Religion and Science

A view from Pew and Pulpit

John Parkin

Also in this He shewed me a little thing, the quantity of an hazel-nut, in the palm of my hand; and it was as round as a ball. I looked thereupon with eye of my understanding, and thought: What may this be? And it was answered generally thus: It is all that is made. I marvelled how it might last, for methought it might suddenly have fallen to naught for little[ness]. And I was answered in my understanding: It lasteth, and ever shall [last] for that God loveth it. And so All-thing hath the Being by the love of God.
In this Little Thing I saw three properties. The first is that God made it, the second is that God loveth it, the third, that God keepeth it. But what is to me verily the Maker, the Keeper, and the Lover, ——I cannot tell; for till I am Substantially oned to Him, I may never have full rest nor very bliss: that is to say, till I be so fastened to Him, that there is right nought that is made betwixt my God and me.
From Chapter 5 of the 'Revelations of Divine Love' of Mother Julian of Norwich

Why this book was written

I'm a Reader (Lay Preacher) in the Church of England. I spent most of my working life teaching Science to young people in Secondary Schools, where I became interested in how people form their ideas of the natural universe, so that they can make sense of the world around them. I also found myself involved in an ongoing conversation (often with myself) about the relationship between my science and my religious beliefs. Reading in this area will often bring you into contact with the 'Great Names' of the Subject, names like John Polkinghorne and Arthur Peacocke to mention two. Their writings are very detailed, but perhaps not aimed at the average person in the pew or street. At the other end of the spectrum one can find writings that follow a simple biblical literalism, and give most of their efforts to 'rubbishing' science - particularly in the areas of evolution and the age of the earth.

Here I am attempting to write something which is short and accessible to the majority of people, aiming somewhere around the level of GCSE up to A level science. I'm mainly a Physicist, so there will be an inevitable bias in that direction, and this is also something of a personal document, for I see my own story as a' work in progress', of which this book forms a part.

This cannot be a Textbook - there are many others better qualified than I to write those, and space does not allow it. For that reason you will find that I do not give detailed references to other books to support a point, though I may suggest a book as appropriate reading in an area. Nor can it pretend to be final, to give ‘answers’. Even if there were any, both Science and Theology are living subjects, practised by real people and move forward, so what I write may be out of date within months or years.

If you want to keep in touch with what is happening in the sciences, my best recommendation is to read ‘New Scientist’ (a weekly) or ‘Scientific American ‘ (a monthly) and keep an eye on publications like ‘The Church times’, which has occasional articles which look at these issues.

One excellent book well worth reading is Bill Bryson’s A Short History of Nearly Everything Doubleday, London 2003 ISBN 0 385 408188

If you want to research any of the ideas here further, then a good starting point is

Wikipedia, an on line, open source encyclopaedia.

http://en.wikipedia.org/wiki/Main_Page

As with all resources on the web, you should treat it with caution, but it has the merit of being kept quite up to date

Chapter 1
What is in our heads?

One of the hardest things to deal with in trying to think about science and religion is the baggage we bring to it in the shape of our ideas about the world around us.

For most of us of mature years, these ideas have been with us for a long time, and we may hardly ever think about them in any detail. Despite this they so colour our views of the world that we need to unpick them a little. The Ideas - ‘concepts’ in the psychologists' language - which we have about the world around us develop as we grow from childhood through adolescence to adulthood, both in the sciences and in theology, (as well as the rest of life) and psychologists have claimed to find ‘stages’ of development which are age related, and also depend on the context in which we are thinking at the time.

For example, if you ask a young child to draw a house on a hillside, they will tend to draw the house at 90 degrees to the hill, so that it is not level. At a later stage they will appreciate that the house should be level, so that one side will need to have taller foundations to support it on the hill.

At an abstract level I may use mathematics to express the relationship between a force, the mass it is applied to and the resulting effect, the acceleration. You may recall this as Newton’s second law of motion, F = ma . People who design cars will certainly have used it in their design calculations, but when driving a car, I don’t consciously sit there doing the calculations, though I must have some sort of intuitive feel for them, based on experience, and acquired (I hope!) during early driving lessons.

Similarly in theology, our first ideas about God, or Heaven can be rather simple, based on our experience of the world up to that time, and what we have been taught. We may have a view of God based on a loving and caring parental relationship, or life may have given us an image of a harsh judge who demands impossible things of us. Later we may begin to develop more sophisticated ideas about God - often basing them on analogy and metaphor taken from other parts of our life

As we grow up, we can refine these ideas depending on our experience and what we learn or study. The process will go at different speeds and reach different ends, depending on our personalities and our experiences in life

When we meet some of the deeper ideas in science or theology, it can cause us some mental distress as we try to add it to our store of ideas. My secondary science students were sometimes heard to say ‘ it makes my brain hurt’ when trying to come to terms with a new idea, and that can almost be literally true.

What can I say to help the process? Well, that it’s worth the effort - like going to the gym, where few of us expect to become Olympic athletes, but we do hope to become fitter, and more aware of our body and its limitations, studying science and theology may not get us a Nobel prize, or the Templeton award (given for outstanding work in science or Theology respectively). It may make us more aware and appreciative of the wonder of the world around and inside us, and better able to make a sensible response to people who ask us if we really believe’ all that stuff in Genesis’, or tell us that ‘evolution is rubbish’

Trying to follow any serious thinking in science or theology may bring us to a point where

we find our current ideas challenged, and this can be a cause of conflict, either inside us, or with people around us who may want us to think differently. Sometimes people want simple certainties - most teachers will have been asked to ‘give us the facts, so we can learn them for the examination’ As we mature, we may be able to make the transition to realising that, though there may be quite a lot of things we are reasonably sure about, there is much which is still under discussion, open to experiment and debate. For many people it’s this feeling of openness, of pursuing the trail of evidence, of testing ideas against experience, of building structures to try and hold them together, which makes both science and theology exciting, so much so that we begin to hope that there aren’t any ‘facts’, just the excitement of finding God’s tracks in the world.

Chapter 2
The nature of Science

Whole books have been written about the nature of science, arguing about the sort of activity it is, how it works, and moves forward. I will try to summarise some of these ideas as well as I can in the space of one chapter!

I think it is fair to say that, probably, no one idea about the nature of science is ‘right’ but that most of the theories have some truth in them, and come to the fore at different times and places, as circumstances change.

One of the most important things about science is the dialogue between theory and experiment.
Theory without experiment is just speculation, though it will probably be influenced by the fact that the person who produces the theory is part of the physical world, and so must be in some way affected by it.

