11

Darwin

To claim the world as creation is not to denounce evolution and debunk science. To the contrary, it is to join in covenant with science in acknowledging creation's integrity, as well as its giftedness and worth. To see the world as creation is to re-commit ourselves to its care, not as the fittest, most powerful creatures on the animal planet but as a species held uniquely responsible for creation's flourishing.

William P. Brown[1]

We are intelligent beings: intelligent beings cannot have been formed by a crude, blind, insensible being . . . Newton's intelligence, therefore, comes from another intelligence.

Voltaire[2]

So far as we know, the tiny fragments of the universe embodied in man are the only centres of thought and responsibility in the visible world. If that be so, the appearance of the human mind has been so far the ultimate stage in the awakening of the world.

Michael Polanyi[3]

Science cannot solve the ultimate mystery of nature. And that is because, in the last analysis, we ourselves are part of nature and therefore part of the mystery that we are trying to solve.

Max Planck[4]

There are three major challenges to religion. The first and deepest, addressed in the next chapter, arises from the very heart of monotheism itself and was first uttered by Abraham: 'Shall the judge of all the earth not do justice?' (Genesis 18:25). How can

the goodness of God coexist with the presence of evil and the suffering of the innocent? The second is a kind of mirror image of the first. It is, as it were, not our question of God but God's question of us: How can religious people commit evil in the name of God? That is the subject of chapter 13. The third challenge – call it the clash between religion and science – varies from age to age, but it usually has the same form, first set out in the Bible in the story of the Tower of Babel.

Human beings discover a new science or technology: in the case of Babel, the art of making bricks. Breaking free from the limitations of the past, they feel as if they have become gods and they set about storming the heavens. Every new accession of knowledge or power has tempted humans into hubris. 'Must we ourselves not become gods?' asked Nietzsche.[5]

Perhaps Freud was right in a way he did not anticipate. He argued that the myth of Oedipus explained much of human behaviour including religion. We, especially sons, have a desire to murder our parents, especially fathers. We then feel guilty for this – Freud called it 'the return of the repressed' – and this guilt becomes the source of religion: the demanding, unearthly voice of the murdered father.[6]

As a theory of religion, this may work for Greek myth; it cannot work for Abrahamic monotheism. In Greek myth the gods were hostile to humans. In Abrahamic monotheism, God loves humans, sets his image on them and creates space for them to exercise their freedom. The myth of Oedipus works much better as an explanation not of religious belief but of its opposite: atheism. People feel the need to pursue knowledge uninterruptedly and without constraint, and they can experience religion – the Church's attitude to Galileo then, or to evolutionary theory now – as a constraint on that freedom. They can then feel the need to murder the beliefs and traditions of the past to create space for a future that is both human and free.[7] Hence the anger of atheism and the intense desire to displace the Father-God. It can be atheism, not religion, that becomes a comforting

illusion. We are free because there is no one to tell us what we may or may not do.

The idea that there is a conflict between religion and science draws heavily on Greek myth, specifically the myth of Prometheus. Prometheus was a figure unique among Greek deities, a god who liked human beings. For their sake he stole the secret of fire from Zeus and gave it to mortals. For this he was punished by Zeus. He was chained to a rock where each day an eagle ate his liver, which grew back each night so that it could be eaten again.

Embedded in this myth is a profound conviction that the universe is hostile to humankind, that knowledge and its pursuit are dangerous, even sinful, and that it is a zero-sum conflict in which either the gods or humankind win. Hence *either* religion *or* science, but not both. A trace of the myth of Prometheus survives in the form of one Christian reading of the first humans eating from the tree of knowledge, a sin for which they were exiled from paradise. On this reading, God does not want us to know.

But that is not the only way of understanding the story. Maimonides, for example, says that the tree of knowledge represented the wrong kind of knowledge: aesthetics, not physics or metaphysics. The fruit of the tree was 'pleasing to the eye'. It represented appearance, not reality.[8] Recall that when Adam and Eve ate it they did not suddenly understand a set of truths. Instead, they saw they were naked and they felt shame. Their sensibility shifted from the ear to the eye. They became more concerned with how things seemed than with the voice of God within the mind that we call the moral sense.

In Jewish tradition God *wants* us to pursue knowledge. The first thing Solomon asked for, and the first thing we ask for in our three-times-daily prayers, is wisdom, understanding and knowledge, and that includes science. Recall that the rabbis instituted a blessing over scientists, whether they shared Jewish faith or not. They also told a story precisely designed to negate the myth of Prometheus.

