

Mechanisms of energy absorption at the cellular level: A first approach.

Gimsa, J., 2000. In Proceedings of the COST 244 BIS conference on "Biomedical effects of electromagnetic fields". 101–114. COST 244 BIS conference on "Biomedical effects of electromagnetic fields", 10. June. Technical University Munich, Germany.

Abstract: *Electromagnetic energy absorption on the cellular level is based on various mechanisms that depend on electric surface, interfacial, bulk and molecular properties. Generally, the energy input into a given volume is described by Ohmic heating that is proportional to the square of the local field strength and the effective, specific conductivity of a certain medium. Cells consist of complexly arranged various media with very different frequency-dependent properties. This is the reason for the frequency dependence of the field distribution at the cellular and subcellular levels. With increasing frequency, the effective electric properties of structures and media change due to dispersions; processes that lead to field redistribution. Generally, dispersions cause a decrease in permittivity and a respective increase in the conductivity. This paper presents an overview of primary, physical mechanisms of cellular dispersion and absorption processes that are related to a thermal energy input. As an example, the effect of the structural membrane dispersion on the local absorption is explained by simplified equations derived for the local field strength and absorption in the cytoplasm, the membrane and the external medium of a spherical, single cell model. For typical cell parameters, a strong frequency dependence of absorption spots was obtained. Up to GHz-range frequencies, the field distribution and thus local absorption greatly depend on the geometric structure and compartmentalization of a cell.*