NOTES ON SCIENCE AND SCRIPTURE

Introduction

Can science and Christianity both be true? Our culture today sees them as offering opposing ways of explaining the world and opts for science. The issue of their relation has arisen only in the last 300 years with the growth of scientific understanding.

Science and religion are distinct. Do they reflect the difference between material and spiritual; or natural and supernatural; or reason and faith (seeing and hearing); or *how* and *why*; or between reductionism (taking things apart conceptually) and holism? There is truth in each of these contrasts, but none is wholly accurate. Furthermore I shall consider mainly the relation between science and the Bible, because I am a Christian and a scientist, and the scriptures of the world's religions are incompatible.

Science is the study of order in nature – of patterns put by God in his creation. So science doesn't mention God: it is *secular* (though not secular humanist, for it does not deny God). It is also silent about what things are for, about purpose. In contrast the Bible was written by the creator, who understands what things are for and who is concerned with redeeming his creation. The Bible was written to be understood by people who knew nothing of science, and it is about the relationship of God to man and the rest of his creation. It tells a remarkable story, but it is not a science textbook. It teaches us how to go to heaven, not how the heavens go (as Galileo, echoing a Cardinal of his time, put it). That God "set the Earth on its foundations; it can never be moved" (Psalm 104:5) and that "the sun rose" (Genesis 32:31) does not imply that the sun moves about the earth; here, science forced a rethink of the meaning of scripture. When Galileo then took up Copernicus' insight, he was a 17th century Catholic who wished his church not to make dogmatic statements on such technical matters, to prevent it from looking foolish. He failed, due perhaps to his fondness for satire, and his church threatened him. Geocentricity holds spiritually, not materially.

Although science and theology are different, they overlap, for there are subjects about which both have things to say. There they are largely in harmony. Many such clashes are really between philosophy, which is Greek in mindset, and theology, which is Jewish in mindset and sees the knitting together of spiritual and material in human life as a good thing. The harmony of science and scripture is because both have the same source in God. They are at odds, however, over miracles, as the philosopher David Hume emphasised in the 18th century. A miracle is an action which violates the scientific laws of nature – the software by which God puts order in his creation. Those "fixed laws of the earth and the heavens" are referred to by the prophet Jeremiah (33:25-26). Although this definition of miracles presupposes absolute knowledge of scientific law, you don't need scientific education in the laws of gravity and displacement to know that miracles took place when Jesus and Peter walked on water, and Peter began to sink as his faith wavered (Matthew 14:25-31). We need our knowledge of the world in order to make sense of the scriptures, for words do not take their meaning from a dictionary (which is merely other words), but from their use by humans as labels for the things they perceive in the world. Other miracles include

Jesus' virgin birth and his resurrection after his very public death. We also read of the turning of a staff into a snake (Exodus 4), and the survival of men thrown into a furnace so hot that its attendants died of their burns (Daniel 3). God achieves his purpose mostly through the mechanisms he has created, or by the timing of 'natural' events, but sometimes he wants to get our attention. It is also possible for angels to perform miracles (including fallen angels: Revelation 13:11-15).

Miracles are rare in the churches of our civilisation, and many churchgoers in Britain probably don't believe they can happen – which is precisely why they don't happen in these churches! Jesus said that strong faith in God is needed to do miracles (Matthew 17:20). People who aren't prepared to say that they don't believe biblical accounts typically talk about "re-interpreting" the accounts of miracles, although eleven of the disciples were martyred for their belief in Jesus' return from the dead; who would maintain a hoax under threat of death? Others say that God did miracles to give the church a good start but does not do miracles today, and they distort scripture (especially 1 Corinthians 13:8) to back this up. But if you look at the stories of Brother Yun (a persecuted Christian leader in China in the 1980s and '90s) or Richard Wurmbrand (a leader of the underground church in communist Eastern Europe after World War II) then you read of miracles of the sort that Jesus did, and his disciples did in *Acts*. Brother Yun went without food or water in prison for more than two months yet nobody can survive without water longer than a few days. You cannot 'reinterpret' contemporary accounts! Some Western Christians are so hungry for miracles that they use a looser meaning of the word than the Bible does, or seize on anything that might be miraculous. It has not helped that many accounts of miracles from the Middle Ages are questionable. We should simply look to Jesus, since if we keep faith then miracles will follow us, rather than us following miracles.

The age of the universe, the earth and life

Astronomy and physics indicate that the universe is getting bigger. (Don't suppose that the universe is expanding into a void beyond itself, for the universe *is* everything. The expansion manifests as an increase in measured distance between objects.) By using the observed rate of expansion and size of the universe to work backwards, guided by Einstein's general theory of relativity which relates mass, space and gravity, we infer that the universe grew from a speck in size thousands of millions of years ago (and perhaps from an actual point a little farther back, but we need to know more physics to be confident of that). The universe has since expanded to what we see today; scientists call the explosive early stage of this expansion the 'Big Bang'. Science and scripture accord that the universe had a beginning. (Buddhism, acknowledging no creator, holds that there was no beginning.) You cannot laud Einstein and disparage the Big Bang. Einstein also showed that time and space are related. Just as space is part of the creation, so is time. God created time, which is why he is sovereign over it. Philo of Alexandria, a Jewish writer (*On the Creation* VII, 26; 1st century) and Augustine of Hippo, a Christian (*City of God* XI, ch.6; early 5th century) understood this fact, reasoning from the motion of created objects, although they obviously did not understand the details worked out by Einstein; here, science has shed light on theology. Asking what happened before the Big Bang is very like asking what is north of the North Pole. (The same wrong thinking is clear if you ask when God created time or where God created space.) It is meaningless to ask

what God was doing before he created the universe, because *before* is a time-word. His name *YAHUWEH* is a verb meaning 'eternal' or 'forever', and his ways are not our ways – Isaiah 55:8. (The best response to the 'who created God' paradox also comes from this point: the question is predicated on a notion of causality that involves time, but this is a false premise.) Regarding space, space is not nothing since it has a certain number of dimensions, whereas genuine nothing would have no attributes at all. There is also a difference between space and time: we can choose where to move in space, but we have no choice what our wristwatches do: they advance.

Geological science supports this timescale, indicating that the earth is 4.5 thousand million years old. Arguments include the slow rate of deposition of sedimentary rocks, the slow rate of cooling of the cores of mountainous regions, and the slow recession of waterfalls upstream by erosion to create gorges. The best evidence comes from the diffusion rates, combined with the decay rates and chains of decay products, of those 'elements' – the various species of atom which are the building blocks in all chemistry – which split into smaller atoms in radioactivity. From their relative abundances we can deduce when the rock containing the elements solidified and diffusion ceased. Furthermore, these heavier elements, in particular carbon which is the basis of the complex ('organic') molecules needed in all life forms, were made from simpler elements in the heat generated when certain types of star explode; such 'supernovae' happen only after the star has shone for thousands of millions of years. Finally, from the shape of the coastlines of the Americas and Africa/Europe (and also from fossil evidence) they were clearly once adjacent; the fit is even better below today's sea level. The Atlantic Ocean is presently widening at about one mile every 30,000 years (the rate has been measured), so that to reach today's width would take tens of millions of years. That is late in the thousands-of-millions of years timescale, but it again demonstrates that the earth is much older than a few thousand years.

So astrophysics and geology both point to an ancient date for creation – unless God deliberately put misleading evidence in his creation and gave the entire universe false memory syndrome. God is not capricious. How are these findings reconciled with the six-day account in Genesis, with man created on day 6 a few thousands of years ago if the genealogies in Matthew 1 and Luke 3, and the family relations and ages of individuals in Genesis, are meaningful? The Hebrew word for day (*yom*) need not mean 24 hours, but 'age' or 'epoch' or 'era' as it can in English ("the day of steam is over") and as it must in Job 15:23 & 18:20. Also, the pattern of "6+1" is not unique to *yom* because it is applied to years in Exodus 23:10-11 about land cultivation. God's scale is so much greater than man's (Psalm 90:4), since God is so much greater than man. *Yom* can also, like 'day', mean the daylight hours, contrasted with night (as in Genesis 1:5a). The usual translation is "there was evening and there was morning: day two" (Genesis 1:8; similarly for the other days), but this verse comes *before* the sun – which governs evening and morning – appears (1:14), and the Hebrew can equally well mean "there was a disordered mixture and there was supervision: the second era." Ancient Hebrew wrote only the consonants, so that different vowels inserted give different meanings: *boker* is morning, and *bakara* is supervision as in Ezekiel 34:12. The root of the word for evening can also mean a disordered mixture. Each day shows a transition from darkness to light due to God's ordering work. The Sabbath day of rest after six 24-hour workdays is inspired by this account, and I believe the double meaning between evening/morning and disorder/supervision (noted by the

mediaeval Jewish scholar Nahmanides before modern science) is deliberate. Unlike the double meaning of *yom* = day it is untranslatable into English, however.

