THE DIFFERENTIAL PROTEIN EXPRESSION OF MCF-7 CELLS IN RESPONSE TO ELF MF OR RF EMF EXPOSURE

Zhengping Xu(1,2), Guangdi Chen(1,2), Han Li(1,2), Yu Weng(1,2), Qunli Zeng(1,2), Deqiang Lu(1), Huai Chiang(1)

(1)Bioelectromagnetics Laboratory, Zhejiang University School of Medicine, 353# Yan'an Road, Hangzhou 310031, P. R. China

zpxu@zju.edu.cn, chengd@zju.edu.cn

(2)Research Center for Environmental Genomics, Zhejiang University School of Medicine, 353# Yan'an Road, Hangzhou 310031, P. R. China

BACKGROUND: Epidemiological studies have indicated an association between exposure to EMF and human cancers. To confirm this association and elucidate the intrinsic mechanism, extensive laboratory studies have been performing to investigate the biological effects of EMF exposure. However, so far the data are contradictory and no clear mechanism is available. As a neutral discovery scientific approach, proteomics offers a feasible tool to compare differentially expressed proteins in large-scale in response to an environmental factor. Here we used this approach to determine effects of ELF MF or RF EMF exposure on protein expression at whole cell level.

METHODS: Human breast cancer cells MCF-7 were exposed to 50 Hz, 0.4 mT magnetic fields, or 1800 MHz EMF at 3.5 W/kg of time-averaged SAR for 24 hr. Total cellular proteins were extracted and 200μg protein was subjected to 2-dimentional electrophoresis. 17 cm pH 3-10 or pH 4-7 linear IPG strips were selected in the first-dimension electrophoresis and the second-dimension electrophoresis was run in 12% uniform SDS-PAGE. Three to nine repetitions were carried out for all experiments. The silver stained images of the gels were analyzed with PDQuest analysis software 7.1. After determining differentially expressed proteins, the potential category and function of these proteins were described. We also annotated 3 ELF MF responsive proteins by LC-IT Tandem MS.

RESULT: After ELF MF exposure, one thousand proteins were detected using pH 3-10 IPG strip. Up to 6 spots have statistically significantly altered (at least 5 fold up or down) compared with sham-exposed group. 19 ones were only detected in exposure group while 19 ones were missing. We searched the SWISS-PROT database and found that all of them fell into five categories: (a) cytosolic transport proteins; (b) regulators of certain protein phosphorylase; (c) ion channel proteins; (e) transcriptional coactivators. Three spots were selected to cut down, in-gel digested and identified by LC-IT Tandem MS as RNA Binding Protein Regulatory Subunit, Proteasome Subunit Beta Type 7 Precursor and Translationally Controlled Tumor Protein.

As to RF EMF, pH 4-7 IPG strips were used to separate the proteins. Several proteins were significantly changed comparing with sham-exposed, but they were not specific in all repetitions.

CONCLUSION: Our result showed that 50Hz, 0.4mT ELF MF can change the protein profile of MCF-7 cell and may affect cellular physiology through different pathways. There were no significant changes in MCF-7 cells in response to RF EMF exposure.

This research was supported by National Natural Science Foundation of China (No. 50137030) and Key Projects of Health Bureau of Zhejiang Province (No. 2004ZD006).