THE FORMATION OF PHYSICALIST AND MENTAL CONSCIOUSNESS FROM A CONTINUOUS FOUR-DIMENSIONAL CONTINUUM

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ABSTRACT

This paper presents a hypothesis regarding the emergence of physicalist consciousness and mental consciousness. Physicalist consciousness arose with the birth of the universe. It is shown that it is the cause of the emergence of life on the planet and the creation of living matter. Mental consciousness arose with the emergence of neural networks 3.5 billion years later to enable more subtle interaction with the environment.

KEYWORDS

Continuum, energy, entropy, metabolic consciousness, mental consciousness

1. INTRODUCTION

Niels Henrik David Bohr, winner of the 1922 Nobel Prize, expressed the opinion that "our definition of life is merely a matter of convenience. If, instead of distinguishing between living organisms and non-living bodies, we extended the concept of life to everything in nature, the distinction between physics and biology would lose its meaning" [1].

The equally well-known physicist David Joseph Bohm was even more specific: "The ability of a form to be active is a characteristic feature of mind. Electrons possess it" [2].

NASA astrobiologist Bruce Yakoski, professor of geological sciences and atmospheric and space physics at the University of Colorado in Boulder, is known for his statement: "Was there a moment in Earth's history when the absence of life was replaced by its appearance? Most likely not" [3].

The reflections of scientists lead to the idea that we live in a world of panpsychism [4], in which all matter in the universe has consciousness from the moment of its birth. Throughout human history, people's thinking, including in everyday life, has been based on this idea, which was finally scientifically described in the 19th century. Alfred North Whitehead and Bertrand Russell were the ones who most deeply understood the idea of panpsychism at that time.

2. THE EVOLUTION OF CONSCIOUSNESS. PART 1

Currently, the idea of panpsychism is most popular in the scientific community due to the fact that emergence and the theory of the random appearance of life and consciousness do not stand up to even the most benevolent criticism [5, 6]. However, there is some uncertainty regarding panpsychismin that the idea does not have a sufficiently clear hypothesis to explain it, except for

the intuitive notion that it is possible. And the main gap in the explanation is a lack of understanding of how matter and consciousness are related.

It can be assumed that consciousness exists separately from matter and, being an independent physical substance, is capable under certain conditions of transforming inanimate matter into living matter and creating homunculi. However, human experience shows that only living matter can create living matter. A stone will not give birth to a lizard, and a mountain will not give birth to a mouse. In all biological laboratories around the world, scientists reproduce living cells in order to accumulate the necessary amount of biological material. The starting material for reproduction is the cells of a living organism.

Despite the efforts of biologists, it has not yet been possible to create an artificial living cell directly from molecules. This indirectly points to the fundamental nature of consciousness. As they say in such cases, quod liced Jovi, non licedbovi — what is permitted to Jupiter is not permitted to the ox.

Thus, scientific observations and human experience show that emergence is not a way to create living matter and consciousness.

But if we consider consciousness to be a fundamental phenomenon, then it would be most reasonable to identify its emergence with the birth of the universe. In this case, the result could have arisen either during the birth of the universe or in the superposition of processes in later periods. However, the second explanation is very similar to emergent phenomena, which, as we can see, do not contribute to the emergence of living matter.

And what could be more fundamental than the universe and consciousness? The only thing that could be more fundamental is a unified, continuous space-time on the scale of Planckian dimensions and energies, that is, what science calls a continuous four-dimensional continuum from which the universe arose and in which we exist.

Simply put, it is a physical vacuum that is not a void with a certain unchanging structure, but a dynamic, evolving environment capable of self-organization.

The continuum can be imagined as an infinite ocean of substance that we call energy, just as the aborigines of remote islands called ethyl alcohol "fire water." The universe, receiving energy from the continuum in the form of radiation, transformed it into matter in the form of fields and substances. All existing forms of matter, both living and inanimate, are carriers of energy in various forms. In other words, there is nothing in the world except energy.

But how, then, did consciousness arise if the world consists exclusively of energy and only energy? In the current paradigm, there is only one possible answer, namely: energy, consciousness, and life are synonyms for one phenomenon.
In this case, the continuum can be considered not only the progenitor of the universe and an inexhaustible source of energy, but also the source of what we call consciousness.

It passed into the universe from the continuum along with energy, just as a mother gives life to her child. Obviously, the continuum, possessing infinite energy, also possesses the same consciousness, being the source of the properties and processes occurring in the universe, and at the same time being a participant in these processes [7, 8].

The energy and mass of matter are related by the well-known equation $E = m c^2$, which was discovered thanks to the genius of Heinrich Schramm, Nikolai Umov, and Oliver Heaviside,

where c is the coefficient of proportionality between the energy and mass of matter—the speed of light.

In his book Physics and Philosophy, Werner Heisenberg commented on the connection between energy and matter: "All elementary particles consist of the same substance, which can be called energy or universal matter."

To understand how energy is related to consciousness, it is necessary to know what energy is. However, for several millennia, humanity has been unable to rise above the understanding that having more energy allows one to do more work.

We judge energy by its properties. However, just as we judge the charge of electrons and protons, their mass, and gravity solely by their properties, i.e., by how they manifest themselves, without knowing the transcendental nature of their appearance.

One of the properties of energy is commonly referred to as the law of conservation of energy, which is the basis of the existence of the universe. Having emerged from the continuum in the form of the material universe, energy cannot disappear without a trace or reappear. Energy in the universe can only be transformed from one form to another, transmitted over distance through fields, and characterized by energy density, similar to mass. These laws operate in both the microcosm and the macrocosm, remaining unchanged from the moment of the creation of the universe to the present day.

Human experience shows that consciousness cannot exist without energy. Consciousness and energy are most likely definitions of the same state of matter, not being in a causal relationship, but essentially being one and the same.

As the alter ego of energy, consciousness can obviously also take various forms, just like energy, and is also an integral property of all matter in the universe. In the microcosm, it manifests itself as the interaction of fields and particles in the form of energy conversion through strong, weak, and electromagnetic interactions.

