



Information Field and its Carriers in Biological Systems

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Abstract

Homeostatic intercellular communication is effected by an information field. Previously, such a field has been considered in relation to quantum and subquantum mechanics whereby physical aspects of the universe may be controlled by intuition. Correspondingly, recent research in fundamental physics reveals much deeper principles of the organization of matter than quantum mechanics prescribes. The study of real physical space discloses an inner structure of this eternal substrate that shares both discrete and continuum properties. Physical space is constituted as a fractal mathematical lattice of primary topological balls, named the tessellattice, from which particles emerge as fractally deformed cells. When such a particle is moving, it interacts with surrounding cells of the tessellattice, which results in the creation of a number of spatial excitations around the particle named *inertons*. In quantum mechanical formalism, a particle and its surrounding inerton cloud are expressed as the wave ψ -function. Thus, inertons represent a substructure of the matter waves; they are carriers of mass and fractal properties of matter, and play the role of an information field in both physics and biology. Experimental manifestations of inertons in condensed media and biological systems are demonstrated. Certain challenges are listed.

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Introduction

It is recognised in molecular and cellular biophysics (Tuszynski, 2008) that intracellular communication systems not only exist within individual cells but also that intercellular information is transmitted and received between different cells of multicellular organisms. The concepts of cellular communication are widely used in biology, biophysics, biochemistry and biosemiotics to define the methods by which living cells communicate with each other. Some of the methods include cell signalling such that groups of cells are able to coordinate to execute important metabolic processes necessary for the survival of the whole organism. Thus, all multicellular organisms heavily rely on coordinated intercellular communication (Reece, 2010).

Hitherto, the mechanisms of cellular communication have been described principally in terms of chemical, electrochemical and photochemical exchange. Although reception of purely physical stimuli are recognised in examples of photo, thermal and tactile impulses, rarely is there any discussion about transmission of physical energy as a form of communication between cells or between whole organisms. The exchange of electrochemical charges in the transmission of nerve impulses is described without any reference to potential importance of the electric field surrounding each charge or to the electromagnetic fields generated by moving charges, especially in the case of transmitting electrical impulses along nerves or cellular nerve fibres within neural tissues.

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Non-invasive computer-brain interfaces have been combined to realize the vision of computer-mediated brain-to-brain communication between subjects, the so-called hyperinteraction (Grau et al., 2014). The first multi-person non-invasive direct brain-to-brain interface called BrainNet was developed for collaborative problem solving (Rezaei and Saghadzadeh, 2019); the interface combined electroencephalography to record brain signals and transcranial magnetic stimulation to deliver information non-invasively to the brain. BrainNet allows Receivers to learn to trust a more reliable Sender, in this case based solely on the information transmitted directly to their brains. The results point the way to future brain-to-brain interfaces that enable cooperative problem solving by humans using a “social network” of connected brains. Although these studies demonstrate the conscious transmission of information between human brains through the intact scalp, these are obviously are electromagnetic signals of a known nature.

Rezaei and Saghadzadeh (2019) and Nwanegbo-Ben (2019) discuss various aspects of neurophysiology and the so-called sixth sense whereby a person can make contact or communicate with distant events and people by unknown procedures that do not engage the application of sensory organs. This concept of extrasensory perception is what we regard as the sixth sense. The latter (Nwanegbo-Ben, 2019) concludes that this extra-sense is both evident and contributes to the advancement of human knowledge.

Baluška and Miller (2018) focus on the need for our understanding of the genome to be complemented by a similar focus on the epigenome¹ and proposed senome, the latter representing the sum of all the sensory experiences of the cognitive cell and its sensory apparatus. The authors argue that this allows a communicative assembly of cells in the form of sentient multicellular organisms.

Miller et al. (2020a) have developed the idea that multicellular bodies express a coordinated system of cellular information management capable of optimizing the quality of sensory information; this allows biological evolution to be re-framed as a continuous process of self-referential cellular management in the perpetual survival of cells within their collective tissues and organs. Subsequently, Miller et al. (2020b) note that self-referential

cellular homeostasis is maintained by adjusting the balance of both internal and external conditions effected through an integrated cellular information field. Thus, a cellular field is bound to a biological information-space-time which coordinates the cellular senome's stimuli, i.e. the sum of the cell's sensory experiences, with its genome and epigenome. The researchers suggest that individual cellular information fields aggregate into a collective informational architectural matrix, termed a *N*-space Episenome, that optimises information management across the whole organism. It is hypothesized that biological organization is expressed as a dual heritable system consisting of the biochemical genome and its associated *N*-space Episenome. Therefore, DNA, RNA and their associated cytoplasmic components can be read by the cell's own operating system, i.e. by the *N*-space Episenome, thus providing an informational management system associated with the biological genome. So, the cell's architectural matrix (*N*-space) serves as a source of informational cues and a coordinated developmental memory system to which every cell of a multicellular organism can react.

The concept of information appeared to have a key role in the study of the phenomenon of consciousness. In his essay Meijer (2015) highlights the scientific vision of J. A. Wheeler, a well-known physicist of the 20th century; in particular, Wheeler stated that information is the most fundamental building block of reality, and that the universe should be seen as a self-synthesized information system: a self-excited circuit that is developing through a (closed loop) cycle. According to Wheeler (1990), the meaning of reality can only be established if there is a universal knowledge field, which transcends physical past, present and future; he wrote that information is fundamental to the physics of the universe. According to this ‘it from bit’ [reality from information] doctrine, information gives rise to physics; all aspects of physics are expressed in the language of information. Therefore, information becomes a natural candidate to play a role in a fundamental theory of consciousness. This is also emphasized by Chalmers (1995) whose views are based on principles of structural coherence and organizational invariance, and a dual-aspect theory of information which allows a new kind of nonreductive explanation, a naturalistic account of

¹ Epigenome: composed of chemical compounds and proteins that can attach to DNA and direct such actions as turning genes on or off.



consciousness. The role that information might play through a convergence of physics and neuroscience in a new theory of consciousness was examined by Trevathan (2016); he suggested that information could be the sole “common denominator” through which the Cartesian mind-body problem might be resolved; his speculative quantum mechanical model potentially provides the information reservoir that Chalmers (1995) believes to be a “fundamental theory of consciousness”. It seems that quantum information theory is directly applicable to the analysis of classically unresolved thought experiments that led to paradoxes of consciousness (Georgiev, 2020) and hence it has been recognized that quantum mechanics plays a significant role in human thinking and consciousness, which goes beyond the limitations of classical physics.

Whitworth (2020) pointed out that deriving the physical world from information processing could reconcile opposing physical theories. He assumes that the universe somehow uses information processing algorithms in its operations and he further hypothesizes that all physical reality arises from external information processing. He admits the hypothesis that virtual reality is nothing but processing output; at the same time he does not consider the world as a computer.

In their review, Meijer et al. (2019) submit a concept of information processing in the universe on the basis of a generalized ‘musical scale’ of discrete electromagnetic frequencies, which provide a conceptual bridge between living and non-living systems. This has relevance for areas of biophysics and brain research, as well as for mechanisms of biological evolution; the authors hold that nature follows a discrete pattern of harmonic solitonic waves, most likely originating from quantum vacuum fluctuations derived from an immanent zero-point energy/superfluid quantum space.

Fröhlich (1968) was probably the first who proposed the project “Theoretical Physics and Biology” in which the main idea was about the existence of long-range phase correlations, i.e., coherence, which had been found to be a general concept required in the description of a non-spatial order as in living organisms.

Conventional allopathic medicine may be expanded to embrace a physical approach that uses biophoton

emissions as well as signal transduction and cellular communication systems (Ross, 2019). The researcher notes that the existence of the human biofield (or human energy field) has to be taken into account to understand that disturbances in the coherence of energy patterns offer indications of disease and ageing.

Rubik et al. (2015) discuss the concept of the biofield and biofield therapies, which may involve biocommunication and/or energy transfer through the biofield. The biofield concept is considered necessary for a better understanding of contemporary developments in biophysics and biology. They emphasize that information connected with the biofield may serve as a bridge between mind and body, which is fundamental to understanding mind-body interactions.

Kafatos et al. (2015) review the evidence for the existence of the biofield and relevant major theoretical foundations. The authors believe that properties of such a field could be based on electromagnetic fields, coherent states, biophotons, quantum and quantum-like processes, and ultimately the upon the quantum vacuum. They also consider the origin and source of the biofield, the specific evidence for its existence, its relation to biology, and how it may inform an integrated understanding of consciousness and the living universe.

It has been shown experimentally (Chaban et al., 2013) that apoptotic and cancerous cells are capable of exerting a non-diffusible, non-neuronal influence over distance on other nearby, but physically disconnected cells. Scholkmann et al. (2013) reviewed similar recent experimental work which examined intercellular communication in biological processes. Non-chemical, distant cellular interactions may explain some cases of confounding effects in cell biology experiments (Farhadi, 2014), which the author reviews to try to shed light on the mechanisms in this highly unconventional field of cell biology. He says that this phenomenon is still speculative and thinks electromagnetic waves appear to have the most experimental support.

