Aqueous systems are non-equilibrium self-organizing systems sensitive to weak external forces.

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Various non-thermal effects of weak external forces on living organisms and artificial biological systems including electromagnetic and acoustic fields, direct current, static electric and magnetic fields, vibration are well known. In the case of electromagnetic fields these effects spread from low until optical frequencies. One of the hypothesis explaining the effects is the influence of these factors on the properties of water itself. Most convincingly it is shown in the experiments (including our own results) with water previously exposed to an external field, keeping the acquired biological activity during long time. Besides, biological activity is observed in water after boiling or ice and snow melting, after small variations of stable isotopes of hydrogen relative to its natural content. Having a long history, homoeopathy uses very low and super low doses of several substances of organic and inorganic nature in particular when formally calculated amount of dissolved molecules is less than the whole number, the so-called “imaginary concentrations”. The common explanations for the above biological effects are usually reduced to changes of aqueous structure. To the present time the significant number of experimental works has appeared, in which the changes of physical-chemical properties of water and aqueous solutions under the action of weak fields of electromagnetic nature and at addition of low and super low concentration of organic and inorganic substances are registered. It is necessary to attribute the studies of optical characteristics in UV, visible and IR ranges, electrical and thermodynamic properties.

It is necessary to emphasize, that it is erroneous to consider water as pure substance consisting of H_2O molecules only. Even at laboratory conditions it contains the dissolved gases and elements of material of the vessel, in which it is stored. Water contains also three stable isotopes with average total amount about 0,3 %. Such amount of isotopes seems to be negligible, but it is shown, that even small variations of natural isotope content can result in large nonlinear biological effects. The physics properties of water molecules can differ in spin orientation of hydrogen atoms. The ratio of orto- and para-water can change under the action of external fields and during some chemical reactions. Water is characterized also by rather labile value of ox-red potential caused by occurrence of active forms of oxygen and nitrogen. Dissociation of water inevitably results in formation of hydroxonium and hydroxyl ions and, accordingly, ionic defects in aqueous structure. Water assemblies possess wide polymorphism and may form large non-equilibrium parametric (non crystallographic) structures including fractal structures consisting of thousands of molecules. The computer modeling of such kind of structures shows enormous amount of possible structures formed by water molecules including rods, spirals, web net, flat and channel structures which are well complementary to various biological molecular and supramolecular structures. The above mentioned testifies that water should be considered as complex heterogeneous system with a set of variable parameters.

Long evolution of luminescent spectra is found out within several days after any manipulation which considerably exceeds common “molecular” times, and the character of transient dynamics can be both - monotonous, or oscillatory. The responce of water to weak external fields essentially depends on a condition of solution and is maximal, when the system is far from equilibrium. The results induce to consider water and aqueous solutions as non-equilibrium systems with dynamic chaos capable to self-organizing. It is shown that the induced change of water properties results in changes of thermodynamic properties of biological membranes, that results in change of a cell homeostasis. Thus, water should be considered as a structural - dynamic sensor and actuator of hydrophobic-hydrophilic balance in biological systems.