



Eighteen distinctive characteristics of life

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ABSTRACT

A practical approach in the inquiry of life is to contrast living beings with nonliving ones from different perspectives and extract the distinctive features of living beings. We can identify features and mechanisms that truthfully account for the differences between living and nonliving beings by making rigorous logic-based inferences. The set of these differences constitutes the traits or characteristics of life. When the living beings are carefully examined, the apparent characteristics of life are ascertained to be *existence, subjectivity, agency, purposiveness and mission orientation, primacy and supremacy, naturality, field phenomenon, locality, transience, transcendence, simplicity, unicity, initiation, information processing, traits, code of conduct, hierarchy and nesting, and the aptitude to vanish*. Each feature is described, justified, and explained in detail in this observation-based philosophical article. Among them, an *agency* with purpose, knowledge, and power is the key feature of life without which the behavior of living beings cannot be explained. These eighteen characteristics constitute a reasonably comprehensive set of features to distinguish living beings from nonliving ones. However, the enigma of life remains.

1. Introduction

The stark difference between living and nonliving beings points to a distinctive quality between the animate and inanimate realms, and that enigmatic quality is broadly labeled as *life*. Despite being the most fundamental attribute of living beings, the definition of life continues to be a challenge. There is no general agreement on what life is, but there seems to be a consensus that life is a perplexing mystery.

We all have an intuitive understanding of life. As physicist Chet Raymo [1] puts it, “*We recognize life when we see it, but it is devilishly hard to say what it is.*” For example, as human beings, we know that we are all alive since we are talking, walking, reading, writing, and feeling, and we are aware of these acts. Also, no one can predict what a person in a room will say or do next during a social gathering and where a person will go after leaving the room. In contrast, an inanimate object like a ball sits where it is left and moves only when there is an external influence, such as a wind or a person picking it up.

Proof of existence is usually easy for physical things: point to it, and all the persons present will perceive it via their five senses. This is also the case for some nonphysical things, such as images in mirrors and mental renderings of sights and sounds out of electric signals. This is not the case for most subjective or nonphysical things such as life, intelligence, knowledge, emotions, and consciousness since they cannot be perceived directly by the five senses. In that case, we can ascertain existence indirectly by pointing out a physical entity that exhibits the subjective quality as an observable feature and contrasting it with a physical entity that does not exhibit it. Of course, we have to agree in advance on what set of observable features, traits, or behaviors constitute sufficient evidence for the existence of the subjective quality.

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Several books are written on life, such as “*What is Life?*” by Schrödinger [2], “*Life Itself: A Comprehensive Inquiry into the Nature, Origin, and Fabrication of Life*” by Rosen [3], “*The Origin of Life*” by Davies [4], “*Defining life: The virus viewpoint*” by Forterre [5] and “*What is Life?*” by Nurse [6]. However, the question ‘what is life?’ still does not have a satisfactory answer. Therefore, it is no surprise that life is usually described by its characteristic features and not defined. Molecular biophysicist E. Trifonov [7] analyzed 123 definitions of life and searched for commonalities. He then defined life as “*Life is self-reproduction with variations.*” But this definition expresses two features of living beings, and it does not say much about the nature of life.

After examining the best-known past and current theories of life, Cornish-Bowden and Cárdenas [8] assessed that all theories contain valuable features of life, but they lack essential elements. They appear to be far unsatisfactory as accurate descriptions of life. Most biologists equate biology with physical chemistry and ignore life as a distinctive phenomenon. Cornish-Bowden and Cárdenas [8] point out that “*If biologists do not study life, what do they study? As Harold pointed out, biologists study, almost exclusively, details of living organisms, not life itself. The Journal of Biological Chemistry published 20,307 pages in 2018, each of them packed with information, but virtually all of them concerned with small details of living organisms, not with living organisms as such, and none of them asking the question of what life is.*”

In biology, it is generally agreed that organisms that possess the following seven characteristics are animate or living beings and thus possess life: the ability to respire, grow, excrete, reproduce, metabolize, move, and be responsive to the environment. However, these are common characteristics of living beings, not life, and not all living beings exhibit all of them. The mule, for example, does not reproduce. Yet, nobody doubts that a mule is alive. If a mule were taken as a nonliving thing, it would be difficult to give a convincing argument that a horse is a living being. In contrast, a virus reproduces, but most biologists such as Moreira and López-García [9], Johnson [10], Hemminga et al. [11] consider it not to be alive because they depend on other organisms for metabolism and replication. Many others maintain that a virus is alive [5].

Life is usually described in terms of physiological processes rather than the underlying subjective phenomena observed in nature. Molecular biologist F. M. Harold [12] warns that people are giving up hope of ever unlocking the mystery of: “*As a subject for serious inquiry, the category “life” has all but vanished from the scientific literature; it is the particulars of life, not its nature, that fill the numberless pages of scientific journals.*”

Erwin Schrödinger [2], who is one of the founders of the quantum mechanics and the recipient of the Nobel prize in physics, appears to be the first scientist who saw the relevance of the laws of nature to life based on observation of the orderly and lawful behavior of matter in living beings. Motivated by the insight provided by Schrödinger, Çengel [13] proposed the following novel definition for the phenomenon of life: “*Life is a supplemental set of laws and influences that act over a confined space which constitutes the domain of life, superimposed on the universal laws and forces of physics.*” He also defines a living being as “*A natural entity whose internal changes and external behavior cannot be predicted by the universal laws and forces of physics alone at all times.*”

A precise definition of life and a comprehensive list of its attributes will help us answer many intriguing questions such as ‘Are robots alive?’ with confidence. As Cheok and Zhang [14] put it, “*If we had an authoritative definition of the terms “life” and “alive,” and an authoritative list of criteria for life, we would be able to provide an authoritative answer to the question ‘Are robots alive?’ But as we can see, no such authoritative list or definition exists within traditional biology.*” Some biologists led by Monod [15] consider chance and necessity the fundamental engines of autopoietic life. The chance-necessity model of life and its ramifications are discussed in detail by Hazen [16] and Chirumbolo and Vella [17]. As the authors state, how chemical molecules form a dynamic self-assembling living entity remains a puzzle.

Although life is all around us, we cannot take it to the lab and analyze it directly since it is not a physical entity. Therefore, the only way we can understand and characterize life is to compare the behavior of living beings with nonliving ones through careful observations. According to some authors, the major difference between inanimate objects and living objects should be retrieved in the nature of dissipative systems, particularly in the informational (or Shannon) dissipation [17].

