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## LETTER TO THE EDITOR: WINDOW THEORY IN NON-IONIZING RADIATION-INDUCED ADAPTIVE RESPONSES

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I read with great interest an article by Jin *et al.* “The Effect of Combined Exposure of 900 MHz Radiofrequency Fields and Doxorubicin in HL-60 Cells,” published in the Sep 2012 issue of PLOS ONE Journal (Jin *et al.* 2012). The authors of the article reported some interesting findings on the induction of adaptive response by pre-exposure of HL-60 Cells to radiofrequency (RF) radiations. As summarized in Table 1, the viability of the cells exposed to DOX alone was  $70.2 \pm 0.2$  while when cells were exposed to 900 MHz RF radiation at  $12 \mu\text{W}/\text{cm}^2$  before treatment with DOX, the viability was  $82.8 \pm 2.1$  ( $P < 0.01$ ). RF exposure at higher power densities significantly decreased the viability ( $60.7 \pm 0.5$  and  $58.6 \pm 0.5$  for  $120 \mu\text{W}/\text{cm}^2$  and  $1200 \mu\text{W}/\text{cm}^2$ , respectively). On the other hand they reported that they had previously conducted a preliminary experiment to determine the minimum power density for RF pre-exposures to minimize the damage induced by subsequent exposure to DOX. We and other investigators have previously reported that radiofrequency radiation can induce adaptive response phenomena (Haghani *et al.* 2012; Jiang *et al.* 2012; Mortazavi *et al.* 2011; Mortazavi *et al.* 2012; Sannino *et al.* 2009; Zeni *et al.* 2012). Jin’s findings as well as findings obtained in our studies (Mortazavi *et al.* 2012) clearly support the dose window theory that is well discussed for adaptive responses induced by ionizing radiation. As discussed by RE Mitchel, “the adaptive response in mammalian cells and mammals operates within a certain window that can be defined by upper and lower dose thresholds, typically between about 1 and 100 mGy for a single low dose rate exposure” (Mitchel 2010). On the other hand, as indicated by investigators who worked on oxidative stress or ionizing radiation-induced adaptive responses (Bose Girigoswami and Ghosh 2005; Dimova *et al.* 2008; Yan *et al.* 2006), Jin’s findings on RF pre-exposures support this theory that the induction of adaptive response requires a

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minimum level of damage to trigger this phenomenon. In this light, it seems that there are similar patterns for induction of adaptive response by ionizing and non-ionizing radiations.

## REFERENCES

- Bose Girigoswami, K., and R. Ghosh. 2005. Response to gamma-irradiation in V79 cells conditioned by repeated treatment with low doses of hydrogen peroxide. *Radiat Environ Biophys* 44 (2): 131-7.
- Dimova, E. G., P. E. Bryant, and S. G. Chankova. 2008. Adaptive response: some underlying mechanisms and open questions. *Genet. Mol. Biol.* 31 (2): 396-408.
- Haghani, M., S. M. J. Mortazavi, D. Sardari, M. A. Mosleh Shirazi, A. Mansouri, and A. Mahbudi. 2012. Assessment of the Role of Specific Absorption Rate on the Induction of Microwave-Induced Survival Adaptive Responses after Exposure to Lethal Doses of Gamma Radiation. *Iranian Journal of Radiation Research* in press.
- Jiang, B., J. Nie, Z. Zhou, J. Zhang, J. Tong, and Y. Cao. 2012. Adaptive response in mice exposed to 900 MHz radiofrequency fields: primary DNA damage. *PLoS One* 7 (2): e32040.
- Jin, Z., C. Zong, B. Jiang, Z. Zhou, J. Tong, and Y. Cao. 2012. The effect of combined exposure of 900 MHz radiofrequency fields and doxorubicin in HL-60 cells. *PLoS One* 7 (9): e46102.
- Mitchel, R. E. 2010. The dose window for radiation-induced protective adaptive responses. *Dose Response* 8 (2): 192-208.
- Mortazavi, S. M. J., M. A. Mosleh-Shirazi, A. R. Tavassoli, M. Taheri, Z. Bagheri, R. Ghalandari, S. Bonyadi, M. Shafie, and M. Haghani. 2011. A comparative study on the increased radioresistance to lethal doses of gamma rays after exposure to microwave radiation and oral intake of flaxseed oil. *Iranian Journal of Radiation Research* 9 (1): 9-14.
- Mortazavi, S. M. J., M. A. Mosleh-Shirazi, A. R. Tavassoli, M. Taheri, A. R. Mehdizadeh, S. A. S. Namazi, A. Jamali, R. Ghalandari, S. Bonyadi, M. Shafie, and M. Haghani. 2013. 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* 11(2):281-292.
- Sannino, A., M. Sarti, S. B. Reddy, T. J. Prihoda, Vijayalaxmi, and M. R. Scarfi. 2009. Induction of adaptive response in human blood lymphocytes exposed to radiofrequency radiation. *Radiat Res* 171 (6): 735-42.
- Yan, G., Z. Hua, G. Du, and J. Chen. 2006. Adaptive response of *Bacillus* sp. F26 to hydrogen peroxide and menadione. *Curr Microbiol* 52 (3): 238-42.
- Zeni, O., A. Sannino, S. Romeo, R. Massa, M. Sarti, A. B. Reddy, T. J. Prihoda, Vijayalaxmi, and M. R. Scarfi. 2012. Induction of an adaptive response in human blood lymphocytes exposed to radiofrequency fields: Influence of the universal mobile telecommunication system (UMTS) signal and the specific absorption rate. *Mutat Res.* 747 (1): 29-35 [doi: 10.1016/j.mrgen-tox.2012.03.013].