# Scripture and Science:

## An Unexpected Harmony

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# PREFACE

The other day I met a retired Christian professor. He asked: 'What are you doing these days?´ Instead of saying the expected 'Okay, keeping busy,' I thought 'Let's give it a try.' So I gave him a highly condensed version of this booklet, *Scripture and Science*. When I went as far as I could politely go, I stopped. Then he said very friendly: 'Well, I think I will stay with the conflict model.' And why not? Having lived a good life with an assumption, why change? That is why I have an audience of students in mind for this overview. That is also how this material developed over some forty years. Starting indeed with the conflict model, it changed through many discussions. Students are usually open to investigate subjects *from scratch*, rather then considering them as an alternative to an established position. Such an established position is not necessarily properly evaluated. One often prefers to keep what one has, instead of investing time in exploring something new. Students (of any age), by contrast, are more open to explore subjects for their inherent value.

I became a Christian as a student at the age of 23. I practiced science as an engineer for twenty years – building computers in laboratories and in industry. For another twenty years I taught how to make computers, what is now known as *computer science*. This is the perspective from which I write.

Recently many books have become available in which experts summarize the results of science for interested laymen. I refer to several of these in the bibliography, where I also offer some brief comments. These books may have been written because experts like to share the riches of their experience. They also may have tried to close the gap between science and the general public. Science can be expensive. At times it is extremely expensive. In 2009 the European Large Hadron Collider situated on the border of Switzerland and France was completed. It has already yielded essential knowledge about the nature of matter and energy. There was a plan to build an even bigger installation in the United States, the Superconducting Super Collider, for $8 billion. Twelve years of preparation and two billion dollars were already spent. The U.S. Congress voted against it in 1993, however. That may have been a wise decision, or not. In any case it shows how important it is for the general public to understand the efforts and needs of science.

This booklet offers an overview of the main issues and a review of the existing literature, not a new proposal. Many have published about the relationship between Scripture and science more thoroughly than I can. Thus, the key assumptions and facts that are mentioned in this review are found in the literature – at times, ages old. I'm happy to refer to the contributions of writers that helped me and summarize their arguments. I hope that this will encourage you to read their works.

The relationship between Scripture and science is not the most urgent problem to come our way. It is a matter of the mind. Our spiritual problems are usually matters of the will. Nevertheless this intellectual problem is often used to forestall an appeal to our wills. I hope that this review, on the contrary, will encourage you to submit your will to God.

In the past science saw the power of God in Nature. Even now there is an unexpected harmony between Scripture and science, as we show in chapters 2 through 5. Where problems must be recognized, we treat that conflict of Scripture and science in chapters 6 and 7.

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Bible quotations are from the *New International Version*.

# 1. THE STUDY OF THE UNIVERSE AS A CHARGE FROM GOD

According to Scripture (the Bible) 'God's invisible qualities – his eternal power and divine nature – have been clearly seen, being understood from what has been made' (Romans 1: 20). In the past science agreed with this statement. Even now there is a remarkable harmony between Scripture and science as we show in chapters 2-5. We should realize, however, that this harmony can only be found where Scripture and science overlap. Where one or the other extends its realm beyond its proper boundary misunderstandings ensue. In chapters 6 and 7 we consider where Scripture is misunderstood and science is misunderstood.

As an introduction to the study of the harmony of Scripture and science we note in this chapter that science – the study of the universe and all that it contains – may be seen as a charge from God. In the following four chapters we then consider the areas where a remarkable harmony may be noted: the beginning of the universe; free will in the universe; the mankind-directed universe; and life in the universe.

## *God's Charge*

We know the Lord through the Scriptures, through his creation and his acting in creation, and through the Holy Spirit. This knowledge, however, is obtained in quite different ways. Thus, Scripture is 'God breathed and is useful for teaching, rebuking, correcting and training in righteousness' (2 Timothy 3: 16). Science, however, is the experimentally obtained systematic knowledge of creation. Science can in this way be a form in which God reveals himself and helps our thinking under the guidance of the Holy Spirit.

According to Genesis 2: 15 the Lord placed man, Adam, in the Garden of Eden, 'to work it and take care of it'. Then the Lord brought the animals to Adam 'to see how he would name them' (Genesis 2: 19). In Hebrew thought a name is not an arbitrary label, but represents the essence of the named object. When a name is given, it is often explained. Thus Joseph calls his eldest son *Manasseh* (to make forget) because 'God has made me forget all my troubles' (Genesis 41: 51). Hence, Adam was invited to study the animals and discover the essence of their being. So we may interpret this passage as the start of science – an effort that clearly has the attention of the Lord. God's attention also concerns scientists, such as Solomon who 'described plant life from the cedar of Lebanon to the hyssop that grows out of walls' and 'who taught about animals and birds, reptiles and fish' (1 Kings 4: 29-34).

## *Science as an Answer to God´s Charge*

Science is only possible if God's works of creation are not arbitrary or chaotic, but can be 'pondered [studied, reflectively examined] by all who delight in them' (Psalm 111: 2). The Lord is reliable and consistent. These attributes we can find in his creation, and they enable science. Thus, the same principles apply everywhere and at all times in the universe; a multitude of events can be described compactly in the laws of nature; and scientific pronouncements can be verified by experiment.

Albert Einstein (1879-1955) stated that the most incomprehensible fact of the universe is that it is comprehensible. Nienhuis (1995, chapter 6) refers in this context to the *layers of creation*. These layers make it possible for each of us, at our own level of development, to 'ponder God's works and delight in them' (Psalm 111: 2). In daily life we all encounter and use the creation described by Isaac Newton (1642-1727), with distances in meters and weights in kilograms (or yards and pounds). Starting with this reality some of us can discover the macrocosm described by Einstein

with distances in *light-years* (the distance light covers in one year) and weights of *black holes* (extremely compact stars). Going in the opposite direction some of us can explore the microcosmic reality of quantum mechanics with its, for us, at times unusual behavior (Rees 1999, chapter 1).

Not every statement is accepted as being scientific. Richard Swinburne (1996, p. 26) states that science accepts a scientific law, if: a. all applicable observations are predicted by it; b. it is simple; c. it fits with present knowledge; and d. the applicable observations cannot be predicted in a simpler fashion. For the universe, or *cosmos*, c. does not apply, since we have no other universe to compare it with. We then summarize these arguments as: a scientific law is the simplest theory that explains all applicable observations. Science is founded on observation.

In contrast to science, Scripture is meant to be understood by all kinds of people. It clarifies and elaborates its truths by *juxtaposition*. Thus the assurance in Psalm 121: 3, that the Lord will 'not let your foot slip' should be read in connection with Psalm 37: 24, 'though he stumble he will not fall' and Proverbs 24: 16, 'though a righteous man falls seven times, he rises again.' Instead of using long sentences with many qualifications, Scripture states a key truth briefly – further detail is obtained by juxtaposing other texts.

Science uses the didactic method that presents its knowledge systematically. Thus, Carl Linnaeus (1707-1778) ordered the worlds of plants and animals according to their kind. Scripture, however, presents its facts in an order that is determined by history and revelation. Scripture also mentions primarily *what* God causes to happen, whereas science wants to know *how* this happens. When we compare Scripture and science we should take this into account.

Science is the work of imperfect people who use an imperfect network of human contacts. The hereditary laws of Johann Mendel (1822-1884) remained unknown for thirty years, because the monk Mendel did not belong to the scientific circle of that time. Mendel's laws were re-discovered by Hugo de Vries (1848-1935) in 1900. At that time one recognized the concept of *genes* in his work. The discovery of genes was a major step forward in biology. Attributes, such as dyslexia, are not diluted as they are carried from one generation to the next generation, but they appear unchanged or not at all in that, or a next, generation.

Mendel's discovery went unnoticed, but the 1915 book by Alfred Wegener (1880-1930) was noted very much indeed. It proposed that the continents of the earth, such as Africa or America, move with respect to each other. Many thought that idea - now known as *plate tectonics* - ridiculous. Wegener improved his book repeatedly, but his proposal was only accepted 30 years after his death. Then it was noted that the spread of the Atlantic ocean could be verified from the magnetic patterns that the changes of earth magnetism had left on the bottom of the ocean (Oreskes 2001, p. 31).

Radical changes in science are far too often accepted only by a new generation of scientists. Thus the theory that explains the mass-extinction at the transition from Cretaceous to Tertiary by the impact of a meteorite was only accepted in geology after much dispute (Powell 1998). Luis and Walter Alvares, father and son, discovered a thin layer of iridium at the Cretaceous-Tertiary boundary. This suggested that an extraterrestrial object had hit the earth and that its impact had caused the extinction of the dinosaurs. Such a sudden event was not customary in geography, which normally thinks in terms of ages. Moreover, Luis Alvares was no geographer. He received the Nobel price for his work in physics. He also liked to shake a dormant establishment. Nevertheless the suggestion of father and son Alvares was eventually accepted.

Fortunately, there are counter-examples to lethargy. Hendrik Lorentz (1853-1928) immediately understood the younger Einstein's theory of relativity and congratulated him. Einstein thanked Lorentz for his letter and suggested that Lorentz write a general description of the theory. Lorentz, however, thought that Einstein would be the best person to perform that task (Pais 1982, p. 271).

The reward of the scientist is his knowledge of God's creation. This is an important path to get to know God. It also helps him to perform his duty of working in, and caring for that creation. Finally, a better knowledge of creation helps mankind to keep and improve health and comfort.

Going a little deeper, there is great reward in being able to see how God made the universe. Einstein worked eight years to develop the general theory of relativity. When this theory was complete in November 1915, he used it to calculate the movement of the perihelium of the planet Mercury. (The *perihelium* is the place where the planet is closest to the sun.) This was important because it was known for about sixty years that Newton's theory did not give the correct value. On November 18th Einstein found that his theory gave the correct result. Abraham Pais says 'this discovery was, I believe, by far the strongest emotional experience in Einstein's scientific life, perhaps in all his life. Nature had spoken to him. He had to be right. "For a few days I was beside myself with joyous excitement."' (Pais 1982, p. 253, quoted by Polkinghorne 1998, p. 3).

The knowledge of science changes constantly – that is its nature. When we say 'we know', we should actually say: 'we think we know'. Nevertheless science advances. Much can be considered established, even though it may be refined by new insights or placed in a wider perspective by new discoveries. But watch out! Science can also come to a radically different opinion. It does not apologize. It does not know love or grace. It laughs at those who build their spiritual life upon faith in it.

We should understand the concept of science in a wide sense. Genesis 1: 27 states with Hebrew emphasis: 'God created man in his own image, in the image of God he created him.' The English theologian and author of detective novels Dorothy Sayers (1893-1957), pointed out that the image of God that is revealed so far in Genesis is the image of the creator (Sayers 1941, chapter 2). Whatever meaning may be attached to the expression 'the image of God,' in any case we may expect mankind to have creative abilities. Thus, right from the start of the Bible, technology and art are declared to be part of human activity. The Lord Jesus even accepts the technological (and often, artistic) products: bread and wine, as an image of his relation to his church.

There can be no scientific proof for the existence of God. A proof assumes a principle that encompasses the truth to be established. But if God exists, then he is the highest principle there is and there is nothing above him that can speak about him. Therefore, the 'proofs of God' of the scholastics in the Middle Ages (for instance, Thomas Aquinas' [1225-1274] five proofs for the existence of God at the start of his *Summa Theologiae*) cannot be proofs but only *arguments* – as they were intended to be. Science neither proves nor disproves God. Stephen Gould says this in his characteristic way: 'I say it for all my colleagues and for the umphteenth millionth time: Science simply cannot by its legitimate methods adjudicate the issue of God's superintendence of nature. We neither affirm, nor deny it. We simply can't comment on it as scientists. If some of our crowd have made untoward statements claiming that Darwinism disproves God, then I will find Mrs. McInnerney [Gould's third grade teacher] and have their knuckles rapped´ (quoted by Collins 2006, p.165).

