

מה שתשיב

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בס"ד

Contents: Science and Torah

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Part 1: In Search of Reality

Throughout the ages, mankind has grappled to understand the nature of the world. Two distinct disciplines have emerged. These disciplines compete for primacy in our attempts to understand the reality we inhabit.

Science has been handed down to us by generations of thinkers. These thinkers have contributed to scientific knowledge and to the development of the scientific methods of deriving this knowledge. Science is a field of study that builds and organises knowledge of the Universe in the form of explanations and predictions that can be tested. It is a logical, evidence-based way of understanding our universe.

The other discipline we have received is Torah. In essence, Torah is much more than the five Books of Moshe, which contain laws, as well as stories of our ancestors. Our Sages describe Torah as God's blueprint for creation; it is the crystallisation of the design held in God's mind for the reality He formed. To study Torah is to study the mind of God.

Science and Torah are both valid methods of evaluating the nature of the world, although each method appears to offer wildly different approaches when explaining some of the most fundamental aspects of Creation. Examples of this difference include scientific conclusions about the age of the universe versus the six days of Creation as described in Bereishit, or the Theory of Evolution versus Creation.

In this series, we will grant both disciplines the respect that they deserve from the outset, without prejudice. It seems to me that both are required in understanding the fabric of reality. We will first explore the concept of belief in God and why Jewish faith in God and the transmission of His Torah has a rational basis. We will then explore the Universe itself by probing concepts such as the age of the Universe, the elementary components of matter and the laws of Physics. We will then turn our attention to the formation of life on Earth and the evolutionary process, before looking at mankind's experience of the world through free will and consciousness. We will conclude with an analysis of the educational challenges which are generated by the apparent conflicts between Science and Torah.

This is not merely an attempt to resolve conflicts. Through an analysis of the differences between Science and Torah, our appreciation and understanding of each discipline will be enhanced. We will reveal the exquisite beauty of both disciplines in their own right, while appreciating the synergy between them.

The next article will review the rational basis for faith in God. We will view God's revelation and the giving of the Torah at Sinai as a beginning of a process of transferring information.

Part 2: Information and Rational Faith

The fifteenth century Spanish Rabbi, Yosef Albo, wrote that the basic axioms of Judaism are not based on deductive reasoning or belief, but are validated through direct experience. Spiritual realities are too important to leave to faith alone.

God's revelation to the Jewish people at Sinai was a unique event, which gave rise to two unique claims:

Firstly, other religions and belief systems claim authenticity through Divine revelation to one solitary individual. In contrast, the Torah claims that the entire Israelite nation witnessed the revelation of God at Sinai (see Shemot 24:17 and Devarim 4:32-36).

The Kuzari (written by Rabbi Yehuda HaLevi, c. 1140) notes that it would have been impossible to fabricate this first claim. Individual claims of personal revelation are neither falsifiable nor verifiable. Followers may choose to believe them if they wish, but their blind faith is all that stands between their perception and reality. However, claims of national revelation (or any national experience) are very difficult to fabricate, as an event of that gravity and significance would have made an indelible mark on those present.

If the Torah had been fabricated, with its tales of a nationwide encounter with God, its 'author' would have had a very hard time selling the story to the Jewish people, who were the descendants of those deemed to have witnessed the revelation. Reports of such a grand experience should surely have been passed on by the people who witnessed it to their children and grandchildren.

Furthermore, if a charismatic Jewish leader had attempted to invent this claim, and the people would indeed have begun to wonder why their own ancestors had never mentioned this phenomenal event, we would expect to find records of such a hero 'revealing' the 'lost history' of our people. Yet there is no record of such a hero in the annals of Jewish history. It is more reasonable to accept that the event was genuine and the Torah's account authentic.

This argument has wider implications, for it demonstrates that the Jewish people themselves are a medium through which Jewish experience and Torah teachings have been transmitted.

A second unique claim about the revelation at Sinai is that the entire Torah, including the Oral Law, was transmitted by God to Moshe, to be passed on from one generation to the next. In the next two articles, we will explore the scientific principles of Information Theory and compare them to this process of transmission. This will test the legitimacy of the transmission of God's message to mankind.

Part 3: Information Theory and the Written Law

In 1948 the American mathematician, electrical engineer and cryptographer Claude E. Shannon published a paper entitled *A Mathematical Theory of Communication*, which determined the process of how information is coded and transmitted through different media. Shannon broke down the process of information transfer into five parts:

There is (i) an information source which produces a message; (ii) a transmitter that processes the message into a signal; (iii) this is carried over a channel; (iv) the receiver then converts the signal back into the message so that (v) it can reach its destination, the person or machine for whom the message is intended.

However, this process does not occur in a vacuum. There is accompanying ‘noise’, meaning unintended effects which disturb the signal and may corrupt the message. All modern communication devices contain technology to reduce noise and maintain the integrity of the message.

In essence, Torah is information; the integrity of God’s message can in theory be tested through applying the same principles of Information Theory which provide the basis for satellite telecommunications, mobile phones, and digital broadcasting.

However, unlike modern telecommunications, the messages of Torah were not only intended to be transmitted over space, but also over time. The medium through which this is achieved is the Jewish people itself; the receiver – or in this case receivers, of that information is each generation of young Jewish minds.

The transmission of the written Torah contains elements that are essential for good information transfer. The system also contains ways of eliminating sources of ‘noise’, such as deliberate corruption, copying errors, mistakes in understanding or a failure to remember parts of the message.

We have laws to protect the Torah from corruption. We are forbidden to deliberately alter the text (Devarim 4:2). In addition, our Sages relate that shortly before Moshe died, he wrote 13 Torah scrolls, one for each of the 12 tribes and one to place in the Ark of the Covenant, so that if someone tried to forge something, they could refer back to the original (Midrash Devarim Rabbah 9:9). A Sefer Torah is invalid unless the entire text is precise. A scribe must copy from an existing Torah; if even one letter has been written by heart, the scroll is invalid.

Israel Prize laureate and Bible scholar, Rabbi Dr. Mordechai Breuer (d. 2007), tested Torah scrolls and manuscripts from across the world for textual differences. He revealed only twelve variances between them; these only reflect differences in spelling, equivalent to ‘colour’ versus ‘color’ in English. Remarkably, over a period of 3,300 years, the Torah we have, copied thousands of times since Moshe, is essentially the same.

In the next article we will evaluate the Oral Torah’s transmission.

Part 4: Information Theory and the Oral Law

God's revelation at Mount Sinai was a unique event, which began the communication of His Torah to the Jewish people. The written Torah was accompanied by a set of oral instructions, from God to Moshe, which form the basis of Jewish law.

This was necessary; the complete written Torah contains the source of all of the mitzvot, but the instructions for Jewish living cannot be derived solely from the written text. It does not usually detail the practical requirements of Jewish observance. For example, when commanding us to place a mezuzah on our doorposts, the Torah instructs: "write these words on your doorposts" (Devarim 11:20). Yet the Torah does not specify which words should be included, which doorposts require them or how we are to write them. All of these details are explained in the Oral Law. The same is true for all of the 613 commandments; their source is in the Written Torah, but the practical instructions and real-world applications are not.

Therefore, it is clear, both logically and textually, that God related the practical laws of Jewish living to Moshe orally. These instructions were passed on from teacher to student (see Shemot 24:12). The Talmud (Berachot 5a) relates that this transmission continued orally until approximately 200 CE, when Rabbi Yehudah HaNasi compiled a concise summary of the legal teachings and discussions of leading Sages into the Mishnah. Approximately 300 years later, Ravina and Rav Ashi compiled the Gemara, which developed the Mishnah. The two are studied together as the Talmud; this forms the foundation text of applied Jewish legal principles and debate. The first Mishnah in Pirkei Avot (Ethics of the Fathers) describes this chain of transmission.

The Talmud contains many arguments (machlokot) between Rabbis. A machloket may indicate a degree of 'noise' in the transmission process. However, the Oral Law contains internal methods of analysis which correct any error, by testing every opinion against other established facts, in an attempt to decipher the correct approach. Sometimes, the Talmud will ascertain that one position is incorrect and refute it.

On other occasions, it will assert that both positions presented in a machloket are equally acceptable. It is only when these positions are applied that practical differences emerge, such as in determining the time of sunset when calculating Shabbat times. Is 'sunset' when the sun starts to set or when it has finished setting? The application of these equally valid positions will yield radically different results. This is relevant to defining when Shabbat starts and ends. In this case, we are forced to operate within the most stringent position; we use the earlier time for the beginning of Shabbat and the later time for the end.

The next article will examine the special function of the Ten Commandments, viewed from the perspective of Information Theory.

Part 5: The Torah's Mnemonic

Claude E. Shannon, the forefather of Information Theory, described the general challenge of transferring a message from A to B as “reproducing at one point, either exactly or approximately, a message selected at another point. In the presence of noise and interference, there are limits to the amount of information that can be reliably transmitted over a communications channel. Imagine trying to speak to a fellow guest at a simcha when the music is playing too loud. Most of us would either shout louder, or leave the room to have the conversation outside. Applied to Information Theory, these solutions are like increasing the amplitude of the signal (shouting louder) or reducing the noise (leaving the room).

Similarly, when revising for an exam, retaining a list of dry facts can be difficult. The ‘message’ is the list of facts, the ‘medium’ is time and the ‘noise’ is our fallible memories. Many schoolchildren will employ mnemonic devices to help remember lists. For example, many of us used ‘Richard of York gave battle in vain’ to remember the sequence of colours in the spectrum of visible light. However, the user must know what the mnemonic means; otherwise, in the example above, the only information transfer would relate to the 15th Century Duke of York!

The Asseret HaDibrot, commonly known as ‘the Ten Commandments’, but more accurately translated as ‘the Ten Statements’, are mentioned twice in the Torah, once in Shemot and once in Devarim. These statements were given by God to Moshe, written on two tablets of stone.

Given that the commandments listed in the Asseret HaDibrot anyway form part of the 613 commandments elucidated in the Torah, what was the purpose of singling out these ten statements and writing them on two tablets of stone?

Rashi (d. 1105) writes that the Asseret HaDibrot contain allusions to all of the 613 mitvot listed in the Torah. He adds that Rabbenu Sa’adiah Gaon (d. 942) composed poems listing all of the 613 commandments, linking each one back to one of the Asseret HaDibrot (see Rashi to Shemot 24:12). It may be beyond us to remember all 613 commandments, but, in line with Rabbenu Sa’adiah Gaon's thinking, we can see the Asseret HaDibrot as a mnemonic for the entire Torah.

Rabbi Mordechai Yoffe (d. 1612) noted that while we no longer recite the Asseret HaDibrot as a part of our daily communal prayers, for fear that some may claim that there is no other Torah than the Asseret HaDibrot, one should recite them every day privately to build faith in God through remembering the revelation at Sinai.

Part 6: Our Infinite God and Finite World

Albert Einstein wrote in his theory of relativity that 3- dimensional space and time are part of the same physical reality, called 'space-time'. Our physical bodies are bound and defined in space. So too, we are compelled to exist in the present time, sandwiched between the inaccessible past and the unreachable, undefined future.

God, however, is not bound by space or time. As the poem 'Yigdal' states: "God has no body or form of body". By logical extension, He also exists beyond time, as we say in 'Adon Olam': "[God is] without beginning, without end".

Infinity is a difficult concept to grasp. For example, mathematically there are an infinite number of whole numbers (1, 2, 3 ...). There are an equally infinite number of even whole numbers and odd whole numbers, even though intuitively there should be half the quantity!

This confusion is a direct result of trying to use our finite human minds to understand infinite concepts. It is precisely this confusion that explains why we might struggle to understand an infinite God. Yet through the Creation of Mankind, God has given us a way of beginning to comprehend Him.

The Torah speaks of God in anthropomorphic terms. For example, God has an 'arm' and a 'hand' (Devarim 4:34) and 'eyes' (ibid. 11:12). If the Torah is the expression of God's mind, then in God's infinite, spiritual reality, He really must have hands, arms and eyes. How is this so? According to everything we have said, those descriptions appear heretical. Yet it is precisely these anthropomorphisms that help us understand God.

