Quantum biophysics of water

Water biophysics works with quantum notions of water, viewing its regulatory function as the basis of a cell life. While this gives rise to new perspectives on cellular metabolism issues, more importantly it sheds light on the state of biosphere, including human health, which is consistently subjected to destructive technogenic impact. This article shows that the measurement system of water quantum states is based on dynamic processes in the water electron subsystem in a state of exchange interaction with the natural background of Bose-condensates, as well as changes in water thermodynamic, electrochemical and structural-physical characteristics.

Keywords: macroscopic quantum states, electron wave packets, biologically active water, cellular metabolism

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Abbreviations

COHERENCE: the consistent flow in time of several oscillatory or wave processes; NON-LOCALITY: non-local connection between particles distributed in space and time, absolute simultaneity

Quantum biophysics of water

Quantum physics of water is a scientific approach to physical perspective on water that studies quantum cooperative processes within it; quantum biophysics of water is a particular section regarding living organisms. Methodology of quantum physics of water is based on the study of critical phenomena [1-4] conditioned by phase transitions in the organizing water phase, and quantum phenomena connected with the macroscopic charge ordering and exchange processes in the open system.

According to scientific assumptions of quantum water biophysics, a liquid-phase state of matter, namely water, is a heterogenic state characterized by the domain organization by metastable polymorphous structures [5].

An example of such metastable structures in water is the associative water phase represented by polymorphous ices VI, VII, VIII (Walrafen pentamers [5-7]), stabilized by nano size hollowness and electrostatic charges.

Electrostatic charges in the associative water phase are in the quantum de-localized state and can engage in macroscopic quantum interactions. An organism is another example of macroscopic quantum system: each organ and cell interacts not only with each other but with similar in properties structures in the environment. It is due to the fact of non-local interconnectedness that health and diseases significantly depend on the electro physical condition of the environment [8]. This interconnectedness is sustained by exchange interactions of quantum oscillators, which yield to (electron) charge transport and information in form of self-similar electron wave packets. For these processes to take place in living organisms, all the cellular structures have to be in the electro physical disequilibrium, i.e. contain excess negative charge [9].

Biophysics of water [10] offers a chance to arrive at answers to pressing challenges of modern natural science, from the lowest levels of water cooperative behavior connected with the formation of water metastable phase, to quantum phenomena of non-local electron transport and regulation of cellular biological processes, to global manifestations of water self-organization in the Earth geosphere as electro physical weather and climate regulator.

Methodology employed by quantum biophysics of water contributes to classical ideas of cell biophysics, especially in terms

of the regulatory role of water in cellular metabolic processes and exchange electron interactions in an open system [11,12]. While classical biophysics views cellular metabolism in terms of biochemical processes, quantum biophysics is based on new understanding and acknowledgement of the regulatory role of water in cellular metabolism. This view opens a fresh outlook on the current problems in regards to, not only cellular metabolism but the state of biosphere including human health subjected to a destructive technogenic impact.

Currently the number of studies dedicated to quantum notions of macroscopic quantum systems such as a cell, human body and the biosphere are progressively increasing. In this regard we reference the work of Vlatko Vedral [13], an acknowledged expert in the field of quantum physics, which points out that quantum behavior of systems persists on macroscopic scales and these effects are much more common than ever suspected, and that they may also be well at work in our body cells.

According to Vlatko Vedral and Seth Lloyd [14,15] the notion of "quantum coherence", which plays a central role not only in chemistry but also in biological systems. It is a fundamental aspect of macroscopic quantum effects. Quantum coherence results in the property of quantum non-locality, i.e. connection between space-distributed states, or processes not connected via a local carrier of interaction. Another interpretation of the term "non-locality" assumes, according to the De Broile-Bohm theory [16], presence of quantum potential responsible for the interactions between events distributed in space and time (so called transactional interpretation of quantum mechanics). These interactions are referred to as non-local correlations and not transactions in quantum mechanics.

The question is: what does quantum mechanics give us and what components of life execute these non-local interactions? The answers to this question may be found in new conceptual formulations of water, which, in fact, itself is the basic substance of life.