Science does not know God. It takes *faith* to believe in God. It also takes faith *not* to believe in God.

In the following chapters the harmony of Scripture and the science that God has charged us with should be very clear— as we would expect. But we can also expect that science does not immediately find that harmony, since God's creation contains remarkable surprises. Nature at times proves to be quite different from what we or our ancestors thought. That also becomes clear in the following chapters. Finally, we may expect that perhaps in some places our understanding of Scripture should be improved. In that respect the following advice of Augustine of Hippo and Thomas Aquinas may be appropriate.

Augustine (345-430) warns us concerning Genesis 1: '. . . if we find anything in Divine Scripture which may be variously explained without injury to faith, we should not rush headlong, by positive assertion, either to one opinion or the other; lest, if perchance the opinion we have adopted should afterwards turn out to be false, our faith should fall with it; and we should be found contending, not so much for the doctrine of the Sacred Scriptures as for our own; endeavoring to make our doctrine to be that of the Scriptures, instead of taking the doctrine of the Scriptures to be ours'. (*De Genesi ad litteram libri duodecim*, written *c.* 410, quoted by Gedney 1950, p. 57)

Similarly, Thomas Aquinas says concerning Genesis 1: '. . . in questions of this sort there are two things to be observed. First, that the truth of Scripture be inviolably maintained. Secondly, since Scripture does admit of diverse interpretations, that no one cling to any particular exposition with such pertinacity that, if what is supposed to be the teaching of Scriptures, should afterwards turn out to be clearly false, he should nevertheless still presume to put it forward, lest thereby the Sacred Scripture should be exposed to the derision of unbelievers, and the way of salvation should be closed to them'. (*Summa Theologiae*, written *c.* 1270, quoted in Gedney 1950, p. 57)

# 2. THE BEGINNING OF THE UNIVERSE

Taking into consideration the past two centuries, science has never been as much in harmony with Scripture as it is now. The steadfast view of Scripture is that the universe had a beginning, whereas nineteenth-century science denied that. Because the knowledge of science has improved we now know that the universe had a beginning. In the next three chapters we also see that other important source of conflict are resolved as science progresses.

When in 1900 the start of a new century was celebrated, Lord Kelvin (William Thomson, 1824-1907) stated that physics was almost completely understood. There were just a few loose ends to be tied down. For example, Albert Michelson (1852-1931) and Edmund Morley (1838-1923) showed that the speed of light was the same in all directions, in spite of the movement of the earth around its axis and around the sun. Furthermore, as we saw in chapter 1, the course of the planet Mercury around the sun was not what was predicted by Newton. Finally, the nature of genetic information was still obscure.

Another unsolved problem was that the energy of the radiation of a heated oven, as measured in practice, did not match the theory. Already in the year 1900 Max Planck (1858-1947) found a solution that explained the practical measurements. He assumed that radiation does not occur in arbitrary quantities, but as multiples of a small unit, the *quantum*. The calculation with these quatums is therefore called *quantum theory*.

Also, in 1905 Einstein answered three more of these questions. The answers of Planck and Einstein were so radical, however, that they gave the physics of the twentieth century a unique character.

Besides these theoretical surprises there were also surprises that followed undeniably from experimental observation. One such observed scientific surprise was the beginning of the universe, which is the subject of this chapter.

## *The Beginning of the Universe according to Scripture*

The Jewish-Christian faith, as well as Islam, which deviated from it,[1] are the only world religions that clearly and prominently describe a beginning to the universe. The Bible starts by saying that 'In the beginning God created the heavens and the earth' (Genesis 1:1). This beginning, however is no isolated occurrence. It is tied to the present by history and genealogies. Thus God's plan for the universe, which pervades all of Scripture, is displayed. Scripture calls this plan *the way* (e.g. Psalm 1: 2) . The way has a beginning and a goal. It is contrasted with the unending cyclic successions of the seasons, as celebrated by the Baal and Ashera fertility cult. It also clearly differs from the eastern ideas about the circle of reincarnation. Scripture says: 'man is destined to die once, and after that to face judgment' (Hebrews 9: 27). The way is illustrated by the call of Abram to go to the promised land; the exodus of his descendants toward that land; and the establishment of a people with a knowledge of God in that land, such that they should be ready to receive the Messiah (Hebrews 1: 1, 2). Ultimately, Jesus shows that he is the way to enter the kingdom of God (John 14: 4-6).

[1] The God of Abraham, Isaac, and Jacob speaks – ultimately by becoming man in Jesus. The God of Ishmael does not speak – Mohammed is his prophet.

Scripture states the beginning of the universe very definitely by saying that 'what is seen was not out of what was visible' (Hebrews 11: 3). Old myths say that the universe is made from something else (a tortoise, an elephant, or the semen of a god). Scripture uses the word *creation* in its proper sense.

Since we now know more about modern science we look first at the all-embracing creation from that point of view. The God-inspired author of Genesis of course did not have that knowledge.

After the very first creation of a universe without form, a number of acts of creation occur that are described as 'days.' Thus on day one (Genesis 1: 3) light is created. This is not the sunlight, which appears on day four, but the *concept* of light, the electromagnetism that at the proper frequencies gives visible light. Because God's ultimate intention is mankind, there must be matter in the form of gas (such as the atmosphere which protects against ultraviolet light and meteorites), in fluid form (such as water, so indispensable) and in solid form (such as carbohydrates, the building material of life). In that way we can read day two and the beginning of day three (Genesis 1: 6-10) as God's choice of the laws of physics that enable these forms of matter. Day three brings about the necessary environment for life (earth and sea) and the nature of life – growth (green) and propagation (seed). The potential of the first three days comes to fruition in the last three days. Day four mentions that the earth obtains a place in the solar system. The night is dark with 'the lesser light to govern the night.' (Genesis 1:16). On day five the water and sky are populated by fish and birds, and on day six the land is populated by animals. It is stated emphatically that mankind is also created that day.

Genesis 1, however, is not a scientific report. It says *what* the Lord brought about, not *how* he did so. Rather, Genesis 1 is a surprising monotheistic theological introduction. All supposedly divine powers are declared to be created by the only and almighty God: light, darkness, heaven, sea, sun, moon, stars (in spite of astrology), animals (even though some are mummified) and mankind (although some kings claim to be divine). Genesis is also an answer to *enuma elish*[2] the polytheistic myth that was popular at the time when Genesis appeared. (Sarna 1970, p. 7). The God-inspired author of Genesis must have understood this very well. In chapter 6 we return to Genesis 1.

## *The Beginning of the Universe according to Science*

Only in the twentieth century could science make a statement about the beginning of the universe. Prior to that time, in the absence of definite knowledge, a 'static' universe was assumed – a universe that had existed forever and would continue forever. Einstein added a 'cosmological constant' to his general theory of relativity to describe that static universe. The Dutch astronomer Willem de Sitter (1872-1936), however, discovered in 1917 that without this constant the theory of relativity describes an expanding universe. The Russian meteorologist Alexander Friedmann (1888-1925) also remarked in 1922 that without this constant Einstein's equations could describe other, differently expanding, universes. These remarks were considered irrelevant until 1929, when the astronomer Edwin Hubble (1889-1953), using the strongest telescope of that time, observed that the universe was expanding indeed and must have had a beginning. Einstein admitted in 1931 that his cosmological constant was a mistake (Pais 1982, p. 288).

[2] *on high* (in heaven). The first words of this text, just like *genesis* is the start of Scripture.

In spite of the efforts of Fred Hoyle (1915-2001) to defend the static universe (1948) the *Big Bang* (Hoyle's phrase of derision, which he used in radio talks during the 1940s) at the beginning of the universe is one of the most defensible achievements of science (Ross 1989). This conclusion is justified because the radiation of the beginning of the universe can still be observed. In 1965 Arno Penzias and Robert Wilson of the Bell Laboratories discovered that an experimental antenna received signals that did not originate from the earth or even from the solar system. At the same time Robert Dicke at nearby Princeton University was building an antenna to receive the cosmic microwave background radiation signals of the beginning of the universe. He heard about the Penzias-Wilson signals and told them what they were receiving. In 1978 Penzias and Wilson received the Nobel price for their discovery (Hawking, 1998). These signals have been studied more precisely through the COBE (COsmic Background Explorer) satellite and its successors.

According to Vilenkin (2006, p.186) the universe was created by a quantum fluctuation that tunneled in non-Euclidian space. A *quantum fluctuation* is an event in which a quantum representing a mass of negative potential and a quantum of positive potential occur spontaneously. Such events occur frequently and disappear rapidly because the quanta annihilate each other. The tunneling, however, caused them to remain longer and be the start of a universe. Borde, Guth, and Vilenkin published this proposal in 2003. Such a beginning occurs only once. It is a definite event. Science thus agrees with Scripture that creation is out of nothing. Vilenkin noted, however, that there was a prior publication that suggested creation of time and mass out of nothing. The author of that suggestion was Augustine, bishop of Hippo, Northern Africa, in his *Confessions* (400).

According to the *inflation* hypothesis of Alan Guth (1981) the initial universe increased in a fraction of a second exponentially to an enormous energy (Guth 1997). This hypothesis was confirmed in 2005 by the careful measurements made by the successor of COBE, the WMAP (Wilkinson[3] Microwave Anisotropy Probe) satellite (2001).

The inflation theory postulates that the physical forces became possible a fraction of a second after the beginning. Guth uses the image of the Mexican hat, the *sombrero*, to explain this beginning. At the end of the inflation period the energy of the universe was extremely high and, figuratively speaking, on a dent at the central top of the sombrero. Because of the extremely high temperature, no laws of physics applied. Then, the universe started to expand and to cool slowly. The energy could no longer remain figuratively at the top of the sombrero and had to find a place on its rim. This rim depicts the many possible laws of physics and their constants. The place found for our universe included the laws of electromagnetism and therefore light. This process is called *symmetry braking*. On the top of the sombrero there is a symmetry that on the rim no longer exists (Guth 1997, pg. 168). After the symmetry braking, the cosmic microwave background became visible. It proved to have very minor irregularities. These were noted by COBE and carefully recorded by WMAP. These irregularities were caused by quantum fluctuations and would ultimately result in galaxies.

According to recent scientific opinion the first stars appeared about 400,000 years after the beginning of our universe. They burn by fusing four hydrogen atoms into one helium atom. The energy that is obtained in this manner gives the light with which the star shines. When a star exhausts its hydrogen supply heavier atoms, up to iron, are made. When the stars have no more energy left they may implode in a supernova and create the heavy atoms that are required for

[3] David Wilkinson, at Princeton, initiated the idea for this satellite, but unfortunately died before the probe was launched.

biological life. Those atoms are therefore found in a second generation of stars and in the planets that accompany them. Our sun with its planets is a second- or third-generation star. (Rees 1999, p. 43).