Volodyaev and Belousov (2015) reviewed the 90 year long controversial history of the so-called “mitogenetic² radiation” discovered by Gurwitsch (1923) who concluded that ultra-weak UV photon emissions in horizontal roots stimulated increased

² mitogenetic radiation—a radiation usually considered to be ultraviolet, which is emitted by mitotically dividing cells and which stimulates other cells to divide.

note the description in nature, (<https://www.nature.com/articles/216169a0>):

Between 1920 and 1935 a great deal was published on the subject of mitogenetic radiation—a radiation usually



cell division in vertical stems. That was the first case of non-chemical distant interaction, which occurred through quartz but not through a usual glass window. Volodyaev and Belousov (2015) think the effect could be related to ultra-weak photon emission. Historical and scientific details have also been described by other researchers (Popp, 1974; Nakamura and Hiramatsu, 2005; Nissen, 2006; Sanders, 2017). It seems that, depending on the situation, UV, visible and near-infrared spectral frequencies of electromagnetic radiation are responsible for the effect of mitogenetic radiation. Alternatively, can there be another explanation for this new type of communication (Chaban, 2017)? Gariaev (2003, 2014), and Gariaev and Leonova (2014) managed to intercept communication from a DNA molecule in the form of ultraviolet photons. They claimed that this communication is not something that happens only inside the individual cells or between one cell and another. They stated that DNA can be reprogrammed by words and electromagnetic radiation and hence DNA can function as a bio computer and emit photons. In their opinion, organisms use the DNA “light” to “talk” to other organisms, which could explain telepathy and extrasensory perception. In essence, Gariaev and his collaborators presented an experimentally proven theory of wave genetics. i.e., wave genes in the form of actual text-like structures and mobile holographic constructions form the chromosome continuum. The authors mention that the human body, through its cells, can understand the wave in two senses – safe and dangerous. They note that the chromosomes emit sound and coherent photons, which are converted into radio waves, and then to the real level of encoding genetic information to the wave; these wave series genomes are involved in the management of the body’s metabolism and in its embryonic development. Therefore, we can see that Bounias’ (1990) ideas about the direct connection between matter and spirit are in common with recent researches (Gariaev and Leonova, 2014). Persistence of electron correlation through aqueous environments (Stöhr and Tkatchenko, 2019) allows the basis for quantum mechanical long-range interaction mechanisms in biomolecular systems. A single-molecule investigation (Leake, 2013) involves robust methods for understanding molecular-level details of the most fundamental

biological processes emerging into a new field of single-molecule cellular biophysics. Biomolecules in a living biological cell are subjected to nonequilibrium processes of huge complexity (Raković et al., 2014), which allow for a quantum mechanical decoherence approach to understanding biomolecular conformational transitions. Illuminating molecules with microwaves of the characteristic frequency $\sim 10^9$ Hz influences local rotations in molecules (with possible quantum tunnelling), while infrared light of the frequency $\sim 10^{13}$ Hz influences vibrations in molecules with possible nonradiative resonant structural isomeric transitions. This means that external electromagnetic signals of the mentioned ranges are able to influence the physical behaviour of biomolecules.

Damasco and Giuliani (2016) and Damasco (2021) proposed a coarse grained physical model of evolution in which resonance phenomena were responsible for the non-linear behaviour of a biological system under study. The model focussed on oscillating stimuli with the natural periodicities of many environmental phenomena. The model holds for periods that are longer than the time between two consecutive generations (in the case of unicellular organisms, i.e. longer than the time for cell division).

Living systems can be treated as complex, nonlinear, dynamic, self-organizing energetic and field phenomena with negative entropy (Gonzalez, 2020) and at the highest level of organization, each life form may possess an innate biologic field, or biofield. The authors note that the resonant frequency of cells and organs happens to be the natural frequency of health for individual cells and organs because Nature always seeks the most efficient state. They also state that many energy-related therapies challenge the current biomedical paradigm because they cannot be explained by conventional biochemical or physiological mechanisms. Quantum physics is a better paradigm with which to understand these therapies.

Poznanski et al. (2016) argue that consciousness emergences from an ontological interpretation of quantum mechanics when quantized electromagnetic fields interact with brain matter and produce “virtual” charged particles. The exchange of energy quanta during quantum field

considered to be ultraviolet, which is emitted by dividing cells and which stimulates other cells to divide. These studies were originated by Gurwitsch [1] and are still carried on in the Soviet Union, but almost ceased in Britain and the United States in the

1930s after much careful but negative work [2–4]. Nobody there was able to stimulate cell division with weak ultraviolet light or to detect radiation from rapidly dividing cells with photoelectric or biological detectors.



interactions emerge as distinct patterns of quasiparticles; their entanglement produces waves of “virtual” particles with periodicities of discrete energies whose interactions collectively represent the emergence of self-awareness as a quantum dynamic effect carried on the magnetic vector potential throughout the brain.

The basic rules and principles of the interaction of matter, energy and information in macro-, micro- and biological objects from a quantum perspective are described in a series of reviews (Milne and Sorgnard, 2013; Nieuwenhuizen, 2014; Marais et al., 2018; McFadden and Al-Khalili, 2018; Orzhelskiy, 2018).

Timofte et al. (2015) consider Pribram-Bohm’s holographic theory of the brain, i.e. that intercellular and intracellular communication implies the existence of a fractal medium that is equivalent to the vacuum between the elementary particles. They studied vacuum dynamics using quantum mechanics and hence allow that the fractal medium implies the use of a quantum type mathematical formalism that is applicable to different resolution scales. However, their research touched upon various processes of the mechanical growth of a tumor which involved a quantum and fractal diffusion. They did not study an exchange of information between cells.

Ottolenghi (2015) tried to develop a subquantum approach but his consideration is completely based on the formalism of quantum mechanics itself, primarily upon the particle’s wave ψ -function and probability. Grössing (2013) modelled a quantum system as a non-equilibrium steady state maintained by a permanent throughput of energy from the zero-point vacuum in which the quantum is considered as an emergent system. He implements a specific “bouncer-walker” model in the context of an assumed subquantum statistical physics, analogous to the results of experiments by Couder’s group on a classical wave-particle duality (Couder, 2012; Pommeau, 2020). Such an approach allowed Grössing (2013) to show that the averaged behaviour of particle trajectories correspond to a specific type of anomalous diffusion termed “ballistic” diffusion on a subquantum level.

Modelling of recent experiments on living sulphur bacteria interacting with quantized light showed (Marletto et al., 2018) a strong coupling between the bacteria and the light that, when both are treated quantum-mechanically, indicated entanglement between the bacteria (modelled as dipoles) and the

quantized light (modelled as a single quantum harmonic oscillator).

Bullon (2020) notes that quantum biology is central to photosynthesis, mitochondrial respiration, enzyme activity, the sense of smell, animal migration, heredity’s fidelity, and consciousness. However, quantum biology might also provide the best approach to the development of treatments of Noncommunicable Diseases and help to evaluate and control risk factors. Bullon emphasizes that subatomic particles having a wave-particle duality and the possibility to tunnel and entangle could create a coherent state supporting homeostasis and hence healthy life.

Summers (2022) emphasizes that information arising from the biologic continuum with the living systems’ natural energy driven actions for homeostasis allows a description in terms of a Lyapunov functional. The trajectory vector of the first derivative of the Lyapunov function serves as a physical signature of substantive meaning associated with the perceived information of living systems.

The Hamiltonian concept could be applicable not only to chemical-physical structures but also relevant to living organisms (Bounias, 2002). Then from a mathematical point of view, individual Hamiltonians of living organisms interacting in more complex systems would have to behave as a non-linear generalized convolution of functions, able to generate self-organization in dynamic systems.

Reduction of developmental biology to self-referential intercellular communication offers a portal for understanding fundamental mechanisms of physiology as derived from physics through quantum mechanics (Torday, 2018), which itself is implicitly related to the Big Bang and hence its further expression is a recoil reaction to that Singularity. The authors express an interesting opinion that, in combination with experimental evidence for the importance of epigenetic inheritance, the unicellular state can be reappraised as the primary object of selection and this can be a significant shift in understanding the relationship between physics and biology, thus providing novel insights into the nature and origin of consciousness. Torday (2019) has further developed the subject of formulating the Singularity of Nature and the significance of quantum mechanics in cellular-molecular biology. He believes that the common denominator between physics and biology predicts that consciousness is the denouement of this



continuum. He suggests that evolution stems from intercellular signalling, which both developmentally and phylogenetically is a manifestation of the Singularity. So, Torday suggests that these novel insights offer an opportunity to empirically formulate the basis for the Singularity of Nature for the first time.

Thus, biophysicists are searching for a fundamental concept of biology, which includes intercellular signalling and information in general based on principles of quantum and subquantum mechanics. The notion of information is actively exploited in various fields of science, including quantum physics. In particular, quantum information is defined as the information state of a quantum system. Probably the first effort to derive quantum mechanics from rules associated with quantum information was done by Clifton et al. (2003). They considered three basic theoretical information constraints: 1) The impossibility of superluminal information transfer between two physical systems by performing measurements on one of them, 2) The impossibility of broadcasting information contained in an unknown physical state, and 3) The impossibility of unconditionally secure bit commitment.

One more derivation of quantum theory based on axioms about information was proposed by Chiribella et al. (2011). Their approach includes five elementary axioms: 1) Causality, 2) Perfect distinguishability, 3) ideal compression, 4) Local distinguishability, and 5) Pure conditioning. These define a broad class of theories of information-processing that can be regarded as a standard. The main structures of quantum theory, such as the representation of mixed states as combinations of perfectly distinguishable pure states, are derived directly from the principles without using the Hilbert space framework. In such a way they showed that a system governed by these rules shows all the familiar quantum behaviours, such as superposition and entanglement.

There are other approaches to put information in the realm of quantum mechanics. Nevertheless, all views on the merging of information with quantum mechanics suffer from a lack of connection with the real space in which all the events of quantum and subquantum physics take place. Real physical space, which is the basis of the whole universe, must be introduced in all the studies looking for fundamental principles of molecular biology, self-organization and signal communication of both individual cells and multicellular organisms.

