

Religion, Science and Immortality

Abstract: The quest for immortality has been the most fundamental existential problem for the *Homo sapiens* species since it became conscious of its own mortality. Humans, unlike other animals, have been conscious of life and death since prerecorded history. The early hominids used religious ideas as their only way to think about physical mortality and spiritual immortality. To deal with the problem of death, organized religions created the concepts of resurrection and reincarnation, but now other explanations, and solutions, are possible. The new approach is based on science and not religion, on physics and not metaphysics, on reason and not faith, on natural and not supernatural views. Modern science is no longer concerned with the possibility of life after death. Instead, we are now looking for ways to prevent death, to extend our physical or material life indefinitely. From a scientific point of view, death is the termination of life and, thus, immortality would be life's ultimate achievement. When the first multi-cellular organisms appeared, immortality was their objective; when intelligence evolved, immortality was its goal; and now, technology is finally making it happen.

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The concept of immortality can be approached from two different perspectives: one religious or supernatural and another scientific or natural. Both views serve to understand better the history behind the most fundamental existential problem that humankind has ever had to face: the quest for immortality. Religion came first, but now science is showing the way for actually achieving immortality.

1. RELIGION AND IMMORTALITY

Since the beginning of recorded times, humans created religion as a way to explain the unexplainable. *Homo sapiens* used religious ideas as a conscious attempt to deal with death. Animals have no conscience of life or death, as opposed to humans, and animals have no religion. Animals are not aware of their own self identity and are not conscious of their own mortality.

The increased mental ability of our first ancestors led to a terrifying piece of knowledge: personal mortality. For the first time, individual animals on Earth became aware that their life was transient; that they would die at some point in their future. According to many experts, this knowledge produced an intolerable emotional drain that was initially satiated by religious ideas based on faith and supernatural powers. In response to the fear of death and a promise of everlasting life, billions of people around the world have turned to religion.

1.1. RELIGION: THE PAST

Early hominids were hunter-gatherers and led a nomadic life for thousands of years. There are very few remnants from those early days, but the first large burial sites date from the Paleolithic Period (Old Stone Age, before 10,000 BCE). Excavations have also shown, in certain places, ashes and other indications of fire used in relation to dead people. Those might have been the first examples of human cremation. Many early settlements show the lavished care that humans gave to their dead, and archeologists have concluded that the rituals and ceremonies demonstrate the importance of, and reverence to, the deceased members of the tribes. Later, cave paintings and megalith monuments, such as menhirs and dolmens, also indicate that humans were trying to transcend their mortal limitations. Such early art forms were also related to the beginnings of religion.

The Neolithic Period (New Stone Age, 10,000 – 4,500 BCE) shows a substantial growth in the number of burial places and some locations indicate a clear cult of the dead. The agricultural revolution allowed the creation of the first large human settlements and the foundation of cities. Humans became farmers and domesticated several plants and animals. Their traditions were disseminated orally among the members of each tribe and were taught to future generations. Much later, when writing was developed, their beliefs were generally recorded in written form. (writing allowed permanence but restricted flexibility).

Unfortunately, because these belief systems were based on tribal groups, the various religions which developed in distant areas of the world were all different. Their teachings were in conflict with each other. Since the followers of most religions considered their beliefs to be derived directly from their Gods, they are not easily changed. Thus, inter-religious compromise is difficult and sometimes impossible. Also, because religious texts are often ambiguous, divisions developed within the religions themselves. Different denominations, schools, sects or traditions have derived different meanings from the same religious texts. Thus were laid the foundations for millennia of inter-religious and intra-religious conflict.

The first religions appear to have been based on fertility. They were focused on the worship of the great Earth Goddess. Religions then evolved to include male Gods who were gradually given increased importance by the priests. This development may have been caused by acquired knowledge of the male's involvement in the process of reproduction. The cult to fertility deities and goddesses developed in several places during the Copper Age (4,500 – 2,000 BCE), as proved by the many Venus-type sculptures found in archeological places. The first Egyptian and Mesopotamian goddesses date from that time. During the Bronze Age (2,000 – 1,000 BCE) the first organized religions were consolidated around the agricultural valleys surrounding the Nile, the Tigris and the Euphrates in the Middle East, and farther east around the Indus river and the Anyang region in China.