Creation is the beginning of time. According to Scripture there is also an end to the universe and to time: 'the earth and the heavens . . . they will perish' (Hebrews 1:10-12).
Science also states that there will be an end to the universe. The universe will 'evaporate', by continuing to expand, so that the light of a galaxy no longer reaches another Galaxy and finally the light of the stars of a galaxy no longer reaches the other stars of that galaxy. Another possibility is that the universe collapses through gravity in a *big crunch* (Rees 1999, chapter 6). But much earlier (some five billion years from now) the sun will exhaust its supply of energy and expand to become a *red giant* that reaches to and destroys the earth. But maybe much earlier a meteorite will destroy life on earth. Christians have the promise of the Lord that he will return before that moment.

The above discussion shows that science has improved its understanding of nature, by accepting the fact that the universe had a beginning. That conclusion occurred after much discussion in which the surprising discoveries of Hubble and the COBE satellite played major parts. There are of course many more questions to be asked and to be answered. The main conclusion, however, is that Scripture and science agree that the universe had a beginning.

# 3. FREE WILL IN THE UNIVERSE

In daily life the concept of determinism has never governed our thinking. Society and the law always consider us responsible for our choices. One counter-example may illustrate this. Around 1924 two young men, named Nathan Leopold and Richard Loeb, worked out how one could commit a murder without being caught. A plot for a detective novel, perhaps. They decided, however, to prove it in practice and murdered an acquaintance. But they had not accounted for two circumstances. First, they were nervous (they were human after all!) and one of them lost his spectacles. Initially the police thought this might be a major clue, except that the prescription was so general that it did not lead anywhere. The second unexpected circumstance was the unpredictability of society. The company that made the spectacles had just changed the design of its hinges. Only very few of these had been shipped and they were easily traced. Imagine the tragedy. All plans for the future canceled. The death-penalty almost a certainty. The desperate families hired the famous lawyer Clarence Darrow (1857-1938). With an eight-hour address, delivered over two days to the jury, he succeeded in getting the death-penalty commuted to a life-sentence. His argument was determinism. These 'boys,' Nat and Dicky, *could not* have acted differently. If that argument were followed everywhere, it would be the end of justice.

## *Free Will according to Scripture*

Free will is a key concept of Scripture. In Genesis, chapter 3, Eve and Adam are given the opportunity to express their will to obey God. Unfortunately they choose not to do so. This freedom to choose is a major theme of Scripture. Moses challenges the people of Israel in his farewell speech to obey God, for 'it is not too difficult or beyond your reach' (Deuteronomy 30: 11-20). His successor Joshua clearly states, after the conquest of the promised land, 'now fear the Lord . . . As for me and my household, we will serve the Lord' (Joshua 24: 14, 15). Then, when a king is chosen to govern the people, Saul makes the wrong choice, but not David and Solomon. Subsequently, the country splits in Israel to the north and Judah in the south. All northern kings choose to follow Baal and only a minority of the southern kings decides to follow the Lord.
In the New Testament the choice for or against God is also central. Jesus states clearly: 'Enter through the narrow gate. For wide is the gate and broad is the road that leads to destruction and many enter through it. But small is the gate and narrow the road that leads to life, and only few find it.' (Matthew 7: 13,14) In all these examples the choice, when made, is definite and the result of that choice may change the life of the person concerned. In some cases the world is radically affected.

## *God's Acting according to Scripture*

Christianity is not deistic – it does not assume that God does not act in his creation. Christianity is theistic, which assumes that God can act in his creation.

Scripture and human experience tell us that we may speak to God in prayer. Scripture also tells us that the Lord speaks to us. He stood near Samuel and called him. After some confusion Samuel answered: 'Speak, for your servant is listening.' The apostle Paul had prayed three times that a serious bodily disturbance would be removed. Then, the Lord said to him: 'My grace is sufficient for you' (2 Corinthians 12: 8).

Scripture also tells us that the Lord acts in his creation. A well-remembered occasion is the crossing of the Red sea, when the Lord 'drove the sea back with a strong wind' such that the Israelites could cross and Pharaoh and his army got stuck and drowned (Exodus 14: 21 and Psalm 136: 13). Another example is the silencing of the storm at the command of Jesus (Mark 14:

36-41). Many miracles can be understood in this manner.

As we saw in chapter 2, God also acts in the life of men. He made a new start in his contact with mankind by calling Abraham such that his people would arise. Then he called Moses to lead his people. He spoke through Isaiah and other prophets to call his people to return to him. Finally he calls Mary, so that he himself can come to earth and present himself to mankind.

God's intervention is distasteful to modern man. If God can act in creation, he can also act in our life. And that is what he does in the life of a Christian. But that is exactly what the conscious non-Christian does not want to happen. 'There comes a moment when people who have been dabbling in religion (Man's search for God!) suddenly draw back. Supposing we really found him? We never meant it to come to *that!* Worse still, supposing he had found us?' (Lewis 1947, end of chapter 11).

## *Uncertainty in Science*

In the nineteenth century, science taught that the future is entirely determined by the past. In a much-quoted incident the emperor Napoleon (1769-1823) congratulated the mathematician Pierre-Simon de Laplace (1749-1827) on his new book. He then remarked that God was not mentioned in it. Laplace replied: 'Je n'ai pas besoin de cette hypothese là' ('I do not need that kind of assumption.'). In other words: Give me the facts and I can calculate the course of the world. Calculation was no problem for the famous mathematician. But those facts are not available. After his time it became clear that the data for the calculation of, for example, the path of a hurricane is so enormous in number and required precision, that even a world filled with the fastest computers would not be able to process it. The American meteorologist Edward Lorenz (1917) stated that the vibration of the wings of a butterfly in Brazil can cause a hurricane in Texas[4] – the start of chaos theory. This shows that what was thought possible at the time of Laplace is considered practically impossible in modern science. Moreover, even those vibrations of the wings of a butterfly cannot be ascertained for sure, as we shall see below.

In the twentieth century science radically improved its knowledge of matter. At the start of the century there were still doubts about whether atoms and molecules really existed. In 1905, however, Einstein published a paper concerning Brownian motion, the microscopic movements of small particles in a liquid. This paper showed how the magnitude of molecules can be determined and was a step in the acceptance of the thought that atoms and molecules actually do exist.

As we saw in chapter 2, Max Planck assumed that the energy of radiation consists of multiples of quantums. This simple assumption has tremendous consequences. For what happens when a very small amount of energy is required? One quantum may be too much, no quantum too little. What actually happens in that case is uncertain. It is like the coin tossed at the start of a game to determine which team will start. We do not know the outcome. But we know that, when many games are played, each team will start about half the number of times. In quantum mechanics this situation is described by the *uncertainty relation* (1927) of Heisenberg (1901-1976). It means that in the universe the action of an elementary particle is not determined. Physics in that case no longer follows the principle of causality – there is no determinism. What *is* known is the exact probability for the action of that particle.

Einstein was unhappy with uncertainty. He tried in vain to find an underlying relation, which

[4] Air currents are described by differential equations which are highly dependent on their initial conditions. A small change in these conditions results in a totally different course of the corresponding current.

would make the universe deterministic after all. He said: 'Der Alte würfelt nicht' (God does not cast dice). But his colleague and friend Niels Bohr (1885-1962) said: 'Who is Einstein that he can tell God what he is allowed to do?'[5]

At the lowest physical level, processes are non-deterministic. Although the action of our brains are far from being completely understood scientifically and the deterministic speculation remains that our thoughts are merely determined by chemistry, Swinburne (1996, p. 93) and Polkinghorne (1998, chapter 3; 2005b, p. 40) speculate that our brains can express our will through this physical uncertainty. A further speculation is that the Lord uses this uncertainty when he acts in his creation (Miller 1999, p. 214; Russell in Miller, 2003, chapter 15). Thus science again is in harmony with Scripture which speaks of the responsibility of mankind and of God who says: 'when I act, who can reverse it?' (Isaiah 43: 13).

God could have used the uncertainty relation or chaos theory, or both together at the proper moment to 'drive the sea back with a strong wind' such that the Israelites could cross the bottom of the Red sea. The miracle would not be any less because of it, but it throws light upon the wisdom and power of the Lord. Many miracles that concern nature could be explained in that manner.

One could of course assume that God as creator could overrule the laws of his creation. But one could rather assume that God made his creation such that he can act in it. For when God wanted to come to earth he decided not to come as an adult but via natural childbirth followed by a common adolescence up to about thirty years of age.

Other miracles, such as the resurrection of Jesus, suggest an acting in creation of such an essential way that this major objective of God's plan for the world could be achieved.

Quantumtheory and chaos theory represent not only a major change in the nature of physics, they also changed the relation of Scripture and science in such a way that we can speak about harmony where formally there was conflict.

We return to scientific uncertainty in chapter 5.

[5] When Einstein was twelve years old he had religious interests. Unfortunately he then did not celebrate his Bar Mitzvah (son of the law). Otherwise he might have realised that according to the Bible the universe has a beginning and mankind a free will.

# 4. THE MANKIND-DIRECTED UNIVERSE

In the nineteenth century, science considered the universe as a place that was not especially suitable for the life of mankind. The universe just happened to exist, and the question whether it could have been different was not asked. Only in the middle of the twentieth century did science become aware that the universe could have been quite different. It became amazing how precisely the universe was 'tuned' for mankind to exist.

## *The Purpose of the Universe according to Scripture*

Scripture states, right from the start, God's intention for a universe with people with whom he can speak and whom he can love. Each act of creation in Genesis 1 is concluded by saying that it was 'good.' When on the sixth day mankind is created a major step toward God's purpose is achieved and it is concluded that it was 'very good.'

That our universe is special is expressed in some psalms. Psalm 19 says: 'The heavens declare the glory of God; the skies proclaim the work of his hands.' Or, Psalm 8: 'When I consider your heavens, the work of your fingers, the moon and the stars, which you have set in place, what is man that you are mindful of him?'

That the universe is special is also shown in the Old Testament through the image of the vineyard that we should both tend and toil and show thankfulness for (Isaiah 5: 1-5). In the New Testament that image is repeated (Matthew 21: 33-41; Marc 12: 1-9; Luke 20: 9-14). The carefulness which a vineyard requires– preparing the soil, planting the vines, digging the hole for the vinepress, constructing the watchtower, making a protective fence – is emphasized. The purpose of this image was originally that Israel should be thankful for God's attention and care. But, besides Israel, we all can affirm that the universe indeed is very remarkable.

The Lord might have expected that mankind, using his free will, would turn to him. At least people could have thanked him for all the earth's goodness, such as life, food, protection and the beauty of nature. That was, however, a disappointment. God 'came to that which was his own, but his own received him not' (John 1: 11).

## *The Anthropic Principle in Science*

Einstein's general theory of relativity is one of the greatest intellectual achievements of the past century. He started in 1907 with 'the happiest thought of my life' that someone who descends in free fall in an elevator feels no attraction by gravity. This led to the theory that mass changes the shape of the space in which it occurs. Yet the theory is not complete. It still lacks the relation between gravity and the electromagnetic and nuclear forces. Also, it does not establish the values of the constants of nature. When completed, the theory would be called a 'theory of everything,' or better *quantum gravity* (Smolin 2000).

Only by the middle of the twentieth century did science become aware of how precisely the universe is tuned for intelligent life to occur, as described in the book *Rare Earth* (Ward and Brownlee 2000). It is indeed very remarkable that the earth and its environment are just right for high-order life to develop. Thus, the distance of the earth from the sun is such that there is water in the oceans – Venus is too hot, Mars too cold. The life of the sun is sufficiently long – five billion years – to allow the earth to develop high-order life. The large planet Jupiter prevents most comets from reaching the earth. The earth has the right mass to retain an atmosphere, to allow plate tectonics, and to have a magnetic field. Our remarkable moon is at the right distance

to allow tides to occur and to stabilize the tilt of the earth's axis – such that seasons occur regularly. All of this makes it possible for plant and animal life to develop with the aid of the right amount of carbon and oxygen, of an atmosphere with the proper temperature. No major meteoric impact has occurred for the last 65 million years.