Accordingly, a theory of the real physical space is presented below together with a variety of new biological phenomena and amazing observations. The following sections describe the constitution of real physical space, how the information field appears from first submicroscopic principles, how quantum mechanics is derived from real space and how all this extends into the biological arena of communication and self-organization in cellular organisms.

Physical Space

In classical physics, 'space' is a three-dimensional Euclidean space where any position can be described using three coordinates. In microscopic physics, or quantum physics, the notion of 'space' is associated with an "arena of actions" on which physical processes and phenomena take place. Such arena of actions can be felt subjectively as a "receptacle for subjects". The measurement of 'physical space' has long been important. The International System of Units (SI) is today the most common system of units used in the measurement of space and is almost universally used within physics. However, let us critically look at the determination of 'physical space' as an "arena of actions". In such a determination there exists, first, subjectivity and, second, objects themselves that play roles in processes cannot be examined at all (for instance, size, shape and the inner dynamics of canonical particles, etc.).

To disclose the constitution of physical space we have to look at the basic notions of geometry.

Riemann (1854) stated that the question of the geometry of physical space does not make sense independently of physical phenomena, i.e., that space has no geometrical structure until we take into account the physical properties of matter within it, and that this structure can be determined only by measurement. In his opinion physical matter determines the geometrical structure of space. He believed that the geometry of space depends on bodies available in the space and therefore the measure of the curvature can have any random value.

Poincaré (1905) wrote: "None of our sensations, if isolated, could have brought us to the concept of space; we are brought to it solely by studying the laws by which those sensations succeed one another. We see at first that our impressions are subject to change; but among the changes that we ascertain, we are very soon led to make a distinction. ...If, then, there were no solid bodies in nature there



would be no geometry. ... “Correlative movement,” therefore, constitutes the sole connection between two phenomena, which otherwise we should never have dreamed of connecting. ... Thus, by means of this reciprocity we can define a particular class of phenomena called displacements. The laws of these phenomena are the objects of geometry. ... It can be seen that experiments plays a considerable role in the genesis of geometry; but it would be a mistake to conclude from that that geometry is, even in part, an experimental science. ... Experiment guides us in this choice, which it does not impose on us. It tells us not what is the truest, but what is the most convenient geometry. It will be noticed that my description of these fantastic worlds has required no language other than that of ordinary geometry.”

Riemann (1854) started the determination of the general topological properties of space showing that the topological properties of figures are invariant under any transformation, in particular motion. He introduced the concept of manifolds in which a manifold is treated as a topological space that resembles Euclidean space near each point, i.e., a point of an n-dimensional manifold has a neighbourhood that is homoeomorphic to the n^D Euclidean space. Or in other words, a manifold is represented as a geometric object obtained by sticking together some open balls.

Meanwhile, different mathematical branches like topology, differential geometry and algebraic geometry cover not only pure mathematical problems but also the knowledge base of physical space, and the nature of the constitution and interaction of matter (Scholz, 1999; Patton and Helmholtz, 2014) have been developed where

interaction implies the presence of a field with its carriers. Then the state of space can closely be connected with the concept of a physical field (Vernadsky, 1938).

In a series of works Michel Bounias (1990), Bounias and Krasnoholovets (2003a,b,c) and Krasnoholovets (2017) constructed a detailed theory of physical space, followed by the related theory of particles as deformations of space. It was shown that objects and distances come from the same origin: the manifold of sets. The association of discrete sets whose interior is continuous although covered by discrete subparts provides a wonderfully organized fundamental ‘substrate,’ i.e., a mathematical lattice. Set theory, topology and fractal geometry made it possible to prove that such a mathematical lattice of tightly packed topological balls is a fractal lattice. It was named the tessellattice and the size of a cell of the tessellattice was related to Planck’s length $\ell_p = \sqrt{\hbar G/c^3} \sim 10^{-35}$ m. Many researchers point to the existence of the granularity of space or some lattice at the Planck length scale, but a consistent theory of the structure of physical space was given only in the works of Michel Bounias and the author.

Although in the tessellattice the cell is of Planck dimension, its volume may vary because the cell is also a topological ball that can have different sizes. In particular, the volume of a fractal deformed cell can be less or large than the volume of a degenerate cell of the tessellattice.

A canonical particle like an electron is created from a cell of the tessellattice as a cell with a fractal deformation (Fig. 1).

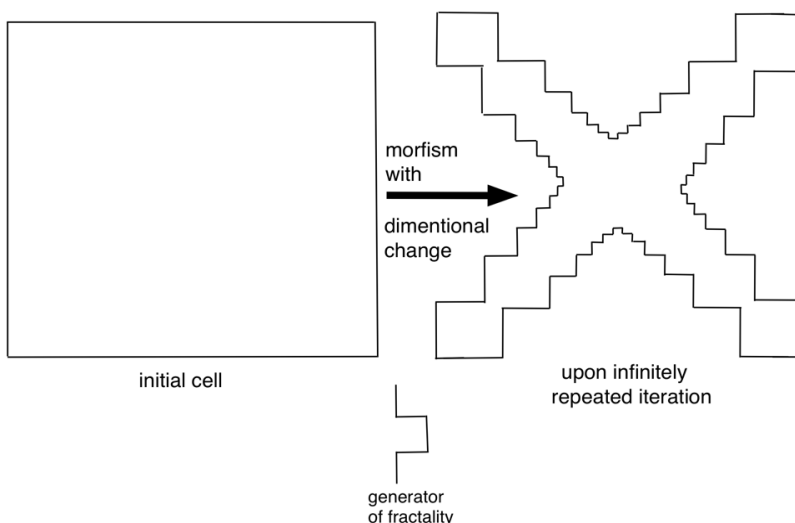


Fig. 1. The continuity of homoeomorphic mappings of structures is broken once a deformation involves an iterated transformation with internal self-similarity (the generator of volumetric fractality), which involves a change in the dimension of the mapped structure

In the tessellattice there may be the transformation of a cell under the influence of some iteration similarity that overcomes conservation of homeomorphism. For N similar figures with the ratio of similarity $1/\rho$ (or the generator of fractality) the Bouligand exponent (e) is given by expression

$$N \cdot \left(\frac{1}{\rho}\right)^e = 1 \quad (1)$$

and the cell of the projected cell changes its dimension from D to $D' = \ln D / \ln \rho = e$ where $e > 1$. A change of the dimension means an acquisition of properties of "solid" objects, i.e. the creation of matter. So, if volumetric fractals begin to accumulate in the cell in question (signifying a contraction), this means that the cell morphs to the solid state and is therefore completely distinctive from the surrounding degenerate cells of the tessellattice.

The revealed circumstance allows us to introduce a definition of the concept of mass as represented by a fractal reduction of the volume of a cell. If V^{deg} is the volume of a cell in the tessellattice (the degenerate state of a ball), then the reduction of volume resulting from a fractal concavity is $V^{\text{particle}} = V^{\text{deg}} - V^{\text{frac}} = \Delta V$ and $V^{\text{deg}}/V^{\text{particle}} > 1$.

Hence, we can introduce the notion of mass m of a particled ball as a function of the fractal-mediated decrease of the volume of the ball, i.e.

$$m = C \cdot V^{\text{deg}} / V^{\text{particle}} \cdot (e_v - 1)_{e_v > 1} \quad (2)$$

where (e) is the Bouligand exponent and $(e_v - 1)$ depicts the gain in dimensionality given by the fractal iteration. Here, $V^{\text{deg}}/V^{\text{particle}}$ and $(e_v - 1)$ is positive and even more $V^{\text{deg}}/V^{\text{particle}} > 1$. This means that the right-hand side of expression (2) is positive and greater than unity; C is a dimensional constant.

Thus, a massive particle is created from a cell of the tessellattice. Its volume is smaller than the volume of a degenerate cell of the tessellattice. The volumetric fractal deformation of the particled cell represents the physical concept of mass derived from the first submicroscopic principles. In the next section we consider how such a massive particle (or an object) moves while being in the environment of similar cells of the tessellattice.

We have yet to formulate the charge in the created massive particle. What is a charge, how can it be determined based on the primary structure of space? The charge is associated with the surface fractal structure of the particulate ball; small protrusions on the surface (inward or/and outward), which obey fractal laws, can be

considered as the surface spikes. If all surface spikes are oriented inwards within the created particle, then it expresses the quantum of the negative charge; if all surface spikes are oriented outwards, then it expresses the quantum of the positive charge (Krasnoholovets, 2017; Ch. 4). The motion of the charge, the appearance of photons and their definition as well as the derivation of Maxwell's equations have previously been described (Krasnoholovets, 2017, 2003, 2018).

One more object that must be understood in the framework of the tessellattice structure of real space is the quark. The quark is defined as a cell that has an inflated volume compared to the original volume of each degenerate cell in the tessellattice. The mechanics of quarks obey the dynamics of bubbles in a liquid (Krasnoholovets, 2016; 2017, Ch. 6).

Any particle created in the tessellattice induces a deformation coat around itself and this coat cells are partially deformed; such a coat shields the particle from degenerate space. The radius of the deformation coat is the particle's Compton wavelength $\lambda_{\text{Com}} = h/(mc)$.

Submicroscopic Mechanics

When a particle starts to move, it begins to interact with ongoing cells of the tessellattice. In other words, a moving particle is involved in active interaction with the real physical space. But this important feature is not taken into account in the formalism of ordinary quantum mechanics.

In fact, quantum mechanics was constructed at the atomic scale ($\sim 10^{-10}$ m) and it considers real physical space as absolute emptiness. In the context of this approach, it was necessary to introduce vague and indefinite characteristics such as the particle's wave ψ -function, wave-particle duality, etc.

