Review

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Are conduits superconductor-like and supported by tetrahedra structure of hyaluronic matrix in living systems? New perspectives

Abstract: All biological–medical treatments need a ground regulation in the intermeshed control loop system in animate matter. The focus of our contribution is to suggest a possible mechanism in this interconnected system that will work in order to supply/assist a higher ordered servo loop. Bonghan ducts indicate similarities to so-called meridians or conduits that are the central part in Chinese Medicine for the energy Qi. It is assumed that the nervous system demands a highly redundant and rapid communication system (RCS) probably established via the extracellular matrix (ECM) and triggered by a threshold value for the entire body. Metabolic processes could work in the picosecond's range while the nervous system is on the time scale at least one order of magnitude lower; probably most of them in the millisecond range. Long-range coherent electromagnetic phenomena and recent experiments indicate a structured superconducting-like system with the Josephson-effect behavior in biological systems. In the ECM are the components proteoglycans and glycosaminoglycans (PG/GAGs) and among them the ubiquitarian hyaluronic acid plays probably an important role and can behave as liquid crystals while the charge transport is performed via proton "jumping" in the proton-chains. Therefore, the water molecules have to be confident on a nanometer scale, lowering their energy states, and set up a phase transition with a rapid jumping of the protons through the water–carbon-chains. These partial chains could probably be modeled by tiny pyramids of the atoms. We propose that in order to set up those long-range coherent effects, a vortex is created. By doing Qi Gong, an energetic vortex through the body is established and the entire body can be modeled by two-base plane-faced pyramids acting as a tunable cavity resonator obeying electrodynamics laws. Therefore, the phenomenon's of pyramids should be considered in animate and inanimate matter in order to achieve long-range coherent effects, which by now controversially discussed and to go new ways to come over the clutter.

Keywords: electromagnetic wave propagation, general theory in fluid dynamics, vortex dynamics, rotating fluids, general theory and mathematical aspects, biological information

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Construction of the rapid communication system

All biological–medical treatments need a ground regulation in this intermeshed control loop system in animate matter. The focus of our contribution is to suggest a possible mechanism in the interconnected system that will work in order to supply/assist a higher ordered servo loop. It is assumed that the highly developed nervous system demands a rapid communication system (RCS) via the extracellular matrix (ECM), with the most important structure components proteoglycans and glycosaminoglycans (PG/GAGs) [1, 2], in order to set up a ground regulation after reaching a certain threshold value for the entire body. We are aware that the limbic

system has a very important influence on the entire system, but here, to our ease and not going beyond the scope, we only focus on a possible mechanism on the microscopic level for the desired value of the euregulation via long-range coherent effects. In the early 1960s, a web in the human body has been found and visualized called Bonghan ducts [3, 4] that could be probably constituent parts what is usually called meridians or conduits, for the energy, named by different expressions, and is a central part in Chinese Medicine: Qi [5, 6].

The metabolic processes could be very fast and work in the picosecond range. Therefore, in combination with the nervous system, this is getting aware of non-euregulated behavior in the body in at least one order of magnitude lower on the time scale, probably most of them in the millisecond range. Therefore, the suggested RCS should now provide the information like a hologram for the nervous system that in turn samples the data in order to react via the cerebral system above a certain threshold value. Such a system should show long-range coherent properties and if we speculate, it acts superconducting-like via Josephson effects [7]. Under this assumption, a system is established and possesses properties for very high sensing and sampling of non-euregulated states at different levels. The nervous system is now able to re-establish the euregulation via the vegetative system via short-range ordering on local and/or via long-range-ordering at non-local parts.

The realization of such a system could probably be done via the soft connection tissue, which is the biggest "organ" in the animate matter and connects every part of the body. Therefore, it possesses the best conditions in order to establish such an effective structured pathway system acting as a complementary system to the nervous system. In addition, it is assumed that the information is stored as a standing wave pattern, like a hologram. In this control loop, all the other processes are then launched on a different time scale in order to re-establish the euregulation of the living system via a homeostasis in combination with the nervous system.

Histological arguments

The potential significance of discovering the Bonghan ducts [3, 4] astonished the Eastern and Western science in order to verify and evidence. Recently, the visualization method of those pathways has been re-discovered via an agent on living tissues by Typan blue or Alcian blue [8–13]. The histological reason of this observation [14, 15] is probably that in the extracellular matrix the hyaluronic acid is almost everywhere and possesses different biological specifications and properties. Therefore, it is reasonable to promote the Bonghan ducts as a strong partial candidate in order to set up such kind of pathway system. The visualization is explainable by emission spectroscopy, and mainly the reaction-like reactive oxygen species (ROS) due to their short lifetime allows a diffusion of several hundreds of nanometer into cells and tissues [16–18]. In the case of Trypan blue, three emission lines are observed and among them, the blue line was the strongest and alterable by the water content. It could be speculated that the other emission lines indicating different metastable states might also belong to such kind of pathways and each emission line with a specific information.