On a cosmological scale, it manifests itself through the interaction of gravitational fields. This suggests that consciousness manifests itself when matter transitions from one state to another, in both living and non-living matter, accompanied by energy conversion. Tam Hunt of the University of California, Santa Barbara, for example, is convinced of this and argues in numerous works that the manifestation of consciousness is accompanied by the appearance of an electromagnetic field [9, 10].

Nobel laureate and neurobiologist Albert Szent-Györgyi imagined the process of the manifestation of life and consciousness as follows: "When a photon emitted by the Sun interacts with a material particle on our planet, it transfers one of the electrons in its ground state to a higher, unfilled level. After a very short time, the electron returns to its ground state. Life manifests itself between these two states and, thanks to its mechanisms, causes the electron to return to its original state" [93]. 11

Thus, what is commonly referred to as the manifestation of consciousness can be considered a property of energy.

3. OUR ENVIRONMENT

For a more complete understanding of the nature of consciousness, let us consider the

environment in which we live. The process of the emergence of the universe from a continuum as a result of a grandiose fluctuation of its energy, commonly referred to as the Big Bang, is currently the dominant, generally accepted scientific hypothesis [12, 13, 14]. This process is very reminiscent of the birth of living matter. Born in the throes of the Big Bang, the universe developed like living matter, with all its elementary particles, atoms, cosmic objects, and human destinies, changing its character with age. The universe, like living matter, also has an incredibly long but limited lifespan.

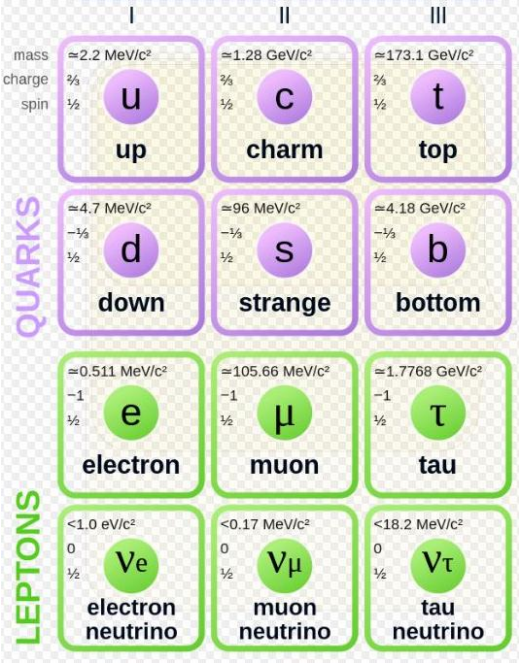
At the same time, the universe continues to exist in the continuum, as if floating in it, experiencing its influence and gradually dissolving into it, like a drop of ink in a glass of water, in accordance with Buddhist ideas about the world — "emptiness is that from which everything appears and to which everything returns." Together with the universe, we too are in a vacuum and are part of it.

However, upon careful analysis, it turned out that emptiness is quite structured. The first step towards understanding this was taken in 1968 by theoretical physicist Gabriele Veneziano, who applied a 200-year-old mathematical apparatus for describing the processes occurring in the world of microparticles, compiled at that time by the great mathematician Leonard Euler. The idea was called string theory.

As a result of their research, scientists described the void as a boundless ocean consisting of clusters of oscillating energy in the form of geometric figures on a scale of 10-34 meters, which were called superstrings. Each superstring oscillates with its own set of frequencies and energies. The oscillations of superstrings lead to the conversion of their energy into elementary particles [15]. Superstrings are the primary, fundamental elements of matter [15, 16, 17].

An alternative theory is the equally well-known loop quantum gravity (LQG) theory. The first ideas were introduced into science in 1986 by Abhay Vasant Ashtekar [18]. According to the theory, space consists of quantum cells united into a continuous, regular structure on the Planck length scale, which is 10-34 meters, in which elementary particles are also formed.

Elementary particles are particles that cannot be composed of other, smaller particles. The table, which can be found in quantum physics textbooks, shows all twelve elementary particles known to date that make up our world. It is amazing that the infinite diversity of the world around us consists of only a dozen building blocks. (The table does not show the same number of antiparticles, which do not participate in the creation of our world.)



It should be noted that regardless of the theories describing the state of the continuum, their main, fundamental content is the energy that was transferred to the universe in the form of matter.

Based on the unity of the universe, we can say that all phenomena that occur in the real world can be viewed as a consequence of processes occurring in a vacuum, similar to waves on the surface of a very deep ocean.

Let us emphasize once again that, as an integral part of the continuum, the elementary particles that make up our world, including ourselves, participate in all the processes that occur in it.

4. THE EVOLUTION OF CONSCIOUSNESS. PART 2

Numerous theoretical descriptions of the origin of the universe[19, 20, 21, 22] suggest that the energy of the initial radiation accompanying the Big Bang formed the first elementary particles with their own physical constants.From that moment on, each elementary particle became a quantum object and a carrier of energy obtained during the fluctuation of the continuum energy.

The dimensions of elementary particles known today, such as quarks, are approximately 10^{-17}meters. Meanwhile, the structural dimensions of the continuum are 10^{-34}meters.Elementary particles are connected to the continuum through interactions that obviously occur at this scale. However, at present,the nature of these interactions in this range is inaccessible for research due to technical reasons. We can only assume that these interactions are what we call consciousness, through which the continuum influences elementary particles.

While in the field of continuum consciousness, unlike, for example, the gravitational vector field, the particles in it do not experience aforceful impact in the direction of the field vector. The continuum consciousness field manifests itself qualitatively differently, resembling a scalar field, i.e., without the presence of force factors in it. Nevertheless, unlike a scalar field, particles are guided in their movement by the continuum consciousness field and, at the same time, by what can be defined as the particles' own consciousness.

