

The aim of this project is to investigate whether and how extremely low-frequency electromagnetic field (ELF-EMF) may alter the mechanisms of epigenetic regulation of genes expression in the endometrium during the peri-implantation period. Currently, the rapid development of technology is observed, which results in an increase in the number of everyday use devices that are ELF-EMF emitters. This phenomenon resulted in the emergence of a new type of environmental pollution, called “electrosmog”. It cannot be ruled out that the consequences of exposure to ELF-EMF will be particularly pronounced in females during the peri-implantation period. About 30% of mammalian embryos have been documented to die during the peri-implantation period, but the reasons for this phenomenon are unknown. We are going to investigate the influence of ELF-EMF radiation on the potential to maintain DNA methylation and *de novo* methylation. We will determine the effect of ELF-EMF radiation on the expression level of the *EZH2* gene encoding a protein that is part of the PRC2 complex, which is responsible for silencing genes expression. The change in the function or the absence of the PRC2 complex contributes to the overexpression of genes related to normal embryo development, i.e. *HOXD1* and *PAX6* genes. We will determine also the effect of ELF-EMF radiation on histone modifications, which are responsible for changes in the chromatin structure, and thus for the control of the availability of genes for appropriate protein factors involved in metabolic processes. We will check whether and how ELF-EMF radiation disturbs the formation of short, single-stranded non-coding RNA molecules (microRNA) - they take part in decreasing the level of genes expression at the stage of translating genetic information (translation repression) or by degrading messenger RNA (mRNA). We will also study the impact of ELF-EMF radiation on the induction of apoptosis (natural, programmed death) and the induction of oxidative stress in the endometrium. We expect to show a significant effect of ELF-EMF radiation on changes in the expression of genes encoding the synthesis of DNA methyltransferases, i.e. DNMT1 and DNMT3a, responsible for the maintenance of DNA methylation and *de novo* methylation and observe the reduction in *EZH2* mRNA transcript abundance. We also expect to determine the influence of ELF-EMF radiation on changes in the activity of histone deacetylase and the expression of the *MBD1* and *UHRF1* genes responsible for the modification of histones. We suppose that as a consequence of exposure of the endometrium to ELF-EMF genes encoding the DICER1 and DGCR proteins, which are involved in the initial stages of microRNA biogenesis, will be altered in the tissue. We also expect to find a significant number of apoptotic cells, as our latest NGS analysis showed the effect of ELF-EMF radiation on the increased expression of the *CIDEB* gene, which induces apoptosis, and the *GADD45G* gene, involved in regulating cell growth and inducing apoptosis. Based on the analysis of NGS, we also showed a significant increase in the expression of the *NOS3* gene (encoding nitric oxide synthase responsible for its production) in the endometrium exposed to ELF-EMF radiation, which suggests that ELF-EMF may induce oxidative stress. The implementation of the proposed research will therefore allow determining whether ELF-EMF radiation affects the mechanisms of epigenetic regulation of genes, and induces apoptosis and oxidative stress in the endometrium.