The satellite Kepler allows us now to discover planets of other stars. So far, however, none of the thousand planets that have been found meets in any way the requirements for intelligent life. We are still alone in the universe (Gribbin 2011).

Besides the special place of the earth in the solar system, the place of the sun in our galaxy, the Milky Way, is also very favorable. The sun is positioned on a branch of the galaxy, far from the crowded and dangerous center, and is not likely to be endangered by another galaxy.

Most remarkable of the universe, however, is its constitution as an entity. Collins (2006, pp. 71-77) mentions fifteen independent critical physical values, such as the speed of light, the strong and the weak nuclear powers, and gravity. These values of physics determine the nature of the universe. They should have exactly the proper value such that a universe can arise that is inhabitable for mankind. The book *Just Six Numbers* (Rees 1999, p. 48) offers examples. Thus, the nuclear force efficiency, which determines which proportion of nuclear mass can be changed in energy, has the value 0.007. Even a small change of this value to 0.006 or 0.008 would be fatal to the operation of the universe and hence to our existence. Yet, no laws are known from which these values can be determined.

Another remarkable requirement for our universe was noted by Fred Hoyle when he observed how carbon is made from helium. One carbon nucleus is synthesized from three helium nuclei. Since this cannot occur all at once, first two helium nuclei combine to form a beryllium nucleus. But the beryllium nucleus is unstable and decays before the third helium nucleus arrives. Hence Hoyle predicted a carbon resonance that allows the third helium nucleus to be 'grabbed' before the beryllium decays and yet prevents a fourth helium nucleus to join and form oxygen. Later experiments proved Hoyle to be right. They also showed that even a four percent shift in nuclear force would spoil this effect (Susskind 2006, p. 182).

The weight of the atoms, such as hydrogen and oxygen, follows directly from quantum theory. One hoped that, similarly, quantum gravity would account for the interrelation of the constants of nature. So far, however, no rules have been found that determine the values of the constants of nature. The most prominent theory of quantum gravity is *string theory*. Many theoretical physicists have developed it for about forty years. Yet this has not resulted in a testable theory (Smolin 2006).

The fact that physical constants and processes are exactly right for the universe to be inhabitable by mankind, even though there are no physical causes for them, is called the *Anthropic* (mankind-directed) *Principle*. Stephen Hawking (1988, chapter 8) says that it is not so surprising that these values are correct. If they were different, we would not be here to observe this fact. Swinburne (1996, p. 67) considers this a misjudgment. It is not remarkable that we observe these values. What *is* remarkable is that the universe exists.

One of the constants of physics that must have a special value to permit intelligent life in the universe is the cosmological constant. We mentioned in chapter 2 that Einstein introduced this constant to describe a static universe. For the expanding universe, which Hubble discovered, the cosmological constant was not needed, hence could be zero. A further development of quantum mechanics, however, reintroduced the cosmological constant as a measure of *Quantum Vacuum*

energy. This vacuum energy is not zero – as we might expect - because of the quantum fluctuations that may occur.

The various quantum particles that may fluctuate contribute positive or negative forces that vary widely in size. Yet their sum should be zero up to 120 decimal places. That is necessary for the universe to expand at the limited rate proposed by de Sitter without exploding or imploding prematurely. One could propose that the inflation that occurred at the start of the universe caused this favorable value, but that leads just to another problem: how the inflation could produce that value. Susskind notes (2005, p.78) that 'for a bunch of numbers, none of them particularly small, to cancel one another to such precision would be a numerical coincidence so incredibly absurd, that there must be some other answer.' But, after forty years of theoretical physics, no law has been found that requires this force to be so small. The only reason for it to be so small is that otherwise mankind could not exist. Susskind calls this *the Mother of all Physics Problems*. It is also known as *the Hierarchy Problem*, because it requires numbers, which differ in magnitude in a major way, to be added precisely.

How did theoretical physicists react to this problem? Susskind lists several responses. Some, of course, left the problem for their colleagues to solve. But Steven Weinberg squarely accepts the challenge of the anthropic principle. So do Susskind and Vilenkin. They suggest that the inflation that caused our universe did not stop, but continued to produce universes. All these universes exist on their own. It is not possible to observe one universe from another, let alone to visit one from another.

Susskind (2006, p.198) and Vilenkin call their assembly of universes a *megaverse* (an extremely large number of universes). They assume that it consists of $10^{500}$ member universes, all with slightly different physical constants, such that our universe would by chance turn out to have the right values. De Duve (2002, p. 299) considers this 'drowning the fish' (a French saying for 'overdoing on an extravagant scale'). Moreover, the proposal can hardly be called scientific, because it cannot be verified by experiment. Also, the atheist is not helped because the question remains: Who created the initial inflation that caused the megaverse?

Of course no scientist proposes that there is only one universe in which the Lord set the desired values. That would not be scientific. Indeed, it *is not* science. But, it would be very simple. We return to this in chapter 7.

# 5. LIFE IN THE UNIVERSE

Around the 1920s several books were written by experts to inform laymen about the advances of science – just as happens today. When, a generation later, I read some of my father's books I was struck that one of those authors (perhaps Eddington, 1882-1944), after explaining the advances in physics, expressed the hope that some day a similar major advance in biology would be made. That advance was made indeed. In 1953 James Watson (1928) and Francis Crick (1916-2004), using the X/ray photographs of Rosalind Franklin (1920-1958), explained how the genetic code – found already in the work of Johann Mendel – is expressed in DNA. In subsequent years the enormous potential of that discovery became apparent. Biology consists no longer in the collection of an enormous amount of facts. There is now a frame that with almost mathematical precision gives a relation between these facts and that can be approached in various ways. Thus the unity and diversity of life is expressed.

## *The Unity and Diversity of Life according to Scripture*

On days five and six of creation the diverse forms of life in the sea, the air, and on land are called forth. Each time Genesis states that God says: 'let there be', followed by 'and it was so'. As stated in chapter 1, the text says *what* is created, not *how* it came to be. Because the various creatures are created on the same days, a unity of life is suggested. Also, when Scripture speaks of 'every living and moving thing with which the waters teem according to their kind', a great diversity of life is suggested (Genesis 1: 21).

At the end of the eighteenth century many thought that God had created the animals one by one. Even though Scripture does not affirm this, that thought is understandable, since the craftsmen of that time also built one carriage or one wardrobe at a time. When I discussed this with another engineer, he agreed, but added: 'you would not do it that way'. Indeed, nor would he. Nowadays we design a whole family of objects, such as cars or appliances, at a time. Since Genesis speaks of entire classes of animals it suggests that these were created also as an entity on God's command. Going even further, we may assume that the Lord designed the entire animal kingdom, as well as all plants and other living creatures as one entity. Not a small task, but very appropriate for the King of life. This process started at that day and continues up to the present. According to Scripture we may therefore expect both unity and diversity in those created kingdoms.

## *The Unity of Life according to Genetic Science*

Science made a great advance in biology when Carl Linneaus (1707-1778) introduced the dual notation, where the first name refers to the genus and the second to the species of an organism. Nevertheless, the unity of life was not clearly apparent. The relation of *Octopus vulgaris* to *Elephas maximus* cannot be derived from these names.

The knowledge of the genetic code made the unity of life a tractable reality. We now know the genetic code of humans, as well as that of other favorites of biology: the colon bacterium *Escherichia coly*, the nematode *Ceanorhabditis elegans*, the fruit fly *Drosophila melanogaster*, the mouse and the chimpanzee. The similarities between these codes prove to be much greater than expected. Thus, De Duve shows at the start of his book (2002) a part of the genetic code of the colon bacterium, the wheat plant, the fruit fly, the horse, and mankind which agree in large measure because they are related to one another. Also, we can now determine the relation of the octopus to the elephant. To that end we first search, using their genetic codes, the last common ancestor of both. Finally, we determine the descension of each separately. Thus the unity of life is expressed in the genetic code.

The knowledge of the genetic code not only proves the unity of life, it also widens the scope of biology. As an example we mention the study of the dispersion of mankind across the world. Scientists think that humans, formally known as *homo sapiens,* first arose in Eastern Africa from a common forerunner of the chimpanzees, bonobos and mankind around 150,000 years ago. Leaving Africa, some 80,000 years ago, a group traveled through the southern Arabic peninsula and through India, to reach Indonesia 75,000 years ago and Australia, via Timor, 70,000 years ago. Meanwhile, another group went north from east India toward central Asia. Another group went along the east Asian coast to reach the Bering Land Bridge 75,000 years ago. At an opportune moment around 22,000 to 25,000 years ago, they could cross from Siberia over to Alaska on the American continent to reach Pennsylvania 15,000 years ago and Chile 12,500 years ago. Another group moved from south Arabia to central Europe 50,000 years ago (Oppenheimer 2003, cover).

As another example the genetic code helps us also to follow the embryological development of living beings. Each individual arises from a single cell that combines a female egg cell with a male sperm cell. Then, very remarkably, this single cell replicates itself repeatedly to become an embryo. As the embryo grows the various cells specialize to form bones, arteries, a heart, lungs, hair, nails, etc. Yet in each cell the original genetic code is preserved. The growth of the embryo at first follows a general pattern. The head and the tail are identified. Then the positions of major body parts, such as arms and legs are marked. These markers are chosen from a so-called 'toolkit'. Several tools can be selected from this kit by 'switches' that may be turned on or off. Thus, the embryo initially is constructed from quite general members that gradually become more and more specific. This evolutionary development (known as *evo devo*) became apparent as the various genes of the DNA code began to be understood. Thus an entire field of research has opened up (Nüsslein 2006; Carrol 2005).

## *The Diversity of Life according to Evolutionary Science*

Eventually biological development caused mankind to arise. The biological world needs to be sufficiently robust and diverse that it can survive the unavoidable changes of the environment. The biological world can also contribute in a positive way to the changes of the environment. Thus, the development of botany caused the change from a hydrogen atmosphere to an atmosphere with 21% oxygen, as is now considered normal. That resulted in the development of beings of a higher level of life (De Duve 2002 , chapter 10).

The diversity of biological life was only fully realized by science when Darwin's famous book *On The Origin of the Species* (1859) pointed out that life adapts. Since the universe is not deterministic, the development of the biological world must permit chance events. Yet it still must be robust, such that it can survive major changes of the environment and can ultimately result in mankind. These requirements are met by Darwin's discovery of the theory of *biological evolution through natural selection*.

Biological evolution is a sign of the genius of the Creator. Human creations, such as the wheel, clock, telephone, airplane, or computer do not live, reproduce, or inherently adapt to their environment. They are like nothing compared to the general principle that Charles Darwin (1809-1882) discovered in creation: the principle that organisms adapt, called *evolution*. When we now read about 'every living and moving thing with which the waters teem' (Genesis 1: 21) we are awed by the Creator who made all these living, procreating, repairing, adapting, and diversifying creatures.

The Surprise of Evolution

For many people, however, evolution is a surprise that causes serious questions. Did that phenomenal realm of plants, animals and even humans really arise through evolution? We consider a few objections.

