

Let's examine what we understand by scientific knowledge and consider the ways of knowing something.

> *It's all questions*

We all ask questions from an early age. You have only got to think of the three year old who begins, 'What's that?' You tell him it's a man crossing the road. 'Why is he crossing the road?' the boy asks. You reply, 'To go to the shop', only to be asked, 'Why is he going to the shop?' And so it goes on. Whatever answer you give produces another question.

What the child is trying to do is to make sense of the world around him. It's something we do all our lives and is also one of the things that distinguishes us from animals. It seems unlikely that a cat will reflect on what life was like last century or what might happen after she dies.

We try to make sense of our world; so does science and so does religion. In this, science and religion are in agreement!

> *Prove it!*

The brilliant thing about scientific knowledge is that it is totally impartial. No matter who does the experiment shown in the photograph below, the outcome should be the same. That's marvellous because you know exactly where you stand. The strange thing is that scientists don't often claim to have totally proved something. They usually say that they have arrived at a working hypothesis, which will be accepted as correct until it is disproved.

Let's consider their method. First the scientist asks: 'Why is this happening?' Then they decide on a hypothesis that is a possible explanation for what they are investigating. To see if their hypothesis is true, lots of identical experiments will be carried out. If the outcome is the same, the hypothesis is accepted until new evidence disproves it.



This is only one of many tests that a scientist will carry out using exactly the same method to prove that the results are reliable.

- 1 Make up three questions that can only be answered by a scientific method.

- 2 Make up three questions that can't be answered scientifically.



Can't prove it!

People often assume that a scientific method is the best way of finding an answer but in reality we use lots of ways. Some things are impossible to prove scientifically.

- 3 What methods do you use to prove that:

- brussel sprouts (or fill in your own pet dislike) taste horrible?
- you are in love?
- ghosts and fairies do (or don't) exist?
- the Battle of Hastings took place in 1066?



Prove it beyond reasonable doubt

That is what a jury is asked to do, as it is extremely difficult to prove something scientifically in a court of law. Evidence is presented to 12 ordinary people and they have to decide, and agree, on what really happened.



When you study this optical illusion, do you see the beautiful young woman or the old hag? Could science and religion ever look at the same thing and see something different? Perhaps neither of their conclusions is wrong – they are just different.

- 4 Design a poster to show different ways of discovering the truth.

And finally

It is worth remembering what the author Oscar Wilde famously wrote in *The Importance of Being Earnest*: 'The truth is rarely pure and never simple.'

Here we examine what it is that makes religious knowledge different from scientific or any other form of knowledge.

People arrive at their religious knowledge and beliefs in various ways. Some are shown here. Not everyone will use all four ways to arrive at their knowledge and it is likely that they will rate some as more important than others. It is also possible that they may reject some of these forms totally.

Personal experience

What can convince people that there is a God who takes an active part in the life of humans is something that happens to them personally. We examined miracles in Unit 4 and they are certainly a powerful experience, but only a few people experience miracles. It is more likely that someone would believe they have felt God's presence, not in any dramatic way but as quiet support when they needed it. This certainly can never be proved but, again, what really matters is not what happened but how the person interprets their experience.

Books

The importance that believers place on books varies. For a Muslim, the Qur'an is without doubt the word of God and everything in it is true and not open to doubt. Some Christians have the same belief about the Bible and accept all passages at face value – you have probably heard the phrase 'gospel truth'. As we learned in *REflections 1* (Unit 6), Christians have a variety of approaches to the Bible. Many believe that the Bible contains words inspired by God, written by humans and then passed down the generations. This means errors and misunderstandings may have crept in. Nevertheless, Christians still rank the Bible above ordinary books in importance.

Faith

This is this area where you will see the biggest distinction between religion and science. Members of all religions hold opinions and knowledge as a result of faith. This means they believe and trust that what they are taught is true because it comes from God. There is no reason why God has to be answerable to man-made laws or earthly restrictions any more than life in outer space does.

RELIGIOUS KNOWLEDGE

Teachings

This is an area where science and religion might overlap. If you think about it, most people's scientific knowledge has been taught to them. No one learns it all from conducting experiments. Any knowledge may have been passed directly from a teacher or transmitted from a book. It may be accepted as accurate information because the source is considered trustworthy and reliable. Religion is just the same. A religious teacher or a book could be the authority that passes the information on. In both religion and science, students have to accept the information on trust because they aren't in a position to check every single point for themselves.

