

Telecommunication signals can cause biological effects: Our 20 years' studies in living systems

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1. Introduction

The big bang of telecommunication applications that started a few decades ago has caused gradually an enormous increase of the electromagnetic pollution (smog) in the environment, the work place and home as well as the personal surrounding of every person. The daily use by people of wireless communication devices has increased exponentially, rising concerns regarding its potential health hazards.

2. Materials and Methods

The research of our Electromagnetic Biology Laboratory is focused long lastingly on the effects of various kinds and sources of telecommunication signals deriving from mobile phones, mast antennas, wi-fi routers, blue-tooth, wireless DECT, baby monitors on the physiology, behaviour and biochemical parameters of various model systems; *Drosophila melanogaster*, *C. elegans*, *Mus musculus*, *Rattus rattus* lizards, plants and spermatozoa *ex vivo*. Our activities are focused recently on the irradiation of the rodent *Mus musculus* to reveal defects on memory, behaviour, brain proteome/gene expression and other lesions induced by this type of non ionizing radiation. All exposures were performed at power densities well below ICNIRP's safety guidelines (ICNIRP 1998)

3. Results and Discussion

Our studies involve multidisciplinary approaches engaging the most sophisticated techniques, such as the Morris water Maze behavioural task, object recognition task, proteomics/transcriptomics analysis, ROS assay, immunohisto-chemistry, confocal and electron microscopy. The data show a decrease in the reproductive capacity of *Drosophila* and deficits in osteogenesis of new-born mice, as well as memory impairment (Ntzouni MP, et al 2012) and brain protein/gene expression changes following irradiation (Fragopoulou AF, et al 2018). Plant growth was shown to be affected by telecommunication signals (Stefi AL, et al 2015)

Drosophila melanogaster was exposed to a telecommunication signal. Elevated ovarian ROS levels were identified after only 30 minutes of adults flies'

exposure and were detected only at the pre-choriogenic stages. (Manta, A. K., et al 2014).

The role of p53 transcription factor was also assessed, using p53-null flies, were no alteration in redox status was observed.

Seeking the answer whether radiation is capable of altering the ovarian-gene expression transcriptional profiling; a genome-wide microarray analysis was conducted. 2h post-exposure alterations in the gene expression pattern of oogenesis were observed. Overall, 168 genes were found differentially expressed; 10 % of these genes are associated with stress and 6% with programmed cell death and especially apoptosis and autophagic self-eating. Thus a proposed general mechanism of action involves the raise of reactive oxygen species as a major early event governing EMF exposure of living matter. (Manta AK, et al. 2016). These observations may illuminate a novel mechanism of apoptosis that is specifically triggered upon non ionizing radiation. Finally, sporadically occurring egg chamber apoptosis was induced in both check points of oogenesis (germarium and stages 7 – 9, while p53-null flies showed increased number of apoptotic follicles only at stages 7 – 9, highlighting the differential, regulatory role of the transcription factor p53 in the externally mobile phone-induced apoptosis during oogenesis.

Thus Wireless Telecommunication signals (WCR) are very unique because they are modulated (Amplitude, Frequency, Pulsed) unlike other form of radiation (Visible light, Ultraviolet, Infrared, X-rays, gamma-Rays) and this explains their bioeffectiveness regardless of their low energy photons.

Keywords: cell phones, mast antennas, radiation hazards, EMF pollution

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Acknowledgements

This research has been co-financed recently (2012-2015) by the European Union (European Social Fund – ESF) and national funds through the Operational Program Education and Lifelong Learning of the National Strategic Reference Framework (NSRF) - Research Funding Program: THALES. Investing in knowledge society through the European Social Fund. UoA- MIS 375784 – Biological effects of nonionizing electromagnetic radiation: a multidisciplinary approach coordinated by L.H.M.