First, we look at the extremely elaborate DNA that is a key part of life. Has this really developed by chance? A favorite analogy is Thomas Huxley's monkey brigade: some monkeys bang fanatically and without coordination on typewriters. Can they really produce a piece of Shakespeare? They cannot, since the monkeys act completely at random. The major contribution of Darwin, however, concerned not evolution as such – that was already proposed by his grandfather Erasmus Darwin (1731-1802) and others. Darwin´s discernment concerned evolution *through natural selection*. And that natural selection the monkeys miss.

A better parallel for the development of DNA via spontaneous modifications of the genes (the *mutations*) is just one automated monkey, such as a computer, which repeatedly adds or deletes a letter to an existing word or changes a letter thereof. The results are only accepted if they appear in the Concise Oxford Dictionary which happens to be on my desk. Thus a collection of valid words arises that can be combined to valid clauses and these to valid sentences. These words and sentences are comparable to the genes of the DNA.

We start with an empty collection. In the first round we only find words that consist of one letter. In English –monkeys always think in English – these are the words *a* and *I*. In the second round we find *an, at, is, it,* etc.. In the third round *eat, man, his, lit,* etc., Words of more or fewer letters can arise in successive rounds, such as *east, ease, easel, weasel*, or *men, me,* or *lie, like,* or *this, thin, think, thinks*. Next we can construct clauses such as *it is* and *a weasel*. Finally complete sentences can occur, such as *me thinks it is like a weasel* (Shakespeare: Hamlet, Act III, Scene II). Similarly, mutations of genes can in turn form valid genes.

Ayala discusses the frequency and power of mutations by giving a realistic example. In primitive life, such as that of bacteria, reproduction occurs every 20 minutes. When that happens a mutation of the genes may occur once per hundred million occurrences. In a culture of 20 to 30 billion bacteria, we therefore may expect that 200 to 300 are resistant to a new pesticide. When we add that pesticide to the culture, those are the only ones that survive. After two or three days they have, because of their frequent reproduction, reached again the population of the original culture.

As a second experiment we may bring this culture to an environment that lacks a means necessary for food or reproduction. Most of the bacteria die. Yet after two or three days there will again be billions of them. That occurs because some bacteria – on the average four out of 100 million – spontaneously develop. They can reproduce without the means for food or reproduction. If the culture has the above mentioned average of 25 billion bacterria, then 1000 survive. Those multiply themselves again to the original size. (Ayala 2007, p. 61).

Since creation adapts to chance events, the outcome of the development of the biological world might differ wildly depending upon the events that occur. Thus Gould (1989, p. 14) speculates that evolution shows *divergence*. He proposes: 'wind back the tape of life to the early days . . . let it play again from an identical starting point, and the chance becomes vanishingly small that anything like human intelligence would grace the replay.' If there would be high-level life at all, those creatures certainly would not resemble mankind.

Simon Conway Morris, however, remarks that the development of life shows a strong *convergence*. Although 'everything is allowed,' certainly not everything works. Thus the camera-like eye of mammals has been developed at least six times independently. For example, the eye of the octopus resembles the human eye, except for the dark spot where the eye nerve enters. Apparently the human eye is the only type of eye that works for larger animals. Conway Morris, therefore, assumes that if that tape of life were to be started afresh the result would not differ fundamentally from what we see in the world today. Conway Morris imagines a space capsule that arrives on earth. When it opens, one of the extraterrestrials grazes his fingers. Red blood oozes to the surface. 'Haemoglobin, I suppose?' They nod. Our hands clasp, both are warm to the touch. It seems superfluous to ask, but the beating of their veins hints at the inevitable dual circulation system (2003, chapter 12).

At times one refers to the laws of thermodynamics (the physics concerning heat and related forces) to show the impossibility of evolution. When a cup drops from the table and breaks in splinters on the floor then, according to physics, the energy of that 'system' remains the same, but a part of that energy is no longer usable. That unusable energy is called *entropy* and is increased by the falling cup. The opposite, that the splinters by dropping from a table form a cup, does not occur: entropy cannot be reduced. The splinters are also less complex than the cup. Entropy is therefore a measure for lost complexity – it measures decay.

Should then the development of plants and animals – each with their enormously complex DNA – not require supernatural intervention? No. God uses the sun. From the time of the origin of the earth the sun has sent an enormous amount of energy to the earth. That energy caused life on earth, with all its complexity, to arise and develop. When eventually that life passes away, only then entropy increases again.

Some objections to evolution are only a mental error. Thus, Herbert Spencer (1820-1903), summarized 'natural selection' by calling it 'survival of the fittest'. That expression, sometimes, is interpreted as the 'right of the strongest'. But 'fit' does not mean 'strong', but 'best adapted'. Evolution also allows doves and rabbits to develop. Nor is evolution responsible for the fact that animals eat each other. Without evolution that would happen as well.

The thought that God cannot intervene in evolution is another mistake. As we saw in chapter 3, the Lord can prevent one sparrow from falling to the ground. (Matthew 10: 29).

Finally, the geologist Charles Lyell (1797-1875) considered an immediate creation of mankind much more worthy than the long way through bacteria, worms and monkeys. This is a thought of the nineteenth century. Since that time we know much more of God's actions at the start of the universe. All those remarkable actions and laws, which eventually allowed mankind to occur, have a majesty and depth that most certainly deserves our veneration, whereas the repeatedly failing human is less impressive.

Biological evolution works, but it is not the only principle that works. The occurrence of higher forms of life in nature appears to be a process of fits and starts (Gould 1990). Therefore their development is also attributed to crisis events. Positive crisis events are the sudden occurrence of eukaryotic cells (Lane 2005), or the many different forms of life of the Cambrian explosion (Conway Morris 1998). But there are also negative crisis events, such as the sudden extinctions of many forms of life, which allow other forms of living to develop (Erwin 2006, p. 51). Thus the large meteorite at the end of the Cretaceous period, mentioned in Chapter 1, perhaps combined with volcanic eruptions, exterminated most of the dinosaurs. This allowed the mammals, including mankind, to develop. In total there were at least five major extinctions, from the start of the Cambrian, 530 million years ago, down to the end of the Cretaceous, 65 million years ago.

These crisis events could be direct actions of the Lord in his creation, or the natural outworkings of laws operating for eons.

These examples show that an event can be understood in various ways. Science knows that meteorites can hit the earth. Scripture tells us that the Lord intended an earth with people and not with large dinosaurs. Thus, an action of the Lord, as mentioned in chapter 3, might be assumed. Nevertheless, Scripture and science are in harmony, without the one forcing the other.

Have we, in spite of this, not introduced after all a conflict between the message of Scripture and the discoveries of science? According to Genesis 1, the Lord says what should happen. And when this occurs, then the conclusion is that it is 'good', yes, on the sixth day even 'very good'. Science, in contrast, observes a succession of changes that are accepted or rejected, according to their success in propagation. This process involves many deficiencies. Thus, our intestines have an appendix, which can get inflamed. There are also many incurable diseases or calamities in nature, such as earthquakes. Is that good? Can these observations from Scripture and science be true at the same time?

The answer is: yes, they are true at the same time. This is an example of the use of juxtaposition in Scripture, which we mentioned in Chapter 1. God's intention with creation was that there would be people who could come to Him in free will and with whom a relation of love would be possible. That this creation occurred certainly can be called 'good', whereas science at the same time can admire the beginning of the universe. But Scripture also agrees with science that the universe contains many dangers which mankind should try to control. This is mentioned repeatedly in Scripture starting at Genesis 3. A good summary is that 'the whole creation has been groaning as in the pains of childbirth up to the present time' (Romans 8: 22).

Finally, evolution is the surprise of biology. Some accepted it immediately. Others found that difficult, as we see in chapter 6.

## *The Nature of the Harmony*

The examples of the harmony of Scripture and science in the last four chapters illustrate the nature of that harmony. First, it is clear that the overlap of the various areas concerns only general concepts – the Bible fortunately is not an introduction to physics. Secondly, the common concepts have for each realm their own content. For Scripture 'the beginning' has the important reference to 'the way' – God's plan for creation. For science the notion that the universe had a beginning opens quite different perspectives, such as the occurrence of stars from initial matter, the occurrence of atoms in stars and the occurrence of life from matter.

We further remark that both scientists and the interpreters of Scripture are inclined to fill in the not–fully–understood areas too specifically. When science could say nothing about the beginning of the universe, the static universe was assumed. When the observations were otherwise, science fortunately changed its position, except for the protests of Hoyle. For the interpretation of Scripture something similar can be noticed. Scripture is silent about the manner in which God's commands are performed. The creation of one animal at a time is a human assumption and therefore open to correction. (We return to that issue at the end of the chapter 6.) Finally these examples illustrate that when science does not find what Scripture says, we can observe this and let it rest until science or the knowledge of Scripture comes to a better conclusion.

Are all potential areas of conflict covered in the last four chapters? Not necessarily. One major problem for science is the occurrence of life from inanimate matter. From Scripture, God's

purpose for life is clear: it entails physical life and spiritual life. For science, the occurrence of physical life is still a major problem and the character of spiritual life, at best, questionable. Scripture, furthermore, describes many individual healings and miracles. These are incidental happenings as a result of God's actions. Those actions, however, are outside the realm of science.

In contemplating the universe, Scripture sees, directly or indirectly, God's hand at work. Could the actions of the Lord be so undeniable that an unbelieving observer would be forced to recognize his existence? That is not to be expected. The Lord never imposes himself – also not by incontrovertible proofs. 'I stand at the door and knock. If anyone hears my voice and opens the door I will come in' (Revelation 3: 20).

# 6. SCRIPTURE MISUNDERSTOOD

In the preceding four chapters we saw that Scripture each time has a clear position on important matters that might have occasioned different answers. Thus Scripture states that the universe has a beginning, that free will is possible in the universe, that the universe has a purpose, and that life is unified, but diverse. Science each time started with a different or neutral position, but then changed to the position that had already been taken by Scripture. This confirms our opinion that there is harmony between Scripture and science. But we are not blind to conflicts between Scripture and science. We now turn to them. As possible causes of conflict we recognize in this chapter that Scripture is misunderstood and in Chapter 7 that science is misunderstood.

We begin with the historic conflict between the scientist Galileo Galilei (1564-1642) and the Vatican. Galileo defended the theory of Nicolaus Copernicus (1473-1543) that the earth turns around its axis and around the sun. Therefore, the center of the universe could not be the earth, but the sun, or perhaps there is no center at all. This assumption makes it much easier to understand the motion of the planets as seen from the earth.[6] The position of the ruling party of the Roman church was that the earth must be the center of the universe since it was here that the Lord Jesus came, lived, died, and was raised from the dead. This theological position, however, ignores the Scriptural view that the Lord humbled himself in coming to the earth and that we should humble ourselves likewise (Philippians 1: 5-8). The Vatican, with all its ostentation, however, did not want to be reminded of that. According to the spirit of that time the debate, however, was between theology and science rather than between Scripture and science. Moreover it was no debate but a trial. Theology, as represented by the Vatican, was by definition decisive.

At the end of the nineteenth century Darwin's book *On the Origin of Species* (1859) caused a debate in which many were critical of the theory of evolution, because they felt it contradicted Scripture. To the Victorian public the idea that ladies and gentlemen descended from those dirty monkeys was plainly revolting. Queen Victoria has been quoted as saying 'if that is true, let it not be known.' Another incident is reported about Samuel Wilberforce (1805-1873), bishop of Oxford. On June 30, 1860, he supposedly gave a highly critical review of Darwin's book. Then he asked Thomas Huxley (1825-1895), the active spokesman for Darwin, whether he claimed descent from a monkey through his grandfather or his grandmother. Huxley replied that if there were a choice between an ape or a man who used his gifts to ridicule serious science, he would choose the ape any day. In fact this incident is apocryphal. It was thought up 30 years after the occasion by journalists. Actually Wilberforce was very familiar with Darwin's work and had written what Darwin called 'an uncommonly clever review' that identified 'some serious weaknesses'; Darwin corrected these in a book of 1868 (McGrath 2004, p. 82).