In Judaism, each week the Sabbath ends and secular time begins with a ceremony known as *havdalah*, literally 'making

distinctions'. It includes the lighting of a special candle. Explaining this candle, the rabbis said that Adam and Eve were created, and sinned, on the sixth day, Friday. They were sentenced to exile, but God deferred the punishment by twenty-four hours so that they could stay one full day – Sabbath – in paradise. As the Sabbath ended and night fell, they were afraid of their journey into the dark. So God taught them how to make fire and kindle a light.' It is in memory of this that we light the havdalah candle. This is the counternarrative to Prometheus. We do not have to steal secrets from God. God wants us to know, and to use that knowledge responsibly.

The process of displacing God in the modern age began in 1796 with Laplace and his statement, in reply to Napoleon's question as to where God was in his scientific system, *Je n'ai pas besoin de cette hypothèse*, 'I have no need for that hypothesis.' The mechanistic universe needed no ongoing interventions on the part of God; it seemed indeed to rule them out. Hence the attraction of Deism, the idea that, as it were, God designed the machine and set it in motion, and then retired from the scene. As a graffito I saw in my undergraduate years said, 'God exists, it's just that he doesn't want to get involved.'

The challenge of Darwinism has seemed altogether deeper than this because it suggested that, at least as far as biology is concerned, life has not been mechanistic and thus designed. It has emerged as the result of a process that is random, fortuitous and blind. The existence of life, sentience, consciousness and Homo sapiens itself are all purely accidental. 'Man', wrote George Gaylord Simpson in *The Meaning of Evolution*, 'is the result of a purposeless and natural process that did not have him in mind.'[10]

If my argument in chapter 1 is correct, it becomes immediately clear why Darwinism has proved to be the single greatest challenge to religious faith, more unsettling to believers than, say, the assault of Marx or Freud or plain common-or-garden atheism. For I have argued that the fundamental issue of religious faith,

specifically of Abrahamic monotheism, is the meaningfulness or meaninglessness of the human condition.

Darwinism, or at least the use made of Darwin by his latter-day followers, the new atheists, seemed to provide a compelling scientific demonstration of the meaninglessness of life. It happened by chance. No one planned it. There was no design, no purpose, no intended and foreseen outcome. There was no intentional act of creation, at least not of life. We are here because we are here, because that is how the random operations of chance and necessity – genetic mutation and natural selection – happened to occur. We might not have been. No wonder that Richard Dawkins said that Darwin for the first time made it possible to be an intellectually fulfilled atheist.[11] Darwinism seems to be proof of the meaninglessness of life.

But if my argument is correct, then the new atheists must also be wrong, for I have argued that the presence or absence of meaning is not, in and of itself, something that can be established by science. Meaning or meaninglessness is in the eye of the beholder. To give two obvious examples, the first Impressionist exhibition in 1874, including works by Monet and Cézanne, created outrage among many traditionalists. This was not art as they knew it. So did the first performance of Stravinsky's *Rite of Spring*, which led to a riot. This was not music or dance as it had been before. But there was nothing chaotic or meaningless about either the paintings or the rhythms. They were precisely planned to achieve specific ends. It simply took time before people learned to see and hear in new ways.

So it is with Darwinism at many levels. At first it seemed to render life meaningless. This was not creation, design or, for that matter, Homo sapiens as people had been accustomed to thinking about them. It was shocking, unsettling, paradigm-shifting. To some, it still is. But it may just be that we have to think about creation, design and the emergence of order in new ways, not that they no longer exist.

The literature about Darwinism and creationism is vast, and overwhelmingly it consists of scientists arguing against religion

and religious believers arguing against this or that finding of science. But again, if I am right, both literatures are misconceived. Science is not religion; religion is not science. Each has its own logic, its own way of asking questions and searching for the answers. The way of testing a scientific hypothesis is to do science, not read Scripture. The way of testing religion is to do religion – to ask, in total honesty and full understanding, is this really what God wants of us? It is not to make assertions about the truth or falsity of some scientific theory.

This is not an argument for *compartmentalisation*, seeing science and religion as did Steven J. Gould as 'non-overlapping magisteria', two entirely separate worlds.[12] They do indeed overlap because they are about the same world within which we live, breathe and have our being. It is instead an argument for *conversation*, hopefully even integration. For if science is about the world that is, and religion about the world that ought to be, then religion needs science because *we cannot apply God's will to the world if we do not understand the world*. If we try to, the result will be magic or misplaced supernaturalism. We will rely on miracles – and the rabbis ruled, '*Don't* rely on miracles.'[13]

By the same token, science needs religion, or at the very least some philosophical understanding of the human condition and our place within the universe, for each fresh item of knowledge and each new accession of power raises the question of how it should be used, and for that we need another way of thinking. As Einstein put it:

> For science can only ascertain what is, but not what should be, and outside of its domain value judgments of all kinds remain necessary ... representatives of science have often made an attempt to arrive at fundamental judgments with respect to values and ends on the basis of scientific method, and in this way have set themselves in opposition to religion. These conflicts have all sprung from fatal errors.[14]

It is precisely the space between the world that is and the world that ought to be that is, or should be, the arena of conversation between science and religion, and each should be open to the perceptions of the other. The question is neither, 'Does Darwinism refute religion?' nor, 'Does religion refute Darwinism?' Rather: 'How does each shed light on the other?' and, 'What new insights does Darwinism offer religion?' and, 'What insights does religion offer to Darwinism?' Those are the questions to which I want briefly to offer some thoughts.

