COSMOSAPIENS

Human Evolution from the Origin of the Universe

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CHAPTER ONE

The Quest

> …if we do discover a complete theory, it should in time be understandable in broad principle by everyone, not just a few scientists. Then we shall all, philosophers, scientists, and just ordinary people, be able to take part in the discussion of the question why is it that we and the universe exist. If we find the answer to that, it would be the ultimate triumph of human reason—for then we would know the mind of God.
>
> —Stephen Hawking, 1988

> When we have unified enough certain knowledge, we will understand who we are and why we are here.
>
> —Edward O Wilson, 1988

What are we? and why are we here? are questions that have fascinated humans for at least 25,000 years. For the vast majority of that time we have sought the answer to these questions through supernatural beliefs. Roughly 3,000 years ago we began to seek the answer through philosophical insight and reasoning. Just over 150 years ago Charles Darwin's *On the Origin of Species* marked a fundamentally different approach. It adopted the empirical method of science and led eventually to the view that we are the product of biological evolution. Around 50 years ago cosmologists concluded that the matter and energy of which we ultimately consist originated in a Big Bang that created the universe. And then some 30 years ago neuroscientists began to show that what we see, hear, feel, and think correlate with the activity of neurons in different parts of our brain.

These towering achievements in science were made possible by advances in technology that generated an exponential increase in data. This in turn drove the ramification of science into ever narrowing and deepening foci of investigation. In recent times nobody has stepped back from examining the leaf on one branch to see what the whole evolutionary tree is showing us about what we are, where we came from, and why we exist.

This quest is an attempt to do just that: to ascertain what science can reliably tell us from systematic observation or experiment about how and why we evolved

from the origin of the universe and whether what we are makes us different from all other animals.

I shall approach this task in four parts. Part 1 will examine science's explanation for the emergence and evolution of the matter and energy of which we ultimately consist; Part 2 will do likewise for the emergence and evolution of life, because we are living matter, and Part 3 for the emergence and evolution of humans. In Part 4 I will see if there are any consistent patterns in the evidence that enable overall conclusions to be drawn.

In each part I shall break down the pivotal question What are we? into constituent questions that relevant specialist fields investigate, try to find from academically recognized publications in each field answers that are validated by empirical evidence rather than derive from speculation or belief, and see whether or not there is a pattern in the evidence that enables conclusions to be drawn. Only if such an approach fails to provide a satisfactory explanation shall I consider the reasonableness of hypotheses and conjectures and other possible ways of knowing, like insight.

I shall then ask specialists in each field (listed in the Acknowledgements) to check the draft results for errors of fact or omission and unreasonable conclusions.

At the end of each chapter I shall list any conclusions so that the reader who wishes to skip any of the more technical sections can see my findings.

The question of what we are has intrigued me ever since I was a science undergraduate. Apart from co-authoring two research studies plus writing one book in the social sciences, and four years part-time tutoring physics for the Open University, I have not practised as a scientist, and so in that sense I am unqualified for the task. On the other hand few researchers today possess the relevant knowledge outside the specialized field in which they were trained and now practise.

I anticipate that many such specialists will feel that I have not written in sufficient detail in their field. If so I plead guilty in advance. I am attempting to write a book, not a library, and that necessarily requires summarizing if the goal of revealing the overall picture of human evolution is to be achieved: a vision of what we are and why we are here.

Despite efforts to correct errors, in such an enterprise some details may prove to be flawed, for which I take full responsibility. Or they may be overtaken by the results of new research between writing and publication, but that is how science, as distinct from belief, advances. What I hope is that the book will provide an overarching framework that others can refine and build upon.

A majority of the world's population, however, do not accept that we are the product of an evolutionary process. They believe in various myths to explain our origins. I shall begin, therefore, with a chapter that examines what these origin myths are, why they have endured for nearly 500 years after the scientific revolution began, and whether they have influenced scientific thinking.

Much disagreement arises because different people use the same word to mean different things: meanings change over time and in different cultural contexts. To minimize misunderstanding I shall define the precise meaning I intend for each

significant and potentially ambiguous word when I first use it, and compile a list of such terms in the Glossary at the end of the book, which also includes definitions of unavoidable technical terms.