Now let us look at the six 'days'. God created the heavens and the earth (Genesis 1:1). This could equally well mean that God created space and matter, or that he created the spiritual realms and the physical realms. Or all of these meanings! The earth was without structure and empty (1:2), and this is the key to what happened next. An unspecified time after came three *yom* in which God imposed structure by differentiating light from dark, then above (sky) from below (sea – in fact God moving "over the waters" in 1:2 could equally well be translated as "above the heavens"), then land from sea. Then came three *yom* in which he filled the emptiness, populating the heavens with stars, the sky and sea with birds and fish, and the land with animals and humans – with life, in all its diversity, activity, intricacy and tenacity. In context, Genesis 1:2 is best translated as "the earth was unstructured and unpopulated." There are no gaps between these six *yom*, for only after them did God rest (Genesis 2:2). Scripture also distinguishes notions of time, *chronos* and *kairos* in New Testament Greek. *Chronos* is clock time, *kairos* is time ordered by significant events, notably God's actions. These are not the same, for according to scripture a thousand years to God can count as a day (Psalm 90:4). At the start of Genesis, for instance, a few verses cover millions of years, but later in scripture certain events in human history are described in detail. The long delay before the coming of man brings to mind a master chef, who puts in the right ingredients and then cooks them to bring forth a masterpiece. Time is of less significance to God (who created it) than what emerges as the climax of the process. In Genesis 1 the account of the days is theocentric, and where a 6 * 24 hour creation has put people off, there is good news.

Genesis uses a particular Hebrew word (*bara*) for 'create': when God creates the universe (1:1), animal life (1:21), and man (1:27). We discern a hierarchy here, taking effect in God's command that man should steward the earth and its creatures (Genesis 1:28). God was prepared to snuff out almost all land animals and birds to make his point (Genesis 6:13 & 7:22-23; the Flood narrative is discussed below in an Appendix). The relation of man to animals raises the hottest topic in the science-religion debate: evolution, especially human evolution. Certain traits within an interbreeding population are inherited from parents (such as skin colour in humans); and some traits obviously help an individual to reach breeding age and then breed in certain environments, so that those traits become more common down the generations if that environment persists. The issue is not whether this 'Darwinian' mechanism operates; it certainly does as hospital bacteria develop immunity to antibiotics. Rather, the issue is whether this mechanism is consistent with the Genesis account, and whether it explains all life today (including humans and the existence of distinct animal species) and explains the traces of past life on earth. In fact this mechanism explains a great deal, and the family tree of life-forms inferred from anatomy matches the tree inferred from genetic patterns. But whether it can explain everything (including man) is scientifically open, for scientists simply do not know enough. It won't do for atheists to assert that there is no alternative because they have not thought of one; or for some fundamentalist Christians to assert that the mechanism is incapable of explaining something merely because nobody has worked out the details. The principle is so general that proving it was definitely responsible for something, or that it definitely could not have been responsible (as advocates of 'intelligent design' attempt), is subtle and difficult. It is rash to say that because science *hasn't* explained

something, it *cannot*. Nick Lane's books *Life Ascending* and *Transformer* show research filling in many gaps that some Christians have claimed unbridgeable; the pieces we have do appear to be parts of a grand jigsaw that fit together. Shorn of philosophy, the questions are: What would you see as you trace the ancestors of today's creatures back through successive generations; how do fossils fit in; and how do you explain what you see? These issues are considered in a (long!) Appendix below. The role of genes in reproduction, and the ways in which mutations occur at gene level, obviously relate to these questions.

If the evolutionary account is accepted then the *yom* (eras) must partially overlap, since land animals appeared on *yom*-6, but birds – which are held to have evolved from them – on *yom*-5. Indeed the creativity of each day is arguably still going on, only not in a way which is the dominant feature of its era from the human viewpoint.

Use of physics to probe backwards in time

How much can we learn by using physics to 'replay the movie' of the Big Bang backwards, starting from the present? Just as the physics of the everyday in which our intuition is schooled – Newton's mechanics – becomes increasingly inaccurate when objects reach speeds near that of light, and Einstein's relativity is needed, so will relativity theory applied to gravity become inaccurate at sufficiently high densities and temperatures. To 'replay the movie' of the Big Bang further back than that, a more accurate theory is needed. It must combine relativistic gravity with quantum mechanics, the theory that supersedes Newton's physics on the atomic scale and at very high densities of matter. Physicists have long sought to combine the two theories, since neglect of quantum effects must lead to imperfect prediction using relativity alone, and conversely. The result would be a theory accurate at every scale. But they do not fit together well; this is the research frontier today. So we cannot yet discuss what happens extremely close in time to the Big Bang. Much research goes on, but (contrary to popular reports) it is all speculative. And even if we find a better theory, that too might break down even farther back. I believe it is God who started the ball rolling, although I doubt that science will ever prove or disprove it.

Science and Western Culture

About 40% of scientists believe in a personal God (see the scientific journal *Nature*, 3rd April 1997, vol.386, p.435). This is near the proportion found in a 1916 survey (mentioned in the 1997 study, although 'personal God' does not necessarily mean the God of the Bible). Why so many? Science points to God, because there is beauty and order in the scientific laws of nature. ("Beauty is truth, truth beauty" – Keats.) Unlike the beauty of a landscape or a sunset you need training to recognise this type of beauty, but scientists recognise it, and great scientists often comment on it. What else could beauty in the cosmos (or elsewhere) imply, other than a creator who is interested in beauty and order? This is a 'design argument', since the universe exhibits aesthetic and other qualities that point to a Designer, as stated in Romans 1:20. (Some ancient Greek philosophers recognised this.) Scientists who are believers can explain the beauty they perceive. Other scientists see the beauty but cannot explain it.

Christians should not try to prove the existence of God to sceptics using design arguments or other logic. The philosopher Immanuel Kant argued that this was impossible. Romans 1:19-20 suggests otherwise, for Paul explains that argument is pointless because people are actually in denial. Scripture itself gives a design argument ("The heavens declare the glory of God": Psalm 19:1). If challenged to prove God's existence, I ask what would be acceptable as proof, or say that I know God personally. Discussions that follow are more fruitful than philosophical dispute.

In science, a researcher sees something that he or she he cannot explain, and ponders it, seeking a theory that can explain it; or a new scientific idea or theory has consequences that scientists hunt for. For faster learning, experiment should if possible be interventionist, beyond mere observation of nature (although observations using custom-designed instruments – which derived originally from technology such as navigation aids – can be invaluable): if I do *this* here, what effect does it have on *that* there, and why? And if I change what I do here, how does it affect what happens there, in quantitative detail? A dialectic exists between predictive theory and designed interventionist experiment. Interplay between theory and experiment is necessary because creation is an act of God and he might have done it differently. (Do not believe that 'God had no choice over the laws of physics.' Consistency arguments might single out one of a particular class of theories, but God has a wider choice of classes.) To see how things are we must look to the creation; it has a 'contingent' character. We are not so smart as to figure out what God did without looking.

Here is a simple example of the interplay from the early days of physical science. One can measure how long an object takes to fall to the ground from particular heights – measurement must be quantitative, which means painstaking. On a graph of the time, plotted against the height, you can put the points corresponding to his experiments. Then you can draw a curve through those points and use it to predict how long the ball will take to fall any other distance. A mathematician will recognise the graph as a simple curve (a 'quadratic' curve) and tell you the formula for it. After that you can use the formula to predict, with no further need for the graph. We also glimpse God's interest in elegance (why else should this curve be such a simple one?) and his intelligence. (Intelligence is a high form of pattern recognition capability, but God actually *invented* the patterns that scientists strive to discern and (with effort) replicate, although we cannot create even a simple flower: Matthew 6:28-30.)

Science matured in the culture most influenced by Christianity, Western Europe. Why? Christians, Jews and Muslims believe in an intelligent designer and therefore expect there to be underlying patterns – order and elegance – in nature, so they are more likely to look for these, whereas polytheists think in terms of capricious gods and spirits driving everything, whose actions they do not expect to be able to explain. Although the ancient Greeks were polytheists, they believed in a perfect order in the sky (not on earth), because planets and stars move with perfect regularity. This regularity, together with Greek mathematical expertise, meant that their astronomy (which does not involve interventionist experiment but merely observation) was superb. Their division between sky and earth was ultimately healed when Isaac Newton applied the same law of gravity to orbiting planets and falling apples.

Jews and Christians expect to find order and beauty because they believe that the creator is interested in these things and that, because they are in the 'image of God',

they can perceive the world as he really created it. (Muslims reject the claim that humans are in God's image, but although they reject this underpinning they see no reason why they may not perceive the world accurately.) This viewpoint underpins science. When scientists say they proceed by scepticism, they refer only to the results of science, while forgetting that they have a deeper commitment to the scientific method as a way of finding truth about the material world. Far Eastern views, in contrast, are monist and view all differentiation as illusion. Even though cultural attainment has been as high there as it was during the birth of science in Western Europe, the monist view does not motivate science. The doing of science is culturally conditioned even though its results are not.

Science – the interplay of theoretical understanding and designed interventionist experiment – did not get going in ancient Israel because that was primarily an agrarian culture. It did not get going in institutionally Christian early mediaeval Western Europe, which slipped into a decline from the 5th century in which few people could read or write. Science got going in the Renaissance in Western Europe after it had recovered. This raises the question of why it did not get going in Byzantine or Islamic civilisations, which contended around the eastern Mediterranean and were at their height while Western Europe was in its decline. They were lacking some crucial further ingredients. The first ingredient is adequate mathematics. To do more than very basic physics, the integrodifferential calculus is needed, and it awaited discovery (or invention) by Newton and Leibniz. Until very recently, mathematics and physics advanced hand in hand – as was exemplified by Newton – and so their histories in the era in question should not be told separately. (There was no revolution in biology until later; biology is not a science triggerable by mathematics or by better quantitative measuring apparatus, although in the late 17th century the microscope was as great an advance as the telescope had been nearly a century earlier.)