Darwinism has immense religious implications.

First, it tells us that *God delights in diversity*. There are, for example, forty thousand different varieties of beetle, an impressive number by any standards. The God who created life in its staggering variety is clearly not a Platonist, uninterested in particulars. The rabbis sensed it better when they said, 'Even those creatures you hold superfluous in the world, such as the flies and fleas and gnats, they too are part of the creation of the world. Through all does the Holy One, blessed be he, make manifest his mission, even through the serpent, even through the gnat, even through the frog.'[15] Biodiversity is a source of wonder to the psalmist:

> How many are your works, O God.
> You have made them all in wisdom.
> The earth is full of your creatures.
> There is the sea, vast and wide.
> There the creeping things beyond count,
> Living things great and small.
> (Psalm 104:24–5)

God loves diversity, not uniformity. That is a fact of theological as well as ecological significance. Every attempt to impose uniformity on diversity is, in some sense, a betrayal of God's purposes. One definition of fundamentalism, and an explanation of why it is religiously wrong, is that it is the attempt to impose a single truth on a diverse world.

Second, and this is Darwin's wondrous discovery: *the Creator made creation creative*. We already knew that he made man creative. Now, thanks to Darwin, we know that this applies to nature too. He did not make a static universe, a mere machine endlessly revolving through cycles of birth, growth, decline and death. He introduced into the very mechanism by which life reproduces itself, the genome, the tiny possibility of copying errors that results in variety and new biological possibilities. The God who chose to create our universe is one who delights in creativity. A universe in which life evolves is more creative than one in which life forms never change.

God as we see him in Genesis 2 is a gardener, not a mechanic, one who plants systems that grow. The constantly evolving, ever-changing nature of life revealed by biology after Darwin fits the theological vision far more than did the controlled, predictable, mechanical universe of eighteenth-century science.

The science writer Timothy Ferris argues that what we know scientifically suggests 'that God created the universe out of an interest in spontaneous creativity'. What would such a universe look like? It would be a universe impossible to predict in detail, just as ours is. It would give rise to agencies that are themselves creative. 'There is in our universe such an agency, spectacularly successful in reversing the dreary slide of entropy and making surprising things happen. We call it life.'[16]

There is even a hint of this in the biblical narrative of creation. The Hebrew text of Genesis 1:1 – 2:3 has a remarkable feature. It is precisely structured around the number seven, in ways not apparent in translation. The narrative speaks of creation in seven days. But the text itself is precisely patterned on this number. So the word 'good' appears seven times. The word 'God' appears thirty-five times. The words 'heaven' and 'earth' each appear twenty-one times. The words 'light' and 'day' occur seven times in the first paragraph. The first verse contains seven words, the second fourteen words. The paragraph describing the seventh day contains thirty-five words, and so on. The passage as

a whole contains 67x7 words. The entire passage is constructed like a fractal, so that the sevenfold motif of the text as a whole is mirrored at lower levels of magnitude.

When a text is written in this way, apparently superfluous words become highly conspicuous. There is one obviously superfluous word: the last of the entire passage. The verse says, 'God sanctified the seventh day for on it he rested from all the work he had created' (2:3). The sentence should finish there. In fact, though, there is one extra word in the Hebrew, *la'asot*, which means 'to do, to make, to function'. What is its significance?

Two classic commentators, Ibn Ezra and Abrabanel, interpret it to mean, '[he had created it] in such a way that it would continue to create itself.' Without stretching the text too far, we might say that *la'asot* means, quite simply, 'to evolve'. Evolution would then be hinted at in the very last word of the Genesis creation story.

It was this creative potential of creation that moved Darwin, in the last sentence of *The Origin of Species*, to almost religious awe:

> There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

The twin operations of genetic mutation and natural selection are the simplest way of creating diversity out of unity, breathtaking simplicity resulting in almost unimaginable diversity.

