Fiscal Year:	FY 2022	**Task Last Updated:**	FY 07/13/2023
PI Name:	Sarma, Mallika Ph.D.		
Project Title:	Stress Response and Neurovestibular Compensation and the Potential Ameliorative Effects of Team Support		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	TRISH--TRISH		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	msarma1@jhu.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	248-930-2729
Organization Name:	Johns Hopkins University		
PI Address 1:	Human Spaceflight Lab, Department of Otolaryngology		
PI Address 2:	710 Ross Research Building		
PI Web Page:			
City:	Baltimore	**State:**	MD
Zip Code:	21287-0006	**Congressional District:**	7
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2021 TRISH-RFA-2101-PD: Translational Research Institute for Space Health (TRISH) Postdoctoral Fellowships
Start Date:	08/01/2021	**End Date:**	07/31/2023
No. of Post Docs:	1	**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	TRISH
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date changed to 07/31/2023 per TRISH. (Ed., 5/31/23) NOTE: End date changed to 08/31/2023 per TRISH. Original end date was 07/31/2022. (Ed., 8/4/22)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Shelhamer, Mark Sc.D. (MENTOR: Johns Hopkins University)		
Grant/Contract No.:	NNX16AO69A-P0601		
Performance Goal No.:			
Performance Goal Text:			

	POSTDOCTORAL FELLOWSHIP Long-duration space flight will likely produce neurovestibular challenges that could have severe negative consequences on astronaut safety and mission success. Basic neurovestibular functions such as fine-motor and sensorimotor control are essential for vehicle control and operation of key scientific experiments. It is therefore imperative that astronauts are able to successfully adapt neurovestibular systems upon exposure to new challenging environments. However, the adaptation process can be adversely impacted by a variety of factors, including stressors from disruptions to sleep, the environment, having to perform, and engaging with new people, all of which are anticipated in a mission setting. The challenge to neurovestibular systems during space flight, compounded with other stressors, will impact the ability to maintain safe and effective space travel and eventual long-term habitation; yet this remains understudied. When experiencing these compounding stressors, the physiological stress response may influence neurovestibular responses. Specifically, the level of stress may impact how well the neurovestibular system adapts to change. In addition, any such mission will have a crew, where a team of individuals are dependent on each other. NASA has conducted substantial research about the negative stress associated with interpersonal issues in isolation and confinement that contribute to compounded stressors. However, the positive factors of team support may dampen the negative effects of a greater stress response, with positive implications on the function of other physiological systems, including the vestibular system. This project will study 1) how stress response can impact neurovestibular adaptation and 2) how social support may ameliorate the detrimental effects of stress response on neurovestibular adaptation. With these insights, we can develop countermeasures to mitigate space flight risks related to human health countermeasures and human factors and behavioral performance.
Task Description:	
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This research critically examines multiple stressors in a mission-relevant experimental setting. The benefits of this research include establishing a framework to better evaluate acceptable ranges of an easily collectable biomarker like salivary cortisol (CORT) for spaceflight specific work. It also introduces group dynamics as a potential countermeasure for multivariate negative effects -- e.g., introducing active social support protocols may have long-lasting impacts on stress reduction as well as downstream effects on vestibular function, improve crew satisfaction and performance, mitigate against social isolation effects etc. The translational clinical implications include developing therapeutic interventions for individuals struggling with vestibular lesions, pathologies such as vertigo, and other vestibular perturbations.
Task Progress:	Astronauts on long space mission are exposed to prolonged exposure to space radiation which causes serious cardiovascular disease. However, there are no effective countermeasures to prevent or intervene ionizing radiation induced cardiovascular complications. The objective of current TRISH fellowship is to develop novel and effective countermeasure against ionizing radiation-induced cardiovascular injury using induced pluripotent stem cells derived cardiomyocytes (iPSC-CMs). iPSC-CMs from three different donors (comparable to astronaut demographics = Caucasian, male, 30s) were exposed to the different dose or X-rays radiation (0, 2, 5, 10 Gy) and various molecular parameters (viability, DNA-damage, oxidative stress, mitochondrial function) were measured at different times post irradiation (1 hour, 1 day, 3 day) and correlated the functional changes (beating rate, contraction velocity, relaxation velocity) at 14 days post irradiation. Prevailing mitochondrial dysfunction was observed at 3 days post irradiation and co-treatment with antioxidant significantly restored mitochondrial function in irradiated iPSC-CMs. Using oxidative stress as a primary screening parameter, we identified genistein or simvastatin robustly reversed ROS accumulation in iPSC-CMs following irradiation. We will further validate the efficacy of genistein and/or simvastatin on advanced 3D culture system (engineered heart tissues) or in a mouse model of radiation induced heart disease in upcoming 2022-2023 TRISH year. A successful completion of this postdoctoral fellowship study will provide (i) study results of chronic space radiation exposure on human hearts and (ii) development of novel radioprotective countermeasure against space radiation-induced injuries. Reducing uncertainties in cardiovascular risks against space radiation will accelerate a humanity’s dream to travel space.
Bibliography Type:	Description: (Last Updated: 01/07/2024)
Awards	Sarma M. "Editor's Choice American Journal of Human Biology, January 2022." Jan-2022
Awards	Sarma M. "2022 NASA Human Research Program (HRP) Investigators’ Workshop (IWS) Postdoc Poster Award (1st place), Virtual, February 7-10, 2022." Feb-2022