

Fiscal Year:	FY 2020	Task Last Updated:	FY 11/06/2019
PI Name:	Cekanaviciute, Egle Ph.D.		
Project Title:	Astrocytes as Key Mediators of Central Nervous System Responses to Space Radiation		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline-- Element/Subdiscipline:			
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) HFBP :Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) BMed :Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	egle.cekanaviciute@nasa.gov	Fax:	FY
PI Organization Type:	NASA CENTER	Phone:	415-623-0033
Organization Name:	NASA Ames Research Center		
PI Address 1:	Space Biosciences Research Branch		
PI Address 2:			
PI Web Page:			
City:	Moffett Field	State:	CA
Zip Code:	94035	Congressional District:	18
Comments:	NOTE: PI formerly at Universities Space Research Association at NASA Ames Research Center; became civil servant at NASA Ames in summer 2020.		
Project Type:	GROUND	Solicitation / Funding Source:	2018 HERO 80JSC018N0001-Crew Health and Performance (FLAGSHIP, OMNIBUS). Appendix A-Flagship, Appendix B-Omnibus
Start Date:	10/17/2019	End Date:	04/09/2021
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 ARC		
Contact Monitor:	Lewis, Laura	Contact Phone:	
Contact Email:	laura.lewis@nasa.gov		
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Costes, Sylvain Ph.D. (NASA Ames Research Center)		
Grant/Contract No.:	80NSSC20K0125		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>One of the main risks of human deep space exploration is central nervous system (CNS) damage, which is associated with neuronal damage and neuroinflammation, caused by exposure to space radiation combined with microgravity, and can lead to cognitive and behavioral dysfunction. CNS responses to injuries are strongly regulated by astrocytes, which are a major glial cell type in the brain that has also been shown to control the blood-brain barrier permeability, essential neuronal functions, and inflammation; and thus could serve as a robust CNS-specific target for countermeasure development. Therefore, we propose to investigate the astrocytic regulation of neuronal health in response to simulated space radiation.</p> <p>We propose to utilize for the first time a novel high-throughput human tissue-on-a-chip model for 3D neuronal/astrocyte cultures. We will investigate the morphological and physiological outcomes as well as gene expression changes after simulated space radiation exposure (5-ion simulation of galactic cosmic rays, 500 mGy) and compare them to the responses to gamma radiation in order to establish the relative biological effectiveness. We will also evaluate the necessity and sufficiency of astrocytes in regulating radiation responses by establishing experimental models where astrocytes are either the only cell type that is irradiated, or the only cell type that escapes irradiation. Finally, we will test whether driving astrocytes more towards A1 (inflammation) or towards A2 (scarring) phenotypes may serve as countermeasures by reducing radiation-mediated neuronal damage.</p> <p>In summary, we will examine whether astrocytes are necessary and sufficient to protect neurons from damage induced by simulated space radiation and evaluate their effectiveness as a target for further countermeasure development. We will also provide a proof of concept for human tissue-on-a-chip use for studying space radiation effects on the CNS.</p> <p>Our proposal addresses the Part "B. Basic Investigations Opportunity for Investigators New to NASA" of the Appendix B. The new investigator (Principal Investigator) and experienced investigator (CoInvestigator/Institutional Principal Investigator) have combined expertise in space biology, neuroinflammation astrocyte functions, TGFbeta functions in regulating astrocyte phenotypes, and responses to particle radiation. Thus, we have the capacity to complete this 1-year project at NASA Ames and, given sufficient interest, could easily expand it to a) investigate the outcomes of combined exposures to microgravity, stress, and radiation, and b) design an in vivo follow-up study on astrocytic regulation of CNS responses to spaceflight stressors.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2020.
Bibliography Type:	Description: (Last Updated: 06/23/2023)