To characterize life at the cell level, we compare two cells that are identical, including their genetic material, except that one is alive while the other is not. Atom-by-atom and molecule-by-molecule, both cells have the same content organized in the same way. Naturally, both cells are subject to the same laws of physics influencing them in the same way, and thus both cells behave the same way. For example, they weigh the same amount, move the same way under the influence of wind, and decay at the same rate if they contain radioactive material. However, this is where the similarity ends.

If both cells were nonliving, they would act the same way under the same influences and undergo the same changes, and we would not be able to tell them apart. However, despite being physically identical and governed by the same set of physical laws, the behaviors of the living and nonliving cells are so different that we had to invent a subjective and invisible entity called ‘*life*’ to account for this difference. The distinctive feature that distinguishes animate beings from inanimate ones is the mysterious life.

2. Inferred characteristics of life

We need to distinguish between the manifestations of life on living beings and the nature of life itself. Living beings are characterized by qualities such as *adaptability* to the environmental conditions, *exploitation* of the resources of their environment to sustain livelihood, *diversity* with the existence of millions of species, *unicity* of complex life forms by acting as one, *autonomy* in action and freedom of behavior, *purposefulness* in the functions performed, *division of labor* among constituents for biological functions, *collaboration* among the simpler life forms such as the cells and organs in the complex life forms or organisms, *symbiosis* among different life forms, such as trillions of bacteria in the human digestive system in a mutually beneficial way, *growth* into a full-fledged multi-cellular organism from a single cell, a highly structured *organization* among constituents, *reproduction* by making copies of themselves and perpetuating their species, *unpredictability* in behavior by the spur-of-the-moment decisions, rendering the set of the laws and forces of

physics inadequate as a predictive tool, and the *capability* for self-healing and self-repairing.

When dealing with the physical realm, we need to always keep in mind the intrinsic nature of molecules, which are piles of interconnected inept atoms, what they can and cannot do and what kind of behavior they can exhibit. The difference between chemistry and biology is the elusive life. Therefore, this grand phenomenon of life cannot be ignored or taken lightly, although it playfully evades all attempts to be deciphered. We will have to continue playing this game until the elusive life reveals its secrets. Since life is a subjective nonphysical entity, the only tool we have at our disposal to study life is logic-based inductive reasoning. Any inferences we derive must be scrutinized based on logical consistency, conformity with observations, and compliance with confirmed knowledge. The propositions developed should also enable us to make testable predictions.

In our quest to understand life better, we should be open to working with virtual mechanisms until corresponding physical mechanisms are found to avoid being stonewalled. The posited quantum fields of the highly successful quantum field theory, for example, are simply virtual mechanisms. Since life is not a tangible entity that can be observed and experimented with, all we can do is observe and identify the features that are characteristic of living beings and thus characterize life. The differences between living and nonliving beings constitute the *characteristics of life*. Further, exploring how the tangible body and intangible life interplay as a distinct entity may help us develop tools and procedures to manipulate life to our advantage.

Based on the careful analysis of everyday observations and experiences with the animate and inanimate beings, we identify the key characteristic features of life as follows: *existence, subjectivity, agency, purposiveness and mission orientation, primacy and supremacy, naturality, field phenomenon, locality, transience, transcendence, simplicity, unicity, initiation, information processing, traits, code of conduct, hierarchy and nesting, and the aptitude to vanish*. We make a special effort to maintain logical consistency and thus avoid contradictions. This list can be refined, expanded, and adjusted as our understanding of life improves. Below we present details of these features.

2.1. Existence

Life *exists*. It just does. Its existence is *intrinsic*, just like the existence of the laws and forces of physics, with causal power. Life is a reality in its own right with its particular ontology, despite its intimate connection to a physical body. The stark difference between living and nonliving beings is sufficient observational evidence to ascertain the existence of life. Recognizing the ontology of life opens the door for scientific and philosophical inquiry into life.

Life does not originate from the physical existence comprised of matter-energy, and it is not reducible to matter-energy. Life itself does not involve even a single fundamental particle of physics as a constituent. Life interacts with physical existence, but it is a different form of existence. There are no known causal effects to produce life and thus no known ways to make life out of nonlife. The felt experience of being alive here and now is real and actual.

When life disappears, a living being reduces to a nonliving being of the same physical content but without the influence of life. The presence of life can be inferred by the influence it exerts on an assembly of matter hospitable to life. Life comes with a set of traits that qualifies the animate being and a code of conduct that fully controls and manipulates the physical body of the animate being, as discussed below.

Life is one of the most commonly observed, recognized, and cherished phenomena in nature. Life is elusive and intangible, but it is not an illusion or delusion. Life is a reality, and all animate or living beings collectively constitute the animate realm. The difference between *chemistry* and *biology* is life. There would be no science of biology if there were no life. Life is deemed so valuable and highly ranked in the hierarchy of existence that all nonliving physical things are subservient to it. For example, a dead honeybee is worthless compared to a live one, although a honeybee is essentially the same physically just before and right after death.

The nature of life continues to remain a mystery. However, not knowing the *nature* of something does not justify not accepting the *existence* of that thing. We don't know the nature of *dark matter* and *dark energy* either, but this did not keep physicists from recognizing their existence. As it turns out, the mysterious dark matter and dark energy together constitute 95% of physical existence [18]. Enigmatic life deserves the same favorable treatment.

Likewise, we do not have any problem accepting the existence of a slew of elusive *quantum fields* that act as concise virtual *particle-generating mechanisms*. The quantum fields make it possible to explain the creation and annihilation of the fundamental particles of physics. Life fits nicely into this family of elusive fundamental threads out of which the tapestry of existence is interwoven.

The emergence of life cannot be predicted by the laws and forces of physics, and it evades cause-and-effect relations. Therefore, life is an *anomaly*. Life appears to be an imposition onto the physical realm out of nowhere, thus a different dimension of existence. Also, both life and the laws of physics do not originate from matter-energy and cannot be reduced to it.

Life, which permeates the inanimate realm and turns it into the animate realm, presents a challenge that evades all explanations. However, it also offers a unique opportunity to unearth a long-concealed phenomenon that may profoundly affect our understanding of reality. Life seems stubbornly determined not to reveal its secrets until we start thinking 'out of the box.' Accepting its existence for what it is, is the first step toward deciphering its secrets.

2.2. Subjectivity

Life is a *nonphysical* or *subjective* existence. Life is the distinctive attribute of living beings. Life falls into the same category of existence as consciousness, free will, beauty, knowledge, and meaning. Living beings are part of the physical realm because their bodies are physical. However, like all subjective existence, life is not part of the physical realm; it belongs to the nonphysical or subjective realm since it is not made of fundamental particles of physics.

