Fiscal Year:	FY 2020	**Task Last Updated:**	FY 08/05/2019
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		
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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:**	09/30/2021
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
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Flight Program:			
Flight Assignment:			
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:	Trained key lab personnel to perform 3-D cell culture, including media preparation, development of 3-D intestinal co-culture model, counting, seeding and infection of 3-D models with rotating wall vessel (RWV)-cultured Salmonella, and confocal imaging of 3-D models. Multiple team members also received training on fecal microbiota handling and preparation, use of the Bioplex to perform cytokine analyses of 3-D intestinal co-culture model and attended flow cytometry training. Successfully optimized infection procedures of the 3-D intestinal co-culture models under relevant environmental conditions in the glovebox using RWV-cultured Salmonella in the presence and absence of human fecal microbiota. This included testing of selective/differential media for microbial plating. Received astronaut fecal samples from our collaborator at J Craig Venter Institute (JCVI), Hernan Lorenzi. Currently finalizing plans to incorporate these samples into our 3-D models. Invited Presentations: C. Nickerson: Invited panelist and speaker, Leading Women: Biotech and Beyond, Phoenix Convention Center, Phoenix, AZ, October 1, 2018 Invited speaker, University of Louisville, Department of Microbiology and Immunology, Louisville, KY, Oct 4, 2018 Invited speaker, ASM Distinguished Lecturer, Eastern New York Branch ASM, Albany, NY, October 16, 2018 Invited Speaker, Gastronauts, Duke University, Durham, NC, Feb 5, 2019 Invited speaker, ASM Distinguished Lecturer, Missouri Valley Branch ASM, Omaha, NB, March 15-16, 2019 Invited speaker, 3D Tissue Infection Symposium, Wuerzburg, Germany, April 5-7, 2019 Invited Speaker, Nature-NASA Conference on “The Microbiology of Human Spaceflight”, Johnson Space Center, Houston, TX June 24-27, 2019 Invited Speaker, NIH-NASA Summer 2019 Seminar Series, “Microbial pathogen responses to biomechanical forces in infected hosts and microgravity environments”, webinar, July 11, 2019 J. Barrila: Dynamic low fluid shear suspension culture enhances the host-pathogen interaction between Salmonella and a human 3-D intestinal co-culture model. * Invited presentation. 3D Tissue Infection Symposium. Wuerzburg, Germany. April 5-7 2019.
Bibliography Type:	Description: (Last Updated: 05/01/2023)
Awards	Barrila J. "Presidential Early Career Award for Scientists and Engineers (PECASE) presented to Jennifer Barrila, CoInvestigator. She is one of 18 NASA researcher awardees. July 2019." Jul-2019