In this regard,Galen Strawsonsuggested that "these protopsychic characteristics will give rise to the mental characteristics that we attribute to living beings. The mental characteristics of elementary particles at this stage of evolution are so simple and insignificant that they are imperceptible to us" [23]. This hypothesis was also supported by the renowned geneticist Sewall Green Wright [24, 25, 26].

To understand the behavior of particles in the field of continuum consciousness, let's consider a small example. Imagine that it has started raining in a park, which is analogous to the general field of consciousness. At the same time, all the inhabitants of the park, which are analogous to elementary particles, rush to their burrows, nests, and homes, each according to their own consciousness.In other words, all matter in the universe, from the moment of its birth, resides in the field of consciousness of the continuum, while simultaneously being its content.

The elementary particles that emerged began to combine into protons and neutrons. From these, with the participation of electrons, more complex structures emerged in the form of hydrogen and helium atoms. The combination of micro-objects into larger ones took place throughout the evolution of the universe.But how can we explain the "desire" of microparticles and subsequent larger formations to unite?

Obviously, first and foremost, by the quantum and physical laws that have established themselves in the universe and have essentially become the working rules of its existence. By combining into more complex structures in the form of atoms and molecules, elementary particles thereby increased the overall level of energy and, accordingly, consciousness,while remaining within the field of consciousness of the continuum.

The processes of unification and evolution of the universe were facilitated by the emergence of a gravitational field in which all bodies with mass, from microparticles to galaxies, experience attraction to each other in accordance with the law of universal gravitation established by Isaac Newton. It became the dominant factor uniting masses on a cosmological scale.

The combination of primary hydrogen and helium atoms led to the formation of stars and galaxies, followed by the appearance of more complex and heavier elements.

With the formation of planets, comfortable conditions arose in which biological processes could take place. In particular, it became possible for atoms to combine into simple molecules on Earth. A very important factor in this process was the selection of elements during the formation of molecules, which resulted in carbon, hydrogen, nitrogen, and oxygen atoms gaining an advantage.[3][There was also a selection of amino acids in the construction of protein molecules along with many other selective processes.

It is important to note a significant circumstance that confirms the fundamental nature of the origin of consciousness.Consciousness, like energy and other quantum constants characterizing the state of elementary particles, survived despite the harsh cosmological conditions associated with high pressures and temperatures, passing through the forge of the Big Bang. This property characterizes it as a fundamental substance. Otherwise, it would not have manifested itself later, at the stage of the formation of atoms and molecules, since molecules, unlike elementary particles, especially organic ones, are known to be highly unstable to external influences due to the relative weakness of covalent and other chemical bonds between atoms. In this regard, the formation of molecules, especially organic ones, became possible with the completion of intense geological processes on Earth and the emergence of an environment with stable temperature, gravitational, and other parameters.

At the same time, evolution had a very specific vector of development, which consisted in molecules uniting within a closed space to create their own environment with a complex of biochemical reactions that allowed them to maintain homeostasis.

The resulting molecules contained different numbers of atoms and, accordingly, elementary particles of which they consist — carriers of consciousness. In this regard, the level of consciousness of molecules of varying complexity was established differently.
At the same time, several groups of molecules and molecular complexes were formed that were adapted to work with each other, like parts and nodes of a common, more complex mechanism, or, in other words, like pieces of a common Lego puzzle.

If molecules were formed on the basis of stochastic processes, each developing on its own, their union could not take place due to their incompatibility with each other, just as truck wheels cannot be put on passenger cars.

Thanks to homeostasis, the cell became an autonomous entity capable of maintaining energy balance with its environment, giving rise to metabolic processes.

All subsequent evolution of living matter has continuously followed the same scenario as in the period before the emergence of cells, i.e., through the active combination of simple elements into more complex ones. At the same time, life on our planet has not been interrupted for a moment and has not arisen anew. Its development began with the emergence of the universe and continues uninterrupted to the present day.

Thus, the fundamental nature and continuity of the evolution of consciousness lies in the fact that ithas been occurring since the birth of elementary particles, bothbefore and after the formation of cells, without interruption. The formation of cells is only one stage in the evolution of living matter.

At the same time, the dominant property of the consciousness of matter is the desire for its constant growth by combining smaller objects into larger ones.

The transition from one level of consciousness to another, i.e., from one state to another, occurs in stages, as is commonly believed to be quantized, since the structure of matter and energy itself is quantum in nature.

Let us apply the biological term "homeostasis" to denote a certain state of any system in which the necessary conditions for survival and a certain level of consciousness are formed. Then we can consider, for example, that the atomic structure, which exists only under certain ratios of mass and charge of electrons, protons, and neutrons, and the presence of electromagnetic, strong, and weak interactions, represents its own environment of homeostasis.Another set of physical, chemical,biological constants determines the homeostasis of cell existence. The union of cells into organisms leads to a new level of consciousness, for which its own environment of homeostasis is necessary. Flora and fauna also owe their existence to the homeostasis established on the planet. And so on up to cosmological scales, where stars unite into galaxies, galaxies into supergalaxies, and black holes exist in their own environment of homeostasis, which we call physical constants or cosmological parameters.

Here, it is worth noting another significant circumstance related to the formation of homeostasis, known as fine tuning. Scientists working in the natural sciences are amazed and delighted by the stable preservation of homeostasis parameters regardless of the scale of objects. These are commonly referred to as physical or cosmological constants.What amazes them is not their

existence, but the fantastic stability of their values and the relationships between them, ranging from the Planck level to the size of the universe [27].

The fantastic constancy of constants suggests that all cause-and-effect relationships are not random and must originate from a single common source possessing absolute self-organization.Only the existence of a self-organizing environment in which all processes occur in an interconnected, interdependent, and symmetrical manner, where energies and forces are balanced, can preserve the stability of what is commonly referred to as fine tuning.

