



OVERVIEW

Professor Colin Humphreys delivered a lecture on 'Can Scientists Believe in Miracles?' on 2nd March 2004 in the Winstanley Lecture Theatre in Trinity College, Cambridge. An audio recording of the lecture and questions along with a transcript of the lecture in pdf and HTML format is available at:

<http://www.st-edmunds.cam.ac.uk/cis>

The lecture was subsequently followed by a dinner/discussion with the speaker at St Edmunds College, Cambridge. An edited transcript of this discussion follows. It was chaired by Prof. Bob White (Department of Earth Science, University of Cambridge) with introductory remarks by Dr Denis Alexander (Babraham Institute). The other contributors are described at the end of the discussion.

Templeton Foundation Post-dinner Discussion *Colin Humphreys – 2nd March 2004*

Bob White: I am going to ask Denis to introduce some thoughts that will kick us off on our discussion.

Denis Alexander: First of all I want to say how very much I enjoyed Professor Humphreys' lecture. I thought it was a real *tour de force* and I look forward to reading Colin's book, which I have bought this evening. I especially appreciated the focus on the historicity of the biblical narratives and the way in which we need to take the biblical text seriously. I will briefly flag up a few points for discussion, some philosophical, some more theological.

Firstly, I think it would be good if Colin could expand on the question of natural law that he introduced earlier – a central issue in the whole discussion about miracles. It was Hume who popularized the idea that "a miracle is a violation of the laws of nature" and so the tradition of thinking of miracles in this way stems largely from Hume. In contrast to physicists, biologists such as myself don't really use the language of 'laws' very much: we are more interested in accumulating data that will count either for or against a particular hypothesis. So we relate more to Peter Lipton's language of 'inference to the best explanation' when it comes to the assessment of theories. Of course biologists realize that the 'laws of physics' underlie the properties of matter that they investigate as biologists, but they don't generally see their role as being to discover new 'laws of biology'. Theologically I suppose one problem about talking of the 'laws of nature' is that it can sound as if these are like traffic laws that should on no account be broken and Karl Popper was fond of pointing out the fallacy in this line of thinking. In a sense laws are simply our own

human short-hand summaries of some of the very reproducible phenomena that we observe in the universe around us, but they are descriptive not proscriptive. The discovery of a single black swan destroys the 'law' that 'all swans are white', irrespective of how many white swans we managed to count. If we take laws as proscriptive then we end up with the curious notion of "God breaking his own laws" and I think that Colin was hinting at the ambiguity intrinsic to such a phrase. So perhaps it is theologically more helpful to talk about God and his normal interactions with the world, his normal pattern of activity, and then the miracles become his unusual mode of activity, irrespective of whether or not this runs counter to what we think of as "laws". I would be interested if Colin could comment a bit more on this topic for us.

The second reflection follows on from that and concerns the question of how God interacts with the world, a much-discussed question in science/religion studies at the present time. There are those round the table who believe, as I do, in a God who interacts with the world and who does things in the world. So when God brings about a miracle of whatever particular category, the question is in what way this is mediated into the created order. Let's think, for example, about an earthquake which is blocking a river – I'm sure Bob can tell us how long back you have to go in order for the tectonic plates to be set up in such a way that that earthquake will happen at that particular time. I would be interested in Colin's thoughts on the issue of how God interacts with the world in bringing about a miracle at a particular time and particular place, given especially that many of the Old Testament miracles, as Colin reminded us, are miracles of timing.

Thirdly, and lastly, a thought that might take us beyond where we want to go this evening, but there was an interesting question asked after the lecture. Somebody asked why it is that a certain branch of theology tends to sit very light to the biblical narratives, attempting to extract the theology without thinking of them necessarily in historical terms, even when the literary style certainly sounds like a historical narrative. I wonder if one of the reasons for that is that within this theological tradition there's a strong feeling that we don't have a God who is really interacting with the world anyway. In many ways it's easier to handle the problem of theodicy if you have a "hands-off" God, a God who doesn't do miracles at all, a deistic God not involved in the world, allowing the world to go its own merry way. In that case things just happen and we don't have the problem of evil and other questions that arise when we do have a God who is very involved in the world. And so I guess the question is, and I'm going to take the devil's advocate position here to stimulate discussion, if God does miracles for some people, why doesn't he do miracles for everybody?

Colin Humphreys: These are very good points so I'll try and make a brief response now. Natural law – I very much agree with what Denis has said, that when we formulate laws of nature, we are describing what *has* happened in the past, and these laws do not determine what *will* happen in the future. But having said that, they greatly raise our expectations of what will happen. To give a concrete example, if we calculate when the next eclipse of the sun will occur, based on the equations of motion of the earth and moon which describe when past eclipses have occurred, if that eclipse did not occur in the future as we had predicted, we would be astonished. So in a real sense, physical laws greatly raise our expectations of what will happen in the future, although they do not say events *must* happen, and presumably a large comet or meteor coming in unexpectedly and colliding with the earth could change the eclipse prediction.

Concerning how God interacts with the world – I think the miracles of timing have got a lot to teach us here. However, I'm not sure of the answers. I think with the water from the rock event, you can deduce that Moses was attuned to the voice of God. Moses was a godly man and heard the voice of God saying, "Go and strike the rock at Horeb". If Moses had not obeyed then there would have been no miracle. What was critical here was Moses hearing the voice of God and acting upon what God said.

