Fiscal Year:	FY 2021	**Task Last Updated:**	FY 03/03/2022
PI Name:	Wyrobek, Andrew Ph.D.		
Project Title:	Variation in CNS Damage Signaling and Blood Sentinels of Neuropathology After Exposure 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 (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:	94720-8099	**Congressional District:**	13
Comments:	For immediate assistance please contact my administrator Caron LaMarsh clamarsh@lbl.gov, 510.486.5317		
Project Type:	Ground	**Solicitation / Funding Source:**	2017 HERO 80JSC017N0001-Crew Health and Performance (FLAGSHIP1, OMNIBUS). Appendix A-Flagship1, Appendix B-Omnibus
Start Date:	04/01/2019	**End Date:**	09/30/2022
No. of Post Docs:	4	**No. of PhD Degrees:**	0
No. of PhD Candidates:	3	**No. of Master' Degrees:**	0
No. of Master's Candidates:	2	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	2	**Monitoring Center:**	NASA JSC
Contact Monitor:	Whitmire, Alexandra	**Contact Phone:**	
Contact Email:	alexandra.m.whitmire@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 09/30/2022 per L. Juliette/JSC (Ed., 5/8/22) NOTE: End date changed to 4/30/2022 per PI information (Ed., 2/11/22) NOTE: End date changed to 12/31/2021 per D. Kulkarni/HRP (Ed., 10/7/21) NOTE: Period of performance changed to 4/1/2019-3/31/2021 per PI/NASA-LBL interagency agreement; previous information showed 11/28/18-11/27/20 (Ed., 9/5/19)		
Key Personnel Changes/Previous PI:	March 2020 report: The individuals are co-investigators on this project: Peterson, Leif; Bowles, Dawn; Celniker, Susan; Witkowska, Helena. The following individuals remain as collaborators on this project: Albou, Laurent-Philippe; Mungall, Chris; Fiehn, Oliver; Settles, Matthew; Froenicke, Lutz; Straume, Tore.		
COI Name (Institution):	Peterson, Leif Ph.D. (The Methodist Hospital Research Institute) Bowles, Dawn Ph.D. (Duke University) Celniker, Susan Ph.D. (Lawrence Berkeley National Laboratory) Witkowska, Helena Ph.D. (University of California San Francisco - ret)		

Grant/Contract No.:	80JSC019T0007
Performance Goal No.:	
Performance Goal Text:	
Task Description:	Major objectives of the NASA space radiation research program are to enable human exploration of space without exceeding limits for immediate and persistent risks to the central nervous system (CNS) from space radiation. The proposed research will investigate the CNS subregions of rodents exposed to simulated space radiation for molecular indicators for vascular damage, inflammation, and neurological abnormalities after space radiation. This project will apply multi-omic technologies (proteomics, metabolomics, and bioinformatics) to archived CNS brain subregions from irradiated mouse and rat behavioral models. The specific aims are: Aim 1. Characterize the persistence of radiation-induced molecular abnormalities in cortex and hippocampus after low-dose exposures to 56Fe particles, and compare the predictions for CNS tissue damage and late-onset neuropathologies in similarly irradiated mice and rats. Aim 2. Identify persistent bio-effect markers in peripheral blood and cerebrospinal fluid (CSF) that correlate with molecular damage in CNS vascular or immune functions. Our research plan will provide testable hypotheses of CNS tissue damage and identify molecular targets for susceptible pathways/functions of CNS damage. This project will also provide proof-of-principle whether CNS damage relevant bio-effect metabolites can be detected in CSF and blood. This project will also identify radiation-sensitive pathways, suitable for future development of biological countermeasures to reduce CNS risks from space radiation. The results of this research are designed to help NASA reduce the uncertainty associated with during mission behavior and CNS risk for astronauts on deep space exploration missions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The predictive model developed in this project will yield numerous hypotheses of mechanisms of CNS radiation damage that are either common or unique to cortex and hippocampus – these hypotheses will be tested in future studies by in situ analyses of archived frozen tissues and fixed contralateral hemispheres that are available from all animals in this proposal. This project will also provide proof-of-principle whether CNS damage relevant bio-effect metabolites can be detected in CSF and blood. This project will also identify radiation-sensitive pathways, suitable for future development of biological countermeasures to reduce CNS risks from space radiation. The results of this research are designed to help NASA reduce the uncertainty associated with during mission behavior and CNS risk for astronauts on deep space exploration missions.
Task Progress:	January 2022 Report: This 2-year research project was seriously delayed (~18 months) due to the COVID outbreak which imposed badging restrictions to enter institute buildings with a full shutdown of the Wyrobek wet lab from February 2020 to July 2021. The research consequences of the COVID shutdown: no tissue samples were processed, no multi-omics profiles were generated, and bioinformatic analyses were limited to pre-COVID datasets. A revised research plan was generated that retained the hypothesis, goals, and the two specific aims of the original plan. NASA granted a No Cost Extension (NCE) to April 30, 2022 to carry out the revised research plan.
Bibliography Type:	Description: (Last Updated: 06/19/2025)