The first word to define is "science". It derives from the Latin *scientia*, which means knowledge. Different kinds of knowledge may be acquired, or claimed to be acquired, in different ways. From about the sixteenth century it came to mean knowledge about the natural world—inanimate and animate—acquired by observation and experiment, as distinct from knowledge acquired by reasoning alone, insight, or revelation. Consequently a definition of science must include the means by which its knowledge is acquired. Our current understanding of science may be summarized as

> **science** The attempt to understand and explain natural phenomena by using systematic, preferably measurable, observation or experiment, and to apply reason to the knowledge thereby obtained in order to infer testable laws and make predictions or retrodictions.

> **retrodiction** A result that has occurred in the past and is deduced or predicted from a later scientific law or theory.

Science aims to formulate a law, or a more general theory, to explain the invariable behaviour of a system of phenomena. We use such a law or theory to predict future outcomes by applying it to specific phenomena within the system. For instance, within the system of moving objects we apply Newton's laws of motion to predict the result of firing a specific rocket in specific circumstances.

Science may also inform us about outcomes in the past. An example of a retrodiction is that from the theory of plate tectonics we can deduce that similar fossils dating from before the breakup of the supercontinent Pangaea around 200 million years ago will be found near the complementary western coastline of South America and the eastern coastline of South Africa.

From the eighteenth century the study of natural phenomena encompassed humans and their social relationships. Use of the scientific method in such studies developed by the nineteenth century into the social sciences, an umbrella term covering such disciplines as archaeology, anthropology, sociology, psychology, political science, and even history. I shall evaluate relevant findings in these disciplines in Part 3.

Some refer to mathematics as a science, but its field of study extends way beyond natural phenomena and its theories cannot be tested empirically. In the context of this investigation I think it better to classify mathematics as a language in which some science, particularly its laws, can be expressed.

"Theory" in science has a more specific meaning than in general use, and even in science "theory" and "hypothesis" are often used loosely. It helps to distinguish between the two.

> **hypothesis** A provisional theory put forward to explain a phenomenon or set of phenomena and used as a basis for further investigation; it is usually arrived at either by insight or by inductive reasoning after examining incomplete evidence and must be capable of being proven false.

The criterion of falsifiability was proposed by philosopher of science Karl Popper. In practice this may not be straightforward, but most scientists today accept the principle that to distinguish a scientific hypothesis from a conjecture or belief it must be subject to empirical tests that can falsify it.

> **theory** An explanation of a set of phenomena that has been confirmed by a number of independent experiments or observations and is used to make accurate predictions or retrodictions about such phenomena.

The wider the range of phenomena explained the more useful is the scientific theory. Because science advances by the discovery of new evidence and the application of new thinking, a scientific theory may be modified or disproved as a result of contradictory evidence but it can never be proved absolutely. Some scientific theories, though, are generally recognized as well-established. For example, while the theory that the Earth is the centre of the universe and the Sun and other stars revolve around it has been disproved, the theory that the Earth orbits the Sun has been validated by so many observations and accurate predictions that it is accepted as established fact. However, even this may not always be so. Indeed very probably it will not be so in some 5 billion years when the Sun is predicted by most studies of its evolution to turn into a red giant star that will expand to envelop and burn up the Earth.

Any investigation is heavily influenced by prior beliefs. I was born and educated a Catholic, became an atheist, and am now an agnostic. I have no prior beliefs in theism, deism, or materialism. I genuinely do not know. And that is part of the excitement of embarking on this quest to discover from scientific evidence just what we are and may become. I invite readers with an open mind to join me on this quest.

CHAPTER TWO

Origin Myths

> I want to know how God created this world.
>
> —Albert Einstein, 1955

> The world and time had both one beginning. The world was made not in time but simultaneously with time.
>
> —St Augustine of Hippo, 417

Since 11 February 2003* science's orthodox account, usually presented as fact, is that 13.7 billion years ago the universe, including space and time as well as matter and energy, exploded into existence as a point-like fireball of infinite density and incredibly high temperature that expanded and cooled into the universe we see today. This was the Big Bang from which we evolved.

Before investigating whether science can explain our evolution from the origin of matter and energy, I shall briefly consider the origin myths believed by a large majority of the world's population. It is instructive to examine the principal ideas in the different myths, the various explanations advanced for them by social scientists and whether these explanations meet the tests of evidence or reason, why the myths have endured, and to what extent they have influenced scientific thinking.