When it comes to the earthquake-induced mudslide and the crossing of the Jordan there are various possible interpretations of how God acted. The first is that the earthquake-induced mudslide that stopped the Jordan was fixed in time and God knew of this in advance. He interacted with Joshua so that the Israelites arrived on the banks of the Jordan at just the right time. Perhaps God told Joshua as he led the Israelites to the River Jordan, "Slow up a bit Joshua," because otherwise the Israelites would have arrived too soon. I think this idea of Christian people, or Jewish people, needing to be really attuned to the voice of God for miracles to occur is a very important point and we have much to learn from this. A key question with the crossing of the Jordan is whether God interacted with the timing of the earthquake as well as with the timing of the Israelites. With earthquakes there is an element of unpredictability because the factors controlling the timing are so complex. Whether God interacts with the world through this unpredictability, as I think John Polkinghorne, for example, suggests in his writings, is a key question. Trying to understand miracles such as the crossing of the Jordan must, I believe, teach us about how God interacts with the world. I believe this is a fruitful area for further thought.

Why does God do miracles for some people and not for everyone? I would say that God wants us to pray – as Christian and Jewish people both believe – and he says he will answer prayer. The inference is that although God knows our needs, he still wants this interaction with us, so if in fact we don't pray then we lose contact with God and miracles may not happen. So prayer is important and maybe that's why miracles happen to some people and not to everyone.

Bob White: Would anybody else like to comment?

Christopher Ash: I wonder if we could include in our discussion the idea of Order in creation, the idea that God has placed an Order in creation which is more than just material, but which is also moral, that there is an *ordering* of creation. I was struck by that word "violation" used in your popular description of miracles, and I think in Richard Dawkins as well, because I think Christian believers would want to say the Created Order has been violated by evil (whatever its origin) and that the Resurrection of Christ is a reaffirmation of Creation Order; that it's the very opposite of a violation, that it's an anticipation of the final restoration of all things. If a truly innocent and blameless human being is done to death unjustly and is not raised from the dead, then the moral fabric of the universe would disintegrate. And if that is so, the Resurrection of Christ, far from being a violation of the natural order, is precisely the opposite. That's provocative, isn't it?

Brian Heap: I found it very helpful to hear what you were saying about the consistency of God and the examples you used of miracles that had been carried out, particularly the ones that you referred to in the Old Testament, which perhaps help one to think of those which we find much more difficult to understand. If one carried it through, then presumably we are faced with the fact that there is an ultimate answer. It was fascinating and quite persuasive when you were speaking of those that I would classify as the physical science miracles, i.e. from your world.

When you strayed into the area of those that might be considered as associated with the biological world, I found you much less persuasive. We would all find difficulty with the resurrection, the miracles that Jesus carried out which were to do with the healing. This is where I found you wanting!

Now I know you're not a biologist but this is a huge challenge, because of the difficulty of *trying* to find an understanding of whether there is any scientific rationality to what was actually being carried out by Jesus on those occasions. You did say something to the effect of what will happen in a hundred years' time with an increase in knowledge – so perhaps what you're really saying is that the physical sciences have advanced so much, they're so far ahead of the biologists, it's going to be another hundred years or so before the biologists even stand a chance of thinking seriously about some of these other miracles.

Bob White: Thank you, Brian. Can I ask for some comments from biologists – we’ve got several round the table, Derek, Ellen, John, Geoffrey – do any of you want to comment?

Ellen Nisbet: There are miracles that aren't physical or biological. What about Jonah and the giant fish? It's certainly not a healing miracle or an earthquake. Was it a fishy tale that Jewish mothers told to scare their kids? Or do you think that there could be another explanation? I can't see it fitting into either of your two categories of miracles.

Colin Humphreys: Concerning Jonah and the giant fish, some parts of the bible contain history, whereas other parts contain parables and allegories. I haven't thought deeply about the Jonah story, but it seems to me that it is not totally clear whether the writer intended this story to be taken literally or whether it is a dramatic parable where the importance is the moral tale which is being taught.

I never responded to Christopher Ash's point about the created order being violated by evil. Let me tell you about a conversation I have always remembered with Donald McKay. I didn't know him well but I spoke with him a few times and I once asked him about the origin of evil. He looked at me and he said, "Open mind and closed lips": he sometimes said this when he didn't fully understand something. So I said, "Look Donald, you must have some ideas on the origin of evil." Donald turned to me and said that the creation story in Genesis suggested to him that God had an idea for creating a world without sin, a perfect world, and then he tore up this blueprint and he created the world that we've got. I think that remark of Donald McKay is quite profound and relevant to the created order being violated by sin.

Derek Burke: Well, the easy miracles are the ones where there is a need for a coincidence of events and of timing and of geological events, those are the ones you talked about. They are easy because we can see that those things would happen anyway and so the difficult thing is why they should happen at the point they did and why they should happen to some people and not to others. But the mechanistic side is more straightforward and maybe Jonah and the whale is in that category too.

