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From cosmos to consciousness: The scientific and theological evolution of creation

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Abstract

This study aims to interpret the holistic journey of creation in light of both scientific inquiry and theological thought. The Science of Evolution is considered a discipline that accurately explains the true-life stories (life cycles) and transformation processes of all creatures (animate, inanimate, etc.) through scientific principles (Demirkuş, 2018;2023). The evolutionary transformation of all creatures, from cosmological origins to the stage of cultural consciousness, is interpreted in the light of natural sciences and as a manifestation of divine truth (Ayala, 2007). This approach sets an interdisciplinary tone by addressing the complex narrative of universal creation with a comprehensive and balanced perspective. How science and theology come together in an effort to understand a singular phenomenon such as creation is the basis of this article. This approach treats science as two complementary perspectives that explain the 'how' and theology as 'the why' and interprets creation as a meaningful process.

Keywords: Evolution Science; Theology; Creation; Cosmology; Abiogenesis; Cultural Evolution

1. Introduction to the great journey of existence

This study aims to examine the complex narrative of universal creation from both scientific and theological perspectives. Although empirical science and faith-based theology are often perceived as distinct or conflicting fields, this study aims to delve deeply into their relationship. John Polkinghorne's work, which categorizes the relationship between science and religion as conflict, independence, dialogue, and integration, enriches the intellectual framework on this subject (Polkinghorne, 2006). Francisco Ayala's view that Darwin's theory offers a solution to the problem of evil, thus being a "gift" to religion, demonstrates that these two fields of knowledge can not only coexist but can achieve a complementary understanding (Ayala, 2007). This report moves beyond a simple "science versus religion" dichotomy, approaching truth with a more holistic, nuanced, and sophisticated tone.

1.1. The Intersection of Science and Faith

The universal journey of creation is not merely a scientific process but also an ontological question of existence and meaning (Ayala, 2007). From this perspective, evolution is the transformation of what exists in Allah's knowledge into creation in the

kawnī (primordial) order. This interpretation suggests that evolution is not accidental but a manifestation of divine wisdom; scientific reality does not contradict theological interpretation, but rather complements it and offers a deeper perspective (Nasr, 1993).

The relationship between science and religion has been defined in various ways throughout history and today: conflict, independence (non-overlapping magisteria or NOMA), dialogue, and integration (Wikipedia, n.d., Relationship between religion and science). Many leading scientists, philosophers, and theologians, such as Augustine, Thomas Aquinas,

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Francisco Ayala, Kenneth R. Miller, and Francis Collins, have argued for compatibility or mutual dependence between religion and science (Wikipedia, n.d., Relationship between religion and science). Stephen Jay Gould's concept of NOMA suggests that science and religion address fundamentally separate aspects of human experience. Science relies on empirical evidence derived from the natural world, while religious belief is not dependent on empirical evidence and often involves supernatural powers that cannot be studied by science (Wikipedia, n.d., Relationship between religion and science). Ayala's view that science and God are not interchangeable also aligns with this approach (Ayala, 2007).

Physicist and Anglican priest John Polkinghorne views both science and religion as "efforts in the quest for truth" (Polkinghorne, 2006). Polkinghorne states that science is "an impersonal encounter with the physical world," while theology is "reflection upon a transpersonal encounter with the sacred reality of God". Despite these different "wavelengths," he states that both use a "bottom-up" way of thinking, which makes them colleagues in the common search for truth (Polkinghorne, 2006). Polkinghorne also notes that a purely physical reductionist stance, claiming only matter and energy exist, is itself a metaphysical statement, implying that both science and religion offer frameworks for understanding reality (Polkinghorne, 2006).

In his work, "Darwin's Gift to Science and Religion," Francisco Ayala argues that believing in evolution does not contradict Christianity. On the contrary, he asserts that Darwin's theory of natural selection is a "gift" to religion by offering a solution to the ancient "problem of theodicy"—how evil can exist in a universe created by a benevolent and omnipotent God. Ayala states that natural selection explains nature's apparent "cruelty" (e.g., predators, diseases) without requiring divine planning. Furthermore, he criticizes advocates of Intelligent Design (ID) with the "fallacy of two explanations"; he states that ID does not propose testable hypotheses on its own and therefore cannot be considered science, but gains credibility from perceived failures of Evolution theory (Ayala, 2007).

Seyyed Hossein Nasr, in his work "Knowledge and the Sacred," advocates for a "sacred science" (*scientia sacra*) that draws from revelation and intellectual intuition, as opposed to modern sciences based solely on sensory perception and reason (Nasr, 1981). Nasr emphasizes that modern knowledge has become detached from its divine source and that there is a need for the "sacralization of knowledge" (Nasr, 1981). By defining the cosmos as "a manifestation of Ultimate Reality" and "a theatre where the Divine Names and Qualities are reflected," he calls for the reestablishment of traditional cosmology that recognizes hierarchical levels of existence (Nasr, 1981).

Although the "truth" sought by science and religion differs in terms of their methods (empirical versus ontological/revelation), they do not have to contradict each other. On the contrary, they can provide complementary layers of information about existence, purpose, and meaning. This situation implies that reality is too rich and multidimensional to be fully comprehended through a single lens. This also invites a more holistic and in-depth engagement with the mysteries of creation.