Life is not composed of the fundamental building blocks of physics, and it cannot be decomposed into them. We do not speak of the

building blocks of life because there is none. Being a nonphysical entity, life cannot be assigned a particular place or time. Like the subatomic particles in the quantum realm but without the probabilistic distribution, life is everywhere within an animate being without being anywhere.

The physical realm, especially the animate world, is intertwined with the nonphysical realm. Any physical entity, especially a living one, is a blend of physical and nonphysical realms since all physical entities, including the fundamental particles, exhibit traits or attributes associated with both realms. Like light interacting with and reflecting off a diamond, life interacts with matter, manifests on the matter, and affects matter, but it does not matter. The source of life is life itself, not the lifeless matter. Life appears out of nowhere and disappears into nowhere. That is why life is a mystery, and it will most likely remain a mystery in the foreseeable future.

2.3. Agency

Life is an *active agent* with causal power. It is not an ordinary emergent property of assemblies of matter that just passively characterizes the assembly. Agency is perhaps the most striking attribute of life. Living beings have a united body and unified authoritative governance as well. Life fits into the description of an active agent which rules matter and fully controls the physical existence within its sphere of influence. Apparently, it gives orders, passes out assignments, promotes cooperation, plans logistics, and ensures that every cell and organ of the body works as stipulated in its job description.

In animals, these genuinely remarkable features are typically attributed to the *brain* since every body part is hardwired to it. But inept matter, by its inherent nature, is unfit to execute these higher-order tasks. Therefore, the proper role of the brain is to serve as the well-equipped control center with a powerful processor, just like the cockpit of an airplane equipped with microprocessors. The glittering control panel lights in the cockpit correlate well with the functions performed. However, we all know that a visible or invisible pilot with the will, knowledge, and skill flies the plane by controlling it from the cockpit. Besides, the same high-level tasks are performed in plants, such as an apple tree producing apples, with no brain.

Life is usually categorized as an *emergent quality* rather than an agency. However, emergent quantities emerge and *passively qualify* the assembly of matter, whereas an agency *actively rules* assemblies of matter. An agency can *subjugate* and *manipulate* physical entities, not just qualify them like the laws and forces of physics. The emergent quantities are pinned on the physical things they appear on [13]. We can facilitate the appearance of emergent quantities by organizing matter in a particular fashion, but we cannot do that for life. Life appears to be much more than an ordinary emergent quality, which is why we cannot make life out of nonlife.

Currently, we cannot organize matter in a way that it acquires life, and the prospect of doing so does not look bright. The only way to make a living being is to start with a living being and thus tap into the existing life. Making something that will acquire the properties of water is easy: just chemically combine hydrogen and oxygen, and water properties will emerge out of nothing. However, making something that will acquire life is beyond our reach. Life will not emerge when we artificially assemble matter to form an exact replica of a bacterium or a cell. Unless and until this happens, the assertion that life is an emergent quality of organization remains baseless.

Life emerges out of nowhere since it cannot be reduced to the constituents of the living body, and the traits that come with life, such as unity, qualify the physical body. However, the agency feature that comes with life does not just *qualify* a living being but rather *subjugates* its body and *operates* through it. Despite the resemblance, life is categorically different from an ordinary emergent quality that just passively qualifies a physical body. Many of the traits that come with life, such as purpose, knowledge, and skill, qualify the agency itself since these seem to be the essential qualities of the active agent.

The most striking difference between a live cell and its nonliving counterpart is the undeniable existence of an inferred *enigmatic agent* in the live cell whose domain of influence is the space occupied by the cell and the apparent absence of such an agent in the nonliving cell. When the live cell dies, it ceases to exhibit harmonious and goal-driven actions. It starts to act like a nonliving cell, which leads us to conclude that the elusive, invisible agent is no longer there and the aura of life has disappeared. From a logical vantage point, the existence of the invisible active agent is as plausible as the existence of the cell itself. It is even more plausible than the existence of the invisible dark matter since the influence of life with a unique signature is profound.

During excavation on the moon, researchers would not expect to find purposive items such as pans, needles, or marble columns, let alone items like robots or smartphones. The striking difference between the purposeful and sophisticated animate realm and the purposeless inanimate realm can only be accounted for by an active agent that we call 'life.' If an item is not the making of the laws and forces of physics, then that item must be a living being or the making of a living being. Therefore, the most tenable stance is to recognize life as an active agent [13].

2.4. Purposiveness and mission orientation

Life is *purposive* and *goal-driven*. From a single cell to an organism, life acts like it has a goal to reach, and the life processes are geared towards accomplishing that goal. Life appears to come preloaded with an elusive program that turns the *potentiality* of a living being into *actuality* by fostering intentional development and growth. As such, life brings *dynamism* and *diversity* to existence, as evidenced by Earth's high activity level compared to Mars.

Unlike inanimate beings, it seems that each lifeform comes with an encoded *mission* and is equipped with the *tendency* to move towards accomplishing that mission. With inherent dynamism, life turns a static assembly of matter into a dynamic entity, like a busy factory floor. There is a continual realization of a set of potentialities embedded within the nature of life of a particular species, driven and directed by *inclinations*, with traits serving as templates.

Such inclinations are conjectured via observation-based inductive thinking by engaging reason and gaging with logical consistency. It is recognized that propositions whose validity is based on reason-based arguments do not constitute scientific facts. Unlike scientific

information, which is epistemically objective, information which stems from reasoning and inference is epistemically subjective. However, it is still appraised as factual if deemed reasonable. Even in the physical realm, discovering a new phenomenon begins by noticing an anomaly or influence. The conjectured or inferred potential cause of that influence is postulated to exist – for example, the postulated existence of elusive dark energy as the culprit behind the universe's accelerated expansion. This subjective information will turn into objective information when the existence of dark energy is confirmed.

The path of life entails the continual activity of hidden potentialities turning into observed actualities. With deductive reasoning, we can discover and identify the invisible potentialities of a species by observing the manifested actualities in the physical realm. We can mentally reverse the natural growth process to arrive at the starting point of inborn potentialities. This is similar to inferring the phenomenon of the Big Bang by rewinding the observed expansion of the universe.

For humans and higher animals, there seems to be in-born instant *gratification* in the very act of actualization of the potentialities since the realization of potentials is innately felt as contentment. Therefore, *active life* is closely associated with a satisfying and enjoyable life. Engagement and enthusiasm are like embodied contentment and delight.