Ancient Egypt developed a religion that lasted over 3,000 years. This religion was polytheistic, had several gods and goddesses, and each region had its own patron deity. It is believed that Egyptian polytheism originated chiefly from the notion that meritorious persons were gifted with a divine principle, and that their soul, after its separation from the body, actually became endowed with divinity. So were Osiris and Isis, according to Plutarch, transformed into goddesses out of good spirits. Some of the local or regional gods gained notoriety throughout Egypt. For instance, the god Ptah gained power when the city of Memphis became the capital of Egypt. Later, the god Re of Heliopolis

eclipsed that of Ptah. Finally, the god Amon rose to supremacy in Thebes in connection with the political authority of the Theban Pharaoh. As a rule, whenever a new capital was founded, a new supreme god was chosen.

It has been said that the ancient Egyptian civilization was the greatest “cult of death” humanity has ever known. For 3,000 years, ending with the death of Cleopatra under the Roman Empire, millions of people lived in a culture which emphasized mummification of the body, and many of those people mummified were actually preserved. Upon assuming office, the pharaohs and nobles would immediately begin construction of their own tombs, the greatest of which were the pyramids.

The Old Kingdom of Egypt is normally dated starting from 3,250 BCE, the time when the first pyramids were built. The pyramids soon became the great monuments for the afterlife of the Pharaohs. The Egyptian quest for immortality included mummification for bodily preservation in the afterlife. (Ironically, the Egyptians used mummification for many of the same reasons and arguments offered by modern cryonicists, but with less understanding of the true science.) Based on their care for the dead and their burial ceremonies, the Egyptians were absolutely convinced of the immortality of the human soul. Indeed, Herodotus wrote that the Egyptians were the first who recognized the human soul as immortal. Why did the Egyptians believe the physical body is so important for an afterlife? Egyptologists speculate that it was because the hot and dry desert sand so effectively removed water, thereby reducing decay of hair, skin and soft parts of the body. Therefore, when early Egyptians saw such well-preserved corpses, they felt that the personal identity of the deceased must have been preserved also. The association of preserved familiar features with the living person or animal was so deeply imprinted in their mind that it was easy to imagine that some part of the person was “still there”.

The religious writings of the Egyptians were compiled as hieroglyphs in a text called *The Book of Coming Forth by Day*, which in modern times is more often referred to as *The Egyptian Book of the Dead*. The Egyptians observed a 70-day ritual period between death and burial. During 40 of those days the corpse was being desiccated with natron. After desiccation the bodies were anointed with hot, melted resins which would combine with the natron salts to produce a brittle glass-like material. Fifteen days were set aside for the meticulous wrapping of the body in linen. Each arm, leg, finger and toe (and a male's penis) was carefully wrapped. Wrapping was done very ritualistically, with the insertion of anointed amulets (“charms”) by priests. In some cases, as many as several hundred amulets were wrapped in the mummy's linen. Several layers of coffins and encasements could be used to surround the

mummy, and placing the mummy in each one was also a process involving enormous symbolism and ritual. (“Sarcophagus” is Greek for “flesh-eating”, symbolizing the consumption of the body by the encasement.)

Mesopotamia developed separately competing religious beliefs starting about 3.000 BCE. The oldest recorded story to come down to us through the millennia is the *Epic of Gilgamesh*, first transcribed over 4,000 years ago in cuneiform script. Although originally written in the Semitic Akkadian language, the Gilgamesh Epic was translated into several Middle Eastern languages and became the most famous literary creation of the ancient Sumerians.

The *Epic of Gilgamesh* is not only important because it is the oldest known written story, but also because it is the first narrative about the search for immortality and perpetual youth. The story tells of the mythical legendary and semi-divine Gilgamesh, King of Uruk at around 2,750 BCE, who after grappling with the loss of a friend, vows to deny death for himself.

The epic describes how the goddess mother of Gilgamesh had created Enkidu, originally a wild animal, in the hope that this creature might challenge the arrogant and ruthless Gilgamesh and thus temper his excesses. After an initial confrontation, Gilgamesh and Enkidu become inseparable friends. On an expedition to the West, the goddess of love and war, Ishtar, asked Gilgamesh to marry her but he refused. She became very angry and retaliated by sending the bull of heaven down to attack them. In the battle, they killed the bull, but Enkidu injured his hand and he eventually died from his wound. After Enkidu died, Gilgamesh went on a quest for immortality. Gilgamesh was trying to find immortality for both Enkidu and himself.