- 1 Draw a similar spider diagram to the one above showing four possible sources of either historical knowledge or geographical knowledge.
- 2 How would you rank the importance of the four major sources of religious knowledge? Decide how you would rank the importance of the sources for the subject you worked on in question 1.
- 3 What do you think are the weaknesses in each of the four areas displayed on this and the previous page?

Current scientific thinking states that our universe began as the result of a cosmic explosion. So where does that leave God?

Here we look at the different views about the creation of the universe and decide whether they are totally at odds with one another.

The origin of the universe is a key area where science and religion can come into conflict. Because scientists constantly develop different hypotheses and test them, as we discovered on page 86, there are regular changes and new ideas in their understanding of things. The origin of the universe is one such area, as scientist Michael Poole explains:

According to current thinking, there was a Big Bang some 13 billion years ago. This was not a gigantic explosion in black, empty space at some point in time, because space and time did not exist; they came into being at the Big Bang...

As a result of the Big Bang, matter moved apart at nearly the speed of light [186,000 miles a second]. But gravity tried to pull it together again. According to Professor Paul Davies, if the explosion had differed in strength at the outset by only one part in 10 (to the power 60), the universe we now perceive would not exist...

As the universe expanded, gravity brought clusters of matter together to form stars.

Stars are gigantic nuclear furnaces like monster hydrogen bombs. In them, the lightest elements (hydrogen and helium) are 'cooked up' into heavier ones like carbon, nitrogen and oxygen, the building blocks of life. This takes thousands of millions of years, since gravity is a weak force. Stars of a certain size finally blow up, scattering these elements into space.

Our bodies are formed from the ashes of long-dead stars. We are made of stardust.

(Source: 'RE Today' Summer 1998)

- 1 Write the 'Frequently Asked Questions' page for a website about the Big Bang.

Try to write three questions and answers. Use page 90 to help you. You can research further information to add to it.

The Bible says:

'In the beginning, when God created the universe, the earth was formless and desolate. The raging ocean that covered everything was engulfed in total darkness, and the power of God was moving over the water. Then God commanded, "Let there be light" – and light appeared.'

(Genesis 1:1–3)

The big clash!

Creation is the area where most people think religion and science clash. The author of the scientific account on the left-hand page, Michael Poole, is both a scientist and a Christian. As you will have noticed, he has no problem accepting the Big Bang theory. This is because he believes that science tells us *how* the universe began, whereas the Bible tells us *why* the universe began. For some Christians, the account of God creating the world in six days, which appears in Genesis, is like a fable. It was told to explain to people that the universe was deliberately created by God and not simply an accident or the result of some random activity. They would argue that the Big Bang was the method God used to bring the universe into being.

Those Christians who disagree with this view are convinced that the Bible gives us an accurate, factual account of the way God created the world in six days. These Christians, often called 'Creationists', point out that the Bible is the word of God, but the Big Bang is only a theory. Scientists have not got any absolute proof that creation really happened that way.

- 2 There is an ongoing Internet debate between the Creationists, who believe the world was created by God as it says in the Bible, and other Christians, who believe in the Big Bang theory.
 - Write brief entries from four different people who want to make their views known and want to comment on what the person before them wrote.
- 3 'The Big Bang theory proves there isn't a God.' What would you say to this statement?

Here we examine some of the ideas people have about the origins of human life.



According to the Natural History Museum, monkeys and humans share 99.4 per cent of the same DNA.

'Then God commanded: "Let the earth produce all kinds of animal life: domestic and wild, large and small" – and it was done.... Then God said, "And now we will make human beings; they will be like us and resemble us. They will have power over the fish, the birds, and all animals, domestic and wild, large and small." So God created human beings, making them to be like himself. He created them male and female.'

(Genesis 1:24–28)

- 1 Explain why there might be a problem accepting the extract from the book of Genesis, above, and the fact that we share 99.4 per cent of the same DNA as monkeys.

> Any problem?

You may have noticed, in Genesis Chapter 1, it says that God made humans distinctly separate from other animals. It also says that human beings were made like God. This could mean many things, such as humans have the same appearance, although this seems unlikely. Some believers interpret this to mean that we have the powers of reasoning and intelligence that enable us to grow closer to God.