Knowledge of the constants themselves and their relationships, even with great accuracy, does not answer the questions: what is the basis of this accuracy and stability, and how and why is it possible? The established laws of physics are merely rules by which the universe lives, similar to the rules of the road on a highway. Traffic rules are established by municipal or federal authorities to ensure the smooth and orderly movement of people. However, how the rules of the universe were formed and for what purpose remains an open question.

In his book "A Brief History of Time," Steven Hawking explained the existence of the problem by saying that physics is a set of rules and equations. But we do not know what gives fire to equations and creates the universe they describe. Physics cannot tell us this.
It is clear that rules could not have established themselves spontaneously, either on the highway or in the universe. Therefore, there can be only one explanation. The dynamic, self-organizing, global substance that establishes the laws of evolution of the universe can only be a continuum.

This hypothesis allows us to answer the questions: why did cells of the same type arise in geographically distant places on the planet, and why did the combination of molecules into organelles and cells occur with the participation of the same atoms:carbon, hydrogen, nitrogen, and oxygen, the same limited set of amino acids, nucleic acids, etc., and contributed to the emergence of similar cells following the same scenario across the entire planet? Finally, why are the same molecules and organic compounds found in meteorites as those found on Earth?

In this regard, it is worth remembering once again that every atom in the universe, including those of which we are composed, being in the field of consciousness of the continuum, are united with it by common quantum laws.

5. SELECTIVE PROCESSES ARE A FORM OF PHYSICALIST CONSCIOUSNESS

Time destroys even granite, turning it into sand. Over time, mountain ranges disappear, turning into sand dunes. The expanding universe will also gradually disintegrate into elementary particles and Hawking radiation [28], which will disappear into the vacuum in a few billion years, or perhaps sooner.
At the heart of these processes lies a common phenomenon known as entropy. Simply put, there is a constant increase in disorder and decay of matter in the universe, which no one and nothing can stop.

However, nowhere except in living matter is the energy entering the system used to increase order and curb the growth of entropy. (To be fair, it should be noted that this exception also applies to the streets of Japanese cities. There you will not see trash on the pavement, even though the pavement is not swept. The people of Japan have come to a deep realization that controlling entropy depends solely on themselves.)

Living matter, receiving energy from outside, is capable of " rationally" expending it to maintain its state, i.e., homeostasis.The body's cells independently decide to spend the energy

received on the synthesis of molecules to renew organelles, perform work, or create energy reserves in the form of ATP, glycogen, and fat reserves, based on survival conditions.

All processes related survival are inextricably linked to metabolism. Britannica states: "Metabolism is the sum of chemical reactions occurring within each cell of a living organism that provide energy for life processes and the synthesis of new organic material." To this we could add: "thanks to which the rapid growth of entropy in living matter is kept at approximately the same level, sustaining its life."

The wise Aristotle, in addition to chemical reactions, saw in metabolism the creative role of movement, devoting two volumes to it in his work Physics. His idea has survived to this day in the form of the well-known postulates "life is movement" and "movement is life."

Observations and analysis of the movement of molecules and organelles in living matter lead to the conclusion that this is not ordinary chaotic movement. All objects in the universe, from elementary particles, atoms, and molecules to cosmic objects that received momentum and energy in the process of the Big Bang, possess chaotic motion. Such motion leads to an increase in entropy, i.e., an increase in disorder.

It is impossible to imagine that metabolic processes proceed according to stochastic laws, according to which molecules, randomly colliding with each other, form the necessary compounds.It is clear that in this case, the processes would take an indefinitely long time, during which life would become impossible [5]. Therefore, the laws of chaotic motion are not applicable to the processes occurring in living matter.

In addition, the presence of a certain amount of energy in molecules is not sufficient for metabolic processes to occur. For them to proceed successfully , selectivity must be observed, whereby molecules can selectively combine with each other in the common space of the cell cytoplasm and outside the cell in the presence of thousands and millions of other molecules simultaneously.

Nevertheless, it is currently accepted that molecules and organelles interact with each other according to stochastic laws. For example, in the well-known three-volume fundamental textbook [29], Bruce Alberts, Dennis Bray, and their colleagues describe the formation of bonds between molecules based on diffusion occurring according to a random law.Here is how, in their opinion, two molecules bond: "Before bonding with each other, two molecules must come into contact. This is achieved by thermal motion, which causes random movements, or diffusion of molecules. Diffusion is an effective way to move molecules over short distances, but it is ineffective for moving them over long distances."

The authors also note that the surfaces of molecules must be prepared as a result of some kind of adjustment, whereby the connection can occur and then break down under the influence of thermal motion.

Thus, according to the scientists: "The sequence of macromolecule subunits contains information that determines the spatial configuration of their surface. It is this information that is used by different molecules and different parts of the same molecule to recognize each other through weak non-covalent bonds.Molecules are in constant rapid motion. If, upon collision as a result of random diffusion, recognition occurs, they bind to each other. In addition, living cells constantly make mistakes. If necessary, errors are corrected using special repair mechanisms."

It is obvious that the described mechanism of stochastic diffusion coupling of molecules is

ineffective and, moreover, inoperable, especially at long distances, as the authors themselves admit.This leads to the inevitable conclusion that there must be some other mechanism for molecule recognition, which the authors mention but do not describe.

Currently, some mechanisms of selective movement are known in the targeted delivery of molecules and organelles in cells through their labeling and transport by protein molecules. For example, COP I molecules are involved in the labeling of synthesized molecules in the endoplasmic reticulum (ER) during anterograde transport, while COP II molecules are involved in the labeling of molecules rejected in the Golgi complex and subject to retrograde transport [30]. This type of targeted delivery works inside cells at close distances only between two organelles—the ER and the Golgi complex.

The transport of cholesterol and ceramide molecules in containers accompanied by protein molecules, described in detail in [31], is also known, as is the transport of molecules and organelles using kinesin transport molecules capable of moving along the microtubules of the cytoskeleton of the cell [32, 33].

The paper [34] describes the transport of mitochondria in the axon of neurons along the cytoskeleton of the cell using transport molecules at an average speed of 0.2–0.5 micrometers per second. The authors refer to this movement as processive, emphasizing its difference from chaotic movement.