Enkidu's death so haunts Gilgamesh that he undertakes to seek eternal life, and so Gilgamesh the mighty hero is transformed into Gilgamesh the broken mortal. The pursuit of immortality leads Gilgamesh into further adventures. The most famous is his encounter with Utnapishtim (which means “I found Life”) and his wife, ancient heroes who were granted eternal life by the gods after surviving the tragic flood. (This is the story of the Deluge, of the time when the gods, unable to sleep for the uproar raised by humans, agreed to destroy mankind; and would have succeeded had not Ea, one of man's creators, instructed Utnapishtim to build a boat and “take up into [it] the seed of all living creatures”. The story is familiar to us not only because it anticipates Noah's story in the book of Genesis, but because it is the story of life, the story of destruction and renewal.)

When Gilgamesh is ready to begin his long journey home, Utnapishtim, at the urging of his wife, reveals another mystery of the gods. He tells Gilgamesh of a plant growing under water that can restore youth. Gilgamesh finds the plant and decides to take it to Uruk to give it to the old men. But as Gilgamesh bathes in the cool water of a well, a serpent rises up and snatches away the plant; and immediately the snake sloughs its skin and returns to the well. (Again this story is familiar to us, not only because we recognize this snake as a precursor of the more sinister one that appears in the Garden of Eden, but because we comprehend it as a symbol. In the Sumerian world, Ningizzida, the God of the Serpent, is also the Lord of the Tree of Life.)

Gilgamesh is warned in the story that “you will never find that life for which you are looking. When the gods created man they allotted to him death, but life they retained in their own keeping”. While Gilgamesh himself had lost the ability to live forever, or the opportunity to pass on this ability to the men of Uruk, it is enough that the snake recalls for us, in its sloughing of its skin, nature's pattern of regeneration.

After the Egyptians and the Mesopotamians, another important religion of the past was that of ancient Greece. In the old Greek religion, gods were thought to have great powers over the world and the afterlife. In general, the Greeks believed that their Gods were immortal and that humans were mortal. Pythagoras and some of his followers, however, believed in an immortal soul and in reincarnation.

Since the Greeks were a trading nation, they were very open to consider new ideas and to be critical of their own. Over the course of centuries, the Greeks recognized the fundamental role of reason, giving birth to the techniques of modern science and mathematics. This was an essential step forward in human thinking: separating science from religion, distinguishing physics from metaphysics, recognizing the natural from the supernatural, dividing reason from faith.

1.2. RELIGION: THE PRESENT

Many of the ancient religions have already disappeared or are simply regarded today as mythology. Judaism, however, still survives as the first and oldest monotheist religion.

The history of the Jews begins with Abraham, their Semitic patriarch, who supposedly lived in the historical Mesopotamian city of Urr at around 2,080 BCE. After a divine trial involving the life of his own son, Isaac,

Abraham received instructions from a supreme God to leave the polytheist lands of Mesopotamia and move to the promised land of Canaan. The original covenant to the single God was also maintained by Moses who, in the thirteen century BCE, led the enslaved Hebrews out of their captivity in polytheist Egypt. During this Jewish exodus and the return to Canaan, Moses received directly from God, in Mount Sinai, the Ten Commandments for his chosen people. After recovering their promised land, founding their kingdom and Solomon’s Temple in Jerusalem around the tenth century BCE, the Jewish tribes were still attacked during centuries by foreign neighbors like Mesopotamia and eventually Rome.

It was roughly two millennia ago that a Jew named Jesus was born. He began a religious movement that eventually became known as Christianity. His main followers, called disciples, considered Jesus to be God and immortal, and they spread his teachings around the world, starting with the territories under Roman control. The Christian teachings were recorded in the *Bible* (“Book” in Greek), divided in two parts: the *Old Testament*, which corresponds roughly to Jewish *Torah*, and the *New Testament*.

In the year 571 CE, an Arab named Mohammed was born in Mecca. He started a new religion called Islam (“Submission” in Arabic) and he became the last prophet in the line following Abraham, Moses and Jesus. According to his teachings, he received directly from Allah (“God” in Arabic) a holy book called the *Quran*, transcribed originally in Arabic. Jews, Christians and Muslims believe that Adam and Eve, the first human beings in their traditions, committed a crime and defied God in the Genesis by eating the fruit of the forbidden Tree of Knowledge, and as punishment they lost their immortality in Paradise.

Judaism, Christianity and Islam are commonly referred to as Western or Abrahamic religions. They have many similarities and, specifically regarding immortality, they believe in the final resurrection of the body. That is why the bodies of the dead are not normally burnt but buried. Spiritual immortality is considered eternal for good (Heaven) or for bad (Hell) after a Final Judgment.

