Life Sciences as Related to Space (F)
Biological Effects of Space Radiation: a Controllable Challenge for Long-term Human Space Missions (F2.1)
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GENE EXPRESSION COLLECTIVE DATA ANALYSIS FOR STUDYING THE EFFECTS OF HIGH-LET IONIZING RADIATION: A BIOINFORMATICS APPROACH

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The use of high linear energy (LET) ionizing radiation (IR) is progressively being incorporated in radiation therapy (RT) due to its precise dose localization and high relative biological effectiveness. At the same time, these benefits of particle radiation become a high risk for astronauts in the case of inevitable long-term cosmic radiation exposure. Nonetheless, DNA Damage Response (DDR) activated via complex DNA damage on healthy tissue, occurring from such types of radiation, may be instrumental in the induction of various chronic and late effects. A method of approach in understanding the possible underlying mechanisms, is studying alterations in gene expression. To this end we identified Differentially Expressed Genes (DEGs) in IR-exposed healthy human tissue, utilizing microarray data available in public repositories. DEG analysis was conducted using R programming language. Consequently, through functional enrichment and biological network analysis, we identified biological pathways and processes implicated in DDR. By comparing low and high-LET radiation effects, our primary results indicate the induction of a differential biological response for high-LET, like an enhanced inflammatory response.

In addition, patterns of DNA repair are substantially distinct compared to low-LET. Finally, we expanded our study in search of possible comorbidities for HZE particle exposure. Pathway enrichment analysis suggests the involvement of mechanisms, tightly correlated with neurodegenerative disorders like amyloid fibrils formation. Regarding blood tissue, platelet activation signaling was found, upholding the connection to cardiovascular disease. This holistic bioinformatics approach revealed cellular trends towards inflammation and degeneration which might be central to the development of late effects of high-LET radiation exposure. It can contribute to the identification of molecular targets for effective countermeasures.

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