The idea that God "created Man in His image" (Bereishit 1:27) means that He has given us physical, finite arms, hands and eyes which are the physical, finite equivalent of His spiritual, infinite arms, hands and eyes. Therefore, when we are told that God took us out of Egypt with a "strong hand and an outstretched arm", we understand what that means from our own physical experiences; the Children of Israel were embedded in the quagmire of spiritual degradation in Egypt, so a strong hand was needed to extricate them. They were distant from God, so an outstretched arm had to be used to reach them.

Our relationships with one another also teach us about our relationship with God. Parenthood teaches us what it feels like to create life and feel unconditional love. That is why our Talmudic Sages associate the commandment to honour God with the commandment to honour our parents. While our finite experiences are of a different nature to God's infinite world, we can get a taste of God's world from our own.

Part 7: The First Thing that Led to Another

Every moment that we live and every choice that we make is the result of an abundance of interconnected causes and effects; from the seemingly mundane to the momentously significant. Philosophers refer to the idea of cause and effect as determinism. It is the doctrine that all events, including human actions, are ultimately determined by prior physical causes.

Since the mid-20th century, scientists have agreed that our Universe began approximately 13.8 billion years ago. In future articles, we will discuss if and how this position fits with traditional Torah views. Imagine all of the events in the physical world – the almost uncountable causes and effects that have taken place in the 13.8 billion years since the Big Bang; then rewind them one by one. Theoretically, we could trace each action back to a prior cause. But there is a catch:

As we continue winding the tape of universal history back, we will eventually reach the beginning, the moment of the formation of the cosmos. If the physical world is run by causes and effects, its very inception – arguably the most important cause of all – must have also had a prior cause. The Universe is defined as having space, matter, and time. Yet before the Big Bang there was nothing: no space, no matter, and no time. What therefore could possibly have caused a physical Universe to come into existence *ex nihilo*, from nothing?

American physicist Laurence M. Krauss proposes a scientific explanation of how the Universe came into being from nothing, pointing to fluctuating quantum (sub-atomic) effects that occur in a perfect vacuum and appear to be nondeterministic. Quantum theory predicts sub-atomic particles popping in and out of existence in this apparent nothingness, *ex nihilo*. Could this hint to a cause for the Big Bang?

I would suggest not. Krauss confuses the pre-Big Bang ‘nothing’ (a total absence of space, matter, and time) with the post-Big Bang ‘nothing’ that we observe as a vacuum. Fluctuations in quantum effects in a vacuum require both quantum fields and quantum particles (which require space to exist) and fluctuations (which are changes in time). David Albert, Professor of Philosophy at Columbia University, points out that Krauss undermines his argument by redefining the word ‘nothing’ to mean ‘almost nothing’.

In fact, if the formation of a finite Universe from nothing means the beginning of space and time, it would require some kind of trigger that is beyond the finite boundaries of space and time, and therefore beyond the finite Universe about to be created.

This is why the Rambam (Maimonides d. 1204) cites philosophers before him who refer to God as ‘The Primal Cause’. The unavoidable characteristic of a finite, deterministic world is that it had to be created by an infinite, Primal Cause. That moment set into action the series of effects which became causes of further effects, and so on. But Something had to start it.

Part 8: Feeling the Touch of God's Hand

In order to predict the weather, meteorologists need two factors. First, they need to collect many observations of what the current weather is. Second, they need to enter those observations into a physical model. This model is a series of equations that mathematically govern the way the atmosphere works. When enough data about the current weather is entered, the physical model can work, in most cases, to predict midrange weather.

Yet it is nearly impossible to observe all the global atmosphere perfectly. It is very hard, for instance, to gauge the weather over the mid-Pacific. There is room for error.

These small errors or differences can have a major effect in weather prediction. The American Mathematician Edward Lorenz discovered the effects of these small changes and errors as they relate to complex systems such as weather prediction.

Lorenz's colleague Philip Merilees famously coined the question: "Does the flap of a butterfly's wing in Texas produce a tornado in Brazil?" This soon became known as the 'butterfly effect'. The flap of the butterfly represents the tiny change in the initial conditions. Put succinctly the butterfly effect relates to the concept that small causes can, over time, have large effects. Initially, it was used in regard to weather prediction but later the term became a metaphor used scientifically and within the popular media.

By logical extension, the butterfly effect is true for every complex system; traffic flow, a football match, and the countless interactions we have each day. At every moment of our lives, the decisions we make and the interactions we have affect the future. Even the smallest differences and choices at every juncture are like forks in the road of life, leading us in different directions. Divine Providence describes God's intervention in the world, from grand events to the minutiae of everyday life.

While free will is Man's sacred prerogative, the idea that God's 'Hand' manipulates events to bring about His purpose for Creation is fundamental in Jewish thought. While God can guide nature through open miracles, we don't necessarily see these anymore. Yet He is still involved in shaping the world.

When we pray, we describe God's miracles 'which are with us every day.' What are those miracles? Rabbi Moshe Chaim Luzzatto (d. 1746) explained that God uses natural phenomena to influence His creation, triggering the hidden miracles which guide our lives.

The Baal Shem Tov, (Rabbi Yisrael ben Eliezer, d. 1760) described these interactions in more detail, such as a wisp of straw blown from a thatched roof or the path of a falling leaf. The difference that these events make appears negligible. Yet we know from Edward Lorenz that they eventually make all the difference. While we cannot see God's guiding 'Hand' directly, the butterfly effect resonates with the notion that God can intercede in the running of the world in the most subtle and yet profound way.

Part 9: The Age of the Universe I

One of my earliest childhood memories is standing on the side of a busy road with my grandmother, watching a police car zoom past with its lights on and sirens blaring out. I remember wondering why the tone of the siren appeared to change from a high pitch as the car approached, to a much lower pitch after it passed. This is known in physics as the Doppler Effect, named after the Austrian physicist who explained the phenomena.

Sound travels as a wave through a medium such as air, like ripples in a pond. The frequency of these waves determines how high or low the pitch will be; waves closely bunched together produce a high pitch whereas stretched waves produce a lower pitch. If the source of the sound is moving, like the police car, the waves bunch up in front of the car and are stretched behind the car. This explains the change in pitch that I noticed.

The same can happen with light waves, if the object emitting the light is moving quickly enough. The American astronomer Edwin Hubble observed this effect when he analysed light spectra from distant stars and galaxies. The spectra shifted to the red, lower frequency end of the spectrum, indicating that Universe was not static but expanding. This in turn implied that the Universe must have had a beginning.

By measuring the distance of these stars and galaxies, coupled with the magnitude of the spectra's shift to red, Hubble was able to calculate the age of the Universe, a figure which has now been refined to approximately 15.8 billion years. The Jewish calendar identifies the date of the creating of Adam on the sixth day of Creation as over 5780 years ago. The Creation story in Bereishit occurred over the six previous days. How can we reconcile the two positions? There are three main approaches to this conflict.

One could (a) accept the Torah as literally true and disagree with the scientific evidence, (b) accept that the Torah is literally true, and that scientific evidence is also accurate and attempt to reconcile the two or (c) view the Torah as authentic but reconcile its messages with science by understanding the text of the Torah in a non-literal way.

The first approach either casts doubt over the scientific method, asserts that the laws of nature have changed - yielding false results - or concludes that God created a fully formed Universe 5777 years ago with a past 'history' stretching back 15.8 billion years. The second approach views each of the six 'days' of Creation as epochs of time lasting for billions of years. The third approach recognises the authenticity of both science and Torah and sees the Torah as primarily concerned with spiritual concepts rather than as a textbook of ancient scientific philosophies.

The next three articles will explore these positions.

Part 10: The Age of the Universe II

The last article discussed the scientific calculation of the age of the Universe – 15.8 billion years. We briefly outlined three approaches to reconcile this evidence with the account of Creation in the Torah (which dates back only around 5780 years). The first approach is to accept the Torah's account of Creation as literally true and explain its discrepancies with science by attempting to disagree with the scientific evidence.

Proponents of this approach question the assumptions made when scientifically calculating the age of the Universe or age of the Earth. For example, the calculation that the Earth is 4.5 billion years old is based on measuring the proportions of various radioactive elements which change at a constant, measurable rate, due to radioactive decay.

Yet what if those changes were not always constant? If the rate at which radioactive elements decay had been affected by the extremes of temperature and pressure that existed at the formation of the solar system, it would undermine the validity of the calculation. Since we cannot know with certainty that these decay rates are constant, 'Torah literalists' state that they have enough reason to doubt scientific evidence and to keep faith in the literal truth of the Torah.

However, scientists have tested the constancy of decay rates. In 1972, nuclear scientist G. T. Emery published a paper detailing attempts to alter radioactive decay rates using extreme temperatures, pressures, and magnetic fields. This included putting a sample of radium inside a steel-encased cordite bomb, which produced temperatures of 2,500°C and a pressure around 1,000 times more than the Earth's atmosphere. Yet there was no change in the radioactive decay of the sample.

One could also ask the question the other way round. If the Universe and Earth are only 5,777 years old, what would the decay rate of these radioactive elements have to be in order to make us falsely believe the Earth is 4.5 billion years old? In an article entitled, 'Were Adam and Eve Toast?' Professor Joe Meert notes that the radioactive decay rates necessary to produce such results would have generated enough heat to melt the Earth long before life could have existed.

To circumvent these difficulties, other 'Torah literalists' have turned to the 'young-earth model', in which God created the Universe around 5,780 years ago with a past history that made it appear older than it was. This accepts all of the scientific evidence as technically true but views it as a smokescreen for an Earth which is actually much younger.

While the 'young earth' argument is logically sound, it implies that God has deliberately deceived us into believing the world is older than it is. Rabbi Dr Dovid Gottlieb (a contemporary scholar and philosopher in Jerusalem) justifies this by arguing that this obscuring of reality helps to hide God and facilitates Free Will. Yet while Free Will is a fundamental axiom of Jewish belief, many disagree with the notion that God has deliberately mislead us. The Midrash states that God created everything in this Universe except for falsehood.

Next week's article will consider the idea that each day of Creation in fact encompassed many billions of years.

Part 11: The Age of the Universe III

In the last two articles we examined the scientific calculation of the age of the Universe, in contrast to the Bereishit story. Cosmologists estimate that the Universe is 13.8 billion years old, while the Earth is 4.5 billion years old. A literal interpretation of the Bereishit account implies that the Universe is approximately 5,780 years old.

There are three main approaches to this conflict. One could (a) accept the Torah as literally true and question the science; (b) accept that the Torah is literally true and that scientific evidence is also accurate and attempt to reconcile the two or (c) view the Torah as authentic but reconcile its messages with science by understanding the text of the Torah in a non-literal way.

The last article discussed the first of these approaches. The second approach involves the fact that our count of around 5,780 years in the Jewish calendar begins on the sixth day of creation, with the formation of Adam. A Torah 'literalist' would assume that the first days prior to man's formation were 24-hour periods. Yet the Midrash implies that before the sixth day of creation, a different system of time existed (Bereishit Rabbah 9:14).

MIT professor Gerald Schroeder uses this idea, together with Einstein's general theory of relativity, to argue that the 'days' mentioned in the Torah were not 24-hour periods, but epochs of time stretching over billions of years. While the technical details are beyond the scope of this article, this resolution, known as the 'day-age approach' is persuasive. However, this approach inevitably means that the chronology of Bereishit should concur with the accepted scientific chronology of the evolution of life. Rabbi Natan Slifkin notes a number of discrepancies which cast doubt on the day-age approach.

For example, the Torah states that the plants and trees were created on the third day, before the fish and sea creatures. Yet according to the fossil record, the sea creatures existed 62 million years before plants and trees. A similar problem occurs with the Torah's chronology of the creation of the birds and animals. Birds were created on the fifth day, while the land animals were created on the sixth day. However, the fossil record indicates that the land animals came first, preceding birds by around 50 million years. Nevertheless, it appears that our own commentators knew that the description of Creation in Bereishit does not necessarily describe the sequential formation of the Universe.