2. Cosmic Dance: The Birth and Evolution of the Universe

2.1. The Big Bang and the Expansion of the Universe

The scientific understanding of the universe's origin begins with the Big Bang, which occurred approximately 13.8 billion years ago (Planck Collaboration, 2020). This cosmological evolutionary process is considered the initial impulse that triggered the emergence of space, time, and matter (Planck Collaboration, 2020). The Big Bang is understood as the moment when energy transformed into matter and light, following a very brief period of cosmic inflation during which the universe expanded faster than the speed of light (NASA Science, n.d., Cosmic History). Just one second after the Big Bang, the universe consisted of an extremely hot (10 billion degrees Celsius) soup of light and particles (NASA Science, n.d., Cosmic History). Within the first five minutes, most of today's helium had formed, and the universe had expanded and cooled enough to halt further element formation (NASA Science, n.d., Cosmic History).

The idea that the universe is continuously expanding is confirmed by Hubble's law, which is supported by the redshift of distant galaxies and quasars (Wikipedia, n.d., Big Bang). This indicates that these objects are moving away from us and that the universe is expanding uniformly everywhere. This cosmic expansion was predicted by Friedmann in 1922 and Lemaître in 1927, based on general relativity (Wikipedia, n.d., Big Bang). Planck 2018 results show good consistency with the standard spatially flat 6-parameter Lambda CDM cosmology, based on recent measurements from cosmic microwave background (CMB) anisotropies (Planck Collaboration, 2020). Key parameters include dark matter density ($\Omega ch2=0.120\pm0.001$), baryon density (0.0224 ± 0.0001), and the Hubble constant (67.4 ± 0.5 km s−1 Mpc−1) (Planck Collaboration, 2020). These results are remarkably stable and do not provide compelling evidence for extensions of the Lambda CDM model, though there are some tensions with local measurements of the Hubble constant (Planck Collaboration, 2020).

This extraordinary precision of modern cosmology solidifies the Big Bang model and its parameters, while also revealing the extent of existing knowledge gaps, such as the nature of components like dark matter and dark energy that constitute most of the universe's mass-energy content. This suggests that the phrase "Transformation of Existence into Light" mentioned in the original document becomes even more meaningful when considering that the majority of the universe still remains "dark". It emphasizes that scientific understanding is a dynamic and continuously evolving process, constantly pushing the boundaries of what is known and opening up space for philosophical reflections on the nature of reality beyond what can be directly observed.

2.2. Cosmic Microwave Background and the Birth of First Stars

The cosmic narrative addresses the cooling of the universe and the subsequent formation of the first large-scale structures. Following the initial expansion, the universe underwent a critical transformation that set the stage for the emergence of light and the building blocks of galaxies, stars, and planets (Planck Collaboration, 2020). Approximately 380,000 years after the Big Bang, the universe had cooled enough for atomic nuclei to capture electrons; astronomers refer to this period as the recombination era. This event had two significant effects: first, with most electrons now bound to atoms, the "cosmic fog" cleared, and the universe became transparent, allowing light to travel great distances for the first time. Second, the formation of these first atoms produced their own light, and this glow can still be detected today as the cosmic microwave background (CMB) (NASA Science, n.d., Cosmic History). This detailed, all-sky image of the CMB reveals 13.8 billion years of temperature fluctuations, which are considered the "seeds" that evolved into the galaxies we see today (NASA Science, n.d., Cosmic History).

After the cosmic microwave background, the universe entered a period known as the "Dark Ages" for about 200 million years, during which it remained dark as there were no stars to shine. As the universe continued to evolve, denser clumps of matter in this dark void heated up due to gravitational collapse. Eventually, these centers became hot enough for nuclear fusion to occur, marking the birth of the first stars. These early stars were colossal, estimated to be 30 to 300 times larger and millions of times brighter than our Sun. Initially, the intense starlight from these newborn stars could not travel far as it was scattered by the relatively dense gas around them. However, ultraviolet light emitted from these stars ionized hydrogen atoms in the gas, splitting them into their constituent electrons and protons. As this reionization process progressed, starlight spread further, breaking apart more hydrogen atoms. When the universe was approximately 1 billion years old, stars and galaxies had transformed almost all of this gas, making the universe transparent to light as we observe it today (NASA Science, n.d., Cosmic History).

The cosmic narrative reveals a remarkable transformation, from the universe's initial fiery state through a process of cooling and self-organization, from primitive plasma to transparency, and then through a "Dark Age" to illumination by the first stars. This intricate sequence is a testament to the universe's intrinsic complexity and its tendency toward self-illumination; where even periods of apparent emptiness or lack of structure are fundamental preconditions for the subsequent emergence of light, galaxies, and the conditions necessary for life. This can be interpreted as a cosmic "unfolding" or "becoming" that resonates with theological concepts of creation as a continuous and purposeful process.