Secondly, to do an interventionist experiment you must first imagine it in your mind. (Good training of children to be physicists is to ask them to build models of things they are familiar with, using assembly toys.) Western Europe gained more practice at visualisation; geometric diagrams, maps and tree diagrams – such as family trees – were universal, but representational art was discouraged in Islam whereas mediaeval art flourished in Western Europe. Perspective was invented there. The falling cost of paper from the 14th century also encouraged the committing of mental imagery onto paper together with one's thoughts about it; every research physicist experiences the interplay of writing and thinking. Finally, a critical mass of interacting scholars was needed, which Western Europe possessed as universities grew, largely from monastic institutions – a transition that did not occur in the Byzantine world.

I doubt that everybody in mediaeval and Renaissance Europe was Christian, meaning personal commitment to Christ and his message of repentance – the place was too corrupt to match that description – but it is possible for people to believe that the Bible is factually true without heartfelt commitment to its message for the individual. That was essentially the situation in Western Europe. To get to science, its scholars had to dump the Greek notion that you must know what mass, force and so on *are* before working with them. Science learns what they are *by* working with them.

As belief in the existence of the God of the Bible has declined in modern Europe, so has the idea that patterns exist in nature. Choosing to work without invoking the

doctrine of the image of God, Kant, who was deeply interested in what humans could know, was unable to connect what our senses told us (including experimental data, which we read) with what the world was really like. By the 20th century many of the physicists of the new quantum theory were claiming that nature truly is random – a word that means 'unpredictable' but disguises the question: unpredictable by whom? (More fully: unpredictable on the basis of whose information? Different people have different information, and God has it all.) Einstein dissented from this view, suggesting that God does not play dice with the universe. (In fact God directs dice, for he sometimes directed Israel to seek his will via lots, as at Numbers 33:54.) This claim of randomness or indeterminism is known as the 'Copenhagen [mis]interpretation' of quantum mechanics; if you have heard of Bell's theorem it simply shows that any 'deterministic' theory going beyond quantum mechanics so as to predict with certainty must have startling properties: everything must interact with everything else undiminished by space, or time (backwards or forwards!) Somehow such interactions are masked in everyday life. Determinism is really an assumption that underlies scientific method: the assumption that there is an explanation. If, for example, the 19th century physicists who observed 'Brownian' jiggling motion of dust particles had supposed there was no explanation, we should still be working with 19th century physics and we would never have learned about atoms – whose collisions with the dust particles are responsible for the jiggling. Determinism is not appropriate to describe divine action, since God always has freedom to change his mind within time (see Genesis 18). God exceeds science.

I question the claim that quantum physics meshes with Buddhist views. Quantum physics is part of physical science, which developed in Western culture underlain by the biblical doctrine of creation, which is not compatible with other worldviews. Too much is written today supposing that science and religion are in the same league. (Quantum mechanics is held by some to be a New Age theory!) Science is not a gnostic way to God: you might learn about his tastes, but nothing about relationship.

Incidentally, so-called 'chaos theory' is deterministic. Consider two systems governed by identical laws, which start from slightly different configurations. The two systems might still look very similar after a long time, or they might look different after long enough. To say which, you need to know more about the law governing how they change as time passes. In the second case, you would need to know the *exact* initial configuration in order to accurately predict the disposition arbitrarily far ahead – and it is impossible to have knowledge to an infinite number of decimal places. If the law of change is 'chaotic' then initially similar-looking systems will quickly look different (technically, 'neighbouring trajectories in phase space diverge exponentially with time'). But it is still possible in principle to crank out with a computer what will happen if we know the starting disposition – and that is the definition of deterministic.

Science and the Wisdom principle

Proverbs 8 puts words in the mouth of a principle called *chokmah*. This principle "was appointed from eternity, from the beginning, before the world began" (8:23) and acted as "a craftsman at God's side" when God "marked out the foundations of the earth" (8:29-30). Is this a personification of the laws of physics? *Chokmah* is something that is also valuable in the human world (Proverbs 8:1-21), and the word is

translated as ‘wisdom’. Mediaeval literature personified joy and pride (for example), who would whisper into the ears of human characters, and this passage is wisdom *per se* speaking, just as the next passage (Proverbs 9:13-18) shows folly speaking. In closer detail, Proverbs 8 speaks of the works of God’s own wisdom. God’s wisdom is understood by St Paul to be Jesus (1 Corinthians 1:24) and, eternally, as the *logos* through whom everything was made (John 1:1-3; notice the relation to ‘logic’). Indeed it is through God’s wisdom that physical and moral laws were made; if physical law had been set up just slightly differently then life could not exist, while moral law (notably Mosaic Law) is an endless wonder to the faithful (Psalm 119).

In Proverbs 8, wisdom is portrayed with feminine characteristics, calling people to gain her and recognise her beauty. The process of coming to know intimately a body of knowledge has clear analogies with wooing. Wisdom’s femininity is also why scientists see beauty in the workings of the creation, and is behind the sexual metaphors used by Francis Bacon and other Renaissance men for the (then) new project of probing nature’s inmost secrets. There is a passion in the doing of science.

A comment on hermeneutics

The book *(Mis)interpreting Genesis* by Ben Stanhope, a Christian expert on pagan worldviews in the ancient Near and Middle East, as well as the book of Genesis, makes a decisive case that the ancients – *including the human author(s) of Genesis* – held incorrect beliefs such as the earth being a flat disc with a hemispherical bubble of air above it, beyond which is water. I believe that the Genesis account, being inspired by God, is insufficiently specific to state these errors unambiguously, and is capable of being understood retrospectively in a way that is consistent with modern science. (The meaning of *yom* is an example.) Stanhope concentrates on the similarities between the Genesis account and creation narratives from ancient Israel’s pagan neighbours – who accepted the hemispherical air bubble – but ignores the differences. The pagan accounts are more explicit than Genesis about the shape and constitution of the earth and heavens, in ways that are obviously wrong in the light of science.

Stanhope explains also that a dragon symbolises chaos in other ancient Middle Eastern creation stories, and is defeated by the Creator; this can be seen in surviving pagan imagery. There is no more reason to take the dragon from written accounts as a material being than from sculpted accounts, which are simply a cartoon strip telling the same story in stone.

Overall, then, unless you are committed to the truth of the Bible as the word for man of an omniscient and omnipotent God; unless you have an accurate up-to-date understanding of the science; and unless you are aware how creation stories were understood in the Ancient Middle East, then you are likely to blunder into a debate about which you know less than you realise. It is well to read before you speak.

Science and the Occult

‘Parapsychologists’ conduct scientific experiments to see if humans can identify hidden playing cards, and similar. Is that divination, which the Bible forbids? In

answering this question it is worth considering that, in the mediaeval era, much that we now know to have a scientific basis – such as heavier-than-air flight – would have been regarded as demonic. So how to advance scientific knowledge without risking interaction with demons? The answer is: don't interact with demons. Don't invoke them; don't talk to them.

Parapsychological experiments such as card guessing are legitimate in order to find out whether humans have such powers, but would be unethical if the subject is somebody liable to invoke spirits. It is now clear that humans do not have such powers. The best experiments are simple and watertight (actually infotight), and conducted 'double-blind' so that the experimenter does not know what result corresponds to 'hit' or 'miss' and cannot unconsciously lead the subject on. Chance results are found. Parapsychologists then propose more complex experiments that are more difficult to interpret. (Who is going to close down their own laboratory?)

It is possible for the forces of darkness to do things that humans cannot, but (quite apart from being prohibited) they are unlikely to do it with consistency, for man cannot bend Satan to man's will. If Satan is given free rein by a subject in a parapsychological experiment who is an occultist, the results will likely be designed to try to lead all involved toward the occult over the longer term.

The right questions

In the relation between science and scripture, eight questions open out the issues involved. Focusing on these questions will prevent diversion into time-wasting philosophical dispute. The questions are:

- Did God create time?
- Why is science beautiful?
- Do miracles occur?
- How old is the earth?
- Was Noah's flood global?
- Who did Adam's children marry?
- Do you believe that some people lived for centuries as Genesis states?
- What would you see if you had snapshots of your father, and his father, and so on, backwards in time?

APPENDIX: GENESIS, SCIENCE AND HUMAN ORIGINS

Schools

Are there clashes between science and the account of creation in the book of Genesis? I can identify several schools of thought:

1. *Secular scientists* believe there is a clash and that science is right, but don't care because they don't respect the Bible, which they take as unauthoritative and out of date. Some think the writers were doing the best they could with the ideas of their time, some think they were furthering a religious agenda.