Table: Basic Comparative Analysis of Western and Eastern Religions

Western (Abrahamic) Religions	Eastern (Vedic) Religions
Judaism, Christianity, Islam	Hinduism, Buddhism, Jainism

One God	Many Gods or none
Judgment Day	No Judgment Day
Universe has Beginning and End	Universe Exists in Endless Cycle
Eternal Heaven/Hell	No Eternal Heaven/Hell
Free Will	Law of Karma
Congregational Practice	Individual Practice
More Carnivorous Diet	More Vegetarian Diet
Prophets (from God)	Meditation (to God)
God's Law and Human Sin	Human Suffering and Soul Liberation
Scriptures are Authority	Scriptures are Guides
For the Peoples of the "Book"	For All Peoples and All Books
Worship at Setup Times	Worship is Continuous
Linear Time	Cyclical Time
One Life	Many Lives
Resurrection	Reincarnation
Burial	Cremation

Thousands of kilometers to the East of Mesopotamia is the Indus valley, where the oldest living religion began. Hinduism, as it is called today, is the historical religion of the Hindus, the people living beyond the Indus river, according to the Persians. Hindus themselves used to call their own religion Sanatana Dharma ("The Eternal Way" in Sanskrit).

The Indus valley civilization began before 2,000 BCE, when Aryan tribes started migrating and pushing south the original Dravidian inhabitants. The religion of the Hindus has no founding prophet and evolved slowly through centuries of oral traditions until around 1,500 BCE when the first *Vedas* ("Knowledge" in Sanskrit) were written. Around the eighth century BCE the *Upanishads* were started to be compiled, and later the *Ramayana* and the *Mahabharata* (including the *Bhagavad Gita* or *Song of God*) epics were written.

Hindus normally believe in many Gods (male or female, earthly or heavenly, animal or human-like) even though the ultimate reality, Brahma, is only one. Brahma himself consists of three other main deities forming the Hindu Trimurti (“Trinity” in Sanskrit): Brahman (the Generator or Creator), Vishnu (the Organizer or Maintainer, usually represented as one of his ten avatars, the most famous of which are Rama and Krishna) and Shiva (the Destroyer).

During the sixth century BCE, several classical schools of thought developed within Hinduism. That was the time when the Buddha (the “Enlightened One” or the “Awakened One”, whose original Hindu name was Siddhartha Gautama) started a new movement that eventually became known as Buddhism. Nearby, also in India, another tradition was formalized by Vardhamana Mahavira (the twenty-fourth Tirthankara or “Teacher”). This religion is known as Jainism (“jaina” means “to conquer” in Sanskrit), which means “conquering” to achieve “moksha” (“liberation” in Sanskrit) from “durkha” (“suffering” in Sanskrit).

Hinduism, Buddhism and Jainism believe in a cycle of birth-death-birth called “samsara”. The purpose of life is to escape from this cycle of suffering (“durkha”) through liberation (“moksha” in Hinduism and Jainism and “nirvana” in Buddhism). Hindus, Buddhists and Jains accept reincarnation according to the law of “kharma” (Sanskrit word usually translated as the principle of cause and effect, action and reaction) and normally cremate their dead people so that the soul is completely liberated from its former body.

Both Western (Abrahamic) and Eastern (Vedic) religions believe in spiritual immortality, but their ideas are very distinct. Additionally, other minor religions and sects have different views on immortality, which complicates much further the simple scenarios explained before. Religions have been a way to express the human wish for immortality and an afterlife. Most people fear death, fear an end, fear the unknown. That is why through the years, tales of an afterlife have been used to comfort those who believed in them. Resurrection and reincarnation were simply religious rationalizations of the human fear of death.

1.3. RELIGION: THE FUTURE

It is not easy to say what might happen in such a controversial topic as religion, and as somewhat said ironically: “it is very difficult to predict, particularly about the future”. However, some emerging trends are evident.

Even if today it is called just mythology, the Egyptian religion lasted over 3,000 years, and comforted millions of people who believed in immortality. Three millennia is more than twice the time that Islam has existed, and many centuries more than Christianity or Buddhism. What will happen to Islam in the future? Or Christianity and Buddhism? Will they also be considered mythologies then?

