SPACE LIFE SCIENCES SYMPOSIUM (A1)
Radiation Fields, Effects and Risks in Human Space Missions (4)

Author: Prof. Olufisayo Jejelowo
Texas Southern University, United States, jejelowo_oa@tsu.edu

Dr. Muhammad Tariq
Texas Southern University, United States, akram@soe.ucsc.edu
Dr. Nader Pourmand
University of California Santa Cruz, United States, pourmand@soe.ucsc.edu
Dr. Hognlu Wu
United States, honglu.wu-1@nasa.gov
Dr. Govindarajan Ramesh
United States, GTramesh@NSU.edu
Mr. Christopher Brumbaugh
United States, cbrumbau@soe.ucsc.edu
Dr. Shahid Yar Khan
United States, shahid@soe.ucsc.edu]

IDENTIFICATION OF TISSUE-SPECIFIC MICRORNA RESPONSE IN MICE FOLLOWING EXPOSURE TO ENERGETIC PROTONS

Abstract

The understanding of cellular responses to proton exposure is of primary importance for the assessment and management of human health risks during space exploration missions. MicroRNAs (miRNAs) are small, non-coding RNAs that are widely involved in gene expression for multiple intracellular processes, including gene expressions made in response to cellular stress. The level of involvement of gene regulation through miRNA intervention in proton irradiated cells or animals are unknown. Balb/C male mice were exposed to charged particle radiation. Group 1 served as control receiving no radiation (0.0 Gy) and group 2 received 2.0 Gy from a proton source at a dose rate of 1Gev/45 seconds. The controls and irradiated mice were sacrificed by cervical decapitation four hours after radiation exposure. Following euthanization, testis tissues were dissected out and immediately frozen in liquid nitrogen. After passing through the quality control, 500ng of total RNA, isolated from testis tissues, was used in Illumina TruSeq small RNA sample prep kit to prepare libraries. Using Illumina HiSeq genome analyzer for miRNA sequencing, the levels of miRNAs in the testis tissues of irradiated mice (2Gy) relative to control mice (0Gy) were measured. Dysregulation of 25 different miRNA species, most of which are involved in cell growth, differentiation, survival and/or apoptosis was observed. Among the 25 differentially expressed miRNAs, a group of 10 miRNAs were up-regulated with mmu-miR- 5100 being the most highly altered miRNA (8.1 fold change) and a group of 15 miRNAs were down-regulated with mmu-miR-142-3p being the down-regulated miRNA (-6.7 fold change). These results provide the first evidence that miRNA play a role in cellular defense against proton radiation. Additionally, the observed changes in miRNA expression are involved in very important signaling pathways such as Ras signaling and MAPK pathway, which may imply a significant health concern for astronauts.

The National Aeronautics and Space Administration (NASA) Office of Education under the University Research Centers (URC) project, (Cooperative Agreements NNX08B47A and NNX10AQ16A), provided funding. National Institutes of Health (P01-HG000205) supported CB and SYK.