2. *Naïve fundamentalists* believe there is a clash and that the Bible is inerrant, but care little because they don't respect science. I agree with inerrancy, which is their driving motivation – because if inerrancy goes then the Virgin Birth and the Resurrection of Jesus Christ can be questioned. But the Genesis clash is really with *their understandin*g of scripture. (There is no room for ambiguity in the accounts of the Virgin Birth and the Resurrection.) To see how limited their understanding is, they would do well to read *(Mis)interpreting Genesis* by Ben Stanhope and *The Lost World of Adam and Eve* by John Walton. (These authors do not accept inerrancy and I disagree with some of their conclusions. But an anti-intellectual strain exists among fundamentalists, stemming from their reaction to liberal academic theologians who call Genesis myth. Stanhope and Walton do not do that; like fundamentalists they seek the 'plain meaning' of Genesis, but the plain meaning to people of the Ancient Near East, rather than to modern Westerners, who hold a materialist view. The irony is that such people think they are more spiritual!) In particular, instead of welcoming the Big Bang as the first scientific theory to propose a beginning, as Genesis stated long before (and Buddhism denies), fundamentalists attack it! These 'creation scientists' don't do proper science in the sense of framing and testing hypotheses, and their writing is agenda-driven rather than curiosity-driven – which they ironically accuse mainstream scientists of being. Science involves seeking a particular category of truth without prior commitment to the outcome. 'Creation scientists' often claim that anomalies which await scientific explanation *cannot* be explained, while ignoring multiple facts that they are unable to give order to. They are unhappy that 'random' events might have given rise to man, although they see God at work in apparently chance events such as meetings that lead to evangelism or marriage. They might say that the second law of thermodynamics (or 'information') disproves evolution, although few can state either principle accurately. They typically avoid science but still want to argue with scientists, and they revert to religious argument as soon as a discussion of the science starts to go against them. They agitate against school science, although secular humanist influence is more insidious in the humanities, and the image-of-God argument itself suffices to lift man above the animals. Some of them practically regard rejection of Darwin as equally important as belief in Christ, deterring potential converts who take an interest in science. Fundamentalists are nevertheless brothers in Christ with a high view of scripture.

3. *Investigative fundamentalists* or *evangelicals* who respect both scripture and science. They do not regard either as a tool for understanding the other (leading to bad science or bad theology or both), and they feel acutely any tension arising between the two, and work to resolve it. They see scientists as fallible truth-seekers within their own field, and scripture as absolute truth but capable of being misunderstood (including by believers). This is the viewpoint taken in the present essay. *Love God with all of your mind* (Mark 12:30). From this perspective the accord of the Big Bang with Genesis in asserting a beginning is a delight, and the challenge to reconcile the details is welcomed.

4. *Christian mythologisers*, who take the Genesis account of creation exclusively as spiritual truth. It includes spiritual truth, but the material language is too detailed for spiritual interpretation of every point and must refer to material fact – which overlaps with science. Mythologisers cannot say at what point the genealogies move from mythological people to real flesh-and-blood people; from myth to history.

Evolution

Charles Darwin did not invent the concept of evolution, but he explored it and used it to order a large body of otherwise shapeless biological data which he amassed for the first time. Although he recognised a 'grandeur' in the resulting picture, he saw the potential for a clash with scripture and, in Victorian Britain, he hesitated to publish. Publication was prompted more by worry over priority; he also gradually lost his Christian faith. Darwin understood that characteristics tended to be inherited but did not know the laws of inheritance, found by Gregor Mendel.

Here is a fuller summary of the theory of evolution. Taller giraffes (for example) can reach higher leaves on a tree, to eat. So they are more likely to survive when food is scarce than shorter giraffes. This is called 'natural selection.' Animals grow according to instructions to make vital proteins, which are long sequences of amino acids. These instructions are carried inside cells by *genes*, part of a chemical known as DNA (deoxyribonucleic acid; only some DNA is for protein-making). The 'double-helix' structure of DNA, suggestive of its role in reproduction, was deduced in the 1950s. A gene is a sequence, in the DNA, of certain chemicals known as *bases*. Genes come from each parent, and if two genes at the same point on the DNA (one from each parent) give differing instructions for something, the 'dominant' form wins over the 'recessive.' (This was Mendel's contribution, although the relation between genes and observable traits is not always simple.) So a giraffe with a longer neck has genes that caused its neck to grow longer, which it passes to its offspring. (Of course multiple genes are involved in neck growth.) Giraffes as a species will therefore develop longer necks, until some other effect (such as spinal fragility or difficulty pumping blood up to the head) limits it. Natural selection obviously reduces the variety of genes. Diversity of genes is increased by *mutation*: changes at the genetic level caused by various biochemical effects, often as cells divide, that are not harmful to survival and which then show up as new features. Latent genetic diversity within a species can be great – the widely differing types of dog are all descended from the wolf. There might be equal diversity in human genes, although probably not brought out in full

(skin colour is only a small genetic difference) because dogs were bred deliberately, whereas humanity has been directed blindly by its environment.

The Frontiers of Life Science

These mechanisms can explain much in biology, and a summary of what evolution explains is given in the next section. But there are so many missing parts of the account that whether these mechanisms provide a complete scientific explanation of all life on earth is hotly argued among scientists. Some of the issues are:

1. The effect of a gene in an individual is influenced by various factors. These include sequences in the DNA, known as enhancers, that do not code for any amino acid. Enhancers switch genes on and off. They work in conjunction with chemicals in the environment around the DNA; a single gene may have several enhancers that each work with different chemicals to influence expression of the gene. Hence a single gene can have different effects in different parts of the body, and its expression may be influenced by chemicals in the external environment. (That environment may directly influence genetics is a recent insight.) This is also why humans are far more complex than nematode worms, even though they have similar numbers of genes.

2. What of the first steps? The simple molecules found in the young earth show a clear tendency to combine so as to produce more complex organic molecules. Critical conditions are also needed (as found in alkaline hydrothermal vents on the seafloor) but, remarkably, the laws of physics point towards chemistry, and chemistry towards biology.

3. At every step of an evolutionary pathway an organism must be no worse at surviving its environment and reproducing than its predecessor. How could complex structures like wings evolve, since half a wing cannot fly? The answer is that many features of an organism are multifunction. Appendages which became wings might first have conferred advantage at something other than flying. After that, once extended hopping or gliding from trees had begun (a precursor to flight), it took over as the driver of evolution of the structure. Feathers were once for heat regulation, but became adapted for flying. Change of function is known as *exaptation*. Similar debate goes on about the function and operation of complex molecules within organisms: 'molecular machines' whose parts are supposedly useless separately ('irreducible complexity'). But each part might have evolved for a specific task, after which they began to act together for a greater task, with each change conferring advantage. Neil Shubin's book *Your Inner Fish* finds chemicals, cells and organs, governed by similar genes across species (including humans), that have been rejigged for different purposes in different animals having common ancestry. Mitochondria (which produce energy in cells) might originally have been absorbed as entire cells into other cells, which they aided; likewise chloroplasts (which perform photosynthesis) in plant cells. Also, the existence of viruses (fragments of genetic material that take over cells to replicate themselves) implies further molecular mechanisms. By such means 'horizontal' gene transfer (across cells,

not from a parent) is common among single-celled forms of life, so that a genetic family tree of them is not definitive. Heritance is more complex.

4. Are there too few intermediate forms between species, in the fossil record, to be explicable by evolution? No, for in progressively younger strata of rock (dated geologically) we find: single-celled life; multi-cellular life; creatures with a body plan (bilateria, having a front and back, top and bottom); bilateria with skulls and backbones (vertebrates such as fish, some of which are the ancestors of modern fish); vertebrates with four limbs (tetrapods); tetrapods with a 3-boned middle ear (mammals). No fossils are out of sequence. This explains why (for instance) four of our cranial nerves follow tortuous paths, and have functions for which other nerves would be better suited: in other modern animals, those nerves have different functions. Animal bodies resemble the plumbing and wiring in a building that has had extensions added to it one by one, differently in different species (including man); if you were designing each species from scratch you would do them differently. Or consider a 1960s computer operating system that had since been used as the basis for distinct dedicated applications: if you were designing an operating system from scratch for each application the results would look different from the 'evolved' one. As for intermediates, there is a reason why they might be rare. Evolution is often driven by environment, not merely by 'arms races' in which (for example) faster lions catch more gazelles and thrive, and faster gazelles escape to breed, so that both species get faster. Environmental change is often catastrophic and rapid (as in the emergence of a land bridge by which species that did not co-evolve then mingle; many fail to compete, and vanish). If evolution proceeds mainly in bursts ('punctuated equilibrium') then many intermediate forms would exist for only a short time. Fundamentalists who deny evolution of species by saying that it has 'not been observed' should be challenged to say what would be seen if evolution of species were true. (It *could* not be observed in the laboratory because, unlike evolution within species, which is seen in bacteria and due to environmental selection of pre-existing genes rather than the appearance of new genes, it would take much longer.) Darwin inferred evolution of the finches of the Galapagos Islands from a common ancestor, based on their behaviour and physiology.

What Evolution Explains

Many similarities exist between distinct species. The forelimb (upper arm, forearm, wrist, hand and fingers) can be matched bone for bone in the porpoise, horse, bat, rat, mole and man, and other species. It is used differently in each, so its construction is not based on its use. Then there are functionless body parts, such as the coccyx which corresponds to the tailbone in mammals. What can this imply other than a common ancestor, then divergence? Why would God include redundant or vestigial organs if he made each species separately?