In the past, many people who did not adhere to the “main” religious tradition of their geographical area were looked down and even considered heretics. There have been many internal persecutions and external religious wars, the Inquisition, the Crusades, the Holocaust, the pogroms, religious cleansings and several domestic and international “jihad” (“struggle” in Arabic) are some of the better known examples.

There were very few prominent non-religious people until the last few centuries. Even the likes of Galileo and Newton, while very respected scientists, had strong religious beliefs. Pascal even constructed his famous religious “wager” to recommend that it was very advantageous to believe in God. Voltaire and Laplace, on the other hand, did publicly express their doubts about God and religion. Later on, Darwin was made fun of when his theory was described as humans descending from apes and not from angels. Answering back, communist founder Karl Marx defined religion as “the opium of the people”, English philosopher Bertrand Russell said that “religion is something left over from the infancy of our intelligence, it will fade away as we adopt reason and science as our guidelines” and Extropian philosopher Max More defines religion as “entropic”.

The last couple of centuries have been a time for much confrontation between science and religion, but also a time of religious proliferation. The Bahá'í Faith was born, the Theosophical Society started, the Rastafarians appeared, the Neo-Pagans resurfaced, the Scientologists surfaced, the New Age movement evolved and the Raelians materialized, among many others. Also several denominations and sects appeared, like the Mormons, the Jehovah's Witnesses, the Pentecostals and the Moonies among Christians, the Hare Krishnas (ISKCON) and the Transcendental Meditation (TM) movement among the Hindus, the Ismailis among the Muslims, the Falun Gong among the Chinese, etc.

The non-religious movement has also grown, even faster. Since the English intellectuals Thomas H. Huxley invented the word “agnostic” in 1869 and Annie Besant wrote *The Gospel of Atheism* in 1877, the agnostic and atheistic populations have grown dramatically. According to Adherents.Com, 14% of the world population is non-religious (atheists, agnostics, secular humanists, etc.) and numerically represents the “fourth largest religion” in the planet

after the Christians, Muslims and Hindus. Other estimates give numbers as high as 20% for the non-religious population today. Additionally, a new movement called the “Brights” started in 2003; they define a Bright as “a person who has a naturalistic worldview, *free of supernatural and mystical elements*”. The movement includes any individuals who say they fit the Brights’ definition: atheists, agnostics, humanists, skeptics, rationalists, philosophers, Buddhists, cultural Jews and Catholics, two Nobel Laureates and even a Presbyterian minister.

There have also been signs of rapprochement between science and religion. For example, the famous scientist Albert Einstein said that “there is no conflict between science and religion, science asks what the world is, and religion asks what humankind and society should become”. Einstein additionally expressed this appreciation of Buddhism: “the religion of the future will be a cosmic religion. It should transcend a personal God and avoid dogmas and theology. Covering both the natural and the spiritual, it should be based on a religious sense arising from the experience of all things, natural and spiritual, as a meaningful unity. Buddhism answers this description”. Maybe that is why, many years later, the respected Tenzin Gyatso, the 14th Dalai Lama, has openly stated that Buddhist goals are “the same as those of Western science” to “serve humanity and to make better human beings”. The Dalai Lama has also gone on record as saying that he believes an artificial consciousness is attainable and should be treated and respected as a person, and he has also indicated that humans may reincarnate in a computer. Whatever the realities of resurrection and reincarnation, science now has a lot to say about physical immortality.

2. SCIENCE AND IMMORTALITY

Religion’s solution to immortality, from a scientific point of view, is just a psychological expression of life’s deepest yearnings to remain alive. Since the beginning of life, to the evolution of intelligence and technology, life’s primary goal has been to preserve itself, in other words, to become immortal.

2.1. THE PURPOSE OF LIFE

To understand life’s ultimate purpose, a definition of life from an objective point of view has to be worked out. First of all, it is important to understand that life is not something on its own. Life is the behavior of a system which makes it *alive*. If there is no living system, there is no life. Therefore, the real question here is not what life *is* but

what can a system *do* to be considered alive. This is actually not a hard question to answer. The problem arises when we try to include, as part of our definition, specific processes or methods used by organisms we know well, instead of analyzing the results and actual objectives of those processes. If an organism behaves in a certain way, is such behavior its final purpose or is it just doing this to achieve a more important goal? When we examine each process and realize its purpose, we find that there are many methods to achieve the same objective and very few objectives essential to all living creatures. It would be “biocentric” to believe that these are the only possible methods for a system to remain alive, or that they are all required. Let us look at some of them:

Metabolism is a process by which living systems *exchange energy and resources with their surroundings to be able to preserve their functioning*. Some kind of metabolism must be required for life, but any similar process, no matter how it works, as long as it fulfils the same objective, is also valid, even if it is not what biochemists would normally call metabolism.

