Fiscal Year:	FY 2023	**Task Last Updated:**	FY 10/06/2022
PI Name:	Nickerson, Cheryl A Ph.D.		
Project Title:	Contributions of the Microbiome in Astronaut Health: a New Dimension in Modeling Crew 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 (2) Microbiology		
Space Biology Cross-Element Discipline:	(1) Immunology		
Space Biology Special Category:	(1) Cell Culture (2) Translational (Countermeasure) Potential		
PI Email:	Cheryl.Nickerson@asu.edu	**Fax:**	FY
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Organization Name:	Arizona State University		
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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	**Solicitation / Funding Source:**	2016-17 Space Biology (ROSBio) NNH16ZTT001N-MS, PS, AB. App D,E,F: Research Using Microgravity Simulation Devices, Parabolic and Suborbital Flights, and Antarctic Balloons
Start Date:	10/01/2018	**End Date:**	09/30/2023
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:**	NASA KSC
Contact Monitor:	Freeland, Denise	**Contact Phone:**	321-867-5878
Contact Email:	Denise.E.Freeland@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 9/30/2023 per NSSC information (Ed., 10/12/22) NOTE: End date changed to 9/30/2022 per NSSC information (Ed., 9/23/21)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Bean, Heather Ph.D. (Arizona State University) Barrila, Jennifer Ph.D. (Arizona State University) Ott, C. Mark Ph.D. (NASA Johnson Space Center)		
Grant/Contract No.:	80NSSC18K1478		
Performance Goal No.:			

Performance Goal Text:	
Task Description:	The diverse communities of microbes that reside in the human intestinal tract play critical roles in the prevention of enteric infection for both astronauts and the general public. A comprehensive understanding of how changes in gut microbiota composition impacts susceptibility to infection has been limited by a lack of cost-effective, physiologically relevant infection models containing both human host and microbial cells. We previously developed an advanced three-dimensional (3-D) model of human colon containing inflammatory immune cells and applied it to study host-pathogen interactions, including the influence of low fluid shear microgravity analogue culture on the ability of the enteric pathogen Salmonella to colonize the host. This same model was also applied to study host-microbiota interactions using patient-derived fecal consortia from both healthy individuals and those suffering from a gastrointestinal disorder. For the proposed study, our goal is to populate our 3-D intestinal co-culture model containing immune cells with astronaut fecal microbiota (previously collected during the Microbiome spaceflight experiment) and assess its influence on infection with Salmonella cultured under microgravity analogue conditions. The outcome of these interactions will be profiled using a variety of approaches, including colonization studies, microscopy, metabolomics, 16S analysis, and cytokine analysis. The foodborne pathogen Salmonella was selected as the model pathogen as it is a leading cause of gastrointestinal disease worldwide and imposes an enormous health and socioeconomic burden. From NASA's perspective, Salmonella is considered a potential source of infection during spaceflight that could incapacitate crew members during a mission. Due to its route of access through spaceflight food, NASA specifically tests for Salmonella prior to flight and has previously disqualified food destined for the International Space Station based on the isolation of this pathogen. The proposed microgravity analogue studies combine microbiology, tissue engineering, and physics to provide new insight into the influence of spaceflight on host-microbiome interactions and the ability to protect against pathogen infection with applications for therapeutic development for spaceflight exploration and health of the general public.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This research will enrich life on Earth through the use of space technology and the application of biomedical knowledge. Specifically, this study will utilize the microgravity spaceflight platform to 1) to broaden our knowledge of the host-pathogen interaction that leads to infectious disease, and 2) for the development of new therapeutic strategies to combat infectious disease for astronauts and the general public.
Task Progress:	We continue to advance our scientific objectives for this work, including characterization and quantification of fecal microbiota for the colonization studies and sample processing. We have also coordinated with our collaborative team members for the metabolomics studies. In addition, we have published multiple manuscripts supported in part by this study. We have continued to encounter some delays due to COVID-19-related supply chain issues (e.g., receipt of materials/supplies) and health issues to lead personnel on this project. We are thus respectfully requesting a No Cost Extension (NCE) to successfully complete our funded objectives. This NCE will also be important to allow Dr. Barrila (Co-PI) to complete her PECASE award from NASA, which is augmented as supplement to this study.
Bibliography Type:	Description: (Last Updated: 04/23/2024)
Articles in Peer-reviewed Journals	Barrila J, Yang J, Franco K, Yang S, Davis T, Aronow BJ, Bean H, Davis RR, Forsyth RJ, Ott CM, Gangaraju S, Kang B, Hanratty B, Nydam SD, Kong W, Steel J, Nickerson CA. "Spaceflight analogue culture enhances the host-pathogen interaction between salmonella and a 3-D biomimetic intestinal co-culture model." Front. Cell. Infect. Microbiol. 2022 May 31. https://doi.org/10.3389/fcimb.2022.705647 , May-2022