Let's consider a fragment from the life of cells. Imagine a receptor located in the cytoplasm of a cell in standby mode. A molecule—a ligand—moves toward it, carrying certain information to the receptor related, for example, to the synthesis of new molecules .After overcoming the barrier of the cell membrane, it purposefully approaches its receptor, "ignoring" the presence of hundreds and thousands of other molecules around it and not interacting with them. Finally, the receptor "selectively reacts" by binding to its ligand, "recognizing" it face to face from among thousands of others nearby, like two friends meeting in the subway.Next, the receptor, having received the signal, passes through the nuclear membrane and approaches the desired section of DNA for transcription. At the same time, numerous participants in transcription come into play: enhancers, silencers, insulators, and many other protein molecules, numbering in the hundreds and thousands.Without creating any "commotion," they jointly proceed to mRNA transcription with the knowledge of the matter "characteristic of a socially developed person," demonstrating consistency in the process and "high professionalism."Next, in the process of splicing, mRNA is edited through individual, "manual" selection of codons.Translation, i.e., the assembly of the polypeptide chain, is also the result of the error-free, joint activity of many different rRNAs, ribosomes, and enzymes with the selection of the necessary amino acid molecules from the huge number of them simultaneously present in the cytoplasm of cells.

Signs of "intelligent" behavior are evident, for example, in protein molecules called chaperones, which "care for" growing molecules, in complex molecular structures called rafts, which "patrol" the cell membrane, and ATP synthases, which participate in the synthesis of ATP molecules.

The process of growth of billions of axons during the formation of a neural network is truly awe-inspiring. The development of each axon is aided by growth cones, which act as guides, using chemoattractants and chemorepellents to lay routes to "their" neurons and dendrites. In some cases, the length of these routes can reach several meters.

All processes involving molecules are characterized by purposefulness, knowledge of the direction of movement and the exact address. It is not possible to explain the selective behavior of molecules and organelles solely by known physical and chemical laws. It is obvious that their

behavior is based on some other, more general laws.

Let us return to Strawson and Wright's hypothesis about the microconsciousness of elementary particles. Molecules and organelles, no matter how complex and massive they may be, are all composed of atoms, which in turn are composed of elementary particles.In this case, the consciousness of each molecule is the integrated consciousness of the primary elementary particles of which it consists. In the behavior of molecules, this looks like a manifestation of their independence, because the number and composition of atoms and, accordingly, particles determine the consciousness of each type of molecule, making it "individual."

It is known that as the complexity of the structure of molecules increases, so does their functionality. This is especially evident in the behavior of protein molecules, which have an incomparably more complex structure and greater mass compared to lipids, carbohydrates, and other molecules. They perform and more complex functions, dominating in the manifestation of their selective movement.

But how do hundreds of thousands and millions of molecules, organelles, and cells, each of which, having started moving from one given point,definitely reaches another given point, while performing its function?

The logistics for moving molecules, organelles, and cells is a branched system of blood and lymphatic vessels. It can be compared to a well-organized urban transport system, through which people and goods are transported. However, all transport operations are controlled byhuman consciousness, since each movement has a starting point and a destination, which are determined by human needs. It cannot be otherwise. We call this movement of people free orderly motion.

The movement of molecules is no different from the movement of cargo, which occurs under the control of human consciousness. One cannot help but assume that molecules also manifest their consciousness, using the existing logistics of the circulatory and lymphatic systems. In other words, molecules, consisting of elementary particles and possessing their own consciousness, move freely in the field of consciousness of the continuum according to algorithms established over millions of years of evolution.

It should be noted that the creators of cars with artificial intelligence control, i.e., without human involvement, copying the idea of the continuum, also came to the conclusion that it was necessary to create algorithms capable of driving a car through busy city streets.

The above arguments convincingly show that the selectivity and specificity of molecules in reactions occurs with the participation of consciousness, which contributes to these processes and can be characterized as a manifestation of a physical form of consciousness. Only under this condition will metabolic processes allow homeostasis and entropy at to be maintained at a constant level.

6. MECHANISMS THAT PREVENT THE FLOW OF SELECTIVE PROCESSES

It is known that microparticles in the quantum world, being in a free state, inevitably and constantly experience the influence of quantum fluctuations during their movement. This leads to the fact that they are forced to move chaotically, unable to move independently in the desired direction, like a person in a turbulent stream of water. Of course, such an environment does not contribute to the unification of particles into larger forms.

An even more noticeable effect on the movement of molecules is exerted by the temperature of the environment, i.e., thermal Brownian motion, the intensity of which depends on the temperature and mass of the particle.

Erwin Schrödinger drew attention to this circumstance, noting the following in his book What Is Life? [35]:"There are bacteria and other organisms so small that they are highly susceptible to this phenomenon. Their movements are determined by the thermal whims of their environment; they have no choice. If they have their own mobility, they can still move from one place to another, but only with certain difficulties, since thermal motion tosses them about like a small boat in a stormy sea."

Simple calculations show that thermal motion can accelerate organic molecules with an average mass of one million Daltons at a temperature of 36 degrees Celsius to a speed of 3.5 meters per second. And that, of course, is a lot.

Therefore, it is not surprising that cell membrane lipid molecules, having a relatively low mass, can drift a distance equal to the circumference of the cell in ten seconds,with a diameter of 30–50 micrometers, and can also jump from one layer of the membrane to another, despite the fact that they are bound to each other by molecular bonds and are located in the viscous gel medium that is the cell cytoplasm [31].

Another example is infusoria, which, with a mass of 0.01 milligrams, much greater than the mass of organic molecules, will experience shocks at a speed of approximately 1 micrometer per second, which can already be considered comfortable living conditions [36].