Evolution

In the 1850s, Charles Darwin came up with a different theory about the origins of life on earth. His 'Theory of Evolution' said that all animals have developed as a result of 'Natural Selection'. He said that the animals best suited to their environment survive, breed and pass on their genes to the next generation. The rest die out or are eaten.

That all sounds a bit cruel, and a long way from the idea of a loving God who put each particular species on earth and then created humans quite separately from the rest of the animal kingdom. There is, however, fossil evidence to support Darwin's theory.

- 2 Use the Natural History Museum's website, found at www.nhm.ac.uk/, to find out current ideas on evolution. Report your findings as a newspaper article.

> Does Darwin win?

Well, not exactly. While there is evidence of the evolution of certain animals, there is no definite proof that humans are descended from apes. As humans, we are distinctly different from the rest of the animal kingdom in several ways. For example, we are the only animals that can use tools to make tools. Admittedly, birds and monkeys do select objects to use as tools but they don't actually make them. Then there is the question of our sense of humour, power of speech, appreciation of beauty and romantic love. It could be argued that no other animals display signs of these. Any answers?

In the 150 years since Darwin suggested the link between man and ape, many early skeletons have been unearthed. There is now lots of scientific evidence to show that we are *related* to apes, but none, so far, to show that we are *descended* from apes.