There are also similarities in the behaviour of different species. Some birds in South America and Britain line their nests with mud in similar ways; one way of mud lining is not likely to aid survival more than another. Common ancestry can again explain these observations. In the geographic distribution of animals as land masses join and

part, the fossil record is consistent with natural selection acting on populations of the same species which have been separated, and eventually become different species.

Similarities across species run to molecular level. Insulin (for example) regulates blood sugar levels in differing animals (and man) but has slightly different structure. The 'family tree' inferred from these divergences broadly agrees with that from the fossil record and anatomy. The family tree inferred from genes also matches – and is definitive, given the role of genes. Two chimpanzee (and gorilla) chromosomes – distinct long strings of genes – match one longer chromosome in man. The obvious explanation is that human ancestors branched off a line that included chimpanzees, after which chromosome fusion took place in the human line. Other chromosomal structure is similar in chimps and humans, which have at least 97% of the genome in common. We also recognise copying errors (including in man) that were introduced from time to time and then propagate down the tree. (When this happens it hobbles the gene. Only changes whose effects are not fatal can propagate.) A library exists of the effects on genes of common types of mutation, occurring by chemical mechanisms that are understood but which we cannot predict. These include gene transposition, inversion – taking a sequence of bases out of DNA and putting it back in backwards – and insertion of particular base sequences at arbitrary points by retroviruses. There are also 'jumping genes', which can insert a fixed pattern at repeated but random points in the genome. These processes may generate new genes, which then act; or simply remain present but inactive in the genome. Evidence for common ancestry from genomic sequencing is decisive: traces of large numbers of random genetic events which match between man and apes but are absent in lower animals. The only explanation is evolution from a common ancestor, unless you argue that the genomes (including human) had to have *exactly* those differences for the animal species to look as they do. But that is untrue, as the relation between genes and bodies is much more contingent – in each species, minor genetic changes occur all the time with no impairment of breeding. Why would God set up similar not-vital-to-function genetic patterns across species if he designed each species from scratch?

Evolution is not Sociology

Some oppose evolution because they think it implies 'Social Darwinism,' the view that human individuals and societies should compete and the weak should perish, like shorter giraffes. Competition involves interaction; manufacturers compete in markets via their products, where they react to rivals' products, prices and popularity; male gorillas rely on genetically influenced traits such as size when fighting for a harem, to reproduce. (Genes and manufactured products do not themselves compete, despite phrases like 'selfish gene'.) Any man who competes for food by killing competitors, or leaving others short, is not loving his neighbour. But human evolution is driven less by competition for resources under population pressure (the 'Malthusian' view) than by involuntary response of individuals to their environment. One man with genetic resistance survives an epidemic to reproduce but another man without resistance dies, so the population gains in resistance. That is the meaning of 'natural selection.' (Genes mutate; individuals are selected – note the passive – and populations evolve.) Competition and cooperation can be learned socially, as scripture affirms. For: (1) human societies that are genetically close may exhibit distinct moral behaviour; (2) human societies have not always worsened, as the Malthusian view implies; (3) some

cultures have changed moral behaviour too fast for genetic explanation. (Our own society has become promiscuous in one lifetime.) Social Darwinism, or 'conscious evolution', is an (evil) social theory and has nothing to do with modern Darwinism.

Genesis and Life Science

Suppose that plants and animals evolved over millions of years to reach their present diversity. Genesis 1:24 & 2:19 state that animals were produced from the earth *but do not say how*. They have been produced in various kinds, but a translation of verse 1:24 as "produced *according* to their own kind" is too strong. These verses mean that wolves and lions (say) don't mate with each other, and breed true from one generation to the next. But nothing is said about whether their descendants thousands of generations later would be co-fertile with their ancestors; only that each generation in that line of descent looks recognisably like its parents – so that small changes may accumulate that yield different species. These verses were written for ancient farmers, not geneticists. If animal species that had somehow been kept apart interbred to produce hybrids then after a few generations there would be only one type of animal. Moreover Satan fell before Adam and was already in the world, so things were unlikely to be perfect outside Eden; Genesis 3 tells of his first interaction with men but not necessarily with the rest of the world. Some plants are deadly although plants were designed as food for humans and animals (Genesis 1:29); why should not evolution hold, but in a way that is fallen? Romans 5:12-14, about death entering the world through sin, appears to mean human death, in which case animal death (and carnivorism) might precede it. We can infer this from Genesis 2:17, where God tells Adam that if he disobeys then he will die – a statement that would otherwise mean nothing to Adam; and also from 3:22-24, which suggests that even before the Fall Adam and his wife would need to keep eating the fruit of the tree of life to live indefinitely. So presumably animals were dying before that. God does not intend animals to savage each other indefinitely, and predators will one day have a herbivorous diet (Isaiah 11:6-9). The tree of life is the key feature in the garden (Genesis 2:8-9), and it will ultimately reappear (Revelation 22:2).

The Creation of Man

Remarkably, the entire universe and its history is summed up in our bodies, for carbon (the basic chemical element of life) was created in supernovae millions of years ago. God thinks big, and Christians may see with awe the universe as God's crucible for creating life. It took aeons, but time is itself part of the creation and is under God.

Simon Conway Morris has argued that mammals are the only way for intelligent life to exist, and that DNA is the only molecule by which complex life could reproduce. (Others insist that life on earth would look very different today given somewhat different conditions long ago.) In that case we *must* look and function broadly as we do; the details are contingent but not the broad outline. Some fairly complex organic molecules have been detected in space; if these are the building blocks of life then the reason we appear to be alone in the universe is that some step in the path to complex life, perhaps involving environment, is statistically improbable.

Secular scientists say that man evolved as just another animal, for whom intelligence and speech – which are clearly interrelated – was a superior survival strategy. (This is why the Christian phenomenon of 'tongues' is significant: a large part of your being is given over to God.) Genesis, in contrast, says that God created man in his own image (1:27) "from particles of earth [*adamah*], and breathed [*nafach*] into his nostrils the breath [*neshamah*] of life, and man became a living being [*nefesh*]" (2:7). This man was called Adam, as a reminder of his origin (the Hebrew for earth); he was made from ground-up ground, ultimately the same chemical elements as everything else. God performed an operation on Adam's side under anaesthetic to remove part of him, from which God made Adam's wife (2:21-22). Adam named her Hawah ("Eve"), which signifies life; this pair are ancestors of all humans (3:20). Adam was a real person according to Romans 5:12. Hebrew relates breathing and living; living animals too are *nefesh* (Genesis 1:24) and were also created from the earth (2:19).

How do the accounts given by Genesis and evolution compare? Here is a three-way discussion between a camp-2 fundamentalist called Frank, a camp-1 secular scientist called Sam, and a camp-4 evangelical called Edward, whose view I share. The aim is to air most significant issues. The Flood is deferred to another Appendix, and I also do not air a 6 * 24 hour creation, which Fundamentalist Frank would believe in, because I regard that issue as settled (as above). At stake for Sam is scientific truth; at stake for Edward is God's personality (does God deliberately strew misleading evidence in his creation?); and at stake for Frank is inerrancy of scripture. Frank has looked at some evolution and genetics texts, and Secular Sam has read Genesis and some biblical cross-references. Note that inbreeding is problematic because each of us carries on average five recessive genes which, if not masked by a dominant counterpart, would make us nonviable. We carry so many genes that a random man and woman who procreate are very unlikely to have any of these 'recessive lethal' genes in common, so that in their offspring such a gene from one parent is masked by the corresponding dominant healthy gene from the other. But a man and woman who are related are likely to carry the same recessive lethal or sublethal genes, which their offspring are liable to inherit from each, precluding masking and raising the risk of deformity. Populations with significant inbreeding are less healthy.

Sam: So you take Adam and Hawah as specific individuals, and the Genesis account of their creation as material fact?
Frank: Exactly.
Sam: And there were no other humans on earth at the time?
Frank: That's right; Genesis 2:18 says Adam was alone before the creation of Hawah.
Sam: So who did Adam and Hawah's children marry? Genesis 4:17 speaks of Cain's wife and no earlier verse speaks of any children other than Cain and Abel.
Frank: At first they married each other. Apart from their parents and before they had their own children, nobody else existed. Genesis 5:4 says that Adam and Hawah had plenty of children after Cain and Abel, and no verse rules out other children before that; Adam and Hawah seem to have been a physically healthy couple and would have had a child every two to three years. Adam lived for 930 years according to verse 5:5.
Sam: But it's incest for their children to marry each other!
Frank: God only banned it centuries later, in Mosaic Law, so it was acceptable before then. Maybe there were many fewer recessive lethal genes so much closer to the Fall.
Edward: But Frank, people have awareness of right and wrong as part of the image of God. That's why the Letter to the Romans says that some things were wrong even