Experiment without theory is just the collection of information, and it is almost impossible for a human being to do this without beginning to look for patterns, to wonder ‘why?’ and to try to design experiments which in some way go along with their ideas.

Sometimes theory can get a long way ahead of experiment - at the moment theories about the very earliest times in the history of the universe, and the relationships between the particles which make it (these two things are closely connected) need much bigger and more expensive particle accelerators to test out their predictions. Even then, some of the predictions are so extreme that it can be hard to think of good ways to test them, though we can find traces in the universe we see now. Interestingly, there are now some areas in Physics where systems, which can quite easily be put together in the laboratory, may behave in ways similar to the earliest period in the history of the universe, giving use hope that progress will still be possible

Occasionally experiment can turn up results which take a long time to explain sensibly - I think the record in recent times may be held by Superconductivity (a situation where some materials, cooled well below room temperature, lose their electrical resistance) which was discovered in the early 1900's and had to wait until the mid 1950's before it was satisfactorily explained.

Scientific research also has its social dimension - even the lone scientist (a rare thing nowadays) has to communicate with other scientists. There can be pressures to follow the line being taken by a particular group, in order to get money to carry out research. There can be the desire to conform, the longing for approval (scientists are only human!), or there can be subtle pressures from politicians or businesses, or even religious groups. There is the incessant demand in Universities to ‘publish or be damned’ - the number of papers produced and how often other scientists quote from them measures success. And there is ‘fashion’ in science. Since the mid 1960's the dominant theory of the origin of the universe has been the ‘Hot Big Bang ‘ and other possibilities have been sidelined. Whenever there are some observations that are found difficult to explain on the ‘Big Bang ‘ theory, scientists who suggest other explanations complain that ‘If only we had been taken seriously years ago, then things would be different now’!

Some people have made a lot of the idea that in science a theory can never be finally

proved right, but can always be proved wrong - ‘It takes one contradictory experiment to disprove something’. This overlooks the point that most experiments are a lot subtler and more complex than at first appears, so it is rare to get a completely clear-cut result. Also, most experiments are designed on the basis of existing theory, so they may ask a loaded question, and it can take a ‘way out ‘ result to get attention for a possibly new idea.

More realistically, new ideas get challenged, knocked around, modified, often over a period of years, before the weight of evidence accumulating begins to either knock them down or they begin to take over from the old theory, often only replacing it as better in some circumstances.
(For example, the sort of work on forces you may have done in school physics is perfectly OK for designing cars, aircraft, spacecraft and so on, even if you send the spacecraft to Mars.
It doesn’t work if you want to design particle accelerators or the microchips which you have inside a computer)

Chapter 3
The nature of religion

There is probably more argument over this than over many things in Human Life!

Religious belief can be motivated by a vast variety of things, often combined in interesting ways.

It may be motivated by a sense of loyalty to a group or community, perhaps to a particular leader.

It may be motivated by a belief in the 'truth' of a written record - It is common to refer to Judaism, Christianity and Islam as ‘Religions of the Book’. (Though that ignores the very different nature of the Books, and the wide variation in believers understanding of how the Book should be used and understood)

It may arise out of one pivotal experience in life (Paul’s encounter with the risen Christ has given us the term ‘Damascus Road’ to describe this form of experience, though often much has led up to and prepared for the moment) or it may be a slow process of formation and change, with many excursions along the way.

It may be determined by the culture in which we develop - even if we later reject it, our world view often continues to have residues from the past, something perhaps encapsulated in the old slogan ' Once a Catholic, always a Catholic.'

It is quite common to use the name of a religion when describing actions that are at the very least antisocial, and may be deeply immoral and criminal. Using such terms is a form of Convenience Tag. Any religion worthy of respect can only begin to justify acts of violence as a response to aggression, and even then only under the tightest of limitations - A philosophy which has its roots in the ancient world and the doctrine of Just War. It is worth noting that for the first 300 years of its existence, Christianity was a pacifist religion, only modifying its stance when it became the official religion of the Roman Empire, and had to deal with the problems of being in power.

Chapter 4
How science and religion interact

This has often been presented as if the situation was one of Warfare, either out in the open or being conducted in a more secretive way. Like most attempts to summarise a complicated situation, this leaves a lot out.

For much of history there has been a fruitful interaction between science and religion. Many scientists were motivated by the thought that science was worth doing because what you were studying was the work of a rational God, who worked in logical, reliable ways. A few abrasive individuals, like Galileo, seem to have got themselves at odds with authority, and it is on these instances that the myth of conflict grew.

For historical reasons the interaction between science and religion is more evident in the Christian west than elsewhere, because it is in this area that the rapid growth of science and technology in the last 500 years took place. Up to around the year 1000 CE, Islamic scholars had done a lot to keep alive the knowledge and philosophy of the ancient world. After that time, the Islamic world was under increasing pressure from the Christian west, and dialogue became difficult. There also arose in Islam a school of thought that claimed that everything that happened was a direct act of the will of Allah, not open to human scrutiny, so that scientific questions of cause and effect were pointless.

There are certainly examples of religious groups who feel that much of what is claimed by science is simply wrong, since it is at variance with the statements of the Bible. This tends to be particularly so in areas such as the theory of evolution, since it seems to call in question the special status of humans, and in the geological timescale, since it questions the biblical account of creation. People who take this view base it on a very selective and literal view of the biblical text, often ignoring inconvenient passages.

On the other side there are people (Richard Dawkins perhaps the most prominent at present) who will claim that only science is reasonable and a sound ground on which to base human progress. They will point to wars and acts of terrorism carried out, it is claimed, in the name of religion (ignoring those done in the name of atheism - for example the purges of Stalinist Russia), and to the activities of groups who want to influence education by promoting a narrowly biblical pretence at explaining the world, or for example, the Church opposing vaccination against the virus which causes many cases of Cervical cancer on the grounds that doing this will encourage illicit sexual activity. They base their claims on a very narrow and untypical sample of people, partly because those who hold strongly to these views often express themselves very vocally. The critics are often (but sadly not always) working with a caricature of religion that would be unrecognisable to many modern believers.

Some people feel that science and religion both describe human experience, but that their areas of authority simply do not overlap, so that they can carry on existing independently of one another. This seems to ignore the problems that arise when work in science has consequences in other areas of human life, where decisions carry moral value. We see such examples in areas such as energy resources, where decisions about the technology have impacts on the quality of human life. They also arise when work in genetics brings up

questions of how much testing of an embryo is acceptable, if it may raise the question of whether to terminate a pregnancy.