A basic scientific definition of the term "biologically active water" proposes:

1. Biologically active water- is electrically non-equilibrium water with unstable anion-radical forms of active oxygen as electron carriers; electron breakdown provides an excess electron inflow onto cellular receptors of a living body as well as maintains electrical non-equilibrium in cells and organic structures necessary for stable functioning of their macroscopic quantum oscillators controlling cellular processes.

2. Biologically active water- is structural- and spin-oriented organization of Walrafen domains in the associative water phase providing cellular metabolic process activity.

Thus, a scientific definition of the term "biologically active water" reflects several physical phenomena, which underlie regulatory function of water in both - intra- and intercellular processes, as well as exchange processes with the environment.

These fundamental concepts form the methodological cornerstone for water biological activation technology, activation of energy within human and other living systems, formation of electro-physically favorable environment for human beings, animals and plants, prevention and treatment of metabolic disorders. These concepts are founded on the principles of naturally occurring processes of electro-physically active water state formation; these processes do not result in metabolic disruptions and do not exceed normal body electrical charge needs.

A range of developed technological and device-based solutions ensures opportunities to solve a variety of issues:

- increasing productivity of agriculture (in crop farming, animal breeding, poultry keeping, fishery) up to 20-50% combined with essential improvement of quality indicators, reduced man-made burden on soil and water ecosystems and increased production profitability;
- providing private and collective consumers with qualitatively different biologically active water aimed to prevent non-infectious diseases in human beings, including one's psycho-emotional sphere;
- altering of the electro-physical state of the living environment for the purpose of increasing body defense functions in human beings and animals in the face of stress factors in the environment and abnormal geophysical conditions;

- correction and treatment of a range of metabolic disorders in human beings and animals using biologically active drinking water, restored as a result of spin-modification of associative water organizing phase after processing it in hypo-magnetic conditions;

- Integrating a device-based methodology of new water technologies use based on natural background state of electron Bose-condensate [17] measurements, along with high-resolution diagnostic instruments for assessing human body systems.

The method of application of these technologies draws from a developed system of bio-energetic water activity indicators, and new technologies which can control the activation levels of seed (genetic) material and bio-energetic state of living environments.

Qualitative character of quantum water biophysics

Quantum water biophysics is a qualitative science. The measurement system of water quantum states is based on dynamic processes in the water electron subsystem in a state of exchange interaction with the natural background of electrons' Bose-condensate, as well as changes in water thermodynamic, electrochemical and structural-physical characteristics.

To evaluate the state of physically altered water that has undergone activation by physical methods, we suggest using a complex of structural-energetic values which indicate drinking standards of water based on its bio-energetic activity. All values are divided into principal and additional (confirming presence of significant physico-chemical, thermodynamic and structural changes in water after processing). The principal values include [10,18]:

1) Redox potential (an electrochemical value indicating electron saturated water),

2) Perhydroxyl ion-radical content indicating catalytic water activity and electron-binding energy in ion-radical complexes,

3) Dynamic viscosity (a value reflecting thermodynamic changes in water),

4) Water structural organization parameters reflecting the associative water phase content in the volumetric water and the phase distribution density according to energy levels (measures).

To prove structural-energetic water changes, besides the principle indicators, it is also necessary to use a host of additional values characterizing identical water changes. Thus, hydrogen ion concentration and electro conductivity (relative changes during activated state or following it post-relaxation state) change their values under electron water saturation (in contrast to molecular forms of water soluble compounds, e.g. hydrogen).

Structural changes in processed water can be measures by changes in its absolute viscosity. This indicator, reflecting thermodynamic changes in water correlates with the associative water phase indicators and can be used when assessing structural changes in the physically processed water.

Additionally, to assess electro physical changes in water, various methods can be used: gas discharge visualization assessing specifics of water transition into donor or electron acceptor states by observing light emission dynamics; the nuclear magnetic resonance method - magnetic resonance characterizing changes in water structural state based on the electronic screening degree; spectroscopy methods (fluorescence, Mie scattering, combinational scattering) allowing to assess structural-energetic water changes and parameterization of water associates [5,10].