Reproduction is a method used by some organisms to *preserve their functioning with respect to their environment* by creating new separate individuals of their same kind. If an organism finds an alternative way of preserving its functions with respect to its environment, it might not need to reproduce anymore. Also, if an organism is born sterile we do not consider it dead. Even a cell that cannot divide, as long as it can metabolize and move, is still alive.

It is important to make a distinction between reproduction and **replication**. While reproduction creates a new and independent cell or organism, replication is the process by which an organism makes copies of its internal structures to develop, grow or repair damage. Therefore, when organisms grow, or a wound is healed, cells inside the body are actually replicating, not reproducing. On the other hand, when a baby is born and it becomes a separate being, we are reproducing. Immortal beings might be able to use replication, instead of reproduction, as a method to *preserve their functioning with respect to their environment*.

Evolution is a method used by living systems to *improve their functioning with respect to their environment* through mutation, reproduction and death. If a species does not evolve because it has reached an optimal state of adaptation to its environment, it is not considered dead. Evolution does not work at the individual level, but at the species level. Species evolve, not organisms. Therefore, evolution is not a requirement for life but a method to preserve the species in exchange for the individual organism’s life.

Development is also a method used by living systems to *improve their functioning with respect to their environment*, but through internal change. Most organisms which reproduce also develop to be able to reach a mature state of functioning after being born. If an organism reaches, or is born with, an optimal state of functioning, it would not have to develop but would still be considered alive; therefore, development is not a requirement for life. It is the only way, though, for an individual organism to improve its functioning. Development can be considered, in a way, an organism's internal evolution by means of replication instead of reproduction. It is directed, however, by the organism's genetic programming, which makes it more predictable than evolution. John Smart, Chair of the Institute for Accelerated Change, argues that evolution and development work together in what he calls evolutionary development. Evolution creates random variation while development takes this variation and turns it into a more predictable convergent selection.

After reviewing many definitions of life, only three common objectives were found: first, living systems must be *open systems*, which means they can *exchange energy and resources with their surroundings*; second, this *exchange of energy and resources*, which all open systems do, is done *to preserve functioning* in living systems; and third, this *functioning depends on the environment*. Combining these three points, we can obtain a general definition that fits all possible life forms: A system is alive when it *exchanges energy and resources with its surroundings to preserve an optimal state of functioning with respect to its environment*.

The definition proposed above is general enough to include all known life forms and to allow for other living systems not yet created or discovered. Artificial or immortal beings would also fit this definition even if they do not reproduce or evolve. As long as they *exchange energy and resources with their surroundings to preserve an optimal state of functioning with respect to their environment*, they are alive and they will find new ways to remain so.

2.2. BIOGENESIS: THE CREATION OF LIFE

There are many theories on how the first cells formed on our planet about 4,000 million years ago. Some believe RNA chains formed first and started to replicate into proteins which created all different cell components including cell membranes and DNA. Others think cell membranes formed first and RNA, DNA and all other cell components developed inside. And yet others believe cell membranes and RNA formed separately and then joined by means of a symbiotic process.

Whichever way it happened, there had to be a period of time when the cells did not know how to reproduce. It is hard to imagine the first cell already knowing how to divide because cell division is a very complicated process that requires many different internal components working together. Metabolism and internal replication had to exist before the formation of the first genes with information on how to divide the whole cell. In the mean time, all the cell could do was to stay alive as long as possible until some environmental process killed it. The initial aim of the first cells was to live forever, adapt and improve by changing and developing; but the first cells were weak and development was slow so they were destroyed by the environment. Life, at this stage, could not survive without reproduction.

Millions of cells which did not know how to divide must have been created before the first reproducing cell appeared, maybe by chance but probably helped by some kind of symbiosis. After several failed attempts, about 3,800 million years ago, the first prokaryotic cells developed the ability to divide and clone. Those which cloned faster than they were destroyed survived and inherited their genes to their daughter cells, while the others died. Due to the same environmental conditions which were destroying the original organisms, these cells mutated and new cells with different properties were created. Those mutations which favored reproduction and adaptation were inherited to future generations, the rest disappeared. The first colonies of bacteria were thus formed.