In the United States the conflict about evolution caused even more confusion and hardening of opinions. In the early twenties it was against the law in the state of Tennessee to teach evolution in public schools. This law was challenged in 1925 when the teacher John Scopes on purpose used an evolutionary text in his class. He was prosecuted by William Jennings Bryan (1860-1925), who was a well-known speaker and had been a presidential candidate. Scopes was defended by Clarence Darrow, who had defended Leopold and Loeb the year before. Darrow was so much involved in the case that he defended Scopes free of charge. The trial became known as the *Monkey Trial*. Thirty years later the movie *Inherit the Wind*, using different names, showed Darrow as the hero at the expense of Bryan. Actually the followers of Bryan felt that he had acquitted himself well (Ruse 2005, p. 167). He did not defend a creation in six consecutive literal days and answered Darrow clearly. Nevertheless, he may have been exhausted, since he died five days after

[6] In 1851 the pendulum of Foucault (1819-1868) gave the real proof that the earth rotates around its axis.

the verdict. The case was closed without reaching a conclusion – both sides claimed victory. Only after 1967 could evolution be mentioned in the schools of Tennessee.

## *What Was Read in Scripture*

During recent years, the conflict fortunately opened to public debate. Thus the theological school Regent College in Vancouver, Canada, published a written debate (Johnson *et al.* 1999). Also, in June 2000 a conference was held in which 26 proponent and critics discussed their views on evolution (Dembski and Ruse 2004). Moreover, many books on this subject appeared.
In particular Kenneth Miller, in his book *Finding Darwin's God* (1999), thoroughly reviews the creationist arguments. He distinguishes three positions: a. the universe was created recently; b. evolution does not change species; and c. at the molecular level evolution does not work and an intelligent designer must have been active. We consider these in turn.

### a. The Age of the Universe

Exodus 20: 11 says 'in six days the Lord made the heaven and the earth.' The creationists understand this to mean that the creation happened in six *immediately successive 24-hour* days. If, furthermore, we consider the genealogy of the ancient fathers (Genesis 5) to be complete, the age of the universe can be calculated. Thus James Ussher (1580-1656), archbishop of Armagh, calculated the moment of creation to be 4004 years before Christ. John Lightfoot (1602-1675), vice chancellor of Cambridge university, refined this to be October 18-24, with Adam created October 23 at 9 a.m. 55$^{th}$ meridian time (Ramm 1954, p. 174).

Scientific estimates of time are obtained in many independent ways. They use, for instance, the decomposition of radioactive materials, the deposition of layers of earth, ice cores from the glaciers of Greenland and Antarctica (Mayewski and White 2002), the spreading of oceans by tectonic movements (Oreskes 2001, Part II), tree rings, ancient pollen, earth magnetism (Fortey 2005), and sun and star activities. All of these match and confirm one another. Miller describes in chapter 3 of his book the radioactivity of atoms and explains how the relative abundance of rubidium and strontium can be used to determine the age of rocks. Using these methods, cosmology assumes the universe to be 13.7 billion years old (Haarsma in Miller 2003, p. 106), geology considers the earth to appear 4.5 billion years ago (Ward 2000, chapter 3), and biology places the emergence of life at about 3.5 billion years ago (Knoll 2003, chapter 4), with mankind (Homo sapiens) appearing roughly 150,000 years before the present (Oppenheimer 2001, p. 16). These differences with Ussher's date are not likely to be reconciled by new developments. Therefore the question arises if Scripture was read properly.

### b. Biological Evolution

Darwin recognized several serious problems with his theory of evolution. Thus, he doubted that there would have been sufficient time for all the changes he postulated (Knoll, chapter 1). Since his time, however, the period in which biological evolution can operate has been considerably extended through a better understanding of geological processes. Also we know now that the sun radiates by nuclear processes and not by burning gas, as was assumed, which means that the sun is older than previously believed. Darwin also wondered if complicated organs, such as the eye could develop through evolution. He therefore describes the steps through which an eye might evolve.[7] Darwin also considered whether there would be enough mutations for the multitude of

[7] Behe describes in *Darwin's Black Box* (1996, p.16) Darwin's reasoning. Creationists like to mention the example of the Bombardier Beetle as an animal that would be too complicated to evolve. Behe, however, shows in his book (p. 31) how this animal could have evolved.

animals, which are known, to evolve. Modern biology, however, gives us the ultimate source of the mutations and tells us that they will appear regularly and sufficiently often. Mutations in the genetic code can result in major changes of the body.

Evolution also has been verified as an operating scientific principle. The yearly inoculation against influenza (because germs evolve) as well as the change of rat poison (because rats evolve) illustrate this from daily experience. Our descent as humans can now be traced in the DNA of our genes and we can identify the moment when humanity split off from other animals. The search for a *missing link* (where one species changes to another) has now been concluded by finding a fossil that shows the transition from fish to amphibians with four legs (Shubin 2008).

c. Biochemical Evolution.

Of the three positions mentioned by Miller, the last, concerning the molecular level, is the strongest. Michael Behe presents that point of view in his book *Darwin's Black Box* (1996). Behe has no problems with the age of the universe or with biological evolution, but claims that in his field, molecular biology, evolution just does not work. Nothing has been published about evolution on that level. Also, *irreducibly complex* (not to be assembled from parts) constructions, such as the rotating *flagellum* (the 'tail' of some cells) cannot occur by evolution.

Miller wrote his book three years after Behe. Hence, Proverbs 18: 17 applies: 'the first to present his case seems right, till another comes forward and questions him.' In particular in a new and rapidly developing field of research this confrontation can give surprising results. Miller *is* able to present publications (1999, chapter 5) and intermediate constructions (Miller, in Dembski and Ruse, chapter 5). Furthermore, there is a problem of timing. According to Behe some action on the molecular level would have occurred four billion years ago, after which this action would have remained unused for a few billion years. This, however, conflicts with biochemical developments that are well known to Behe (Miller 1999, p. 162). Terry Gray (in Keith Miller 2003, chapter 13) gives various examples of irreducible complex constructions that in fact occur spontaneously.

At the biochemical level, therefore, no action of an intelligent designer is needed, as proposed by the *Intelligent Design* movement. At the highest level of creation, however, an intelligent designer is quite appropriate, as we will see at the end of this chapter.

The debate between Behe and Miller illustrates the mistake that is called 'the God of the gaps'. In the past the gaps in our knowledge of the laws of the universe were admitted by a remark, such as 'that is how God made it.' There is nothing wrong with this remark, but the danger is that when we know *how* God made this - perhaps by using evolution - we might erroneously conclude that God does not exist. This is an example of the reduction discussed in chapter 7.

It is gratifying that these Christian biologists made the debate about Scripture and science more rigorous.

The creationists undoubtedly honestly imagine that the Lord created the heavens and the earth 4004 years before Christ. And if this statement gives us peace with our creationist brethren, without either considering the other a lesser kind of Christian, I'm happy to forgo further discussion. But, because this happens to be our subject we must point out a basic problem that is involved. A recent creation would have included the above-mentioned relative abundances of rubidium and strontium in the stones of the earth, as well as the magnetic patterns on the bottom of the oceans, the layers of ice of Greenland's glaciers and the fossils of extinct animals. Miller

(1999, chapter 4) gives the example of the elephant. We now know the African and the Indian elephant. But these two species were preceded by at least twelve species of elephants, now extinct. Since there is no time for evolution, why were these extinct animals hidden in the earth? Did the Lord want to fool us about a universe that seems much older than it is and an evolution that appears to be there but did not happen? That would be completely foreign to the *trustworthiness* of the Lord. If we are invited to ponder his works (Psalm 111: 2 and 7), such an action would be very inconsistent. Hence the warning of Thomas Aquinas in Chapter 1 is still very appropriate: By stubbornly maintaining an opinion about secondary matters, Scripture is made ridiculous and the way to eternal life closed to non-believers.

## *What Can Be Read in Scripture*

From what we have seen it follows that the misunderstanding of Scripture comes down to the interpretation of the word 'day' in Genesis 1. Where some read '24 hours', others understand 'ages'. We should therefore consider if the word 'day' has been properly read.

Genesis 1: 5 says: 'And there was evening, and there was morning – the first day.' What does the word 'day' mean? The sun has not yet been mentioned, hence the assumption of a period of 24 hours is not obvious. The text itself, however, helps us by mentioning 'evening' and 'morning.' The Hebrew day starts at sunset. It consists of the darkness of evening and night followed by the light of morning and day. Thus, in view of the deeper meaning of darkness and light, we may say that the disorder of chaos is followed by the order of creation. This means that every day of creation is an act of the Lord that results in the order which he desires. The writer of Genesis 1 whom the Lord used under his inspiration must therefore not have meant a literal 'day'. A figurative interpretation, however, requires an alternative that is understandable for the author and for his readers. When Jotham in his parable lets the trees talk, everyone knows that people are meant (Judges 9: 7-15). But if 'day' does not mean an ordinary day, it is not clear what else is meant. There is however an interpretation of Genesis 1 that assumes that this chapter is a piece of literature. It is not a poem or a deed, but a carefully formulated *enumeration* in which the 'days' give structure to the text. Thus we remark that days 1-3 divide the unmovable objects darkness and light, heaven and earth, land and sea, day and night; they are parallel to days 4-6, which yield movable objects. Furthermore, day 4 is a high point that marks (festive)times. Finally day 7 has no 'evening and morning' but lasts forever. God's Sabbath is the end of his creative labor. All these and more spiritual concerns of creation become visible when the text is considered as having such a literary form. This matches the intention of Genesis 1 that enumerates all divinely imagined powers, which actually are creations of the (monotheistic) God, as we saw in chapter 2.

That the 'day' represents an enumeration and not a chronological report is not a new thought. Henry Blocher (1984, p. 49) notes that Augustine[8] already mentioned the form of literary enumeration for Genesis 1. Ramm, Payne and Thompson further developed this thought in the anglophone world and Ridderbos in the Netherlands.[9]

[8] Augustine, however, assumed that creation occurred in one day instead of six.

[9] Aaldert van der Vegt mentions, based on his experience with illiterate people in Nigeria, that for lists often a story is made with days as a means of enumeration.

Note also that the expression 'immediately successive,' italicized in the section concerning the age of the universe, is not part of the Hebrew bible text. More important, the definite article in '*the* first day' is absent in the Hebrew. One could have read '*a* first day' instead, or just 'first day.' Only for the sixth day is there an article, emphasizing the completion of the days of creation. When after each saying of the Lord night changes into day, in any case chaos changes into order. The text of Scripture does not deny that this might involve considerable time. Even with the definite article in the text, this does not demand that the days be immediate consecutive. In view of these considerations, Genesis 1 might be read to describe a process in which each word of God introduces a new phase of creation of unspecified duration. Such a succession of phases is in harmony with our scientific knowledge.

A second misunderstanding of the text of Genesis 1 follows from the first. Once we assume that all creation days were part of one week we must conclude that mankind was created on one day. This leads to the interpretation that Adam was created literally 'from the dust of the ground' on that day (Genesis 2: 7). When, however, longer periods may have been involved, we may consider that expression in a figurative way. The text further mentions an essential occurrence**:** the mammal, which could walk erect and perhaps could make drawings on rocks, became man by receiving the 'breath of life' that God blew into his nose. C. S. Lewis points out that the figurative manner of speech is unavoidable when we speak about the spiritual world or about as yet not understood matters, such as an unborn child or the physics of the twentieth century (Lewis 1947, chapter 10).