Principal themes

Every culture throughout recorded history has one or more stories about how the universe and we humans originated: understanding where we came from is part of an inherent human desire to understand what we are. The Rig Veda, the

* The day NASA scientists announced that data from their satellite-based Wilkinson Microwave Anisotropy Probe (WMAP) had confirmed the Big Bang model and had enabled them to determine the age of the universe with an unprecedented accuracy of one per cent margin of error. On 21 March 2013 European Space Agency scientists announced that data from their Planck space telescope meant that the age should be revised to 13.82 billion years.

oldest sacred text in the world and the most important scripture of what is now called Hinduism, has three such myths in its tenth book of hymns to the gods. The Brahmanas, the second part of each veda largely devoted to ritual, have others, while most of the Upanishads, accounts of the mystical insights of seers that tradition attaches to the end of the vedas,* express in various ways a single insight into the origin of the universe.[1] Judaeo-Christian and Islamic cultures broadly share a creation explanation, while other cultures have their own. The Chinese have at least four origin myths that exist in several versions. Although every myth is different,[2] nine principal themes recur; some overlap.

Primordial chaos or water

Many myths tell of a pre-existent chaos, often depicted as water, from which a god emerges to create the world or parts of it. The Pelasgians, who entered the Greek peninsula from Asia Minor in about 3500 BCE, brought with them the story of the creator goddess Eurynome who arose naked from Chaos.[3] The myths of Heliopolis in Egypt dating from the fourth millennium BCE speak of Nu, the primordial watery abyss, from which Atum arose to masturbate the world into existence. By around 2400 BCE Atum became identified with the Sun god Ra and his emergence was associated with the rising of the Sun and the dispelling of chaotic darkness.

Earth diver

Other myths, widespread in Siberia, Asia, and some native American tribes, have a pre-existent animal—often a turtle or bird—that dives into the primordial waters to bring up a piece of earth that later expands into the world.

Cosmogonic egg

In parts of India, Asia, Europe, and the Pacific an egg is the source of creation. The Satapatha Brahmana says the primordial waters produced the creator god Prajapati in the form of a golden egg. After a year he breaks open the egg and tries to speak. His first word becomes the earth, his second the air, and so on. Similarly, one version of the Chinese P'an Ku myth begins with a great cosmic egg inside of which the embryonic P'an Ku floats in Chaos. In the Greek Orphic creation myth, deriving from the seventh or sixth century BCE and contrasting with Homer's Olympian myths, it is time that creates the silver egg of the cosmos out of which bursts the bisexual Phanes-Dionysus who bears with him the seeds of all gods and all men and who creates Heaven and Earth.

World parents

A widespread theme has the world father—usually the sky—mating with the world mother—usually the Earth—to give birth to the elements of the world.

* See Glossary at the end of the book for a more detailed explanation of these terms.

Often they lie locked in sexual embrace, indifferent to their children, as in one Maori creation myth.

Rebellion by children

In several myths the progeny rebel against the world parents. The children in the Maori myth—forests, food plants, oceans, and man—battle with their parents for space. Perhaps the best-known myth of this type is the *Theogony* composed by the Greek Hesiod in the eighth century BCE. This records the rebellion of successive generations of gods against their parents, the first of whom were Chaos, Earth, Tartarus (the underworld), and Eros (love); it leads eventually to the triumph of Zeus.

Sacrifice

The idea of creation through sacrifice often occurs. The Chinese myth of P'an Ku says "The world was never finished until P'an Ku died. Only his death could perfect the universe. From his skull was shaped the dome of the sky, and from his flesh was formed the soil of the fields….And [lastly] from the vermin which covered his body came forth mankind."[4]

Primordial battle

The great Babylonian epic, the *Enûma Elish*, describes warfare between the Sumerian gods and the local deity of Babylonia, Marduk, and his followers. Marduk slays the surviving original goddess, Tiamat, and her monsters of Chaos, establishes order, and becomes the supreme, universal creator god: all nature, including humans, owes its existence to him. Similar myths appear all over the world, for example the Olympian victory of the masculine sky gods of the invading Aryans over the fertile earth goddesses of the Pelasgians and Cretans.