Third, we now know that *all life derives from a single source*. That is the remarkable, unexpected fact. Here is Matt Ridley on the subject:

> The three-letter words of the genetic code are the same in every creature. CGA means arginine and GCG means alanine – in bats,

in beetles, in bacteria. They even mean the same in the misleadingly named archaebacteria living at boiling temperatures in sulphurous springs thousands of feet beneath the surface of the Atlantic ocean or in those microscopic capsules of deviousness called viruses. Wherever you go in the world, whatever animal, plant, bug or blob you look at, if it is alive, it will use the same dictionary and know the same code. All life is one. The genetic code, bar a few tiny local aberrations, mostly for unexplained reasons in the ciliate protozoa, is the same in every creature. We all use exactly the same language. This means – and religious people might find this a useful argument – that there was only one creation, one single event when life was born.[17]

Again, unity in heaven creates diversity on earth.

Fourth, science and Genesis have now converged, in an utterly unexpected way, on the same metaphor. *Life is linguistic.* 'And God said, Let there be . . . and there was.' The Jewish mystics held that all life was the result of different permutations of the letters of God's name. To be sure, this is mere metaphor. It is poetry, not science. But it is nonetheless remarkable that life has a structure no one expected prior to Crick's and Watson's discovery of DNA. It has hardware and software. The cell is an information-processing system. Was this even conceivable before the invention of the computer?

Recall that Crick and Watson were working in Cambridge in the 1950s where, barely a decade before, Alan Turing had been setting out his pioneering thoughts on the possibility of an information-processing machine. Recall too that Francis Collins, leader of one of the two projects to decode the human genome, was moved by that experience to religious belief, and called the book he wrote *The Language of God.*[18] That life is both intelligent and linguistic breathes new fire into the idea that the Source of life is both intelligent and a user of language, and that nature, no less than the Bible, is not a machine to be disassembled but a book to be decoded. It took the discovery of artificial intelligence to give us an insight into divine intelligence.

Fifth, the *interconnectedness* of all life – the fact that plants, animals and humans have a common origin – helps us understand in new depth the Bible's phrasing, 'Let the earth bring forth . . .' and its generic name for Homo sapiens, Adam (from *adamah*, meaning 'the earth'). Rabbi Joseph Soloveitchik[19] took this as one of the central insights of Darwinian biology, echoing key biblical verses:

> All flesh is grass. (Isaiah 40:6)
>
> Man has no pre-eminence over a beast: for all is mere breath. All go unto one place; all are of the dust, and all turn to dust again. (Ecclesiastes 3:19–20)

We are responsible for the preservation of nature and the animal kingdom, for we and they are part of the same continuum of life. Here is how the rabbis put it:

> When the Holy One created the first man, he took him and led him around all the trees of the Garden of Eden, and said to him: Behold my works, how beautiful, how splendid they are. All that I have created, I created for you. Take care that you do not become corrupt and thus destroy my world. For if you become corrupt, there will be no one after you to repair it.[20]

The idea that in some sense the findings of science in the past two hundred years – whether in cosmology, quantum physics, the theory of relativity, Darwinian evolution, genetics and the mapping of the genome, or PET scans and the working of the brain – challenge our religious understanding of the universe is absurd.

The Jewish theologians of the Middle Ages faced a far more serious challenge: the Aristotelian belief in the eternity of matter, which implied that one of the fundamentals of Abrahamic faith, that God created the universe, was false. All

of them, not just the rationalist Moses Maimonides, but also the critic of rationalism, Judah Halevi, agreed that if Aristotle had proven his point, they would simply reinterpret Genesis 1. In chapter 3 I gave two examples – planetary motion and the ensoulment of the foetus – where the religious sages were happy to acknowledge that they were wrong and the Greeks right. As it happens, on the first the Greeks were wrong, and on the second we have no way of knowing. But they recognised that within its own domain science has its own integrity and that faith must be compatible with the facts as we know them. This itself follows from the conviction that the God of creation and the God of redemption are one.

If an eternal universe was conceivable to the theologians of the Middle Ages, so should one 13.7 billion years old be to us. When a questioner troubled by Darwinism wrote to the famous Rabbi Abraham Kook, the rabbi replied (in 1905) by quoting an ancient rabbinic teaching that at the dawn of time, God 'kept creating universes and destroying them until he created this one, and said, This one pleases me; those did not please me.'[21] The idea that there were ages and extinct species before ours is one that should not trouble the theistic imagination.

Of course it was not this that represented the fundamental challenge of Darwinism to Abrahamic faith. It was the fact that it seemed to prove, beyond doubt, that the emergence of life and the appearance of humanity were unscripted, unplanned, the result of blind processes iterated over billions of years. We are here as the result of a 'purposeless and natural process' that did not have us in mind.

It is precisely here that the Bible tells a subtle story about stories in general, and what it is to see events as random on the one hand, designed on the other. Consider, as one example, the following episode from the Joseph narrative in Genesis. Joseph is envied and hated by his brothers. They resent the fact that their father loves him more than them. They are provoked by the sight of his

many-coloured coat. They are angered by his dreams in which he sees them bowing down to him.

