Mitochondrial Effects of High Energy High Charge (HZE) Irradiation on the Liver

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Galactic Cosmic Rays are primarily composed of protons (85%), helium (14%), and (~1%) high charge-high energy ions (HZE) such as 56Fe, 28Si, and 16O. Humans are normally not exposed to HZE ions, but will be exposed during deep space travel. Exposure to HZE is a major risk factor for astronauts due to the possibility of HZE induced cancer, which is of major concern for astronauts on a mission to Mars. C57BL16 mice were placed into 6 treatment groups and received the following irradiation treatments: 600 Me V/n 56Fe (0.2 Gy), 137Cs (1.0 Gy) gamma rays, 137Cs (3.0 Gy) gamma rays, 1 GeV/n 16O (0.2 Gy), 350 MeV/n 28Si (0.2 Gy), and no irradiation. I used tissues that were radiated from a previous study of irradiated mice and were collected at 30, 60, 120, 270 & 360 days post-irradiation. After using an Integrated Omics Workflow encompassing lipidomics, proteomics, and RNA sequencing, results indicated possible mitochondrial dysfunction. To validate these results mitochondria were isolated from two 40 micron slices of liver and an assay for Complex I was then used to determine functionality. Results show that liver samples that were radiated with HZE experienced a big decrease in mitochondrial functionality. Trends examined revealed that in comparison to the control or non-irradiated samples, it has a much lower absorbance. Further testing could be the creation of a mitochondrial count to prove the exact interaction of the mitochondria to HZE once damaged which could lead to a creation of a drug to inhibit mitochondrial dysfunctionality.

Awards Won:

National Aeronautics and Space Administration: Second Award of $750