Picking up Brian's point that the healing miracles are much more difficult, I don't have any solutions – just a few stones to drop in the pond. Things we pray for in healing don't always happen and we know that only too well in our own lives. The healing miracles of the New Testament, all the miracles in John, were spoken of as signs, not of any particular importance in themselves but as indicators, and John apparently carefully selected those in order to convey a particular story or message. But going back to Brian's point, we can't do what you can do, as a physical scientist – which is to think *biologically* of a way in which a withered limb might be made whole, or a dead body rejuvenated by using any sort of biological mechanisms that we know of at all. So I cop out at this point and I remain reverently agnostic about those miracles. I can't gainsay them, they are certainly indicators; I have absolutely no idea at all how they might have happened and I don't think I ever will, not at my age!

Bob White: John, do you mind if I draw you in because you've been chairman of Addenbrooke's Hospital Trust so you may like to comment.

John Bradfield: One major biological miracle that I have no difficulty with nowadays is the virgin birth. Excel seems to do the most extraordinary things at the slightest provocation! That at least I think is easy not to be worried about.

Like others I can't produce any explanation or thoughts of any use really about the healing miracles, or indeed about the resurrection. I was all keyed up with my pencil poised when you got to the resurrection but you were clearly as puzzled as the rest of us. But as I say, about the virgin birth I don't feel any difficulty at all. It would be nice to know whether Christ was haploid or diploid but I didn't worry as to which it was, either of them is perfectly acceptable really. As to the

other biological miracles, even things like changing water to wine, I can't cast any light on them really although that is easier to conceive of than the healing miracles which are really very difficult to conceive of at all.

I have to confess I've got one or two questions and comments on different aspects but I won't muddy the discussion by bringing them in now.

Bob White: Colin, do you want to respond to that?

Colin Humphreys: If you believe in an all-powerful God then clearly that God can do anything but the key question is not what God *could* do, because he could do anything, but what God *did* do. As we have seen, for many physical miracles it seems that God worked in, with and through nature to achieve his will at the right time.

It seems to me that the problem with the healing miracles, and I don't have biological expertise, is that the rate at which the healing happens is far faster than occurs in normal biological processes, which tend to be slow. As we know, if you cut yourself then healing is a slow process. So if you believe in these healing miracles, as I do, then it seems to me that God is behaving differently here and speeding up biological processes.

Brian Heap: But I think that's the fascination from a scientific point of view. If you take what you just said then it would suggest that there are mechanisms by which the healing process can be hugely accelerated and changed, and yet we have really no handle on that process. It's something that is incomprehensible and miraculous.

I have reservations about the idea that the resurrection of Christ was a "localized singularity". I think it was touched on by a person in the audience who identified the resurrection for those of us who are Christians as being the single most epoch-making event that the world has ever known and to reduce it to a localized singularity, remarkable as that may be, is to introduce constraints to our thinking. If we hold the view that ultimately we will all undergo some change of nature, a localized singularity limits rather than expands our thinking about this event.

Colin Humphreys: I agree absolutely with what you said. I was trying to use, and Paul Shellard may correct me, an analogy with a mathematical singularity. If, in the Resurrection, God is acting differently from normal, what I was trying to say was that the laws of nature didn't change and stay changed, they just changed locally at that time and in that place. Everywhere else, the world behaved as we expect it to, so in that sense the Resurrection was like an isolated mathematical singularity I very much agree with you that the Resurrection for Christians is the single most epoch-making event that the world has ever known.

Bob White: But isn't Brian's point that nature has changed now, that we will be resurrected if we're Christians? In that sense it's not a singularity, is it? Is that the point you were making, Brian?

Brian Heap: Yes, that it's the beginning of something that is totally different in the way that Christ was seen before and after his resurrection. This presented his disciples and those that observed him after his resurrection with a totally different view because of the fact that he underwent this extraordinary event.

Colin Humphreys: Yes; but are we saying that it is only those who lived after Jesus who will be raised, and that people who lived before Jesus, like Moses would not be raised?

Brian Heap: I wasn't.

Colin Humphreys: I totally agree. My mathematical isolated singularity analogy was aimed at mathematicians and physicists who know about isolated singularities. I think the analogy is probably not helpful to those who are not mathematicians and physicists. I very much agree that

for Christians, Christ is “the first fruits of those who rise from the dead” and this is of fundamental importance, and that his death and Resurrection retrospectively applied to people like Moses as well as to ourselves. However, it seems to me that the Resurrection of Jesus did not affect the way in which our *physical* world operates, and hence my isolated singularity analogy is still valid.

Pat McKeown: Could I ask how many of us have had any experience of what is often called “faith healing”, the power of mind over matter? There seems to be significant evidence that some people have powers that can effect very rapid improvements in the health of others, both psychological and physical, including the marked acceleration of repair of human tissue.

In my opinion as an engineer scientist and humanist, one of our major problems is that we, in the scientific community, seem to be terrified of addressing the paranormal, including proper investigation of faith healing. Here, I do not mean necessarily Christian faith or any religious faith, merely faith in the power of another to improve or repair one’s health. This is a sad if not reprehensible situation. So how does this relate as a possible explanation for the “miracles” of a healing nature? Jesus Christ who in my opinion is unlikely to have been “divine” obviously was a man of outstanding, quite exceptional intellectual and mesmeric power. Could he have had and used those powers to bring about the sort of “miracles” of a physiological nature that we are talking about. What do you think?

Colin Humphreys: It’s a very good question and we need to learn a lot more. I believe it is well known that our own mental attitude has a huge influence over the physical diseases which we might get, and on our rate of recovery from some diseases. With faith healing, I would want to carefully analyse the claims being made, but I do believe that God can heal people.