Evolution had won over development as the means for adaptation, and reproduction became the only way for cell colonies to survive in exchange for the initial purpose which was the immortality of the individual cell. This was, however, a necessary step at this stage because development was too slow. Without reproduction and natural selection, it would have taken much longer for those original cells to develop into multi-cellular organisms, or maybe it would have never happened.

A similar process occurred when the first multi-cellular organisms formed. First, about 2,000 million years ago, some cells evolved into eukaryotic cells by forming a nucleus inside. They were still unicellular organisms because they *reproduced* in order to form separate and independent beings, but the formation of a nucleus inside the cell paved the way for the first multi-cellular organisms to evolve about 1,000 million years later.

Instead of dividing into separate daughter cells to form colonies, eukaryotic cells found a method to *replicate* into functional groups to try to create an immortal organism. Some cells would die after producing more cells, but the

group could become immortal if the multi-cellular organism remained alive. If bacterial colonies were able to survive this way, why couldn't multi-cellular organisms do it?

It is possible that many multi-cellular life forms could not initially reproduce but, instead, lived for a very long time. Some trees are known to live for thousand of years but, even thousands of years is not long enough if you do not reproduce. Again, the same environmental conditions which did not allow the individual cells to be immortal also killed all non-reproducing multi-cellular organisms. In addition, having to perform a shared function made the whole group vulnerable because cells depended on each other. If too many important cells died, the whole group died. Once cells developed into groups, they differentiated and lost their ability to survive on their own. Also, cells could not replicate forever when performing a common function because, unlike colonies, they had to maintain a certain functional size and form. If cells started to divide indefinitely, like bacteria do, tumors were created and the organism died. For this reason cells were programmed to stop dividing after a certain number of generations; if this programming failed, cancer formed.

Again, the only solution to be able to survive against environmental threats was reproduction. In order for multi-cellular organisms to reproduce, some undifferentiated cells were liberated from the group to develop into a new independent organism. This is similar to the way bacteria survive. The colony only dies if all cells are killed, but if one cell survives, a new colony is immediately created. With sexual reproduction, only half a cell is undifferentiated and, when liberated, it joins another half cell from the opposite sex and a new cell with a new combination of genes is formed. This introduces an even greater genetic variation in addition to those produced by mutation, increasing the probability of finding a beneficial combination.

During the last 4,000 million years, reproduction has been the only method for species of multi-cellular organisms to remain alive. If more organisms are born, more organisms survive beyond their reproductive age and the species does not become extinct. The life of each individual is not important as long as they reproduce. Even death has been programmed into the organism's DNA to make sure they do not compete for their offspring's resources. The species has thus become the new immortal organism. But even using this method, and because of extreme environmental conditions, some species become extinct when all organisms die before being able to reproduce. Evolution had to find a better way to avoid death.

2.3. INTELLIGENCE: THE NEW FACTOR FOR SURVIVAL

Adaptation of some multi-cellular organisms to new environmental conditions favored the creation of a central nervous system which made them more intelligent. With this intelligence it became possible to better defend against environmental threats. Massive reproduction has been a very successful surviving method, but evolution found an even better way: having less offspring but taking such good care of them to make sure they do not die before they reproduce. It is no longer the *quantity* but also the *quality* of life the surviving factor of the species.

Biologists use an r/K scale to classify different species according to their surviving method: r-selection for more reproduction and K-selection for more nurturing. Species which respond to the r-selection do not take care of their offspring but have thousands of them, so they survive by *quantity*; while species which respond to the K-selection are more concerned with the *quality* of life of their offspring and do not reproduce that much. All species fall somewhere in between the r-end and the K-end of the scale. Bacteria and insects respond more to the r-selection while mammals respond more to the K-selection. Interestingly, species with bigger and more developed central nervous systems tend to fall more on the K-side of the scale. Additionally, evolution seems to have been favoring the K-selection: multi-cellular organisms are more K than unicellular organisms, reptiles are more K than insects, mammals and birds are more K than reptiles, and primates are more K than rodents.

Theoretically, the next evolutionary step would be a species which responds 100% K-selection and 0% r-selection. This would mean that the species would not reproduce at all, and the only way for it to survive would be if each individual lived forever. For a species to reach such a degree of care, it would have to be extremely intelligent to be able to defend against all possible environmental threats and maintain its internal functions intact by repairing molecular decay.