However, Nature, having conceived the idea of creating living matter, found a brilliant solution. It uses gravity. The appearance of matter, of which the universe is composed, led to the emergence of a gravitational field, i.e., the appearance of inertia. Many people are familiar with the fact that inertia is greater the greater the mass of a body. To build living matter, Nature created molecules with a very large mass, whose movement cannot be affected by the chaotic movement of smaller masses, just as a person cannot affect the movement of a moving car, but can easily stop a flying tennis ball and change its direction of movement.

Thus, by combining into heavy organic molecules, up to hundreds of thousands and millions of Daltons, regardless of whether these molecules are proteins or something else, they gained the ability to move purposefully and actively participate in selective processes to the fullest extent.

7. PHYSICAL AND MENTAL FORMS OF CONSCIOUSNESS.

When discussing consciousness, researchers describe its manifestations in different ways.The question inevitably arises: why is there such a wide difference of opinion on the same problem of consciousness? This is a good time to recall the parable of the blind travelers (which is often mentioned in articles), each of whom, touching different parts of an elephant's body, described the animal differently.

Isn't there a similar situation with the understanding of consciousness? Neuroscientists, psychologists, philosophers, physicists, sociologists, and ordinary people have different attitudes toward the problem of consciousness, each describing its various manifestations in their own way.

In this regard, it becomes clear that the efforts of biologists, physicists, philosophers, or psychologists alone cannot explain the nature of consciousness, since it contains the entire body

of knowledge about the world. Only a synthesis of all knowledge will provide an answer to the question of what consciousness is.

Currently, discussions about the consciousness of living matter are traditionally focused on the activity of the neural networks of organisms and their subjective experience. This tone was set by Rene Descartes, who concluded Je pense, donc je suis – I think, therefore I am, in the commonly accepted transcription cogito ergo sum – I think, therefore I exist.However, when talking about life, we must agree that living matter that has no neural structure at all can possess consciousness.

Essentially, the problem of consciousness manifests itself in two components. The first problem is related to the physical form of consciousness, which is the basis of metabolism, i.e., metabolic consciousness. The second problem is related to the mental form of consciousness, i.e., mental consciousness, which is authored by the neocortex with its mysterious super-complex neural network in conjunction with the endocrine system.
The physical form of consciousness and the mental form are based on the dynamics of two different processes. The physical form of consciousness is associated with selective biochemical processes that occur between molecules and organelles in cells and between cells.

The mental form of consciousness is also linked to selective processes, but between neurons via electrical impulses.

Physical consciousness, synonymous with life and energy, was the unifying factor in the creation of molecules,organelles, and cells. Thanks to it, metabolic processes identical in all living matter at any stage of its development were formed. Professor Robert Morris Sapolskydrew attention to this aspect of cell metabolism, noting with his characteristic humor:"We are the product of cells and everything else, and our brain is as much a biological organ as, say, the bladder: the cells of the bladder wall and the mega-complicated neurons of the cerebral cortex have much more in common than differences" [37, 38]. However, why, in that case, do we observe different levels of consciousness?

The physical form of consciousness, having created life on the planet, sustaining and improving it, fulfilled its main function. The dialectic of life's development over 3 billion years led to the need for the development of a new type of consciousness capable of analysis, i.e., the constant comparison of external stimuli with preserved experience.In other words, living matter, in its struggle for survival, needed a "processor" to analyze both the external environment and the internal environment in order to ensure a quick and optimal response to the emergence of danger.

Cells developed this ability only 250–500 million years ago. During this period, the first neurons appeared, which most likely transformed from simple cells [39, 40].With the emergence of neurons and neural networks, a mental form of consciousness appeared,which is associated with the development of qualia and, accordingly, a more subtle interaction with the surrounding world. Mental consciousness is characterized by cognitive abilities, experience, analysis, and self-identification. The most important quality of mental consciousness is its ability to actively influence the environment, as well as internal processes. The mental form of consciousness is individual, unlike the physical form. There is no individuality in physical consciousness. All cells of living matter, including neurons, function according to one common algorithm.

The dynamics of the development of computing technology can serve as an example of the development of consciousness.Let us recall that the first electronic computers were built on vacuum tubes, then on transistors, later on microprocessors, and finally quantum computers appeared. Most people know that all generations of computers differ from each other by several orders of magnitude in terms of their capabilities, although they can perform the same functions.

However, computers operate based on general physical laws related to the flow of electric currents through conductors, resistors, transistors, and other elements of electrical circuits, which are a constant, unchanging part of computer design. They can be identified with the physicalist form of consciousness. On the other hand, processors, memory elements, and other components, being an integral part of computers, are constantly being improved and updated. This part of the design of computers is analogous to the mental form of consciousness.

The same thing happened in the development of living matter. The development of the neural network led to a relatively rapid increase in the level of consciousness. However, this increase did not occur due to an increase in the physical component of consciousness, but due to the growth and complexity of the neural network, which forms mental consciousness together with the endocrine system of living matter.

Unlike the physical form of consciousness, which is the same for all types of living matter, the neocortex, forming the mental part of consciousness, constantly developed, being a variable quantity. Therefore, as the number of neurons and, accordingly, the connections between them increased, there was an "increase in consciousness."

Thus, the historical and biological evolution of consciousness is determined by its mental component. The physical form of consciousness remains constant for all types of living matter.

But what about the unification of matter into larger forms for the purpose of raising consciousness? The process has not stopped. It has been going on since the beginning of the universe. If previously the unification took place at the level of atoms, molecules, and cells under the control ofphysical consciousness, then with the emergence of mental consciousness, it took over these functions. Unification occurs both in microorganisms and in the animal world and humans, who unite in flocks and communities.

I would also like to clarify the issue of "consciousness in electrons."

The authors of the articles, philosophizing about consciousness, mention the presence of mental consciousness in electrons, forgetting that only owners of neural networks possess mental consciousness. As is well known, no neural networks have been found in electrons. However, according to panpsychism, they must still possess consciousness. How can this contradiction be explained?

