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Some problems in modern Bioelectromagnetics

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During XX century Physics suffered a lot of changes in general ideas, which was called as catastrophes. Each such catastrophe refreshed Physics and poured in it new forces. Thanks to this Physics was quickly developing. During the last two decades the impression is giving that the new catastrophe is approaching or even is going at full speed. In the middle of 80-th Profs. Blackman [1] and Liboff [2] revealed that DC and AC combined magnetic fields (CMF) caused increase in concentration of free calcium in nervous tissue. Such increase manifested in the form of very narrow resonance peaks with maximum at cyclotron frequency of AC magnetic field corresponding to Ca^{2+} ions. These works initiated a new line in development of Bioelectromagnetics, causing a lot of experimental and theoretical works. The strangest feature of this effect was extremely small width of these resonance peaks with their half-width of about cyclotron frequency, which was a lot of orders less than values assumed by Statistical Physics. According to the Theory of Oscillations the half-width of resonance peak is equal to damping coefficient caused by viscosity of the surrounding liquid medium should be unbelievable small. Orthodox physicists could not bear such outrage upon their beloved science, and they are considering the experiments where these effects are observed as «bad science". However, the outrageous peaks appeared again and again. And some doubts are cast upon validity of the Statistical Physics of liquid media itself when the effects take place on the microlevel. During the last decade the Quantum Electrodynamical theory of water was developed by Preparata [3] and Del Giudice [4]. This theory showed that on the microlevel the liquid medium can have very low viscosity and damping, which are much less than on the macrolevel. It allows hoping of solution of the problem on extremely narrow resonance peaks arising at the action of DC and AC CMF.

Another problem, old, but undecided one yet, coming to the solution of the following question: on what ions the CMF act – on the free ions of a dielectric solution or on the bound ones within macromolecules. The idea advanced by Prof Liboff [1] that the CMF act on the free Ca^{2+} ion in the nervous tissue, which became acting on cells and organelles, was historically first one. But it was confronted by some difficulties the main among these was the following: at room temperature, at which most such experiments were carried out, the diameter of the free Ca^{2+} ion rotation should be measured with meters. This was pointed with Prof. Liboff himself. This idea was arising many times in different works. On the other hand, several investigators [5,6,7,8] suggested different mechanisms of action of an ion bound in molecules. The bound ion is considered to be liberated from molecule and escape into surrounding medium thus becoming a free ion inaccessible to CMP action. I think that some crucial experiment should be performed to solve this problem.

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