Creation out of nothing

Only a few myths have the theme of creation out of nothing. However, its belief is not only one of the most widespread but also the currently favoured scientific explanation.

The oldest version comes from the Rig Veda. Recent archaeoastronomical investigations challenge Max Müller's nineteenth century dating and claim support for Indian tradition; they conclude that it was compiled over a period of two thousand years, beginning around 4000 BCE.[5] In the tenth and last book, Hymn 129 says "Then was not non-existent nor existent: there was no realm of air, no sky beyond it….That One Thing, breathless, breathed by its own nature: apart from it was nothing whatsoever."

This idea is developed in the Upanishads, the principal ones of which were probably written down between 1000 and 500 BCE. The Chandogya Upanishad epitomizes their central insight that "The universe comes forth from Brahman and will return to Brahman. Verily all is Brahman." Various Upanishads employ

metaphor, allegory, parable, dialogue, and anecdote to portray Brahman as ultimate reality existing out of space and time, from which everything springs, and of which everything consists; it is generally interpreted as the Cosmic Consciousness or Spirit or Supreme Godhead beyond all form.

Daoism expresses a similar idea. The principal Daoist text, known in China as *Lao-Tzu* and in the West as *Tao Te Ching*, was probably compiled from the sixth to the third century BCE. It emphasizes the oneness and eternity of the Dao, the Way. The Dao is "nothing" in that it is "no thing": it is without name or form; it is the ground of all being and the form of all being. The Way, or nothingness, gives rise to existence, existence gives rise to the opposites of yin and yang, and yin and yang give rise to everything: female and male, Earth and Heaven, and so on.

The first book of the Hebrew scriptures, written no earlier than the late seventh century BCE,[6] begins with the words "In the beginning God created the heavens and the earth."[7] The next verse describes the Earth in terms reminiscent of the primordial watery chaos myths, after which God says let there be light and light is created, and then God separates light from darkness on this first day of creation. Over the next five days he likewise creates by command everything else in the universe.

In the Qur'an, written from the seventh century CE, God similarly creates the heavens and Earth by command.[8]

Eternal cycle

Several myths originating in India deny that the universe was created and maintain that the universe has always existed, but this eternal universe undergoes cycles.

The Buddha in the fifth century BCE said that to conjecture about the origin of the universe brings madness to those who try.[9] This did not, however, prevent his followers from trying. They applied his insight that all things are impermanent, constantly arising, becoming, changing, and fading, with the result that most Buddhist schools now teach that the universe expands and contracts, dissolves into non-being, and re-evolves into being in an eternal rhythm.

Possibly they were influenced by the Jainists, whose latest Tirthankara (literally Ford-Maker, one who shows how to cross the river of rebirths to the state of eternal liberation of the soul), began teaching before the Buddha in eastern India. The Jainists hold that the universe is uncreated and eternal. Time is like a wheel with twelve spokes that measure out *yugas*, or world ages, each with a fixed duration of thousands of years. Six *yugas* form an ascending arc in which human knowledge and happiness increase, while these attributes decrease in the descending arc of six *yugas*. When the cycle reaches its lowest level even Jainism will be lost. Then, in the course of the next upswing, Jainist knowledge will be rediscovered and reintroduced by new Tirthankaras, only to be lost again at the end of the next downswing in the endlessly rotating wheel of time.

This is similar to most Yogic beliefs, which derive from Vedic philosophy. Typically they posit only four *yugas*. The first, Satya Yuga or Krita Yuga, endures 1,728,000 years, while the fourth, Kali, lasts 432,000 years. The descent from Satya to Kali is associated with a progressive deterioration of *dharma,* or righteousness, manifested as a decrease in the length of human life and quality of human moral standards. Unfortunately we are now in the age of Kali.

Explanations

The many explanations for these origin myths may be grouped into five categories.

Literal truth

Because every origin myth is different, they all cannot be literally true. However, some cultures claim that *their* myth is literally true. 63 per cent of Americans believe the Bible is the word of God and literally true,[10] while the overwhelming majority* of the world's 1.6 billion Muslims believe in the literal truth of the Qur'an because it is the eternal word of God written on a tablet in Heaven and dictated to Muhammad by the Archangel Gabriel.