Both living and nonliving things involve chemical processes, except that they are geared towards specific results in living things. The intense chemical activity in a living entity reminds us of a well-running chemical factory with a virtual governing *agency of factory* responsible for order, coordination, intent, knowledge, and skill. Even if we do not see the management, we infer its presence from the purposive acts and the apparent order throughout the production floor. The operation of a factory cannot be explained by the universal laws and forces of physics, which constitute a purposeless agency.

As Nobel-prize-winning cell biologist Paul Nurse [6] explains, “*Living organisms stand out because they are things of action; they behave with purpose, reacting to their surroundings and reproducing themselves. None of these characteristics apply to things that are not living, like a pebble, a mountain, or a sandy beach, for example.*”

Indeed, sophisticated technological gadgets such as robots, nanomachines, and smartphones are purposive yet lifeless. However, behind all such equipment are purposive living beings – engineers, scientists, and technicians. Even a simple plate or a needle would not exist without human involvement since all such findings during archeological excavations are categorized as human-made artifacts and not natural formations. Robots and nanomachines are the makings of living beings and thus are associated with life.

2.5. Primacy and supremacy

Life is *primal*, and it reigns *supreme*. Life is *fundamental* – as fundamental as the fundamental particles of physics. Life is the distinctive and defining characteristic of living beings that separates them from the nonliving ones. Life is the *primary* subjective attribute or quality of living beings as it underlies all other subjective qualities which accompany life, such as unity, perceptions, sensations, emotions, thoughts, and consciousness. Subjective life has *supremacy* over the objective body since life rules and fully controls the body, like the laws and forces of physics fully controlling material things. By careful observations of living beings, it can be conjectured that the realm of life has *primacy* and *supremacy* over the physical realm since life as an agency subjugates matter. Enigmatic life is a *primary* reality, whereas the familiar matter-energy is a secondary reality. This notion runs counter to the prevalent stance that life is secondary to and derived from physical reality.

Life is the *most fundamental attribute* of living beings since, without life, we cannot have consciousness, emotions, and perceptions. When life is lost, all the qualities accompanying life are also lost.

2.6. Naturality

Life is a *natural* phenomenon. Life just occurs; it cannot be made – just like the laws and forces of physics are natural and cannot be made artificially by humans. There is no such thing as ‘human-made life’ created from scratch using lifeless ingredients. We can tap into life and modify life as humans, but we cannot create life. Therefore, everything we make using inanimate entities as constituents is bound to be lifeless.

Ordinarily, the actions and behaviors of inanimate beings are entirely determined by the laws and forces of physics. All human-made technological items such as robots, smartphones, and machinery which resemble living beings are nonliving as well. Even devices that closely resemble humans are also governed by the instructions in their software. However, they are still lifeless beings since their software or driver is human-made, whereas the set of laws and instructions of animate beings is natural. Gene editing is simply the *manipulation* of life, not the creation of life.

There is no cause-and-effect relationship between life and the physical realm. Unlike bringing together hydrogen and oxygen to produce water, there are no physical causal links that we can use to produce life. Life just happens – we do not have any control over making it, just like we do not have any control over the law of gravity. As a result, life is not produced from nonlife; it is reproduced from life. Life disappears from a living being when the physical body conditions are no longer hospitable to life. Therefore, all we can do to preserve life is to keep the physical body of the living being in favorable conditions compatible with life. We cannot create life, but we can accommodate the spread of life by setting up environments in which the spark of life in seeds and fertilized eggs can flourish and thrive.

2.7. Field phenomenon

Life is a *field phenomenon*. Unlike the quantum fields, whose domain is the entire spacetime, the domain of influence of life is limited to the animate realm. In a living being, the field of life has definite and discernible boundaries. The observed well-ordered and executed

goal-oriented influences exerted within the bodies of a living being cannot be reduced to the nonpurposive laws and forces of physics.

Life exerts a dominant influence on all matter within its domain of influence. This is like a *magnet* influencing iron particles nearby in a particular way. An artificial DNA molecule synthesized in a lab remains as a cluster of atoms and does nothing. The DNA molecule is inherently incapable of performing any astonishing acts inscribed on it.

Nothing will happen if the entire content of a bacterium, including its DNA and membrane, is artificially reproduced accurately. Again, nothing will happen if the artificial DNA is replaced by its natural twin from a live bacterium. However, if the natural DNA of a bacterium is replaced by its artificial twin, the artificial DNA molecule comes alive and starts doing things that no molecule in a chemistry lab ever does. It seems that synthetic DNA must be transplanted into a *domain of life* to be active. This constitutes sufficient observational evidence for the existence of a field of life that constitutes the domain of influence of the agency of life discussed below.

2.7.1. An analogy with the electromagnetic field

An intriguing analogy between the *life field* and the *light field* (more generally, the electromagnetic field) is that both can be quantized. In a paper published in 1905, Einstein suggested that phenomena related to light, such as the photoelectric effect, can be explained better by viewing light as consisting of discrete pockets of energy that he called ‘the light quantum,’ also known as the *photon*. (This work earned Einstein the Nobel prize in 1921.) Each quantum of light has a specific set of properties that come with it, such as the wavelength and the amount of energy, and it is indivisible. Light travels as discrete tightly-sealed energy packages, which explains its particle behavior. A quantum of light or photon always retains its integrity; it cannot be partitioned.

Similarly, we can think of the field of life being *quantized* into distinct pockets of life that transcend the physical bodies and ‘animate’ them, similar to light enlightening transparent bodies. The quantum of life is also indivisible, like the quantum of light. Both are taken in and given out as a whole, and both come with a discrete set of properties.

2.7.2. An analogy with quantum fields

There is also a good analogy between the *life field* and the *quantum fields*, which are the backbones of the highly successful *quantum field theory*. First of all, both the life field and the quantum fields are nonphysical – all are conceived by the mind, not the five senses. No one has seen or touched them, and no one ever will. However, the subjective constructs of quantum fields accurately model physical existence and draw a tenable picture of physical reality. A quantum field is quantized into virtual mechanisms. When a quantum field is activated, it produces a particle – like the electromagnetic field producing a photon or the electron field producing an electron – that has the inherent properties of that field. As such, quantum fields qualify as *agencies* because of their causal power to govern matter-energy and their purposive behaviors, which resemble virtual mechanisms.