2.3. The Mystery of Dark Matter and Dark Energy

The enigmatic components that dominate the universe's composition, yet remain largely invisible, have influenced the formation of galaxies, stars, and planets as a cumulative product of billions of years of cosmic evolution (Planck Collaboration, 2020). A groundbreaking discovery in 1998 revealed that the universe's current expansion was not slowing down as previously thought, but accelerating. This observation was made by noting that certain supernovae appeared fainter than expected, indicating they were moving away at a faster rate (NASA Science, n.d., Cosmic History). Scientists currently suspect that a mysterious substance they call dark energy is responsible for accelerating this cosmic expansion (NASA Science, n.d., Cosmic History). Planck 2018 results provide precise measurements for dark matter density (Ωch2=0.120±0.001) and confirm that the dark energy equation of state parameter (w0=−1.03±0.03) is consistent with a cosmological constant, strongly supporting dark energy as the driving force behind the accelerating expansion (Planck Collaboration, 2020).

Despite these precise measurements and strong observational evidence for their existence and effects, the fundamental nature of dark matter and dark energy remains one of the greatest unsolved problems in modern physics (Wikipedia, n.d., Big Bang). Rather than being directly observed, they are inferred from their gravitational effects (Wikipedia, n.d., Big Bang). Although the existence and dominant influence of dark matter and dark energy are precisely measured through their gravitational effects, their fundamental nature remains deeply mysterious. This highlights the current limits of empirical observation and the critical role of theoretical inference in scientific understanding. It also opens up significant space for philosophical and theological reflections on the unseen or incomprehensible aspects of creation; suggesting that reality extends far beyond what our senses or current scientific tools can directly perceive. This enduring mystery can lead to a deeper appreciation of the universe's intrinsic wonder and complement the quest for scientific explanation.

3. The First Sparks of Life: The Emergence of Molecular Codes

3.1. From Inanimate Matter to Life: Theories of Abiogenesis

This section will address the initial, critical steps in the emergence of life from inanimate matter, namely chemical evolution. This stage represents the first major transformation where the fundamental molecular codes of life began to form (Britannica, n.d., Abiogenesis). Abiogenesis is defined as the process by which life arises naturally from non-living matter, such as simple organic compounds (Britannica, n.d., Abiogenesis). The prevailing scientific hypothesis suggests that the transition from non-living to living on Earth was not a single event but a gradual process involving increasing complexity. This process likely included the formation of a habitable planet, prebiotic synthesis of organic molecules, molecular self-replication, self-assembly, and autocatalysis. Although the full transition from non-living to living has never been experimentally observed, numerous proposals have been made for different stages of this complex process (Wikipedia, n.d., Abiogenesis).

As far as we know, life operates through the unique chemistry of carbon and water, built upon four main chemical families: lipids for cell membranes, carbohydrates like sugars, amino acids for protein metabolism, and nucleic acids (DNA and RNA) for inheritance mechanisms (Wikipedia, n.d., Abiogenesis). Every successful abiogenesis theory must explain the origins and interactions of these critical molecule classes (Wikipedia, n.d., Abiogenesis).

The "Primordial Soup Theory," independently proposed by J.B.S. Haldane and Aleksandr Oparin in the 1920s, suggests that life emerged from chemically rich shallow pools on the Earth's surface, with energy provided by intense UV radiation or lightning strikes (Britannica, n.d., Abiogenesis). One of the main problems with this theory is that the resources of such isolated systems are limited compared to the vastness of the oceans. Other alternative explanations for abiogenesis include "Stable Environment Theories," which propose that life slowly evolved in stable environments such as thick ice sheets (creating stable, isolated oceanic environments during ice ages) or mineral-rich clay, rather than extreme energy gradients. The main disadvantage of these theories is that they rely more on chance for the emergence of life (Marine Madness, 2020). Panspermia, on the other hand, is a theory that postulates life originated elsewhere in the cosmos and reached Earth by surviving within meteorites or other space debris (Marine Madness, 2020).

Abiogenesis is a complex, multi-stage process rather than a single event. The difficulty of explaining the spontaneous emergence of self-replicating, information-carrying molecular codes from simple inorganic matter highlights the profound complexity of the origin of life. This situation suggests the existence of a fundamental order rather than mere chance. This supports a view where creation is seen as a complex unfolding.

3.2. Miller-Urey Experiment and the Role of Hydrothermal Vents

The Miller-Urey experiment was a turning point in the field of prebiotic chemistry. Published by Stanley L. Miller in 1953, this experiment aimed to test whether organic compounds, particularly amino acids, could form by simulating primitive Earth conditions (Miller, 1953). The experimental setup involved heating water to simulate evaporation from oceans, then mixing this water vapor with methane (CH_4), ammonia (NH_3), and hydrogen (H_2) to simulate the primitive atmosphere. Electrical discharge was applied to this gas mixture. After only two days of experimentation, glycine was detected, and after one week, an oily substance formed inside the flask, and the water turned yellowish-brown. Analyses showed that in addition to glycine, various amino acids such as aspartic acid, α-alanine, β-alanine, and α-amino-n-butyric acid were also formed. Surprisingly, the products were not a random mixture of organic compounds but a relatively small number of compounds of biochemical significance (Miller, 1953).

However, the current scientific view suggests that the primitive atmosphere was not as reducing as Miller-Urey assumed, but rather weakly reducing or neutral, which would reduce the quantity and variety of amino acids produced. This has increased the importance of other potential reducing environments for the origin of life, particularly deep-sea hydrothermal vents. Hydrothermal vents are considered strong candidates for the origin of life. These environments provide necessary conditions for abiogenesis, such as a continuous source of chemical energy, microscopic compartments, hot fluids, chemical gradients, and protection from radiation/impacts (Wikipedia, n.d., Abiogenesis). Nevertheless, there are also arguments against vents, such as low concentrations of prebiotic compounds, their inability to concentrate materials due to their open systems, the lack of some essential elements, and conditions that might inhibit macromolecule polymerization (Wikipedia, n.d., Abiogenesis).

