

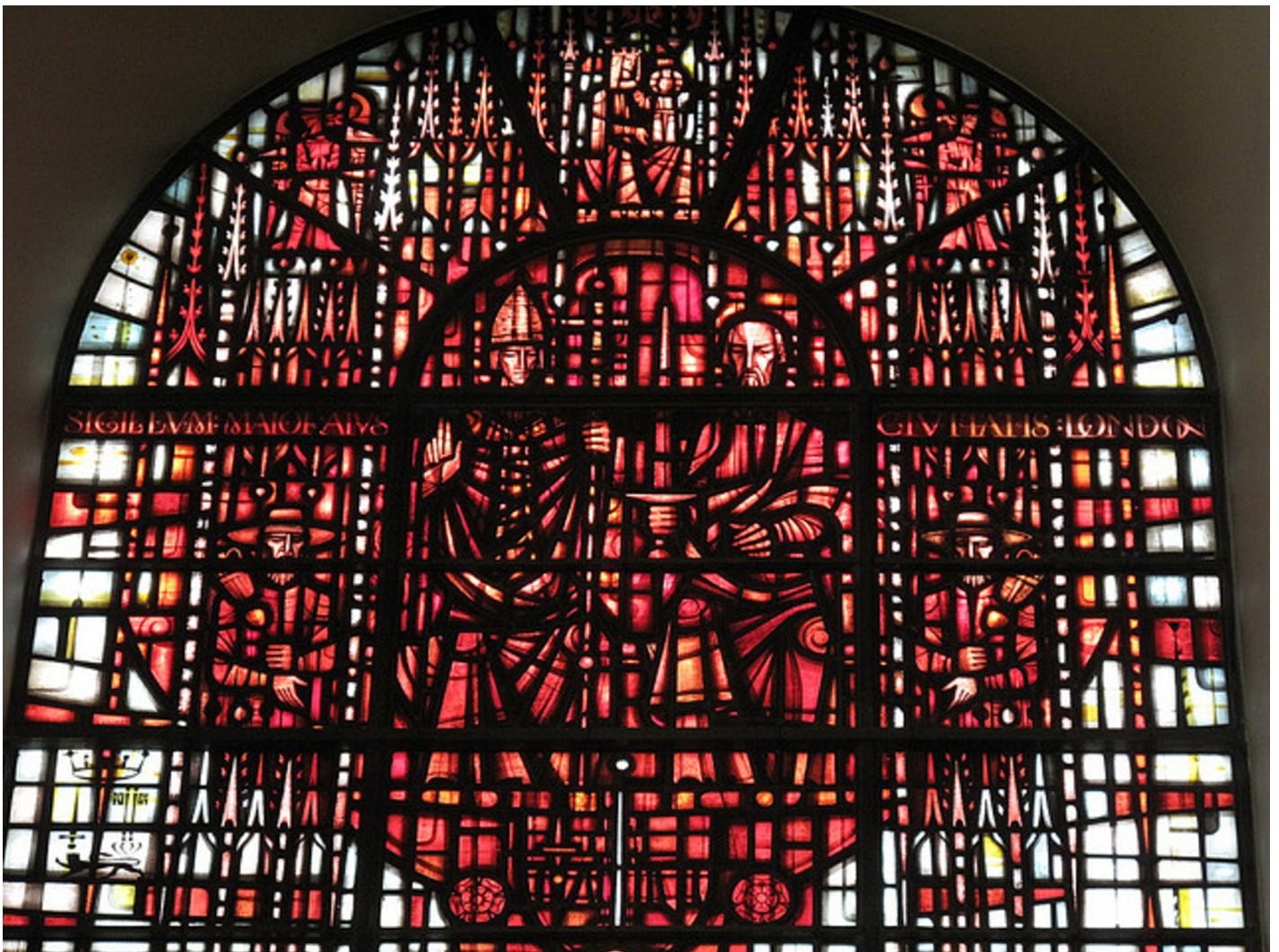


GRESHAM COLLEGE
Founded 1597

The Boyle Lectures: Science and Religion in Dialogue Transcript

Date: Monday, 8 April 2013 - 6:00PM

Location: St Mary-le-Bow, Cheapside



8 April 2013

The Boyle Lectures: Science and Religion in Dialogue

The Rev. John Polkinghorne KBE FRS

The key to understanding the relationship between science and religion lies in the recognition that both are, in their own specific ways, concerned with the search for truth, a truth that is attainable through commitment to well-motivated beliefs. The 'new atheists' fail to acknowledge this fact, polemically alleging that religious people believe without evidence, or even against the evidence. This false caricature results in the new atheists paying no honest attention to serious theological discussion. Their writings are full of assertion but lacking in engaged rational argument.

In their search for truth, science and religion are exploring different dimensions of the human encounter with reality. Science is concerned with impersonal encounter – reality treatable as an 'It', you might say. This is a realm in which experience can be manipulated and repeated as often as is desired. This ability gives science its great secret weapon of experimental testing. If you do not believe that the pressure and volume of a given quantity of gas at constant temperature are inversely proportional, just investigate for yourself and you will find that Robert Boyle was right. Yet we all know that there is a different dimension of reality, the personal and transpersonal, where reality is encountered not as an 'It' but as a 'Thou', and in that realm testing has to give way to trusting. If I am always setting little traps to see if you are my friend, I shall soon destroy the possibility of friendship between us. The attempt to manipulate God and put God to the test is the sinful error of magic. It is in this rich and profound realm of personal and transpersonal experience that religion pursues its quest for truth. In consequence its questions are different from those of science. The latter is concerned with the processes by which things happen and it has achieved its great success by the modesty of its ambition, bracketing out from its consideration issues of meaning, value and purpose. These latter questions – whether there is something going on in what is happening – are central to the concerns of religion. We know, in fact, that we have to ask both sorts of question if we are to understand the world adequately. The kettle is boiling because burning gas heats the water; the kettle is boiling because I want to make a cup of tea. Both statements are true and are necessary to a full understanding of the event of the boiling kettle.