Long before the advent of modern science, Rabbi Shlomo Yitzchaki (known as Rashi d. 1105) noted that the description of Creation in Bereishit cannot be considered chronologically accurate (Rashi to Bereishit 1:1). However, this does not in any way mean that the Torah is a nonsensical fabrication.

Rather than trying to understand Bereishit as a scientific description of the formation of the Universe, the next article will view it through the prism of the timeless spiritual messages God actually needed to convey to the fledgling Israelite nation. These messages are still true and relevant today.

Part 12: The Age of the Universe IV

The last three articles have examined different methods of reconciling the accepted scientific view that the Universe is 13.8 billion years old with the Torah's account of Creation over six days. This article will explore the view that while the Torah is the true, absolute word of God, the attempts to reconcile the literal interpretation of Bereishit with science are often unconvincing. This does not mean that the Torah is merely symbolic or metaphorical; it means that our simple understanding of the text is at fault and the messages which God wishes to convey are much deeper than we first thought.

There is precedent for this. Many of the Rambam's (Maimonides d. 1204) philosophical writings address the conflicts between Greek thought and the Torah. In particular, he targets Aristotle's view that the Universe is eternal, without beginning or end. This notion is in direct contradiction to the opening verse of the Torah and the entire concept of Creation.

Yet the Rambam writes that even if Aristotle's position could be proven scientifically and we would be forced to accept it, that would not mean that we would abandon the Torah or declare it false. On the contrary, the Rambam affirms that scientific evidence is not a threat to the veracity of our religious texts. In fact, it offers a positive way of refining our own understanding of the Torah narrative. Yet one question remains. The Torah contains a narrative which ostensibly contradicts scientific fact. Why would God confuse us by describing Creation as a six-day process if it wasn't literally six periods of 24 hours?

The answer requires a fundamental paradigm shift in our approach to understanding Bereishit. The purpose of the Torah is to help us comprehend our identity and guide us to live a proper, moral, and spiritually connected life. It is not the Torah's role to explain the mechanics of Creation. It therefore does not make sense to view the Torah as a textbook of cosmology, biology, or anthropology.

Furthermore, as the crystallisation of God's Divine wisdom, the Torah must be eternally relevant. Revelation about the scientific mechanics of reality is not the highest priority for building an ethical and just society. In any case, no one in Biblical times would have had the tools to understand it. Attempts to force an interpretation of Bereishit which concords with science essentially misses the point.

Among a multitude of other eternal lessons, God's description of Creation over six days teaches us the importance of Shabbat, which reflects the natural cycle of applying our own creative powers for six days of the week while refraining from creative activity on Shabbat. This gives us time and space to shift our focus and remind ourselves of the core purpose of our creative efforts.

Part 13: Time

Until the early 20th century, scientists believed that time was one of the absolute constants of the Universe. The English physicist Sir Isaac Newton (d. 1727) declared in his 'Mathematical Principles of Natural Philosophy' (1687) that "absolute, true, and mathematical time, in and of itself and of its own nature, without reference to anything external, flows uniformly and by another name is called duration."

It was only when the young Albert Einstein published his paper on Special Relativity in 1905 that the idea of universal time was abandoned. Einstein demonstrated that when someone moved through space, the flow of time slowed down relative to someone who was stationary. The faster you move, the slower the clock ticks relative to a stationary observer. Einstein went on to unify the ideas of three-dimensional space (height, width, and depth) and one-dimensional time into a four-dimensional reality that he called Space-Time.

The first important result of this concept is that before the beginning of the Universe, there was no space and no time. Time itself began with the Big Bang. It is an inherent part of the fabric of the Universe, not a separate entity.

Moreover, Einstein's Space-Time implies that our very perception of the passing of time is wrong. From our perspective we exist only in the present, in a moment which exists for no time at all, sandwiched between our inaccessible past and our unwritten future. This constraint is the time-dimension equivalent of existing in finite space. Our physical bodies differentiate exactly where we are, from where we are not. But we are also constrained to exist only in the present.

The shocking implication of Einstein's idea of Space-Time is that just as all of space exists, so too all of time – past, present, and future – is real. We may not be able to access the past or future from our finite world, yet "the distinction between past, present, and future is only an illusion, however persistent." If a Being were able to perceive our Universe from the outside looking in, it would not only see all of space, but it would also see all of time. Such a Being would be able to perceive past, present, and future at once.

God exists beyond the physical Universe He created. As we say in the song *Yigdal*, "God has no body or form of body" (see green siddur, p. 12). Yet He is also eternal, as described in Adon Olam, "He was, He is and He will be in His glory" (ibid. p. 10). The reason we struggle to comprehend God is due to our own cognitive limits, brought about by the physical, finite world in which we live.

Part 14: The Torah Time-Machine I - Teshuvah

While scientists have debated whether time-travel is possible, the next two articles will discuss the reality of time-travel in the Torah, or at least our ability to change the effects of our past and to alter our future.

The 19th century Danish Philosopher Søren Kierkegaard crystallised the problem of free will – we cannot possibly fully know the consequences of our decisions at the time we make them. Yet once decisions are made, we cannot turn the clock back and undo them. He described the angst of decision making by stating that, “Life can only be understood backwards; but it must be lived forwards.” The Rambam (Maimonides d. 1204) discusses at length the mitzvah of teshuvah. Teshuvah is often translated as ‘repentance’ but is more accurately translated as ‘return’.

The Rambam delineates four stages of teshuvah: One must (i) recognise and discontinue the transgression, be it in thought or action, (ii) verbally confess it, (iii) regret the transgression and (iv) decide never to repeat it. While teshuvah cannot erase the action itself, it can erase the negative spiritual effects the transgression has had on the individual, thus returning him/her to the same spiritual state they were in before the mistake was made.

When returning the Sefer Torah to the Ark, we recite the verse from Eichah (Lamentations 5:21): “Turn us back, O Lord, to You, and we will return. Renew our days as of old” (green siddur, page 432). Whilst we cannot change the past, we ask God to change the effect it has had on us, to regain the state we were in before our transgression.

After Moshe completed his recounting of the grave sin of the Golden Calf, he said: “And now, O Israel, what does the Lord, your God, demand of you? Only to fear the Lord, your God, to walk in all His ways and to love Him, and to worship the Lord, your God, with all your heart and with all your soul, to keep the commandments of the Lord and His statutes, which I command you this day, for your good” (Devarim 10:12-13).

The first words “And now” seem superfluous; why did Moshe introduce this section by telling them what they should do “now”? It is common to look back at decisions we have made which, with the benefit of hindsight, we regret and wish we could undo. There is a danger that these regrets affect us so deeply, that even after doing teshuvah, we live our lives yearning for the past, failing to live in the present. Moshe reminds us that once we have gone through the teshuvah process, we should aim to live in the ‘now’ and focus on improving our future. God forgives us our past; we should also forgive ourselves for not having had the foresight to know those things we can only know with hindsight.

Part 15: The Torah Time-Machine II - Tefillah

The previous article examined the Torah's method of 'time-travel' to the past, to negate the harmful spiritual effects of our prior transgressions (teshuvah). Is it also possible for one to affect the future?

God has the capacity to make changes to our future reality through our requests for blessing and providence. The Talmud (Berachot 34a) notes that there are three sections to our daily prayer; shevach (praise), bakashot (requests) and hoda'ah (thanksgiving).

The central part of prayer, in which we ask God to fulfil our needs, both physical and spiritual, appears puzzling. Many verses in the Torah describe our relationship with God in parent-child terms (see Devarim 8:5 and 14:1); Rabbi Moshe Chaim Luzzatto (d. 1746) explains that these indicate that God loves us and only ever desires our good. In addition, he asserts that one of the fundamental features of God is that He knows everything. If God loves us and knows everything, what is the purpose of relating our needs to Him? Surely if He knows what our needs are and He loves us, He would inevitably provide for them without us having to ask.

There is another aspect to our requests. While the word tefillah is often translated as prayer, tefillah implies a deep, meditative process of introspection. Tefillah highlights the dependency we have on God, emphasising that parent-child dimension of the relationship. The founder and Rosh Yeshiva of Kerem B'Yavneh, Rabbi Chaim Goldvicht (d. 1995) notes that the punishment of the snake in Bereishit was to "eat the dust of ground" (Bereishit 3:14). This meant that the snake's food could be found anywhere; there would never be a need to ask God for sustenance and therefore no opportunity to develop a relationship with Him.

The Talmud states that if one is about to determine the amount of grain in one's silo, he may pray that God should increase the quantity; even though all the grain has already been deposited in the silo, the paryer may continue right up until the last grain has been measured. Yet once the measurement is complete, such a prayer is considered wasted (Bava Metzia 42a). Rabbi Yitzchak Arama (d. 1494) explains that this statement is teaching us that genuine blessing is not found in the physical, quantifiable benefits of wealth or our commercial success. The most profound blessings are found in our spiritual successes such as through learning Torah and the performance of mitzvot.

Through prayer, we have the capacity to change our future by developing our relationship with the Divine and making positive, incremental changes to the way we live our lives. Sometimes, God's answer to our requests is negative. As the prophet Yeshaya (Isaiah) states, only God knows what is ultimately for the best (55:8).

Part 16: The Fabric of Reality I

The Rambam (Maimonides, d. 1204) proposed that the study of science and the natural world helps to bring a person to love and fear God. Understanding the nature of God's creation of a physical world is an essential scientific study for those who seek to enhance their understanding of God.

From a scientific perspective, it is very hard to pin down what physical things are actually made of. The ancient Greeks were the first to propose that all matter is made of fundamental, indivisible building blocks. The idea probably originated with the Greek philosopher Democritus, around 2,500 years ago. The word 'atom' comes from the Greek word *atomos*, which means indivisible. However, one of the most successful scientific endeavours of the late 19th and early 20th century was the discovery that atoms consist of smaller particles – protons, neutrons, and electrons.

The model of the atom was refined by Danish scientist Niels Bohr (d. 1962), who described a central nucleus comprised of protons and neutrons surrounded by orbiting electrons. The dimensions of the atom are astonishingly small. Humans can see objects as small as 0.4 mm wide, roughly the diameter of a human hair. The width of a human hair contains approximately 100,000 atoms, end to end! Yet the relative distance between the nucleus and the orbiting electrons is vast. If we expanded the size of the nucleus to the size of a standard fish ball, the electrons would be orbiting approximately five miles away. In other words, if that fish ball was at the New West End kiddush, its electrons would be orbiting as far away as Golders Green United Synagogue! The rest of the atom is empty space, which means that the substance that makes up all physical objects is also mostly empty space.

By the mid-20th century, scientists had discovered that these smaller building blocks consisted of even smaller, fundamental parts called quarks. Trying to understand what quarks and electrons are made of is very challenging, even for scientists!

For our purposes, imagine a snooker table; these particles are represented by the different balls on the table. In varying circumstances, the balls could whizz around anywhere on the table; so too these particles could exist anywhere in the universe at any time. Physicists would describe the 'table' as a 'field'. The strength of the field in positions where there are no balls is low. In contrast, the strength where there is a ball is high. Electrons and quarks (like the snooker balls) are described by scientists in similar terms.

However, if those particles are always whizzing around at very high speed, they cannot come together to form all the physical things in the Universe. In the mid-1960s, Peter Higgs proposed the idea that there is a unique field which gives other particles mass by slowing them down below the speed of light. This would be like someone pouring golden syrup all over the snooker table, which would slow the balls down so they could come together. The Higgs field has the same effect.

The discovery of the Higgs Boson, dubbed 'the God particle' proved the existence of this field which explains how almost everything in the Universe is solid and stays still. While scientists do not currently know how these fields originate, the concept highlights Einstein's famous remark that reality really is an illusion, "albeit a very persistent one."

Part 17: The Fabric of Reality II

One of the most fundamental questions in Jewish thought relates to how an infinite God could create a finite world. One cannot add something finite to something infinite. Perhaps an understanding of the fundamental building blocks of reality can shed light on this conundrum.