A view held by some post-modern philosophers is, that we each bring and impose our own meaning on our experience. This might be true of our interpretation of a play, a piece of music or a work of art, though even there unless we isolate ourselves, there will be interaction with others who have reacted to the same stimulus.

My own preferred view is usually called 'critical realism'. It seems to be widely held among those who have backgrounds in both science and theology. In outline it holds that there is a real world in which both science and religious experience exist, that we have to interact with this world in order to exist ourselves, and that in doing so we have to construct ideas to give ourselves a way of working. Our knowledge and our ideas are incomplete and imperfect, so we have to engage with them in a critical but constructive way if we are to make progress

If we regard religion as something which is fixed, which can never be changed, then probably science and religion have little to say to one another. If however we regard Science and religion as attempts to explore, in as rational and thoughtful a way as possible, two areas of the vast tapestry of human experience, then I believe there is the possibility of moving forward in a mutually respectful and helpful manner.

Chapter 5
In the Beginning

In the beginning was the Word, and the Word was with God, and the Word was God.
He was in the beginning with God.
All things came into being through him, and without him not one thing came into being.
What has come into being in him was life, and the life was the light of all people.

John 1:1-4

The familiar words at the opening of John's Gospel make it clear to the believer that God is in some way responsible, through Jesus, for the world we inhabit, and for our life.

But for quite a lot of history, people have found it hard to cope with the idea that the Universe had a beginning (or could have an end). Such an idea seemed to be at odds with the idea of a perfect, unchanging universe, which was the logical outcome of it being made by a perfect, unchanging God. Scientifically, the idea that a universe might have a beginning was hard to cope with, because it required one to consider how and why such a thing might happen. When Einstein developed his general theory of relativity in the early 20th Century, he struggled hard with the difficulties of setting up the theory so that it would produce a stationary, unchanging, universe, before abandoning it in the face of evidence from astronomy in the 1920's that it was in fact expanding. Now we think that, at its beginning, the universe was more compressed - everything was closer together than it is now - and a lot hotter (rather like the end of a bike tyre pump getting hot when you have used it because the air inside gets hotter as you compress it). The part we can see now as our Universe (there may be more outside it, but we cannot see further, as light from it has not had time to reach us) was so small - only a few m.m. across - and so hot that the particles which make up the atoms were torn apart. What happened before this is till the subject of much debate, as it goes beyond the point at which we can test out the Physics on earth, and even eventually reaches the point where we do not understand the structure of space and time itself.

One of the problems we meet at this point is that the two great theories in physics at the moment (they are both about 80 years old, and have been well tested in their own areas)- General Relativity, which describes the large scale structure of Space -Time and helps us understand gravity, and Quantum Mechanics which describes the very small, and finds practical application in devices like LASER's and computers, do not combine happily when they are put together, as they must be, at the first moments of the Universe, when it is very small. The problem is in some ways analogous to doing a calculation where all of a sudden you divide by zero - a calculator will throw up an error message and mathematicians will tell us the answer is 'Infinity' and since we don't think real things can have that sort of value, we have problems. If you have heard of String Theory or M Theory, (There is an outline in Brian Greene's The Elegant Universe) then you have made contact with some of the efforts of mathematicians and theoretical physicists to grapple with this problem. One problem is explaining how the Universe is so relatively even and smooth, with just the right amount of variation in temperature and density to get star and galaxy formation going, but not too much. The currently accepted explanation is called inflation. It proposes that the universe expanded increasingly rapidly (exponentially, for those who have a mathematical inclination), by a factor of about 10 000 000 000 000 000 000 000 000 000 times over a short period of time. This is a bit like stretching a piece of cling film - almost all the creases and irregularities get smoothed out.

What happened next?

In outline, the rapidly expanding universe cooled to the point where the particles, which form the nuclei -the centres - of atoms, could join together. In the extreme conditions, only the simplest ones could survive, mainly Hydrogen and Helium, with microscopic traces of Lithium. By the time the first three minutes or so had passed, the basic mix of the universe - 75% Hydrogen, 25% Helium, had been fixed. The temperature had dropped so far that there was not enough energy for any more nuclear reactions. It was however still so hot that the electrons could not join up with their nuclei to form atoms - that did not come until some 380 000 years later.

Once the atoms could join together, the next step was a slow one, as gravity got to work on the very slight variations in density of matter left over from inflation, and began to pull it together to form stars and galaxies. This process must have occupied some considerable time, but was an essential first stage for the development of life. A modern view is that this process was influenced by the presence of other forms of matter, referred to as dark matter (dark in the sense that normal observations using telescopes don't show it), which makes up some 23% of the mass of the universe.

This story, and that human beings have been able to work it out from a mixture of observation and theory, is a remarkable testimony to the basic intelligibility of the Universe. It is however only part of the story. We can account quite well for the 'ordinary' matter of the universe.
In the 1930's astronomers studying the motion of stars in galaxies and star clusters began to realise that all was not well. Stars were moving so quickly that they would be able to escape from the gravitational pull of the material that could be seen in telescopes. Faced with either throwing away the well established laws of physics, or assuming that there must be material there that could not be seen, astronomers chose the latter. They called the matter they could not see' Dark matter' because it seemed not to give out or absorb light.

As measurements, particularly of distant galaxies, improved, the existence of a third form of mass, 'dark energy' entered the field. The most recent estimates put the Universe as 73% Dark Energy, 23% Dark Matter and only 4% ordinary matter (the stuff that we and the earth and other stars are made from.)

What the other two are is the subject of intense discussion and study. There are no generally accepted 'answers' yet, but a lot of ideas - this really is a field where you have to read the periodicals to keep up with changing ideas.

Chapter 6
Cosmic evidence

What evidence do we have for this story of the origin of the universe?
There are several different things which all point the same way

The Expanding Universe

I have already mentioned that astronomy gives us evidence that the Universe is expanding. This is from looking at the light from distant galaxies - the light coming from them has its colours shifted towards the red end of the spectrum (usually referred to as the Red shift - it is an example of the Doppler effect). This is similar to the sound of a police car siren lowering in pitch as it goes away from us, and it can be used to measure the speed at which the galaxies are moving away. Measuring the distance is trickier, but can be done in a number of ways. The result, called Hubble's law after its discoverer, shows that the further away they are, the faster they are receding. If we were to run the whole process backwards, in imagination, the universe looks to have started from one spot about 13.7 billion years ago.
One idea, which is important to get hold of, is that Galaxies and the stars that form them only move through space quite slowly. The expanding Universe is actually due to Space stretching (You may have met the 2D model of a 3D universe, where we look at spots on a rubber balloon getting further apart as the balloon is blown up. The spots do not move across the balloon, the rubber just stretches, taking them with it)- so the very distant edge of the universe, where objects start to move away from us faster than light, is our Horizon. This does not violate the principles of Special Relativity, which forbids travelling faster than light through space.

