Fiscal Year:	FY 2018	**Task Last Updated:**	FY 06/21/2018
PI Name:	Lemere, Cynthia Ph.D.		
Project Title:	Sex- and Apo E-specific Late CNS and Cardiovascular Effects of Space Radiation		
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) **BMed**:Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (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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Zip Code:	02115-6110	**Congressional District:**	7
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2016-2017 HERO NNJ16ZSA001N-SRHHC. Appendix E: Space Radiobiology and Human Health Countermeasures Topics
Start Date:	06/01/2018	**End Date:**	05/31/2022
No. of Post Docs:		**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:**	NASA JSC
Contact Monitor:	Simonsen, Lisa	**Contact Phone:**	
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Taylor, Doris Ph.D. (Texas Heart Institute)		
Grant/Contract No.:	80NSSC18K0810		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Our overall objective is to determine the short- and long-term risks of radiation from the space environment on cognition, motor abilities, fatigue resistance, anxiety, and changes in the brain and cardiovascular system. Over the past 3 years, we have determined that low-dose 56Fe (iron) radiation has long-term, sex-specific consequences on cognition, locomotion, neuroinflammation, and Alzheimer's disease (AD) pathogenesis, with males being more vulnerable than females. Analysis of proton-irradiated mice is underway. Over the past year, we have developed a collaboration with Dr. Doris Taylor (Texas Heart Institute), Co-Investigator on this proposal, by sharing the heart, one kidney, and bone marrow from each of the mice irradiated in three of our studies. Over the next 4 years, we will extend our research by comparing our existing data from our current studies on the late central nervous system (CNS) and cardiovascular (CV) effects of a single dose of iron radiation or a single dose of protons with a single dose of oxygen-16 or mixed beam galactic cosmic radiation (GCR) (protons, oxygen-16, and iron) in male and female AD-like transgenic and wildtype mice, and gamma irradiated wildtype mice (Aim 1). In addition, we will examine the sex- and Apo E-specific late CNS and CV dose-specific effects of iron radiation in the same AD-like mouse model modified by targeted replacement of murine Apo E with human Apo E3 or E4 to determine if human ApoE4, a strong risk factor for AD and CV disease, exacerbates the effects of radiation (Aim 2). This work will be conducted in collaboration with investigators at Wash U, Duke U, and NYU. We will perform longitudinal Magnetic Resonance Imaging (MRI) on the brain and heart in a subset of mice in Aims 1 and 2 to determine radiation-induced changes within individual animals. In addition, mice will undergo extensive behavioral testing as well as pathological and biochemical analysis of brain and heart. Lastly, we will conduct a study to test 2 novel human 3D neural organoid models of Alzheimer's disease, developed by our collaborators at Massachusetts General Hospital (MGH) and Massachusetts Institute of Technology (MIT). (Aim 3), for acute and late CNS effects of space radiation on neuronal health, amyloid plaques, tau pathology, and epigenetics, and to investigate the potential of these models for screening mitigating treatments in the future. In collaboration with Dr. Taylor, we will also irradiate undifferentiated induced pluripotent stem cells (iPSCs) from human males and females to determine whether highly charged, high energy (HZE) particle irradiation alters their ability to differentiate into cardiomyocytes, morphology, and/or maturation. In summary, we propose to take our current studies to the next logical step in an effort to better understand the potential risks of galactic cosmic radiation (GCR) to the brain and cardiovascular system in order to prepare astronauts for long-term deep space mission, including missions to Mars.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2018.
Bibliography Type:	Description: (Last Updated: 11/20/2024)