In the last article we noted that everything is made of atoms, which in turn are made of subatomic particles, such as electrons and quarks. However, if we try to investigate the subatomic particles even further, we hit a snag.

We can consider these subatomic particles as occupying a location in space, at a particular time. This point in Space-Time is a set of coordinates; three of these coordinates describe the point in three-dimensional space (x , y , and z) and one coordinate determines the point in time (t). These coordinates are numbers which are objective and absolute; for example, the number 3 represents the same concept regardless of who you are, where you are or what it is that you are counting.

This objectivity, coupled with the fact that mathematics has an almost supernatural ability to describe and predict the physical world, leads some philosophers and scientists to believe that mathematics is the most fundamental entity in the universe.

But are numbers actually ‘real?’ Intuitively we view mathematics as merely a human concept we use to describe and model reality. Therefore, mathematics itself originates in the human consciousness; therein lies the snag. Human consciousness is also part of the reality which mathematics is supposed to describe. How can the most fundamental element of reality arise in something that is part of that reality?

This paradox has led some to believe that consciousness itself arises from some deeper, fundamental source. One school of philosophy, known as Solipsism, believes that consciousness is in fact the only thing that is certain to exist at all.

If consciousness is the most fundamental element of the universe, how do we answer our initial question and bridge the gap between the mind and the physical world?

Man was created by God blowing into his nostrils, such that man became a “nefesh chaya” – a living soul (Bereishit 2:7). The Aramaic translator, Onkelos (d. 120) translates this as a “speaking spirit”. Speech is not merely communication, which is not unique to humans. It is a higher expression of deep thought and contemplation. Rabbi Chaim Volozhin (d. 1821) explains that speech is fundamental to creation precisely because it bridges that gap between the spiritual and the physical worlds. This explains why the Mishnah teaches that God created the Universe with 10 utterances (Pirkei Avot 5:1). For example, “God said, ‘Let there be light’” (ibid. 1:3).

We too can ‘create through speech’; for example, prayer and oaths have the power to create a new spiritual reality. By forming mankind in the image of God, the Almighty has given mankind speech, the most powerful creative tool which transforms thoughts into actions and helps to perfect the world in which we live.

Part 18: The Multiverse I

As we go about our daily business, it is unlikely that we spend too much time contemplating the seemingly minute probability of our very existence. Although our Universe and the Earth we inhabit are constructed in such a way that makes life possible, it did not have to be that way.

The Earth exists in what is known as the 'Goldilocks Zone', a specific distance away from the sun, which is not too hot or too cold, but is just right for allowing the existence of life.

Moreover, it is not just the temperature that is just right. Earth itself has so many necessary ingredients for life; there is liquid water; it is a solid planet with a protective atmosphere; the large moon ensures climatic stability by moderating changes in the Earth's tilt; it has a solid inner iron core and a liquid outer core which produce the Earth's magnetic field, which in turn helps to protect us from deadly solar radiation. We also have some helpful neighbours; large planets such as Jupiter help shield the Earth from asteroids.

Furthermore, the Astronomer Royal, Lord Martin Rees published a book in 1999 called 'Just Six Numbers'. He lists six constant and fundamental physical factors. The value of each factor is utterly decisive in determining the way our Universe operates.

Lord Rees's point is that if even just one of these constants was modified by the tiniest amount, the Universe would cease to exist in its current state and would become totally sterile. The fine tuning of these constants suggests that the Universe was not the result of a random occurrence but was designed in such a way that supports the formation of life.

Lord Rees cites a metaphor given from the Canadian philosopher, John A. Leslie: "Suppose you are facing a firing squad. Fifty marksmen take aim, but they all miss. If they hadn't all missed, you wouldn't have survived to ponder the matter. But you wouldn't just leave it at that - you'd still be baffled and would seek some further reason for your good fortune."

This good fortune is known as the Anthropic principle, or colloquially as the 'Goldilocks Paradox'. The English clergyman William Paley (d. 1805) popularised a similar argument (known as the Teleological Argument) with his well-known analogy that just as the complex design of a watch implies a watchmaker who designed it, so too the complex nature of the Universe implies a Designer who created it.

Lord Rees acknowledges that some might conclude from the Goldilocks Paradox that only a Divine Creator could have designed these constants to support the existence of life. This is essentially a modern reworking of Paley's idea.

Yet Lord Rees proposes another, scientific explanation. Suppose that our Universe is merely one of billions, trillions or perhaps even an infinite number of universes that exist, and all of them contain different laws of physics. Our Universe happens to be the one that supports life. This 'multiverse' is a popular answer to the Goldilocks Paradox, but in next week's article we will explore its veracity and its implication.

Part 19: The Multiverse II

The previous article described how the laws of nature appear to have been very finely tuned to allow life to exist. If one of these factors would be altered, by even a minute amount, the conditions needed for life would not be met and it is likely that the Universe would become sterile. This is known as the 'Goldilocks Paradox.'

This remarkable set of conditions needed to guarantee life could be thought of as follows: the probability of winning the UK national lottery is one in 13,983,816. Given the tiny odds, it's fair to say jackpot winners would feel very lucky. Yet in the grand scheme of things, with around 15 to 45 million tickets sold for every draw, some lucky person somewhere is likely to win.

Now imagine that one week, only one ticket, with one set of six numbers, was bought. The chances of there being a winner are exactly one in 13,983,816, which is highly improbable. Yet imagine the reaction when the lottery is run and precisely those six numbers – on the only ticket bought – come up. It would be incredible. One would probably conclude that there must have been an outside fixer selecting the numbers from the outset, in order to ensure the correct result. The Goldilocks Paradox is a bit like that scenario. Our Universe could have had any combination of numbers. Yet those values – and only those values – can bring about life as we know it, and those are exactly the numbers that came up. It is as if the factors which allow life to exist in our Universe have been tweaked with perfect precision through Divine Providence. Has modern science just uncovered God? Not so fast. Astronomer Royal Lord Martin Rees writes in *Just Six Numbers* (p. 166): “[Our] Big Bang may not have been the only one. Separate universes may have cooled down differently, ending up governed by different laws and defined by different numbers”. While he admits that this theory – known as ‘the Multiverse’ – is “conjectural” and “extravagant”, the idea that our Universe is merely one of many, where each has its own set of variables and laws of physics, has actually gained enormous scientific credence. In our lottery example, the ‘Multiverse’ is equivalent to making sure that every single combination of six numbers – all 13,983,816 of them – are printed and sold as tickets. Now there is a 100% chance of someone winning. While the winner will feel special (and much richer), there is nothing particularly strange or special about it; it is merely good luck. Yet not everyone is convinced. In a debate between evolutionary biologist Professor Richard Dawkins and geneticist Professor Francis Collins in *Time Magazine* (November 2006) Collins notes that: “you either have to say there are zillions of parallel universes out there that we can't observe at present, or you have to say there was a plan”. While the Goldilocks Paradox may not absolutely prove the existence of God, it certainly helps us to appreciate the providential nature of our very existence.

Part 20: The Vastness of the Cosmos – Could Alien Life Exist?

As the English author Douglas Adams (d. 2001) noted in *The Hitchhiker's Guide to the Galaxy*, "Space is big. Really big. You just won't believe how vastly hugely mind bogglingly big it is. I mean you may think it's a long way down the road to the chemist's, but that's just peanuts to space."

As one gazes up at the night sky into the deep dark cosmos, it is hard not to wonder whether there is an intelligent being in some far off planet gazing back at us and wondering the same thing. Many attempts have been made to detect intelligent life outside our own solar system. In the early 1970s, NASA funded a project to analyse radio signals from outer space in the hope of discovering alien radio signatures. Ohio State University became famous on August 15th, 1977 for a particularly strong anomaly which became known as the "Wow!" signal. The signal has not been found since and its source cannot be verified.

More recently, the Kepler observatory has been searching for Earth like planets outside our solar system since 2009. By the middle of May 2016, NASA announced that the Kepler mission had verified 1,284 new planets. Around half could be rocky planets and nine of these orbited within their star's habitable zone, meaning that they had the potential to support life.

Some may think that the notion of extra-terrestrial life is inconsistent with the Torah's account of creation. Yet nobody claims that Genesis provides an exhaustive list of creatures or creations. Furthermore, the idea that mankind occupies some special place in the Universe, inevitably precluding the possibility of life on other planets is also not a Jewish concept. Maimonides (known as the Rambam, d. 1204) writes explicitly against this notion (*Guide to the Perplexed* III:25) while Rabbi Hasdai Crescas (d. 1411) notes that the existence of extra-terrestrial life does not contradict any aspect of Jewish philosophy (*Ohr HaShem* 4:2).

Rabbi Yosef Albo (d. 1444) disagrees and asserts that mankind is the only being that could have been endowed with free will, defined as being able to make moral choices. Since there would be no purpose to animals on other planets, God wouldn't have created them.

The third position is that of Rabbi Pinchas Eliyahu Horowitz of Vilna (d. 1821) who maintains that extra-terrestrial beings could still exist even though they could not have free will (*Sefer HaBrit* 1:1:3). He notes that the sages of the Gemara hinted to the existence of aliens (*Moed Katan* 16a) but that creatures from other planets are unlikely to resemble mankind.

While many rabbinic disputes can be settled, the nearest Earth-like habitable exoplanet orbits a star called Gliese 581 around 20.4 light years (193 trillion kilometres) away in the constellation of Libra. Sadly, in order to meet our alien neighbours, we would have to either find a way of travelling at the speed of light for over 20 years or invent warp drive.

Whatever the truth about extra-terrestrial life, let us ensure that the inhabitants of our own little planet all 'live long and prosper'.

Part 21: The Formation of Life

If one reflects for a moment on the composition of living things, a puzzle may soon develop. How can life emerge from the sterile, inanimate building blocks that are the foundation of all physical things? A carbon atom is not alive, but the same carbon atoms that make up a lump of coal also help to form a human being; for it is these very same carbon atoms which make up organic compounds such as amino acids, the building blocks of life.

The American chemist Stanley Miller (d. 2007) and his colleague Nobel laureate Harold Urey (d. 1981) became famous for producing amino-acids from inorganic substances through an experiment which used electrical sparks to mimic lightning in the early atmosphere, together with water vapour and the atmospheric gases likely to have been present on primordial Earth. From this he successfully produced many types of amino-acids. This gave rise to the idea that life on Earth emerged from a 'primordial soup', made up of these amino acids.

Yet there is a snag. Science journalist Claire Ainsworth explained that while the Miller experiment still "holds a great deal of water... details remain sketchy. It is still unclear, for example, how a primordial soup of simple molecules could give rise to today's system of DNA and proteins". Ainsworth explains that while DNA produce amino acids which are the building blocks of protein, it is these very proteins which facilitate the reactions which replicate the DNA. She explains: "It is a classic chicken-and-egg problem". Furthermore, she points out that a sufficient concentration of amino acids is necessary in order to meet one another and react.

There are theories which address these points. While there is much more work to be done, it is likely that scientists will eventually be able to explain how inorganic atoms and molecules can transform into organic structures which go on to produce self-replicating cells. But does that really answer the question of how life emerged from a particular arrangement of lifeless component parts?

One scientist that shaped my own interest in this question was medical journalist Dr. James Le Fanu. He highlights the difference between a mechanism by which something works and understanding the essence of that thing: "Much of the prestige of science lies in its ability to link together disparate observations to reveal the processes that underpin them. But this does not mean that science 'captures' the phenomena it describes - far from it". Life is more than the mere ability to self-replicate.

Rabbi Meir Leibush Wisser (known as the Malbim, d. 1879) notes that the Torah describes vegetation, sea-creatures and animals coming forth from the land and the water (Bereishit 1:11, 20 and 24). He explains that this means they were formed from pre-existent physical matter. Yet in addition, God created them *ex nihilo* - from nothing (Malbim on Bereishit 1:24). Though science is still struggling to come to terms with the beginnings of life on Earth, our Sages approached the question of Creation by proposing two complementary components for life. These distinct creations are physical form and spiritual essence. One is natural and spontaneous, the other a gift from God, but both are essential for life.