Submicroscopic mechanics (Krasnoholovets, 2017) is devoid of such flaws because it has been derived at the Planck scale ($\sim 10^{-35}$ m) and hence it can describe the moving particle's direct interaction with its environment, i.e. the tessellattice.

When the particle is moving, it elastically collides in a peculiar way with ongoing cells of the tessellattice and gradually loses velocity. Besides, step-by-step, the particle loses its fractals as each subsequent collision strips one fractal from the particle. Finally the particle must stop. At this point the particle's velocity is zero and it has no more fractals. All the particle's volumetric fractals are now distributed among quasiparticles that have appeared due to the huge series of collisions of the particle with ongoing cells.



The distance (or section) that the particle travels before it is finally stopped is exactly equal to the particle's de Broglie wavelength. At this point, although the particle is naked, that is, devoid of fractals, it returns to the original size but must become rigid due to the induced tension to be different from the degenerate cells of space. All the spatial quasiparticles are distributed around the particle and the resistance that they encounter from the tessellattice directs them back to the particle. An important point! The fractal-free rigid particle is the particle without mass and the particle goes to a tension state, $m \rightarrow \Xi$. Each volumetric fractal is a bit of mass. Therefore, the mentioned spatial quasiparticles are carriers of mass. They were named *inertons* because inertia is defined as the resistance of any physical object to any change in its motion. At the point where the particle stops

moving, its entire mass is transferred to and distributed within its cloud of inertons. Then after stopping, the particle begins to reabsorb its inertons and its speed is restored ($0 \rightarrow v$), as well as its mass being returned ($\Xi \rightarrow m$). All this occurs during the next section of the particle's de Broglie wavelength $\lambda_{dB} = h/(mv)$. Hence the entire particle path l can be divided into even and odd segments $\lambda_{dB} = h/(mv)$ (the de Broglie wavelength). In even sections the particle emits its inertons and in the odd sections the particle again absorbs its inertons. The principle of such motion is shown in Fig. 2. So, the dispersal of fractals builds up tension in the particle. This tension is then released as the fractals are reabsorbed. It's like going from kinetic to potential energy and back, in a continuous oscillation.

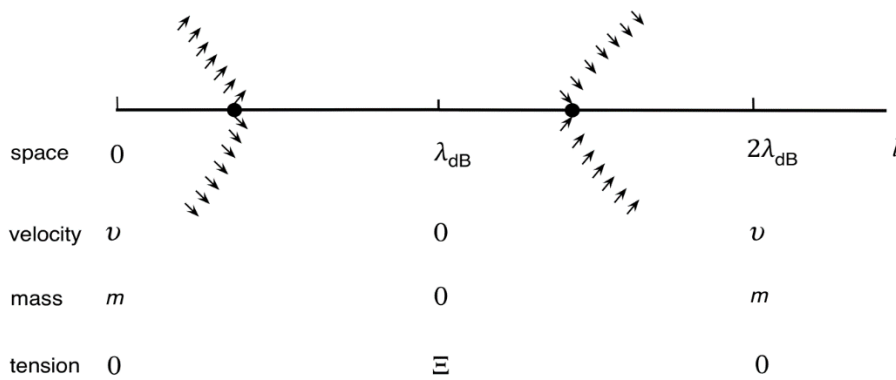


Fig. 2. Motion of the particle in the tessellattice. The path l is divided into equal sections $\lambda_{dB} = h/(mv)$. In the first section the particle emits its inerton cloud and the particle parameters change: velocity $v \rightarrow 0$, mass $m \rightarrow 0$ and tension $0 \rightarrow \Xi$. In the next section the inerton cloud guides the particle forwards again as the particle absorbs its inertons, and its initial parameters are restored: velocity $0 \rightarrow v$, mass $0 \rightarrow m$ and tension $\Xi \rightarrow 0$

It should be noted that inertons move according to a relay mechanism, hopping from cell to cell, carrying volumetric fractals, or fragments of mass. Such inertons connected to their particle have their speed equal to the speed of light c and this speed has to be interpreted as the sound velocity of the tessellattice.

What are the commonalities with the formalism of conventional quantum mechanics? The same section $\lambda_{dB} = h/(mv)$ is used, but now we understand its meaning. What about the wave ψ -function. This is the particle together with its inerton cloud. The volume that the system {particle + its inerton cloud} occupies is $\lambda_{dB} \times \pi\Lambda^2$ where the amplitude of the particle's inerton cloud is

$$\Lambda = \lambda_{dB}c/v. \quad (3)$$

The amplitude (3) shows how far from the particle its inertons can propagate. In the case of an electron having a typical velocity $\sim 10^6$ m/s, we obtain $\Lambda \sim 100 \lambda_{dB} \approx 10^{-8}$ m.

So, the wave ψ -function characterizes the density of mass distribution up to the distance Λ (3) from the particle. In other words, the wave ψ -function determines the volume in which the mass of the particle is distributed around its singularity position.

The mass of a particle in motion, or the mass of atoms, which oscillate forming acoustic waves (phonons), can be described by the following Lagrangian

$$L = \frac{1}{2}\lambda^2\dot{m}^2 + \frac{1}{2}m_0^2\dot{\Xi}^2 + \nu m_0\lambda\dot{m}\vec{\nabla}\Xi \quad (4)$$

where the variables $m(\vec{x}, t)$ is the mass of the particle in the point \vec{x} and time t , $\Xi(\vec{x}, t)$ is the tension of the particle in the point \vec{x} and time t , which is a vector value that shows the direction of stretching of the particle along the particle velocity vector \vec{v} when it becomes rigid; $v = |\vec{v}|$ is the initial velocity of the particle (or the velocity of the acoustic



wave, i.e. phonons). In the expression (4) λ is the characteristic particle wave, namely, the de Broglie wavelength in the case of an electron or the wavelength of an acoustic phonon in the case of the crystal lattice; m_0 is the initial mass of the particle (electron or phonon).

The Euler-Lagrange equations for variables m and $\vec{\Xi}$ are

$$\lambda^2 \ddot{m} + \nu m_0 \lambda \vec{\nabla} \dot{\vec{\Xi}} = 0, \quad (5)$$

$$m_0^2 \ddot{\vec{\Xi}} + \nu m_0 \lambda \vec{\nabla} \dot{m} = 0. \quad (6)$$

From these equations we obtain typical wave equations of motion for each of the two variables

$$\ddot{m} - \nu^2 \nabla^2 m = 0, \quad (7)$$

$$\ddot{\vec{\Xi}} - \nu^2 \nabla^2 \vec{\Xi} = 0. \quad (8)$$

Therefore, the equations for the variation of mass (7) and tension (8), which move in antiphase, show that any matter moves as a typical wave. In such a wave the fractal contraction (the mass m) is periodically replaced by stretching (the tension $\vec{\Xi}$).

Interaction of Inertons with Matter

In some cases we can consider a particle with its inerton cloud as two subsystems. Such an approximation is suitable for a system of many entities (atoms or molecules) in which inerton clouds of many entities overlap. Then we can distinguish two subsystems: a network or lattice of atoms/molecules and an inerton gas that fills the lattice. These inertons indeed behave like a gas that fluctuates at the same frequencies as the molecules of the lattice (compare this with a casing filled with a usual gas).

It is possible to release some inertons from one object (i.e. from the interior of a casing) and introduce them into an adjacent system. Such a procedure can be effected in many different ways. Such transition will violate the stability of homogeneous media when they absorb external inertons, which can be perceived as dust entering the adjacent system under consideration. Why does this happen?

The point is that in a network of entities, for example in a crystal lattice, the entities oscillate near their equilibrium positions and so far nobody has considered this small harmonic potential as a power tool that is able to significantly change the equilibrium in the whole system. But for each atom we can apply expression (3). Then we can see that

the atom's amplitude of $\delta r \approx 10^{-11}$ m is able to push the atom's inerton cloud out to a distance of a few microns:

$$\Lambda = \delta r \cdot \frac{c}{\nu} \sim 3 \cdot 10^{-6} \text{ m} \quad (9)$$

This estimate makes it possible to add the harmonic term $\frac{1}{2} m \omega^2 \delta r^2$ to the Lagrangian of the system in question. For example, it can be a system that includes the dispersion potential of interatomic interaction, which is usually written as $-C_6/r^6$, and a potential formed by a trap, which can be modelled by a harmonic potential $\frac{1}{2} m \Omega^2 r^2$. Hence the attraction part of the Lagrangian now looks as follows

$$L_{\text{attraction}} = -\frac{C_6}{r^6} + \frac{1}{2} m \Omega^2 r^2 + \frac{1}{2} m \omega^2 \delta r^2 \quad (10)$$

Through the last term in the expression (10) the system absorbs external inertons, which results in an alteration of the equilibrium position of the initially homogenous system and it starts to alter its phase state. A number of systems like this were studied in detail both theoretically and experimentally (Krasnoholovets, 2017, Sect. 5.2). Namely, external absorbed inertons change the mass potential characteristics of the system studied. These inertons come from rapid physicochemical reactions and the environment in general. The mass defect Δm becomes an inherent property not only of atomic nuclei but also of any physical, physical chemical and biophysical systems. Atoms and molecules are able to absorb inertons, which results in the entity's increased mass. This results in the amplitude of the entity's vibrations decreasing

$$m \rightarrow m + \Delta m, \delta r = \frac{h}{m\nu} \rightarrow \delta r' = \frac{h}{(m+\Delta m)\nu}, \delta r' < \delta r \quad (11)$$

where ν can be the sound velocity and/or thermal velocity, i.e. the rate of thermal oscillations of atoms. The appearance of an additional mass has an immediate effect on the mechanism of cluster formation in initially homogeneous systems (Krasnoholovets, 2017; Sect. 5.4), as shown by the following examples.

