Fiscal Year:	FY 2020	**Task Last Updated:**	FY 10/03/2019
PI Name:	Pariset, Eloise Ph.D.		
Project Title:	Investigation of Blood-Based Circulating Biomarkers of Responses to Space Radiation		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	TRISH--TRISH		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	94035-0001	**Congressional District:**	18
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2019 TRISH RFA-1901-PD Translational Research Institute for Space Health (TRISH) Postdoctoral Fellowships
Start Date:	11/01/2019	**End Date:**	03/31/2021
No. of Post Docs:	1	**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:**	TRISH
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date changed to 3/31/2021 per E. Urquieta/TRISH (Ed., 4/14/21) NOTE: End date changed to 1/31/2022 (originally 10/31/2021) per TRISH (Ed., 6/1/2020)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Costes, Sylvain Ph.D. (Mentor: NASA Ames Research Center)		
Grant/Contract No.:	NNX16AO69A-P0405		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	POSTDOCTORAL FELLOWSHIP Understanding the mechanisms underlying the human responses to space radiation is a high priority for upcoming lunar and Mars missions and could enable preventive actions and countermeasures to avoid radiation-induced risks. Peripheral blood lymphocytes have been commonly studied to evaluate radiation-induced biological responses since they are easily accessible, can provide individual assessment of radiation sensitivity, and are among the most radiosensitive cell types in the human body. Our laboratory aims at understanding the individual variability of human sensitivity to ionizing radiation, for the first time focusing on space-relevant high mass and charge (HZE) particle radiation based on DNA and cellular damage in Peripheral Blood Mononuclear Cells (PBMCs) and genomic associations. Here we propose to extend this ongoing study by identifying blood-based circulating factors regulating radiation responses in humans, which will provide better understanding of how radiation influences human health to develop countermeasures. We will study radiation-induced damage in human immune cells following exposure to two types of space-relevant radiation (gamma ray and Fe particles), with a focus on expression changes and functional roles of two types of blood-based biomarkers: cytokines (small proteins) and exosomes (extracellular vesicles transporting protein and nucleic acid components), which are both released by cells and participate in inter-cellular communication. Specifically, we hypothesize that a) in human PBMCs, ionizing radiation elicits the release of circulating factors that modulate the negative effects of irradiation; b) cytokines and exosomes are the best candidate biomarkers for radiation, based on their association with radiation-induced responses and interpersonal variability; and c) cytokines and exosomes are the circulating factors participating in the transport of the radiation message from irradiated cells to unirradiated cells. We will address this hypothesis studying cytokine responses to gamma and high-linear energy transfer (LET) particle irradiation, across a genetically diverse population of 400 healthy individuals. We also aim to identify exosomal RNA and miRNA from human PBMC supernatants that are common indicators of responses to low and high-LET radiation. The respective role of cytokines and exosomes in the transport of the radiation risk across cells will be validated by investigating whether cytokines or exosomal content are sufficient to transmit the cellular outcomes of irradiation. While previous studies have identified either circulating biomarkers or exosomal components related to radiation exposure, here we propose to take into account the variation in individual sensitivity to radiation with the study of a large cohort, and to compare the respective effects of circulating vs. exosomal factors of irradiation. In addition, this study will be the first to investigate the cytokine and exosome expression a) by human primary cells and b) under space-relevant doses and types of irradiation. The proposed work is essential to the preparation of upcoming prolonged spaceflight and deep space habitation by identifying circulating blood biomarkers of radiation responses and understanding the physiological role of these biomarkers in the propagation of radiation-induced biological damages. Detection of radiation-related blood biomarkers will provide an easy and fast solution for individual diagnostics and risk prevention, while a better understanding of novel mechanisms involved in the spread of radiation-induced effects will enable to better target these mechanisms for preventive and therapeutic solutions with the perspective of protecting the crew from space radiation-induced biological risks.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2020.
Bibliography Type:	Description: (Last Updated: 06/29/2021)