The RNA World Hypothesis proposes an early Earth where self-replicating and catalytic RNA molecular codes existed in the absence of DNA or proteins (Wikipedia, n.d., Abiogenesis). The critical role of RNA in the translation process in modern organisms and the ability of small RNAs to catalyze all chemical groups and information transfers necessary for life support this hypothesis (Wikipedia, n.d., Abiogenesis). Abiotic synthesis of RNA components (e.g., from formamide and HCN) and RNA's self-replicating ability suggest that natural selection would favor the proliferation of autocatalytic sets (Wikipedia, n.d., Abiogenesis).

A more recent approach, Cyanosulfidic Protometabolism, demonstrates that RNA, protein, and lipid precursors can be simultaneously produced from the same starting reagents (hydrogen cyanide, acetylene, and their derivatives) and similar early Earth conditions (Patel et al., 2015). These reactions are driven by ultraviolet light and hydrogen sulfide, and can even be accelerated by a Cu(I)-Cu(II) photoredox cycle (Patel et al., 2015). This "flow-chemistry" scenario offers a plausible mechanism for the simultaneous emergence of the building blocks of life (Patel et al., 2015).

Various theories, such as Miller-Urey, RNA world, hydrothermal vents, and cyanosulfidic protometabolism, propose different yet plausible pathways for the origin of life. This indicates that the conditions for life's emergence were quite robust. The focus on common precursors and interconnected chemical reactions implies a fundamental, perhaps intrinsic, tendency for matter to organize towards life. This supports the concept of a life-prone universe rather than a singular, low-probability event.

4. The Transformation of Earth into a Stage for Life: Geological Evolution

4.1. Earth's Structural Transformations and Great Extinctions

Geological evolution encompasses the transformation of Earth's physical structure over time, and these transformations have directly influenced the evolutionary process by creating new environmental conditions for life. Geological events such as plate tectonics, mountain building, ice ages, and mass extinctions are key factors in this process (Condie, 2011). Earth formed approximately 4.6 billion years ago from the dust leftover from the Sun's birth (Dynamic Earth, n.d., Geological timeline pack). Around 4.5 billion years ago, Earth's core and crust formed, and 4.4 billion years ago, the first oceans came into being as water vapor released by volcanism cooled and fell as rain (Dynamic Earth, n.d., Geological timeline pack). All of Earth's subsystems, including the crust, mantle, core, atmosphere, oceans, and life, have worked and changed together over time. These interactions have been affected by catastrophic events such as supercontinent cycles and other major events (Condie, 2011).

There are "Big Five" mass extinction events that profoundly affected the diversity of life throughout geological time (National Park Service, 2025):

- Late Ordovician Extinction (approx. 444 million years ago): Affected marine invertebrates, linked to rapid glaciation on the Gondwana supercontinent and subsequent sea-level drop (National Park Service, 2025).
- Late Devonian Extinction (approx. 372 million years ago): Caused major losses in marine life, associated with various causes such as global cooling, volcanic activity, or excess nutrients (National Park Service, 2025).
- Permian-Triassic Extinction (approx. 251.9 million years ago): The largest extinction event in Earth's history. Massive volcanic eruptions in Siberia led to climate change and ocean acidification, wiping out 96% of species (National Park Service, 2025).
- Triassic-Jurassic Extinction (approx. 200 million years ago): Occurred as a result of the breakup of the Pangea supercontinent, opening of the Atlantic Ocean, and associated volcanic activity, paving the way for the rise of dinosaurs (National Park Service, 2025).
- Cretaceous-Paleogene Extinction (approx. 66 million years ago): Triggered by an asteroid impact (Chicxulub crater), it brought an end to dinosaurs (except birds), allowing for the diversification of mammals (Dynamic Earth, n.d., Geological timeline pack; National Park Service, 2025).

These mass extinctions, though devastating, have also paradoxically been critical drivers of biodiversity and evolutionary innovation, enabling surviving groups to undergo evolutionary bursts and new organisms to fill ecological niches previously occupied by extinct species (Dynamic Earth, n.d., Geological timeline pack; National Park Service, 2025). Mass extinctions, though destructive, are paradoxically critical drivers of biodiversity and evolutionary innovation. This indicates that periods of disruption and "reset" are an integral part of life's long-term unfolding. This also points to the dynamic, resilient, and adaptive nature of the creative process.

5. The Diversification of Life and the Path to Humanity: Biological Evolution

5.1. Genetic Changes and Mechanisms of Natural Selection

Biological evolution explains the diversification of living organisms over generations through changes in their genetic structures (Futuyma and Kirkpatrick, 2017). This process operates through mechanisms such as mutation, natural selection, adaptation, genetic drift, gene flow, and non-random mating (Futuyma and Kirkpatrick, 2017; Bioprinciples, n.d., Evolution by Natural Selection). Mutation generates variation through errors in DNA in hereditary cells and is the raw material for evolution. Mutation rates are generally low, but when combined with other evolutionary mechanisms (genetic drift, natural selection), they can lead to significant changes in populations (Bioprinciples, n.d., Evolution by Natural Selection).