The difference between the How? questions of science and the Why? questions of religion might at first sight seem to suggest that the two are so distinct that they have no real connection with each other. Stephen J. Gould took this view and called them Non-Overlapping Magisteria. However this is not true, because though the questions are different, their answers have to be consonant with each other. Putting the kettle in the refrigerator is not compatible with wanting to make a cup of tea! Consequently science and religion interact and complement each other, and John Hedley Brooke's Boyle Lecture reminded us that the conversation between them has in fact had a long history. Science and religion are friends and not foes in the great quest for truthful understanding. They have things to tell each other. In actual fact, a fruitful dialogue is currently taking place between the two.

The tenth anniversary of the revived Boyle Lectures offers an opportunity to review the present state of this conversation. I want to take us on an excursion along the busy frontier between science and religion, starting in my home territory, the end where the physicists dwell. They are deeply impressed by the wonderful order of the universe, revealed to us through its remarkable rational transparency to our enquiry. Of course it is not surprising that we can understand the everyday world in which we have to be able to survive. Evolution will surely have shaped our brains to that end. But why are we able also to understand the hidden subatomic world of quantum physics, remote from direct impact upon us? That world is quite different in its character from the Newtonian world of everyday. The latter is clear and regular in its character, but the quantum world is cloudy and fitful. In it, if you know where an electron is, you cannot know what it is doing, if you know what it is doing, you cannot know where it is. That is Heisenberg's uncertainty principle in a nutshell. Yet we can understand that world on its own terms and, it turns out, that the key to this understanding is the seemingly abstract subject of mathematics. It is an actual technique of discovery in fundamental physics to seek theories that are expressed in equations that the mathematicians can recognise as being beautiful. Not all of you may know about mathematical beauty – it is a rather rarefied form of aesthetic experience, concerned with qualities such as elegance and economy – but it is something that the mathematically minded can agree about. Time and again in the history of physics it has turned out that it is only such theories that have the power of long-term explanation which persuades us of their validity. The greatest physicist that I have known personally was Paul Dirac, one of the founders of modern quantum theory. Asked once about his fundamental beliefs, he strode to a blackboard and wrote 'The laws of physics are expressed in beautiful equations'. He made his great discoveries by a life-long devotion to that belief.

