Fiscal Year:	FY 2023	**Task Last Updated:**	FY 03/30/2023
PI Name:	Nickerson, Cheryl A Ph.D.		
Project Title:	Effects of Low Dose Radiation and Radiation Countermeasures on Infection by Spaceflight Analogue Cultured Salmonella using 3-D Biomimetic Human Tissue Models		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Microhost**:Risk of Adverse Health Effects Due to Host-Microorganism Interactions		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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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:**	2020 HERO 80JSC019N0001-HFBP, OMNIBUS3 Crew Health: Human Factors and Behavioral Performance-Appendix E; Omnibus3-Appendix F
Start Date:	04/28/2021	**End Date:**	04/27/2024
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 JSC
Contact Monitor:	Brocato, Becky	**Contact Phone:**	
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 04/27/2024 per NSSC information (Ed., 3/20/23). NOTE: End date changed to 04/27/2023 per NSSC information (Ed., 4/28/22).		
Key Personnel Changes/Previous PI:	Barrila, Jennifer, Ph.D. (Arizona State University) Colorado, Audrie, Ph.D. (KBR/NASA Johnson Space Center) Ott, C. Mark, Ph.D. (NASA Johnson Space Center)		
COI Name (Institution):	Barrila, Jennifer Ph.D. (Arizona State University) Colorado, Audrie Ph.D. (KBR/NASA Johnson Space Center) Ott, Mark Ph.D. (NASA Johnson Space Center)		
Grant/Contract No.:	80NSSC21K1024		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Background: While both microgravity and radiation are major biological stressors associated with the spaceflight environment, their cumulative impact on host-pathogen interactions and infectious disease risks are rarely considered. This is critical to address, since the cumulative effects of these stressors during spaceflight may result in unexpected negative impacts on crew health and performance that neither condition alone would predict, thus limiting the ability to develop effective countermeasures. Previously, we showed that both spaceflight and spaceflight analogue culture increased the virulence and pathogenesis-related characteristics of the foodborne pathogen, Salmonella Typhimurium (S. Typhimurium), which is responsible for disqualification of food destined for the International Space Station and has been found aboard NASA spacecraft. Recently, we demonstrated that spaceflight-analogue culture of S. Typhimurium increased its ability to infect 3-D biomimetic human intestinal tissue models. In a separate study, we showed low dose radiation damaged our 3-D intestinal models. The primary objective of this proposal is to evaluate the possibility that low dose radiation will exacerbate the already increased bacterial pathogenicity of S. Typhimurium observed following spaceflight analogue culture. In addition, we will determine the impact of a radiation countermeasure to provide protection against both radiation and pathogen-induced tissue damage and inflammation. Hypothesis: The already enhanced infection potential of spaceflight analogue cultured S. Typhimurium will be further exacerbated when used to infect host cells exposed to low dose radiation and this enhanced pathogenicity can be mitigated by a radioprotective compound. Aims: 1. Characterize the impact of spaceflight-analogue culture on the ability of S. Typhimurium to infect 3-D biomimetic intestinal tissue models before and after exposure to low dose radiation. 2. Evaluate the ability of the radioprotective compound, EC-18, to protect 3-D intestinal models from low dose radiation, S. Typhimurium infection, and the cumulative impact of these stressors. Significance: Current infectious disease risk assessments for spaceflight do not consider the potential for increased susceptibility to infection and disease resulting from exposure to low dose radiation, which is a critical consideration. This study will provide key evidence to determine if exposure to low dose radiation may be a factor in astronaut susceptibility to infection during long duration exploration missions and the impact of selected countermeasures to mitigate that risk to crew health.
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 were delayed in starting the project due to receiving funding several months late from NASA to begin the study, as well as COVID-19 related personnel and supply chain issues – we are continuing to make good progress in accomplishing the objectives of this grant and optimizing experimental conditions. Multiple trials have been performed to test and optimize experimental conditions for the irradiation, drug treatments, and infections using the 3-D intestinal co-culture model, the EC-18 compound, and the foodborne bacterial pathogen Salmonella Typhimurium. We are in the process of finalizing data collection – including colonization studies, imaging, and cytokine analyses.
Bibliography Type:	Description: (Last Updated: 03/26/2025)