1. It has been demonstrated that the rate of evaporation of aqueous solutions saturated with an inerton field were abnormally slow (Krasnoholovets et al., 2006a, b) and that different aqueous solutions of sorbent clays that have been processed with an inerton field significantly change in viscosity for 3–5 days (Krasnoholovets, 2017; Sect. 5.5).
2. Electron clusters, X-rays and nanosecond radio-frequency pulses were produced by 100



mW continuous-wave laser illuminating a ferroelectric crystal of LiNbO_3 (Krasnoholovets, 2006c). A long-living stable electron droplet thus produced, having about 10^{10} electrons and the size of about 100 microns, freely moved with the velocity 0.5 cm/s in the air near the surface of the crystal. The restraining force to its motion resulted from inertons being ejected from the crystal lattice by the laser pulse which were subsequently captured by the electron droplet.

3. A particle was created, in which a proton and electron formed a stable pair having the typical size of a nucleon, (Krasnoholovets et al., 2016) demonstrating the formation of a subatomic particle. A massive inerton cloud torn off a tungsten atom was absorbed by the electron and proton, which strongly coupled these two particles in a new stable entity - a subhydrogen particle. We also generated subhelium and argued for the existence of subdeuterium, and also nuclear pairs formed by a subatom with a proton, a deuteron and a neutron.
4. An intensive inerton field is able to significantly intensify chemical physical reactions through creating conditions for splitting of some chemical bonds and the formation of others. The effect of a novel chemical process intensifier was investigated in relation to Biodiesel production from a high FFA feedstock. This process involved exposing a reaction zone with magneto strictive agents to an oscillating electromagnetic field; the appropriate reactor was named the Biaktor (Fig. 3). The effect on the reaction time and biodiesel yield, specifically in the case of high-FFA³ feedstock (Litinas et al., 2020) was investigated. The transesterification was investigated and it was observed that esterification reactions were intensified under the action of inertons directed from an oscillating electromagnetic field that forced magneto strictive agents to rapidly vibrate. The complete conversion of oils was observed at an extremely short reaction time (30–180 s) and ambient temperature. The biodiesel yield reached 96–98%.



Fig. 3. Biaktor reactor in which a powerful inerton field is generated using a mechanism of striction of small iron/nickel cylinders

So, summing up we can say that an inerton field can experimentally be studied, measured and generated. The Sun, Earth and the earth's atmosphere are also sources of inertons. Inertons appear in systems in which non-adiabatic processes occur. Inertons are released during inelastic collisions of particles, atoms and molecules. In particular, it is important to establish an inerton observatory that will study the inerton activity of the Sun and the universe.

Interaction of Inertons with Biological Systems

Our research team studied effects induced by a Teslar watch, which is based on an invention of Andrija Puharich. The Teslar watch has a chip or two chips mounted in the back cover of the electronic watch and its distinguishing feature is a Mobius flexible magnetic strip. The chip generates a scalar signal in the Mobius strip. The frequency of the measured scalar signal was 8 Hz (Krasnoholovets et al., 2006a). The two Teslar chips were attached to a cuvette that contained a solution under investigation. It was observed (Krasnoholovets et al., 2006c) that the refraction index of degassed pure distilled water and aqueous solutions of L-tyrosine and b-alanine affected by the Teslar watch did not change during the first 10 minutes of influence. In contrast, the refractive index of a 1% aqueous solution of blood plasma extracted from the blood of a patient with heart-vascular disease was changed when affected by the Teslar watch. The characteristic time of reaction was about 100 s. So, a weak inerton field with the frequency of 8 Hz changed the properties of the aqueous solution of blood plasma. Perhaps the viscosity of the aqueous plasma solution decreases as well, as mentioned above with sorbent clay solutions (Krasnoholovets, 2017; Sec. 5.5).

³ FFA = free fatty acid



In some aspects, a similar approach has been applied at the measurement of inerton signals at the operation of peculiar facilities by AWAS Heinz Ihne GmbH & Co. KG, a German company. For the purpose of water purification in swimming pools, they use a lamp that is positioned within a flow of water. In the lamp, a metal spiral is placed along the axis of a long glass cylinder, first in one direction and then in the opposite direction, so that the total induced magnetic field is subtracted. Nevertheless, some scalar field propagates in the water, purifying it. To control the operation of his lamps, Mr. Heinz Ihne ordered several Rudra devices from our R&D teams or measuring inerton fields.

Moving charged particles are surrounded by their inerton-photon clouds, but in the case of the two described devices, there is a collision between the inerton-photon clouds of oncoming particles within each metal spiral and although in this case the electromagnetic component in the cloud is cancelled, the mass-tension component remains. Due to the collision of the two opposite flows of inertons, quasiparticles carrying mass and tension, free inertons are scattered around. Thus both in the Teslar watch and Heinz Ihne's lamp inertons are generated, which is also typical for any electric device, but until the magnetic field is subtracted, the effect of the scalar field is not manifested, it is overshadowed by more efficient electromagnetic processes.

The potential application of free inertons is considerable. Irradiating body lotions, ointments, gels, skin cremes, and hand cremes, etc. with an inerton field has shown reduction in their dynamic viscosity and shear viscosity, demonstrating a kind of superfluidity (Krasnoholovets, 2017; Sect. 5.5). The rate of penetration of hand cremes through the skin increased by an average of 25%, as measured by a Dermal Penetration Test used in cosmetology.

The first study of the general effect of inertonized water on a living organism began in the 1970s. It all started with the research of the Zelepukhin brothers (Maugh II, 1978; Zelepukhin and Zelepukhin, 1987). Their wonderful water was formed by the collapse of air bubbles before boiling, but it was not until the 1990s that it became clear that all the wonders of such degassed water were due to its inertonization. The Zelepukhins in the city of Alma-Ata (Kazakhstan) conducted numerous studies on how such degassed water influences plants (in particular,

tomatoes, cucumbers, grapes, apple trees, etc.) and also small animals. In particular, it was observed that the rate of evaporation of agricultural plants was approximately 20-30% lower when the plants were watered with inertonized water; so, such water protected the plants from drought. Testing the effect of inertonized water on livestock showed an increase in the average level of hemoglobin by about 10%, and an obvious increase in the activity of most enzymes and other metabolites. Even from personal experience, if one drinks a glass of water processed for a few minutes within an inerton field, one will feel an inner cold for a few hours. Hence the entropy of the body has decreased. This effect could especially be applied to situations in which activity is required in hot environments or to alleviate heat stress in the elderly. If the ambient temperature is 35°C, a person who drank a glass of inertonized water will feel as if the outside temperature is only 25 °C.

In 2004, while working on the Teslar Chip Testing project⁴, it was observed that the chip helped to improve intestinal motility disorders in children and eliminate constipation and, in 2007, a Teslar watch dramatically controlled my own inflamed appendix for several days when surgery was not available. My body temperature rose to 41 °C and I was shivering with fever. However, as a physicist, I reasoned the local inflammation could be stopped by cooling from inside and I put my Teslar watch with two Teslar chips on the relevant area of the abdomen where the pain was felt. Within half an hour the feverish shivering ceased, the temperature reduced to 36.7 °C and the sharp local pain subsided. I attached the watch by adhesive tape to the appendix area and went to sleep. Two days later I removed the Teslar watch from the appendix area since there was no longer any pain and thanks to inertons surgery was no longer necessary.

The examples above definitely show that the change in the state of water affects physiology. Namely, due to the absorption of inertons, aqueous solutions become more viscous as they acquire a mass defect Δm , which immediately alters local chemical physical reactions. Initially, this leads to a general decrease in the entropy. The heterogeneous solution is destroyed and that is why we observe the water molecules being able to separate from their ions. Namely, the molecular mechanism of the phenomenon of absorption of inertons is associated

⁴According to the authors of the present invention, TESLAR Technology, incorporated into specialised wrist watches, creates a signal that mimics the earth's natural frequency to help

the body strengthen its own electromagnetic field against the subtle effects of external, low-energy electromagnetic fields.



with at least a partial separation of aqueous solutions (Krasnoholovets, 2017; Sec. 5.4): water molecules are assembled into a pure system separate from their previously bound ions and organic molecules, i.e. the solvate shells of ions and organic molecules become weakened due to the tendency of water molecules to gather in a single liquid. This makes it possible to increase mobility of water and all diluted solutions will experience improved flow with such 'superfluid' water (such water weakly interacts with ongoing molecules, which leads to its high flow).

There are a lot of publications about different effects revealed in model pyramids. Kumar and Nagenda (2011) described the positive influence of their model pyramid on the germination, root emergence and seedling vigour of fenugreek which is cultivated worldwide as a semiarid crop. Bhat et al. (2006) revealed the antistress effects of pyramid exposure on the status of cortisol level, oxidative damage and antioxidant status in rats during chronic restraint stress; housing in a pyramid counteracts neuroendocrine and oxidative stress caused by chronic restraint in rats. Their conclusion was based on the measurements of erythrocyte malondialdehyde (MDA) and plasma cortisol levels, erythrocyte-reduced glutathione (GSH) levels, erythrocyte glutathione peroxidase (GSH-Px) and superoxide dismutase (SOD) activities.

The pyramid effect is caused by the fact that the pyramid, which is oriented with sides to the cardinal points, is a resonator of the Earth's inerton waves (Krasnoholovets and Byckov, 2000; Krasnoholovets, 2017, Sec. 5.11). Earth's inertons contribute to the effective interaction of atoms and molecules in samples put in the pyramid as the mass defect (11) prescribes, as for example with birch sap.

