Fiscal Year:	FY 2021	**Task Last Updated:**	FY 12/02/2020
PI Name:	Vunjak-Novakovic, Gordana Ph.D.		
Project Title:	Human Multi-Tissue Platform to Study Effects of Space Radiation and Countermeasures		
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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Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2020 TRISH Space Radiation Solicitation TSRAD-2020. Translational Research Institute for Space Health (TRISH) Human-Based Models to Study Effects of Space Radiation and Countermeasures
Start Date:	10/01/2020	**End Date:**	12/31/2023
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:**	TRISH
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: End date changed per E. Urquieta/TRISH (Ed., 8/19/21)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Amundson, Sally Ph.D. (Columbia University) Brenner, David Ph.D. (Columbia University) Garty, Guy Ph.D. (Columbia University) Hibshoosh, Hanina Ph.D. (Columbia University) Shuryak, Igor Ph.D. (Columbia University) Leong, Kam Ph.D. (Columbia University)		
Grant/Contract No.:	NNX16AO69A-RAD0104		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The exact effects of space radiation, a potentially serious risk encountered during prolonged missions to Moon and Mars (“red risk”), are still uncertain. There is a compelling need to better understand the safety thresholds and mechanisms of various types of tissue/cell/DNA damage, and to develop safe and effective radiation countermeasures for extended space travel. This proposal is to implement an already established multi-tissue platform to study the effects and mechanisms of space radiation and develop effective countermeasures for long missions. Over the last 8 years, we have bioengineered multiple human tissues starting from induced pluripotent stem cells (iPSCs) (heart, liver, bone, bone marrow, skin, sensory neurons, motor neurons, skeletal muscle, and midbrain). These tissues are matured and physiologically connected into an “organs on a chip” platform by vascular perfusion containing immune cells. With the addition of strong expertise in radiation biology, we collected preliminary data for the effects of photon and neutron radiation on sensory neurons, heart muscle, vascular endothelium, and bone marrow. Notably, the use of iPSCs allows individualized studies (e.g., for a specific astronaut). We now propose a radiation research platform consisting of four tissues: bone marrow (acute damage target), heart muscle (delayed damage target), liver (depo of granulocyte colony-stimulating factor (G-CSF)), and vascular perfusion with circulating cells. We further propose to evaluate an advanced nanoparticle-based modality for sustained delivery of G-CSF (a hematopoiesis stimulating factor) with oral delivery, or transactivation of the endogenous G-CSF gene for prolonged protection. These countermeasures will be tested against acute and fractionated high-linear energy transfer (LET) neutrons, simulated galactic cosmic rays, and photons (controls). We will validate the platform using iPSCs from healthy males and females and benchmark the collected data against known whole organism outcomes. The project will be milestone-driven and is expected to deliver a radically new approach enabling studies of space radiation damage and countermeasures.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2021.
Bibliography Type:	Description: (Last Updated: 04/24/2024)