before God issued a decree against them. Cain was cursed for killing his brother. Exactly when in the genealogies did the ban on incest get written on the hearts of the righteous, and enter their consciences; and why then? Surely incest was improper!
Frank: Incest and murder aren't analogous. Abraham's wife, Sarah, was his half-sister (Genesis 20:12) and they were blessed. Scripture records other marriages of relatives. Before the Romans, Egypt was run by the Ptolemies who had full sibling marriage.
Edward: Cleopatra's family were generally depraved. And the marriage of Abraham and Sarah is simply *mentioned* in scripture, so we can't say whether God approved or not. Moreover this couple was scarcely fertile together – they had only one child, Isaac, in many years of trying, whereas Abraham quickly got his wife's unrelated servant girl pregnant (Genesis 16:1-4) and had six children by a further wife when he was even older (Genesis 25:1-2). Infertility is typical of inbreeding – anything conceived is so unhealthy as so spontaneously abort so early that the woman doesn't realise. How much worse were unions of full brother and sister between Adam and Hawah's children? No marriage of siblings is recorded in the Bible.
Frank: Everything was perfect before the Fall thousands of years ago. I believe God gave Adam and Hawah a perfect set of genes, with no hidden 'bombs' in them. So their children carried far fewer recessive lethal and sublethal genes than we do farther down the line today, and those children could have had healthy offspring together.
Sam: But the taboo against incest was around long before knowledge of genetics. Moreover, if we are all descended from just a single couple then geneticists could tell, by looking at the amount of variation between different people's genes, which increases down generations. There seems to have been a bottleneck in cheetahs. But we don't see a genetic bottleneck in humans a few thousand years ago. We inherit our 'mitochondrial' DNA from our mother, and the record of the female line seems consistent with a single woman over 100,000 years ago being a common ancestor of everyone alive today. That is not unexpected – statistically, sooner or later one lineage will dominate – but it's not the timescale you insist on. So we all have (mutated versions of) Hawah's mitochondrial DNA. Similarly, the male-determining part of the genome, the Y-chromosome, suggests that if one man is a common ancestor of everyone alive today then he lived many tens of thousands of years ago.
Edward: Which is, interestingly, about the timescale on which the traces suggest a huge change in behaviour, consistent with the dawning of consciousness…
Frank: This is all too far from Genesis. Genetics must be wrong somewhere.
Sam: Where is it wrong?
Frank: I don't need to know. I'm not a scientist.
Sam: If you take part in this discussion, you may not unilaterally limit its scope.
Edward: Since science and scripture are from the same source I believe that they are consistent, as with the Big Bang.
Sam: Really? In Genesis 2:10 you get a river dividing into four. Rivers join up but they scarcely ever bifurcate, except at a delta. Division into four is nonsense!
Edward: The writer was obviously looking upstream. That statement then provides a clue to where the Garden of Eden was.
Sam: Frank, you said that the whole human genome is becoming more corrupt on a timescale of millennia. Genes are shuffled in unrepeatable ways within human ovaries and testes as eggs and sperm are created; that is why different children of the same parents are generally genetically distinct. Sexual reproduction leads to far greater variation in the attributes visible in the next generation, and so to greater flexibility of the population to adapt to changing conditions. In fact, DNA in cells is continually being damaged by (for example) chemicals and ultraviolet light, and is continually

being repaired as best as possible by various mechanisms. When a change manages to get into a sperm or egg, a mutation can arise in the next generation (although most genetic mutations merely make the offending sperm or egg or embryo unviable). Even then some mutations within a population die out by chance over many generations, like male aristocratic lines. A few mutations even prove to be good for survival. In view of all this, your timescale for genomic decay is wishful thinking. Without evolution, how can you explain why are there vestigial organs and redundant genes?
Frank: I can't explain that yet.
Sam: Then what evidence *would* you accept as supportive of evolution?
Edward: Frank, I doubt that you'll explain it, because what Sam says is scientifically sound. But I think Genesis does not say we are all descended from Adam and Hawah alone – it tells us only that they are included among everybody's ancestors.
Frank: I suppose that's true, but so what?
Edward: I think Sam is right about genetic problems. If others were present, the in-laws issue goes away.
Frank: Adam was alone once he was created – you presumably accept Genesis 2:18, which says that it was not good for him to be alone.
Edward: Suppose evolution had got as far as hominids with bodies like ours but not human spiritually, not the image of God – then God made a couple in the Middle East human by some means? All you can reliably take from Genesis about human origins is that living beings in the image of God have been around for only thousands of years. This hypothesis solves the 'in-laws' problem: their children bred with the hominids. Then the Flood wiped out all who were in the image of God except the people on the Ark; in particular it wiped out the products of sex between fallen angels and humans. If I were to summarise evolution in the language of 4000 years ago while stressing divine purpose, I could not improve on Genesis' "God made man from particles of earth". That doesn't say *how* God did it. God also made animals from the earth (Genesis 2:19), suggesting that they were made in the same way. Notice also that among the animals brought to Adam, "no suitable helper was found" (Genesis 2:20). That is a curious phrase, for it is obvious that lions, tigers and so on are not suitable helpers – but hominids might be until closer inspection. A secular expert has written that "Not only is the ability for symbolic reasoning lacking among our closest living relatives, the great apes; such reasoning was apparently also absent… from the earliest humans who looked exactly like us" (Ian Tattersall, *Masters of the Planet*, Prologue, p. *xiv*). European voyages that encountered native peoples always led to a debate about whether they were in the image of God. (They were, even if they had regressed from the farmers of Genesis 4:2 to hunter-gatherers.)
Frank: Before I criticise this scenario, which I call bestiality, let me point out that if life *has* to look much the way it does then you can't use the observed similarity of life forms to argue for a common ancestor followed by divergent evolution.
Sam: Frank, please let me go first. Edward's claim about a god just clutters the evolutionary scenario. At some stage the brains of hominids became so complex that they were different, and became human. Self-awareness, which I take to be what consciousness means, aids survival because if you carry a model of yourself in your head then you can extend it to predict how others would respond to you and would act in other important situations. Intelligence is also just a better way of surviving.
Edward: Morality too?
Sam: Individuals often survive better in groups. Different groups may have different sets of internal rules, and the set that gives better group survival will become more common, and be called morality, as sociobiologists put it. History is written by the

winners! Of course, some things will be hard-wired in all humans. It's not obvious that being nasty is the best strategy, so you needn't worry about that right now.
Edward: That equates good with survival, but humans know these are not the same thing. Notions of good and evil come from elsewhere – God, in whose image we are. Sociobiology makes exactly the same mistake as social Darwinism; the difference is that one is regarded as a right-wing mistake and the other a left-wing mistake.
Sam: I say religion was born in the personalising of the forces of nature, because these were more powerful than man: storm gods, sea gods, and so on. Man moved up to a dualist myth as he saw things as good or bad, then a monotheist myth that integrated those. Now a secular view is overthrowing that and man is growing up. In the 18th century European Enlightenment, scientific reasoning promised to explain all phenomena, pushing divine action into corners where scientific explanation was hard, a 'god of the gaps' who withers as science progresses. Nitrogenous fertiliser made by the Haber process, and insecticides, show that science is more effective than prayer in growing crops. Not all religions can be right, but they can all be wrong.
Edward: And we shall all live happily ever after? Weapons of mass destruction also stem from science and will be used, given man's record; the two greatest wars had no religious motive, and Stalin and Mao, both utterly bloodsoaked, were atheists. You say science pushed back religion, but do you consider it a coincidence that science, the systematic search for order in nature, emerged in the one culture to believe that such order existed and could be comprehended by man, because man was in the image of the God who put it there? As for 'gods,' the biblical account is not of a climb from polytheism to monotheism but of a fall from monotheism to polytheism followed by a call to return. Humanity had one beginning, one creator, one God. Secular people have no idea of the binding influence of paganism in pagan societies. If somebody dies, a shaman might be consulted to identify the person who supposedly cursed them, and employed to curse the killer he has identified. The shaman could then profit from a bidding war, or the supposed killer might be hauled before the tribal elders and made to pay compensation. In societies with few material goods, the compensation might be a female family member. Small wonder that Paul spoke to the Galatians (4:3) of pagans being slaves to elemental spiritual forces. So I agree with you that not all religions can be right. Jesus lived and preached a peaceful way, but some religions were begun by people who exploited motives like nationalism/racism, envy and plunder. Those are reasons for wars that have nothing to do with religion.
Sam: Jesus' followers haven't always been peaceful!
Edward: Anybody can say they are Christian, but God knows who meant it. Your belief that man invented gods is as much a faith as mine that God invented man. Every religion is a belief system, and Western secular humanism is just a belief system that happens to be non-theistic. There are plenty of non-theistic belief systems, just as there are plenty of religions – some forms of eastern monism are non-theistic. And atheism is just faith that no god – no powerful spiritual being – exists; what can you build on that? You and I agree that reason is important, but when using logic to prove something to someone you still begin from premises in which you share faith.
Sam: I trust reason. You might even say I have faith in it. It works well in science, where you can go out and check everything experimentally.
Edward: Have you personally done every experiment on which modern science rests? Or do you rely on the authority of textbooks, just as Frank and I rely on the Bible?
Sam: That's different; scientific experiments are repeatable, but the Bible isn't.
Edward: Do you trust history textbooks?
Sam: They don't have miracles in!