Then it is plausible that we view the elusive life field, similar to a quantum field, that produces discrete virtual life particles that can interact with living beings when activated. We can call the life particles ‘*lifeon*’ in analogy with the strong force particle ‘*gluon*.’ We can postulate that lifeons with different attributes are produced for different species. In this model, the beginning and end of the body - lifeon interaction represent the birth and death of a lifeform. When excited, a quantum field acts as a virtual mechanism that transforms the incoming energy into a particle with specific properties. A quantum of the life field, on the other hand, produces a life particle with an embedded agent equipped with purpose, knowledge, and skill, as discussed above. Virtual entities work exceptionally well in particle physics in analyzing certain physical phenomena, and perhaps they might also work in biology.

We do not have a sensed experience of the quantum fields in the subatomic world. However, we can visualize them mentally as they convert pockets of energy into particles with a distinct set of properties. The life field is easier to grasp since life has a direct observable influence on physical beings, like the force of gravity.

2.8. Locality

Life is a *localized* phenomenon. Its sphere of influence is restricted by the boundaries of the physical living body, no matter how irregularly shaped the body is. It has no influence outside the body other than interactions. It seems that life infuses every part of the body and subjugates it, imposing its laws and influences. It is like life creates a micro realm within the region occupied by the living body with a locally acting set of laws and influences. All constituents of the physical body, including the DNA molecule, are intrinsically lifeless. They acquire life and are subjected to the influences of life so long as they remain within the sphere of influence of life.

For example, oxygen molecules move randomly in the air under the influence of the forces of physics. However, once a person inhales air into her lungs and oxygen becomes part of the body, the oxygen molecule does what it is told to do, and it goes where it is sent to go in complete submission to the governing rule within the live body. The same thing happens to the carbon dioxide molecules in the air absorbed by the leaves of plants during photosynthesis. When a constituent leaves the live body and thus the domain of life, the now lifeless constituent again becomes subject to the laws and forces of physics alone.

2.9. Transience

Life is a *transient* phenomenon. Life is an acquired quality and a transient phenomenon for living beings since there is no such thing as ‘live matter.’ Matter is inherently lifeless. However, it starts acting like it is alive when it enters a live body. When we drink water, for example, water becomes subject to the laws and influences of human life. A chemical molecule turns into a biomolecule when it becomes part of a living body. When it leaves the body, like water molecules dripping off our face during sweating, life vanishes, and water returns to being lifeless matter. The water that we drink becomes alive for the duration of its journey through the body. The same is true for the physical structure of our bodies which are continually rebuilt using food intake as the building blocks [19].

The behavior of water can be predicted precisely by the laws and forces of physics alone when they are outside living bodies, but this is not the case in living bodies. An additional set of laws and influences are needed in living beings. This observation shows that life is a field phenomenon with observable boundaries. A living being dies when the conditions in the body are no longer hospitable to life. When death occurs, the body turns into a pile of lifeless atoms and molecules.

Living beings resemble a conduit with mass entering continually from one end and interacting chemically, and the products leaving from the other. However, a chemically active mass stream does not constitute a living being. A human being, for example, is not the material contained within a shell of skin, just like a chemical factory is not the chemical content within a shell of a building, with raw materials entering from one end and finished products leaving from the other. Materials come and go, but the purposeful operation endures in both a living being and a factory. Therefore, the core existence of both a living being and a chemical factory is the *able agency* and not the streaming materials.

2.10. Transcendence

Life is a *transcendent* phenomenon. It is not an intrinsic quality of matter or any physical existence. There is no such thing as a *physical substance of life*, and life cannot be reduced to the physical constituents of living beings. Apparently, life itself has the intrinsic core quality to permeate physical bodies amenable to life and manifest within them, similar to light permeating transparent things like a diamond and reflecting off them.

The components of a wristwatch cannot have any idea about the watch as an instrument, and the watch itself cannot have any idea about the concept of time. What makes a human being a human are the higher-level human qualities that *transcend* all its organs and cells and control them. A nonphysical higher-level existence must be controlling physical existence, even if we have no idea about its nature.

Cells are simply bags of molecules floating in water with *no* knowledge, will, purpose, or power to unite as organs or organisms. The individual cells of an organism cannot possibly have an *awareness* of the entire body. All *molecules* in a living being are assemblies of atoms that possess *no* life, knowledge, purpose, or consciousness. The *atoms* cannot see, hear, speak, think, or imagine. Therefore, no molecule is aware of what is happening in its cell, let alone in the adjacent cells and the organism. No molecule is even aware of its existence and its role. It appears that *cell life* transcends all cell content. Biomolecules, including DNA, become ordinary chemical compounds when they leave the cell and their association with the transcending cell life is cut off.

The subjective life with the bundle of traits and code of conduct seems to constitute the *real existence* of a living entity as a robust, invisible matrix with an in-house agency, with drafted matter moved to the right places to form the body and materialize the living entity. The material building blocks of the body come and go, but the invisible matrix of life remains intact, preserving the unity of the body and its identity and continuity. Life is not merely a quality of living beings – it is the *essence* of living beings. This provocative notion is in complete contrast to the prevailing emergence notion, which posits that life is an emergent property of organized assembly of matter.

Being a subjective existence, life itself may have *permanence* as its intrinsic core quality. This conjecture seems tenable since life is nonphysical and thus subjective, and as such, it is beyond space and time. In analogy with light, a section of a river that receives direct sunlight at the correct angle shines light like a giant diamond. The start of shining of water droplets on the surface of a river when entering the sunny section eludes the existence of an external source of light. In contrast, the stop of shining of water droplets after leaving that section eludes the continuity and permeance of that source of light.

Life is commonly viewed as an *emergent quality* since it appears within a physical entity out of nowhere and qualifies the physical entity as a living being. However, it differs from ordinary emergent qualities since the organization of the physical entity does not ensure the necessary emergence of life. Therefore, life is better characterized as a *transcendent quality* to signify that life transcends the body instead of emerging from the organization of the body. The organization of matter as the exact replica of the body of a living being is no guarantee for life to emerge on that body and turn it into a living being. This never happens when we start with lifeless matter. The physical light always shines on a well-cut clear diamond, but this is not the case for the nonphysical light of life on bodies amenable to life. So far, life has evaded all attempts to be captured by humans, failing all ambitious projects to create life. However, life gracefully allows us to play in its playground as it honors the changes made in genetic code by gene editing.