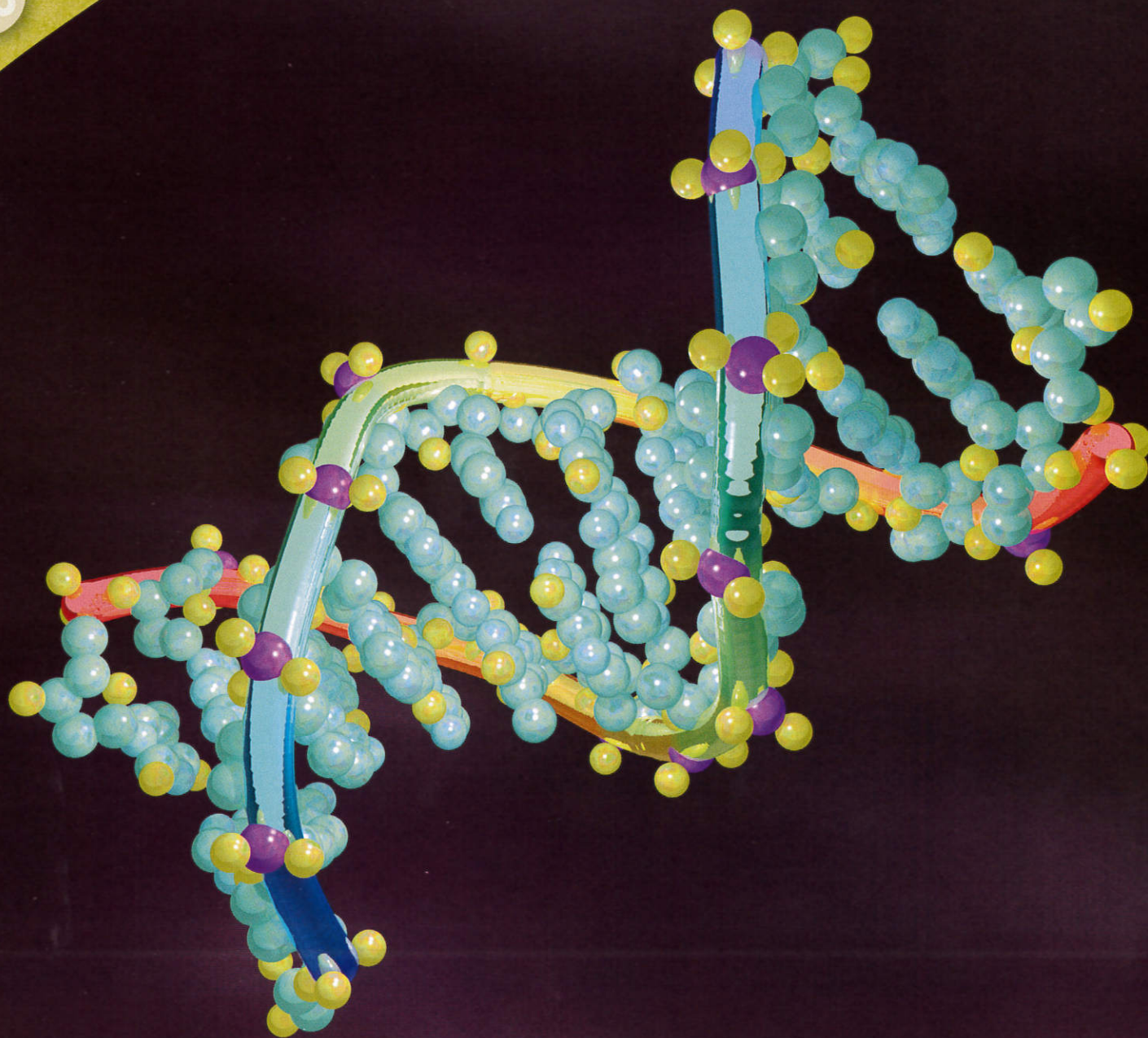


This reconstruction is from an adult skeleton, only one metre tall, that was found in an Indonesian cave in 2004. Scientists nicknamed him 'The Hobbit'. Could this be an early human?

> Where does that leave us?

- 3 Write three entries for a natural history website about the evolution of humans, giving the views of:
 - a a person who takes the Bible literally;
 - b a person who is convinced that Darwin's Theory of Evolution can explain the origins of man;
 - c someone who is unsure.

Here, some eminent scientists discuss why they see no conflict between their work and their beliefs.



This is a model of the Human Genome, one of the most important scientific discoveries in recent years.

Dr Denis Alexander is a well-respected scientist in the field of cancer research. The following is how he interprets science and religion:

'A lot of people see evolution and believing in God as somehow in tension or incompatible, whereas my thinking has been coming round to the idea that God has to use evolution in order to create intelligent life.' (Speaking on the television programme 'Testing God: Darwin and the Divine'.)

Professor Jocelyn Bell Burnell is a highly respected astronomer and a Quaker. She was part of the team that discovered pulsars or collapsed stars. Here are her thoughts about creation:

'From what I have learnt as an astronomer I believe that the universe evolved itself without any active participation from God, and it seems reasonable to me that the world continues, at least on a grand scale, to evolve by itself – that God does not directly interfere with the running of the world; but that he does through people and their attitudes....' (Source: Philadelphia Yearly Meeting of the Religious Society of Friends, 1976)

The Rev. Dr John Polkinghorne was Cambridge professor of mathematical physics before becoming a priest. He was asked whether science had disproved religion.

'It would seem to me that it couldn't be so. I believe that science is asking one set of questions about the world – the 'how' questions and religion is asking the 'why' questions. These questions do not contradict each other. We can ask and answer both questions about the same thing. If I raise my hand it is because it is my willed intention, perhaps to give you a cheerful wave. On the other hand we can have a description of how the muscles of my body work. These two descriptions are not at odds with each other, they are complementary descriptions of the same reality. In the same way I think that science and religion are complementary descriptions of the very rich and varied world of our experience.' (Source: RE Today 863, 1991)

- 1 Choose one of the three scientists mentioned here and explain why they do not see any problem in being both a Christian and a scientist.
- 2 Explain what Dr Polkinghorne is saying when he compares religion and science with putting his hand in the air?

The following is the Humanist view of evolution. Humanists do not believe there is sufficient evidence to prove that God exists.

Millions of years of evolution by natural selection (which continues even now) happened to produce Homo sapiens, human beings, one species amongst the many and various species that exist and have existed. And you are one individual of our species, here because your parents conceived you. No other reason. It is a wonder that you exist, and your uniqueness is amazing! We should also celebrate how much humans have managed to find out about how we got here – we are a remarkable species. (British Humanist Association)

- 3 How do Humanists give meaning to our existence without needing to involve God?

Let's examine the long association Muslims have had with scientific discoveries.

'An hour's study of nature is better than a year's prayer.'

(Muhammad)

From this quotation, you can see that Muslims have no problem with scientific investigation. What Muhammad was saying was that a detailed study of God's creation will lead people closer to God. This is supported by various passages in the Qur'an, where believers are urged to discover the truth about the world and to question things, so that they can arrive at the truth. This seems to support scientific methods of investigation.