Part 22: Evolution I

There is little question that the Theory of Evolution is one of the most important and defining ideas of the 20th century. When Charles Darwin (d. 1882) took his famous voyage on the Beagle around the world he collected animal specimens from a variety of locations of biological interest. Yet it was his visit to one of the Galapagos Islands in September 1835 which sparked this new line of thinking.

In his notes from the voyage, he observes the differences in body size, plumage, and beak shape of the same species of mockingbird. This led him to realise that these birds had adapted to the unique environment on each of the different islands in order to maximise their ability to locate food and protect themselves from predators.

Darwin wrote in his notes that *“If there is the slightest foundation for these remarks, the zoology of archipelagos will be well worth examining; for such facts would undermine the stability of species.”* It was this comment that suggests that plants and animals can evolve and even diverge into different species through natural selection, as a process of adapting to its local environment. The next stage was to propose that all life came from a common ancestor which had evolved into all of the species of animals and plants we see today.

The threat that Darwinian evolution posed to religious doctrine was readily apparent. Even though the biological mechanism of evolution was not yet understood, Darwin had the evidence necessary to explain that life had formed in gradual stages, over long periods of time and not, as Genesis had implied, in discrete creative bursts.

Yet while Christian scholars were grappling with the implications of Darwin’s idea, the Russian commentator, Rabbi Meir Leibush ben Yechiel Michel Wisser (known as the Malbim, d. 1879) noted that the language used in Genesis differentiates between the creation of something from nothing (which uses the Hebrew verb א.ב.ר.), and the formation of something from pre-existing physical matter. Only the beginning of creation (Genesis 1:1), the creation of animal life (ibid. 21) and man (ibid. 27) use the verb א.ב.ר. and can be considered creations from nothing. All other acts of creation involved forming what was already there, using the verb ה.ש.ע meaning to make (ibid. 25) or describing life being brought forth (ibid. 11, 12, 20).

The Malbim states explicitly that the process of creation was through gradual stages. He writes, ‘Creation progressed from level to level, inanimate matter, plants, animals, and man. Everything that came earlier was a preparation for that which came later’ (Malbim on Genesis 1:20).

Another angle on this was brought by Rav Avraham Yitzchak Kook (d. 1935) who saw Darwinian evolution as a way of learning deep Jewish theological truths. The idea that life had advanced from simple to more complex creatures, reflected God’s desire for our own spiritual development. He wrote, ‘For evolution itself, moving upwards ... from the lowest to the highest demonstrates a clear pre-vision from afar – a preset purpose for all creation.’

Part 23: Evolution II

When Charles Darwin (d. 1882) published *On the Origin of Species* in 1859, he articulated the evidence which implies that life has emerged on Earth through natural processes operating over millions of years. By the 1870s the scientific community and majority of the public had accepted Darwinian evolution as fact. Nevertheless, the biological mechanism which drove the evolutionary process was still unclear.

The Czech abbot and horticulturalist, Gregor Mendel (d. 1884) first noticed that certain traits are inherited by offspring. Swiss biochemist Friedrich Miescher (d. 1895) discovered the DNA molecule present in every living cell which is responsible for passing these traits on through sexual reproduction. By the mid-1950s the structure of DNA was fully understood through the seminal work of Rosalind Franklin (d. 1958, a former member of the New West End Synagogue), Maurice Wilkins (d. 2004), James Watson and Francis Crick (d. 2004).

Biologists such as Ronald Fisher (d. 1965) and Julian Huxley (d. 1975) proposed that random mutations in this DNA code could provide some organisms with more beneficial features, giving them an advantage in locating food more successfully or protecting themselves from predators. In a competitive environment, those organisms would be more likely to survive, reproduce and pass on these traits. This adaptation to the local environment would ultimately generate new species, accounting for the diversity of life on Earth.

There are, however, a number of scientific issues with this idea. The mutation rate of DNA is very low, and mutations are often inconsequential or damaging; few mutations ever help an organism to survive. Nonetheless, there may be a variety of scientific mechanisms which could account for this. Our concern is that the theological challenge is of much greater importance, for if life had evolved through natural processes the diversity of life on Earth could presumably be accounted for without Divine intervention. Neo-Darwinian Evolution has seemingly removed the need for God to explain the origin for life.

There is, however, a logical flaw in this argument, as it assumes that God's existence depends on our need to explain things about the world. This is not true. God was not 'invented' to explain the diversity of life; His existence is absolute and unconditional. Yet the question remains: if natural processes are driving the diversity of life, what role is there for God?

On this point the German scholar, Rabbi Shimshon Raphael Hirsch (d. 1888) noted that the laws of nature can "no more do without the One Who governs and guides the course of the Universe ... than a steamship, operating with the laws of mechanics, can do without the helmsman who guides it" (Collected writings II, pp. 261-262). Similarly, he states that "the [natural] phenomena are present in nature, and God is their invisible Source Who guides and maintains them at all times." Hirsch's view of Darwinian Evolution was in principle to accept the idea of natural selection, but view it as guided by God. Being able to explain the mechanisms of life, does not preclude the existence of a spiritual source and a higher purpose for existence.

Part 24: Evolution III

The last two articles focussed on the challenges of Darwinian Evolution and Neo-Darwinism to Jewish thought and the responses given by leading contemporary scholars of the time. However, there remains an important question. A cursory glance at Genesis reveals that the order of creation does not match the scientifically accepted chronological order of evolution. In Genesis, God created light and dark; the sea and sky; the land and vegetation; the Sun, Moon, and stars; the fish and birds and finally the land animals and mankind. From an evolutionary perspective, things were quite different. Once the Universe began, the Earth, Moon, and stars (including our Sun) took form. Life began in the oceans followed by land insects, flying insects, vegetation, reptiles, mammals and finally birds.

Yet even without contemporary scientific knowledge, the classic commentators such as Rashi (d. 1105) did not necessarily view the order of Genesis as chronological (see Rashi to Genesis 1:1). Maimonides also notes, in accordance with the Talmud (Chagigah 60a) that all creations were made fully formed and then sequentially distinguished from one another (Guide for the Perplexed 2:30). This approach does however beg the question: even if we can find a sound Jewish philosophical basis on which to accept Genesis and the rest of the Torah as Divine and reconcile this with the principles of Darwinian Evolution, God chose to describe the creation of life in Genesis in a particular order. Why did God describe the formation of life in that way given that it is at odds with the evidence based, scientific order of evolution?

Rabbi Yitzchak Arama (known as the Akeidat Yitzchak, d. 1494) and Don Yitzchak Abravanel (d. 1508) both understood Maimonides to mean that the order described in Genesis is not chronological, but hierarchical (Akeidat Yitzchak, Genesis 3 and Abravanel, Genesis 10). This paradigm shift is remarkably liberating as it allows us to view Genesis as a theological text, rather than a scientific description of the formation of life.

It is especially perplexing for example, that the Sun, Moon, and Stars were created on the fourth day, after the creation of the vegetation on the third day, which requires sunlight to exist. Rabbi Levi ben Gershon (known as the Ralbag, d. 1344) explains that description of the luminaries after the vegetation, downplays their importance to steer mankind away from worshiping them as gods (Milchamos HaShem 2:6:8).

There is also a broader pattern in Genesis which correlates the first set of three days with the last set of three days. In the first set of three days the fundamental elements were created followed by the creations that operate in and use these elements. Therefore, Light and Dark (day 1) becomes paired with the luminaries (day 4); the sea and the sky (day 2) pair with the fish and the birds (day 5) and the land and vegetation (day 3) pair with the animals and mankind (day 6).

With this in mind, the lessons of Genesis become theological rather than biological, spiritual rather than physical, and focussed on mankind's place in the Universe rather than what the Universe means to mankind.

Part 25: The Formation of Humans

One of the most difficult conflicts between Jewish wisdom and modern scientific thought relates to development of mankind. The Torah describes Adam as having been created on the sixth day of creation. This was God's final act of creation before Shabbat, the seventh day on which God stopped creating (Genesis 2:2). Yet the creation of man is somewhat of a mystery. Written in the second century CE, the Midrash of Seder Olam Rabbah calculates the dates of biblical events from creation of Adam through to the conquest of Persia by Alexander the Great. This is where we derive the current Hebrew calendar year of 5,777. This means that 5,777 years have elapsed since the creation of Adam.

This presents a stark problem. According to modern anthropology, humans are from the species of *Homo sapiens*. The earliest remains of *Homo sapiens* are the Omo remains found in East Africa and date back to around 195,000 years ago. By the time the Midrash claims the creation of Adam took place, *Homo sapiens* had long become the only established branch of humans alive. Anthropologists describe this as the middle of the Neolithic period before metal tools were invented, but long after humans had settled into farming communities with domesticated animals. Human tools, cave art and musical instruments have been discovered dating back tens of thousands of years.

While scholars acknowledge that the fixing of the Hebrew calendar and current year is relatively modern, it would take a farfetched reinterpretation of the Midrash to match the dates of Biblical events and the ages of Biblical characters to the scientific origin of mankind. Besides, there is no one anthropological marker that defines the beginning of mankind. If so, who was Adam? What does the Torah mean when it describes his creation?

In the creation of Adam, God says (Genesis 1:26) "Let us make man in our image, after our likeness..." The use of the plural "us" is confusing. Surely God is the only Creator? Rabbi Moshe ben Nachman (known as Nachmanadies, d. 1270) explains that man was created by God together with the earth, meaning the physical world. Man is part physical body, just like the animals but is also part Divine soul. The Italian rabbi, Ovadiah Seforno (d. 1550) adds that "Adam" describes a type of animal which had already been established and was now being endowed with an extra spiritual element. This is a remarkable statement. Three hundred years before Charles Darwin, one of our commentators notes that Adam was not a new physical creation but the spiritual elevation of an animal-like being.

In 'The Emergence of Ethical Man', the pre-eminent contemporary rabbi, Yosef B. Soloveitchik (d. 1993) explains that Adam's creation represented the development of all of mankind's ability to make moral decisions. This didn't happen in one moment but developed with time. The answer then to our original question is that Genesis is a theological text, not a historical or anthropological account of man's beginnings. As the former Chief Rabbi Dr. Joseph Hertz (d. 1946) writes, "It is not so much the descent, but the ascent of man, which is decisive."

Part 26: Human speech

The last article described the creation of man as a spiritual change in humanity, as opposed to a new physical creation. In light of this, Genesis must be viewed as a theological text, not a scientific account of mankind's creation. This idea is further supported by a careful reading of the Torah's account of God creating man. The Torah says (Genesis 2:7) 'And the Lord God formed man from the dust of the ground and breathed into his nostrils the breath of life; and man became a *nefesh chayah*, a living soul.'

While man is formed from the "dust of the ground", the same physical material as the animals, he is given a special "breath of life". The Aramaic translation known as Targum Onkelos, attributed to a Roman convert to Judaism understands the phrase *nefesh chayah* (living soul) as *ruach memalelah*, which literally means a 'speaking spirit'.

Speech appears to be a defining characteristic of human beings. Yet on closer reflection, if speech implies the ability to communicate through sounds or words, many animals do that too. Birds tweet to attract mates and warn others away from their territories; dogs bark when they sense a threat; meerkats yelp to warn others of danger. Yet from a Jewish perspective, speech is not merely about communication.

While humans can also use speech to attract a mate, mark their territory or warn others of danger, Rabbi Shlomo Wolbe (d. 2005) explains that speech is much more than that. In his magnum opus, *Alei Shur* (II:4) he explains: "Speech is like a violin. The beautiful sound of the violin is not produced by the strings alone, but from the echo produced by the box upon which those strings are strung. So too, the tone of the speech does not come from the words alone, but from the soul which makes a unique impression on the words."