Olbers' Paradox

It might seem obvious that the sky is mainly dark at night except for the Moon, planets and stars, which on the whole give us little light. Stopping to think about it can produce the realisation that it isn't quite that simple. Several people seem to have realised this, but the one who brought it to wider notice was called Olbers, hence its name.

The argument runs like this: - If the universe is infinitely big, has been around forever and has stars reasonably evenly spaced out, then the sky ought to be about as bright as an average star (far too hot for comfort!).
Why? Well if the universe has been around forever then light from all parts will have had time to reach the earth. In an infinite universe, whichever way you look you will eventually see a star. If the star is far away, its light will be more spread out and fainter when it reaches the earth, but there are more stars further away, and the two effects just cancel out.
This obviously isn't true because we are here, so at least one of our assumptions must be wrong. It turns out that stars are on the large scale fairly evenly spread (there is a lot of interesting structure to it, but that's another story) and measurements taken recently suggest that it may really be infinite, so we are left with the conclusion that it hasn't been around forever. This means that we can only see part of the universe, the part from which light has had time to reach us. There is more, but we don't know anything about it. The simple assumption is to go for the 'more of the same' option, to assume that the laws of physics do not change just because we are not watching, but we just don't know.

Cosmic Background Radiation

The third line of evidence comes from the mid 1960's, when the first communications satellites were being launched. The people who were working on developing the ground stations were trying to produce very sensitive radio receivers to pick up the signals from the satellites. They found that they were unable to get rid of the last of the random noise they were picking up. When you hear the hiss on a radio receiver as you tune between stations, some of the hiss comes from the radio itself, and some comes from outside sources. They had tried all they knew, and still had more noise from outside than they calculated they should. After some frustrating searches, they finally realised that his was the remains of the high temperature stage of the universe shortly after its beginning. As the universe expanded, this radiation cooled and now is only 2.7 Kelvin, only just above the absolute zero of temperature, but just where it should be if the ‘Big Bang ‘ theory is essentially correct. Over the last couple of decades, increasingly detailed satellite observations have revealed slight variations in this temperature, and these give some clues as to the early beginnings of structure, as gravity and the effect of dark matter began to pull normal matter together to form stars and galaxies

The composition of the universe

Calculations based on the theory of the 'hot big bang' and what we know about the way the basic particles of matter interact together produce a universe of about the correct composition, just as we find it today.

Chapter 7
Stardust

The evidence from astronomy, and calculations about what happened in the first few minutes of the Universe tell us that the early universe was made up of only a few elements: - Hydrogen (75%), Helium (25%) and a very small amount of Lithium and traces of a few other light elements. Yet we sit here on a planet made of rocks containing Silicon, Oxygen, Iron and many other elements, while we and other living things are completely dependent on the chemical properties of Carbon to form the vast array of molecules that living things are made from. By the middle of the 20th Century about 100 different elements were known, some of them very familiar, others mainly of academic interest. In the universe as it is now, these other elements only make up about 1-2% of matter, the rest is still Hydrogen and Helium

Where did these materials come from?

The clues come from a variety of places, but mainly from a study of the stars. In the middle of the 19th Century the development of Spectroscopy - the detailed study of the light coming from hot objects such as stars - showed that a lot of stars contained many of the same elements as were found on earth (You have done some basic spectroscopy when you have seen the red glow of neon in a shop sign, or the yellow glow of sodium from a street lamp.)

Discoveries in Nuclear physics in the period leading up to and following the Second World War gave the background theory behind the way stars generate their energy. Measurements of some important properties of atoms meant that by the mid 1950's the knowledge and information was ready. The Burbidges (husband and wife) Fowler and Hoyle wrote one of the longest scientific papers on record - over 100 pages -, which set out the basic scheme. As part of the process of fusing (Joining together) atoms of light elements to make heavier ones, the stars not only released the energy we depend on for our existence, but created the elements from which we are made. It turned out that some elements are made in stars like our Sun, slowly over many billions of years, and sent out in a cloud of gas when the star reaches the end of its life as a Red Giant and then fades away. Others are made in a brief few seconds at the end of the life of a large star, when it can no longer generate energy to support its own weight, and explodes as a Supernova, ejecting mainly heavy elements in to space. Since then, detail has been added and a few corrections made, but basically what they wrote then still stands today.

(Ken Croswell's The Alchemy of the Heavens is worth reading here)

These elements must drift through space for billions of years before being brought together in a new phase of star formation - this time one in which planets can be formed, orbiting a star, as we find in our Solar System.

Eventually the planet cools, and by processes not yet fully understood, life develops (at least on our planet - we await further evidence from other planets in our solar system, and outside that we must depend on very indirect evidence). After that the mechanisms of evolution, a combination of chance and necessity, direct things towards more successful forms - with blank ends, which have died out.

Chapter 8
Relativity and Time

One of the great problems worrying 19th Century Physics was the question of what substance light travelled in. They had good evidence from experiments that light was a sort of wave, which could do the things that other waves did. It was easy to visualise it as something like a wave on water, and other waves, such as sound, also had to travel in something, air for example, or water. So they tried to devise experiments to detect the presence of this substance and even gave it a name ‘ The Aether’.
The experiments failed - they have been described as the greatest negative results in the history of science. It was consideration of these and similar questions which led Albert Einstein to develop what we know as the Special theory of Relativity (the word special is used here in the sense of being restricted - a Special Case - in this instance, not being accelerated, but moving at a steady speed). The basic starting point for this theory is that anyone who tries to measure the speed of light always gets the same answer, regardless of whether they are moving or not. This is not what we expect in everyday life, where a car doing 90 mph who overtakes us when we are doing a legal 70 mph seems to pass us at 20 mph.
Why don’t we notice this in everyday life? Mainly because light (and radio waves) travel so much faster than anything else. (300 000 Km - about 186 000 miles - in a second). In fact the theory demands that this speed is the fastest that anything can travel, and is a limit on how fast we can transmit information. (You will have witnessed this, perhaps without realising it, if you have watched a TV reporter being interviewed on the news. The apparent slight hesitation is not just thinking time, it is also the delay caused by the TV pictures and sound having to do a two way journey by radio up to a communications satellite and back again twice (for the question and the answer))

