Fiscal Year:	FY 2022	**Task Last Updated:**	FY 07/21/2021
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
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	**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:**	09/30/2022
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 9/30/2022 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:	While we have made progress on this project, including advancing scientific objectives at the bench, as well submission and publication of multiple manuscripts, we have still encountered some delays due to significant COVID-19-related health issues to lead personnel on this project, as well as routine access to our lab. We are thus respectfully requesting a NCE (no-cost extension) to successfully complete our funded objectives. Invited Presentations during the reporting period: Invited speaker, Biomedical Advanced Research and Development Authority (BARDA), March 16, 2020. Invited speaker, 21st Century Research – Moving Beyond Animals in the Neurosciences and Infectious Disease Research, Arizona State University, Tempe, AZ, April 24, 2020 Invited speaker, American Society for Space and Gravitational Research (ASGSR) Decadal Workshop: Space Microbiology Town Hall. October 14, 2020 Invited speaker, Infectious Diseases and Global Health Training Program, University of Manitoba, Nov 26, 2020 Invited speaker and panelist, New York Health Forum "Investing in Space – Next Frontier of Healthcare", March 16, 2021 Invited speaker, Gastronauts Global Symposium, “Where the Gut Meets the Brain”, Virtual Meeting, May 19-22, 2021
Bibliography Type:	Description: (Last Updated: 04/23/2024)
Articles in Other Journals or Periodicals	Nickerson CA, Colorado A, Barrila J, Poste G, Ott CM. "A vision for the next generation of spaceflight microbiology: human health and habitat sustainability." Nature Microbiology. Under revision, as of July 2021. Invited Review. , Jul-2021
Articles in Peer-reviewed Journals	Barrila J, Sarker SF, Hansmeier N, Yang S, Buss K, Briones N, Park J, Davis RR, Forsyth RJ, Ott CM, Sato K, Kosnik C, Yang A, Shimoda C, Rayl N, Ly D, Landenberger A, Wilson SD, Yamazaki N, Steel J, Montano C, Halden RU, Cannon T, Castro-Wallace SL, Nickerson CA. "Evaluating the effect of spaceflight on the host–pathogen interaction between human intestinal epithelial cells and Salmonella Typhimurium." npj Microgravity. 2021 Mar 9;7(1):9. https://doi.org/10.1038/s41526-021-00136-w ; PMID: 33750813; PMCID: PMC7943786 , Mar-2021