Genetic drift is the change in allele frequencies in populations by random chance. This is particularly pronounced in small or endangered populations and can lead to the complete disappearance of an allele from a population, sometimes reducing a population's ability to adapt to its environment. Natural selection occurs when the environment places pressure on a population, ensuring that only certain phenotypes successfully survive and reproduce. Galapagos finches, with their beak sizes varying according to seed availability, provide an example of natural selection. Similarly, the adaptation of rock pocket mice to their environment's color through fur coloration, protecting them from predators, is a rapid example of natural selection (Bioprinciples, n.d., Evolution by Natural Selection). These examples demonstrate how environmental pressure reduces phenotypic and genetic diversity and leads to adaptations.

While mutation and genetic drift introduce elements of randomness, natural selection provides direction to life through adaptation. This highlights the complex balance between unpredictable variation and environmental filtering. This also suggests that the creative process uses both chance and intrinsic principles to guide the diversification of life.

5.2. Epigenetics and New Dimensions of Evolution

Epigenetic variations include modifications that do not alter the fundamental nucleotide sequence of DNA but can affect gene expression and protein synthesis, influencing behavior, morphology, and physiological phenotypes. These modifications can be transmitted across generations and play a significant role as an adaptation mechanism. Transgenerational inheritance refers to the consistency of epigenetic marks between parents and offspring exposed to a specific environment or stressor as embryos or embryonic germ cells. Transgenerational inheritance, on the other hand, refers to epigenetic marks passed on to offspring who were never exposed to this environment or stressor as embryos (F1) or even as germ cells (F2); in females, this is usually the F3 generation after the stressor (Frontiers in Ecology and Evolution, 2022).

The degree of epigenetic activity and transmission of epigenetic marks varies greatly between plants and animals, as well as between vertebrates and invertebrates; plants allow for much more transgenerational epigenetics, while vertebrates, especially placental mammals, are more restrictive. Current evidence indicates that individual phenotypic trait values are determined by both genetic and environmental influences. Epigenetics serves as a mediator for short-term effects through phenotypic plasticity and transgenerational inheritance, and in some cases, for long-term (transgenerational) effects of the environment on phenotype. Even modest transgenerational transmission, such as six different methylated regions passed on to future generations after exposure to hatchery conditions in Atlantic salmon, has been shown to be ecologically relevant through experimental applications. This suggests that multi-generational epigenome transmission can offer pathways for adaptation to new and stressful environmental conditions by preparing future generations to cope with these stressors (Frontiers in Ecology and Evolution, 2022).

Epigenetics provides a layer of "environmental memory" that enables organisms to adapt to their environment faster than genetic mutation. This indicates that evolution is a more dynamic and responsive process, where environmental cues can directly affect heritable traits. This further clarifies the complex and adaptive nature of creation.

6. Consciousness and Cultural Evolution: A Creature Evolving Towards the Search for Meaning

6.1. The Development of Language and the Rise of Human Consciousness

Humans are not only a biological outcome of evolution but also beings enriched by consciousness and culture (Donald, 2001). The development of language and cultural structures such as social organization, morality, belief systems, art, and science represent a qualitative leap in human knowledge production (Donald, 2001). Studies on the evolution of language show that wild chimpanzees can change the meaning of singular calls by placing them in different call combinations; this reflects linguistic operations in human language. This suggests that chimpanzees have a complex communication system and can combine calls to create new meanings, which is similar to human language. This complexity suggests that complex combinatorial capacities may have already been present in the common ancestors of humans, chimpanzees, and bonobos. However, human language has the capacity to generate infinite meaning by combining phonemes into words and words into sentences; this process relies on linguistic rules (ScienceDaily, 2025). This is a fundamental characteristic that distinguishes human language from the communication systems of other animals.

The transition from complex animal communication to human language, especially to symbolic thought and infinite meaning generation, represents a qualitative, not quantitative, leap in evolution. This indicates a unique unfolding of cognitive capacity in humans, enabling abstract thought, meaning-making, and a profound change in our relationship with the world.

6.2. Cultural Adaptation and the Common Ancestor of Humanity

Humans, unlike other animals, are largely dependent on social learning to acquire a significant portion of their behavioral repertoires. Human cultural capacities produce adaptive strategies and knowledge that accumulate over generations. This cumulative cultural evolution includes technologies such as kayaks, blowguns, bone tools, boomerangs, and bows, as well as intangible culture like seed processing techniques, tracking abilities, and knowledge of medicinal plants. These skills and accumulated knowledge are so complex that no single individual could figure them out in a lifetime (Henrich and McElreath, n.d.).

Gene-culture coevolution and dual inheritance theory examine the interactions between genetic and cultural inheritance systems; where individual phenotypes are a combination of genetic and socially transmitted traits, which in turn affect the transmission rates of different alleles and cultural variants. Social learning enhances adaptation because it allows organisms to respond more quickly to environmental changes compared to rigid behavioral responses, especially in moderate environmental fluctuations. However, Rogers' paradox states that social learning alone does not increase overall adaptation, but can lead to higher average fitness if it allows for the accumulation of behaviors that a single individual cannot acquire in a lifetime, or if it increases individual learning efficiency. "True imitation" or observational learning (direct and accurate copying of behaviors, strategies, or symbolic knowledge) is necessary for cumulative cultural evolution and differs from simpler forms of social learning. Cognitive mechanisms driving cultural evolution include content biases (using informative cues of an idea, belief, or behavior) and context biases (such as success/prestige bias, conformity bias) (Henrich and McElreath, n.d.).