Ordinary emergent qualities appear consistently and predictively out of nothing when a physical existence is arranged or organized in a particular way. When oxygen and hydrogen are allowed to react chemically, water always forms with distinct properties that characterize water. If we wish to obtain a particular scent associated with a molecule, we simply build that molecule, and the scent emerges automatically. Therefore, through the reorganization or manipulation of matter, we can build something with desirable properties repeatably and predictably. So far, life has skillfully managed to remain outside this category, evading all prospective causal links. This is why we cannot create life. It appears that emergent and transcendent qualities are encoded in the very fabric of reality, and it will be unwise to ignore them because they do not quite fit into the narrow materialistic worldview of existence. Irregularities in the fabric of observed reality should be viewed as opportunities for discovering exciting new phenomena.

2.11. Simplicity

Life is inherently *simple* and *elemental*. It is not composed of building blocks that are more elemental, and thus it cannot be decomposed into more elemental building blocks. The life field cannot be reduced to a more fundamental field, just like a quantum field cannot be reduced to a more fundamental field in physics. Also, elemental particles such as electrons, photons, and quarks cannot be reduced to more elemental particles. Being a nonphysical entity, life is not subject to the constraints of physical beings, such as the

conservation of energy principle.

2.12. Unicity

An intrinsic characteristic of living beings is *unity* or *oneness* with well-defined boundaries. Life integrates and unifies living beings into individual entities, behaving in unison. Unicity – the notion of maintaining unity – is an encoded feature of life. Cells are bounded by membranes. Skins serve as the bounding surfaces of animals. Life interlinks all constituents of an organism to function as one entity, distinct from others

Life transforms multiplicity into unity, interrelating constituent parts to each other and the whole. Life unifies seemingly unrelated and unconnected constituents under one rule and subjugates them to one code of conduct within the domain of life. No matter how large or complex a living organism is, it functions as ‘one’ with definite borders – like a car with thousands of parts acting together as one entity at the command of a driver (or driver software in the case of autonomous cars). Another essential feature of living systems is the *non-fractionability* of components in an organism, which requires a definite relation between the parts and the whole [3]. Biologist Francisco Varela [20] also emphasizes the unity, autonomy, and autopoietic aspects of a living being in the space where it exists. Barbara [21] gives a comprehensive account of Varela’s work.

Life is like an *invisible glue* that transfuses into all constituents and holds the physical body of a living organism together as one to maintain wholeness within its boundaries. It seems like all the activities in a living organism serve life and work toward maintaining life and integrity. When an organism dies, it loses its integrity. The dead body starts to disintegrate as if the invisible glue has disappeared, and the parts become untied and fall apart. Therefore, an organism is much more than a collection of chemically active molecules. Chemical reactions continue to occur within the decomposing body of a dead organism. However, those incoherent stray chemical reactions transform the lifeless whole into its constituent pieces to be reused as building blocks in constructing other living organisms.

2.13. Initiation

Life initiates action. Life is active and proactive, whereas matter is passive and reactive. Matter does not initiate actions out of its volition, but life does. Life exerts influences on matter and reforms it as it wills. Matter (and energy) simply complies with that exerted will.

A fully automated car on the road, for example, simply reacts to the traffic conditions as dictated by its driving software. It cannot just decide to turn the radio on and tune in to a particular station or initiate a trip of its own. A smartphone cannot initiate a phone call. The camera of a smartphone cannot just decide to take a picture. Unlike a live person, a life-like humanoid cannot initiate a conversation as it wills. All ‘intelligent’ devices simply react to the instructions from their users or the stimuli from their environment per their software without having any sense of what they are doing and why.

Contrary to popular belief, future robots cannot take a proactive stand to eliminate the human race simply because they are lifeless. The material beings such as air, water, soil, stones, bricks, and tools do not initiate anything. Instead, they are fully controlled by the non-initiative immaterial agency of physics, which consists of the laws and forces of physics. The material bodies of living beings built of atoms and molecules are fully governed by the agency of life in compliance with the agency of physics.

2.14. Information processing

Life comes loaded with *information*. As life sciences bear witness, living beings are the center of a high level of information put into action, from photosynthesis in plant leaves to energy production in the cells to recording mega-files of genetic information within each cell. The 1000-page-long cell biology textbooks, for example, are indicative of the vast amount of information being used in a tiny *cell* that contains only about a one-billionth gram of mass as life functions are performed.

Life sciences are the outcome of the pursuit of discovering knowledge exhibited by living beings. We try to explore and exploit the technologies already at work in living beings through biomimicry. Since we do not see any activities that require knowledge in the inanimate realm, all the sophisticated knowledge exhibited by animate beings must be coming with life as an intrinsic attribute.

Interestingly, the plants that give us fruits and vegetables, such as apples, oranges, and potatoes that they construct by skillfully extracting the right amounts of the right ingredients scattered in dark soil, do not even have a brain, let alone consciousness. The humble leaf, which looks like an aesthetic piece of fabric, is the site of converting light and carbon dioxide into chemical energy via photosynthesis. The leaf resembles a well-running elegant *chemical factory* with no noise and waste. We have been trying to mimic the photosynthesis process that converts light energy into chemical energy by building *artificial leaves* but with only limited success. Also, we need to build large, expensive *dialysis machines* to artificially perform the functions of walnut-sized *kidneys* that work nonstop without an operator and external power supply.

An ordinary plant leaf exhibits a wealth of information, as detailed in the biology books. A plant is not alive because information is processed in its leaves, but rather, information is processed in its leaves because the plant is alive. Processing information in a purposeful manner is one of the attributes accompanying enigmatic life. We can build a machine (an artificial leaf) that performs the photosynthesis process and converts sunlight to chemical energy. However, that machine will not acquire life because it is processing information. Likewise, an autonomous car, a robot, or a computer will not acquire life no matter how much information is processed. When a living being dies, all goal-oriented acts such as processing information end.

Information is appropriately characterized as meaning represented by physical symbols, which are physical states of assemblies of

letters, numbers, signs, marks, shapes, patterns, emojis, sounds, waves, lights, motions, electric circuits, 0s–1s, DNA strands, and the like. The symbols of information are the media of representation and the means of transmission of information. Without the associated meaning, the mere symbols of information have no significance since meaning is an ascribed quality and not an inherent property of symbols.

Information can be reduced to a physical *symbol* and a nonphysical *meaning*. These two are of different natures and thus cannot be reduced to one another. Therefore, the two most basic ingredients of information are the symbols and the meaning – similar to *syntax* and *semantics* in languages. Symbols represent information, but they are not information since they do not contain any meaning as their constituents. So, it is no accident that meanings assigned to symbols are arbitrary, as evidenced by the same meaning assigned to different words in different languages. Communication involves the transmission of the physical symbols of information, with the understanding that the transmitted symbols evoke the same meaning in the minds of conscious beings at both ends of the transmission.

