Fiscal Year:	FY 2005	**Task Last Updated:**	FY 11/23/2004
PI Name:	Pierson, Duane L Ph.D.		
Project Title:	Flight-Induced Changes in Immune Defenses-DSO 498		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Operational and clinical research		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Immune**:Risk of In Mission Impacts, Adverse Health Events or Long-Term Health Impacts due to Altered Immune Response		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77058	**Congressional District:**	22
Comments:			
Project Type:	Flight	**Solicitation / Funding Source:**	96-OLMSA-01
Start Date:	04/01/1999	**End Date:**	04/01/2008
No. of Post Docs:	0	**No. of PhD Degrees:**	
No. of PhD Candidates:	0	**No. of Master' Degrees:**	
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
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Flight Program:	Pre/Post Flight		
Flight Assignment:	STS-96, 95, 93, 107 ISS In flight development phase (data collection has begun)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Kaur, Indreshpal (Enterprise Advisory Services Incorporated)		
Grant/Contract No.:	None		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Space flight may affect the delicate host-parasite relationship, thus increasing susceptibility to infectious disease. Changes in the human immune response during space flight suggest that the ability to meet infectious challenges may be attenuated. The early phases of the host response to infection depend on innate immunity in which a variety of innate resistance mechanisms recognize and respond to the presence of a pathogen. Innate immunity is present in all individuals at all times, does not increase with repeated exposure to a given pathogen, and does not discriminate between pathogens. Our hypothesis is: essential functions of neutrophils, monocytes, and natural killer (NK) cells will be altered during space flight. The constraints inherent in space flight (e.g., few subjects) mandated the use of ground-based models to supplement flight investigations. These models included a closed population in a closed environmental chamber and Antarctic expeditioners. These studies evaluated quantitative and functional data from important components of the immune response such as: neutrophils, monocytes, platelets, and natural killer cells. Our objectives are to determine the effects of space flight on: (1) neutrophil and monocyte functions such as phagocytosis, degranulation, oxidative burst capacity, and expression of surface molecules (including adhesion molecules), and (2) natural-killer cell and lymphokine-activated killer cell cytotoxicity against target cells, and cytokine production. Results from these studies provide essential data complementing other ongoing space immunology investigations. Realization of our specific aims will increase our understanding of the host-parasite relationship and the risk of infectious disease during space flight. To determine changes in the immune functions associated with space flight Astronauts live and work in a relatively crowded and stressful environment. Stresses integral to space flight, such as containment, isolation, space radiation, physical exertion, psychosocial interactions, anxiety, and sleep deprivation, can adversely affect astronaut health. Addition of microgravity to the list of stressors and one can see that space flight is a unique stress environment. Long duration exploration missions of the Moon and Mars require astronauts with fully functional and robust immune systems to reduce the development of infections and tumor cell. Successful completion of this investigation will result in a better understanding of the effects of space flight on an essential element of the human immune response. This will complete one more piece of the immunity puzzle in an effort to determine if long duration space flight results in adverse effects on the immune system. If medically significant changes occur, efforts to prevent or diminish adverse effects on the immune system will be investigated.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The reductions in neutrophil, monocyte, and NK-cell functions are most probably the result of stress associated with space flight. We believe that space flight is a unique stress model, and new insight into the physiological effects of stress will result from these immunological studies. Perhaps, the asymptomatic changes in immune function observed in these studies may be helpful in determining clinically relevant thresholds in the human immune response.
Task Progress:	Exploration class human spaceflight missions will require astronauts with robust immune systems. Innate immunity will be an essential element for the healthcare maintenance of astronauts during these lengthy expeditions. This study investigated neutrophil phagocytosis, oxidative burst and degranulation of 25 astronauts after 4 space shuttle missions and in 9 healthy control subjects. Space flight duration ranged from 5 to 11-d. Blood specimens were obtained 10-d before launch, immediately after landing, and 3-d after landing. The number of neutrophils increased by 85% at landing compared to preflight levels. The mean values for phagocytosis of Escherichia coli and oxidative burst capacity in neutrophils from astronauts on the 5-d mission were not significantly different from those observed in neutrophils from the control subjects. Before and after 9 to 11-d missions, however, phagocytosis and oxidative burst capacities were significantly lower than control mean values. No consistent changes in degranulation or expression of surface markers were observed before or after any of the space missions. This study indicates that neutrophil phagocytic and oxidative functions are affected factors associated with space flight and this relationship may depend on mission duration. .
Bibliography Type:	Description: (Last Updated: 03/24/2020)
Articles in Peer-reviewed Journals	Kaur I, Simons ER, Castro VA, Ott CM, Pierson DL. "Changes in monocyte functions of astronauts." Brain Behav Immun. 2005 Nov;19(6):547-54. PMID: 15908177 , Nov-2006
Presentation	Kaur, I., Simons, E.R., Fontenot, S.L., and Pierson, D.L. "Stresses of Spaceflight and the Response of Monocytes to LPS. " 11th Annual Meeting of the Psychoneuroimmunology Research Society. Titisee, Germany, May-2004