The literary approach to Genesis 1 leaves unaltered the majestic sayings 'God said . . . and so it was.' At least these pronouncements are even more breathtaking, when we can imagine what the scientific impact of God's word was and that for all these impressive developments only a single command of the Lord was required. But that leaves unchanged the important fact that for the original reader and hearer that light and darkness, as well as ' the large and small light'[10] are not gods, but part of God's creation.

In summary, we suggest that God created the universe at the moment of the Big Bang. In the universe that arose he acted at a few critical moments. Thus the laws of physics were established, as well as the Milky Way nebula including the solar system with the earth and the moon. Subsequently there was life and eventually there were the mammals, including man. Each of these actions was likely brief, and after each action the universe continued according to the laws that God had selected (Lewis 1947, chapter 8). Between these actions there may have been billions of years.

I just summarize. Some may want to add further detail (for instance exactly six actions). Others may not want to do so (for instance because of the poetic or liturgical nature of the text). This scenario is not new. It matches the proposals of authors like C. S. Lewis (1940, chapter 5, pp. 65-69) and John Stott (1994, pp. 162-166).

[10] Scripture on purpose does not speak about Sun and Moon since these have divine connotations.

## *The Design of the Universe*

William Paley (1743-1805) said in his *Natural Theology* (1802) that if we find a watch, we may assume that a watchmaker made it. Dawkins says in his *Blind Watchmaker* (1986) that the watch happens to be made by chance. Swinburne replies (1996, p. 57) that Paley's supposition concerns *who* made the watch, whereas Dawkins explains *how* the watch was made. That could, for instance, have happened in a (blind) watch factory. Nevertheless a designer is still required.

As mentioned in chapter 5, Paley probably imagined that the Lord designed the animals one by one. We now rather think that the Lord would, on a higher level, have used genetics and evolution as a tool to create the animal kingdom as a whole. Indeed, now that we begin to understand how the universe arose, it is obvious and very impressive that the Lord designed the universe such that all types of physical entities (electrons, atoms, molecules, living organisms, plants, and animals) appeared (Van Till, in Miller 2003, chapter 14). That is a breathtaking design that we certainly may take time to admire. After all, if the Lord exists, he would in any case have designed the universe. Even atheists admit that they can say nothing about the source of the beginning of the universe (Ayala, in Dembski and Ruse 2004, p.68). Finally we may – what Einstein considered so incomprehensible – slowly begin to understand that universe.

The really intelligent design is the design of the universe. When the intelligent design movement focuses on the tail of a bacterium it overlooks that magnificent design. Rather, it unintentionally shows a shortcoming of creation. Apparently, that tail got lost and had to be supplied as an afterthought! Science undoubtedly will fill that 'gap' sooner or later[11] and the atheist will triumph. But the glory of God's creation is overlooked.

The constitution of the United States prohibits the teaching of religion in public schools. That explains why the intelligent design movement does not state *who* that intelligent designer is, even though that could be only one Person. Their case was brought to court. A district court of Dover, Pennsylvania ruled the 20th of December 2005, that 'Intelligent Design is a religious view, a mere relabeling of creationism, and not a scientific theory,' with 'utterly no place in a science curriculum'. Moreover, it stated that many proponents of this theory make the wrong assumption that evolutionary theory is antithetical to a belief in the existence of a supreme being. Prior to that ruling, more than ten thousand Christian ministers had expressed themselves in a similar way (Carrol 2006, p. 246).

We discussed in this chapter where Scripture was misunderstood. We also saw how many believers changed, where necessary, their thinking without affecting in any way their faith in God, or his word. These changes in opinion concern secondary, but still important, issues. For them that part of the relation of Scripture and science changed from conflict to harmony.

[11] Science has already fully repudiated the irreductable complexity of the tail. (Ayala 2007, p. 152).

# 7. SCIENCE MISUNDERSTOOD

In the previous chapter we saw what problems occur when the space that Scripture allows is filled in too specifically. In this chapter we signal a number of areas where science cannot make pronouncements, but where the temptation to do so anyway appears to be too great. In those areas science is misunderstood and comes to the indefensible conclusion of rejecting Scripture or God.

We notice two major areas in the misunderstanding of science. Scripture may be rejected, or God may be rejected. Finally we ask what more there is to say.

## *Scripture Rejected*

Our review frequently refers to Scripture. But, is the Bible still relevant and really reliable? Does its story agree, for instance, with archeology?

Lewis wrote in his book *Miracles* (1947) about God's activity in his creation. He called his book 'a preliminary study'. Before we can talk about God's acting we must know from which preconceptions we do this (chapter 1).[12] According to Lewis, the most frequent preconception is naturalism, the assumption that only the natural exists. When someone has that preconception he will explain everything as a natural occurrence. Thus the start of the Christian church, where 'many wonders and miraculous signs were done by the apostles' (Acts 2: 43), may be explained by referring to mass psychology or by outright rejection of the text. Christians, because of *their* preconceptions, may see God's hand at work in the early church. Sooner or later one must decide which preconception is true. A first help in these matters is a reliable series of commentaries, such as the *Tyndale* series, or the series *The Bible Speaks Today* (see Bibliography). For texts that deal with Scripture, it is of the utmost importance to know the preconceptions of the authors.

In 1942 the theologian Rudolf Bultmann (1884-1976) said that it is impossible to use electric light, radio, and modern medical discoveries and at the same time believe in the New Testament world of spirits and miracles. Bultmann was clearly impressed by the technology of his time, which still preceded television, spacecrafts and the internet. But technology is based on the trustworthiness of God's creation. It is one of the great possibilities of God's creation, that within that creation in turn creative activity is possible, although at another level. Bultmann's remarks do not hold in practice. Technology is used by believers to spread the 'good news' (paper, printing, shipping, broadcasting, etc.). While studying technology I became a Christian. While working as an engineer I saw colleagues become Christians and grow in faith.

It is still often claimed that the Scriptures were written long after the events described took place. This delay in time supposedly gave ample opportunity for legends to develop and made the text unreliable. Paul of Tarsis, however, describes the key fact of the New Testament, the resurrection of Christ (about 30 AD), in his letter to the Corinthians (1 Corinthians 15: 16) written in the year 55 AD. He mentions that of the 500 brethren who saw Christ after his resurrection, many are still

[12] Lewis discusses the natural and the supernatural (2); the natural is created by the supernatural (3); our understanding does not fit in the natural (4); nor does our morality (5); the supernatural is not obvious (6); progress in science does not affect the possibility of miracles (7); the natural is always subject to the supernatural (8); an independent eternal nature is not preferable to a created nature (10); miracles are necessary (11); God does perform miracles (12); what kind of miracles are probable (13). And only then does Lewis get to the magnificent miracle – the incarnation (14) – and to miracles of the old creation (15) and of the new creation (16).

alive. Therefore the delegation from Greece that accompanies Paul on his visit to Jerusalem (Acts 20: 4) has all the opportunity to verify this with these eyewitnesses.

In comparison with classical Greek and Roman texts, the New Testament texts are available in far larger numbers and are of much older date. The oldest fragments of the New Testament date from the first century after Christ. Complete texts (codices) of the New Testament date from 350 AD. Bruce (1942) describes these texts extensively and compares them with a classical text, such as Caesar's *de Bello Gallico* (about 50 BC) of which the oldest existing copy dates from the ninth century (Bruce 1960, p. 16).

For the Old Testament we have the documents found at Qumran, which comprise the entire Old Testament except for the book of Esther. They date from 100 BC to 300 BC. Before these documents were found, the oldest copies were from about 800 AD. When we compare those copies with the Qumran documents, they prove to have been very faithfully copied (Vermes 2010).

## *God Rejected*

Science is by definition limited to nature. It tries to make a model of nature that is governed by explicit laws. As this image becomes more complete, there is the temptation to think that it is the only thing that exists. That, however, is a statement about the supernatural, about which science cannot speak. Three such statements are: God does not exist (atheism); God exists, but cannot act in nature (deism); and we cannot say anything about God (agnosticism, Huxley 1869).

Deism was popular when the universe was considered to be deterministic, as postulated, for instance, by Laplace. Since quantum mechanics has been accepted, determinism no longer is that important, and deism has lost its appeal. Agnosticism has an inner contradiction, since it *does* say something about God after all, by claiming that God cannot, or does not want to, reveal himself. Hence we only consider atheism, which rejects God.

Two common misunderstandings of science are: a. extrapolation, where scientific opinion is applied to regions beyond its proper domain; and b. reduction, where regions beyond the proper domain of science are considered of minor importance, or are plainly ignored.

### a. Extrapolation

One of the best chapters of Kenneth Miller's book (1999) is chapter 6, in which he asks why the creationists defend their position so tenaciously. It cannot be the scientific value of their position. That is disproved time and again and nevertheless presented unchanged (Miller 1999, p. 298, n. 9). Miller's concludes that the creationists object to the scientist's violation of the proper domain of science – the science of some cosmologists and biologists. There is nothing wrong with cosmology or biology. But it is wrong to conclude from these fields of science that God does not exist. That is not science, it is faith – faith in a process (a god) that makes eyes, but cannot see (Dawkins 1986; compare, for instance, Psalm 115: 6).

Evolution through natural selection is a simple principle: when there is change, and multiple versions occur, the best-adapted version wins. This principle works in biology. The temptation exists, however – yes, is almost irresistible – to apply it also outside biology. Miller (1999, pp. 174, 175) signals that capitalists as well as socialists use evolution to justify their aims, without any proof that it is valid in economics. Especially in the social sciences, this extrapolation is attractive. Thus, the social biologist E. O. Wilson, who is famous for his study of ants and bees, states that

religions, just as other human institutions, have evolved in such a way that they further the well-being of their adherents (Miller 1999, p. 112). Here faith is reduced, very unscientifically, to an inherited habit, without any reference to the difference between men and ants and without any reflection by the author that his proposition might also be the result of an inherited habit.

In the early days of evolution it was mistakenly identified with progress. Lewis states (1967, p. 82) that this identification has nothing to do with the biological value of evolution. He calls *progress* a myth that started prior to Darwin's book (1859), was accompanied by the music of Richard Wagner (1813-1883), the poetry of John Keats (1795-1825), and the promotion of Herbert Spencer (1820-1903), but eventually disappeared when times proved to be less prosperous than predicted.

b. Reduction

Now that there is a theory for the beginning of the universe, some say that there is no need of a God. This reasoning, which in chapter 6 we recognized as 'the God of the gaps', however, is a misconception. The Big Bang theory says nothing about the relation between God and the universe. Indeed it cannot say anything about that relation. What we *can* say, as believers, is that we now know more precisely how God created the universe and which laws of nature he designed and used. Even if quantum gravity were available, it would just tell us more completely how God's creation fits together.

Our increase of knowledge of the universe, however, does not say *why* there is a universe. The question 'why does the apple fall from the tree' was answered by Newton with: 'through gravity.' But that answer causes the question: 'What is gravity?' Einstein's theory of relativity answers that question and poses the question: 'What is quantum gravity?' And when we know its answer, the question remains: 'Why is that valid?' And the reply is 'That is how God made it.' That the Lord each time turns out to be active on a higher level than expected may impress us. It should not estrange us from him. Alan Guth says (1997, p. 276) 'if the creation of the universe can be described as a quantum process, we would be left with one deep mystery of existence: What is it that determined the laws of physics?' Indeed, only it is not 'what', but 'Who'.