Birch sap is harvested in late March and early April. Roasted barley grains are then added to the juice which is fermented over the next 2-3 weeks to make birch kvass. Usually, kvass is consumed by the end of May, after which time it peroxidizes and from June it becomes unfit for consumption. However, Dr. Yatsyuta has kept and seasoned birch sap in the pyramid where kvass was fermented and stored. Even in late July – the kvass was absolutely fresh and cool to the taste. At that time, the temperature in the pyramid was 35 °C, but after drinking the inertonized kvass, our body entropy decreased and the ambient temperature seemed much cooler. Although the pyramid temperature was 35 °C., the 6-litre plastic water bottles were covered with dew (Fig. 4). The reason for this is that bottled water in

the pyramid had absorbed inertons which altered the water's intermolecular potentials. Therefore, the water in the bottles started to interact with the environment more actively, in particular, they attracted water molecules present in the air. This caused the cluster formation of dew, on the outer surface of the bottles. Inertons are the principle cause of clustering in initially homogeneous condensed matter systems (Krasnoholovets, 2017; Sec. 5.2).

Moreover, pyramid field effect has found already a practical application in an electric generator (Grandics, 2011) where a patent describes a device that amplifies the input electrical power, due to the pyramid field, so that the output power is several times greater.

The formation of clusters in biological tissues caused by an inerton field reveals the essence of homeopathy and leads us to develop a more powerful application in empirical medicine, which may be called information therapy. In condensed matter, inertons behave as a typical wave oscillating between the compressed (mass m) and stretched (tension $\vec{\epsilon}$) states. The frequency of these inerton waves are capable of being emitted from the system of vibrating entities. Such waves can carry necessary information to a remote receptors (Krasnoholovets and Fedorivsky, 2020). In such a case we can transmit signals of required frequencies to treat a remote patient's weak systems and organs, at a distance of many kilometres, bringing them the restorative information of a typically healthy body.



Fig. 4. Inside the pyramid; dew condensation on the outer surface of bottles with water at an ambient temperature of 35 °C

Inertons play also a crucial role in low-energy laser therapy because they help to trigger movement of Ca^{2+} ions, which launches a chain of reactions that activate various systems in the human body (Moskin, 2014). Specifically, proteins with metal complexes that absorb laser light go into an excited state. The lifetime of such an excited state is very short, perhaps hundreds or tens of femtoseconds. But the amplitude of oscillations of each of these protein complexes increases and according to formulas (3) and (9) the corresponding inerton cloud can extend to neighbouring excited protein complexes. The overlapping of inerton clouds of excited protein complexes results in their synchronous oscillation. This interaction prolongs the lifetime of the complexes in the excited state by a certain additional time. So, the whole system of metal protein complexes, which under laser irradiation has become connected through overlapping of inerton clouds, can be described by a differential equation of the attenuating oscillator:

$$\delta\ddot{r} + 2\alpha\delta\dot{r} + \omega^2\delta r = 0 \quad (12)$$

where δr is the amplitude of the excited oscillating protein complex, 2α is the damping coefficient and ω is the cyclic frequency of oscillation. The solution to Eq. (12) is

$$\delta r(t) = \delta r_0 e^{-\alpha t} \cos(\omega t) \quad (13)$$

where δr_0 is the initial amplitude. In a moment of time $t = t_c$ the protein complex emits a photon and will revert back to the initial non-excited state. However, the time delay t_c can be quite long, such that during this time decelerating protein complexes will release some inertons from their inerton clouds into the environment. As a result, the system under consideration is saturated with inertons, which changes the initial homogeneous conditions and creates circumstances for clustering of aqueous solution components. Then, during changes in chemical bonds, Ca^{2+} ions are released, which stimulates reparative processes depending on Ca^{2+} at various levels (Moskvin, 2014). To implement the descriptive scenario, there must be a coherent light beam (this is the laser light) and the beam intensity should be above a certain threshold (typically 5 mW/cm²).

Due to the global crisis caused by the COVID-19 virus, it is worth noting that laser therapy can be used to effectively cure infected persons. An example of rapid curing of a patient with severe pneumonia was shown by American doctors (Sigman et al., 2020). Discrete frequencies of light exhibit antimicrobial properties, since it is a form of

biophotomodulation. In fact, Enwemeka et al. (2020) have shown that phototherapy has immense potential to reduce the impact of coronavirus diseases and other infections; the authors demonstrated that coherent light is antimicrobial against numerous bacteria. The use of photobiomodulation therapy, through the low-level laser at treatment of COVID-19, has been shown to be beneficial in treating the disease complications (De Maros et al., 2021).

A good example of a laser therapy device is the Helios laser apparatus, the first version of which was developed immediately after the Chernobyl radiation disaster in 1987. In the first years after the disaster, the Helios device helped restore the health of about 300,000 severely irradiated people. Some of the possibilities of the Helios are described in the article (Krasnoholovets, 2020). Why is laser therapy against this virus and many other diseases still not widely used? It is not clear. After all, throughout 34 years of operation, the Helios has shown that it is essentially a monotherapy; that is, the Helios alone is enough to cure a huge number of different diseases. Laser irradiation of the throat and nose acts as a preventive measure that stimulates the immune system for several months and then the need for any vaccination is eliminated altogether.

The natural radiation of inertons from the Earth has already been mentioned and their effect on plants and people have been studied. For example, crop circles have attracted the attention of many researchers (Levengood, 1995; Levengood and Bruke, 1995; Bruke, 1998; Kingsbury, 2019). In these circles, stalks are bent up to ninety degrees as something softened and stretched the plant tissue at the moment of flattening. In many places, stalks are covered with iron oxides (Levengood and Bruke, 1995). While some crop circles have been deliberately man-made, the observed thickening and lengthening of herbaceous plant nodes found in spontaneous crop circles have not been explained and remained incomprehensible anomalies (Levengood, 1994; Haselhoff et al., 2014). However, those anomalies can easily be explained by the intervention of inertons that came from underground. In fact, the geological mechanism for radiating inertons is associated with intra-terrestrial processes occurring in the outer core and the mantle of the terrestrial globe (Krasnoholovets and Gandzha, 2012). It is known that internal motions within the mantle cause crustal rocks to move against each other (plate tectonics). That is why magnetostriction



phenomena should take place in the solid nickel-iron layers of the terrestrial globe. During macroscopic striction in the interior of the Earth, pulses of inerton fields are irradiated, and through non-homogeneous (mantle) channels of the globe's crust they reach the surface of the Earth. Due to the interaction with walls of these channels, fronts of inerton flows come to the surface as kaleidoscopic fringe images. It is these inerton flows, i.e. Δm , that affect local plants and cause them to bend, which results in the formation of the so-called crop circles. It was estimated that a few hundred kilograms of mass in the form of inertons are emitted from the underground in places in which crop circles are formed. Such flows of mass could not only affect plants but might also be dangerous for animals and people.

Have other researchers in the past examined unusual phenomena that could be explained with inerton physics? Yes, they have. In 1945, documentary film materials on the Die Gluke project (the Bell Project) were seized from the Nazis by Polish intelligence, which later came to the attention of the USSR intelligence service (The Bell Project, 2018). In the documentary (The Bell Project, 2018) some video materials of the Nazis had been used (from 4.0 to 5.24 minutes) showing the structure of the Bell and its interior, where two cylinders were rotating at a very high speed up to 60,000 rpm in opposite directions, emitting a kind of radiation. A concave spherical mirror reflected the emitted radiation. Figs. 5 and 6 are screenshots from the documentary (The Bell Project, 2018).

Of course, information about the Nazi Bell Project having terrible side effects became known in the Western world, although not all scientists still take this project seriously enough. Cook [97] describes the Bell as follows: "It was made out of a hard, heavy metal and was filled with a mercury-like substance, violet in color. This metallic liquid was stored in a tall thin thermos flask a meter high encased in lead three centimeters thick. Each test lasted for approximately one minute."

While the Bell emitted its radiation, personnel were kept 150 to 200 meters away from it. Cook (2002) further states the following, which is also mentioned in the Bell Project documentary: "During the tests, the scientists placed various types of plants, animals and animal tissues in the Bell's sphere of influence. In the initial test period from November to December 1944, almost all of the samples were destroyed. A crystalline substance formed within

the tissues, destroying them from the inside; liquids, including blood, gelled and separated into clearly distilled fractions."

"Plants exposed to the Bell included mosses, ferns, fungi and molds; animal tissues included egg white, blood, meat and milk; the animals themselves ranged from insects and snails to lizards, frogs, mice and rats."

"With the plants, chlorophyll was observed to decompose or disappear, turning the plants white four to five hours after the experiment. Within eight to fourteen hours, rapid decay set in, but it differed from normal decomposition in that there was no accompanying smell. By the end of this period, the plants had usually decomposed into a substance that had the consistency of axle grease." (A similar decomposition of liquid acidic biological substances can be observed in the inerton field of a model pyramid with a base size of several meters.)

"In a second series of experiments that started in January 1945, the damage to the test subjects was reduced to around 12—15 percent following certain modifications to the equipment. This was reduced to two to three percent after a subsequent set of refinements. People exposed to the program complained of ailments, in spite of their protective clothing. These ranged from sleep problems, loss of memory and balance, muscle spasms and a permanent and unpleasant metallic taste in the mouth. The first team was said to have been disbanded as a result of the deaths of five of the seven scientists involved."



