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	Project Title:	Protracted Exposure to NASA's GCR-Simu	lator: Cytogenetic Validation	n and Beam Time Optimization
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Task Description:	Exposure to galactic cosmic rays (GCR) presents a health risk to astronauts on deep space missions. To study these risks, NASA is developing the GCR simulator that will be able to irradiate cell or animal samples with combinations of ions known to be present in GCR. This device will, by necessity, irradiate these samples at doses and dose rates considerably high than that found in space in order to produce statistically meaningful results. To produce the best simulations, dose rates and exposure sequences will need to be optimized. This proposal will endeavor to optimize these parameters by measuring the induction of chromosome aberrations. Normally, cells can repair these breaks, but on occasion, if two or more breaks are close to one another, a mistake can be made whereby the cell joins break ends to inappropriate partners causing an exchange of chromosomal segments. The damage forming these breaks is caused by ionizations along the paths (tracks) that ions take as they pass through a medium. While in some cases all the breaks necessary for an exchange to form occur along a single particle track, in other circumstances, breaks are formed along separate and independent tracks in a process referred to as track interaction. Tack interaction events become important at higher doses when the number of tracks produce damage that is sufficiently close to interact increases. Track interactions are not likely to occur at the doses thrule the sone. This produces a reduction in the frequency of chromosome exchanges result from single track action. At this "limiting low dose rate" no additional reduction in chromosome exchanges result from single track action. At this "limiting low dose rate" he so additional reduction in chromosome exchanges result from single track action. It has eas on the interaction is a series of doses at doses at doses at doses at doses at doses at the present in space. Specific aim 1 of our proposal will endeavor to determine the limiting low dose rate protons at the energy stated in the NASA SA a		
Rationale for HRP Directed Research:			
Research Impact/Earth Benefits:	Our project will endeavor to help optimize exposure protocols for NASA's GCR simulator by determining the limiting low dose rate for chromosome aberration induction. This will allow investigators to optimize their experimental protocols in ways that will better simulate the low doses and dose rates found in the space radiation environment. These results may impact how low dose and dose rate experiments are conducted in the future and might provide better risk estimates for low radiation doses both in space and here on Earth.		
Task Progress:	Note: NASA Johnson Space Center indicates that this grant has been put on hold as research responsibilities are transferred to the Co-Investigator. The project will be continued under Michael Cornforth, Ph.D. A published peer-reviewed article has been added to the Cumulative Bibliography (Ed., 10/29/23).		
Bibliography Type:	Description: (Last Updated: 10/29/2023)		
Articles in Peer-reviewed Journals	Loucas BD, Shuryak I, Kunkel SR, Cornforth MN. "Dose-dependent transmissibility of chromosome aberrations at first mitosis after exposure to gamma rays. I. Modeling and implications related to risk assessment." Radiat Res. 2022 Apr 1;197(4):376-383. <u>https://doi.org/10.1667/RADE-21-00180.1</u> ; <u>PMID: 35030259</u> ; <u>PMCID: PMC9109216</u> , Apr-2022		