The rational transparency and rational beauty of the universe are facts that scientists are happy to exploit, but which science itself does not explain. Yet these are surely remarkable facts that it would be intellectually lazy just to treat as fortunate accidents. Theology can make the deep intelligibility of the universe itself intelligible when it sees cosmic order as a reflection of the Mind of its Creator. I believe that science is possible in the deep way that it has proved to be just because the world is a divine creation and we are, to use an ancient and powerful phrase, made in the image of our Creator.

This insight is an illustration of the right relationship between science and theology. Religion should not pretend to be able answer science's questions for it, for we have every reason to believe that scientifically stateable questions will receive scientifically stateable answers, but religion's role is to address questions that arise out of scientific experience but which go beyond science's self-limited power to address. The learned call these metaquestions. Such questions are deep and it cannot be claimed that the answers proposed are logically certain beyond demur. Rather, the claim must be that they are insightful and intellectually satisfying. It is not being asserted that atheists are stupid, for many are in fact highly intelligent and truth-seeking people, but that theism explains more than atheism can. This kind of reasoning is called natural theology, appealing to aspects of general experience, such as the character of the world that science explores, that are claimed to be best understood as offering hints of the veiled presence of God. Belief in the possibility of a natural theology of this kind has been a key theme in the Boyle Lectures.

A second metaquestion relevant to natural theology asks 'Why is the universe so special?' On the whole, scientists prefer the general to the particular and their natural expectation was that our world is just a common or garden specimen of what a universe might be like. However, as we have come to understand many of the processes that over 13.7 billion years have turned the almost uniform ball of energy that sprang from the Big Bang into the present world that is the home of saints and scientists, we have come to realise that it is only a very particular - one might say 'finely-tuned'- universe that is capable of the astonishingly fruitful process of generating carbon-based life. This surprising and unexpected conclusion is often called 'The Anthropic Principle' and many considerations have led to it.. John Barrow's Boyle Lecture summarised many of them. Here one example will have to suffice. The very early universe is so simple that it only makes the two simplest chemical elements, hydrogen and helium. There is only one place in the universe where the vital element carbon, essential for life, can be made and that is in the interior nuclear furnaces of the stars. Every atom of carbon in our bodies was once inside a star. We are people of stardust. One of the triumphs of astrophysics in the twentieth century was the unravelling of the processes by which the heavier elements were made. It turns out that the generation of carbon depends very delicately on the details of the nuclear forces involved. If these had been only a little bit different from what they are, there would have been no carbon and we would not be here. Again, it would surely be intellectually lazy to treat this fine-tuning of the laws of nature, which science accepts but does not explain, as just a happy accident. The theist will see it as an expression of the Creator's will in bringing into being a creation endowed with great potentiality. Those who resist the threat of theism are driven to the somewhat desperate expedient of the hypothesis of the multiverse, the supposition that there exists a vast, possibly infinite, array of different universes, each with different laws of nature and all of them, apart from our own, inaccessible to us. In this vast collection, ours is just by chance the one capable of being anthropically fertile. Because of the lack of the possibility of direct observation, the prodigal assumption of the existence of a multiverse is as metaphysical as the assumption of the existence of a divine Creator and it does not have the kind of collateral support that considerations such as cosmic intelligibility afford to the concept of creation. Moreover, without further argument, it is by no means clear that even an infinite multiverse must include an anthropic member. An infinite array does not necessarily include every possibility. After all, there are an infinite number of even integers, but none of them has the property of oddness.

Physicists are deeply impressed by the wonderful order of the cosmos and by the profound potentiality which was already present in the fabric of the laws of nature immediately following the Big Bang that has enabled the universe, after ten billion years of unfolding development, to generate life. Many physicists, even if they are not conventional religious believers, feel a kind of cosmic religiosity such as Einstein expressed when he said that in making his great discoveries, he felt like a child in the presence of the Elders.