Another frequent form of reduction concerns mankind. Genesis 1 says that on days five and six life developed according to its kind. But when it speaks about mankind on those days, it says that it has 'the image of God,' not just an animal 'kind' (Genesis 1: 26, 27) Man, therefore, is an animal, but more. Pascal (1623-1662) says that man is special by being 'miserable' (Pascal, *Pensée 403*, quoted in Kreeft 2004). People realize that they are not just an animal, but also that they are not what they should be.

The extra quality of human life is often minimized by biology. To counter that reductionism Polkinghorne (2005, p. 42) lists seven typical human characteristics. Some of them can be found in apes or dolphins, but the difference with humans is always so large that it cannot be ignored:
• Humans are self-conscious beings. In the present, but also in the future this self-consciousness is reflexively assessed.
• Humans possess language, which is exercised in a wide variety of ways.
• Humans have a great range of rational skills. Even counter-intuitive scientific results are understood and exploited.
• Humans have creative powers, expressed in music, sculpture, painting, dance, theater, literature, architecture, and technology.
• Humans are moral beings.
• Humans have God-consciousness - admittedly in very diverse ways.
• Humans are conscious of what theologians call *sin*

When these qualities are ignored, God's charge to develop science is not taken seriously.

## *What More Is There to Say?*

Up to now we carefully maintained a fence between the patch of the theists and the patch of the atheists. Do they really have nothing to say to each other? Since we say that Scripture and science can exist in harmony next to each other, it should be appropriate at the end of our considerations to remove that fence, to hear what they have to say to each other - of course with proper limitations.

At the end of his interesting book (2008) Neil Shubin comes to the conclusion that mankind is not the result of design, but occurred by chance as the result of evolution, with attendant limitations. Thus, the large head of a baby can obstruct a successful delivery. Also, the human spine is not appropriate for the seated life of a driver. The theist, however, may remark that the large head of the baby contains the extra brains that allow a doctor to apply a 'Cesarean' birth and to encourage a driver to spend more time on sports.

Howard Van Till quotes the atheist Peter Atkins. He fully affirms the extraordinary design of the universe, but not the designer. According to Atkins, nature can produce that development on its own. (Van Till in Miller 2003, chapter 14).

Both Shubin and Atkins ignore the anthropic principle that gives the necessary requirements for life. Therefore Daniel Dennett, atheist, philosopher, and author of *Darwin's Dangerous Idea* (1995), assumes that a black hole can make a new universe, whose laws and constants differ slightly from those of its current universe. He expands a suggestion by Stephen Hawking, the expert of black holes. Thus, the correct values of our universe would sooner or later occur by repeatedly trying different sets of values. Dennett calls this a possibility for the 'traditional alternative', with which he means God. Meanwhile Hawking has retracted his suggestion (*The Economist*, July 24, 2004, p. 68, and elsewhere). He says that he regrets for his science-fiction friends that it is not possible to make a new universe through a black hole. (In contrast to science, which has no grace, he graciously apologizes.) Dennett can, of course, refer to Susskind's megaverse. According to Lewis, Dennett, as an atheist, will always choose a naturalistic alternative, no matter how complicated.

Richard Swinburne points out (1991, chapter 3) that the assumption that there is a God who made the universe meets the scientific requirement of simplicity. Theism is simpler than the atheist's assumption that only the natural exists. A creation which enables life and mankind, with a soul and moral responsibility, is explained more easily by theism than by naturalism. The anthropic principle can also be explained most simply by assuming that God acted during creation. Susskind's megaverse is not particularly simple, nor does it answer the question what, or who, caused the megaverse to occur.

Our Lord is not only a master designer, but above all he is the source of divine love. That shows in his design, which is an independent entity that has life and is open to love. But it is shown above all in his love towards his creation, which he does not abandon even when it rejects him (Haugh, in Dembski and Ruse, 2004, chapter 12). We depart from the exact sciences, however, when we refer to philosophic concepts such as goodness, justice, and love.

Concerning God's love, Stephen Gould describes how for a certain beetle the young are hatched

while still inside their mother. They develop by eating the mother from the inside. Another example is the parasite wasp, which lays its eggs in a caterpillar and paralyses the caterpillar, such that it can be eaten fresh when the eggs hatch. And does not almost everyone eat everyone else in nature? C. S. Lewis, however, asks the essential question whether there is conscious pain in these cases (1940, chapter 1 and 9).

Then, the formidable atheist Richard Dawkins gives the example of the cheetah and the antelope. The cheetah is perfectly equipped with fast legs and sharp teeth to catch and tear to pieces the antelope. Could a loving God have designed such a gruesome being? Dawkins considers that ridiculous (Ruse 2003, p. 330).

Michael Ruse first remarks that the antelope in turn is so designed that it often escapes the cheetah. But then he considers the issue more thoroughly. In a world with people who have a free will, would it not be *impossible* to eliminate pain and suffering (Ruse 2003, p. 333)?[13] Could that free will not be used the wrong way?

C. S. Lewis states that pain is used by God as a means of speaking to us: he whispers in our happiness, he speaks to our conscience and shouts in our pain (Lewis 1940, p. 81). Has God then intended a suffering world? That certainly was not the original intention, but a world without pain as a warning was not intended either.

David Livingstone (1813-1872) tells how a lion attacked him. At that fatal moment he felt paralyzed and benumbed, such that there was no struggle for life, or fear of death. He saw this (after he was rescued just in time) as a provision of the Lord to soften the pain of violent death (Munday in Miller 2003, Chapter 19). Livingstone's experience is certainly not universal. It points out, however, that we must be careful in judging what we are not able to discern for sure.

After Auschwitz the belief in God is often questioned. Why believe in a God who did not act to prevent this terrible crime? (But also, why still believe in mankind which committed this terrible crime?) The question of undeserved suffering is asked time and again in Scripture. 'Who sinned, this man or his parents, that he was born blind?' (John 9: 2); 'These eighteen who died when the tower of Siloam fell on then – do you think they were more guilty than all the others?' (Luke 13: 4). Paul says, in spite of his experiences (2 Corinthians 11: 23-29), 'that our present sufferings are not worth comparing with the glory that will be revealed in us' (Romans 8: 18).

In the book of Job, the just Job does not get an answer about his undeserved suffering. The reader knows about a wager in heaven, but that does not answer the question either. The Lord then meets Job and asks, 'could you do it better?' (Job 38-41) The reader might say 'surely!' But when Lewis (1940, chapters 2 and 3) looks at this question more carefully, the answer is no longer that sure. The Lord, however, invites Job for a walk (Atkinson 1991, p.145). He is with his love near the sufferer. Thus, the answer to the question concerning Auschwitz, according to Scripture is: 'He was with the believers in Auschwitz.' Didn't he suffer *himself* undeservedly for mankind?

Finally, the theists will point to the moral responsibility of mankind with all its possibilities, dangers and conflicts. Clearly, not all that science enables is allowed. (Polkinghorne 2000a, chapter 9; Collins 2006, Appendix). For this an ear that listens to God certainly is required.

[13] A world without pain and death is not attractive. People that feel no pain probably suffer from leprosy. They constantly damage themselves, such that they may lose their fingers. Jonathan Swift writes how Gulliver visits a country where some people do not die. Gulliver is elated: that is just what we desire in our country! But his guide says these people are to be pitied because they deteriorate without ever dying.

Ruse says that the presence of a creating and sustaining God gives meaning to our scientific work. He concludes his book with a quotation from the biologist Raven: 'Here is beauty – whatever the philosophers and art critics who have never looked at a moth may say – beauty that rejoices and humbles, . . . akin to the authentic encounter with God.' Ruse has nothing more to add (Ruse 2003, p. 336).

But there *is* more to add. If we open ourselves, by whatever experience, to the Lord, accept his forgiveness, and put our lives into his hands, then he will give us eternal life and allow us to work and take care of his creation (Genesis 2: 15).

# 8. CONCLUSION

Even though Scripture is old, it speaks about the universe in such a way that its truth is understandable in all ages. Science sometimes differed in opinion with Scripture, but changed - according to its nature - during the last century such that it acquired a remarkable agreement with Scripture. Thus the harmony of science with Scripture increased.

The fundamental claim of Scripture, that the universe has a beginning, is now firmly accepted by science. The further claim of Scripture, that the universe is reliable – which encourages science and enables technology – proves not to be in conflict with the claims that man has a free will and that God can act in the universe. Furthermore, God's design of the universe can be recognized in the remarkable precision with which the constants of nature and the laws of physics enable high-order life and in the unity and diversity of life – which allows the realms of plants and animals to develop and adapt.

With respect to Scripture, its conflict with science is limited to the misinterpretation of a few verses and the untenable conclusions that follow from that mistake. As far as science is concerned, care should be taken that it does not exceed its proper sphere by extrapolation and reduction and as a result, in turn, comes to untenable conclusions.

Finally, with Scripture and science in remarkable harmony, each can be fully accepted in its own realm. Neither takes anything away from the other. Of course not all that *can* be done *should* be done.

I have written this text as a Christian. I hope to have represented Scripture in a reasonable way. As far as science is concerned, I have borrowed left and right from books that try to explain science to interested laymen. The argument of this review does not require anyone to have a living relation with God. Of course, you are cordially invited. For my part, I am thankful that I have met the Lord.

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**PSALM 111**

*alef* 1. Praise the Lord. I will extol the Lord with all my heart
*bêt* in the council of the upright and in the assembly.
*gimel* 2. Great are the works of the Lord:
*dalet* they are pondered by all who delight in them.

*hê* 3. Glorious and majestic are his deeds,
*waw* and his righteousness endures forever.
*zajin* 4. He has caused his wonders to be remembered;
*chêt* the Lord is gracious and compassionate.

*têt* 5. He provides food for those who fear him;
*jôd* he remembers his covenant forever.
*kaf* 6. He has shown his people the power of his works,
*lamed* giving them the lands of other nations.

*mêm* 7. The works of his hands are faithful and just;
*nûn* All his precepts are trustworthy.
*samek* 8. They are steadfast for ever and ever,
*ajin* done in faithfulness and uprightness.

*pê* 9. He provides redemption for his people;
*sadê* he ordained his covenant forever -
*qôf* holy and awesome is his name.
*rêsj* 10. The fear of the Lord is the beginning of wisdom;
*sjîn* all who follow his precepts have good understanding.
*taw* To him belongs eternal praise.

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# INDEX

## ABOUT THE AUTHOR

Gerrit Blaauw was born in 1924 into a caring Christian family in The Hague. He began his studies in electrotechnology at the Technische Hogeschool in Delft in 1942. After an interruption because of the war in 1943, he was able to resume his studies. During a meeting in 1947 concerning the social meaning of cinema he was struck by the speaker's spiritual background. From a conversation with him, it soon became clear that he was a committed Christian and what this meant for him. Through this encounter he came to faith. Two weeks later he left to continue his studies in the United States. There, he took part in evangelical student work, both as a student and as a leader. He obtained his Ph.D. at Harvard University in 1952, with a thesis on computer design. He designed and built one of the first working computers in the Netherlands. From 1955 to 1965 he worked for IBM in the United States. He was professor of digital technology at Twente University from 1965 to 1989 and was chairman of the evangelical student association IFES-Netherlands from 1967 to 1986. Since 1982 he has been a member of the Royal Dutch Academy of Sciences.