had to be such that organisms that use carbon dioxide could develop. This is one more instance of the Anthropic Principle, although in this case, the principle is weak because there are so many millions of stars that a few suitable planets were bound to turn up.

More strikingly, the cosmologist Fred Hoyle worked out in 1953 that the nuclear reaction processes in stars could only produce the carbon that organic life requires if there existed a particular isotope of carbon. This led to a search for this hitherto unknown isotope, which led to its discovery and so to further support for the Anthropic Principle. The idea that our universe was designed to create a home in which humanity could evolve links cosmology to the study of human evolution.

Theories of Evolution

The existence of the animal world was seen as an interesting problem when it was recognized that systematic groupings were possible, and that by selective breeding certain characteristics could be enhanced. When Darwin analysed the wide range of evidence that he had collected about the multiple variations between plant and animal species he laid the basis for the theory of evolution by natural selection. One of those who challenged the theory at a public meeting was Bishop Samuel Wilberforce, who at the time (1860) was vice-president of the British Association for the Advancement of Science. He said that "we have objected to the views with which we are dealing solely on scientific grounds". One such objection was that Darwin's proposed process was a slow one – it would take far too long to evolve our species. Another was that there was no known mechanism that could produce the random variations that the theory required.

The 'too slow' objection was eventually overcome through the study of the various radioactive nuclei in our earth's rocks, which showed that these must have been assembled 4.5 million years ago. The theory of the 'mechanism' was revealed later with developments in theories of genetic variation. Many Christians, however, in common with Muslims and Jews who share the same Old Testament traditions, have continued to reject the theory. The objectors are labelled as 'creationists', an ambiguous term since in one sense all who believe in a Creator are creationists. A better title would be 'young-earth creationists', for they start with an interpretation of the Old Testament that sets the origin of our universe at 4,000 BC. At this point, the Creator created all the species simultaneously.

A different objection is that evolution by natural selection relies on the slow accumulation of one in a million chances from random variations to produce an evolutionary advantage: no Creator would have relied on such a clumsy process. However it has been found that a process of exploring the effects of a large number of random changes in any design may be the most efficient way of producing improvements in that design. The profiles of aeroplane wings, and the planning of the optimum locations for ambulance centres in large urban environments, are two examples of current use of this approach: it can be the *optimum design* process.

Many 'creationist' arguments involve the 'God of the gaps' approach: when science cannot explain how the Big Bang started, or how 6,000 B.C. can be reconciled with the slow pace of evolution, God is brought in to fill the presumed gap in our understanding. Andrew Coulson, echoing Galileo, described the error in this approach as follows:

"If He is in nature at all, He must be there right from the start, and all the way through it... When we come to the scientifically unknown, our correct policy is not to rejoice because we have found God: it is to become better scientists."

In late Victorian times a different type of conflict arose, led by a scientist, T.H. Huxley. He had been present at the 1860 meeting and was offended by an ill-judged aside by Wilberforce, asking whether Huxley was related to an ape on his grandfather's or on his grandmother's side. He led a group of nine scientists united by a "devotion to science, pure and free, untrammelled by religious dogmas". Whilst the 1860 meeting received almost no mention in newspapers and reviews at the time, this group publicised an inaccurate account of the event twenty years later – an account which has been copied ever since.

Whilst concerns about the potentially negative relationship between Christian belief and evolutionary science can easily be satisfied, the Jesuit theologian, John Mahoney, has proposed a strongly positive relationship. Put briefly, he asserts that the argument that the 'facts', of Adam, Eve and the Fall, made necessary the Incarnation and Christ's act of redemption, is inadequate. It implies that God had a plan A, which was undermined by humanity's preference for pride and disobedience, so He had to implement plan B. Mahoney suggests a quite different perspective, in which the creation plan included a process of evolution with humanity as the end-point of the design.

In human history one can trace the evolution of moral sense, of altruism and of reflective and spiritual thinking. However, the ultimate step in the development was for our human life to be incorporated into the life of the Creator a step beyond the scope of natural evolution. The Incarnation, the complete sharing of the Son with our human heights and depths in his Passion, and the subsequent descent of the Spirit, bridged this gap. The Incarnation and the Redemption were the final completion of the process of evolution, an essential and integral part of a single plan, designed to enable humanity to take the ultimate step into participation in the Divine life.

This simplified précis of Mahoney's argument risks bowdlerising a serious and scholarly work which draws on the work of theologians, from Augustine and Aquinas to Küng and Rahner. My main reason for including it here is to draw attention to the problem that Mahoney was trying to tackle, one that was presented in the following terms by Pope John Paul II :

"Does an evolutionary perspective bring any light to bear on theological anthropology, the meaning of the human person as imago Dei, the problem of Christology – and even upon the development of doctrine itself?"

Conclusion

This last quotation brings me back to my opening paragraph. It is tragic that so many shallow arguments, inaccurate histories, and clashes between leading actors and their institutions, have created the tradition of conflict between science and Christian belief. The mistakes made, on both sides of the divide, can be identified and corrected. The positive aspect, the wonder and delight that scientists enjoy and share as they have continually uncovered more wonderful features of the created universe, should be seen as a divine gift of opportunity. We need to be more bold in asserting both this wonder and delight, and in exploring further the potential of scientific results for refining our understanding of Christian revelation.

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This article is based on a talk given to the Wimbledon Circle in March 2013 by Paul Black, Emeritus Professor of Science Education at King's College, London.

Book Reviews

The Way Opened Up by Jesus

A Commentary on the Gospel of Matthew *by Jose A. Pagola;* Convivium Press 2012

This beautifully-produced little book really might change your life!

The writer sees God the Father somewhat as Pope Francis does; the bishop of Rome declares that the salvation of God is available for everyone, believers and unbelievers alike, and Pagola speaks of the crazy love and scandalous generosity of God, whose unconditional forgiveness is given unasked, who desires only our good. Pope Francis insists that we must be a church for the poor, as Pagola does, and is calling a halt to honorary titles. But it is painful to face the author's damning indictment of the church we love and belong to, the institution which the new pope has been chosen to reform.

Pagola describes a church in which status takes priority over service, an institution weakened by routine and paralysed by fear, in which people will not take risks – yet Pope Francis urges us to do just that and not to be afraid of what the CDF will say. We are living in a state of embedded codependency, with the hierarchy assuming autocratic power and offering us security in return, as long as we do not question its judgements.

Our failing as Christians is that we adhere to an institution instead of following a person; instead of making Jesus the vital centre of our life. We act as if devoutly receiving the sacraments is all that is required of us, while following an apparently respectable and inoffensive Gospel. Pagola breaks open for us the Sermon on the Mount and shows how Jesus's teaching will never be as meaningful for us, in our comfortable lives – our basic wants supplied, our leisure occupied with possessions and entertainment – as it will be for the grieving, the poor, the despised and the oppressed.

We need to begin by learning to be quiet alone in a room, open to the mystery of God in the depth of our soul. We cannot, as true followers, be indifferent to the sufferings of the world, and are called to care and work unremittingly for justice and peace. We must call for reform in the church with tenderness not condemnation. But we can be joyful, because it is as everyone takes on the love and compassion of the risen Christ that God's reign is created.

Pagola's words reflect, perhaps, our experience of the institutional church of Rome but in the Church of God at such and such a place we can see how the Holy Spirit is alive and active, as a bishop kneels to receive the blessing of a newly ordained priest and a minister offers the Cup as if actually sharing Christ with us. Josephine Way