For the first time in life's history, and thanks to intelligence and science, development is faster and more efficient than evolution as a method to *improve functioning with respect to the environment*. As mentioned earlier, development, which depends on internal replication, is usually preprogrammed and more predictable than evolution, which depends on mutation and reproduction. Through intelligent design, these programs could be modified and better development programs could emerge by using evolutionary methods, like neural networks and genetic algorithms. Hence, a more stable and predictable internal evolutionary development would be possible.

2.4. BECOMING IMMORTAL

How could humans take that next evolutionary step and become the first immortal species on Earth? First, we have to understand our own internal replication both at the procedural level and at the molecular level; second, we have to reprogram our genes to get rid of evolution's primitive alternative to immortality: cellular death; third, we have to avoid or repair cellular decay; fourth, we have to defend ourselves against any environmental threat; and finally we have to implement an efficient process of internal evolutionary development to *improve our functioning with respect to the environment*.

Understanding: This first step seems to be almost solved. Darwin's theory of evolution makes it possible to understand the process by which organisms change through mutation, reproduction, natural selection and death. Applying this concept to individual cells, it was obvious that there had to be an internal code which directed life's processes and was inherited to newly created cells. In 1953, James Watson and Francis Crick found this code: the DNA molecule.

It is interesting to note that the real function of DNA is not to mutate, reproduce and evolve. The DNA code is actually used by the cell to develop its internal structures through the process of replication. Of course, reproduction is also coded, but it is a secondary function. By analyzing the cells inside the human body, we can see that only one type of cells is concerned with reproduction and most of them are actually never used. DNA's real purpose is to keep the cell alive.

To finally understand our own internal replication process, it is necessary to be able to read each gene in our DNA code and interpret its function. The Human Genome Project took care of the reading part, and now the functional part needs to be completed. The good thing is that not every gene needs to be interpreted in order to become immortal, only those concerned with cellular death.

Reprogramming: Once the function of those genes related to cellular death is understood, it might be possible to start reprogramming their DNA to make the cell immortal. Theoretically, immortal cells could be created by not limiting the number of times they divide but, in the process, we risk creating cancer cells. When DNA is replicated inside the cell, there is the possibility of errors being introduced in their code, thus producing cellular decay. If the code which tells the cell to divide is mistakenly activated, the cell starts to divide indefinitely and tumors form. If

those cells also fail to stop dividing after a certain number of times, tumor could turn into cancer. So, before cells are reprogrammed to not stop dividing, we should make sure to know how to keep them healthy.

Repairing: Cellular decay is usually caused by waste molecules, or free radicals, produced by the cell's own metabolic process. When these free radicals react with the cell's DNA, its code is altered and errors are introduced. These errors also have an effect on the cell's metabolic process, making it less productive and creating even more free radicals, a cycle which ends up killing the cell. How do we stop cellular decay? One possible way is by restricting caloric intake to slow down the body's metabolic rate and reduce the production of free radicals. But a better solution, maybe ten years from now, might be to implant stem cells inside our bodies. Stem cells are undifferentiated cells which can grow into any type of tissue. If we could make all cells in our bodies act like stem cells, we could regenerate any damaged tissue including those lost by an accident. Theoretically, even if we lost an arm, it should grow back. An even better alternative might be to use nanobots (tiny robots the size of molecules) which act like cellular organelles that repair any damage. We could even create artificial cells to replace lost ones, eventually replacing the whole body with an artificial one.

Defense: Even if we become theoretically immortal, we could still die by an external cause, like an accident, a disease, or a virus. Initially, stem cell and nanobot implants should be able to prevent any disease or virus attack and, maybe, mitigate some light accidents by regenerating lost tissue. Eventually, we could prevent any catastrophic accident from killing us by replacing all our cells with artificial ones and by merging with cybernetic technology.

Development: Finally, we have to improve ourselves. Just like 4,000 million years of evolution were needed to create human beings, three million years of technological development have created the means to achieve immortality. Once we merge with our technology, it will be this technology which will replicate and develop into even better technology. We will be acting like eukaryotic cells did 1,000 million years ago by creating extensions of ourselves instead of reproducing into separate beings. Maybe the cycle will repeat itself and these "meta-organisms" will decide to reproduce into more "meta-organisms" but, this time, it will be by choice and not as the only means to survive.

Our cells did not have the intelligence to become immortal, but they were able to create beings which could. Let us not waste this transcendental opportunity. The goal of human history and civilization is the conquest of death. The meaning of life is life. The goal of life is more and better life. Immortality is our evolutionary destiny.

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