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Bioflexoelectricity: a Physical Motor of the Living Cell

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Several motors driving living cell alive have been recognized: electric motors, light motors, chemical motors, thermal motors, mechanical motors, etc. etc. Recently, the existence a new type of electro-mechanical motor has been recognized in cell membranes: bioflexoelectricity.

Phenomenon of bioflexoelectricity has been postulated, discovered, and investigated by us in the last 45 years. In this lecture the theory and experiments of biomembrane flexoelectricity of model and living membranes are reviewed. In general, flexoelectricity is a reciprocal relation between electricity and mechanics in soft lyotropic systems, i.e., in case of membranes, between curvature and polarization.

Experimental evidence of model- and bio-membrane flexoelectricity (including the direct and the converse flexoelectric effects) is reported. The biological implications of flexoelectricity are underlined. Flexoelectricity enables membrane structures to function like soft micro- and nanomachines, sensors and actuators, thus providing important input to nanobioionics applications. Nanobio manifestations include membrane transport, membrane contact, mechanosensitivity, electromotility, hearing, nerve conduction, etc.

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