Fiscal Year:	FY 2006	**Task Last Updated:**	FY 09/25/2008
PI Name:	Nickerson, Cheryl A Ph.D.		
Project Title:	Evaluation of Host-Pathogen Interactions During Exposure to Microgravity Analogues		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SHFH**:Space Human Factors & Habitability (archival in 2017)		
Human Research Program Risks:	(1) **Immune**:Risk of In Mission Impacts, Adverse Health Events or Long-Term Health Impacts due to Altered Immune Response (2) **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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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:**	2003 Biomedical Research & Countermeasures 03-OBPR-04
Start Date:	09/01/2006	**End Date:**	08/31/2009
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:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Sonnenfeld, Gerald (Binghamton University, State University of New York)		
Grant/Contract No.:	NNJ06HE92G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Changes that occur to both the host immune system and pathogenesis of microbes during spaceflight could represent a formidable challenge to the successful transition from short-to-long-duration spaceflight. This is a critical issue to address for several reasons, since a) in-flight infections could potentially pose serious risks to the health, safety, and performance of the flight crew, b) studies have indicated that spaceflight negatively impacts the immune system in both humans and animals, and c) culture of the ubiquitous human bacterial pathogen, Salmonella typhimurium, under conditions simulating aspects of spaceflight has been shown to increase the disease causing property of this organism. Microbiological risks associated with spaceflight are expected to increase with the length of mission duration. However, the effect(s) of microgravity on the risk of infectious disease events during spaceflight is not well characterized. In particular, no information is available regarding the ability of microgravity to alter the dynamics of the host-pathogen interaction which leads to infection. Moreover, the biological importance of the immunological changes induced by spaceflight with regard to resistance to infection remains to be established. A significant application of this research is that by investigating host susceptibility to infection when both the host and pathogen are exposed to microgravity analogues – we can identify mechanistic effects of spaceflight on host resistance to infection. Specifically, we will examine the effect of hindlimb unloading (HU) on the innate immunity, production of stress hormones, and susceptibility of mice to infection with Salmonella typhimurium cultured under conditions of modeled microgravity (MMG). Hindlimb unloading of rodents is one of the most commonly used ground-based models to simulate aspects of spaceflight on the immune system. In the HU model, rodents are suspended in a harness by the tail with no load bearing on the hindlimbs and with a head-down tilt (i.e. antiorthostatic). These conditions induce muscle and bone loss, a fluid shift to the head, and altered immune responses, which are similar to changes induced by spaceflight. In addition, we will use both male and female mice in many of the proposed studies to determine the effects of sex-differences on the course of infection and the immune response. The use of male and female mice in our studies may provide important insight into sex-specific differences in immunological responses to infection among astronauts. This project uses a unique ground-based model of infection wherein both the host and pathogen are exposed to microgravity analogues to investigate the mechanistic effect of spaceflight on host resistance to infection. By investigating the effect of HU on innate immunity, production of stress hormones, and susceptibility of both male and female mice to infection with S. typhimurium cultured under MMG, this study will be the first of its kind to investigate the mechanistic effects of microgravity analogues on both the host and pathogen in a sex-specific fashion. Published findings by both the PI and Co-PI demonstrate that a) hindlimb unloading in rodents can suppress host innate immune responses, change production of stress hormones, and alter resistance to infection and, b) MMG culture of S. typhimurium results in increased virulence, stress resistance, and global alterations in gene expression and physiology. Thus, we anticipate that results generated during the course of these studies will be instrumental to understanding the effect of spaceflight on host resistance to infection, and the risk of in-flight infectious disease. Moreover, these studies will provide a solid foundation for the development of vaccines and other novel countermeasures, which are not achievable by any other ground-based means, for the treatment and prevention of infectious diseases occurring during spaceflight and on Earth.
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 provide a solid foundation for the development of vaccines and other novel countermeasures, which are not achievable by any other ground-based means, for the treatment and prevention of infectious diseases occurring both on Earth and during spaceflight.
Task Progress:	New project for FY2006. This project is a continuation at Arizona State University of grant with same project title from May 2004-July 2006, while PI was at Tulane University; see that task for Task Progress during that time period.
Bibliography Type:	Description: (Last Updated: 07/02/2025)