Fiscal Year:	FY 2013	**Task Last Updated:**	FY 01/03/2013
PI Name:	Ott, C. Mark Ph.D.		
Project Title:	Efficacy of Antimicrobials on Bacteria Cultured in a Spaceflight Analog		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Space Human Factors Engineering		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SHFH**:Space Human Factors & Habitability (archival in 2017)		
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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Zip Code:	77058	**Congressional District:**	36
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2011 Crew Health NNJ11ZSA002NA
Start Date:	10/01/2012	**End Date:**	10/01/2013
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
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Wotring, Virginia (Universities Space Research Association, Columbia) Nickerson, Cheryl (Arizona State University)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
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As humans travel into outer space, microorganisms will travel with them. While the current NASA standards limit the presence of infectious agents, they are not completely eliminated, and spaceflight missions maintain antibiotics as the primary countermeasure after infection.
One factor that could impact the efficacy of antibiotics is the change in microbial resistance. Previous experiments have confirmed that the spaceflight environment alters a variety of microbial characteristics (1-3). Most notably, alterations in microbial virulence in Salmonella typhimurium (4, 5) and virulence characteristics in S. typhimurium and Pseudomonas aeruginosa (4-6) have been demonstrated in response to spaceflight, thus influencing our perception of infectious disease risk during missions. Several spaceflight experiments have shown alterations in antibiotic resistance. During the Cytos 2 experiment aboard Salyut 7, the minimum inhibitory concentration (MIC) of oxacillin, chloramphenicol, and erythromycin for Staphylococcus aureus and of colistin and kanamycin for Escherichia coli were compared to those of

Task Description:	ground controls (7). These results indicated an increased resistance of both S. aureus and E. coli to all antibiotics used in this experiment (7). In 1999, Juegensmeyer, et. al. observed both increased sensitivity and resistance of S. aureus, P. aeruginosa, Bacillus subtilis, and E. coli that had been re-grown after having been on the MIR space station for 4 months (8). Ground-based spaceflight analog systems provide a practical approach to understanding this change. The rotating-wall vessel (RWV) culture apparatus was developed to produce a low-shear, low-turbulence environment for suspension culture that models aspects of spaceflight (9-11). This analog does not completely reproduce all of the effects of microgravity, but has been shown to be predictive of trends that will be seen during spaceflight (1, 12).\ Hypothesis: Bacteria cultured in the low fluid shear RWV environment will demonstrate changes in efficacy of antibiotics commonly used during spaceflight missions compared to higher shear controls. Aims: The MIC of antibiotics currently manifested during spaceflight missions will be evaluated on three medically significant model organisms (Salmonella typhimurium, Pseudomonas aeruginosa, Staphylococcus aureus)that have either been isolated from spaceflight vehicles or have a clear route of infection. Deliverables: Improve the Quantification of Health Risk by determining the degree to which microbial resistance is altered in a spaceflight analog. Gap Mapping: Risk of Adverse Health Effects Due to Alterations in Host-Microorganism Interactions. IRP GapAEH10: What changes are occurring to the efficiency of current countermeasures against microbial associated risks during human exploration of space that could affect crew health? Risk of Therapeutic Failure Due to Ineffectiveness of Medication ; IRP Gap PH15: Are the antimicrobials carried onboard effective against microbes that exhibit spaceflight-related changes? References 1. C. A. Nickerson, C. M. Ott, J. W. Wilson, R. Ramamurthy, D. L. Pierson, Microbiol Mol Biol Rev 68, 345 (Jun, 2004). 2. K. J. Dickson, ASGSB Bulletin 4, 151 (1991). 3. J. A. Rosenzweig et al., Appl Microbiol Biotechnol, (Oct 22, 2009). 4. J. W. Wilson et al., Proc Natl Acad Sci U S A, (Sep 27, 2007). 5. J. W. Wilson et al., PLoS One 3, e3923 (2008). 6. A. Crabbe et al., Appl Environ Microbiol 77, 1221 (Feb, 2011). 7. R. Tixador et al., Aviat Space Environ Med 56, 748 (Aug, 1985). 8. M. A. Juergensmeyer, E. A. Juergensmeyer, J. A. Guikema, Microgravity Sci Technol 12, 41 (1999). 9. T. G. Hammond, J. M. Hammond, Am J Physiol Renal Physiol 281, F12 (2001). 10. C. A. Nickerson et al., J Microbiol Methods 54, 1 (Jul, 2003). 11. R. P. Schwartz, D. A. Wolf, T. T. Trinh. (1991). 12. D. M. Klaus, H. N. Howard, Trends Biotechnol 24, 131 (Mar, 2006).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2013.
Bibliography Type:	Description: (Last Updated: 11/01/2023)