Effect of ELF e.m. fields on metalloprotein redox –active sites.

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Abstract

The electron-transfer properties of the metal site play a key role in the regulation of the catalytic activity of a number of enzymes. In fact, the electronic properties change according to the conformation of the active site. Moreover, the peculiarity of the distribution and geometry of metallic ions in enzymes pushed us to set the hypothesis that metallic ions in active-site act like tiny antennas, able to pick up very feeble e.m. signals.

Enzymatic activity of Cu, Zn Superoxide Dismutase (SOD1) has thus been studied, following in vitro removal and generation of free radicals, considering these enzyme as model systems for a more general conceptual framework. It was observed that the SOD1 kinetics is sensibly reduced by exposure to a weak electromagnetic field with intensity equal to the intensity of the geo-magnetic field and frequency equal to the Larmor frequency f_L of Cu^{2+} ion.

The effect seems not to be confined only to oxidoreductase, in fact, a preliminary test on restriction enzyme RAG1 under the influence of a magnetic field having the Larmor frequency f_L of Zn^{2+} ion shows an alteration of the cleavage.

Furthermore, a series of experiments on rats have been done studying the effects of long time (50 days) exposure to electromagnetic fields of extremely low frequency (ELF) (less than 100 Hz) and amplitude (non thermal). We monitored a series of biochemical parameters and haematology of rats and, comparing their values during the periods of exposure (field ON) and non exposure (field OFF). The initial evidence that long term exposure to well defined electromagnetic fields may have relevant effects in mammals, affecting parameters like body weight, blood glucose and fatty acid metabolism have been obtained.

A new study on structural changes in enzyme configuration due to ELF fields action has been undertaken recently. The effect of exposure to the Larmor frequency of the ion in the ligand group will be analyzed using IR spectrometry.