However, when we move to the biological sector of the frontier, the scene changes and there is a great deal of border warfare. Partly this is due to the unwise way in which some religious believers have mistakenly refused to accept the insights of evolutionary biology, but it is also due to the fact that the biologists see a much more complex and ambiguous scene than the physicists' view of deep cosmic order. Biological evolution is certainly fertile, but at the cost of predation, parasitism and extinctions. The Boyle Lectures of Celia Deane-Drummond, John Haught, Simon Conway Morris and Keith Ward addressed these issues from a variety of perspectives.

The basic theological way to think about evolution was neatly formulated by Charles Darwin's clergyman friend, Charles Kingsley, soon after the publication of *The Origin of Species*. He said that Darwin had made it clear that God had not created a ready-made world but had done something cleverer than that in bringing into being a world so endowed with fruitful potentiality that creatures could be allowed to 'make themselves' by their unfolding exploration of divinely given fertility. From the theological understanding that the Creator is the God of love, such a creation, in which creatures are given the freedom to be themselves and to make themselves, is truly fitting, since the gift of love is always the gift of some appropriate measure of freedom afforded to the objects of love. An evolving creation is, therefore, a great good, but it has a necessary shadow side. It is a fundamental scientific insight that regimes which are capable of generating true novelty always exist 'at the edge of chaos'. That is to say, they are regimes in which order and disorder, regularity and contingency, necessity and chance, interlace. If things are too orderly, they are too rigid for anything really new to emerge. If there were no genetic mutations, no new forms of life could appear. Yet if things are too disorderly, nothing of novelty that emerged could persist. If there was too much genetic mutation, no species could become established on which the sifting and preserving process of natural selection could act. The fruitfulness of the three and a half billion year history of life on Earth, which has turned what was originally a world of bacteria into a world with elephants and human beings in it, has depended on there being just the right amount of genetic mutation to be the engine

of fertility. Yet if germ cells are to mutate and produce new forms of life, it is inevitable that somatic (body) cells will also be able to mutate, and sometimes this will result in malignancy. The anguishing fact of cancer is not something gratuitous which a Creator who was a bit more competent or a bit less callous could easily have eliminated. It is the necessary cost of a creation in which creatures are allowed to make themselves. Ironically, biological evolution is not the point of irreconcilable confrontation between science and religion, but it is where theology receives some help from science as it wrestles with what is surely its most challenging perplexity: the existence of natural evil and suffering in a world claimed to be the creation of a good and powerful God.

We all tend to feel that if we had been in charge of creation, frankly we would have done it better. We would have kept all the nice things such as flowers and sunsets and got rid of the nasty things, such as disease and disaster. However, as science has shown us how the world actually has to work, we have come to see that it is a kind of package deal, in which 'good' and 'bad' are inextricably intertwined as fruitfulness comes to birth at the edge of chaos. I do not suggest for a moment that this removes all the perplexity and anguish that we feel about evil and suffering, but I think these insights are of some help as theologians continue to struggle with these issues.

Evolutionary process is not restricted to biology alone. Its general character is the interplay of regularity and contingency. For an example from physics, consider the history of the generation of cosmic structure. The very early universe following the Big Bang was not completely uniform but there were small random fluctuations in its energy density (contingency). Through the contractive influence of gravity (regularity) these inhomogeneities were progressively enhanced, resulting in a snow-balling effect which over about a billion years led to the vital emergence of stars and galaxies. The universe itself is fundamentally an evolving world.

