**The 'Cosmic silence' experiment: on the potential adaptive role of environmental background radiation**

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In low dose radiobiology, there is a strong interest in phenomena that could imply a deviation from the linear-no-threshold (LNT) model, which is currently used to estimate the excess relative cancer risk at low doses of ionizing radiation (IR) via a linear extrapolation from high- and intermediate-dose epidemiology risk data. Such phenomena include the *adaptive response* as well as *bystander effects*, occurring in cells which do not experience direct radiation exposure. These phenomena suggest that biological response to harmful agents such as ionising radiation may be more complex than that assumed by the LNT model. In particular, environmental background radiation represents a source of chronic low dose-rate exposure which may condition the response of living systems to acute exposure to genotoxic agents, also including IR itself, via an adaptive response. To clarify this aspect is essential not only to better evaluate the risk of chronic occupational exposure, but also to understand the role of environmental background radiation on biological evolution. Reduction of background environmental IR dose rate exposure is achieved at the National Laboratories at Gran Sasso (LNGS) of the Italian Institute for Nuclear Physics (INFN). Located underneath the Gran Sasso mountain range in central Italy, these laboratories offer an excellent opportunity to continuously maintain cell cultures at extremely reduced levels of environmental background radiation. The Cosmic Silence experiment represents the natural extension, to a human cell culture model (TK6 lymphoblastoid cells), of earlier experimental studies on S. Cerevisiae (L. Satta et. al. Mut Res 1995) and V79 Chinese hamster fibroblasts (L. Satta et. al. Radiat Environ Biophys 2002), which indicated a progressive disappearance of an adaptive response in cells kept under reduced environmental background IR conditions. For the Cosmic Silence experiment, TK6 parallel cultures were set up in the underground LNGS laboratories and in Rome and planned to be maintained and assayed for 12 months. Starting at 6 months of continuous, parallel cultures, measurements of DNA damage (micronuclei) or oxidative metabolism (antioxidant enzymatic activities of SOD, GPx, and Catalase) indicate that significant deprivation of environmental background IR renders cells less tolerant to an acute X-ray exposure of 1-2 Gy. These results are compatible with the concept that environmental background IR is behaving as an *adaptive* agent.



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