One consequence of the theory is that for someone or something in motion, time goes slower than for some one who is not moving. For things moving at everyday speeds, this effect is so small that we don’t notice it, but careful experiments show that it happens. If you have ever used a satellite navigator (a GPS) then without knowing it you have been a part of this effect. To work properly the system has to know the time very accurately, and it works it out by time signals from the satellites. They are moving fairly fast as they orbit the earth, so the engineers who designed and run the system have to make a correction for the clocks in the satellites running slow.
One consequence of Relativity is that it is impossible except over a very short distance to get two people to agree on what is ‘now’ - any signal they could exchange to check their clocks would travel at the speed of light, and the clocks they used would count time at different speeds, depending on how they are moving. This poses problems for some views of the ‘end of all things’, and has caused some theologians and physicists to speculate that, from God’s viewpoint, all of space and time can be comprehended at once. (Our sense of time having a past, a present moment and a future is very much a part of our being creatures bound up in a world of change and decay - the Second law of Thermodynamics tells us that statistically, in the long run, things degenerate to chaos and disorder, and that we can only beat this trend by putting in energy from somewhere. This is certainly true in our own local experience, but how it applies to the universe as a whole is not so clear)(Paul Davies' About Time is relevant)

Chapter 9
The very small & Quantum Mechanics

If you have survived school physics or chemistry, you will probably be familiar with the picture of an atom as something with a positive nucleus and negative electrons going round it. The picture is a bit like that of the solar system, with the sun at its centre and planets going round it. Unfortunately this analogy is not perfect. It is a standard piece of physics that anything going round in a circle must be accelerating towards the centre of the circle. (You can feel this pull if you swing a conker on a string). Late in the 19th Century it had been found that an accelerated charge lost energy as electromagnetic waves (This is how all radio communication works). Putting the two together we can see that the electrons should lose energy, and spiral into the nucleus in a fraction of a second. That would be the end of the universe as we know it almost before it began. Clearly something was wrong!
It took some 20 years for the working out of a theory we know as Quantum Mechanics. The underlying idea is that measurable properties like energy cannot just have any values they like, but are all multiples of a very small basic amount, the Quantum (Common language has taken over the word in the phrase ‘Quantum Leap’ to imply a big step forward - something which both annoys and amuses scientists!)

These ideas allowed scientists to explain and predict a lot of interesting and unusual things - much of chemistry for example, and to develop the physics behind microelectronics - used in computers and iPods and mobile phones.

On the other hand it also did some profoundly unsettling things to our understanding of the world around us, for it implied that some pairs of properties of things (like the energy and time) simply could not be known accurately at the same time - not just that we weren’t good enough at measuring carefully, but a basic limitation inherent in nature (The Heisenberg Uncertainty Principle). So measuring one thing accurately implied that we could not know the other thing in the pair as accurately as we might wish. It also implied that some things simply were not definitely decided until some ‘observer’ made an observation, at which point something happened and a definite result had to come out of the experiment.

The outcome of all this is that, while quantum mechanics works excellently well as a practical tool - as seen by its fruits in technology etc., scientists and philosophers still actively debate what it means for our understanding of the world. Some physicists (Einstein among them) still feel unhappy at the idea that at the bottom level, the world is governed by chance. They ask questions about how far ‘up’ towards our everyday human size scale this ‘uncertainty’ reaches, and if there is not, behind the uncertainty, some hidden system where things really are definite and certain.

For the believer, it can seem both worrying, if in fact God is not ultimately 'in charge', and things are the result of chance interactions, and hopeful, for here is a way in which God might act in the universe in an 'unseen' way.

Chapter 10

A special place

I hope that by now it will be becoming clear that the Universe (at least the part we live in) is really quite a special place.

The ‘laws’ of nature, as far as we have at present discovered them, and the strength of some of the forces at work in the universe, are such that the universe will be big enough, and last long enough for us to exist. They also allows stars to generate energy, and synthesise the elements of which we are made
It is not clear if the laws of nature are the same in the parts of the universe we cannot see (those so far away from us that light hasn’t had time to get here) Nor is it clear whether or not other universes, not connected to ours, might exist. If they did, would the Laws of Physics be the same in all of them? It seems clear that only small changes in some of the laws and forces in our universe would make it difficult for life to develop, but some believe that there are other alternative universes where different combinations of changes to the laws and forces might still leave open the possibility of complex systems and life evolving. This is all extremely speculative work, and not all agree with its conclusions.

Some recent workers have put forward theories in which there are enormous numbers of Universes (10 with 500 0's after it) and we are just lucky enough to be in one of those which can support life. Far from doing away with a creator, this just leaves open the question of why there are universes at all

Thinking about this has caused scientists to come up with the ‘Anthropic principle’. At it’s simplest and weakest, this really only amounts to stating the obvious, that the universe has to be suitable for human life - otherwise we could not be here! Stronger versions amount to saying that the universe has been set up to be suitable for life, and can be taken to imply the presence of some sort of organiser (perhaps God? though an impersonal one!)

To some extent the anthropic principle can be used to make predictions. I mentioned earlier that the basic processes by which the elements were created had been worked out in the 1950's.
At one point in this work there was a difficulty in explaining why there is enough Carbon in the universe for life to exist.

The process by which carbon is formed in a star is basically one in which three Helium-4 nuclei have to be joined together to form a Carbon-12 nucleus. It is very unlikely that this would happen all at once. It is much more likely that two would join to form Beryllium-8 and then a third Helium- 4 would join in. Unfortunately Beryllium- 8 is unstable, and the only way to get the needed amount of Carbon is if there is a favourable energy level in the carbon nucleus, which makes the process easier. Fred Hoyle worked this out, and went to check in reference books to see if the energy level was there. It wasn't, so he asked the experimenters to check it out. They did so with some reluctance, and found it as Hoyle had predicted. Hoyle is reputed to have commented that " If the energy level isn't there as predicted, then neither are we' as he could see no other way of getting enough carbon. The discovery caused Hoyle, a lifelong atheist, to say that 'The universe was a put up job'.