Of course, electrons have consciousness, but not mental consciousness. We should not expect manifestations of mental consciousness from them. This is the prerogative of neural networks. Electrons possess physical consciousness, which manifests itself differently. It manifests itself in the clear, flawless execution of all physical laws while in the field of influence of the continuum. Therefore, the phrase "what it is like to be an electron," based on the idea of mental consciousness, is an oxymoron.

8. MENTAL CONSCIOUSNESS

Mental consciousness developed alongside the development of the neural system and cannot exist without the physical.The difference in neural networks, due to the formation of individual experience, leads to different processes and, accordingly, to different perceptions of the same phenomena, which we call subjective perception of the world, as well as different manifestations of consciousness, sometimes epiphenomenalism.

What is commonly referred to as mental consciousness in the form of images and sensations is the product of the coordinated work of the central nervous system, including the neocortex, the peripheral nervous system, and the endocrine system .

As a neurosurgeon, Galen Strowson knows this subject best. He states with conviction: "Human experience is the activity of the neural system. At this point, there is no reasonable doubt about that."

The "intellectual games" of the neocortex form mental images that are largely the result of a combination of several factors. This is confirmed by the practice of artificially generating images by interfering with the workings of the mental consciousness.

Erwin Schrödinger, for example, described subjective perception of the world as follows: "Several areas of 'personal' consciousness partially overlap.The common area in which all areas overlap is the construction of the 'real world around us'. But with all this, there remains an unpleasant feeling that raises questions such as: is my world really the same as yours? Is there a single real world, different from the images introjected through perception into each of us? And if so, are these images similar to the real world, or is the latter, the world 'in itself', very different from what we perceive?" [41].

In other words, no one has the right to claim that mental consciousness allows us to perceive the world objectively. Each of us can only subjectively imagine the observable world with a degree of probability. However, a large number of subjective perceptions can bring us closer to an objective assessment of the observed phenomenon. But only closer.

At the same time, the mental form of consciousness is not as unambiguous as it seems at first glance. It has something in common with all living matter and only individual features in which it manifests itself. Obviously, the individual part is characteristic of each separate neocortex,

with personal experience. This state of consciousness is commonly referred to as phenomenal consciousness.

The lack of monolithicity of mental consciousness was also noted by New York University professor Ned Joel Block, who concluded that mental consciousness consists of two components: phenomenal consciousness and cognitive access, as he defined it [42, 43, 44].

Phenomenal consciousness, as already noted, is formed as a reaction of the central nervous system, including the neocortex, to signals from the external and internal environment, generating a continuous sequence of mental images that follow one another.It is a unique product of each individual and occurs individually in each owner of the neocortex in accordance with individual experience, as a result of processes occurring in the individual neural network. At the same time, phenomenal consciousness is always emotionally colored, since the endocrine system, responsible for the emotional state of a living organism, participates in its formation.

Perhaps the most accessible explanation of the phenomenon of consciousness was offered by Nobel Prize winner Francis Crick, who is convinced that phenomenal consciousness is the product of the individual activity of each person's neural network. In his popular book The Astonishing Hypothesis, published in 1994, he writes:"The amazing hypothesis is that 'you', your joys and sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.As Alice in Lewis Carroll's novel might say, 'You are nothing but a collection of

neurons'" [45].This humorous and simplified description of the processes occurring in the neural network nevertheless explains much about the formation of phenomenal consciousness.

It is also important that the entire diversity of phenomenal consciousness is formed with the participation of all cells in the body, not just the neurons in the brain. At the same time, despite the huge number of cells and their "opinions," the overall decision is always made in the singular through a process of "democratic choice."

For example, in medical practice, there is a phenomenon known as "brain splitting," when the connection between the right and left hemispheres of the brain is lost due to disturbances in the corpus callosum. In such cases, the right and left hemispheres perceive the surrounding world differently, but consciousness always manifests itself in the singular.

The second part of mental consciousness could be called the algorithm for the formation of phenomenal consciousness, reminiscent of the protocols by which computers and networks operate.

It is evident that the exchange of impulses between neurons does not occur randomly, but rather according to a "protocol" for the exchange of impulses between neurons, as in any computer, their sequence of passage between microcolumns and macromodules in the layers of the cortex, as well as areas of the brain and their transformation into images and semantic definitions. It is clear that this algorithm is constantly active and evolving, arising with the emergence of the neural network.
Similar to computer protocols, it consists of physical protocols, which in living matter are physiological, ensuring the physical connection and functioning of all cells in the body, as well as logical protocols.

Physical protocols are responsible, for example, for the functioning of vision, i.e., the conversion of light quanta arriving at rhodopsin molecules in the retina of the eye in the wavelength range from 0.36 micrometers to 0.78 micrometers, into a sequence of electrical impulses, the conversion of sound waves in the acoustic range into a sequence of impulses, the conversion of smells into the same sequence of impulses, etc.

Physical protocols are the same for all humans. But they may differ from animals. For example, corvids see well in the ultraviolet region of the spectrum, while owls see well in the infrared region. Bats and dolphins have the ability to emit and receive ultrasonic waves for location and communication, plants absorb energy in the form of ultraviolet radiation, etc. Physical protocols may differ between species, but not fundamentally.

Logical protocols establish rules for data transmission and image formation. They determine the semantics of the transmitted message, i.e., the meaning of a particular message, as well as the choice of route and addressing of the message. In a neural network, logical protocols integrate visual, auditory, and other signals in the form of impulses into corresponding images, identify and establish substances or events by smell, etc., in order to perform subsequent actions.

Torsten Nils Wiesel and David Hunter Hubel made an enormous contribution to explaining the formation of images, particularly visual ones, and were awarded the Nobel Prize in 1981 for this discovery.[46, 47]. They were the first to describe the complex algorithm of image formation by neurons and receptors located in different layers of the cortex and different areas of the brain. It has now been reliably established that images are formed by sequential, conveyor-belt processing of information by specialized groups of neurons, starting with receptors and ganglia and ending with generalization by groups of neurons in the upper layers of the neocortex and areas of the

brain [48, 49, 50, 51].