Edward: If you are saying miracles can't happen, isn't that a position held by faith?
Sam: Reason is enough. We just need to educate people better to use it.
Edward: Do you trust human intelligence to apply reason? 20th century Europe had public education systems more widespread and knowledgeable than anywhere before, but still gave us two world wars, the Holocaust and communist revolution, none of which had anything to do with religion. Education informs the head, but the problem is in the heart – the priority application of know-how is weaponry. Secular people do not seem to be very happy, and our promiscuous way of life with its 'sex education' programs has yet to prove its stability by lasting more than one lifetime.
Frank: I agree with your critique of secularism. But let's go back to your claim that God chose Adam out of a population of hominids. For Adam and Hawah's children to procreate with hominids would involve bestiality. God would not countenance that.
Edward: It's different if they looked the same and could interbreed. And it doesn't involve incest. There are hints in Genesis. God told Hawah that he would *increase* women's pain in childbearing (3:16). He was using language she would understand, so he cannot have meant that the pain would be greater than he originally intended, of which she had no knowledge. So although Hawah had not had children, childbearing was obviously not unknown among hominids before that time. Neanderthals and other hominids not unlike us have been on the earth. Perhaps this increase in birth pains relates to an increase in the size of the human head which has to fit through the birth canal, which in turn is due to an increase in the capacity for knowledge.
Frank: But the hominid wives of Adam and Hawah's boys would not then be 'suitable helpers'. Who on earth did God intend Adam's children to marry when he commanded man to populate the earth in Genesis 1:28?
Edward: Without the special creation of Hawah, Adam would have been alone, with no other human. So a 'suitable helper' was made for him, according to Genesis 2:18. Their children would, of course, have had each other and their parents for company.
Frank: You say God did something to make Adam special unlike the other hominids. Where is that described in scripture?
Edward: In Genesis 2:7 God blew the *neshamah* of life into Adam. Only God and man are described as having *neshamah* in the Old Testament. Genesis 7:22 might be taken to apply the word to animals, but the reference is ambiguous and the other 23 references aren't, which settles the ambiguity. The similar word *ruach* is applied to animals at Genesis 7:15, where it clearly means 'breath' rather than its other meaning: spirit. So *neshamah* is the key word and it is part of the image of God in us. With advances in brain imaging we shall start to see what God did, although we have to factor in the effect of the encounter with Satan (Genesis 3). I wouldn't be surprised if human creativity stems from an upgrade of part of the primate brain relating to sex.
Frank: But Genesis 2:7 is describing an act of animation – the ultimate 'kiss of life'.
Edward: You are supposing that God assembled Adam's inert body, then made it come alive. But chronology and the time sequence matter less to the Hebrew mindset. And God created animals that lived and moved without any blowing-in.
Frank: The scriptural language here is vivid; don't you believe it is literally true?
Edward: It's a *literary* account, so 'literally true' means the same as 'true'. What do you think the tree of the knowledge of good and evil means, in Genesis 2:9? I'm not sure. If you are really asking whether the account is *material* truth, read Jesus' reply to Nicodemus about being 'born again' (John 3). You and I agree that God made man; we differ on what part of the process was miracle and what was explicable scientifically. I doubt that the creation of Adam's body and the blowing-in are a time sequence, because mind and body are so intertwined. Your brain learns to control

your body by trial and error. As a baby you need frequent touching or you wither and die. You learn language from others. All this becomes part of you. What would you find in Adam's mind where this usually is? As a physical analogue, did Adam have a 'belly button' scar where the umbilical cord to the mother was attached?
Frank: I don't know. I presume you believe in Jesus' virgin birth?
Edward: Yes.
Frank: Then where did his Y-chromosome, the string of genes that makes someone male, which boys inherit from their fathers, come from? Jesus was a fully human male so he must have had one. It can't have come from his mother.
Edward: I don't know.
Frank: That's the same type of miracle that you are trying to deny. You also can't say what would have been in Hawah's mind in view of how she was made from Adam, or whether she had a belly button. What God blew into Adam must surely be what leaves a human body at death. The Bible teaches life after death so something must leave.
Edward: It's not that simple. A body that has just died has a great deal wrong with it – that's why the personality left it. A healthy body is a living body, intrinsically.
Frank: What about Lazarus? John's gospel says that he died of illness and Jesus brought him back to life days later. Something must have left and returned to a body that had been terminally ill and even decaying. In a discussion of what happens after death, St Paul calls the body a 'clothing' (2 Corinthians 5), so the thing that is clothed is what left Lazarus' body and what God blew into Adam.
Edward: That is indeed what left Lazarus' body. If his body was made healthy and came alive then it could contain only his personality, not another's – mind and body are that closely intertwined.
Frank: What about the creation of Hawah from Adam's side?
Edward: This description must indeed be taken materially, although it has spiritual consequences. God gave Adam a companion in this way to set up the relation between man and woman, which we could not have deduced from evolution. Hawah comes from Adam, so that union between them makes them one flesh (Genesis 2:24) and brings wholeness. That she is a companion for him (2:18) explains why women remain sexually receptive when infertile: when pregnant or lactating, throughout the oestrus cycle, or after menopause. Sexual receptivity is extraordinary in mammalians at such times, as is female orgasm and face-to-face copulation. Human sex is for bonding as well as reproduction, as Genesis 2:24 says. ("A man will bond with his wife and they become one flesh.")
Sam: You are arguing for a natural origin of Adam's body but a supernatural one of his wife. That's inconsistent!
Edward: Sex is only one way of procreating. God himself is intrinsically a father and son. He put his son into a human womb without sex. Christians become sons of God by a spiritual process. Sex is a gift of great joy to humans when God's instructions about it are obeyed, but God is not acting inconsistently in generating Hawah as Genesis says. The things in common when God created humans, and when humans procreate, are that it is an act of love, and that creator has authority over created.
Frank: There are other miracles in Hawah's creation. She was made from Adam but she cannot have been cloned or she would have been male. She must have had different genes; this difference ensures that her and Adam's descendants are not all identical genetically. Also astonishing is that, even without access to the fruit of the tree of life, Adam lived 930 years (Genesis 5:5).
Edward: I agree that the long lifespans in Genesis 5 & 11 are not figures of speech.
Sam: You two can't seriously believe that people lived for hundreds of years?

Edward: Research suggests that genes for ageing are so primitive that they are few and simple – an anti-ageing pill is actually more feasible than an anti-Alzheimer's pill, since Alzheimer's disease arises from multiple factors caused by ageing, rather than by ageing itself [Nick Lane, *Life Ascending*, ch. 10]. We are near to working out what was in the fruit of the tree of life! Who knows what environmental factors were influencing the expression of those genes in the Middle East thousands of years ago?
Sam: I suppose you'll tell me that Jesus would still be around today had he not been crucified! I don't believe those ages. We don't live so long today. What has changed?
Edward: There is a reduction from Genesis 5, before the Flood, to Genesis 11. That could be due to in-breeding among the descendants of the survivors on the ark, or a specific genetic defect in Noah, or the fact that reduced lifespan is favoured by natural selection (You breed sooner!) But even then people lived for centuries, whereas we live for about 70 years, as Psalm 90:10 says. It doesn't worry me that we haven't yet found bones that imply people lived for centuries, for there were only a few of them, living in a small area.
Sam: Speculation! Evolution indicates that we are here by blind chance. Don't you think that if "we ran the tape again" from far back, with just a few differences in life forms then, that life would look very different on the earth today?
Frank: See what Sam says, Edward – according to evolution we came about by blind chance. That is a disgraceful thing for any Christian to believe!
Edward: Frank, if you believe in an omnipotent God then you may not invoke chance. Was it chance when you bumped into your future wife at that party, or God's doing? As for Sam's question, Gould thought Yes to whether life would look different, Conway Morris argues not. But if Gould – and Lane – are right then it is astounding that intelligent life forms like us evolved, whereas if Conway Morris is right then the inevitability of intelligent life evolving from a soup is astounding. Whichever, the more we learn of evolution, the more awesome is the God who brought it about. And either way, Sam, it points to a *deus ex machina*, a God who saw to it.
Sam: Whatever else, evolution is a powerful blow to the notion of a designer. Life is not like a watch or other complex mechanism, that requires a watchmaker.
Edward: Really? Even if intelligent life will always arise given the right conditions, it is remarkable that those special conditions arose. It seems that the whole universe conspired to bring us about! Reasoning of this sort is called the 'anthropic principle'. We still do not know enough biology for 'intelligent design' arguments to have much scientific value; arguments that life forms had to be invented holistically. I see intelligence more clearly in the laws of physics that make chemistry possible, and thence biology (such as contingencies in the folding of proteins which give the structures by which these molecules play their roles). If you change by a tiny amount the speed of light, the electric charge carried by the electron, and other physical constants, but keep the laws the same, then there is no way that life could have arisen.
Sam: Haven't you heard of the multiverse? It is possible that nature consists of multiple versions of what we perceive as the universe, unable to communicate with each other because of how they separated and the finite speed of light – but with differing values of those constants in each. There are speculative arguments for this from quantum theory and the first moments after the Big Bang. Life would then exist only in those sectors in which the values of the constants are compatible with life – in which case we would inevitably find the values of the constants that we observe.
Edward: Speculation indeed! To discuss the first instants after the Big Bang we need first to find a joint theory of quantum mechanics and gravity. Physicists might also

find a deeper theory that constrains the constants. That would strengthen the argument from beauty for an intelligent designer. *Why* is physics elegant?
Sam: Science doesn't deal with that question. I don't know.
Edward: Are you not interested in questions that science doesn't answer?
Sam: Yes, but I don't guarantee to answer them all.
Edward: Current theories of physical cosmology posit a period of inflation, a boost to the early expansion of the universe. But perhaps a transition in the laws of nature occurred at the Fall of Satan, well before the Fall of man. We see that biology is fallen in its 'redness in tooth and claw', which will be reversed after the world's redemption when wolves and lambs feed together and lions eat straw, according to Isaiah (65:25). Presumably the laws of physics fell too, although their goodness can still be seen in their beauty which is evident to secular and religious physicists alike. So perhaps these laws changed once in the past. *That* would make a difference to physical cosmology. Finally, a question for Frank: do you accept that the fact that God *intended* a race of creatures in his image is ultimately less important than differences over your and my understanding of how he accomplished it, in the book of Genesis?
Frank: Yes.
Sam: Edward, I disbelieve a change in the laws of physics at the Fall. We see light, deriving from transitions in the hydrogen atom, which was emitted hundreds of thousands of years ago, before any Fall, and the ratio of wavelengths is exactly the same as in modern atoms in the laboratory. Those transitions are explained by quantum mechanics, so that is unchanged at least.