Chapter 11
The end of all things

In theological terms the study of ‘last things’ (eschatology) is concerned with the second coming and the ‘making of all things new’. From a scientific point of view, there is a range of events that could conceivably end ‘things’ (Paul Davies' The Last Three Minutes refers to this)

Our own existence on this planet is under pressure - are we for instance the ‘last word’ in evolution, or is there more change to come, whether done by us, or by ‘nature’? Only relatively recently (a few tens of thousands of years ago) we shared this planet with Neanderthal man - not a direct ancestor but another Hominid who lived alongside us. They left no written records, but their burials speak of a care and reverence which cause us to ask whether they too should included as partakers in the mystery of Salvation. So in the future will other creatures look back on us as just one stage on the journey of evolution? (If you can find a copy of Olaf Stapledon's Science fiction story 'First and last men' you can find this theme explored at more length. It is dated, having been written in the 1930's and its different worldview makes it worth reading for that alone)

Will our own activities - wars, overpopulation, exhaustion of resources, pollution and global warming, either end our existence or so cripple possibilities of development that we can go no further?

Beyond these results of human activity, there are the long-term possibilities - volcanic activity, meteorite impact, the sun developing to its red Giant stage before finally running out of energy, the long term stability of the Galaxy, the fate of the Universe - will it expand for ever, simply getting more and more spread out? - And there is also the question of whether the very matter the Universe and we are made of is stable, or will eventually decay away.

These are essentially long-term issues - with time scales of millions or billions of years - or even longer. To put ourselves in perspective, it is worth recalling that all we value as civilisation, and its achievements, has happened since the last ice age, no more than about 15 000 years ago. On the Astrophysical and geological time scales we are most definitely newcomers, and we have to ask ourselves whether the easy assumption that the world was made for us and that we have dominion over it is not a relic of the past when assumptions of human pre-eminence went relatively unchallenged.

Theologians, even ones from a scientific background, can get decidedly woolly, - almost evasive-, about what will be renewed when 'God makes all things new'

It is quite clear that over a time scale of a few billion years the earth must become uninhabitable as the sun reaches the end of its life. It is interesting to speculate whether humans or their successors will have devised ways of 'moving out' to new homes with longer to run on the lease! This is of course the stuff of science fiction, but whether it can ever be realised is a different matter - though the word 'impossible' has to be used with due caution over predictions about future technology, having been proven wrong many times in the past.

It seems to me - and this must be entirely personal opinion - that any hope of 'life after

death' - however one understands that term - must be independent of a universe that is doomed to eventual decay. Some writers (John Polkinghorne for example) expect the universe to be recreated in a form of matter that is not subject to decay and the inevitability of increasing chaos, so that we really will have resurrection bodies (though of what age? - Augustine held that babies would be resurrected as age 30!) This is a consequence of believing that humans are a psychosomatic unity (body and soul as one) and must be resurrected as such. (Compare this with earlier ideas of the soul being imprisoned in the body) Others have held that since resurrection must occur outside time and space, it will be our whole lives, seen now from a sharing of God's timeless perspective, which will be redeemed and purified. I don't think that there is any way of deciding this other than to wait and see - in some sense our death is the last experiment in which we will be involved in this universe.

Chapter 12
Miracles?

I hope that you will understand that science has considerable problems with the idea of miracles - the degree of problem depending on just what is understood by the word miracle.

If by miracle you mean, for example, the sudden reappearance of a limb, which has been severed or atrophied, then there is serious disquiet in the scientific community - deeply held beliefs about the nature of the matter of the universe are being challenged. The question is not so much one of whether God could do this, but whether God would do something so inconsistent with the way the universe seems set up to work. It is similar to refusing to wear a seat belt while driving, believing that God will take care of you if you have an accident. This involves asking God to suddenly negate the laws of physics on which the car (not to mention the Universe!) has depended for its operation up to that moment. It also ignores the moral question as to why God should show favour towards you, and not toward the many other presumably equally good people who die or are injured in accidents.

You can of course retreat in to some of the almost fatalistic philosophy which regards all events as being the direct result of the unchallengeable, inscrutable will of God, something which has been a thread of Islamic thought since Al-Ghazali. This seems to me to be an abdication of a God given duty to regard the world as ultimately intelligible, as being the work of a rational creator.

In other areas it seems to me there is more room for God's action. Most doctors will accept that the mental state and spiritual outlook of a patient can have a noticeable effect on the success of treatment. The mind - body interface is a significant one, whose influence is still incompletely understood

At the microscopic level, it is conceivable that God might intervene in quantum processes, where things are a matter of probability, or in chaotic systems, like the weather, where we cannot predict the outcomes very far ahead because we do not know the present in enough detail, nor have we sufficient computing power to look far ahead.

In these areas we have to ask ourselves again if we have to believe in a God who behaves in what seems to be an arbitrary manner, or if this is just our human interpretation of events in a world where many things happen as a matter of chance, and we select outcomes that agree with our expectations.

From a scientific point of view, the miracles reported in the Bible are no longer accessible to us, so that the gathering of evidence, which would convince a reasonable person today, is simply not possible. To take an extreme example, it's not possible to determine Jesus' paternity by sequencing His DNA as might happen in a dispute today.

We have to try and imagine ourselves inside the worldview of someone who lived in the near east 2000 years ago.
Clearly something happened which made a deep impression on them, which they regarded as a sign from God that his power was at work in the world. What they experienced changed their lives, and the history of the world in a very extreme way. Their

interpretation of their experience then might not be what we would make of it now, and stories are subject to change as they are re told down the years, so it is hard to come to simple yes / no conclusions on this. Ultimately this must be a matter for faith!

Chapter 13
Life and Evolution

While there is no universal agreement on the definition of life, scientists generally accept that living things must do the following:

1. Be Organized
Living things are composed of one or more cells, which are the basic units of life.
2. Metabolise
Metabolism produces energy that Living things require to maintain life.
3. Grow
A growing organism increases in size in all of its parts.
4. Adapt
Adaptation is when a living organism changes to suit its environment.
5. Respond to stimuli
. A response is often expressed by motion: the leaves of a plant turning toward the sun or an animal chasing its prey.
6. Reproduce
The division of a cell to form new cells is reproduction, though in common usage the term is applied to the production of a new individual.

Doing all these things requires some building blocks from which can be assembled the huge variety of molecules needed to make living things. The majority of the molecules in living things are made up from four elements Carbon, Hydrogen, Oxygen and Nitrogen (along with a few others like the Iron we find in the Haemoglobin in the red cells of our blood.) Vital to all this is the ability of Carbon atoms to join together in long chains, and so make possible a huge variety of molecules. No other element seems able to match carbon in this respect, though Silicon gets somewhere near. It is very interesting, (to say the least) that a very special set of properties of the carbon atom's nucleus makes it possible for stars to make enough carbon for life to exist. If this very special arrangement did not work out, there would be some carbon, but not nearly enough.

