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Radiation Fields, Effects and Risks in Human Space Missions (5)

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PROTON AND FE ION-INDUCED EARLY AND LATE CHROMOSOME ABERRATIONS IN HUMAN EPITHELIAL AND FIBROBLAST CELLS

Abstract

Proton and Iron (Fe) are two of the most abundant types of charged particles in deep space. Both charged particles produce ionization along their path. Protons are called low linear energy transfer (LET) because they are able to pass through matter without losing much energy, like gamma rays and x-rays. Protons have been proven to induce DNA double strand breaks, which are one of the more dangerous DNA lesions, similar to that induced by high energy irons. The purpose of this study was to determine early and late chromosomal aberrations in human epithelial cells and fibroblast cells induced by high energy protons and Fe ions. Since astronauts are often exposed to ionizing radiation in space, it is imperative to investigate health risks associated with space radiation exposure. This study is aimed at investigating genomic instability for its known association with cancer. In the study, GI is quantified by chromosome aberrations in two of the cell types, human Epithelial cells and human fibroblasts after exposure to protons or Fe ions. two representative particle types encountered in space. Exposure to radiation in outer space is one of the main concerns for space exploration by humans. Exposure to gamma rays and x-rays can lead to acute and chronic health effects, by focusing deliberately on the works performed on Human Epithelial Cells (HECs) and Fibroblast cells. One approach for evaluating the effects of radiation is collecting human specimens and exposing them to different radiation doses over a specific time frame. Analysis of chromosome aberrations in Human Epithelial cells and Fibroblasts was performed after Proton and Fe ions radiation using the fluorescence in-situ hybridization (FISH) technique. FISH technique has proved to be an accurate method for analysis of chromosome aberrations. FISH uses fluorescent probes to detect the position of specific DNA sequences on chromosomes. It can be concluded that paint probes that was used to score the induced chromosomal aberration, translocations are visibly seen and easy to analyze and score. Dose response and dose dependency was observed and the number of translocations was scored by using paint probes and microscope. The wide range variety of deoxyribonucleic acid (DNA) damages that radiation produces remains a confusing factor in this study. This study demonstrated several potentials of the effect that ionized induced radiation causes, as they may relate specifically to the induction of degenerative diseases by ionizing radiation. Increasing DNA damages introduce genomic instability involving chromosomal aberrations.