A very important discovery made by Torsten Wiesel and David Hubel is the relative uniformity of the neocortex structure.They summarized their findings with earlier studies by E. Jones of the University of Washington School of Medicine and Nauta and P. Goldman of the Massachusetts Institute of Technology, as well as T. Imig,H. Edrien, and J. Braja from the University of Wisconsin School of Medicine, who studied auditory areas, and concluded that regardless of the functions performed, the structure of microcolumnscombined into macromodulesis the same for all areas of the brain [52, 53, 54].

Different types of neurons in microcolumns are rigidly linked to each other in accordance with physical protocols recorded in the DNA of each species and are a physiological property of the species. Microcolumns consisting of neurons can be compared to the simplest computer microprocessors consisting of a multitude of transistors designed to perform standard operations.

However, different forms of communication between microcolumns in macromodulesprovide different specializations of macromodules, from which different areas of the brain are formed. In addition, during the process of learning and accumulating experience, patterns of states are formed, largely due to connections between macromodules and areas of the brain.

This structure explains the plasticity of the brain, in which some groups of neurons are able to replace other damaged groups [55]. This may indicate that information processing algorithms should be similar for any information entering different areas of the brain.

Undoubtedly, the role of mental consciousness is not just significant.It is revolutionary, because mental consciousness transformed the humanoid creature into Homo Sapiens, enabling it to move from a primate herd to a social society in which, in addition to the numerical parameters that characterize humans, criteria completely new to living beings appeared, such as the spiritual level of mental consciousness, moral norms, religious relations, and other qualities based primarily on humanism.

A neural network is an extremely complex system that is difficult to study, in particular because of the infinite number of processes that occur simultaneously within it.
In addition, studying the problem of consciousness is like studying a black box inside which there is another black box interacting with the first, the properties of which are far from being studied, which greatly complicates the understanding of the nature of consciousness.

Therefore, the study of consciousness could be divided into the study of the physical form of consciousness and the study of the properties of the neocortex, which forms the mental form of consciousness.

9. CONCLUSION

Alfred North Whitehead had an ambiguous attitude toward religion and God. He did not deny religion with its rituals, but he did not accept it either. He wrote: "When considering religion, we must not be obsessed with the idea of its necessary goodness. This is a dangerous delusion."

Nevertheless, Whitehead's philosophical works were permeated with the idea of God. And this is not surprising. Panpsychism arose long before the advent of modern knowledge and was created by observant and thoughtful people who sought an explanation for the phenomena of Nature not in religion, but in the dialectic of its existence.However, due to the lack of modern scientific knowledge known to us, in the times of Thales and Plato, the unifying force of all existence and

the unity of the diversity of the universe were associated with God, without having a more complete description of space-time at that time.Continuing Plato's philosophy, Whitehead uses the idea of God as a force that "does not lead to chaos and contributes to order and novelty" [56].

The manifestation of the consciousness of the self-organizing continuum environment was intuitively interpreted by people as a manifestation of divine forces. Gradually, various ritual processes were added to the manifestation of natural phenomena, which, thanks to the efforts of enterprising people, grew into religion.

However, unlike any religion based on blind faith in the influence of a divine being on all that exists, the hypothesis of continuum consciousness is a completely scientific hypothesis, the explanation of which is based on scientific facts.

Without scientific methodology and relevant knowledge, it was indeed possible to turn Whitehead's philosophy into theological philosophy.Such an adaptation of Whitehead's process philosophy was undertaken by theologians with the participation of the renowned University of Chicago professor Charles Hartshorne under the title "Process Theology" in the 1950s [57].

In this regard, it should be noted that some scientists are still inclined to experience religious feelings. Obviously, this can be explained by despair over the inability to obtain the necessary answers to the questions that arise in their minds.

In essence, all human experience and all religious teachings of the world are historical records of the phylogenesis of humanity, which can be considered a global experiment of living matter existing in and interacting with the continuum.However, this invaluable experience has been transformed into various religions without sufficient scientific basis. In this regard, humanity's religious experience can be considered convincing confirmation of the participation of a self-organizing environment in the evolution of living matter.

With the birth of the universe, the laws of development and existence of our world were formed. Without this, our world could not have appeared and existed, because then chaos would have reigned, in which the existence of matter and the emergence of life would have been impossible.

On the contrary, our world is arranged in a surprisingly harmonious way. Possessing our own mental consciousness, we can move through life at greater or lesser speeds, guided by our own experience and established rules of movement on this path. At the same time, it is indisputable that a developed consciousness is the most optimal and best means in the struggle for biological survival.However, why living matter is doomed to survival remains a mystery.
Let's think about it together.

Considering consciousness to be a fundamental substance, we can make some generalizations.

1. The source of all properties and processes occurring in the universe is continuous space-time on the scale of Planck dimensions and energies, i.e., a continuous four-dimensional continuum that possesses absolute self-organization.
2. Consciousness, along with energy, is the essence of the continuum. Consciousness and energy are inseparable from each other. Consciousness manifests itself when the state of the system changes and is accompanied by a change in energy.
3. The universe originated from the energy and consciousness of the continuum. All processes in the universe occur in the field of consciousness of the continuum and are harmoniously connected with it. The commonality with the continuum is based on the continuity of connections between events and objects and the continuity of their evolution.

4. The emergence and development of living matter is a consequence of the manifestation of a physicalist form of consciousness that arose simultaneously with the birth of the universe. Physical consciousness manifests itself equally in all forms of living matter. It contributed to the emergence of selectively occurring biochemical reactions and free selective movement, i.e., metabolic processes, thanks to which it became possible to maintain homeostasis and restrain the growth of entropy.Physical consciousness is dominant over mental consciousness because it is responsible for survival.
5. The mental form of consciousness is characteristic of neural networks, which are constantly evolving. The mental form of consciousness exists thanks to the physical form of consciousness, ensuring adaptation to the external environment.

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