Life needs energy, and we are used to the idea that life on Earth depends on the sun, whose light drives photosynthesis in green plants, providing the input for food chains, which reach up to the predators - and Humans - at the top.

It was only recently that ecosystems were found on the deep ocean ridges, far from light, existing on chemical energy from hydrothermal vents, in conditions of temperature and pressure, which had been thought impossible for life. It's not clear if the life found there developed from life that needed sunlight to start with, or if life could develop there independently of sunlight.
Discoveries such as these have raised hopes of finding life in less hospitable places in our universe - for example the moons of some of the outer planets. This is an exciting prospect!

Evolution

Evolution is a subject that arouses a great deal of emotional reaction, for it seems to touch on the nature of our humanity, and to be at variance with a strictly literal account of

creation from the Bible. Surveys in America have shown a relatively stable 40% of the population taking a literal, creationist viewpoint, a view held by only 5% of scientists

From a scientific point of view, it is the most efficient and rational way of explaining the diversity and interrelatedness of living things - including us. The fossil record and observations by zoologists, and the work of Mendel strongly suggested that a long slow process had led from simpler and more basic life forms to the more complex, and that there was some way of passing on information about a living thing to its offspring-'genes'. In the last 50 years or so discoveries in molecular biology have provided a glimpse of the detailed mechanisms by which the processes of inheritance and evolution take place, and have opened the door to human intervention in these processes. These discoveries have helped to reinforce our sense of the interrelatedness of all life, for they show how much of our genetic material is similar to that of other living things - most of the life processes we need to live are also needed by other animals.

What is harder to work out is why humans seem to be such a big step beyond what seems to be next lower level, the other primates. Evolution is believed to take place in small stages, with each one giving a slight but significant advantage - but the step from the other primates, however much we may be able to see common features with our own behaviour, to ourselves, with a technological society seems a very large one, and some of our behaviours do not seem to be conferring much advantage.

The biblical account needs to be read, not literally, but as an expression of humanity's place as part of the created order, made of the same atoms and having much the same material needs as the rest of creation, but having a responsibility, a stewardship, towards it because of our position of dominance over much of it. Some theologies have regarded creation as 'fallen', there for us to use and exploit, but that does not work on a finite planet.

Chapter 14
Human Behaviour

Social grouping and cooperation

As organisms grow more complex, so do their interactions with other organisms. At a very simple level they may excrete chemical substances that affect creatures near them. For example some moulds produce chemicals that inhibit the growth of other organisms, and we make use of some of them as antibiotics like penicillin, or as natural antiseptics like tea tree oil.

At the highest level (so far) we communicate with verbal and visual signals and these demand that there is some shared code or language, which tries to ensure a common understanding. This sort of interaction allows the development of complex systems of social interaction. In systems with many variables, there will be many possible social systems, which allow some sort of stability to emerge. Problems can develop when systems, which have developed in isolation, come in to conflict - as can be seen most recently perhaps in the interaction of traditional Japanese or Arabic culture with American or European culture. Questions of group loyalty and identity produce stress, and systems, which have sustained ideas of group morality, are questioned.

What motivates human beings to behave in a particular way is a difficult problem, and much of the discussion about it is strongly coloured by the cultural assumptions of the commentator. It seems likely that much of the way we behave is derived from the culture in which we are brought up, and that culture will contain sub groups who deviate from it's norms in some way.
In the earliest stages of development it seems likely that survival within the environment would be the first priority, and then establishing identity and differentiating their group from others. Only when the basic needs of survival are met is there much room for more exotic developments. Some developments seem bizarre to an outside observer, for example the huge cost of human sacrifice in some Central American religions.
In this context much of the Old Testament can be seen as distinguishing the tribes of Israel from their neighbours, with whom they competed for resources (the history of this part of the world has been described as being the struggle for land and water), and from whom they saw them selves as set apart by their covenant relation with God. Many times bad things that happened to the nation were seen as being the results of failure to keep the strict terms of this relationship, a situation which was changed for all time by Jesus' radical revision of the codes under the divine imperative of unrestricted love.

Many of our problems can be seen in this light as being caused by limiting the Gospel of love to a smaller group than the whole of creation. An instance of this is that the developed world is rich at the expense of the underdeveloped world, and to attribute this to God's favour toward the already wealthy is to do violence to the Gospel, for even within wealthy countries, there are often pockets of extreme poverty.

What constitutes 'moral' behaviour is to a considerable extent dependant on cultural background, but in general it means living in such a way that you do no harm to others, and do good wherever possible. In the strictest sense it's not clear if this can ever be

achieved - simply living obliges me to consume some materials and use energy, producing waste that has to be disposed of. It can also be difficult to measure the gains and losses, so that we make decisions based on feelings, not on measurable outcomes.

Chapter 15
The environment

In the widest view, the environment could be the whole universe - without it we would not even be here, and in the long run it will determine our final fate. In the real world of everyday human lifetimes, and the span of human history, it is usual to restrict the meaning to our immediate surroundings on this planet, with which we interact in our daily lives. (We should not however ignore the influences of our Sun, whose 11-year sunspot cycle has been shown to have links with weather on earth, and whose activity can affect communication systems on the earth.)

It is not possible to exist without having some influence on the environment. We all need at least something to eat as food, and water to drink. In some areas of the world, it is possible to exist on those two things alone, for the climate is such that minimal clothing or housing is needed for protection. As long as the concentration of people is not too great, life can continue in equilibrium with the natural inputs, sunlight and rain can provide sufficient plant growth for food, and people's waste products - including their bodies when they die - return to the environment to be re used.

When population densities become large enough to put pressure on resources, then competition begins to produce conflict between groups, resulting in the need to fight or to move on. Both these pressures can act as spurs to technological development, and in the end to demands that require more from the environment than it can give, both in term of energy and raw materials. At an early stage these limitations may not be evident, though to a thinking observer their existence must be clear (e.g. Malthus)

As humanity has grown both numerically and in its demands on the environment, the limitations imposed by living on a finite planet begin to appear, as they have during the last century. Raw materials become difficult to find, cost more, and extracting them may bring environmental and human problems in its wake (for example illegal logging leaving soil open to erosion, diamond mining being used to finance wars) The other side of this is that our energy usage has begun to have measurable effects on our environment, so that Global warming is now generally accepted as being due to the production of greenhouse gases. When we burnt mainly wood as fuel, we were returning carbon to the atmosphere that had only recently been in the atmosphere. When we began to use fossil fuels, we started to return carbon that had been laid down millions of years ago.

