Fiscal Year:	FY 2022	**Task Last Updated:**	FY 01/31/2022
PI Name:	Mao, Xiao Wen M.D.		
Project Title:	Bion-M2 Spaceflight-Induced Effects on Neurovascular Remodeling and Blood-Retina Barrier Function: Role of Oxidative Stress		
Division Name:	Space Biology		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Cell & Molecular Biology (2) Animal Biology: Vertebrate		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	92350-0001	**Congressional District:**	31
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2018 Space Biology NNH18ZTT002N:Russian Bion-M2 Mission
Start Date:	05/01/2020	**End Date:**	04/30/2023
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:	Loftus, David	**Contact Phone:**	650-604-1011
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Flight Program:	Bion-M2		
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Delp, Michael Ph.D. (Florida State University) Pecaut, Michael Ph.D. (Loma Linda University) Sun, Shu-Wei Ph.D. (Loma Linda University) Wang, Charles M.D., Ph.D. (Loma Linda University)		
Grant/Contract No.:	80NSSC20K0986		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The health risk of spaceflight-induced neuronal damage and potential adverse neurovascular effects has long been a concern. A recent report shows that more than 50% of the astronauts returning from space were diagnosed with visual problems that can cause blurry vision. Our previous studies from mice that had been subjected to spaceflights (space shuttle mission Space Transportation System (STS)-118 and STS-135)) showed that environmental conditions during space travel lead to oxidative stress and induce adverse microvessel remodeling in the retina. To date, the mechanisms behind these effects are not fully understood. The objective of this proposed project is to characterize the effect of Bion-M2 mission on retinal vascular remodeling and visual function. Furthermore, the molecular and cellular mechanisms involving oxidative stress-induced vascular response and impaired blood-retina-barrier (BRB) and blood-brain barrier (BBB) integrity will be investigated. Mature male and female mice will be exposed to the spaceflight environment on board Bion-M2 mission for 30 days and compared to that of ground-based control groups. Animals will be sacrificed 3-15 days after return to Earth. Non-invasive intraocular pressure (IOP) and electroretinography (ERG) will be used to measure intraocular pressure and retinal function before sacrifice. Eyes and brains will be removed for fixed or frozen for ex vivo diffusion tensor imaging (DTI) imaging, genomic profiling, and immunohistological analysis. Together, our unique, integrative, quantitative approaches with advanced imaging techniques and comprehensive genomic analysis will provide insight into the cellular mechanism of spaceflight-induced effects on the interaction of parenchymal activity with neurovascular response and provide criteria for risks of functional detriments. Understanding how spaceflight impacts neurovascular remodeling and BRB/BBB function will help focus the approach for more effective countermeasures during human spaceflight and planetary exploration.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Blood-retina barrier (BRB) disruption induced by oxidative stress and other factors are important causes of irreversible blindness in many retinal diseases, including diabetic retinopathy and macular degeneration. Our mechanistic studies may also lead to new efficacious therapies that can prevent, reverse, or stop the progression of neurovascular-related diseases and retinal degeneration by targeting ROS (reactive oxygen species) production and antioxidant enzyme activation.
Task Progress:	NOTE: Per F. Hernandez/ARC, there is no additional progress to submit for this reporting period. The NASA Space Biology Program has indicated that the project is presently on hold (Ed., 8/12/22). January 2022 Report: Bion-M2 is scheduled for launch in 2023. Due to the nature of the work that involves multiple Principal Investigator (PI) groups and international counterparts, work groups for each subtopic have been identified. Studies and requirements have been presented in our first virtual kickoff meeting.
Bibliography Type:	Description: (Last Updated: 12/15/2023)