In swift strokes as the story unfolds we sense their anger build to dangerous levels. Then comes the critical moment. The brothers are away from home, at Shechem, tending the flocks. Jacob sends Joseph to see how they are doing. We sense it will be a critical encounter, and so it is. The brothers see him at a distance, plan to kill him, and eventually sell him into slavery. Ironically, it is this act that begins the sequence of events that leads to Joseph's dreams coming true.

Between Joseph setting out and his meeting up with the brothers, however, we read the following:

> When Joseph arrived at Shechem, a man found him wandering around in the fields and asked him, 'What are you looking for?'
>
> He replied, 'I'm looking for my brothers. Can you tell me where they are grazing their flocks?'
>
> 'They have moved on from here,' the man answered. 'I heard them say, "Let's go to Dothan."' So Joseph went after his brothers and found them near Dothan. (Genesis 37:14–17)

Joseph arrives at the place where the brothers are supposed to be and finds that they are not there. A stranger appears who is able to guide Joseph to them. This is an extraordinary piece of biblical prose. The Joseph story is one of the most tightly scripted in the whole of the Bible. Every detail is significant and we are told nothing we do not need to know. Why then are we told this utterly irrelevant detail that at first Joseph could not find his brothers and needed a stranger to point the way?

The story of Joseph is carefully constructed to be read on at least two levels. On the one hand, it is a story of chance human interactions. It is a tale of parental favouritism and sibling rivalry. People speak, have emotions and make decisions that have consequences. It might have been otherwise.

Read at another level, it is a story of divine providence in which the end is foretold at the beginning – one of the very few

such stories in the Bible. The outcome is announced through the dreams. Joseph will become a leader. His brothers will bow down to him. As in a Greek tragedy, every act, whatever its intention, has the effect of leading towards the predestined end.

On the one hand, the Joseph story can be read as pure chance. At the key moment, he might not have found his brothers. He might have wandered around looking for them and then returned home. The entire drama of Joseph's fall and rise might never have happened.

On the other hand, divine providence is active at every stage. That is what this curious detail of the unnamed stranger is there to signal. At just the right moment a man appears to set Joseph on his way for the fateful meeting with the brothers. Not surprisingly, Jewish tradition identified the stranger who meets Joseph when he is lost as an angel – an 'angel who did not know he was an angel', in the fine phrase of the thirteenth-century scholar Nahmanides.[22]

In case we miss the point, the Bible later puts it explicitly in Joseph's mouth. Many years later, by now the viceroy of Egypt, Joseph tells his brothers, 'And now, do not be distressed and do not be angry with yourselves for selling me here, because it was to save lives that God sent me ahead of you . . . So then, *it was not you who sent me here, but God*' (Genesis 45:5–8).

In case we still miss the point, Joseph repeats it in a second scene, years and chapters later: '*You intended to harm me, but God intended it for good* to accomplish what is now being done, the saving of many lives' (Genesis 50:20).

The Bible is making, here and elsewhere, a philosophical point of some delicacy and power. It is rejecting the Aristotelian principle of the law of contradiction: either p or not-p. It is rejecting what William Blake called 'single vision'. It is telling us that there may be no unequivocal answer to the question, 'Was event X a chance event, or was it intended by divine design?' It may be both. From one perspective, the story of Joseph is a series of random events, driven by a series of human decisions that might have

been otherwise. From another perspective, it is the working out of a providential pattern whose end was announced (in Joseph's dreams) at the beginning.

That is why a sentence like 'Man is the result of a purposeless and natural process that did not have him in mind' may be true and false in equal measure. Let us now give some substance to this proposition without invoking divine providence.

It is often said that Darwin refuted a famous argument for the existence of God, the 'argument from design'. Indeed, he believed this himself. Darwin did in fact refute something, but it was not the argument from design; it was one particular and faulty version of it.

In 1802 William Paley published a book called *Natural Theology* that had wide circulation in Victorian Britain and exercised a deep influence on the young Charles Darwin in particular. In it, Paley offers an early nineteenth-century updating of one of the classic arguments (dating back to Cicero before the birth of Christianity) for the existence of God, the 'argument from design'.

Imagine, says Paley, that we are walking across a heath. In our path is a stone. Seeing it, we are not moved to ask who put it there or why. It is just there. But suppose in our path we see a watch. That could not have been there since the beginning of time. The fact that it is fashioned from many different materials, precisely engineered and put together with integrated complexity, tells us that it was designed. It is a thing made. It bears the evidence of deliberate construction. Therefore it had a designer. The universe, says Paley, is more like a watch than a stone. Therefore it too had a designer.