Cumulative cultural evolution functions as a separate but interacting inheritance system alongside genetics. This fundamentally alters the human evolutionary trajectory by allowing for rapid and flexible adaptation and the intergenerational transfer of complex knowledge. This highlights a unique dimension of creation where shared knowledge and collective learning become powerful drivers for the development and survival of species.

7. Theological and Philosophical Interpretation: Is Evolution the *Kawnī* Creation of Divine Knowledge?

7.1. Evolution and Divine Wisdom: A Contradiction or Complementarity?

The universal journey of creation is not merely a scientific process but also an ontological question of existence and meaning (Ayala, 2007). From this perspective, evolution is the transformation of what exists in Allah's knowledge into creation in the *kawnī* (primordial) order. This interpretation suggests that evolution is not accidental but a manifestation of divine wisdom (Nasr, 1993).

Views on evolution within the Islamic world vary: some Muslims believe that "humans and other living beings evolved over time," while others believe that "they have always existed in their present forms". Some Muslims believe that life processes on Earth began from a single point of species with a mixture of water and viscous, clay-like matter. Many Muslims, particularly Sunni and Shia Muslims and liberal movements within Islam, believe in evolutionary creationism; this view argues that the mainstream scientific analysis of the universe's origin is supported by the Qur'an (Rizqan Kareem, n.d.; Wikipedia, n.d., Islamic views on evolution). Other Islamic scholars argue that the Qur'an should be understood in its historical and literary context, and that this is consistent with the theory of evolution. This perspective emphasizes the distinction between facts and interpretations and the importance of interpreting the Qur'an in its proper context, not literally. According to this view, the relationship between science and religion does not have to be mutually exclusive; rather, they can coexist and complement each other (Bouguenaya, 2023).

However, some argue that evolution contradicts the concept of a divine creator, particularly that rejecting the belief that Adam and Eve were directly created from earth goes against Islamic principles. The emphasis on randomness and purposelessness in Evolution theory is seen by these critics as empirically, logically, and mathematically unfounded and unacceptable (Bouguenaya, 2023).

The fundamental tension between some religious views and evolution lies in the perceived randomness of natural selection versus divine intent. However, many Islamic scholars interpret evolution as a divinely guided process where divine wisdom orchestrates "natural" mechanisms. This transforms the discussion from a conflict to a complementary understanding; where the scientific "how" meets the theological "why," enriching the understanding of creation as a purposeful unfolding.

7.2. Evolutionary Approaches in Islamic Thought

Islamic scholars have integrated the evolutionary process with the concept of Allah's will and continuous creation, interpreting evolution as a divine process (Rizqan Kareem, n.d.). Specific examples of evolutionary approaches in Islamic thought include:

7.2.1. Al-Jahiz (9th century)

Considered a pioneer of the idea of evolution with his work "Kitab al-Hayawan" (Book of Animals), Al-Jahiz believed that Allah's will lay behind all mutations or transformations. He referred to modern theories such as the "struggle for existence" and food chains (Rizqan Kareem, n.d.; Wikipedia, n.d., Islamic views on evolution).

7.2.2. Ibn Miskawayh (10th-11th century)

His theory, also found in the "Encyclopedia of the brethren of Purity," describes a gradual development initiated by God. This development, starting with matter and energy, involves evolution into minerals, plants (the date palm being the highest form), from the lowest animals to monkeys, then to primitive humans, and finally to a superior human being. Miskawayh extends this evolutionary process to include spiritual evolution, stating that humans can become a saint, a prophet, and then an angel to approach Allah (Rizqan Kareem, n.d.).

7.2.3. Mevlana Celaleddin Rumi (13th century)

In his famous Masnavi, he directly attributes the human evolutionary process to Allah. He describes the progression from minerals to plants, animals, and finally the Creator drawing him from animality to humanity. Rumi saw studying creation as a way to approach Allah and gain knowledge, believing that all branches of knowledge originate from the oneness of Allah (Tawhid) (Rizqan Kareem, n.d.; Wikipedia, n.d., Islamic views on evolution).

7.2.4. Mevlana Emin Ahmed Islahi (20th century)

The author of "Tadabbur-i Qur'an" (Reflections on the Qur'an), Islahi believed that humanity passed through "crude animal-like stages". According to him, God brought humanity to its present state, bestowing upon it "the Divine Spark, soul, and faculties of intellect and heart". This transformation changed a largely instinctive being into a distinguished human being (Rizqan Kareem, n.d.).

7.2.5. Muhammad Asad (20th century)

In his work "The Message of the Qur'an," when interpreting Qur'anic verses 71:17–19, he explains the expressions "And Allah has brought you forth from the earth [by] a [gradual] growth [like a plant, a tree]; then He will return you to it [in death]: and [then] He will bring you forth from it [in resurrection]" by referring to the gradual evolution of the human body from the embryonic stage to adulthood, or the evolution of the human species from primitive organisms to higher stages of development, up to the complexity of body, mind, and spirit evident in human beings (Rizqan Kareem, n.d.).