Many believers in the literal truth of the Bible endorse James Ussher's calculation from Genesis that the six-day creation of the universe was completed on Saturday 22 October 4004 BCE at 6pm.†[11] However, overwhelming geological, palaeontological, and biological evidence, using radiometric dating of rocks, fossils, and the ice core puts the age of the Earth as at least 4.3 billion years. Astronomical data indicate that the universe is 10–20 billion years old. The evidence against the literal truth of the creationist belief is conclusive.[12] Moreover, to believe in the literal truth of the Bible is to believe in at least two contradictory accounts of creation. In Genesis 1:26–1 God creates plants and trees on the third day, fishes and birds on the fifth day, animals early on the sixth day, and male and female humans in his own image only at the end of the sixth day. In Genesis 2, by contrast, God first creates a male human from dust; only after that does he create a garden and cause plants and trees to grow, and then from the earth creates all the animals and birds—the fish don't get a mention—and finally he creates a woman from the man's rib.

It is illogical, too, for believers in the literal truth of the Qur'an to believe that God created the Earth and the heavens in eight days (Sura 41:9–12) and that he created the Earth and the heavens in six days (Sura 7:54).

* The mystic and the modernist strands of Islam are now marginalized, see Ahmed (2007).

† Since Ussher (1581–1656) was Archbishop of Armagh in Ireland, presumably this is Greenwich Mean Time.

Metaphor

Barbara Sproul, one of the leading scholars of origin myths, argues that, while they may not be literally true, all myths use metaphors to express their truths. The only evidence she quotes is the ethnologist Marcel Griaule's interpretation of a Dogon wise man's explanation that his people's myth has to be spoken in words of the lower world. For the rest she explains what different origin myths really mean. Thus in the Heliopolis myth the creator god masturbating the world into existence represents the internalised duality manifesting all duality "and becomes sacred and revealing about the nature of reality if only we understand what is meant by it".[13] She supplies no evidence that the Heliopolis myth-makers, still less the population of Heliopolis, of five thousand years ago shared her understanding.

For the other examples she cites it is difficult to avoid the impression that she is simply projecting onto those myths her own late-twentieth-century interpretations. If 63 per cent of the most technologically sophisticated nation on Earth believe that a Genesis creation myth is literally true, is it reasonable to suppose that nomadic tribes of four thousand years ago, or even King Josiah's scribes of two and a half thousand years ago, believed it to be a metaphor?

While it is reasonable to conclude from their context that *some* origin accounts, like those in the Upanishads, deliberately employ metaphor, Sproul offers no evidence to demonstrate that most such myths were either intended or recognized as other than literal accounts.

Aspect of absolute reality

Sproul maintains that all religions declare an absolute reality that is both transcendent (true for all time and places) and immanent (true in the here and now), and that "Only creation myths have as their primary task the proclamation of this absolute reality."[14] Moreover, her collection of creation myths "does not show any essential disparity in understanding; rather it reveals a similarity of views from a rich variety of viewpoints".[15]

Thus many origin myths speak of polar opposites: light and dark, spirit and matter, male and female, good and bad, and so on. The more profound trace these back to Being and Non-being, with some, like the Chandogya Upanishad, saying that Non-being was produced from Being, while others, like a Maori myth, assert that Not-Being-Itself is the source of all Being and Non-being. Some see the origin of all polarities as Chaos, in which all distinctions are potentially there; creation occurs when Chaos coalesces into form and acts on the rest of the unformed to produce further distinctions and thereby create the world. "Which is the absolute reality here? The Chaos itself? Or the child of Chaos that acts on it? *Both*. They are one."[16]

Apparent differences arise only because the myths speak about the unknowable in terms of the known, commonly by anthropomorphizing or using relative words to try to describe the absolute. According to Sproul, even the Buddhist, Jainist,

and Yogic rejections of a creation event do not set their eternal universe apart from one that is created; myths that tell of creation events are simply temporalizing: they speak of the absolute in terms of the first.

The claim that all origin myths reveal aspects of the same absolute reality is a fascinating one. It is not, however, supported by any evidence. It is equally explained by Sproul's interpreting these myths to accord with her own belief as to what constitutes absolute reality.

Archetypal truth

According to Sproul, who was a student of Joseph Campbell, creation myths are important not for their historical values alone but also because they reveal archetypal values that help us understand our own personal growth "physically, mentally, and spiritually, in the context of the cyclical flow of being and not-being and ultimately in the absolute union of the two".[17]

Her use of Campbell's Jungian-derived psychology fails to present a convincing explanation.