The power of Darwin's theory of the origin of species is that it shows, with great simplicity and elegance, how design might emerge without a designer, through the simple processes of variation and natural selection, repeated in generation after generation over huge expanses of time. Within any given life form, there will

be variations. They will compete for the scarce resources necessary for their survival. Those best adapted to their environment will commandeer what they need to live long enough to breed a new generation. Those less well adapted may die. This will account for variations within a species, as different environments favour different adaptations. Over time, those variations may be great enough to constitute a new species. The dual operation of chance (genetic mutation) and necessity (the competition for scarce resources) will generate design without a designer. So, says Darwin in his *Autobiographies*:

> The old argument of design in nature, as given by Paley, which formerly seemed to me so conclusive, fails, now that the law of natural selection has been discovered. We can no longer argue that, for instance, the beautiful hinge of a bivalve shell must have been made by an intelligent being, like the hinge of a door by man. There seems to be no more design in the variability of organic beings and in the action of natural selection, than in the course in which the wind blows.[23]

Darwin is careful to register a qualification. He says he has refuted the old argument of design in nature *as given by Paley*. Life turns out not to be like a watch after all. But who says that is the only way to design a system?

One of the great influences on Darwin was the economist Thomas Malthus, and Malthus himself was a disciple of the first great economist Adam Smith. In *The Wealth of Nations*, Smith put forward a famous argument about the working of the market economy. The division of labour leads to economic growth. The more people specialise, the more they are able to produce, and through market exchange they are able to sell their goods and acquire what they need. The paradox is that this process, which benefits (almost) everyone, is driven throughout not by empathy and altruism but by the pursuit of personal gain. 'It is not from

the benevolence of the butcher the brewer or the baker that we expect our dinner, but from their regard to their own interest.'[24]

The system as a whole – the free market – has a property shared by none of its constituent parts, namely the men and women and their myriad transactions that make the system work. It results in the *common* good, but the people within the system intend only their private, individual good. Smith described this paradox in almost mystical terms: 'by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an *invisible hand* to promote an end which was no part of his intention'.[25]

By 'invisible hand' Smith meant that the system has a logic visible only when seen as a whole. Macro-economics is different from micro-economics. The result of many individuals seeking personal benefit is that collectively they produce general benefit, 'the wealth of nations'. The 'end', the consequence and effect of the system, is no part of the 'intention' of the millions who take part in it. To them it is 'invisible'.

This is a general feature of systems. From ant colonies to cities, individuals come together to form highly structured patterns of behaviour without anyone or anything ordering the process. The name given to this process is 'emergence', and the result, 'organised complexity'.[26]

What makes emergence distinctive is that it works through a highly distributed, bottom-up intelligence rather than a top-down centrally imposed one. Ant colonies function because individual ants follow simple rules of pattern recognition, tracking the pheromone trails left by fellow ants. The result is a kind of collective intelligence represented by the colony as a whole.

That is how natural selection works. Out of a seemingly blind process of life forms replicating and passing on their genes to the next generation, variants are produced. Natural selection operates, sifting out the best from the worst adapted, and out of this apparently blind process there emerges an evolving biodiversity

that produces life forms of ever-increasing complexity until it arrives at us. Like the market economy with its billions of transactions, no one within the system intends the outcome, but it is not random. It was precisely to produce such an outcome that the system as a whole was designed.

So powerful is natural selection that since the 1980s it has been used in computing to develop artificial intelligence. Inspired by Richard Dawkins's book *The Selfish Gene*, David Jefferson and Chuck Taylor of UCLA devised a computer programme that reproduced itself with minor random changes as in natural reproduction, and then tested the resulting programmes against one another, jettisoning those that failed, keeping those that succeeded, letting them reproduce and so on.[27] The result is a computer that designs its own programmes to solve problems by mimicking the process of natural selection.

The implication of this is simple and momentous: *You can design a system that works on Darwinian lines.* There is nothing random or accidental about such a system, even though every component part of it seems to be functioning blindly. Out of a myriad local operations, none of which has the end point in mind, an order emerges at the level of the system as a whole.

What might make us think of evolution as part of a larger system of order like the market economy? The answer, suggests the Cambridge biologist Simon Conway Morris, is *convergence*. Biological systems are not random. Often, by taking different routes, they arrive at similar destinations. So, for example, cephalopods like the octopus developed a camera eye very similar to that of vertebrates like the blue whale. The development of intelligence in different phyla shows similar convergence. The paths taken by different life forms have not been random. They are constrained by the conditions in which they function and the problems they have needed to solve. Life forms begin from different starting points and take different routes, but they land up at the same destination with very similar soft- and hardware.