Fig. 5. No plants survived near the Bell over a distance of about 30 m in the segment irradiated by the Bell's spherical mirror (The Bell Project, 2018)

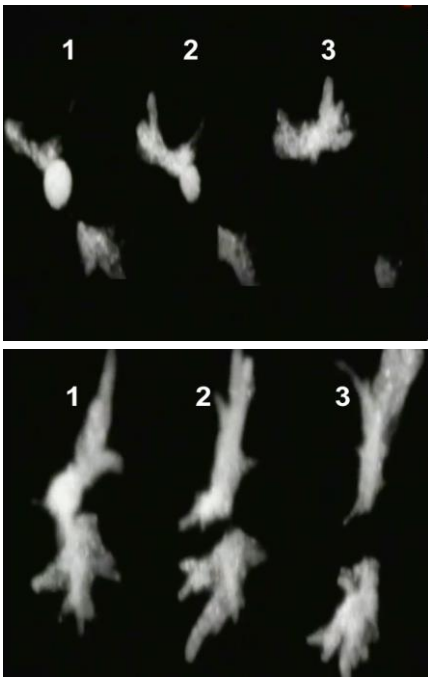


Fig. 6. A series of consecutive screenshots of living entities exposed to the unknown Bell's radiation, which decomposed into a kind of white coloured mucus without rotting and then fell apart over several tens of minutes (The Bell Project, 2018)

Had the Bell experiment been an attempt by the Nazis to influence biomaterial, people or change gravity? In any case, in those studies they discovered a new physical field. We have now revealed the secret of the past and found a comprehensive answer to it: the Bell radiated a powerful inerton field.

In our Biaktor reactor (Fig. 3), which generates a power inerton field, the destruction of biomaterials occurs in a very similar way that has been demonstrated in the Bell Project's video and published materials. It is now important to carry out similar and possibly new experiments in other laboratories using the Biaktor

Discussion

We have highlighted a number of views on self-organisation and communication of cellular organisms. Many of these ideas use the notion of an information field in addition to conventional exchange by molecular agents and photons. This is often identified with a certain biofield. We have considered many aspects which show how multicellular organisms can be affected and restored to health using an information field. Various researchers have pointed to the fact that correcting a flaw in the information can be more effective than interfering with the biochemical processes resulting

from the flawed information (Gariaev, 2014; Krasnoholovets and Fedorivsky, 2020; Sagi, 2016). The information field, which is exploited in molecular biology, has a subquantum nature and it would therefore be logical to associate it with an inerton field responsible for a short-range action at the quantum mechanical interaction of microscopic objects. The submicroscopic mechanics dealing with inertons, which carry fragments of mass, originates from real physical space constituted as the tessellattice whose cells are primary topological balls of nature. The submicroscopic mechanics is by design more fundamental than quantum mechanics, which means that theoretical models based on the submicroscopic consideration have to be most fundamental.

As shown above, inertons are present everywhere. Free inertons appear at any non-adiabatic fast processes, such as scattering of particles, magneto- and piezostriktion, capacitor and plasma discharge, sharp mechanical shock, cavitation, turbulent flows, etc. Our R&D team designed a device that measures inertons (Fig. 7). When the device is attached to the chest it can measure the inerton signals coming from the heart; different people have different patterns of inerton signals in their intensity, frequency and duty cycle, which are not to be confused by the normal heart beat.



Fig. 7. The 'Rudra' device measures inerton intensity (number of beats per second per sq. cm area) and frequency (1 Hz to 100 kHz) detected by its antenna

What consequences should we draw from the fact of the existence of inertons? First of all, inertons are able to change the mass of an object under consideration. The object absorbing external inertons increases its mass. A mass defect Δm may not appear to be significant solely in terms of mass, but its effect dramatically changes the initial

homogeneous configuration of its constituent components. The chemical bonds are altered; atoms and molecules begin to regroup and form cluster structures. In aqueous solutions, the solvate shells of ions and various molecules become weaker and the released water molecules are more actively integrated into the general water matrix, which is composed of large dynamic water clusters. Such a water lattice acquires special properties: water molecules become more strongly bound together, the surface tension reduces, the viscosity decreases and water acquires distinct superfluid properties. It is interesting to note that similar results were also reported by Fuchs et al. (2019): During four solar eclipse events a correlation was observed between a change in water surface tension and the magnitude of the optical coverage; evaporation experiments were carried out which showed a reduction in water evaporation at the same time as a rise in the surface tension. So Fuchs et al. suggested that an hitherto not-considered, possibly unknown cosmic force influences the properties of water on earth.

Thus, if the site of inflammation of biological tissue is saturated with a certain amount of external inertons (of a comparatively low intensity and low frequencies in comparison with intramolecular ones), the water present in this place will become much more mobile. Hence the lymph nodes also become very active and remove harmful substances from the inflamed area. This can be seen as a kind of tissue cleansing at the cellular level. When the cells are cleansed, the inflammation subsides because the body's cells begin to function in a normal manner.

In both of the systems under consideration, the mass defect Δm , which is related to absorbed inertons, may be the same but the fractality in these two cases can be different. For example, imagine a snowball made of snow and a piece of ice of the same weight; both of these subjects are made of the same H_2O molecules, but their structures are radically different. Similarly, there is no indication of such information components listed for pharmacological drugs that are given patients – do the drugs bring the correct fractality to the patient? For instance, in the early 2000s, a drug based on the algae *Spirulina* was widely advertised and recommended for people with impaired thyroid and parathyroid function. We tested spirulina pills from at least 20 manufacturers, measuring their electrochemical parameters (pH, conductivity and redox potential) which are known to be important characteristics of biological systems. In addition, the characteristic frequencies of such systems in the electromagnetic, inerton and sound

spectra are also important. Therefore, we checked whether the tested pills responded to the frequency and current typical of healthy thyroid and parathyroid glands. However, none of the pills showed a resonance response. This means that they were just a ballast for the body and had no medicinal effect on the thyroid gland. Hence it is obvious that the information component must be present on consumer products and medicines.

We also must consider the effects of gravity on living organisms since this is increasingly considered to be a critical field of investigation (Fitton and Battrick, 2016; Bizzarri et al., 2014; Bizzarri et al., 2015; Takahashi, 2021). Gravity affects biological systems at different levels from molecules to cells, tissues and organisms as a whole. Systems like the cytoskeleton are recognised to be sensitive to gravitational change which induces a mechano-signal into biochemical pathways (i.e. mechanical loading is possibly translated into bone formation through the periosteal skeletal stem cell). Gravity is considered as an 'inescapable' constraint that causes living beings to adopt various configurations. Space microgravity ($g \ll 9.81 \text{ m/s}^2$) eliminates direction in biochemical reactions, which in particular hinders the adherence of cells to a substrate.

We mention gravity because the origin of gravity is also associated with inertons, the carriers of mass (Krasnoholovets, 2017, Ch. 8; Krasnoholovets, 2021). Standing spherical waves of inertons, which occupy any massive object, generate the fundamental standing spherical wave of the object where the solution to the appropriate wave equation is inversely proportional to distance, $1/r$. Such a peculiar geometric landscape in physical terms is Newton's gravitational potential $-GM/r$ whose absolute value determines the gravitational acceleration g on the Earth's surface.

So, the more inertons that are present in any volume under consideration, the greater will be its value of the mass. This means that we can enhance space microgravity by radiating inertons in a certain direction; in the same way, centrifugal force is also a result of an inerton flow. Besides, in any local process where inertons are released, they can be absorbed by the environment resulting in a mass defect Δm . Such additional mass immediately reduces entropy and ions and molecules begin to behave as though at a low temperature, which in the case of microgravity can be considered as an increase in the value of g .

Inertons reach us not only from underground, which we saw in the example of crop circles, but also from



the Sun and the turbulent states of the atmosphere (Krasnoholovets, 2017, Ch. 9). Solar sunspots are the source of a new radiation that brings to the Earth novel particles called 'spirino' (Pugach, 2015, 2018; Olenici et al., 2014; Nikolsky and Pugach, 2015, 2016). For example, samples of a pyrite crystal FeS_2 (weight 19.77 g) and thin-layer hidden-grained tuffite (15.5 g) gained weight when exposed to solar active 'spirino' radiation when sun spots were present. The observed change of weight varied between 0.002 to 0.02 g with a measurement error of ± 0.00012 g. The radiation had a significant effect also on the behaviour of water and living organisms, and notably affected the weather and climate system. It is obvious that Pugach, Nikolsky and their colleagues recorded the effect of solar inertons (the same as Fuchs et al. (2019)).

Although inerton rays continuously irradiate the Earth's surface both from the underground and from the sky, to date no national scientific organizations are inclined to study them seriously. How safe is inerton radiation? Where is a safety threshold in inerton intensity and frequency? Can it be possible to avoid excessive inerton radiation? Do inertons affect weather systems on the Earth? Can inertons help to stabilize the functioning of cells in a weightless environment so that there is no loss of intercellular signalling? There are many questions, but still no answers...

At the same time, it seems that inertons are able to interconnect human consciousness, forming a universal network of minds and thoughts. In fact, Vernadsky's 1938 theory of the noosphere (Vernadsky, 2012) becomes the third in a series of major phases of Earth's development after the formation of the geosphere (inanimate nature) and the biosphere (living nature). Just as the biosphere is formed by the interaction of all organisms on the Earth, so the noosphere is formed by the interaction of minds. Noble (2016) formulates his theory of biological relativity in which living organisms operate at multiple levels of complexity: molecular, cellular and organ networks. He shows that the organism constrains its chemistry, including its genes, to serve the organism as a whole, especially in the interaction with its social environment.