These scholars emphasize that the evolutionary process is not random but guided by Allah's divine will and command, with special developments or interventions at various stages. By integrating scientific observations with Islamic theological principles, they view creation and evolution as manifestations of Allah's continuous power and wisdom (Rizqan Kareem, n.d.). The diverse interpretations within Islamic thought, from early scholars to modern ones, demonstrate the flexibility and richness of religious frameworks in accommodating new scientific knowledge. This historical and ongoing intellectual interaction emphasizes that faith is not static but can evolve in its understanding of divine action in the natural world. This also fosters a dynamic relationship between revelation and empirical discovery.

8. The Scientific Journey of Existence and Humanity's Encounter with Knowledge

This article aims to explain the creation adventure of man, which extends as much as a conscious creature in the formation of the universe, from both scientific and theological perspectives. At every step, from cosmological evolution to cultural evolution, a deep connection has been established between the science of evolution and theological truths (Ayala, 2007). This connection clearly reveals that creation is both a scientific and a meaningful process.

The precise measurements of modern cosmology reveal the complex self-organizing process of the universe, from the Big Bang to the birth of the first stars. However, mysteries beyond the visible, such as dark matter and dark energy, highlight the limits of scientific knowledge and the critical role of inference. Theories on the origin of life indicate that the transition from inanimate matter to life was a complex and multi-stage process, pointing to the existence of robust conditions for life's emergence. Geological evolution reveals that even mass extinctions served as catalysts for evolutionary innovation, showcasing the dynamic and resilient nature of creation. In biological evolution, the interaction between the randomness of mutation and genetic drift and the guiding force of natural selection demonstrates the role of both chance and intrinsic principles in the diversification of life. Epigenetics, furthermore, adds a layer of heritable environmental memory, offering a more dynamic and responsive dimension to adaptation. Finally, the development of language and cumulative cultural evolution reveal the unique leap of human consciousness and the transformative power of collective learning in the development of our species.

When these scientific narratives are interpreted as manifestations of divine wisdom and purpose, they provide a richer and more multidimensional understanding of creation. The interpretation of evolution as a divine process by Islamic scholars, by combining the scientific "how" with the theological "why," demonstrates that these two fields of knowledge are complementary rather than conflicting. When humanity unites with knowledge, it will approach the secrets of creation more closely and comprehend the truth of existence more deeply (Ayala, 2007). This implies that the harmonious pursuit of truth through both scientific and spiritual lenses reveals a more comprehensive and awe-inspiring picture of the universe and our place within it.

9. Discussion

9.1. Science

Science is a big concept that accepts all true and real information as a database and covers all branches of science. It is a tool for recognizing all creatures, events, phenomena, processes and revealing the truth about everything. In short, 'science' is as if it were the evolutionary change of dividing all other science disciplines by mathematics (Demirkuş 2023), (see Figure 1).

9.2. Mathematical Science

It is the main face of science, which expresses all the information, events, facts, processes, creatures and relationships in science with symbols, writing, equations, sets and shapes. No branch of science can function without mathematics. If we consider science as a body, then mathematics is like its heart. However, mathematics can work alone without the need for other disciplines. For this reason, mathematics is like the heart of science and the common denominator of the sum of all other branches of science. Based on this logic, all branches of science except mathematics form the natural, cultural and life interface of science. The evolutionary interface of science refers to the real scientific life story of all changes in science. Evolutionary interface refers to science that changes depending on natural and social conditions (Demirkuş 2023). "By this logic, science has three faces: 1-Natural, cultural and life interface (all other branches of science except mathematics), 2-Mathematical interface (all disciplines of mathematics), 3-Evolutionary interface, (Figure 1).