The direction of evolution is not open-ended. It tells a cumulative story of organisms of ever-growing complexity, able to thrive in different ecological niches, often in symbiotic relationship with other life forms. Steven J. Gould famously said that if the tape of evolution were replayed there is no guarantee that Homo sapiens would have emerged at all. Yet if convergence is a feature of evolution, then sooner or later something like Homo sapiens – a being with intelligence and self-consciousness – would have appeared. As Conway Morris himself puts it, 'What we know of evolution suggests the exact reverse [of Steven J. Gould's view]: convergence is ubiquitous and the constraints of life make the emergence of the various biological properties [e.g. intelligence] very probable if not inevitable.'[28] In short, you can design a universe that will eventually give rise to something very much like Homo sapiens, even when the process is built of steps none of which has this outcome in mind.

Darwinian biology does not entail the absence of design. What Darwin refuted was not the argument from design but Paley's version of it. The natural universe is not like a watch. It is not mechanical, a predetermined arrangement of interlocking parts. *But who thought the universe was like a watch to begin with?* Not the theologians, but the natural scientists and philosophers of the seventeenth and eighteenth centuries: Newton, Leibniz, Laplace and Auguste Comte. They believed that all physical phenomena were determined by, and could be predicted on the basis of, simple laws like those of Newton. What was wrong with Paley's argument was not the theology but the science. Good science refutes bad science. It tells us nothing at all about God.

What might make us think that this is the way God designed the universe? Because that is the way the Bible portrays him acting in relation to humans. The early experiments fail. God gives Adam and Eve paradise, but they sin. God tries to warn Cain against violence, but Cain does not listen. Seeing a world 'full of violence', God brings a flood, saves Noah and begins again, allowing him

things, like eating meat, he forbade to the first humans. Again the plan fails. Noah gets drunk. Humanity starts building Babel.

God tries again, this time with a single human, Abraham. This too does not achieve the intended result. Within three generations Jacob's children are selling one of their brothers into slavery. God then exposes their descendants to slavery so that they will learn what it feels like and thus be motivated to create a society of freedom. Liberating them, God then gives them a command, the Sabbath, on which even slaves are free, so that they will eventually learn that no human should enslave another. Even this takes more than three thousand years.

The complex interaction between God and humanity in the Bible is more in the spirit of Darwinian evolution than in that of the God of Plato or Aristotle, the unmoved mover contemplating the unchanging, abstract forms of things. God, like evolution, operates in and through time. Humans act, God reacts, humans respond to divine response, and so on in ways that are often surprising and unpredictable. How this dovetails with Divine foreknowledge is a classic problem in Jewish theology (in the Middle Ages, Gersonides thought that God's foreknowledge was limited by human freedom, Crescas that human freedom was limited by God's foreknowledge, and Maimonides that human and divine knowledge were so unalike that we can know only that we will never know how God knows).[29] God, like evolution, is oriented to a not-yet-realised future: hence his name, 'I will be what I will be', which might equally serve as a Darwinian definition of life itself. God, like evolution, works on the basis of convergence, that distant vision of an end of days in which nation will no longer lift up sword against nation and the world will be in a state of *shalom*, the integrated diversity that constitutes peace.

What Darwinian science represents is not the refutation of the God of Abraham but the final overthrow of Aristotelian science, the idea that purposes are unequivocally discernible within nature. The Bible tells us, as in the narrative of Joseph, that at one level the story of life may seem like an entirely random sequence of

events. There is nothing obvious about divine design. It is oblique, subtle and sometimes non-linear. It needs much intelligence and depth to perceive it, and it is arrived at not by the left-brain process of analysing microscopic detail, but by the right-brain capacity to step back and see the picture as a whole.

Why would a Creator choose to operate this way, allowing species and eventually humankind to emerge obliquely rather than directly? For the same reason that the planned economies of the Soviet Union and Communist China failed and the market economies of the West succeeded. A planned economy fails to liberate energies. It does not grant freedom. It does not generate creativity. It is predictable, ungenerous, dictatorial, precisely the things the God of Abraham is not.

Darwinian evolution precisely fits the model I argued for in chapter 1, in the case of Abrahamic monotheism and the meaningfulness of life. *The meaning of the system lies outside the system.* That, I argued there, applied to systems in general and to the universe as a whole. Any system is made up of rules that govern events within the system. Those rules explain how the system works, but not why it was created or evolved. That is why Darwinism fulfils an important function for Abrahamic monotheism. It tells us that God, having created the conditions for life, transcends life as he transcends the universe. The idea that we should look for God in nature is essentially pagan and constitutes a pagan residue even within the great Aristotle himself. Faith says, all that breathes praises God. It does not say, all that breathes proves the existence of God.