Interestingly, our cells and organs come loaded with all the information they need and the skills to apply that knowledge. However, at the organism level, despite being the most developed species on Earth, we as humans come with a vast capacity to acquire knowledge, yet with hardly any knowledge and life skills at birth. A newborn baby knows nothing and can do nothing other than feeding and crying. It seems like human life is intended to *discover* and *acquire knowledge*. In contrast, the lives of other species – fruits, vegetables, flowers, honeybees, birds, fish, chicken, and cows – are intended to *practice* the knowledge that comes with them at birth, resembling marvelous live machinery with little or no emotions. Even in the simplest cases of cells and plants, the ability to apply knowledge points to a fully functional *active agent* discussed earlier.

2.15. Traits

Life comes bundled with a set of traits that characterize the living species, similar to all fundamental particles of physics coming bundled with a set of traits such as charge, spin, and amount of energy. For all lifeforms, a proper set of subjective attributes accommodate life. Wherever there is life, there appears to be a deep-rooted all-encompassing purpose, as discussed before. This is shown by the functionality, high level of organization, coherence, and harmony in all animate beings. The specific set of traits serves that purpose.

Life appears to be the *switchboard* for launching these qualities, traits, and characteristics, including sensations, emotions, thoughts, consciousness, and free will in the case of humans. For example, an eye cannot see without life. When the elusive life switch is somehow turned off, and the organism dies, all these attributes are also instantly turned off, and life activities in the living being at the organism level come to a complete halt. Therefore, the agency of life appears to be the underlying common platform for all subjective qualities of a living being. When life disappears, the bundle of traits that accompany life vanishes, and a living being becomes a lifeless matter, with no trace of the subjective qualities associated with life.

The traits seem to be coming as *potentialities* that turn into *actualities* as the living being develops, just like the seeds of plants sprouting and turning into a tree while passing through different stages of development. *Training* is the process of inhibiting or enhancing the rate and direction of development of these inborn traits in the case of humans. Of course, human life comes with a wide variety of traits, each with an unlimited potential to develop.

2.16. Code of conduct

Life appears to be coming complete with a built-in *code of conduct*, which is a set of laws, rules, principles, and norms by which the living entity behaves in conformity with the physical body, functions, traits, and inclinations of the species. DNA appears to constitute the code of conduct at the cellular level. Life comes complete with packages of operating manuals for all the organs, cells, and organelles of the body. This is just like a computer software package that comes with driver software for all the components of the machine, such as the screen, speakers, and hard drive, as well as application software called apps for specific tasks.

The code of conduct is the *rule book* for the live organism to follow when performing the prescribed life functions. It contains the protocols and commands to abide by, and it details how the constituents of the body will respond to the stimuli from the outside, such as perception through the five senses, food and drug intake, repair of injured tissue, assessment of danger, elimination of threats, preservation of life, and managing contingencies. The life sciences, and the social sciences in the case of humans, are all about inquiring about the codes of conduct of different species, both physiologically and behaviorally.

Most life functions such as the heart beating, kidneys filtering blood, and holding the body temperature at a certain level are automated and beyond the organism's control. Sentient, conscious beings with free will, like humans and to a limited extent higher animals, have a certain level of control on the overall actions of the body and the external body parts, but hardly any control over the operation of the internal organs such as the heart, liver, and kidneys. They are internally hardwired and are inaccessible to us. This is like driving a modern car: we can control when and where the car will go, when it will speed up and slow down, and when it will stop, but we cannot control the internal operation of the engine, battery, etc. With a TV set, we can change the channels and adjust the volume to our liking, but we cannot interfere with the internal operation of the device. The driving software of autonomous vehicles with millions of lines of coding gives an idea about the complexity of the elusive code of conduct.

Only a fraction of the genes on a cell's DNA is 'turned on' and is expressed and thus is active. The rest of the genes remain 'off' or repressed and thus are passive or dormant. The set of genes expressed is different in different tissues in organisms. Turning genes on and off is referred to as *gene regulation*. The 'on' genes of DNA can be said to comprise the code of conduct of life at cell and organ levels. This also seems to be the case at the organism level for plants and simple lifeforms since cells, organs, plants, and simple lifeforms behave like automated machines in a predictable manner. The code of conduct of higher-level organisms like humans appears to be far

more comprehensive than what is inscribed on DNA.

By modifying some genes and thus making some changes to the code of conduct, we can modify the production of some lifeforms such as bacteria – for example, making them produce human insulin for people with diabetes, as is currently being done. By observing how they function, we can reverse engineer their software – like writing a book on cell biology by carefully observing what life functions are performed in a cell. This is how we ‘read’ the inscriptions on genes written with the four-letter genetic alphabet in a language we do not understand: we turn a gene off and observe what feature of the organism changes and how. This way, we know that the deactivated gene is associated with that feature.

In the case of an apple tree, for example, the enigmatic agency of life is equipped with all the necessary capabilities, from collecting the right amounts of suitable raw materials from the soil, body-building, and leave-weaving to the 3D printing of apples complete with the inscribed genome in each seed. And this is done in full compliance with the specifications inscribed on the DNA, which no longer exists after the seed germinates.

It takes a complete manufacturing facility with knowledgeable engineers and a skillful workforce to manufacture apples per DNA specifications out of the raw materials used by an apple tree. Therefore, it seems like the life of an apple tree comes equipped with a *virtual apple manufacturing facility* with a level of technology that we can only dream of having in the future. On the negative side, the brainless humble apple tree makes us humans with big brains and bigger egos look incompetent. On the positive side, the apple tree conveys that we can reach unimaginable technological levels by unearthing and manipulating the apparent virtual mechanisms hidden within plants or other life forms.

How do we know that a *code of conduct* comes with life? Quite simple: lifeless things, such as a chair or a piece of stone, are chunks of passive matter, and they act under influences like the forces of physics per the laws of physics. A living being such as a bacterium or a plant is like a chemical factory, taking in particular chemicals and turning them into certain products by consistently following specific operating procedures that can be observed and recorded, as done in the labs and written in science books. We call those principles of operation the code of conduct, which changes from species to species. How do we know that the *principles of operation* accompany life? Again, simple: when the bacterium or plant dies, the entire operation comes to a halt, and the remaining corpse, including the information-laden genetic material, behaves like lifeless matter.