Pat McKeown: Could I then ask if any of our bio-medical experts would care to comment on that possibility; I won’t say probability, but possibility?

Brian Heap: I don’t know if anyone saw the recent television programme “What do people think about God?”. You may remember that there was an example given by a senior Vatican cardinal, Cardinal Arende, of a person who returned to Nigeria as a corpse. People who received the corpse prayed and believed this person would come back to life. Baroness Susan Greenfield immediately said that this was the well-known placebo effect and that it was all a matter of belief and the miracle was brushed aside.

Perhaps we could invite our Catholic friends to comment on the acts of faith healing and the wealth of historical evidence that has been used to attest to miraculous events.

John Bradfield: I’m sure what Pat was saying about the investigation of the paranormal is very important and we are still very much on the fringe of it: unfortunately all the support for science is adverse to it. At the beginning of the 20th Century there were quite a lot of wealthy people who were willing to use their own money here in Cambridge and elsewhere, to study the paranormal. They didn’t have to get grants from the research councils, which on the whole you only get through positive results. Negative results are just as interesting in this field. I’m sure that there is a vast amount to be discovered in the study of the paranormal in relation to human behaviour which causes one to, at the very least, have an enormously open mind on all the biological miracles, even of rapid healing, simply because there is so much yet to be discovered about the influence of mind over matter.

Peter Lipton: I wanted to raise a general difficulty I have with belief in the miracles. For miracles to perform their theological functions requires a difficult balancing act. On the one hand, the miracle has to be sufficiently remarkable. If it is too mundane then it just won’t work, it will be just something else that happened in the world, not something that points to divine power. So the miracle has to be sufficiently remarkable; but it cannot be *too* remarkable, because if it’s too remarkable then we will not have good enough reason to believe that it actually happened. So a

balancing is required and, Colin, I thought that you handled that balancing act in a particularly elegant way, at least for the non-biological miracles, by saying that the miracle is not a violation of the laws of nature, so it is not too remarkable; but it is remarkable enough, because of its timing.

But I think there is still a question about whether there is a gap between *not remarkable enough* and *too remarkable* and I think the problem is especially acute because of the nature of the evidence involved. The evidence is testimonial and that creates problems on both ends. It creates a problem on *remarkable enough* because for you the remarkableness is the coincidence, but if your evidence is testimonial then of course your evidence is selected. You are not told everything that happened and would not be surprising that the things you tend to be told are the more coincidental things, the more remarkable things. So in fact it may, if you had a fair sample of everything that happened over a very long period of time, not be all that remarkable that certain coincidences occurred in a very large population. So that is a problem I have on that end: the miracle may not be sufficiently remarkable.

On the other end, the worry that the miracle is going to end up being *too* remarkable, too remarkable to believe, goes back to a point in Hume's notorious discussion, 'On Miracles'. Hume did think, as Denis pointed out, of miracles as violations of laws of nature, but I think some of his argument would apply also to your account of miracles. For if the coincidence is sufficiently remarkable then the rational thing may be not to believe that it actually happened. The way that Hume puts it is you should only believe in a miracle on the basis of testimony if the falsehood of that testimony would require a greater miracle, and Hume held that that condition could never be satisfied. Hume was not saying that miracles are impossible; rather his point was epistemic. He was saying we could never have sufficient reason to believe that they did occur, even if they did, since the balance of evidence would always have to point the other way. My worry is similarly that if something is amazing enough to be a miracle, then it is too amazing to believe. That is, there may be no space between *not remarkable enough* to be a miracle and *too remarkable to believe*.

Denis Alexander: I was going to make another not unrelated point because I think, just going back one step, that it's worth emphasizing that a Christian miracle is not just some weird and wacky event that suddenly happens in isolation. It happens in a historical context and it becomes a Christian miracle or a Jewish miracle by the fact that it is a particular sign of God's grace in and for a particular situation, an emphasis we find particularly in John's gospel. The miracle has a message, it has content. I think, therefore, that this presents a concept of a miracle that is rather different from the kinds of examples that that Pat was referring to, when an individual, who might not believe in God at all, claims to have some kind of power which they are seeking to exert which then brings about a miracle. So I think the metaphysical framework, the big picture one lives in, makes an enormous difference to how one handles evidence and whether events are or are not counted as believable.

Now personally as a biologist I have absolutely no problem at all with the healing miracles of Jesus. The reason for that is not at all because I know how they were done – I haven't a clue how they were done – but because of the context of my Christian belief. If Jesus is the Son of God, through whom the world was made, it's not a problem for Jesus to do anything – He can do what he wants. So in a sense, the framework in which I tackle this question determines my view of the believability of what happened. You may say that's a circular sort of argument, and in a sense it is – it involves accepting a world-view, a metaphysical package – but that's what we do in science the whole time. There are extraordinary things in science which I find extremely difficult to believe, especially from physics. Cosmologists tell me that the whole universe was at one point just after the Big Bang, contained within a space the size of this table or even smaller. I find that strictly unbelievable, much more unbelievable than the virgin birth. In other words the believability of things depends a lot on the context and whether we have become accustomed to

it or not. John Donne, the Dean of St. Paul's Cathedral, made a related point in a sermon which he preached there on 25 March 1627:

“There is nothing that God hath established in a constant course of nature, and which is therefore done every day, but would seem a Miracle and exercise our admiration, if it were done but once; Nay, the ordinary things in Nature, would be greater miracles than the extraordinary, which we admire most, if they were done but once ... and only the daily doing takes off the admiration.”