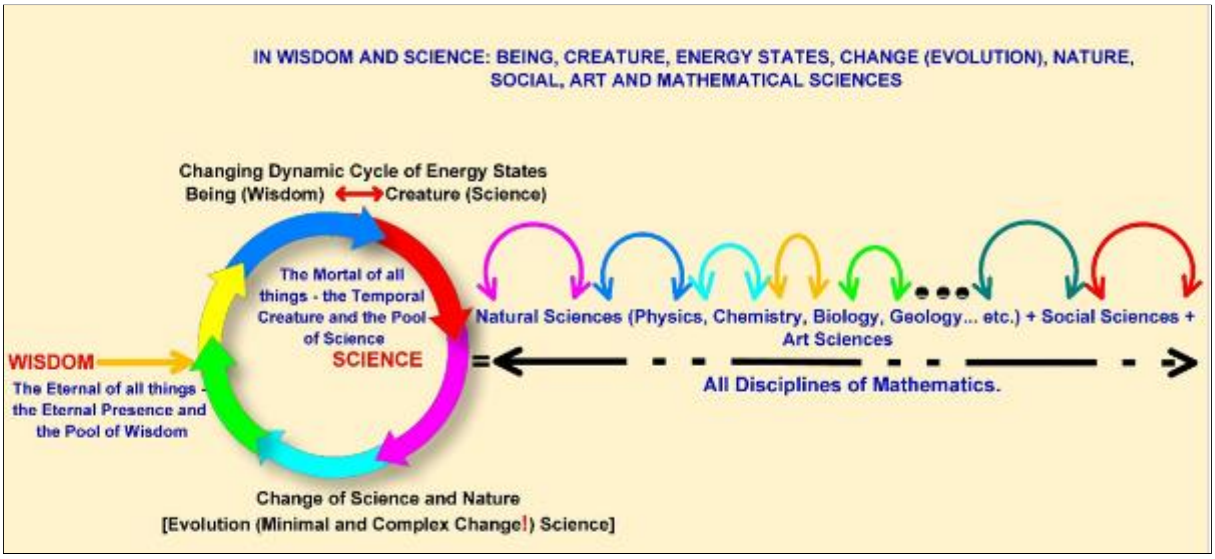

Figure 1 Relationships Between All Disciplines of Science, Evolution Science, Natural Sciences, Social Sciences, and Mathematics

9.3. Important Concepts in Evolution

9.3.1. Evolution science

Evolution science is accepted as a branch of science that explains the real-life stories (life cycles) and change processes of all creatures (living, inanimate, etc.) with scientific rules (Demirkuş, 2018; 2023). The best example of the evolution of living things is the new species and fossils that have formed on Earth for millions of years. Good examples of inanimate evolution are explained by the 'Big Bang Theory' about the formation of the universe. In the first stage of the universe, the formation of electrons and hydrogen atoms from plasma and the formation of all light elements from supernovae are very important examples for the evolution of lifelessness (Hoyle et al., 2000). Based on these two examples, basic information about both living and non-living things should be given in evolutionary science courses. The evolution of living and non-living creatures produced in natural and artificial environments must be combined. New definitions and relationships should be determined on these issues. In short, information about the production of elements in the laboratory, the production of elements in supernovae, viruses produced from biological bases in the laboratory, or new species produced in nature should be given under the discipline of Evolution science (Smith at al. 2003).

9.3.2. Evolution

It is a high-level umbrella concept that covers the events, phenomena, processes related to the changes that all creatures (living and non-living) undergo throughout their lives, and the concepts that are used to explain this change. It is a holistic process that involves changes at the cosmological, biological, and environmental levels.

9.3.3. Theory of Evolution

It is a scientific approach put forward by Charles Darwin to explain the change of living things over time, especially based on the principle of "natural selection" (selection). According to this theory, life began with very simple forms in water and the change of living things; genetic diversity, mutations and environmental pressures have been realized by the effect of genetic structure.

9.3.4. Mechanisms of Evolution

Just as the functioning of a cell is determined by its internal and external environmental conditions, organelles and structures, the mechanisms of evolution interact with the habitats, environmental conditions and genetic structures of the planets where creatures live. These mechanisms are the totality of dynamic systems that direct the process of change of living things.

9.3.5. Evolutionary Response

Evolutionary Response is the evolutionary change of living things when they encounter strong internal or external environmental influences. In other words, as the mechanisms of evolution begin to work, living things not only age, but also change genetically and structurally. This is an evolutionary response to adapt to the natural environment.

9.3.6. Factors Directing and Motivating Evolution

Evolutionary change begins only when serious changes occur in the internal-external dynamics of creatures and environmental conditions. Microhabitats, i.e. the local environments in which living things live, directly influence this process. However, there are 6 broader and fundamental universal processes that drive evolution:

- The gradual acceleration of the universe
- The gradual expansion of the universe
- The gradual cooling of the universe
- The universe is gradually plunging into darkness
- Progressive changes in gravitational fields
- Progressive dilution of the substance (decrease in density)

These six basic processes affect not only the physical universe; It triggers the change of creatures by affecting the life on the planets, the environmental conditions of living things, and therefore the evolutionary mechanisms.

10. Result

Science equals: the relational equation of definition that we have established between all branches of science (as a numerator), all disciplines of mathematics (as a denominator), and the evolution (change) of science does not contradict the relationality of the Big Bang, science, and the evolution of all creatures. (see Figure 1).

Everything exists as a being in ashy energy (in the light of the creator). But each of these energy states in the visible universe is called a creature.

Within the scope of the Science of Evolution, the lessons on the evolution of living and non-living creatures should be taught together relationally. In order not to make a misconception about this: Cell, Cell Science, Cell Theory, Cell mechanisms and Cell Formation... etc.: Evolution, Evolution Science, Evolution Theory, Evolutionary Mechanisms, Evolution, Evolution, definition, boundaries and relations should also be clearly defined.

In the course of all these studies, we conclude that evolutionary change can be a dimension of the universe, just like the dimension of time.

11. Conclusion

In this study, the following conclusions have been reached:

- Epistemological Grounding: The principle "A correct 'how' is required for a correct 'why'" reflects the complementary relationship between science and religion.
- Scope of Evolutionary Science: While the theory of evolution primarily concerns living organisms, the science of evolution is defined more broadly as a discipline that explains the real-life histories (life cycles) and transformation processes of all entities—both living and non-living—based on scientific principles.
- Evolution as a Universal Dimension: Evolutionary change is interpreted not merely as a biological phenomenon but as a fundamental dimension of the universe, comparable to the dimension of time.
- Establishing an epistemological complementarity between science and religion is expected to enhance the meaning, efficiency, and practical applicability of knowledge related to evolution, ultimately benefiting society.

Compliance with ethical standards

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