Fiscal Year:	FY 2024	**Task Last Updated:**	FY 01/11/2024
PI Name:	Lau, Anthony G Ph.D.		
Project Title:	Effects of Acute and Protracted Proton Radiation Exposure on Bone Health		
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) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	08618-1104	**Congressional District:**	12
Comments:	NOTE: As of Fall 2015, Dr. Lau is at The College of New Jersey. Previously at University of North Carolina at Chapel Hill while NSBRI postdoc.		
Project Type:	Ground	**Solicitation / Funding Source:**	2023 HERO NNJ23ZSA001N-OMNIBUS : NASA Human Research Program Omnibus Opportunity
Start Date:	11/01/2023	**End Date:**	10/31/2024
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:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Mraz, Alexis Ph.D. (College of New Jersey) Davis-Takacs, Catherine Ph.D. (Henry M Jackson Foundation For The Advancement Of Military M)		
Grant/Contract No.:	80NSSC24K0247		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The exposure to ionizing space radiation can lead to damage of multiple biological tissue systems. The proposed work investigates degeneration of the central nervous system (CNS) and bone tissues from exposure to different dose rates of Proton Radiation. Radiation is known to affect biological pathways that regulate both the CNS and bone. The objective of the proposed work is to investigate the relationship between declines in cognitive function and declines in bone health from exposure to Proton Radiation, quantify these changes, and explore osteocalcin as a potential biomarker of these changes. The objectives will be addressed through animal studies exposing rats to acute and protracted (or fractionated) Proton Radiation and investigating the relationship between neurobehavioral deficits, bone degradation, and blood osteocalcin levels, at 7, 30, 90, and 180 days after radiation exposure. This interdisciplinary tissue sharing proposal investigates the cognitive degradation in rats exposed to acute and protracted proton radiation and the corresponding bone strength changes in these same rats. Neurobehavioral assessments include odor recognition memory tests and sustained attention tests. Blood osteocalcin levels will be measured with Enzyme-Linked Immunosorbent Assays (ELISAs). A multi-length scale approach will be performed to assess the corresponding bone health changes. Bone health assessments include microstructural (microCT scans), material property (micro-indentation), and whole bone (3-point bending) evaluations of bone strength. Analysis will be performed on CNS, osteocalcin, and bone endpoint measurements to determine the relationships between CNS and Bone deficits, and if osteocalcin is a biomarker of radiation induced changes in these two systems. The work is significant to NASA’s goal for astronaut health during long-duration spaceflight. Further exploring the relationship between the CNS and bone response to radiation, as well as osteocalcin as a potential biomarker, can provide valuable information for identifying potential mechanisms and developing countermeasure targets for both systems. This work addresses the following risks and gaps outlined in the NASA Human Research Program (HRP) Human Research Roadmap (HRR): Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders (BMed-102); Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (Bone-102, Bone-301).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The work is significant to NASA’s goal for astronaut health during long duration spaceflight. The proposed work explores a novel framework to utilize the longitudinally measured neurobehavioral performance to determine dose-rate effects of proton radiation exposures on bone degradation, which can only be determined invasively or terminally. This work also explores osteocalcin as a biomarker for radiation effects on multiple physiological systems.
Task Progress:	New Project for FY2024
Bibliography Type:	Description: (Last Updated: 03/30/2016)