Foetal experience

Molecular biologist Darryl Reanney suggests that the common theme of pre-existent dark, formless waters into which light appears and the birth of the universe begins may be explained by subliminal memories of the foetus's birthing experience from the dark, formless, nourishing waters of the womb. "Pre-natal brain imprints of experience of birth predispose myths to evolve particular configurations of symbolic imagery which strike deeply responsive cords in psychology."[18] In support he says that electrical activity can be recorded in the cerebral cortex of foetuses from about the seventh month onwards (more recent data suggests this occurs before six months).

This is an interesting conjecture, but it is difficult to see how it can be either validated or disproved.

I suggest three other explanations.

Limited comprehension of natural phenomena

At the stage of human evolution when these myths developed, most cultures had a mistaken or limited understanding of natural forces and, except for eastern India and parts of China, philosophical inquiry had not begun.

The primordial water element of many myths may stem from the reason many late Neolithic peoples developed their settlements by the banks of a river. They used water to drink and sustain their own lives and to irrigate their crops. Water was the source of life and fertility; before the growth of cities it was commonly associated with the spirit or goddess of life.

Most myths stem from Bronze Age cultures in which science, apart from astronomy, was unknown. When asked where the world came from, the wise men drew upon their own experiences of creation. Humans and animals were created

by the sexual union of their fathers and mothers, and so the world itself was created by the union of a father and mother. To fertilize the world this father must be all-powerful, and the most powerful force they knew was the sky, whence came heat from the Sun, thunder, lightning, and rain to fertilize everything that grows. To gestate the world this mother must be all-fecund, and the most fecund thing they knew was the Earth, whence came all trees, vegetation, and crops. Hence the sky-god father and earth-god mother.

Sages of different peoples saw the egg as the thing from which life emerges. Hence the cosmos, or the god that creates it, must have emerged from an egg. Other sages noted the cycles of the Sun, the Moon, the seasons, and the crops. Each of these wanes, dies, re-emerges, and develops in an apparently endless series. This is how the essential elements of the universe function, and so must the universe itself.

Political and cultural need

By the Bronze Age the spirits of nature invoked by the hunter-gatherer and primitive agricultural cultures had evolved into gods, whose functional hierarchy reflects that of the evolving city-states, while their origin myths often meet a political or cultural need.

Atum, the self-sufficient creator god worshipped in Heliopolis in the fourth millennium BCE, was downgraded by the theologians of the Pharaoh Menes to an offspring and functionary of Ptah, hitherto god only of destiny, whom they wished to elevate to creator god because he was a local Memphite deity and Menes had built a new capital at Memphis.

The creation through primordial battle myths typically conforms to this explanation. Thus in the Babylonian *Enûma Elish* myth, Marduk's slaying of Tiamat and her monsters of Chaos and his elevation to supreme creator god sanctifies and legitimizes the Babylonians' triumph over the old Sumerian powers and the creation of their order throughout Sumeria.

Late twentieth century archaeological evidence[19] suggests that the written biblical account of creation by the word of God is most probably explained by political and cultural need. In the late seventh century BCE King Josiah charged his scribes to compile from the region's myths and legends a canonical text that sanctified and legitimized the union of his kingdom of Judah with the now-fallen kingdom of Israel under one absolute patriarchal ruler with one code of laws. Yahweh, the local god of Judah, who originally had the goddess Asherah as his spouse, became not only the chief god but also the only god. Yahweh is the name for God in the Genesis 2 creation account. But to persuade the people of Israel to accept the union, he is seen to be the same as their gods. Elohim, the name given to God in Genesis 1, is the generic term for a divine being and was used by the Canaanites, whose territory and culture the Israelites had taken over, to denote their entire pantheon of gods; in Genesis 1 they are subsumed into a single deity. Reflecting the role of absolute ruler of the United Kingdom of Judah and Israel

that Josiah wanted sanctified, this one God had only to say a thing and it was done; thus was the world created.

