POSSIBLE MECHANISMS OF SYNAPTIC PLASTICITY MODULATION BY EXTREMELY LOW-FREQUENCY MAGNETIC FIELDS

Understanding the biological mechanisms by which extremely low-frequency (ELF, < 300 Hz) magnetic fields (MFs) interact with human brain activity is an active field of research. Such knowledge is required by international agencies providing guidelines for general public and workers exposure to ELF MFs (such as ICNIRP, the International Commission on Non-Ionizing Radiation Protection). The identification of these interaction mechanisms is extremely challenging, since the effects of ELF MF exposure need to be monitored and understood at very different spatial (from micrometers to centimeters) and temporal (from milliseconds to minutes) scales. One possibility to overcome these issues is to develop biophysical models, based on the systems of mathematical equations describing the electric or metabolic activity of the brain tissue. Biophysical models of the brain activity offer the possibility to simulate how the brain tissue interacts with ELF MFs, in order to gain new insights into experimental data, and to test novel hypotheses regarding interaction mechanisms. This paper presents novel hypotheses regarding the effects of power line (60 Hz in North America) MFs on human brain activity, with arguments from biophysical models. We suggest a hypothetic chain of events that could bridge MF exposure with detectable effects on human neurophysiology. We also suggest novel directions of research in order to reach a convergence of biophysical models of brain activity and corresponding experimental data to identify interaction mechanisms.