Fiscal Year:	FY 2021	**Task Last Updated:**	FY 04/29/2021
PI Name:	Jacob, Naduparambil K Ph.D.		
Project Title:	Predictive Biomarkers for Space Radiation Induced Cancer and Cardiovascular Injury Risk Assessment		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SR**:Space Radiation		
Human Research Program Risks:	(1) **Cancer**:Risk of Radiation Carcinogenesis (2) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	UNIVERSITY	**Phone:**	614-685-4246
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PI Web Page:			
City:	Columbus	**State:**	OH
Zip Code:	43210	**Congressional District:**	3
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2017 HERO 80JSC017N0001-Crew Health and Performance (FLAGSHIP1, OMNIBUS). Appendix A-Flagship1, Appendix B-Omnibus
Start Date:	07/02/2018	**End Date:**	07/01/2022
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Elgart, Robin	**Contact Phone:**	281-244-0596 (o)/832-221-4576 (m)
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 7/1/2022 per NSSC information (Ed., 6/22/21) NOTE: End date changed to 7/1/2021 per NSSC information (Ed., 9/25/20)		
Key Personnel Changes/Previous PI:	April 2021 report: Dr. Peter Lee is no longer CoInvestigator on the project.		
COI Name (Institution):			
Grant/Contract No.:	80NSSC18K1691		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	To reduce the uncertainty in estimates of cancer and cardiovascular risks from space radiation, we will evaluate changes in molecular biomarkers in rodents and rabbits exposed to ions relevant to exposures of astronauts in the space environment. Serum, heart, liver, and lung tissues collected from exposed animals and matching controls (as available) will be used for biomarker discovery following systems-biology approaches. The study will use modern analytic technologies and rigorous statistics for assessing changes in expression of microRNAs (miRNAs) associated with clinical endpoints for mechanistic understanding of disease initiation and progression. Analysis of samples from patients receiving radiation therapy and organ targeted and organ protected low-linear energy transfer (LET) irradiation model studies have shown changes in circulating miRNAs originating from organ systems as a function of dose exposed and time. Circulating miRNAs collected from mice exposed to low doses of neutrons will be compared with gamma rays and sham controls of changes in cancer endpoints. Cellular and molecular mechanisms involved in space radiation-induced cardiovascular disease, and cancer will be studied, which will contribute to risk assessment and developing effective countermeasures.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The goal is to develop blood test for early detection of delayed cardiovascular complications and cancers resulting from high-LET radiation exposure to astronauts during long duration space travel.
Task Progress:	In the reporting year, we have analyzed serum specimens collected from C3H (male) and BALB/c (female) mice exposed to varying chronic low-dose rate neutrons and maintained for carcinogenesis risk assessment. These mice were previously exposed to chronic low-dose neutrons (sham, 118 mGy, 200 mGy, or 400 mGy) and sacrificed at around 800 days after exposure. We have completed the analysis of serum levels of 15 miRNAs in 139 mice, following an internally controlled assay that we have optimized for quantitative analysis of changes in circulating miRNAs. The candidates selected in the analyses include molecules that we have identified from our earlier screen for biomarkers (by nanoString based profiling) and/or are reported to be linked to molecular processes associated carcinogenesis and degenerative diseases. The discovery and validation of functional biomarkers in multiple animal models are predicted to help us develop benchmarks for both risk assessment and evaluation of efficacy of countermeasures.
Bibliography Type:	Description: (Last Updated: 06/02/2023)
Significant Media Coverage	Gourd E. "Potential new method for rapid diagnosis of radiation sickness. Commentary in Lancet Oncology on PI's work in article, Yadav M, Bhayana S, Liu J, Lu L, Huang J, Ma Y, Qamri Z, Mo X, Jacob DS, Parasa ST, Bhuiya N, Fadda P, Xu-Welliver M, Chakravarti A, Jacob NK. 'Two-miRNA-based finger-stick assay for estimation of absorbed ionizing radiation dose.' Sci Transl Med. 2020 Jul 15;12(552):eaaw5831. https://doi.org/10.1126/scitranslmed.aaw5831 [Ed note--see cumulative bibliography link] " Lancet Oncol. 2020 Sep;21(9):1142. https://doi.org/10.1016/S1470-2045(20)30421-6 ; PMID: 32738931; PMCID: PMC7392597, Sep-2020