Speech allows human beings to express their innermost thoughts and feelings, thus conveying the depths of their soul to others. It is more than mere communication. Speech is the medium through which two human souls can touch and influence one another in the most profound ways. Speech therefore has the capacity to facilitate the formation of deep, meaningful relationships with one another, allowing us to become social beings who have the capacity to share our innermost world.

Speech also allows man to form a deep and meaningful connection to God. Rabbi Wolbe explains that this is why prayer and repentance, through private verbal confession utilise speech to form, maintain and repair our relationship with God.

It is also why negative speech such as *lashon hara* (unnecessarily saying something true about someone which casts them in a negative light) and *motzi shem ra* (slander) cause so much damage to personal relationships, communal unity, and societal cohesion. Rabbi Yisrael Meir Kagen (known as the Chofetz Chaim, d. 1933) led a movement to train others in the art of positive speech. Speech can be used as a powerful tool for building, or a weapon of great destructive force.

Part 27: Neuroscience and Free Will I

Neuroscience describes a broad range of disciplines which relate to the study of the nervous system, and in particular the structure and function of the brain. The human brain consists of brain cells known as neurons which are interconnected and pass messages to one another through tiny electrical impulses. All of our senses, thoughts, emotions, and actions are processed through these neural networks.

Scientists generally view the world as being made up of physical matter which follows certain rules of cause and effect. For example, if you let go of a ball in mid-air, it predictably falls to the ground because of gravity. Gravity is the cause, and the falling ball is the effect. According to this view the entire physical Universe operates in this way. But returning to the subject of our brains, taking this idea to its logical conclusion implies that the neurons in our brains also follow the rules of cause and effect, albeit considerably more complex than a falling ball. If true, all of our thoughts, emotions and actions are merely caused by our brain activity responding to the plethora of stimuli we experience through our senses.

We like to think that there is an inner self that we refer to as “I” that is separate from our physical brain, who freely controls our actions. We believe that this inner self consciously makes our decisions and then our brain dutifully follows through. This is known as conscious free will. From a neuroscientific perspective, this account of decision making cannot be true as it would imply the existence of an external, non-physical cause which somehow triggers an effect in our brain. According to neuroscience, the sense we have of an inner self that we identify with which freely makes our decisions must therefore be an illusion created by our brain. In reality, the brain is in charge and there is no ‘I’ to speak of.

In the early 1980s, Benjamin Libet became the first scientist to attempt to determine whether conscious free will really exists. He measured the brain activity of volunteers who were told to press a button and record when they had the urge to do so. He found that the brain readied itself to act shortly before the volunteer became aware of the desire to press the button. While his results seemed to conclude that conscious free will is indeed an illusion, many scientists including Daniel Dennett have criticised the experiment on a number of scientific grounds.

From a Jewish perspective however, the issues with Libet’s experiments are much deeper. Conscious free will is not merely the ability to make mundane decisions, but rather involves making difficult moral choices in the spite of the compulsion to act differently.

This would be impossible to test, as we are usually reluctant to contravene Jewish law or act immorally or against societal norms in public. This would make testing genuine free will decisions practically impossible. In the next article we will explore the true nature of free will in Judaism and how it relates to our relationship with other people and with God.

Part 28: Neuroscience and Free Will II

The human brain is a phenomenal organ. As humans evolved, our brains developed into multi-tasking biological computers able to regulate our body functions while simultaneously calculating, processing, and responding to the world around us.

Neuroscientists roughly divide the brain into two sections: the reptilian brain and the cortex. The reptilian brain contains the more basic, atavistic parts which are also found in animals. It regulates the vital bodily functions such as heart rate, blood pressure and core temperature and governs emotion and the response to external threats, as well as memory. The cortex processes the information from our senses and controls our muscles. The front part of the cortex (the prefrontal cortex) governs executive functions and moderates the body's response to emotional stimuli. There is an intimate connection between these two parts. Yet while animals have a cortex, the human cortex evolved rapidly, far outstripping its equivalent development in animals.

When God created man, He formed a creature with similar physical features to an animal, together with the same instincts and drives to eat, reproduce, and protect themselves against predators and other threats. But God also invested within each human a *neshamah*, a Divine soul capable of raising mankind above these raw, animalistic urges (Genesis 2:7). While it may be mistaken to directly associate something spiritual with something physical, the relationship between the older reptilian brain and the prefrontal cortex mirrors the relationship between our basic animalistic drives for instant, physical gratification, and the Divine aspirations of our *neshamah*. The *neshamah* therefore moderates or suppresses the individual's response to those desires.

From a Jewish perspective conscious free will is therefore not merely the ability to make decisions, but the ability to deploy our *neshamah* to act against our animalistic nature when confronted with temptation.

Rabbi Eliyahu Dessler (d. 1953) offered perhaps the most cogent approach to Free Will. He explained that each of us has a *nekudat habechirah* – a point of Free Will which represents an area of experience in which we have the capacity to control ourselves. This point of Free Will is unique to each human being. The more spiritually refined a person becomes, the more that point of Free Will shifts upwards. In contrast, the more a person indulges in negative or immoral behaviour, the less control they have.

For a choice to be a genuinely “Free Will” decision, it must both have a moral or spiritual element to it and be something which is within the individual's control. As such, this fleeting experience is difficult to capture. Yet we've all been there. When confronted by the lure of something we know to be wrong, we vacillate while we wrestle with conflicting thoughts of self-justification for indulging ourselves, versus trying to escape the clutches of an act we know to be wrong. We have the power to escape, but do we really want to? Our *neshamah* tugs in one direction while our body – and the instant gratification it will receive – tugs in the other.

Yet whatever the result, our *nekudat habechirah* – the point of Free Will, will never be the same again.

Part 29: The Enigma of Consciousness I

Dr. Seuss (d. 1991) once wrote, *“Today you are You, that is truer than true. There is no one alive who is Youer than You.”* Yet for all its positivity, Seuss’ quip unwittingly alludes to a fundamental philosophical and scientific mystery.

There are two distinct definitions of consciousness. The first describes the state of being aware of one's surroundings. The second refers to the awareness of one’s own existence – the sense of self, the inner workings of the mind and the subjective experience of what it is like to be you. This “Youness”, as coined by Dr. Seuss, is the experience of what it is like to be you. It is the person we identify with inside of our body; the self who makes our decisions which the British philosopher Gilbert Ryle pejoratively called ‘the ghost in the machine’.

Scientists and philosophers have long debated whether this “self” really exists. The vast majority argue that the subjective experiences of self-awareness and the mind can be reduced to complex neural activity. The sense of there being an individual inside our bodies who makes our decisions is actually an elaborate illusion. In reality, we are nothing more than a brain.

The American philosopher Thomas Nagel argues however, that for any organism there must be an experience of what it is like to be that organism. The phenomenon of being that organism can only be experienced by the organism itself. I cannot experience what it is like to be you, and you cannot experience what it is like to be me.

In a 1974 paper published in *The Philosophical Review*, Nagel highlighted this idea by posing the question, ‘What is it like to be a bat?’ He writes, “In so far as I can imagine this (which is not very far), it tells me only what it would be like for me to behave as a bat behaves. But that is not the question. I want to know what it is like for a bat to be a bat.”

The alternative view is that the mind is real and made of something non-physical. Yet even those scientists who are adamant that self-awareness is merely the result of clever neural processing, admit that no one can explain how physical processes in the brain could give rise to these subjective experiences. Australian philosopher David Chalmers dubbed this ‘the hard problem of consciousness’.

Modern Jewish thinkers such as Rabbi Eliyahu Dessler (d.1953) differentiated two different types of awareness; the *Mabat HaChitzoni*, the external awareness (lit. gaze, vision) and the *Mabat HaPnimi*, inner awareness. The former relates to our five senses and logical processing of the outside world. The latter, to everything else that we know intrinsically, without the need for external verification or evidence. The primary example of this inner awareness is the awareness of our own existence.

The fact that scientists and philosophers find the concept of consciousness so difficult to grapple with, is because it represents the bridge between the objective physical world, and the inner, subjective world of the mind. The next article will develop this idea in relation to mankind’s spiritual experience.

Part 30: The Enigma of Consciousness II

The previous article introduced the idea of inner consciousness as self-awareness and the inner knowledge of one's own existence. While consciousness is assumed to exist in some animals to varying degrees, the question is whether human consciousness is different and whether there are Jewish sources to support this idea.

Studies in animals have demonstrated varying levels of self-awareness, which is closely linked to a high level of conscious experience and an understanding that other beings can have mental states such as knowledge, beliefs and intents which are different from their own. While it is impossible to know if animals contemplate their own existence, the Torah indicates that mankind has a different type of self-awareness.

Firstly, while animals have a spiritual essence called a *nefesh* (see Genesis 1:20-26), unlike the animals, man was made in God's image (Genesis 1:27) and with a higher spiritual essence called a *neshamah* (Genesis 2:7). This *neshamah* is what elevates mankind above the animals and allows us to contemplate and yearn for God. In his book 'Beyond Your Ego' Jewish psychologists Dr. Judith Mishell and Dr. Shalom Srebrenik associates self-awareness with this *neshamah*.

When Adam and Eve ate from the Tree of Knowledge of Good and Evil, the Torah indicates that they changed the nature of what it is to be human. Immediately following the sin, the verse (Genesis 3:7) states "And the eyes of both of them were opened, and they knew that they were naked, and they sewed fig leaves and made themselves garments."

Rashi (d. 1105) notes that it does not mean that they suddenly saw that they were naked but refers to a new level of awareness. Rabbi Yehudah Loew (known as the Maharal, d. 1609) explains that until this point, Adam and Eve only understood things which were good, such as the comprehension of God and the reality they existed in. Following the sin however, they perceived evil.

Rabbi Ovadiah Seforno (d. 1550) adds that they now turned their attention to things that were pleasurable, even though potentially damaging. This is why unlike the animals, they recognised their nakedness and covered themselves out of shame. Before the sin, the purpose of reproduction was innocently viewed only in the context of procreation, which was a commandment from God. Now it was desired for the personal gratification it offered.

Rabbi Sholom Mordechai Schwadron (Techeiles Mordechai, d. 1911), notes that mankind must contemplate the greatness of God in distinction to the lowliness of man. Before their sin, Adam and Eve looked only towards God, because they possessed the same spiritual purity. Their sin damaged the very nature of their being, polluting their minds with self-serving thoughts of physical gratification. They were therefore able to contemplate their own downfall – their nakedness and attempts to hide it with fig leaves.

This translates into our own inner struggle between the self-awareness of who we really are, versus the supreme spiritual potential we possess – the human we could become. Mankind's inner consciousness is therefore dominated by this struggle: how much of our lives will we strive for greatness, and how much will we expose our animalistic nakedness?

Part 31: The Enigma of Consciousness III

One of the most successful scientific ideas of the twentieth century is Quantum Mechanics, the theory of how matter and energy behave at the atomic and sub-atomic levels. The concept began in 1900 when the German theoretical physicist Max Planck (d. 1947) proposed that energy existed in individual units, called quanta. This explained a number of phenomena, including the change in colour of radiation produced by an object as its temperature rises. Planck's idea was then developed by other scientists including Albert Einstein (d. 1955), Louis de Broglie (d. 1987) and Werner Heisenberg (d. 1976).

Yet for all the questions Quantum Mechanics has answered, it has generated some extremely surprising results which challenge the way we think about the physical world. One of the most famous experiments which highlights this involves firing atomic particles through a double slit, onto a detector screen. In theory, particles can only travel through one of the two slits. Yet the pattern which builds up from the two slits suggests that these particles are interfering with one another, like the waves produced by dropping two stones into a still pond at the same time.

When scientists tried to uncover what was going on by detecting which of the slits each particle went through, the pattern produced changed and became two thin lines, corresponding to the two slits. In order to ensure that their detectors had not affected the results, they left them in place but switched them off. Astonishingly, the results returned to the original pattern. It became apparent that the act of observing an atomic particles' behaviour, changes what they do.