Such a change of myth is not the prerogative of the conqueror. The creation story of the Chiricahua Apache is a tragi-comical fusion of the Old Testament and their pre-conquest mythology. The biblical Flood drowns those who worship the mountain gods Lightning and Wind. After the waters subside a bow and arrow and a gun are put before two men. The first takes the gun and becomes the white man, while the second has to take the bow and arrow and becomes the Indian.

Insight

Some cultures in India and China valued training the mind to focus within and gain direct knowledge by becoming one with the object of inquiry. From such meditating seers in India came the insight that *atman*, the essential Self, was identical with the universe, which itself was identical with Brahman, the ineffable self-existent entity from which it came forth. This mystical insight is very similar to that of the early Daoists and of later seers in other countries. The essence of these common insights should be distinguished from their culturally refracted interpretations by disciples, which often showed a lack of understanding of natural phenomena or a social or political need.

Tests of evidence and reason

We have no evidence to validate in a scientific sense any origin myth or the explanations for them. We do have sufficient evidence, however, to disprove the literal truth of most such myths, including those claimed to be revealed by an external, transcendent God.

A limited, if not false, understanding, of natural phenomena, plus cultural and political need, and culturally refracted interpretations of mystical insights may be more prosaic explanations than those advanced by most mythologists, ethnologists, psychologists, or other scholars, and I cannot cite conclusive evidence in support. However, they have the advantage of being in accord with such facts as we know, and are arrived at by applying Ockham's Razor, or the scientific rule of parsimony: they are the simplest explanations.

The origin accounts that rest their claim for truth not on material evidence or reasoning or revelation by a transcendent God, but on insight, can neither be validated nor disproved by science or reasoning. I shall return to insight in more depth when considering the development of philosophical thinking. However, purely from a scientific and rational perspective, most origin myths fall into the category of superstition, which I define as

> **superstition** A belief that conflicts with evidence or for which there is no reasonable basis and which usually arises from a lack of understanding of natural phenomena or fear of the unknown.

Reasons for endurance

One explanation for the endurance of creation myths, even in our most scientifically advanced cultures, is that science examines only the physical world, but there exists an ultimate reality that transcends the physical world; all the different creation myths express this ultimate reality in terms—frequently anthropomorphic—that reflect the different cultures.

While this could be true in some cases, too many myths are mutually contradictory for this proposition to be valid generally. A simpler explanation is that the endurance of such conflicting beliefs is not testimony to their truth but rather to the power of inculcation by two hundred generations of human societies over five thousand years.

Influence on scientific thinking

Their enduring power not only withstood the first scientific revolution, but most of the architects of that revolution saw their role as discovering the laws by which the Judaeo-Christian God governed the universe he had created. Isaac Newton, the consummator of that revolution, believed that the universe "could only proceed from the counsel and dominion of an intelligent and powerful being".[20]

Their enduring power also withstood the second scientific revolution that began in the mid-nineteenth century with Darwin's arguments for biological evolution and culminated in the first third of the twentieth century with the transformation of physics by relativity and quantum theories. Darwin himself abandoned his Christian beliefs and ended life an agnostic,[21] but Albert Einstein, originator of the Special and General Theories of Relativity, shared Newton's belief that a supreme intelligence had created the universe, although he denied that such a God intervened in human affairs.[22]

Many pioneers of quantum theory espoused the belief that matter does not exist independently but only as the construction of the mind. Some, like Erwin Schrödinger, had a life-long fascination with the Upanishadic insight that everything, including the universe, sprang from the consciousness of Brahman, the ultimate reality existing out of space and time;[23] to what extent this influenced his work is an open question. David Bohm's scientific thinking was certainly influenced by such a belief.[24]

Today a minority of scientists openly profess their religious faith. They include John D Barrow, cosmologist and member of the Christian Emmanuel United Reformed Church, Francis Collins, former director of the Human Genome Project and evangelical Christian, who sees "DNA, the information molecule of all living things, as God's language, and the elegance and complexity of our own bodies and the rest of nature as a reflection of God's plan,"[25] and Ahmed Zewail, Muslim and the 1999 Nobel laureate in chemistry. Generally such scientists hold

that science and religious belief operate in different domains, although some, like John Polkinghorne, theoretical physicist and Anglican priest, actively promote debate on the intersection of science and theology.

Moving on from myth, science gives us a clearer understanding of the origin of the universe, and hence of the matter and energy from which we evolved. Or does it?