Fiscal Year:	FY 2024	**Task Last Updated:**	FY 04/11/2024
PI Name:	Nickerson, Cheryl A Ph.D.		
Project Title:	Effects of Lunar Dust Simulant on Human 3-D Biomimetic Intestinal Models, Enteric Microorganisms, and Infectious Disease Risks		
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:	None		
Space Biology Special Category:	(1) Cell Culture		
PI Email:	Cheryl.Nickerson@asu.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	480-727-7520
Organization Name:	Arizona State University		
PI Address 1:	Center for Infectious Diseases and Vaccinology/The Biodesign Institute		
PI Address 2:	1001 S McAllister Avenue		
PI Web Page:	https://		
City:	Tempe	**State:**	AZ
Zip Code:	85287-5401	**Congressional District:**	9
Comments:	NOTE PI moved from Tulane University to Arizona State University in 2006.		
Project Type:	Ground,NASA GeneLab	**Solicitation / Funding Source:**	2022 Space Biology NNH22ZDA001N-SBR: E.9 Space Biology Research Studies
Start Date:	02/26/2024	**End Date:**	02/25/2026
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
Contact Monitor:	Griko, Yuri	**Contact Phone:**	650-604-0519
Contact Email:	Yuri.V.Griko@nasa.gov		
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Ott, C. Mark Ph.D. (NASA Johnson Space Center) Scully, Robert Ph.D. (KBR WYLE SERVICES, LLC) Yang, Jiseon Ph.D. (Arizona State University) Barrila, Jennifer Ph.D. (Arizona State University)		
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Task Description:	The objective of this proposal is to determine if exposure to lunar dust simulant will alter the characteristics of human intestinal cells and intestinal-relevant bacteria, both independently and during their interactions – in ways that could increase health risks. We will further evaluate if the combination of both lunar dust simulant and low shear modeled microgravity (LSMMG) culture of intestinal-associated bacteria could further alter their characteristics and interactions with human intestinal cells. We hypothesize that exposure to lunar regolith simulant will alter the phenotypic and molecular genetic characteristics of both human intestinal cells and intestinal-relevant bacteria. We further hypothesize that culture of a model enteric bacterial pathogen under LSMMG conditions, in combination with lunar dust simulant, will exacerbate the alterations observed for either stressor alone. To retain applicability of these findings for spaceflight applications, all microorganisms selected for this study have a direct route of access to the astronaut intestine (e.g., through food, water, air), and include isolates from the International Space Station (ISS) and other organisms with clear relevance to crew health. Proposed Aims: Aim 1. Characterize the impact of lunar dust simulants on the viability and pathobiology of 3-D biomimetic models of human intestine. Cytotoxicity, pathology, and inflammatory responses of 3-D models of human intestine will be profiled in the presence and absence of lunar dust simulants. Aim 2. Characterize the impact of lunar dust simulants on phenotypic characteristics of pathogenic and commensal microorganisms associated with human spaceflight and the intestine. Aim 2a: A high throughput screening approach will be applied using multi-well plates to profile a panel of intestinal-relevant bacteria (pathogens and commensals) for alterations in growth/viability in response to challenge with lunar dust simulants. Aim 2b: The model enteric pathogen Salmonella typhimurium (S. typhimurium) will also be profiled for alterations in growth, acid resistance, and biofilm formation in response to the combined impact of dust simulants and LSMMG culture. Aim 3. Characterize the impact of lunar dust simulants on the viability and pathobiology of 3-D biomimetic models of human intestine following challenge with a model enteric pathogen. Susceptibility of 3-D models to infection will be evaluated using S. typhimurium, a model pathogen previously shown to exhibit spaceflight – and LSMMG-induced alterations in virulence, 3-D intestinal infection profiles, pathogenesis-related stress responses, and multi-omics profiles. S. typhimurium will be cultured under LSMMG (with and without simulants) prior to addition to the 3-D model (with/without simulants). Cytotoxicity, inflammatory responses, colonization, and dual RNA sequencing (RNA-seq) of the host-pathogen interaction will be performed. We will also transcriptionally profile LSMMG-cultured S. typhimurium just prior to infection.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Knowledge from these studies will pioneer new scientific discoveries into the impact of lunar regolith simulants on human intestinal health and intestinal-relevant bacteria and enable space exploration through the discovery of potential astronaut health risks during deep space missions.
Task Progress:	New Project for FY2024
Bibliography Type:	Description: (Last Updated: 06/05/2024)