Brian Heap: Yes, but as a scientist you still ask questions about the science even though you find it remarkable and you're suggesting that you wouldn't ask Jesus how do you do this, how does this happen? It seems to me you're suspending the importance of asking questions about how and why this happened by simply saying “Well, I just believe in Jesus as the Son of God, so I just take that as it is”. That is one position – but surely as a scientist you don't find that very satisfactory, do you?

Denis Alexander: It was the late Nobel prize-winning immunologist Peter Medaware who used to talk about science as the ‘art of the soluble’. If today someone claimed that blood miraculously emanated from the stone statue of a saint regularly at lunchtime on Fridays in some medieval town in Italy, then this is clearly a testable hypothesis. You could go along next Friday and take a sample and if it didn't contain haemoglobin then it's not blood. And if it did, then you might want to poke around in the statue a bit and find out where it was coming from. So the claim, at least, lies within the domain of the potentially soluble from a scientific perspective. And it is certainly true that the domain of the soluble expands as science itself enlarges its explanatory capabilities. A century ago, discussing what the other side of the moon looks like was not within the domain of the soluble: now it is. In contrast, historical events are unique and unrepeatable by definition. So I would suggest that the mechanisms involved in the healing miracles of Jesus, for example, lie beyond science – they do not lie within the domain of ‘soluble events’ for the simple reason that we have no way of investigating them. Of course with the passage of time it is possible that new discoveries in biomedical science might shed light on some of the healing ministries of Jesus, just as our greater understanding of reproductive mechanisms has shed some limited light on the possible mechanisms involved in a virgin birth, but we would never know for sure that our guesses were relevant because we could have no access to the healed individuals. This is a very different situation from contemporary claims of healing where we can investigate thoroughly and see if the claims stand up to critical analysis. Also, as Colin points out, the healing miracles of Jesus are in a somewhat different category from the Exodus miracles that we were hearing about tonight, for which some of the historical and geographical detail provided in the accounts helps to construct a convincing explanation of how the miracles may have occurred. There is no parallel set of data to help us understand how the healing miracles of Jesus took place.

Certainly with the virgin birth we can come up with pretty good models about how virgin births can happen, so I think I agree with you there are some things we can have a good go at but there are other things where, at the moment, we just don't have the methods to know and therefore we come up to a certain barrier at that point.

Colin Humphreys: I agree with what Denis says. Peter Lipton made the very good point that Hume basically argued that you can never have sufficient reason to believe that a miracle did occur. I would say in answer to that, if you consider the water from the rock miracle, if the story had been made up – and the main options are that it's either a miracle or it's made up – then wouldn't the writer have said that Moses commanded the rock to bring forth water, or Moses rubbed the rock's surface with snake oil, to take an expression from Richard Dawkins. But the story said he struck the rock with his staff and the scientific explanation of obtaining water from a rock demands that sort of blow to crack the crust on the rock. So it seems to me that if you

understand the possible science behind the miracle then this suggests that the story is true, and that Hume is incorrect here.

If you then take the crossing of the Jordan, the fact that the writer said the water was stopped upstream at Adam, which we know is where subsequent earthquake-induced mudslides have occurred, then this is a key geographical point which to my mind gives considerable veracity to the story of the miracle. I would argue here against Hume, that in this case we do have sufficient reason to believe the miracle did occur. So it seems to me that a scientific analysis of miracles brings forward points which theologians may not have considered, which give reason to believe that at least some of the biblical stories are plausible as miracles.

Peter Lipton: In the case of the rock, it is not clear to me. I think that may fall to the other end, that it ends up on your account *not* being sufficiently remarkable because it is something that, just as a boy scout, Moses could have done.

Simon Mitton: I want to build on Colin's theme, which I like a great deal, that some of these miracles with their scientific explanations – that reading you can put on it – and I think this is where science can make a real contribution. To use your expression, this indicates that it wasn't all made up, as a stream of consciousness stuff which the book of Mormon certainly is. Do you agree? An area which I've looked at, which won't surprise some people round the table, is I'm very interested in the narrative of the nativity, which like some of the things you spoke about is actually only a few sentences and since you did your work on that 20 years ago, has been built upon by others.

The extent to which modern astronomy can give a natural explanation of remarkable phenomena in the sky is actually very interesting, because if you were writing what these days we would call a novel or a story, and just made up comets doing this and doing that, then it would not be possible to say today OK in 6 BC and 7 BC the following things really were happening in the constellation of Aries and observable things were standing still and so on and so forth. The phenomenology has been remarkably well explained, perhaps five years ago now, so that to me is very interesting, to me that indicates that the nativity story is not a fairy story, as it were. Of course there are other astronomical phenomena in the Old and New Testaments such as eclipses, particularly the eclipse which may have coincided with the crucifixion that has been modelled with astonishing detail taking into account the slowing of the rotation of the earth in the last two thousand years, so that the eclipse takes place in the Holy Land rather than taking place in the Atlantic Ocean, and so on.

This is an aspect of your work that I really admire, that you're bringing the scientific method to certain kinds of incidents and saying this illustrates that the narrative is informed by things that really happened. That's what I really like about your work.