In relation to biology, the question naturally arises of whether the role of contingency does not imply that the eventual emergence of self-conscious beings in the history of life is no more than a fortunate but ultimately meaningless accident? Stephen J. Gould notoriously claimed that if the tape of life were to be rerun a second time, so to speak, nothing remotely like ourselves could be expected to result. Certainly homo sapiens in all our five-fingered specificity would not be expected a second time, but Simon Conway Morris has argued that self-conscious beings of some kind would be a natural expectation. He points to the phenomenon of convergence in biological evolution, suggesting that the history of life is not some kind of random drunkard's walk through an infinite possibility space, never likely to be in anything like the same direction twice, but something much more constrained. The number of systems that are both biologically accessible and functionally effective seems to be quite limited. In consequence, there is a notable degree of repetition in evolutionary process. For example, the eye has evolved independently several times in the course of terrestrial history. The symphony of life is neither like the performance of a fixed score predetermined in eternity, nor like random noise, but like a grand improvisation with the strikingly fruitful harmony in its contingent variations taking place within the laws of biological counterpoint. This view of unfolding fertility has encouraged theologians to add to the venerable concept of creation out of nothing (that is, the timeless holding of the world in being by an eternal Creator) the further concept of continuous creation, the unfolding within time of the Creator's will realised within the divinely ordained processes of nature. The balance between creaturely action and divine providential action is one to which I shall return shortly.

We now move to the final sector of the frontier, the place where theology's neighbours are the human sciences, such as psychology and anthropology. The Boyle Lectures of Philip Clayton and Malcolm Jeeves surveyed this territory. It is clearly one of great significance for theology, but I think that a great deal of exploration still remains to be done. Our attention will be directed briefly to what can be learned about the nature of the human person. Neuroscience is currently making great progress in identifying the neural pathways by which our brains process the information coming to us from our external environment. This work is surely significant, but I believe it is also necessary to be aware of its limited scope. It is clear that we are intrinsically embodied beings and our conscious experience is closely linked to the physical state of our brains. A smart tap on the head with a hammer would be a crude way of making the same point. Yet there is a great gap yawning between talk of neural firings and the simplest mental experiences, such as seeing red or feeling toothache. This is a gap that no one currently knows how to bridge. The problem of qualia (feels) is a very hard problem indeed, which we are far from being able to solve. Bombastic talk of consciousness being 'the last frontier' that the heroic armies of reductionist science just are about to cross is extremely ill-judged. In fact, it is just possible that the nature of consciousness is one that will never be amenable to full understanding in scientific terms alone. Everything else that science studies, whether matter or life, can be treated as external to us, but consciousness is internal and private. We have no direct access to the consciousness of another person. We know that we can agree about attaching the label 'red' to the same object, but I do not know whether your experience of seeing red is exactly the same as mine. Science has certainly not established that mental experience is nothing but the firing of hordes of neurons, though it is certainly related to physical activity in the brain.

Human beings are psychosomatic unities in which the mental and the material exist in some kind of profound complementarity. Such a view of human nature would not have surprised the writers of the Bible, for in Hebrew thought persons were seen, in a celebrated phrase, as 'animated bodies rather than incarnated souls'. Although Christian thinking has often tended to be platonic in character, regarding the soul as a kind of detachable spiritual component temporarily housed in a fleshy body and awaiting release at death, this devaluation of our embodied status was a bad mistake. Human beings are not apprentice angels and our ultimate hope is not spiritual survival but the resurrection of the body. Must we then give up the idea of the soul? I do not think so,

but we shall have to reconceive it. The soul is presumably 'the real me', the carrier of my personal identity. At first sight, it is almost as perplexing to know what this is in this present life as it might be beyond death. What makes me, a bald elderly academic, the same person as the schoolboy with the shock of black hair in the photograph of long ago? It might seem that the answer is material continuity, but that is an illusion. The atoms that make up our bodies are changing all the time, through wear and tear, eating and drinking. I am atomically distinct from that schoolboy. What is the real me – and here the problem is so deep that I admittedly have to wave my hands, but I believe in the right direction – is something like the almost infinitely complex information-bearing 'pattern' (memories, character, etc) carried at one time by the atoms of my body. That pattern is the soul. In a very crude analogy, it is software rather than the hardware. I shall return to this point later.