The most common explanation, known as the Copenhagen interpretation, was devised by Niels Bohr (d. 1962) and Werner Heisenberg (d. 1976). Essentially, at the fundamental level of reality the position and velocity of subatomic particles only exists as a probability (producing the interference pattern). Once the particle has been observed, the set of probabilities immediately reduce to only one of the many possible values (producing two thin lines).

But this is where it gets interesting. The Hungarian American mathematician John von Neuman (d. 1957) noted that if the results are affected by the observer, a question arises: at what point is the observation being made? The detector, the eyes of the scientist and even the scientist's brain are merely physical systems. They are not 'doing' the observing. Only the scientist is actually observing the results. But who is the scientist? If it's not their eyes or their brain, what is it? Von Neuman concluded that the point of observation which alters the results must be the scientist's non-physical inner consciousness.

This startling result implies that human consciousness is not only a non-physical entity, but also somehow more fundamental than the physical world. If no one is observing reality, it appears to only exist in probability, not in certainty. As Max Planck himself put it, "I regard consciousness as fundamental. I regard matter [physical stuff] as derivative from consciousness." The next article will develop this idea further in Jewish thought.

Part 32: The Enigma of Consciousness IV

The last article introduced the bizarre world of Quantum Mechanics, the theory which describes motion and interaction of sub-atomic particles, smaller than an atom. One of the astonishing results from Quantum Mechanics, repeated in the laboratory many times, is that unless particles are detected by a human observer, their location and velocity are undefined. In other words, the particles which are the building blocks of the physical world only have a definitive existence when they are observed by a conscious human mind.

Philosophers have understood the importance of the conscious human mind for generations. In 1637 the French philosopher René Descartes (d. 1650) published his '*Discours de la méthodei*' (Discourse on the Method) which has been dubbed one of the most important philosophical works ever written. In it, he sought to address the question of whether it is possible to prove that the reality we experience is in fact real. Our senses are often wrong and mislead us. Worse still, while asleep Descartes had once dreamt that he had woken up and believed that he was awake. Perhaps, he mused, we are all dreaming or are simply part of some elaborate illusion. Descartes couldn't even be certain of absolutes such as mathematics. Perhaps an evil demon was manipulating his mind to make errors in his calculations. All he had left with were doubts.

There was only one thing he could be certain of. He realised that even if these doubts were true, nothing could deceive him that he was actually thinking. The inner consciousness of his thoughts was all he had, proving at least that he existed as a thinking being. Descartes famously concluded with the words *Je pense, donc je suis*, 'I think, therefore I am', or in Latin, '*Cogito, ergo sum.*'

In a feature article for the New Scientist (26th September 2012), science journalist Michael Brooks notes that due to the importance of the conscious observer in Quantum Mechanics, it's not just a case of "I think therefore I am" as Descartes concluded, but "I think therefore you are". Our consciousness appears to hold reality together.

The American physicist John Archibald Wheeler (d. 2008) compared reality to an elaborate papier mâché construction supported by a few iron posts. Those posts are only nailed in when human consciousness observes that reality.

Yet mankind is made in the image of God (Genesis 1:26). Our experiences as humans are a metaphor which can give us an insight into the the mechanics of God. For centuries, Jewish philosophers have described how the physical world requires God's constant creative input.

Rabbi Chaim Volozhin (d. 1821) explains that God is 'the Place which bears and maintains all the worlds and creations, that if He would, Heaven forbid, remove His creative energy from it for even a moment, the maintenance and life-force of all creation would cease.' (Nefesh HaChaim 3:1).

The link is more apparent when we consider that our conscious experience derives from our Divine soul, which in turn is rooted in God. Our consciousness describes our true inner essence, yet our very existence, and the whole of reality we experience is entirely dependent on God.

Part 33: The Enigma of Consciousness V

The last four articles focussed on the concept of consciousness in science, philosophy, and Judaism. This final article on consciousness turns our attention to dreaming, one of the most mysterious of all human experiences. Most neuroscientists, psychologists and psychotherapists accept that the content of our dreams is significant, whether it has been influenced by our psyche, our experiences during waking life or from medication or the food we eat.

The famous neurologist and forefather of psychoanalysis, Sigmund Freud (d. 1939) viewed the content of his patients' dreams as a window into their primitive, unconscious desires. Swiss psychiatrist and psychoanalyst Carl Jung (d. 1961) who collaborated with Freud, felt that Freud's analysis of dreams was too limited. He viewed dreams as a communication from the unconscious as part of the self-regulation of the psyche. While contemporary opinions still differ, modern studies support the theory that dream content is primarily related to the experiences a person has while awake.

From a Jewish perspective, the Torah itself describes how God communicates with man through dreams. Having dreams and interpreting their meaning is for example, one of the prominent threads that runs through the story of Joseph. Commentators have poured over the meaning of these dreams and whether dreams in the post-Prophetic era can also contain elements of prophecy. The Talmud indicates that while some dreams are insignificant and meaningless (Horayot 13b) while others have the potential to contain prophetic messages (Berachot 57b). While Joseph's dreams were clearly prophetic, could our own dreams contain elements of prophecy or portent?

Rabbi Moshe Chaim Luzzatto (known as Ramchal, d. 1746) concurs with the scientific approach that dream content is affected by the thoughts and emotions one experiences, as well as through food and other substances in the body. Yet he also adopts the Talmud's assertion that our modern daydreams can have prophetic significance or relate to things only the spirit can experience (Derech HaShem 3:1:6). This is because when we sleep our souls can sometimes interact with external spiritual forces which enter our subconscious awareness and affect the content of our dreams. Nevertheless, even such extraordinary dream experiences are tricky to decipher.

One might think this is a little far-fetched. Yet in a recent article, Psychologist Dr. Patrick McNamara notes that a wide range of unexplained dream phenomena, such as shared dreams and precognitive dreams containing exquisite, incontrovertible detail are widely reported (Psychology Today June 2016). He admits that science has "no good explanations" for such astonishing phenomena for "science has no place to put them within its current worldview – but this is all the more reason to investigate them."

In conclusion, consciousness is difficult to study scientifically. Scientists wedded to the idea that there is nothing other than the physical world will inevitably conclude that consciousness, defined as our sense of self and inner thoughts, is merely an elaborate illusion. While scientific mysteries can't provide concrete evidence to the existence of the supernatural, for those with a conviction that reality is more than just atoms and molecules, the footprints of the spiritual world can be found in many areas of the human experience.

Part 34: Judaism and Psychology

Psychology is the branch of science which investigates the mind and human behaviour. While ancient civilisations across the world developed psychological theories, it was not until the eighteenth and nineteenth centuries that academic psychology took off. At the same time, psychologists realised that an understanding of the human psyche could help develop psychological therapies to treat disorders of the mind.

Jewish philosophers have also sought to understand the interaction between the mind and human behaviour. In Biblical and Rabbinic Hebrew, the word לב, *lev*, often translated as heart (as it is in Modern Hebrew), is more accurately understood to refer to the mind. In the Shema (Green Siddur page 68) we assert that we should love God, בְּכֹל לְבָבְךָ, *bechol levav'cha* (Deuteronomy 6:5). Our sages understood this to mean 'with each of our inclinations' - good and bad (Talmud Brachot 54a).

These inclinations are part of the psyche's apparatus used in making decisions and moderating emotions. They relate to the ideas of the eleventh century Spanish rabbi, Rabbeinu Bachya ibn Pakuda who explains in his magnum opus, *Chovot HaLevavot*, 'Duties of the Mind' that "Man is made up of diverse entities and natures which are conflicting and mutually antagonistic." (Shaar HaBechirah 5). Our emotional drives often conflict with our moral or spiritual convictions. Our soul is always yearning for Godliness whereas our body desires instant, physical gratification.

In addition, each character trait weaves together to make the tapestry of our personality. This determines how we respond to external emotional stimuli. Consequently, the virtue of personal character refinement is viewed as a fundamental part of Jewish practice. In works such as the Book of Proverbs and Pirkei Avot, Ethics of the Fathers, we see examples of what American psychologist Daniel Goleman calls 'Emotional Intelligence' - being in control of one's emotions and inclinations.

Rabbi Yisroel Salanter (d. 1883) and his followers aimed to bring character refinement into the foreground of Jewish practice through the Mussar (discipline) movement. The Hebrew for 'character traits' is middot. Literally the word means 'measurements' because human character traits are neither good nor bad; it is how a particular trait is expressed which is key. The virtue of courage expresses a balance between recklessness and cowardice. Self-respect expresses a balance between narcissism and self-deprecation. Each trait has something valuable to offer, provided it is expressed in a balanced way.

The same is true for emotions. American Psychotherapist Richard Schwartz developed a system of psychotherapy that recognises each emotional part as playing an important role. One can only be in control when each emotion plays its part in a measured and composed way. The most refined individuals ensure their core 'Self' is in control of their emotions, which in turn helps them to moderate their behaviour in the face of external emotional threats.

Some Jewish psychotherapists identify this 'Self' as the *Neshamah*, the core soul of a human being. By allowing it to keep our emotions in check, our behaviour can be elevated to supernatural levels so that in the face of emotional needs, desires and external stimuli, our response can be refined and virtuous.

Part 35: Genetics I

The Czech abbot and horticulturalist, Gregor Mendel (d. 1884) first noticed that certain physical traits such as the colour of pea plant flowers are inherited by offspring. Swiss biochemist Freidrich Miescher (d. 1895) discovered the DNA molecule present in every living cell which is responsible for passing these traits on through sexual reproduction.

By the mid-1950s the structure of DNA was fully understood through the seminal work of Rosalind Franklin (d. 1958, a former member of the New West End Synagogue) and Maurice Wilkins (d. 2004) who studied DNA using a technique called x-ray crystallography. Their results were used by James Watson and Francis Crick (d. 2004) who eventually won the Nobel Prize in 1962 after discovering the double-helix structure of the DNA molecule.

In 1990, the Human Genome Project began deciphering all of the information held in human DNA. The project was completed in April 2003 which means that scientists can access the 20,000 or so genes which determine the physical characteristics of every human being. These are encoded in the DNA, found in almost every one of our approximately 37.2 trillion cells.

The ability to understand and analyse human DNA has many practical applications such as forensic science and new medical technologies. In addition, since genetic information is passed on from parents to children, our genes contain information about who our ancestors were. In addition, since until recently people generally married people who were geographically close to them, the ability to read our genetic code also offers the opportunity to understand where each one of us comes from.

A number of studies carried out on the genetics of the Jewish people have provided some fascinating results. One of the pioneers in Jewish genetics, Professor Karl Skorecki from the Rambam Hospital in Haifa determined that male Kohanim – Priests who are descendants of Aharon, the brother of Moses, have a common gene on their Y-Chromosome, which determines that a baby will be a boy.

Other work which examined sets of genetic variations which tend to be inherited together, known as haplotypes, implied the accuracy of the historical migration of the Jewish people. A letter published in the Nature in 2010 by over twenty researchers including Professor Doron Behar from the Technion – Israel Institute of Technology in Haifa, outlines the evidence that the Jewish people originated in the Middle East, but later migrated to Europe, Africa, and Asia.

Behar also studied mitochondrial DNA which is only passed on from mother to child. While there is significantly greater variation in the maternal line, the conclusions were that most Jewish communities appear to be genetically similar, sharing a common geographical origin.

Genetic research cannot determine one's Jewish status; only those who have a Jewish mother or convert can be considered Jewish. Yet while our genetic makeup is made more diverse through conversion and intermarriage, the genetics of the Jewish people highlights that we are all part of one diverse family.

The next article will examine whether our genes can teach us anything about the origins of spirituality and religious belief.

Part 36: Genetics II

Our genes determine physical traits such as the colour of our hair and eyes, the shape of our nose and our height. They also determine whether we are more prone to developing certain diseases. But what about aspects of our personality?

While our environment – including our upbringing, schooling, and childhood experiences – has an enormous influence on our personality, for some time geneticists have thought that our genes also influence our character traits. For example, in a 2011 paper published in *Personality and Social Psychology Bulletin* (37:12), German Professor of Psychology, Christian Kandler found significant genetic influences on the five primary personality types of extraversion, agreeableness, openness, conscientiousness and neuroticism.