Bob White: I am going to ask Alan and Lydia next, and after that perhaps some of the younger people may like to give their comments.

Alan Windle: I thought there were some extraordinarily perceptive questions from the floor earlier this evening. One of these really touches to some extent Peter's point and that is that in exploring the physical explanation of the Old Testament miracles which you illustrated in your book, we can see rational scientific explanations behind them, especially when one reads the text properly. But that perhaps you hadn't explored with quite the same diligence the issue of analyzing the time issue which was the miracle part. There is the point that Peter makes very clearly that it has to be sufficiently unusual to be recorded at all. There is the issue – the children of Israel were in the wilderness for forty years at a time obviously of some volcanic activity – things were going to happen to them, odd coincidences to use the word, and these are the things that are going to be written about. I'm very enthusiastic to encourage you to apply the same

scientific method to the analysis. I suppose there are statistics in there, in terms of things happening in time and what it is that actually makes something special. Really I think I'm echoing Peter's point to encourage you that there's scientific method in looking at coincidences in time.

Lydia Jaeger: Picking up on Denis's comments and partly on Peter's comments, I really think that we need to work more closely on the larger picture and I wonder if a kind of multi-level view of natural laws isn't the best approach to the whole issue of miracles. We have only been speaking about science but this is a very reductionist view, as if there were only one layer of explanation, and so my suggestion would be that there are physical laws but there is also a biological area which is different from physics – and then also perhaps there's a psychological area, where faith healing might play a role. Why shouldn't there be a kind of spiritual or religious area, which would not be in contradiction with the lower levels but still significantly different? Miracles would not be against natural order but would be events that would only find an explanation in this higher-order reality. There are phenomena in the biological or psychological world which are very difficult to explain on a physical level, but we no longer realize it because we are used to these phenomena. For example, we haven't a clue how to explain human thought in terms of physics. Why shouldn't a more open-ended reality with different layers be able to accommodate a real miracle which doesn't have a physical explanation, but which is still not in contradiction with the natural order? In addition, I must say that I wouldn't like any physical explanation or biological explanation of the resurrection of Christ. If somebody came out with an explanation and said this is how the event happened, and then for example would be able to reproduce it, I would think they would go against the theological meaning of the miracle. This kind of reasoning doesn't apply to all miracles. I'm quite happy with a physical explanation of some miracles because there are miracles in the biblical text which are represented as miracles through natural means (as the crossing of the Red Sea, where the Biblical text speaks of a strong wind). But I wouldn't be happy with a natural explanation for all miracles. I think you really need a distinctive religious or divine realm that is not reducible to physics, if you want to stay inside the traditional Jewish or Christian faith.

John Hilber: I appreciate what Lydia's saying about the resurrection. From a theological standpoint there is one event in human history, time-space, when the future breaks into the present and that's the resurrection. There's a biblical expectation of a whole new creation and order of things, principles perhaps even at the level of physics and biochemistry, and those things are expected in the future when the travail of creation is lifted (anticipated in Romans 8.) The resurrection was a time when that miracle of the future breaks into the present. So I say explore all you wish for a naturalistic explanation that may be the secondary cause where God is the ultimate final cause, but that miracle, I think, is something that has really to stand on its own as unique.

Pat McKeown: Are you saying that because you want to believe it?

John Hilber: No, I'm saying that is because the biblical witness speaks of the resurrection as that kind of miracle. I'm not trying to dissuade anyone from exploring or trying to explain it naturalistically. In fact I had a professor once – calling things back from twenty years ago, theology's not my area now, it's Old Testament studies – who was aware of naturalists who believed in the resurrection and they would say that we just need to re-describe the laws of nature and accommodate some kind of spontaneous resuscitation of the dead person. So there's nothing illogical about being a pure naturalist and believing in resurrection, there's nothing philosophically illogical about that, but the biblical expectation is that the resurrection is something that's truly miraculous.

Let's muddy the waters even more. I recall an apologetic argument from the early church on the issue of the eclipse at the crucifixion. The miracle was explained away as a natural solar

eclipse, and the Christian comeback was that no, this happened during the Passover, there was a full moon and (at which time there could be no natural eclipse). So the inexplicable nature, naturalistically speaking, of that event is critical to the witness that it makes to it.

Another example comes from the Exodus story. Even the Egyptian sorcerers were able to parrot the work of Moses up to the plague when he takes the immaterial dust and creates life with it, if you will. The sorcerers themselves, according to biblical tradition, recognised that this was the finger of God. There's a different class of miracle happening here if I could use that terminology. So I think the biblical witness resists at some point of naturalistic explanation as a secondary cause in many of the events.

Alan Roberts: I want to make the point that I feel that as scientists we can get confused between whether we're trying to explain the universe or really describe it. As a Christian as well myself, I feel that God is the explanation for absolutely everything that happens, that he's constantly interfering in the world and makes it happen in the way it does. Often, most of the time, it seems to follow what we would describe as natural laws. For example, Einstein said that the most incomprehensible thing about the universe is the fact that it's so comprehensible. I think that that's in many ways a witness to God, the way the God of the bible describes the universe but also going along with that, it doesn't mean that what we would call miracles – things that happen outside of what we can describe scientifically – can't happen, because the observations we are describing with scientific "laws" do not take into account that which hasn't yet occurred and are based on axioms that are "artificially" introduced into scientific method. The biblical description is that it is God makes the whole thing work, for which an ordered universe that appears to follow laws is a testament to. Our living inside the universe means there is no way we can know the "why" simply by observing it from the inside.