The Hebrew Bible is simply uninterested in *Homo sapiens* the biological species. It is even relatively uninterested in *Homo faber*, the tool-making, environment-changing life-form. It passes over, in short order, Jabal, 'father of those who live in tents and raise livestock', Jubal, the first to 'play the harp and flute', and Tubal-Cain who 'forged all kinds of tools out of bronze and iron'. It is interested exclusively in *Homo religiosus*, the first humans to hear and respond to the Divine voice.

Ecclesiastes says that biologically, 'Man has no pre-eminence over the animals.' We are creatures of earth, physical beings with physical drives. We live, we eat, we sleep, we reproduce, we age and die. But humans remain unique. We are culture-producing animals. There are other social animals, but none that produce – except at the most rudimentary level – cultures, symbols, systems of meaning. It is this that gives us our unique adaptability. Other animals are genetically conditioned to act in certain ways under certain conditions. We have something more powerful than genetically encoded instinct. We are culture-producing, information-sharing, meaning-learning animals. Nature built us for culture.[30]

No animal painted the bonobo equivalent of the Sistine Chapel ceiling. No animal said, 'To be or not to be.' No animal philosophised that he or she might be nothing more than a hairy human. No animal was even an atheist, as far as I know. We may share many of our genes with the primates, as we do with fruit flies, bananas and yeast. The stones of an ancient cottage have mineral similarities to those out of which Chartres Cathedral was built. But there the resemblance ends.

The Bible is interested not in *physis*, but in *nomos*: not in the laws that govern nature, but in the moral laws that should govern humankind. The Greek translation of *Torah*, the Jewish name for the Mosaic books, is *Nomos*, 'law'. Hence the Bible does not begin with the birth of Homo sapiens, a biological species, hundreds of thousands of years ago, but much later, with the discovery of monotheism some six thousand years ago. The critical moment seems to have been the dawn of individual self-consciousness.

Bruno Snell argues, in *The Discovery of the Mind*, that the Greeks discovered the human person as a person sometime between Homer and Aristophanes, that is, between the ninth and fifth centuries BCE.[31] The Bible dates it several thousand years earlier, at the dawn of civilisation. Adam and Eve are typological representations of the first monotheists. Finding God singular and alone, they found the human person singular and alone.

Because virtually all human activity is culturally mediated, and because humans are the only culture-producing animals (if we exclude such modest behaviours as chimpanzees learning how to wash potatoes), it follows that the biological similarities between humans and animals are irrelevant to most of human behaviour. The comparisons are interesting, but what makes humans human is the way basic drives — eating, reproducing, hierarchies of dominance – are transformed by culture into elaborately choreographed minuets that are forms of enacted meaning.

Evolutionary psychology tells us that we may have genetically encoded instincts, some of which date back to our pre-human history, our 'reptile brain'. Religious thinkers knew this long ago. The Jewish mystics spoke about our 'animal soul' which has to be overcome by our 'godly soul'. Even the most committed scientific materialists concede that genetically encoded instinct has nothing to do with ethics. Richard Dawkins himself says in *The Selfish Gene*, 'We have the power to defy the selfish genes of our birth . . . We alone on earth can rebel against the tyranny of the selfish replicators.'[32] Steven Pinker writes that we can act against genetic predisposition, 'and if my genes don't like it they can go jump in the lake'.[33] Katherine Hepburn said it best. 'Nature', she says majestically to Humphrey Bogart in *The African Queen*, 'is what we were put on earth to rise above.'

The biblical story begins at that moment at which humans developed sufficient self-consciousness to become aware of themselves as deliberating, choosing, free and responsible moral agents, the point at which they were first able to understand that 'nature is what we were put on earth to rise above'. The Bible is interested not in Homo sapiens the biological species, but in the moral animal who, communing with the source of his and all being, discovers for the first time that although, like everything that lives, we have desires, like nothing else that lives, we are able to pass judgement on our desires. That is when humans first heard the voice of God.

The story told by modern cosmology and Darwinian biology is wondrous almost beyond belief. It tells of a universe astonishingly

precisely calibrated for the emergence, first of stars, then of second-, third- and fourth-generation stars, then of the formation of planets, one of which met exactly the conditions for the possibility of life. Then, in a way that still remains utterly mysterious, life emerged and evolved, through billions of years, yielding self-organising systems of ever-increasing complexity, until finally one life form appeared, capable of standing outside its biological drives for long enough to become self-conscious of itself and the sheer improbability of its own existence, and sensing in all of this a vast intelligence that set it in motion, and a caring presence that brought it into being in love. It took 13.7 billion years before the first human turned his or her thoughts beyond the physical universe and, searching for God, found God searching for us.

How it happened, we will never know for sure. But it suggests a story of almost infinite divine patience consistent with everything we know from the Bible yet on a scale only mystics hitherto imagined. So I am not surprised that the rabbis formulated a blessing to be said over scientists, for it remains the most unlikely and beautiful story ever told.