So far in our perambulation of the frontier, most of what I have said would be as consistent with the spectator God of deism, who simply decreed the order of the world and then stood back to see what happened as a result, as with the God of Christian theism who is providentially active within the history of creation. But doesn't science portray a world so deterministic in its character that there is no scope for such specific divine action? Certainly, after Newton many people believed the universe to be purely mechanical, a clockwork world whose God could be no more than a celestial Clockmaker. In consequence the eighteenth century saw the rise of deism. Yet the twentieth century has seen the death of a merely mechanical picture of the physical universe. This was due to the discovery of intrinsic unpredictabilities present in nature, first at the subatomic level of quantum theory, and later at the macroscopic level of chaos theory. The word 'intrinsic' is important here, for these are not unpredictabilities which could be removed by more precise calculation or more exact measurement. They are properties of nature. Unpredictability is an epistemological property, concerned with what can or cannot be known. How epistemology relates to ontology (what is the case) requires further metaphysical decision. For example, it has been found that the uncertainty in quantum physics can be interpreted either as due to an intrinsic indeterminacy present in nature or it could be due simply to a necessary ignorance of some of the factors that actually fully determine what happens. It has turned out that there are theories of either kind which give exactly the same empirical results, despite their very different characters. The choice between them therefore cannot therefore be made on purely scientific grounds but it is a matter for metaphysical decision, which has to be defended by metaphysical arguments. Those of a realist turn of mind, who think that what we know is a reliable guide to what is the case, will closely align epistemology and ontology and so interpret unpredictabilities as signs of an actual causal openness. To do so does not imply that the future is some sort of random lottery, but that there is space for the operation of other causal factors beyond science's reductionist account of the exchange of energy between constituents. An obvious candidate for such causes would be the willed acts of agents, either the whole human person or God's providential action within the open grain of creation. In any case, it is clear that science has not established the causal closure of the world on its reductionist terms alone.

If something like this is right, it has three significant implications for theology. The first is that events cannot be exhaustively analysed and itemised, as if nature did this, human agency did that, and divine providence did a third thing. Details of causes are inevitably partially hidden behind a veil of unpredictability. The eye of faith may discern God's providence at work, but this cannot be demonstrated explicitly. The second point to emphasise is that, while there are these unpredictabilities in nature (clouds) there are also reliable predictabilities (clocks). The Sun will rise tomorrow at the expected time. In consequence, there are some things that it is not appropriate to pray for. The great early Christian thinker, Origen, who lived in Alexandria, said that one should not pray for the cool of spring in the heat of summer, tempting though that must have been to him at times. The third point is to emphasise that this picture of providence portrays God as acting within the unfolding open grain of nature and not fitfully interfering with it from the outside. Christian theology has to steer a course between two unacceptably extreme pictures of divine action: the one the Cosmic Tyrant in tight control of absolutely everything, giving no freedom at all to creatures; the other, the indifferent deistic Spectator. How the balance is actually struck between divine and creaturely action is the classic problem of grace and freewill, now written cosmically large.

A final issue has now to be faced. It is the significance of the future, an issue that Jurgen Moltmann addressed theologically in his Boyle Lecture. Every story that science has to tell ends ultimately in decay and futility. This is due to the second law of thermodynamics, which says that without external intervention the disorder of a system can only increase and never decrease. This is because there are so many more ways of being disorderly than there are of being orderly, so that statistically the waters of chaos continue to rise. We know that we are going to die on a timescale of tens of years and the cosmologists reliably tell us that the universe itself will die on a timescale of many billions of years, most probably by becoming ever colder and more dilute till all life must vanish everywhere within it. Does not this fact put in question theology's claim that the universe is now and always a meaningful divine creation?