Paul Shellard: I don't have much to say except to comment that I like the use of the word "singularity". In general relativity, singularities are where you get to a state of infinite density and the known laws of physics break down and indeed singularities out of which came the whole universe, the big bang singularity. There are black holes and theories in which maybe universes can appear out of singularities, so even though they appear localized they can have an enormous extra-dimensionality and significance to them.

Jonathan Doye: One thought I had is that the favoured view here seems to be that miracles of timing are easier to think about than miracles where natural laws are broken. But in some sense I see miracles of timing as being more difficult, because they require a stronger view of God's providence. To achieve miracles of timing God has to have a more global control over events in the world, whereas if you have a miracle in which a natural law is broken, you can envisage God just giving a local "kick" to the world in order to achieve the miracle.

Soraya Newton: Just a general comment, based on the issue of being a scientist and a Christian at the same time. Sometimes you feel as if you're being torn into two because unless I have it wrong, I guess that the essence of faith in being a Christian is just believing without needing an explanation. I believe in the resurrection because it's in the Bible, because it's what's been said to me, and as a scientist that's probably not sufficient for me. There has to be a line or a meeting point between the two so that you can reconcile both of them and say 'OK I'm satisfied as a scientist but at the same time I'm satisfied as a Christian', and where is this?

Geoffrey Cook: I would like to say two things. As a scientist I'm very grateful to the disciple Thomas because he was the one who demanded to see the evidence. The other thing I would say is that as we understand it the Gospel portrays the resurrected Christ as somehow different - he didn't seem to obey the laws of nature in that he could go through closed doors, so in a sense he'd been released from those natural laws and that's something that we haven't touched on tonight in discussing the use of science to investigate miracles.

Jason Fletcher: I have a question in my own mind regarding the relative strength of arguments from miracles for God's existence, as opposed to other arguments for God's existence. Although there are outstanding questions (such as Professor Humphrey's willingness to admit of non-miraculous irregularities in nature, i.e. flukes) I think what Prof. Humphrey's has said in his lecture goes a long way toward demonstrating that an argument from biblical miracle stories for God's existence has currency. Particularly he has restored a sense of confidence in the authenticity of biblical story telling. If those stories are true, the miracles to which they bear witness demand a response. I am thankful for Prof. Humphrey's contribution to the debate.

Bob White: There are a lot of comments you could respond to, Colin!

Colin Humphreys: Let me be brief! Concerning the crucifixion eclipse, which both Simon Mitton and John Hilber brought up, an early suggestion, as John says, was that there was a solar eclipse at the Crucifixion. However, this is scientifically impossible at Passover time, which occurs at the full moon. Graeme Waddington and I then showed in our 1983 *Nature* paper, using astronomical calculations, that there was a *lunar* eclipse on the most probable date for the Crucifixion, and Simon Mitton referred to this. There is biblical and non-biblical textual evidence for a lunar eclipse on the evening of the Crucifixion. If this is accepted, then it is another remarkable miracle of timing.

A comment was made about Egyptian magicians doing similar things to Moses and Aaron up to a point, and that's certainly what the book of Exodus reports. For example, Moses and Aaron had a snake which turned into a rod and then back again to a snake, and the Egyptian magicians did the same thing. If you read ancient Egyptian literature you will find that the Egyptians were experts in snake charming – it's one of the things they practiced. They had snakes that somehow they trained to become rigid like a rod. The Indians also have some expertise in snake charming. So this was maybe a trick that Aaron and Moses had learnt and then the Egyptian magicians did the same trick, but then Aaron and Moses moved on to things which the Egyptian magicians couldn't do.

Yes, I'm grateful to Paul for making his point about singularities. Singularities have huge significance and, as Paul says, the universe arose from the big bang singularity. It is therefore not inappropriate to describe the epoch-making event of the Resurrection as a singularity.

John Bradfield: On the particular point, could we ask Colin to comment on the aspect of science getting lost in the very big and lost in the very small whilst in the middle, laws work reasonably well. One can't help feeling that the very big and very small either don't work at all, or people simply haven't elucidated it, or they are constantly changing their minds about it. Some miracles do seem explicable if one wants to explain them on the grounds that they are based on the very large or the very small, or do very few miracles fall into those possible areas of physics? I haven't thought about it enough and you've obviously thought about it more than any of us.

Colin Humphreys: I think this is a good point. A good example of a well known physical law not working on the very small scale is Ohm's Law, $V = IR$, which doesn't hold for very thin wires because of quantum mechanical effects. In addition, if you regard the very big as something tending asymptotically to infinity then these things are hard to deal with mathematically. Maybe the healing miracles are a bit like this, and involve new regimes of science.

Ellen Nisbet: I've just had a thought on that. I've talked to friends from India and they told me about miracles that they've seen and believe. However, the scientists predominantly seem to be in Cambridge and miracles are in India. Maybe if we prayed a bit more and had a few more miracles in Cambridge or we sent a few more scientists to India, we might actually have a better idea of what's going on.