American geneticist Dr. Dean Hamer took this idea one step further. Hamer wondered whether there was a genetic influence which explained why certain people appeared to be inclined towards religious beliefs, while others do not. In his 2005 book, *'The God Gene'*, Hamer sets out his argument as follows. Feelings of spirituality can be related to what Hamer calls self-transcendence. He explains that “Self-transcendent individuals tend to see everything, including themselves, as part of one great totality. They have a strong sense of ‘at-one-ness’ – of the connections between people, places, and things.” (*The God Gene*, p. 18). This includes feelings of being at one with nature, being able to lose oneself in a task, feeling mystical about life experiences and viewing intuition as being profound and significant.

Hamer was able to measure self-transcendence of volunteers through a personality questionnaire and then analyse their DNA. If any genes were more prevalent in people scoring high on the self-transcendence scale, according to Hamer they may be influencing the way humans relate to God. The results yielded one gene, known as SLC18A2 which was significantly more likely to be present in one particular form in people with a high score of self-transcendence. The gene produces a protein called VMAT2 which regulates the flow of mood-altering chemicals in the brain. Hamer speculated that this could account for a greater disposition to feelings of spirituality.

His theory comes surprisingly from studies on the effects of psychoactive drugs. Substances such as psilocybin, found in over 200 species of mushroom, are known to generate intense ‘mystical’ or ‘spiritual’ hallucinogenic feelings and have been used to enable trance-like visions by many religious and cultural groups such as Siberian shamans and Native Americans. Hamer argued that the VMAT2 protein produces a similar neurochemical effect, albeit on a much smaller scale.

If so, is religion hardwired into our genes? The simple answer is a resounding ‘no’. Critics argue that spirituality cannot be reduced to one set of personality traits, let alone to one gene. Indeed, Hamer admits that his research has not been repeated in any other study as most genes only have a small effect and personality and behavioural traits are very complex by their nature.

Most importantly however, as Hamer himself contends, there is a stark difference between spirituality and religion. The next article will develop this idea further and examine the emergence of faith in humans through the development of spiritual feelings and religious belief in children.

Part 37: The Emergence of Faith I

Many scientists, such as American neurologist Professor Jordan Grafman, believe that spiritual convictions, superstitions and faith in a Divine being provide humans with an evolutionary advantage. Individuals could use their religious convictions to survive emotional hardships which may have defeated other humans with no religious faith.

Yet the emergence of faith and belief in the supernatural may be more complex than that. Children have a naturally pure and untainted curiosity, which is a product of their unfettered minds striving to make sense of the world around them. While other creatures are occupied with building dens, searching for food, and caring for their young, Humans are uniquely burdened with an additional type of curiosity. From an early age our instinctive minds search for much deeper meaning, asking questions about the purpose of life itself, our place in the cosmos and the meaning of our own existence.

In his 1981 book, 'Stages of Faith', American theologian, James W. Fowler (d. 2015) described the emergence of faith in children in a much broader sense as part of their natural development.

He writes, "Our first experiences of faith and faithfulness begin with birth. We are received and welcomed with some degree of fidelity by those who care for us. By their consistency in providing for our needs, by their making a valued place for us in their lives, those who welcome us provide an initial experience of loyalty and dependability. ... Notice that even in this rudimentary form faith exhibits what we may call a covenantal pattern of relationship. In the interaction of parent and child not only does a bond of mutual trust and loyalty begin to develop, but already the child, albeit on a very basic level, senses the strange new environment as one that is either dependable and provident, or arbitrary and neglectful."

Fowler explains that this 'covenantal pattern of relationship' has three elements: the child, the parents and the shared centres of values and power which hold the relationship together. These include what Fowler calls the family's 'story'; the shared principles, memories and ambitions which bond all the family members together.

This resonates with the idea that our relationship with God can be understood in similar parent-child terms. God Himself expresses this when he says (Deuteronomy 14:1) אַל־תִּקְחֶם לֵה' אֱלֹהִים... - 'You are children of the Lord, your God'. Idolatry is not just about the mere worship of statues or foreign gods. It is the abandonment of one's Divine parent and spiritual home with the aim of committing to finite centres of value that fall outside the family's shared story and therefore undeserving of adulation or respect.

The ritualistic aspect of organised religion therefore has two elements. Services, festivals, and daily laws build our relationship with God through reminding us of our part in the story of the Jewish people. But they also provide opportunities for our own families to share experiences together and build a personal family story.

Jewish covenantal faith is therefore less about 'belief' in God and more about building lasting familial relationships to resonate with the paradigm of God's personal relationship with us.

Part 38: The Emergence of Faith II

One afternoon I walked into the living room to find my five-year old son blowing kisses to the air. When I asked him what he was doing he told me that he was kissing Hashem. "Hashem is everywhere!" he said innocently. "So, I wanted to show how much I love Him!"

While it was a very cute moment, it highlights the simplistic way young children view the spiritual concepts they learn about. Yet as inquisitive children mature, they naturally ask deep and intelligent questions about God, the Torah and spirituality as they seek to understand the world around them. Answering those questions is challenging because they often contain abstract concepts which are difficult for even adults to truly grasp.

One parent mentioned to me that they came into the kitchen one morning to find their seven-year-old daughter sat at the breakfast table in floods of tears. She had been taught in cheder that God had created the world and all of the animals, but at school, that the animals came about through evolution and natural selection. She didn't know which one to believe. How could they help their daughter understand that the two concepts are not necessarily mutually exclusive?

The issue is compounded by the fact that we live in a world where complex issues are often simplified into black and white concepts. Whether it's done to sensationalise, save time or dumb-down information, the effect is that we tend to eschew complex and nuanced discussion in favour of simplistic, alluring, and persuasive sound bites.

We also naturally assume that questions require answers. Yet from a pedagogical perspective, if being inquisitive is the first stage in learning, giving answers to questions may be counterproductive. If an answer is too definitive it could inadvertently shut-down the discussion and therefore stifle the educational process. This is especially true between an adult and a child. I therefore prefer to use the language of response and approach. This leaves the door open for a child to ask follow-up questions and extends the learning process, helps them to see that their question was intelligent and leaves them feeling empowered to be ever more inquisitive.

So, what advice did I give this parent? Should they introduce their seven-year-old to the nuanced arguments espoused by many Jewish thinkers, or would that merely confuse her more?

I told them to explain that sometimes, two ideas can seem to clash but that's because they are really looking at the same thing from different angles. For example, imagine a circle. It has no corners and is completely round. Now imagine a rectangle. It has four corners and four edges. How could these two shapes be part of the same thing?

Now imagine a cylinder. If you look at it edge on, it appears to be a circle but if you look at it sideways, it appears to be a rectangle.

Just as both shapes are part of the cylinder, so too science and Torah view reality from two equally valid, but different perspectives. Our job is to appreciate the value of both.

Part 39: The Emergence of Ethics I

Since the dawn of civilised society, some of the world's greatest thinkers have grappled with the relationship between societal laws and the concept of ethics and individual morality. While it seems obvious that the rule of law is designed to prevent anarchy, should private acts deemed to be immoral be punished even when there is no obvious harm to others, or do our personal freedoms come first?

Furthermore, many actions fall within the boundaries of secular law, but seem morally repugnant such as the scandals in the UK involving corporate tax avoidance. While the actions of some multinational companies technically fell within the law, the public outcry was that these operations were immoral.

In a secular Western democracy, if such immoral acts are to be punished, can subjective humans ever genuinely decide for themselves what is moral or immoral? Without God's objective perspective on human morality are we doomed to a society of moral relativism?

This debate has raged for generations. Take for example the Wolfenden report of 1957 which reviewed the illegality of homosexuality and prostitution in the UK. At the time, British judge and Law Lord, Patrick Devlin vociferously argued that the law should uphold public morality by continuing to outlaw homosexual acts. Against him was British legal philosopher and professor of Jurisprudence at Oxford University, Herbert Lionel Adolphus Hart. He argued that the function of law is to 'preserve public order and prevent the exploitation of others.' From Hart's viewpoint, even if one could argue that an act is immoral, provided it did not harm others the law should not intervene, especially where societal attitudes to particular acts change.

Nevertheless, from a Jewish perspective the questions are even more complex. If Divine law is definitively and objectively ethical, how do we explain concepts in the Torah which jar against accepted contemporary morality? How do we view the Torah's sanctioning of slavery, polygamy or the command to annihilate entire nations such as Amalek? Must we discount contemporary moral sensitivities in the face of Divine law, or could Jewish law accommodate the idea of an evolving morality?

Former chancellor of Yeshiva University, Rabbi Dr. Norman Lamm notes that, 'Separating Halakha from morality does violence to both, turning Halakha into a codex of rigid and sometimes heartless rules, and morality into a kind of unstructured and emotionally driven method, as imprecise as it is subjective, of deciding upon one's conduct.' (Faith and Doubt, 2006)

Indeed, rabbinic law instituted laws of slavery to protect the rights of slaves, proscribed polygamy, and notes that the commandment to annihilate Amalek never applied if they pledged to keep the seven Noachide laws of basic societal morality.

Rabbi Lamm concludes that, while we are not free to invent new moral doctrines that are contrary to Torah, we are not only permitted, but obliged to 'use our creative moral and halakhic reasoning to reveal the latent moral judgments of the Torah that may contradict what we have previously accepted as the only doctrine in Torah.' This means the application of Divine law to the modern world is an ongoing, living, and evolving process.

Part 40: The Emergence of Ethics II

The purpose of God communicating to mankind was to make it possible for us to become partners with Him, in order to engage in the perfection of ourselves and the world around us. This requires an understanding of the world – both physical and spiritual, – and a moral code to live by.

Therefore, God gave us the Torah and mitzvot, as the guide and framework of law which directs us. Yet God also created mankind in His image (Genesis 1:26-27) which highlights that we are partly physical beings drawn to physical things, but also possess a *neshamah* (soul), a God-like quality within us (ibid. 2:7) which serves as an inner guide and is intimately connected to God.

King Solomon writes that, ‘A person’s soul is the candle of God, searching out the chambers of our innermost parts’ (Proverbs 20:27). Rabbeinu Yonah (d. 1264) and Rabbi Levi ben Gershon (known as Ralbag, d. 1344) explain that the soul’s connection to God is the source for each human being’s moral compass and spiritual intuitions and convictions. In theory, humans can discern moral and spiritual truths about the world, without having to defer to the Torah. The Midrash explains that this is how Abraham originally came to recognise God and keep His commandments (Genesis Rabbah 95:3).

Yet while the soul seeks eternal moral and spiritual Godliness, the body seeks the opposite in the form of instant physical gratification. The Gemara recounts that a candle shines above the head of an unborn child, with which the baby can see from one end of the world the other (Niddah 30b). Rabbi Yehudah Loew ben Bezalel (known as the Maharal, d. 1609), explains with reference to the above verse in Proverbs, that the ‘candle’ refers to the baby’s soul. Before birth, the soul is above the baby’s body – outside of it yet associated with it.

The reason it can see from one end of the world to the other, is that this pure soul, as yet unsullied by attachment to the physical world, can discern spiritual truths with absolute clarity. As soon as the baby takes its first breath, its soul merges with its body and comes into contact with the physical world, obscuring the soul’s ability to perceive spiritual truths (Chidushei Aggadot on Niddah 30b). As we grow evermore attached to the physical world, our soul’s vision of spiritual and moral truth is increasingly obfuscated. Our notion of morality and spirituality becomes subject to our physical experiences.

In conclusion, Science is only concerned with understanding the physical world. Mankind has the capacity to be morally and spiritually sensitive and can develop ethical codes and spiritual convictions through societal consensus and philosophical deliberation. Yet society’s man-made notion of morality, ethics, and jurisprudence, devoid of God’s objective ethical goals, can never be free from human bias and prejudice. These are the limits of mankind’s endeavours to understand and manage the world.

As this series draws to a close, in the coming months a new series will begin to explore the relationship between Jewish law, human morality and contemporary societal ethics.