

<b>Fiscal Year:</b>	FY 2024	<b>Task Last Updated:</b>	FY 01/26/2024
<b>PI Name:</b>	Galazka, Jonathan Ph.D.		
<b>Project Title:</b>	Responses of Microbes and Microbial Communities to Prolonged Exposure to Space Radiation		
<b>Division Name:</b>	Space Biology		
<b>Program/Discipline:</b>			
<b>Program/Discipline-- Element/Subdiscipline:</b>			
<b>Joint Agency Name:</b>		<b>TechPort:</b>	No
<b>Human Research Program Elements:</b>	None		
<b>Human Research Program Risks:</b>	None		
<b>Space Biology Element:</b>	(1) Microbiology		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Zip Code:</b>	94035	<b>Congressional District:</b>	18
<b>Comments:</b>			
<b>Project Type:</b>	GROUND	<b>Solicitation / Funding Source:</b>	2020 Space Biology NNH20ZDA001N-SB E.12. Flight/Ground Research
<b>Start Date:</b>	03/01/2022	<b>End Date:</b>	02/01/2025
<b>No. of Post Docs:</b>	0	<b>No. of PhD Degrees:</b>	0
<b>No. of PhD Candidates:</b>	0	<b>No. of Master' Degrees:</b>	0
<b>No. of Master's Candidates:</b>	0	<b>No. of Bachelor's Degrees:</b>	0
<b>No. of Bachelor's Candidates:</b>	0	<b>Monitoring Center:</b>	NASA ARC
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<b>Flight Program:</b>			
<b>Flight Assignment:</b>	NOTE: End date has changed to 02/01/2025 per F. Hernandez/ARC (Ed., 1/16/24) NOTE: End date has changed to 03/01/2024 per F. Hernandez/ARC (Ed., 3/30/23)		
<b>Key Personnel Changes/Previous PI:</b>	No changes.		
<b>COI Name (Institution):</b>	Barrick, Jeffrey Ph.D. ( University of Texas, Austin )		
<b>Grant/Contract No.:</b>	Internal Project		
<b>Performance Goal No.:</b>			
<b>Performance Goal Text:</b>			

Task Description:	<p>The built environment of spaceships is host to a microbial community that affects crew and craft alike. While the static composition of this community has been characterized, and its temporal dynamics examined, the mechanisms controlling its make-up and evolutionary trajectory are not understood. Systematic analyses of microbial diversity such as the "Earth Microbiome Project" and the "Human Microbiome Project" have shown consistent patterns in community composition and function. Understanding the ecological origins of these patterns remains a major challenge, as it requires connecting processes that occur at varying temporal and spatial scales. However, it is clear that the state and trajectories of microbial communities are in-part determined by their physical environments. In this regard, the spaceflight environment includes numerous interacting factors that differentiates it from Earth environments, including an altered atmospheric composition, reduced gravity (and thus altered fluid dynamics), and increased ionizing radiation. These factors impart selective pressures on microbial communities that effect their evolutionary trajectories and thus, the risks and benefits these communities represent to crew and craft. The radiation environment of space leads to chronic exposure to low doses (<math>&lt;0.1</math> Gy/hr) and is difficult to mimic on Earth. Thus, little is known about how microbial communities in spacecraft will respond and evolve. Therefore, given the limitations of existing studies, we propose to empirically determine how exposure to low doses of ionizing radiation for thousands of cell divisions affects rates of mutation accumulation in microbes and the trajectory of microbial evolution. In this way, we will provide a critical set of data for the design of safe and robust space missions.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>Our research on the impacts of chronic low dose rate irradiation on microbial mutation rates and evolution will impact our understanding of how terrestrial microbes respond to analogous environments. This includes naturally occurring environments and those impacted by human activities. Moreover, our research will help understand how human associated microbes and microbiomes respond to radiotherapies.</p>
Task Progress:	<p>In the past year, an Material Transfer Agreement (MTA) was established between NASA Ames Research Center (ARC) and the University of Texas at Austin (UT Austin) to allow the transfer of E. coli strains that will be used for this work. Strains were transferred safely. Work was completed on a leaded acrylic box used to contain the <math>^{57}\text{Co}</math> source necessary for exposures. This was certified as safe for use. Pilot fluctuation assays were completed to estimate background mutation rates.</p>
Bibliography Type:	Description: (Last Updated: )