Muslims have always valued the use of human intellect because it is a gift from God. Unlike the problems scientists such as Galileo faced with the Catholic Church, Muslims have never regarded science and religion as separate areas. The Golden Age of Islamic science was in the early medieval period when Christian Europe was going through a dark time in terms of science. As you will see, the developments of modern science owe a great debt to these early Islamic scholars. The following are a few fields where Islamic scholars particularly shone.



Astronomy

Because the Islamic calendar is a lunar one (the one used in the Western world is a solar calendar), a good knowledge of astronomy was essential for calculating when the months begin and end, especially the holy month of Ramadan when fasting takes place. Muslim studies went far beyond that. Scholars found out exactly what caused a rainbow. The studies of astronomer Abu al-Fida have led to his name being given to a crater on the moon.



Muslim astronomers were far ahead of the rest of the world in their observations and understanding of the moon.



Mathematics

Today we use Arabic numbers, whereas in earlier times Roman numerals were used. You have only got to try working out a simple calculation such as 'CXII + LVIII' to realise the difficulties of advancing the study of maths very far. There is another difficulty with Roman numerals – there is no symbol for a zero. If you think about it for a while, you will realise how limiting that is for some calculations. We have Muslim mathematicians to thank for zero. They also retrieved the work of ancient Greek scholars, such as Euclid, translated their work into Arabic and then built on it. We also have Muslim scholars to thank for the decimal system.

- 1 Muslim scholars were responsible for developing 'al-jabr'. What particular part of maths is that? (Hint: pronounce it!)



Medicine

Hospitals appeared in major Islamic towns and their organisation was impressive. Patients suffering from fevers were separated from the rest because Muslim doctors were aware of contagious diseases. They studied smallpox to discover its origin and in the process came to understand something about how the immune system worked. Ibn Zuhr, a twelfth-century physician, perfected surgical and post-mortem techniques. The search for cures led some to study botany and the production of an encyclopaedia of medicinal plants.

- 2 Explain why Islam does not think religion and science are in conflict.



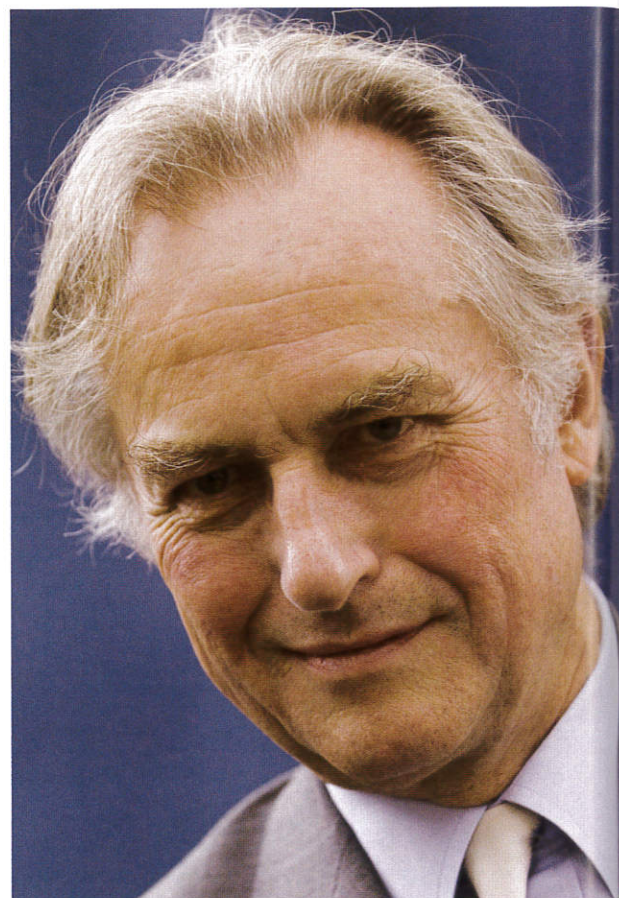
The original ideas for both these optical devices came from Ibn al-Haytham, a first-century Egyptian who studied the functions of the eye and the behaviour of light.

- 3 Write an entry for a science website giving some idea of the contribution Islam has made to scientific development.

