Fiscal Year:	FY 2022	**Task Last Updated:**	FY 03/25/2022
PI Name:	Schwertz, Hansjorg M.D., Ph.D.		
Project Title:	Megakaryocytes Orbiting in Outer Space and Near Earth: The MOON Study		
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		
Space Biology Cross-Element Discipline:	(1) Immunology		
Space Biology Special Category:	None		
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Zip Code:	84108-1263	**Congressional District:**	2
Comments:			
Project Type:	Flight	**Solicitation / Funding Source:**	2020 Space Biology NNH20ZDA001N-SB E.12. Flight/Ground Research
Start Date:	12/01/2021	**End Date:**	11/30/2024
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 ARC
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Rondina, Matthew M.D. (University of Utah, Salt Lake City) Rowley, Jesse Ph.D. (University of Utah, Salt Lake City)		
Grant/Contract No.:	80NSSC22K0255		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Megakaryocytes (MKs) and their progeny, platelets (PLTs), are dynamic effector cells with recently discovered novel functions, which bridge the inflammatory, immune, and hemostatic continuum. Changes in bone marrow MKs, resulting in low PLT numbers, (thrombocytopenia, which occurs in astronauts during spaceflight) are associated with dysregulated host inflammatory/immune responses. MKs and PLTs sense and respond to environmental cues. MKs also differentially invest developing PLTs with RNAs and proteins that alter functions of newly-released cells, influencing cellular and host responses. Surprisingly, there is a paucity of data regarding in-flight, long-term dynamics of MK development and function, as well as PLT function and production. Given previously identified and published space-travel associated risks on dysregulated inflammation, immune responses, thrombus formation, and hemostatic systems, filling this critical knowledge gap is important for the health of spaceflight crewmembers during and after missions. Moreover, as other blood cells (e.g., red blood cells, leukocytes, etc.) may be altered by microgravity, data generated are likely to contribute to our understanding of how spaceflight affects other hematopoietic processes. This proposal is based on our robust preliminary data demonstrating that conditions mimicking microgravity (rotating wall vessel culture, RWVC) markedly alter human MK morphology and gene expression. We hypothesize that microgravity will re-program MKs and newly-released PLTs, resulting in critical changes in their transcriptome, proteome, and alterations in PLT number and function. We will determine how microgravity and space radiation conditions on board the International Space Station (ISS) alter human MK and PLT maturation/production, gene expression (DNA, RNA, and protein), and cellular function. We will study in vitro human hematopoietic progenitor cell (HPC)-derived MKs in Earth-based experiments under standard or microgravity conditions. In parallel, human MKs will be studied on the ISS. Integrated, cutting-edge OMICS toolsets (e.g., RNA-sequencing and ribosomal footprinting [Ribo-seq]), comprehensive morphologic studies, and cell production kinetic studies will be used. They will provide unprecedented insight into adaptation processes needed for MK and PLT function under conditions experienced by humans performing spaceflights. These studies will directly address crew health concerns that currently limit human space exploration and will assist in developing targeted countermeasures. This proposal concurs with the major National Research Council (NRC) Decadal Survey Recommendations for cellular and molecular biology studies using state- of-the-art tools coupled with systems biology, and for studies evaluating the physiological interplay of cardiopulmonary and immune functions during application of spaceflight. Furthermore, we will address goals of the NASA Space Biology Science Plan 2016-2025, including: (1) determine the effects of the space environment on DNA function, (2) develop a systems biology-based understanding of the cellular and molecular changes to explain how gravitational changes in spaceflight effects organisms and causes phenotypic changes, and (3) identify how spaceflight affects the ability of cells to generate and maintain their complex internal cyto-architecture, processes critical for MKs and PLTs.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2022.
Bibliography Type:	Description: (Last Updated: 09/26/2024)