How should we respond to this? Some have attempted to deny the problem, or claim that it is being exaggerated, possibly those who say this are driven by political or financial demands (Churchill is reputed to have said 'There are statesmen, who think of the future, and politicians, who think of the next election'). As Christians we have a scriptural responsibility to care for the environment for as long as the earth looks likely to be able to sustain our existence (this looks like being at least a billion years, unless some of the shorter term cosmic catastrophes occur.)

We have to recognize and accept our guilt in being part of a community which has brought about the problem - but confession has to be followed by a will to amend our lives if it is to be valid.

Carolyn King's Habitat of Grace has much to say on this and is well worth reading,

both for its overview as well as for its detail.

Chapter 16
Where do we stand now?

Well there it is - at least my view of it - does it mean anything?

There seem to me to be a number of possibilities

For some fundamental reason that we do not yet understand, this is the only possible universe, which leaves us with the question 'Why?'

Or possibly there are huge numbers of universes, some - maybe just this one - of which have the conditions for us to develop. This seems to be a bit extravagant, though some theories of space and time suggest that this may be the case. Scientists are generally very cautious about suggesting more ideas or things than are needed to explain what is going on

Or the Universe was formed with a purpose.....

Whichever of these possibilities, and I'm sure you can think of others, may be the case, there are basic questions about why there is a Universe at all - to which you can just say ' well there is' and get on with the rest of life. Or you can see our presence in it and curiosity about it as signs of a creative hand. There are no simple proofs, no knock down arguments - you have to decide for yourself on the basis of what you understand and feel where your beliefs lie

As for myself: -

'God does not exist' said a friend who is a lapsed Catholic.

And I have to say that I think she is, in a sense, right.

The stark, vengeful, authoritarian, judgemental god with which so many people associate the Holy Name is not only non existent, but deserves to be so. Such a god, ruling by fear of Hell, urging (so its ministers tell us) its followers on to commit loveless acts of violence against 'unbelievers' is a singularly sinful artefact of the human mind. It is unworthy of Worship.

That image has nothing to do with a God who brought this universe (and maybe others) in to being as an act of pure, unselfish love, sustained it through billions of years of evolution, and when it flowered with a life form capable of relating to God, was prepared to take human form and all its limitations to show us the way to overcome the evil in to which we have found it so easy to slide.

How then do we respond to this God?

Taking a lead from a famous Hymn writer, I'm inclined to say Wonder, Love and Praise

Wonder - at a Universe whose basic laws are so subtle that, for all the achievements of

science, I feel that we are only just beginning to tease out how their apparent simplicity can result in such abundant and fruitful complexity.

Love - the only way to respond to the love shown to us is, however feebly, to return it, both to God - though that can be difficult in the abstract - and to other human beings, those we meet everyday, and those far off, who are the immediate symbols of God in our lives. Love for Jesus is I think a very individual thing, and depends on your personality - for some people it comes easily and naturally, for others, and in that group I have to include myself, it is not so easy, though I remain fascinated by the historical figure of Jesus. Love also includes our action towards the environment, for we cannot separate ourselves off from it.

Praise - for a Universe (at least one!) in which we can come into existence, in which we can begin to understand our place.

So what should we do about it?

Any response we make may appear in some circumstances to be indistinguishable from that of any normal concerned individual, with or without any religious commitment. For example to be concerned about climate change could be seen as simply a matter of self-preservation. (Though why many of us who express such concerns are not prepared to go as far as seems to be necessary to try and put things right is probably worth a research project on its own! There may be a residue of theological perspectives in which creation is seen, as distinct from humans, as a resource to be exploited)

Concern for the fate of other Human Beings, even if they live far away from us, is perhaps more likely to have a distinctly religious motivation. It can certainly be found in the teachings of Jesus.

Simply looking after their material needs is only one level of the discussion - spiritual and social concerns are also part of the imperative, and we may have to make the effort to try and understand the very different situations and worldviews of people from different backgrounds.

For example the situation of women in society can vary from one of at least nominal (probably not actual) equality, to one in which they are treated almost as a separate species from males, unclean (at least on a monthly basis) certainly not having equal access to the hope of salvation.

Anyone who is significantly different for example in sexual orientation or in his or her family or relationships is also likely to be discriminated against.

Sometimes these forms of discrimination (and others, such as slavery) are simply excused as being tradition, but more worryingly ,they are often justified by their supporters on the basis of supposed scriptural authority, and such is the diversity of material in the Bible that it is possible for the determined searcher to uncover quotations in support of their belief. Most likely this is a residue (both in scripture and in the behaviour of those who misuse it) of practices meant to make one tribe distinctly different (better in their eyes) than those

around them
This is to seriously, probably blasphemously, misuse Holy Scripture, for if the Bible truly is to be good news for all, it must be taken as a whole, with it's story of growth and change, mistakes and triumphs. If it says anything at all it speaks of God's unbounded love for creation, not of a book of rules to be followed. We have inherited a rich harvest from God's creation of our universe, and represent, for the moment, the end point of his purposes on this planet.

We need to respond to this love shown to us by caring for creation - this planet with its resources on which we depend, and one another, made in the image of a God who was prepared to suffer the evil we did and still do to our fellow humans.

One viewpoint is that God has to let the world behave in apparently random and chaotic ways, as part of the price of leaving it free to develop. As parents we have to get used to the idea of letting our children have freedom to develop - we have a duty to provide the correct environment and to give guidance, but not to constrain beyond the limits of the environment- and in a much larger sense, God has done the same to the Universe, providing the environment - the Universe - and in the scriptures and through the spirit, and for Christians through the person of Jesus, giving guidance as to how we should live our lives.

Following this path will not be without pain. We have got used to having things very much as we want them, especially in the developed world, and now we have to face the consequences. Clever use of technology may help considerably, but in the long run only a marked reduction in our consumption of resources will have any impact on the situation.

From a purely objective point of view there are too many people on the surface of the earth. Socially this is caused by a number of factors, among them the need to have sufficient children to ensure that you are cared for in old age, or to ensure sufficient fighters to be able to compete with others. These would not be a problem on a planet with infinite resources, but we do not have that luxury. The next century or so will probably see us resolve these problems, or will show that we have set ourselves on the road to extinction