The traits, information, and code of conduct that accompany life can be considered to comprise the *software* of life, while the physical body constitutes the *hardware*. The built-in active agent with the ability to initiate action serves as the *operator*. The invisible active agent has the power to run the body and its parts and oversee all interactions with the environment. The agency of life uses DNA as the template at the cell level. In animals and humans, the brain serves as the body’s control center with the agency of life as the controller, similar to the cockpit serving as the control center of an airplane with the pilot as the controller. In plants and simple life, there is no apparent control center. They resemble remote-controlled devices.

When a car acts orderly by following the traffic rules and adjusting its speed and direction according to the road conditions, we know a conscious driver is in control even if we do not see her. If the driver suffers a cardiac arrest and dies, the car starts moving under the sole influence of the laws of physics, with no regard for the traffic rules and the road conditions, and comes to a halt after a while (hopefully before crashing).

On the other hand, if we see a car with no physical driver but moves like a car with a driver, we infer that it is an autonomous vehicle with a virtual driver that resides on board or in the cloud. The driver of a ‘driverless car’ is simply software comprised of millions of lines of commands executed per the signals received from the sensors, which are like the senses of autonomous vehicles. Without a driver (or an autonomous driving unit that includes the software, sensors, and control mechanisms), a car is merely an assembled collection of physical parts. Similarly, a cell is a pile of molecules in a sack without life. Therefore, life is to a cell or any other animate being what a driver or autonomous driving system is to a car.

2.17. Hierarchy and nesting

Life appears to come *nested* in layers of *hierarchy* in both horizontal and vertical directions. The high level of the hierarchy is apparent in the governance of animate beings compared to inanimate existence, which is governed merely by the laws and forces of physics. Life at the cell level is the lowest level of life. However, the functions that different types of cells perform are different. Therefore, the bundle of traits and the code of conduct accompanying cell life are different for different types of cells. A study of *cell biology* is essentially a study of life at the cell level. Next on the hierarchy ladder is life at the *organ level*, which is nested with life at the cell level and enables an organ to perform its functions as a semi-autonomous entity.

The top tier of life for complex organisms is life at *the organism level*, nested with life at *the organ level*. It is associated with the traits and functions of the organism. Life at the organism level represents the highest level of authority and the overarching purpose of the organism as a whole. Only the organism level life vanishes when an organism dies, but life at lower levels endures. The organs and cells of a dead person are still alive and continue to be alive for some time, making organ transplants possible.

2.18. Aptitude to vanish

Life has the predisposition to *vanish*, rendering a living being dead. Life appears at the birth of a living being and disappears at death. The *capacity to die* is a unique, distinctive, and characteristic feature of living beings. An entity that cannot experience death cannot be alive. All existence that possesses life is born and eventually dies. They have a beginning and an end. Every living being dies, and every being which dies was once a living being. Nonliving beings cannot be killed. This suggests a simple and practical test for assessing life: if an entity can be killed, it is alive. This is because only living beings can experience death. Seeds and viruses are living

beings by this definition since both can be killed [13].

Death is the process of permanently reverting to the inanimate state and thus being fully controlled by the laws and forces of physics. Death is an irreversible phenomenon. Once *biology* reduces to *chemistry*, and all life functions come to a complete halt, there is no coming back – at least for now. The vanishing of life when a living being dies shows that life is not an intrinsic property of matter that constitutes the physical bodies of living beings. Life is not an ordinary emergent property of the physical body either, since life does not automatically emerge when the physical matter is organized precisely as a living body. If it were, we would now be routinely making things that are ‘alive,’ as we are remaking things with desired properties. Unfortunately, life evades all cause-and-effect relations and thus causality since no causal link triggers the emergence of life.

When life is present in a body, it does not just passively qualify the body and confine itself to a passive subdued role. Instead, life takes over the body and subjugates it to the laws, regulations, and attributes bundled with life particular to that species. Enigmatic life seizes the body and establishes its authoritative rule over it. It builds a body from scratch atom by atom to its specifications and preserves it. As bystanders, we simply watch life do its thing on the body and run its show. Considering that life reigns supreme over the body, it seems like life is to a body much more than what a driver is to a car.

3. Closing remarks

There is a close resemblance between the sphere of influence of life, the region bounded by the living being, and the unbounded quantum fields described in the highly successful quantum field theory. The former underlies the animate realm and gives rise to animate beings with a bundle of traits that come with life for a species. In contrast, the latter underlies the entire physical realm and gives rise to elemental particles with a consistent set of properties. Both the quantum fields and the life field are nonphysical entities, and both involve virtual machinery for the tasks performed.

By comparing living and nonliving beings, the apparent subjective characteristics of life are inferred to be *existence, subjectivity, agency, purposiveness and mission orientation, primacy and supremacy, naturalness, field phenomenon, locality, transience, transcendence, simplicity, unicity, initiation, information processing, traits, code of conduct, hierarchy and nesting*, and the *aptitude to vanish*. Each feature is described, justified, and explained in sufficient detail. Of course, this list can be refined, expanded, and adjusted as our understanding of life increases.

Life continues to be an intriguing secretive phenomenon, evading all efforts to find a causal link. The *hard problem* of distilling life out of lifeless matter is dubbed by many as the *impossible problem*. We have not yet discovered a magic wand that bestows life to lifeless beings by simply tapping, and most doubt that we ever will since we do not even know what we are trying to discover. Apparently, life does not fit into the narrow all-material framework of existence. It defies this physicalist description and refuses to reveal its secrets. So, it is not surprising that we are not getting any closer to understanding life, and the hope of ever reaching a true understanding is waning.

A. H. Knoll [22] explains the peculiarity of living beings compared to nonliving ones and the deep divide between the two: “*The particulars of the jump from nonliving to living that occurred in our planet’s early history is a profound enigma, and will likely remain that way for some time to come. ... I imagine my grandchildren will still be sitting around saying that it’s a great mystery, but that they will understand that mystery at a level that would be incomprehensible to us today. ... Making the individual parts of DNA may not have been too difficult, but getting to the point where DNA began directing proteins to carry out important life functions – that leap remains tantalizingly mysterious.*”

Life is a radically different existence with the potential to shatter our current understanding of reality. There is a need to abandon all ideological preconceptions that limit thought and adopt unorthodox new approaches while staying away from any prejudice. One such approach is used here by posing life as an existence outside the physical realm, like the quantum fields. It is shown by arguments based on careful observations that not only a distinct nonphysical realm of life exists, but also it has primacy and supremacy over the physical realm. The enigmatic immaterial life is sturdier than the seemingly robust matter since life subjugates and rules matter.

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Yunus A. Cengel: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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