Taking advantage of existing capabilities in current water physical treatment technologies to assess water bio-energetic activity, a 4-level differentiation is suggested to measure water activity levels (see table below). In this, water activity level is determined according to one or several principal value indicators confirmed by indicators of the additional value parameters.

This approach allows registering dynamic changes in the activated state of water, characterized by kinetic parameters of temporary water transformation under the influence of environmental triggers.

The necessity in using this method to evaluate levels of activity in water arises from a few predicaments: present differences in water structuring kinetics, which lasts for a prolonged period of time (up to 7 hours), manipulation of structuring parameters by intense mechanical agitations, sudden fluctuations in temperature and, relaxational processes of chemical and electrochemical activity undergoing critical

concentration states characterized by phase instability in water [10].

The list of values given in this **TABLE 1** is a minimum requisite but does not exclude other methods of parameterization of physically processed water.

The history of water quantum biophysics

The first quantum notions of water as a coherent macroscopic system were introduced in the works by Giuliano Preparata and Emilio Del Giudice [19-22]. In 1995, Preparata published his theory of water coherent states, so called "coherent water phase" [23]. This is the year that marks the starting point of research studies on collective water properties and its biological activity.

The next stage in the founding of quantum notions of water appears to be the rationale presented in the scientific discovery [24]. This scientific discovery initiated research studies on quantum properties of the associative water phase stabilized by nano scale hollowness and de-localized electrostatic charges [25,26].

To develop these ideas Gilbert Ling in his works [27] gave evidences of the intracellular water ordering and a special water state in the cell cytoplasm. Dynamic changes in water state close to cellular membranes have an impact on polypeptide conformational transformations.

Cooperative behavior of the associative water phase results in a range of non-linear effects in water, which are determined by electro physical properties of the phase [5,25,26]; this has been proved by Gerald Pollack in his works [28-30]. The results of the experiment have shown that water bordering a surface has greater conductivity and less heat capacity in comparison with ordinary water; this points to less freedom potential of molecules in the given layer in comparison with the volumetric water. Furthermore, when approaching the surface in the bordering layer, a non-linear change appears in the electrical potential; this fact proves the monopolar character of hydrate structures.

Regulatory functions of active forms of oxygen in blood and in water model systems and experimental support of the water oscillatory dynamics were obtained in the works by Vladimir Voyekov [31]. His works support the relations of oscillatory processes in water with its macroscopic quantum properties and charge disequilibrium [10]; additionally, his work also provides evidence of the regulatory role of water associative states in cellular metabolism.

Research studies on changes in the electrons' Bose-condensate natural background confirm presence of a new life risk factor – electron deficiency in the environment [19,32]. They determine causes of the human metabolic disorders, which may be specified as the associative water phase degradation in cellular membranes under the influence of unfavorable changes in the electrons' Bose-condensate natural background.

Thus, as a science of water quantum states, biophysics of water, an essential field in order to primarily understand laws of interaction of all living things with the planet, not only affirms cellular metabolism as the fundamental basis of life, but allows to productively respond to the key challenges of evolving civilization. Classical scientific view inherent in genetic engineering and modern medical and biological sciences can is unable to find solutions to problems associated with pandemics of non-infectious diseases, reduction of the Earth bio productivity and biological community species degradation [33-35].

Modern classical science, in spite of enormous efforts in this sphere, has not found itself in a position to explain key issues of mechanisms underlying the planet pandemics, because it does not possess in its vocabulary such terms as macroscopic quantum states, quantum interactions, space and time non-locality, transmutation of elements in the living organisms [36,37], quantum teleportation and other manifestations of the quantum system characteristics. The associative water phase being an electron reservoir in living organisms performs principal regulatory functions in biochemical processes.

Practical application of quantum notions of water is also important for adequate understanding of geosphere processes directly influencing biosphere [38-40]. Global Earth changes, primarily climate warming, cannot be prevented or delayed if the planet academic elite does not adopt new approaches to understanding geosphere processes in which associative water phase impacted by destructive

Table 1. Levels of bioenergetic activity of drinking water.

