



## LETTER TO THE EDITOR

## Is mobile phone radiofrequency radiation all bad?

## Dear Editor

In 1992, Dr. Sheldon Wolff published his widely cited paper ‘Is Radiation All Bad? The Search for Adaptation’ [1]. Dr. Wolff was widely honoured for his findings on the stimulatory effects of low doses of ionising radiation. Now, due to *exponential increase in mobile phone* use (4.6 billion users globally), we should ask a new question, “Is mobile phone radiofrequency (RF) radiation all bad?” It should be noted that, currently in some parts of the globe, mobile phones are the most reliable or even the only phones attainable. *A large body of evidence indicates* that when cells are pre-exposed to low doses of ionising radiation and DNA-damaging agents, such as ultraviolet (UV) radiation, alkylating agents, oxidants and heat, they become more resistant to high doses of those agents and in some cases to similar agents, a phenomenon that is usually referred to as the adaptive response. The induction of adaptive response after pre-exposure to low doses of ionising radiation was first described by Olivieri et al. for radiation-induced chromosomal aberrations in human lymphocytes [2]. Other investigators and I have recently indicated that RF radiation can induce an adaptive response phenomenon [3–5]. We have also recently revealed that pre-exposure of laboratory animals to RF radiation emitted from a GSM (*Global System for Mobile Communications*) mobile phone increases their resistance to a subsequent bacterial infection [6,7]. As discussed in our work, this phenomenon may have implications in humans’ long-term stay in space [8]. However, the *potential beneficial effects of* (RF) radiation are not limited only to the induction of adaptive phenomena. Previously, we have indicated that the visual reaction time (VRT) of university students was significantly affected by a 10-min exposure to electromagnetic fields (EMFs) emitted by a mobile phone [9]. Furthermore, we have previously shown that occupational exposures to radar radiations decreased reaction time in radar workers [10]. Altogether, our results revealed that these exposures caused decreased reaction time, which might lead to a better response to different hazards and decrease the probability of human errors and fatal accidents. Meanwhile, cognitive beneficial effects of long-term exposure to high-frequency EMFs have been indicated

by some studies. Using a word interference test, in 2007, Arns et al. showed that long-term heavy cellphone use resulted in better performance in normal subjects [11]. Moreover, Schuz et al. in 2009 reported that long-term cellphone users (subscribers of 10 years or more) had a 30–40% decreased risk of hospitalisation due to Alzheimer’s disease (AD) and vascular dementia [12]. In this light, it will be challenging to investigate if there are other RF-induced stimulating effects and to explore their potential applications. Further research may shed light on the dark areas of the health effects of short- and long-term human exposure to RF radiation.

## References

- [1] Wolff S. Failla memorial lecture. Is radiation all bad? The search for adaptation. *Radiat Res* 1992;131:117–23.
- [2] Olivieri G, Bodycote J, Wolff S. Adaptive response of human lymphocytes to low concentrations of radioactive thymidine. *Science* 1984;223:594–7.
- [3] Sannino A, Sarti M, Reddy SB, et al. Induction of adaptive response in human blood lymphocytes exposed to radiofrequency radiation. *Radiat Res* 2009;171:735–42.
- [4] Mortazavi SMJ, Moseleh-Shirazi MA, Tavassoli AR, et al. A comparative study on the increased radioresistance to lethal doses of gamma rays after exposure to microwave radiation and oral intake of flaxseed oil. *Iran J Radiat Res* 2011;9:9–14.
- [5] Mortazavi SMJ, Moseleh-Shirazi MA, Tavassoli AR, et al. Increased radioresistance to lethal doses of gamma rays in mice and rats after exposure to microwave radiation emitted by a GSM mobile phone simulator. *Dose Response* 2013;11:281–92.
- [6] Mortazavi SMJ, Motamedifar M, Namdari G, et al. Non-linear adaptive phenomena which decrease the risk of infection after pre-exposure to radiofrequency radiation. *Dose-Response*, in press.
- [7] Mortazavi SMJ, Motamedifar M, Namdari G, et al. Counterbalancing immunosuppression-induced infections during long-term stay of humans in space. *J Med Hypotheses Ideas* 2013;7:8–10.
- [8] Mortazavi SMJ, Mozdarani H. Deep space missions and the issue of overcoming the problem of space radiation. *Int J Radiat Res* 2013;11:199–202.
- [9] Mortazavi SMJ, Rouintan MS, Taeb S, et al. Human short-term exposure to electromagnetic fields emitted by mobile



- phones decreases computer-assisted visual reaction time. *Acta Neurol Belg* 2012;112:171–5.
- [10] Mortazavi SMJ, Taeb S, Dehghan N. Alterations of visual reaction time and short term memory in military radar personnel. *Iran J Public Health* 2013;42:428–35.
- [11] Arns M, Van Luijtelaar G, Sumich A, et al. Electroencephalographic, personality, and executive function measures associated with frequent mobile phone use. *Int J Neurosci* 2007;117:1341–60.
- [12] Schuz J, Waldemar G, Olsen JH, Johansen C. Risks for central nervous system diseases among mobile phone subscribers: a Danish retrospective cohort study. *PLoS ONE* 2009;4:e4389.

S.M.J. Mortazavi \*

*Medical Physics & Medical Engineering Department,  
School of Medicine, Setad Square, Shiraz, Iran*

*\*Address: Medical Physics & Medical Engineering Department,  
The Center for Research on Protection against  
Ionizing and Non-ionizing Radiation,  
Shiraz University of Medical Sciences, Shiraz, Iran.  
Tel.: +98 711 2349332; fax: +98 711 2349332/2289113.  
E-mail address: mmortazavi@sums.ac.ir*