It has been found that the proton balance in a confinement undergoes a phase transition and behaves superconducting-like via Josephson effects [28]. As a curiosity in GAGs-matrix, e.g. hyaluronic acid, the content of the water corresponds almost to the concentration of water in the entire body. Therefore, regulating the water content in hyaluronic acid regulates and stabilizes the entire water content of the body at the desired value.

There exist many theories concerning the meridians/conduits, reticular planes – a finer web interconnecting the meridians/conduits – and acupuncture points. In our suggestion, we like to emphasize the assumption that liquid crystal collagen fibers and the hyaluronic acid probably are responsible for transmission of sound waves, longitudinal waves, and/or transversal electromagnetic waves (TEM), e.g. photons, in the soft connective tissue acting as a bulk for the entire body [19–21]. Among the different frequencies in this broad frequency spectrum, probably optical modes arise even if their intensity is weak [22]. These assumptions fit very well to the model of Fröhlich that is basing on the two aforementioned modes of waves [19]. In addition, Needham, a British biologist and sinologist, found that the protoplasm in living system acts actually as liquid crystals, with many metastable phases [23]. The long molecules like GAGs create the liquid crystals therein; not only in the cell itself also in the ECM, which plays a key role in this business.

Proton chains – information system

The effect is basing on water and the water molecules, formed from two hydrogen's and one oxygen atom and the common angle for the charge equilibrium by repulsion is usually found to 105° and not at 180° between the

hydrogen atoms acting than as a dipole. Many studies of water revealed that all the crystallographic structures around us can be realized therein, what a very profound and meaningful statement is. In the case of aligned water molecules with their opposite charge in a chain, it seems theoretically possible that a proton jumping could take place like a Newton cradle. Then, the proton does not move along the chain, but the chain behaves like a pendulum where the impetus is given by a proton bump. This mechanism is much faster than electrons can do in a wire and in addition much faster as ions can do by diffusion. Investigations of trapped water in carbon nanotubes, where the water enters via defects in the nanotube wall lead to the discovering of proton-chains therein [24]. The finding indicates that the charge transport therein is a jumping mechanism of the protons as aforementioned while no reaction with the tube wall took place. Summarizing these facts, water in the confinement behaves much different from that of bulk water while creating a new phase. Probably the confined water molecules therein undergo a phase transition [25] and set up an information system via the proton jumping that is very much faster as the saltatorial signal propagation in the nervous system.

We speculate that the RCS works at a much higher signal velocity as the nervous system but the initiation is still an open question. Deviations from the desired value appear as a standing wave pattern and give the impression of a modulated memory while the control loop is reading out and changing the information until the euregulation state is achieved. We consider the standing wave pattern in the entire matrix as a hologram where only precise interference pattern are stored, which demands coherent “light” that are in principle states of Bosons. The latter implies that the superconducting-like behavior seems possible via Bosons. Therefore, the entire RCS acts as a holographic detector, probably creating liquid nanocrystals in order to establish this hologram. However, it seems that still very controversially discussed, the phenomenon could be simply modeled by Bragg reflection via a crystal as in solid-state physics.

A further strong support that the structure of the RCS is basing on “water” indicates the Traditional Chinese Medicine (TCM) according to the Yin-Yang theory. Therein, especially obeying to the phases of changes – in the daoistic way of thinking – the regeneration phase belongs to the water-phase and is responsible for the structure from thence creating the functionality via a mutual exchange process [5].

In the case of surplus protons in the cell, the homeostasis of water content is not anymore sustained, and causes a hyperpolarization. This leads to a higher activity via adenosine triphosphatase (ATPase) and additional metabolic processes start for compensation while also an interaction with the deoxyribonucleic acid (DNA) takes place probably including the RCS. Further, the homeostasis of the cells, concerning the ion equilibrium between internal (cytosol) and the external (interstitial) medium, this equilibrium has to be constant and dynamically supported by diffusion mechanisms or by active or not transport-based specific exchanger. This process in general takes a velocity of milliseconds as in the nervous system transmission as well. Therefore, during the cell homeostasis process the external ion variation constantly informs the water conducts about this and thus a big interstitial alteration, e.g. calcium, sodium, potassium or whatever has a very relevant role on the conducts messages.

As a matter of fact, the information is distributed to all other cells as aforementioned via the RCS. We like to emphasize that the RCS acts as an example that the physical, biological, chemical and metabolic levels combines for the ground regulation.

Superconducting-like behavior?