Value	Levels of bioenergetic activity			
	1 - low	2 - medium	3 - high	4 –extremely high
Biocatalitic activity ($HO_2^{-(*)}$ concentration, μ g/l) – determines the level of water electron disequilibrium responsible for the intensity of oscillatory and conformational processes, biological membranes, proteins and nucleic acids, "cell pumps" activity, ligand-receptor interaction, vesicle transport and cellular proliferative activity.	<0,1 (tension of energy providing cell organelles, failure of regulatory mechanisms activity – metabolic disorders, promotion of cell anabiosis)	0,1...1 (appearance of tensions in organelle and cellular regulatory system functioning resulting in adaptation resources reduction).	1...10 (ensuring stable activity of the enzyme catalysis systems, mitochondria and cellular vesicles activity under optimal levels of the cellular proliferative activity)	10…40 (normal cellular metabolism recovery and cellular accelerated proliferation)
Redox potential Eh, (mV) - assesses stability of the cellular antioxidant protective system, the level of free-radical load on the cellular structures, and participates in triggering the cellular apoptosis program.	400… 230 (low efficiency of the antioxidant protective system, increased level of aberrations and mitotic activity of the altered cells).	230…150 (medium level of the antioxidant protective system, manifestation of free-radical activity, and acceptable level of cell aberrations).	150…-50 (high efficiency of the antioxidant protective system, blockage of free-radical activity and triggering the apoptosis of the damaged cells).	-50…-200 (adaptation resources recovery and triggering the apoptosis of functionally altered cells).
Thermodynamic value (dynamic viscosity, μ, cP) – determines thermodynamic and rheological body liquid properties, energy supply of cellular protein structure hydration and their potential to conformational reconstruction.	1,100…0,995 (decreased hydration energy, difficulties in conformational protein activity and metabolite transfer)	0,995…0,980 (hydrate structures reduced stability and difficulty in conformational protein transfers).	0,980…0,970 (increased hydrate structures and catalysis stability under conformational processes stabilization).	0,970..0,955 (ensuring high hydration level and recovery of basal states in protein conformations).
The associated water phase portion, (q, %) - corresponds to the level of protein hydration, determines efficiency of the electron transfer and intracellular metabolite transport, enzyme and cellular organelle activity, provides stimulating action on the cellular cycle.	0,0012…0,4 (low efficiency of the electron transfer and intracellular metabolism).	0,4…0,7 (balanced regulation of cell functioning, DNA expression and cellular cycle stability).	0,7…1,0 (high level of coupling of inter-substrate electron transfer and intermolecular interaction stability in cells).	>1,0 (recovery of electron coupling with protein structures and cellular compensatory metabolic pathways).
Energetic distribution of the associated water phase (fraction of states Δ (q_i), relative units) – demonstrates direction of the activating and regulatory action on the intracellular structure functioning and allows selective expression of DNA operons controlling the cellular cycle and cell differentiation.	Δ<0,1 q_i>1,0% (cellular cycle functioning disorders (operon expression), high likelihood of "an entry" by functionally altered cells through "restriction points", systemic disproportions in the cellular organelle activity).	0,25>Δ>0,1 1,2%>q_i>1,0% (appearance of disbalances in the system of cellular metabolism regulation, presence of dominant states of organic structures).	0,15>Δ>0,05 q_i>1,2% (balanced regulation of cell functioning, DNA expression and cellular cycle stability).	Δ>0,15 q_i>1,2% (cellular basal states recovery, high stability of cellular cycle).

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technogenic factors plays a regulatory role. The main cause of warming is the degradation of electro physical state of the Earth's lithosphere, a global climate regulator on Earth and a source of biological energy, and not greenhouse gases, or, disturbed balance of planetary self-regulation mechanisms.

This new scientific movement - "physics and biophysics of water" - in its genesis and development is expected to withstand great pressure from its opponents, who are accustomed to classical physics, chemistry and biochemistry perspectives. Mentality of these people, the power of habit and social circles are so firmly cemented together that it seems impossible to convince these "critics" and conservators within the current schools of thought. In these conditions firm will and unconditional support of people truly fighting for the stable development of humanity is a must; otherwise, states and countries will spend colossal resources on solutions to visible issues instead of solving the basic issue- support of the negentropy water state as a cosmic factor in maintaining stability of biosphere and human health.

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