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Radiation Fields, Effects and Risks in Human Space Missions (4)

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THE EFFECT OF ACUTE DOSE CHARGE PARTICLE RADIATION ON EXPRESSION OF DNA REPAIR GENES IN MICE

Abstract

Various components of the space radiation environment are as follows: trapped particle radiation, solar particle radiation, and galactic cosmic radiation (GCR). In the above types of radiation protons are the most abundant type of particle. A preeminent health concern for astronauts is the constant exposure to GCR and occasional solar particle events. For their safety posed health risks must be determined. In order to fully determine health risks during space missions, an understanding of cellular responses to proton exposure is vital. Gamma rays and X-rays are types of ionizing radiation. Up to this point, the expression of DNA repair genes in response to ionizing radiation has been studied. However, DNA repair in response to protons is deficient. By employing qPCR analysis, we investigated changes in gene expression resulting from positively charged particles in four categories (0, 0.1, 1.0, and 2.0 Gy) in five different DNA repair genes. These 5 genes were isolated from the testes of irradiated mice. The 5 DNA repair genes were selected on the basis of their known functions. The DNA repair genes selected are: ERCC1 (5'incision subunit, DNA strand break repair), PARP1 (base excision repair), XPA (binds damaged DNA in pre-incision complex), ATM (activates checkpoint signaling upon double strand breaks), and XRCC3 (DNA breaks and cross link repair). Our results evince that ERCC1, PARP1, and XPA genes, show no change at 0.1 Gy radiation, display up regulation at 1.0 Gy radiation (1.09 fold, 7.32 fold, 0.75 fold respectively), and a prevalent increase in gene expression at 2.0 Gy radiation (4.83 fold, 57.58 fold and 87.58 fold, respectively). These DNA repair proteins operate in cellular pathways. Here we present data on possible mechanisms of action.