PHOTOGENERATION OF SINGLET OXYGEN IN BIOSYSTEMS: APPLICATIONS IN MEDICINE AND BIOTECHNOLOGY

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Modern medical techniques, photodynamic therapy of a cancer and is low-intensive laser therapy, are exerting an important influence on the general progress in understanding of primary mechanisms of the light control biological systems. In the first of them a cellular damage is reached, and to the second, on the contrary, cells are activatted, but the operating agent is common to both techniques. It is the singlet oxygen, the standard name of an oxygen molecule at the lowermost level of electronic excitation. Both techniques are easily modeled in vitro. Cellular damages are provided with input from the outside of a photosensitizer which transfers energy of excitation to molecular oxygen (the photodynamic action). In the second method the oxygen molecule acts as a photoreceptor, a triplet in the ground state (the light-oxygen action). It is known that triplet-singlet transitions are forbidden in optics by quantum-mechanical selection rules and, consequently, have small probability. This lack is compensated by extraordinary high sensitivity of biosystems to the singlet oxygen when last is generated in absence of any living-cell perturbation.

The analysis of primary mechanisms of biological action of singlet oxygen is far from end, many riddles and paradoxes have been amassed. However, thanks to last experiments on light-cell interaction in various laboratories of the world, some questions starts to be clear up. In the report a review of state of art on the problem will be presented and some prospects are discussed for applications of the singlet oxygen photogeneration in medicine and biotechnology.