Colin Humphreys: Yes, It would be very good to send some scientists to India to study the miracles reported there. Coming back to Soraya, she said that the essence of faith is believing without needing an explanation. In a real sense that is true. However, we are asked to worship God with all our mind and Paul talks about our faith as being a reasonable faith. I think if you are uneducated, then having “blind faith” may be fine. But if you are fortunate enough to be well educated, then your faith needs to be a reasonable faith, and when we believe we should not close down our mind. As Soraya says, you have to be satisfied with your beliefs both as a Christian or Jew, and as a scientist (or historian, etc.) Having said that I think most people here who are Christians or Jews would say there is a leap of faith in belief, but it is something which does not go against our scientific beliefs,

Finally, let me take up the points which Jonathan Doye and Lydia Jaeger made. I take the point that miracles of timing, in which God acts in, with and through nature in a sense require a stronger view of providence than miracles which we cannot (yet) explain, like healing miracles or indeed the Resurrection. However, they are all the work of God if you are a believer.

Bob White: Thank you very much, Colin. I’m afraid I’m going to have to call a halt. Thank you very much for all your contributions and please give Colin a round of applause.

Colin Humphreys: I have greatly enjoyed this discussion which I believe has raised some key issues. One of these is how God “arranges” miracles of timing. Another is the whole area of the healing miracles, and what modern biology may have to say about these. Perhaps this would be a good topic for a future talk!

WHO’S WHO

Professor Colin Humphreys is the Goldsmiths’ Professor of Materials Science at Cambridge University, Professor of Experimental Physics at the Royal Institution in London and a Fellow of Selwyn College Cambridge. He is also the Director of the Rolls Royce University Technology Centre at Cambridge on Ni-base superalloys for turbine blades for aerospace engines, and the Director of the Cambridge Gallium Nitride Centre. He became the President of the Institute of Materials in January 2002. Prof. Humphreys has written and lectured widely on the subject of science and religion and his latest book is *The Miracles of Exodus: a Scientist Reveals the Extraordinary Natural Causes Underlying the Biblical Miracles* (Harper Collins, 2003).

Denis Alexander, Fellow of St. Edmund’s College and Chairman of the Molecular Immunology Programme, The Babraham Institute; Editor of the journal *Science & Christian Belief* and writes/lectures on science and faith. Author of *Rebuilding the Matrix* (Lion).

Christopher Ash, Rector of All Saints, Little Shelford. In September 2004 he is to become Principal of the Cornhill Training Course in central London; this course equips preachers to teach the Christian faith from the Bible. He has Degrees in Engineering from Cambridge and Theology from Oxford. Author of *Marriage: Sex in the Service of God*.

John Bradfield, a former Bursar of Trinity College, Cambridge and founder of the highly successful Trinity Science Park. He is a former Chairman of Addenbrooke’s Hospital, graduated in zoology at Cambridge, and is to be found in Trinity most days.

Geoffrey Cook, Vice-Master St. Edmund’s College, Department of Anatomy, Cell Biologist and Biochemist.

Jonathan Doye, Royal Society Fellow and member of the Department of Chemistry, University of Cambridge.

Jason Fletcher is the Manager of the Jubilee Centre, has an M.Phil degree in church history and is a former teacher of RE; interested layman.

Brian Heap FRS, Master of St. Edmund's College, Cambridge, former Vice-President and Foreign Secretary of the Royal Society, former member of the Nuffield Council on Bioethics, member NATO Science Committee, Brussels; endocrine physiologist.

John Hilber received his B.S. in Geology from the University of Washington, followed by a Th.M. in Semitics and Old Testament studies at Dallas Theological Seminary. After 15 years of pastoral ministry he recently completed Ph.D. studies in Old Testament at Cambridge and starts as Associate Professor at Dallas Theological Seminary in July 2004.

Lydia Jaeger holds a permanent lectureship and is academic dean at the Institut Biblique de Nogent-sur-Marne, an interdenominational Evangelical Bible college near Paris, following postgraduate studies in physics and mathematics at various European Universities. She is an associate member of St. Edmund's College and is currently completing her Ph.D. thesis in Philosophy at the Sorbonne.

Peter Lipton is Professor and Head of the Department of the History and Philosophy of Science at Cambridge University and is a Fellow of King's College.

Pat A. McKeown was Professor Emeritus at Cranfield University in High Precision Engineering and Nano-technology and is now retired. Having always had intensive interest in Christianity (member since childhood of a succession of Protestant churches) and in other religions and philosophies, is now a Humanist.

Simon Mitton, Fellow of St. Edmund's College, former Head of Science, Cambridge University Press, astronomer.

Soraya Newton is a fourth year student at St. Edmund's College studying for a PhD in Physics.

Ellen Nisbet is studying for a PhD in Evolution, Dept. Biochemistry, Cambridge.

Alan Roberts is a Geophysics PhD student studying the North Atlantic Margin. He is also a Christian attending the Round Church in Cambridge, is heavily involved in cross-cultural ministry and also very interested in the relationship between Christianity and science.

Paul Shellard, Department of Applied Mathematics and Theoretical Physics, Cambridge.

Bob White FRS, Professor of Geophysics, Fellow of St. Edmund's College. Leads a research group investigating crustal structure of the Earth, earthquakes and volcanoes. Co-author with Denis Alexander of *Beyond Belief: Science, faith and ethical challenges* (Lion, publication in March 2004).

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