There is certainly no natural expectation that science could offer of the hope of a destiny beyond death. Yet the 'horizontal' story that science tells of the unfolding of present process is not the only tale to tell. There is theology's 'vertical' story of the faithfulness of God, who will not allow anything of good to be lost. This is just the point that Jesus made in his controversy with the Sadducees about whether there is a human destiny beyond death (Mark 12:18-27). He pointed them to the fact that at the burning bush God was declared to be the God of Abraham, Isaac and Jacob, commenting 'The God not of the dead, but of the living'. If the Patriarchs mattered to God once, as they certainly did, they must matter to the faithful God forever. They were not cast aside at death, like broken pots thrown onto a rubbish heap. While there is no natural hope of a destiny beyond

death, theologically there is every hope arising from the faithfulness of our Creator. Christians, of course, believe that this hope has been exemplified and guaranteed by the resurrection of Jesus Christ

Science, of itself, can speak neither for nor against this theological conviction, but there remains the question of the credibility of such a hope. Can we make sense of the claim that human beings shall live again after the decay of their bodies? Because I believe that we are intrinsically embodied beings, I believe that this hope must take the form of the resurrection of the body and not some form of merely spiritual survival. If such an idea is to be credible, two basic criteria must be satisfied, one of continuity and one of discontinuity.

It must really be Abraham, Isaac and Jacob who live again in the Kingdom of God and not just new characters given the old names for old times' sake. This is the criterion of continuity. It requires a carrier of that continuity between this world and the next, which traditionally has been understood as the human soul. I have suggested that the soul something like an almost infinitely complex information-bearing pattern. This pattern will dissolve with the decay of my body, but it is a coherent hope that God will not allow it to be lost but will preserve it in the divine memory. That in itself would not be a fully human destiny beyond death, for that would require the re-embodiment of that pattern in some form of environment of God's choosing - in other words, the resurrection of the body.

However there would be no point in making the Patriarchs live again simply so that they could die again, so this re-embodiment will have to be in some form of 'matter' which is different from the matter of this world. This is the criterion of discontinuity. It seems a wholly coherent possibility that God could create a form of 'matter' so endowed with strong self-organising principles that it would not be subject to the thermodynamic drift to decay which characterises the matter of this world. But two further questions then immediately arise. One is what will be the relation of this 'matter' to present matter? I believe that the one is the redemptive transform of the other, just as Christ's risen and glorified body was the transform of his dead body (hence the empty tomb). Human destiny and cosmic destiny lie together in the Creator's purposes (see the Cosmic Christ of Colossians 1:15-20).

More critical is the second question. If the new creation is going to be free from death and futility, why did the Creator bother with the old creation subject to decay and transience? I believe the answer to lie in a recognition that the Creator's purpose is intrinsically two-step: first the old creation existing at some distance from the veiled presence of its Creator so that creatures can be allowed the freedom to be themselves and to make themselves, and then the new creation, drawn freely into ever closer encounter with the unveiled riches of the divine nature.

These ideas that I have been trying to sketch are inevitably to a degree speculative - in many ways 'wait and see' is the best strategy for eschatological thinking - but I believe they help us not to waver in our trust in a destiny beyond death, whose guarantee lies ultimately in the faithfulness of God and the resurrection of Christ.

Our exploration of the frontier between science and religion has been rather a lightening tour but I hope it has served to show something of the fruitfulness of the dialogue that is taking place. Both scientists and theologians tend to be critical realists, recognising that there is a truth to be found but one that is subtle beyond Enlightenment expectations of unproblematic objectivity, for the quest for truth is guided by taking seriously experience which only becomes meaningful when it is interpreted according to a chosen but potentially corrigible point of view. The claim is not to the attainment of final and absolute truth, either in science or theology, but of conclusions that are sufficiently well-motivated to justify commitment to belief, without giving up the hope of attaining further understanding in due course. Both science and theology know that truth often seems surprising, leading us to conceptions that we would not have been able to form without the nudge of reality. In 1899, no one would have supposed that the wave/particle duality of light was a rational possibility, but it proved to be the case. Early Christianity had to struggle with the deeper duality of the human and divine in Jesus Christ.

I see a cousinly relation between my scientific experience and my theological experience. I like to say that I am two-eyed, viewing reality with both the eye of science and the eye of religion. I believe that with this binocular vision I can see further and deeper than I could with either eye on its own.