A clear example of noospheric interaction has become apparent from a recent historical discovery (Shilov, 2015) in relation to the first European civilization, which started circa 8,000 years ago. This is represented by the ancient primary culture of communal Aratta (which occupied territory between the Danube and Dnipro rivers) – a highly

developed country of pre-slavery, pre-capitalist and pre-totalitarian state structure. Remarkably, this type of culture is still partly preserved in folk traditions. Their commune culture rested on a figurative-intuitive perception of the world, which subconsciously brought their culture to an information (noospheric) field (which is evident through the all-powerful, all-seeing god of the Slavic, Indian and Iranian Vedas). Aratta's people automatically followed a naturally civilized behaviour as if they were in 'autopilot' mode. The community's efforts strived for connection to this 'autopilot', through understanding the natural harmonic of space within their environment and within themselves. These laws of space automatically lead a person through life (in the same way that wild animals also follow their instincts: elephants, lions, deer and birds, as well as insects such as bees and ants; they are all at one with nature). An important, but lost, part of the ancient Aratta society was the practice of cultivating field sensitivity or, as we would say today, extrasensory sensitivity. The whole community was simply a harmonic ensemble. Everyone knew what to do and what not to do since any deviation from the rules of harmony led to disharmony for both the individual and for society as a whole. In the Arattan society everything was subordinated to this pervasive field, they felt the field and tried to perform their actions in harmony with it, based on their figurative and intuitive perception of their environment. Most noticeably, they always chose places for sanctuaries with strong earth energy (which are now known to be associated with 'mantle channels', i.e. regions of elevated inerton intensity arising from deep within the Earth). The remarkable culture of Aratta remained practically unchanged for 3,000 years! Is not that a reason to learn and follow its harmonious example?

Examples of essential ancient Arattan customs existed in Ukraine until the early 18th century as a democratic system of government, which clearly flourished in the 15–17 centuries: independent of the legislative, executive and judicial authorities, all positions (such as those of the prime minister, managers of the Cossack elders, local governments, judges, senior police officers) were directly elected in accordance with the prescribed procedures which included the requirement of social assistance for poor people. The Code of Laws, known as the constitution of Ukrainian Hetman Pylyp Orlyk, were written in Latin and brought to Western Europe in



1710^[5]. Until then, Asian and European civilizations were characterized by secondary cultures, such as slavery, feudalism and totalitarianism (still exemplified in modern slave-holding, feudal, capitalist and socialist societies). Those cultures were, and still are, based on a logical-analytical world outlook, which through the means of rationalism leads culture towards material manifestations of the real world. This type of culture has become transformed to 'manual control', which substitutes the natural culture of 'autopilot'.

In 1719, Sweden took the Cossack Code of liberties (the constitution written by Pylyp Orlyk) as the basis for building of their society. In 1788, that constitution was adopted by the United States, and two years later it was approved by France, and so on. Those actions strongly led to the democracies of America and Europe. However, the balance between democracy and totalitarianism has experienced variable success. The drive for totalitarianism which prevailed in the 20st century can still be observed in the beginning of 21st century: mankind is still in the throes of routine religion, international conflict, terrible wars, environmental, epidemic and conspiracy problems. The system of material control over people is constantly increasing: passports, identity cards, fingerprints, iris photos, video surveillance, digitization, authorization (a QR code), and probably in the future will include indication of blood group, urine analysis, semen analysis, DNA analysis, and perhaps other things too (for example, even an inerton footprint). Governments of the developed countries try to maximise preservation of the modern materialistic doctrine, which means the conservation of *Homo sapiens* in its present very imperfect state, forever. Thus, modern society shows an increasing variety of fractalities that deviate from the obvious 'linear' laws of nature.

But the heart of the democratic laws of social order are simply the laws of the harmonious coexistence of the individual and Space, exemplified by ancient Aratta (known as the Golden Age in Vedic heritage). Understanding the existence of an all-pervasive field and the ability to use it in order to harmonize society is an important challenge for modern civilization. The natural harmony of society prevails over a 'tunnel vision' of digitalization (in particular, a persistent digital identifier, the so-called ORCID iD for researchers), video and Wi-Fi control of people.

A clear example of a full-fledged harmonized society is metronomic synchronization; see, e.g. (The Surprising Secret of Synchronization, 2018). One can watch in the video that dozens of 'metronomes' synchronize themselves via an all-pervading information field in a couple of minutes, which reflects a particular law of crowd behaviour. If there is a positive dominant, then synchronization occurs in the name of good ideas, a creative collective force; the spirit of the people, the spirit of the collective is based on this.

The Maharishi Vedic Research Institute (World Government of the Age of Enlightenment, 1977; Borland and Landrith, 1977; Orme-Johnson and Fergusson, 2018) proposed a peculiar theory and technology for alleviating violent conflict through reducing societal stress in an underlying field of "collective consciousness". To achieve this goal, a group of individuals practice a special yogic teaching. The meditating group uses practice of the Maharishi Technology of the Unified Field (a transcendental meditation). In fact the meditation showed a change on the quality-of-life indicators, reduced stress in the collective consciousness and behaviour of Israel and Lebanon during the civil conflict of August and September, 1983, in Jerusalem (Orme-Johnson et al., 1988).

Maharishi Mahesh Yogi has postulated that there is a fundamental level of consciousness—Transcendental Consciousness—at the basis of each individual's mind, which is the source of thought located beyond the subtlest level of mental activity (Orme-Johnson and Fergusson, 2018). A direct experience of Transcendental Consciousness is an experience of the unified field of nature's intelligence. The authors point that individuals experiencing Transcendental Consciousness through their program create coherence in not only their own brain, in the form of 'electroencephalic ordering' or brainwave synchrony and coherence, but in the wider society as well, in the form of harmony, order, and peacefulness and they have named this phenomenon the Maharishi Effect. These are typical action-at-a-distance phenomena directly full into the subject of this paper because the connection and harmonization between human consciousness occurs through an inerton field.

A striking example of positive synchronization is the current situation with the opening of borders for

⁵ Pylyp Orlyk's Constitution, also known as The Constitution of Benders of 1710, established the principle of the separation of powers in government between the legislative, executive, and judiciary branches well before the publication of Montesquieu's

Spirit of the Laws. The document limited the executive authority of the hetman, and established a Cossack parliament called the General Council.



refugees from Ukraine due to the invasion of savage Muscovite soldiers. At present, visas, foreign passports, long bureaucracies, etc. are not required to cross the borders into the European Union. The presence of a living person is quite sufficient.

Thus, people consist not only of matter, but also of a field component. Everyone has his/her own aura with a specific inerton spectrum and set of fractal properties. And mankind, whether they want it or not, begin once more to revert to the mode of 'autopilot', but this time, at the level of up-to-date technologies and a modern outlook. Governments must loosen the reins of materialism and seriously take up the introduction to and the development of the field component of humanity. Spiritual and yogic practices developed under the supervision of scientists and sages should be supported and put into everyday activity.

It is now the time for scientists to direct civilization in harmony with the laws of the universe; and the manifesto of scientists must be perceived seriously (Bounias et al., 2006).

Conclusion

Subtle details revealed by many researchers in biological processes, which involve intercellular communication, point to the existence of a certain information field. Such a field appears in fundamental physics based on the idea that the universe is based upon an eternal substrate that shares both discrete and continuum properties. Mathematical studies have shown that physical space has the structure of a mathematical lattice (the tessellattice) and that fractal volumetric deformations of a cell of the tessellattice can be interpreted as the physical notion of mass. The motion of a particle-like deformation with adjacent cells of the tessellattice involves a process of fractal decomposition that supports the existence of a cloud of spatial excitations around the particle. These excitations were named *inertons* because they really represent carriers of the force of inertia (i.e. the resistance of space to change the position of the object is associated with the force of inertia). A moving particle together with its inerton cloud is mapped to the quantum mechanical formalism as a particle's wave ψ -function; so, inertons as a substructure of the matter waves, i.e. the wave ψ -function, represent a basic comprehensive field of the universe (Krasnoholovets, 2017).

Inertons carry mass and fractal properties of matter in general and it turns out that all living organisms are formed by a set of primary fractal structures

such as images in a kaleidoscope. It has been shown how inertons manifest themselves in condensed media including biological systems and how they change the properties of the system in question. Thus, inertons can interact with living cells either as free field particles or as waves, i.e. inerton clusters, and affect its vital functions in a variety of ways.

Inertons indeed should be related to an information field, which is so important for cellular-molecular biology. Synchronization of cell signals contributes to the harmonization of body systems and the formation of a certain resonant frequency or spectral band. The degree of harmonization determines the ability of body systems to withstand an aggressive environment; for example, the balance of the nervous system in the presence of external stimuli or the stability of the immune system in the presence of pathogenic microorganisms. That is, in a healthy living organism, the behaviour of cells can be compared with a network of synchronized metronomes.

Inertons are fundamental to mechanisms of physiology as derived from the precise laws of behaviour of real physical space. Hence the appearance of this common denominator between physics and biology predicts that consciousness is the denouement of this continuum. This is in line with Torday (2019) who suggested that evolution is a result of intercellular signalling, which is both a developmental and a phylogenetical manifestation of the Singularity of Nature which is hidden in the submicroscopic deterministic concept of physics based on the fractal laws of the universal tessellattice.

An inerton field allows further studies in biology and biophysics, and particularly in practical applications for clinical therapy. It can be applied locally to sites of inflammation and be used to reduce the entropy of the body as a whole. Moreover, the body's inerton spectra may become an element of the medical examination of patients and a general examination of other biological species.

Understanding the presence of inertons as carriers of information also has an important application in understanding the ordering of social phenomena and the harmonization of human communities (where a clear example is the harmonization of a huge number of metronomes).

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