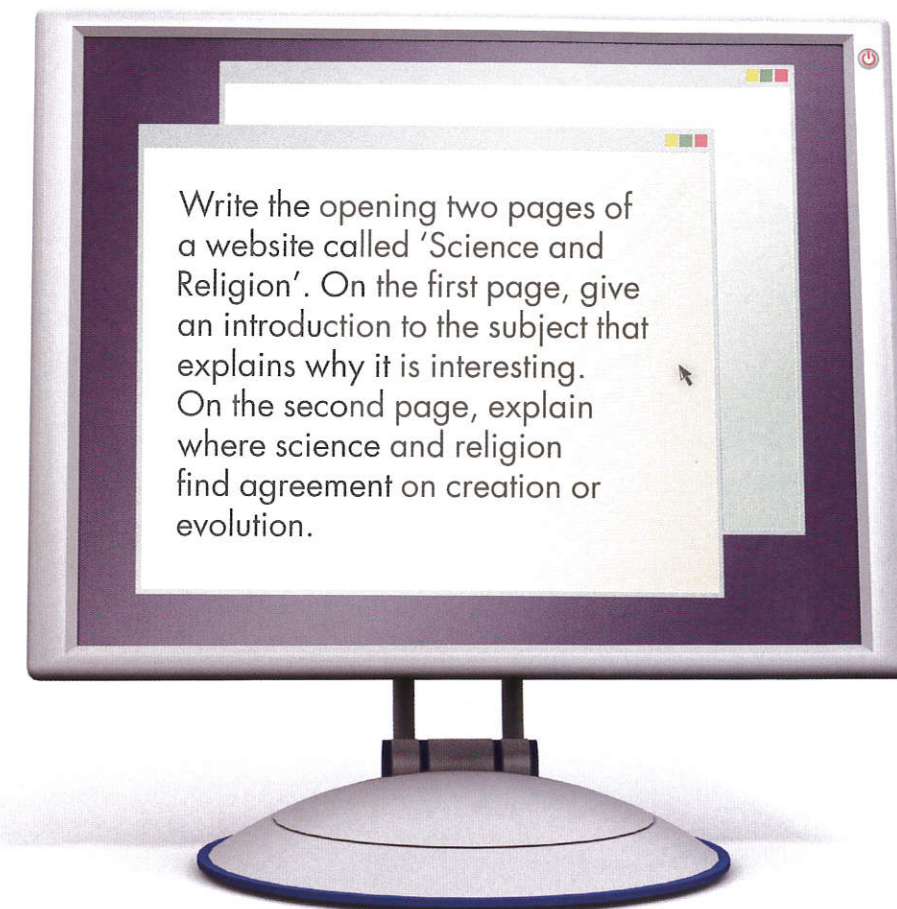
To finish

It has been said that, without the contribution of early Muslim scholars, modern science would have taken a lot longer to develop.

- 1 Design a poster, entitled 'Man or Monkey?', showing the two sides of this argument. What is your own view on evolution?
- 2 The conflict between science and religion began in the medieval period. One of the most serious clashes was between the scientist Galileo and the Roman Catholic Church. Find out what it was that they could not agree on and what happened to Galileo. Give a presentation to the class about this clash.
- 3 Richard Dawkins, a leading professor in evolutionary biology and also an atheist, is a well-known critic of religion. Here are some of his comments on the religion and science debate. Choose one of his attacks on religion and explain the point he is making. Then give your own views on his comments.
 - 'I am against religion because it teaches us to be satisfied with not understanding the world.'
 - 'It is grindingly, creakingly, crashingly obvious that if Darwinism was really a theory of chance, it could not work.'
 - 'Religious people split into three main groups when faced with science. I shall label them the "know-nothings", the "know-alls", and the "no-contests".'
 - 'Most people, I believe, think that you need a God to explain the existence of the world, and especially the existence of life. They are wrong, but our education system is such that many people don't know it.'
 - 'Religions do make claims about the universe – the same kinds of claims that scientists make, except they're usually false.'



Professor Richard Dawkins is a leading evolutionary biologist and an outspoken critic of religion.



- 5 Construct an acrostic poem about EVOLUTION. See if you can show two sides of this debate.
- 6 The great Albert Einstein once said: 'Science without religion is lame, religion without science is blind.' This was his version of the argument that religion and science are both trying to understand the world in different ways. Give your own views about whether you think it is possible to be a scientist and hold religious beliefs.
- 7 In Alabama, USA, biology textbooks today must carry a warning on the front, similar to that shown on the book on the right. As a class, discuss whether you think this should also appear on textbooks in the UK to give us a fair balance in the evolution debate.