Fröhlich already reported about a superconducting-like effect basing on long-range coherent electromagnetic phenomena in biological living systems [26]. In his model, the cells act as oscillating dipoles with a non-vanishing dipole moment where the ECM is considered as heath bath [27]. A set of dielectric dipoles causing a large number of minimized energy states where on the macroscopic scale the phases of the dipoles are correlated and describable by the behavior of superconductors rather than by the Maxwell equation in this state. In recent experiments, it was justified that in nearby domains of biological systems the criteria for Josephson are obeyed, e.g. excluding magnetic fields and quantized in the correlated region similar as Fröhlich found earlier [28]. The coupling of the cells could act like weak-link-junctions in superconductors that can be separated by a very small distance, e.g. in [29]. Those configurations have been extensively investigated in the past [30]. The quantum tunneling of Bosons across such barriers was proposed by Fröhlich for biological systems.

Using the dc- and ac-Josephson effect, the RCS can now be permanent in contact with the entire body via the cells and ECM and in addition to use them as a memory as well. Therefore, it is then understandable that deviations of the desired value often show signs on different parts of

the body – leading to mental state troubles – and can be manipulated via local and faraway parts. The properties of this RCS sound similar as in Eastern Medicine what is called meridians or conduits. In Western Medicine larger areas of the surface body, known as Head zones where the inner organs possess a morphologic relation to dermatomes and viscera-cutaneous reflections and vice versa takes place with evanescent effectivity from the point of maximum [31].

The RCS possess probably at least two signal transmission methods, a proton jumping mechanism and a Josephson-like effect, and probably both exist according to local conditions at the same time.

Tetrahedral structure

The significance of the polyhedrons has been studied for thousands of years, and they are very important in Physics, Chemistry and Geometry [32] and it is a curiosity that the five Platonic solids correspond exactly to the five elements in Eastern Medicine. Supposing, nature is creating larger particles and structures basing on the vortex theory, it is likely that at a certain level of energy the Platonic solids are formed, starting by an extension from the line as an abnormal Platonic solid [33]. According to the theory who is obeying the Eulersche polyhedra axiom, tetrahedra are created, which are a central part in the crystalline superconductors, e.g. in Yttrium-Barium-Cupperoxide (YBCO) a well-known studied perowskite structure [34]. The unit cell of this structure possesses octahedrons and build by oxygen and cupper atoms as can be found elsewhere. Let us in addition suppose and basing on vortex theory, as a working hypothesis, a vortex inside the octahedron has to exist [35]. When this is the fact and the vortex is usually created by an inward and outward spinning vortex as seen in many examples in nature. The radius of the vortex at the baseplane should be wider while on the top is getting narrow corresponding to the vorticity, respectively. In the case of superconductivity of the orthorhombic phase of this perowskite structure, superconducting current flows in the Cu–O baseplane, which is higher as in the chains. In addition, it was found that the oxygen apex atom plays a central role for the superconducting properties [36].

Considering these findings, it sounds similar to the Chinese Philosophy and especially to the book of changes where by an octagonal ordering of archetype symbols, hexagrams, a dynamic ordering of possible states is expressed and called “Bagua” [5]. According to this way of thinking, first the structure has to be established before the phase energetic can start and bringing out the physical properties [37]. Further, one could assume that those pyramids can couple to a higher ordering mechanism in order to create larger components and increasing the efficiency.

In the case of biological systems, water chains form also tetrahedra, and it is reported that the charge transport is performed via a proton jump along the water chain [38]. In a “Gedanken experiment”, that in principle the same mechanism should happen independent whether it is animate or inanimate matter. Therefore, it is highly speculative to assume that a kind of this “jumping” mechanism should be found in the octahedrons in inanimate matter too. Albeit no H-atoms are obviously not in the unit cell, the question arise what could cause the zigzag chain of “H”–O–“H” atoms similar to the water chains in biological systems.

Conclusion and outlook

In summary, we can state that the findings from an interdisciplinary point of view leads to the following conclusions:

1. We suggest an effective highly redundant and RCS on the microscopic level in biological systems.
   - It works in combination with the nervous system.
   - It provides the information of deviations from the desired value and probably acts simultaneously as a memory like a hologram.
2. At least two mechanisms could be taken in account for the signal transmission.
   - The liquid crystal formation in the hyaluronic acid plays probably an overwhelming role in this system.
   - The water phase transition in confinements in the organic molecules and in the ECM as well resulting in a proton jumping in the water chains.
   - On larger compartments, a superconducting-like behavior with Josephson effects seems possible.
3. Pyramids possess science from ancient time and we suggest as a test to consider them as a kind of cavity resonator who supports coherent phenomena like long-range coherence effects in animate and inanimate matter.

We would like to offer these ideas as an alternative according in the way of thinking of Feynman, … *when the problems are too much in the clutter we have to go new ways since the old methods stuck already in the beginning* [39].

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