Overall, apart from miracles, scripture and life science are reconcilable, with a few details to be reconciled.

APPENDIX: THE FLOOD

One major problem was not tackled in the preceding three-way discussion: the relation of genetic findings in humans and animals to the Flood record in Genesis 6-9. From the day the ark was sealed shut, rain fell continuously for 40 days and nights and the sources of the oceans were *baqa* – cleaved, rent, broken asunder (Genesis 7:11-12). The mountains were covered over (7:19,20). Was this a local flood in the Middle East, with the *eretz* that was flooded meaning 'the land' rather than 'the [whole] earth'? Or was it global?

Just as science settled the ambiguity over whether *yom* meant 24 hours or era in Genesis 1, so it can settle this ambiguity over *eretz*. The following scenario reconciles all of the science, in particular the genetics, with the Genesis account. Hominids evolved to look like us but were not in the image of God, as explained in the three-way discussion in the previous Appendix. God blew his image (the *neshamah* of life) into one of them, and created his wife from him. The Fall of man occurred. The Fall of nature had occurred previously due to Satan's activity outside the Garden of Eden, as also stated above. Next, men procreated with the hominids, and the resulting offspring carried the image of God. This was Edward's position in the discussion above. After that, fallen angels ('sons of God' in Genesis 6:2, a phrase used also for angels in Job 1:6, another ancient part of the Old Testament as Job did his own sacrifices according to the previous verse) procreated with the 'daughters of men' (as distinct from the hominids?) God determined on a flood to wipe out everybody having fallen-angelic ancestry. This flood was local, since humans and part-angels had not spread beyond the Middle East. All of them were wiped out, and the image of God remained only in the people on the ark. After the Flood, these survivors and their direct offspring recommenced procreation with hominids, once they encountered each other again. Only a local flood matches the genetic data for animals and humans (which will be detailed below). Furthermore, this scenario makes the Flood possible without need to find enough water to cover over all the mountains of the earth. Counter-suggestions by fundamentalists that the world's mountains were much lower at the time of the Flood call for enormous geological upheavals in order to create today's mountain ranges just a few thousand years ago, whereas geology indicates many millions of years. Any such upheaval would transform the landscape – yet the Tigris and Euphrates riverbeds recognisably survived the flood, since they are mentioned as existing before it in Genesis 2:14.

But if the Flood was local, why did God command Noah to take animals onto the ark to preserve their kind (Genesis 7:3)? Some of the animals on the ark obviously allowed Noah to restock a mixed farm promptly, without waiting for these species to trek back into the flood zone and undergo domestication anew. (Animals were useful for milk, hides and other products, but meat would not be eaten by God-fearing men, at least, until after the Flood: Genesis 9:2-3.) The ark held wild animals as well as domesticated ones (Genesis 7:14). Perhaps the idea was to preserve those animal species which dwelt exclusively in the flood zone, and the fact that *all* animal species living in that zone were taken onto the ark was because Noah had no idea whether any animals would survive otherwise. That the Flood was local is suggested also by the fact that polar bears, penguins and other cold-adapted animals were unlikely to be collectable by Noah in the Middle East.

Why, if the Flood was local, did God not simply instruct Noah's family to move far enough away to be safe? Why build an ark at all? Perhaps the family would have been killed by hostile hominids, who would not take kindly to refugees – competitors for resources – coming out of the stricken area. Also, the project gave Noah a preaching platform while he was building the ark, which would obviously have excited comment. We are told in 2 Peter 2:5 that he was a preacher of righteousness.

How did the water rise so high? It rained hard, for a long time. We are familiar with the fact that continued heavy rain causes extensive flooding, as the rivers that drain the land cannot keep up with drainage requirements at their usual level. Not only was there an exceptional rainstorm, but water might also have come from below (as in Genesis 2:6), since at least as much water as the seas hold is stored in magnesium silicate (ringwoodite) some 300 miles underground. Tectonic activity could have brought some of this water to the surface in the Middle East. The same geological activity might have caused events that temporarily dammed the outlets from a natural basin. All of this is a possible science-based exegesis of the statement that the sources of the oceans were broken asunder.

Here is a detailed translation of Genesis 7:18-20:

[18] The water swamped and rose greatly upon the earth, and the ark was carried on the [sur]face of the water,
[19] And the water totally overwhelmed the earth, and all the high hills under the skies were covered over [*kasah*];
[20] Fifteen cubits upward [*mahal*] the water came over, and the hills were covered over.

I have translated *gabar* in each of these verses respectively as 'swamped,' 'overwhelmed' and 'came over' (overcame) in order to convey the connotations of the Hebrew. Verse 20 is often translated as: *the water covered the hills by at least 15 cubits*. But there is no reason from the Hebrew to connect the two halves of this verse; this translation has been made for consistency with an assumed water-covering scenario. (Neither is the Hebrew passage punctuated or divided into verses, although the repetition of phrases, with development, is typical.) According to Genesis 6:15 the ark rose 30 cubits high from its keel, and I suggest that, in verse 20, when the ark began to float it was determined by plumbline to have a draft of 15 cubits. In context, *mahal* can be translated there as 'at least' or 'deep;' both translations are fully consistent with the starting-to-float scenario, which nicely develops the second half of verse 18.

As for the mountain peaks, nowhere does this narrative rule out their being covered by snow rather than water; although the second clause in verse 19 is generally taken as a consequence of the first, the two clauses could instead be making a distinction between water-covered parts and hills. The word *kasah* even means 'covered' in the sense of 'blanketed' – Noah's sons *kasah*-ed him with a garment when he lay naked, in Genesis 9:23. A blanket undulates with the contours of what it covers. (When Psalm 104:6-9 says that the waters stood above the mountains, which then appeared and will never again be submerged, this is a reference to the primordial differentiation of land from sea mentioned in Genesis 1:9, not to the Flood.)

Genesis 8 states that the Flood receded over about a year due to a strong wind. Wind is capable of causing evaporation at the necessary rate. The snow eventually melted. Genesis 8:4-5 tells us that the mountain tops (plural) became visible on a particular day. This is often taken to mean that the water level fell below the peaks, but they have different heights and would not all become visible on the same day. Also, the ark grounded before the peaks became visible (2½ months before); it would be remarkable if the ark had happened to snag on the highest peak. It makes better sense to suppose that the mountains became visible as darkness due to atmospheric dust or thick fog cleared. The mountains of Urartu (Ararat in 8:4) form the northern boundary of the Mesopotamian plain through which the Tigris and Euphrates rivers flow, which is the general area where Noah would have lived. The Persian Gulf has an average depth of only 35m today, meaning that much of it would have been inhabited before the Flood.

In 1 Peter 3:20 it is stated that just eight people survived the Flood. Genesis tells us that these were Noah, his wife, their three sons and the sons' wives. All humans today therefore include some of these eight among their ancestors, so as to be in the image of God. Human genetic diversity is much greater today among Africans than among the rest of humanity. This observation suggests that a subset of the hominids migrated 'out of Africa' before one of them received the *neshamah* in the Middle East, and that the genes of hominids are preponderant in humans today even though the image of God reaches us exclusively from our ark ancestors (who procreated with the hominids).

Further genetic evidence for a local flood comes from animal species, for if all animals descend entirely from the individuals on the ark then every species would show a 'genetic bottleneck' in which the population comprised only a few individuals a few thousand years ago. (Genetic bottlenecks can be inferred by looking at many individuals across a species in combination with rates of genetic mutation.) In fact such a bottleneck is found in house cats; all of them today appear to be descended from about five females in the Middle East some 10,000 years ago. The date and location are strikingly consistent with the ark narrative, and indicate that the domestic cat survived only on the ark. (This is not true of all wild cats, with which house cats are able to interbreed!)

The Middle Eastern origin of the image of God, recorded in Genesis, is consistent with the observation that the oldest agriculture was in Mesopotamia. As for the spread of language, we must take heed that wherever folklore speaks of a great flood, the story has been transmitted orally from Noah's family as their descendants dispersed. Because no non-human hominids have been recorded by modern explorers, that dispersal must have encountered the remaining hominids everywhere the hominids were living; no hominids without the image of God remained by the time explorers made records.

If this scenario at first appears to represent a considerable distortion of the text of Genesis, remember that God has to explain the situation to future generations using only language and concepts understood by very early generations. His solution to this difficult problem may involve divergent wording and ambiguity (as in the meaning of

yom). This is more obvious in the original Hebrew; most people are familiar only with an interpretive translation.