

<b>Fiscal Year:</b>	FY 2009	<b>Task Last Updated:</b>	FY 03/25/2009
<b>PI Name:</b>	Stowe, Raymond Ph.D.		
<b>Project Title:</b>	Space Flight-Induced Reactivation of Latent Epstein-Barr Virus		
<b>Division Name:</b>	Human Research		
<b>Program/Discipline:</b>	HUMAN RESEARCH		
<b>Program/Discipline--Element/Subdiscipline:</b>	HUMAN RESEARCH--Operational and clinical research		
<b>Joint Agency Name:</b>	<b>TechPort:</b>	No	
<b>Human Research Program Elements:</b>	(1) <b>HHC:</b> Human Health Countermeasures		
<b>Human Research Program Risks:</b>	(1) <b>Immune:</b> Risk of In Mission Impacts, Adverse Health Events or Long-Term Health Impacts due to Altered Immune Response		
<b>Space Biology Element:</b>	None		
<b>Space Biology Cross-Element Discipline:</b>	None		
<b>Space Biology Special Category:</b>	None		
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<b>Comments:</b>			
<b>Project Type:</b>	Flight	<b>Solicitation / Funding Source:</b>	98-HEDS-02
<b>Start Date:</b>	07/01/2004	<b>End Date:</b>	06/30/2010
<b>No. of Post Docs:</b>	<b>No. of PhD Degrees:</b>		
<b>No. of PhD Candidates:</b>	<b>No. of Master' Degrees:</b>		
<b>No. of Master's Candidates:</b>	<b>No. of Bachelor's Degrees:</b> 1		
<b>No. of Bachelor's Candidates:</b>	<b>Monitoring Center:</b> NASA JSC		
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<b>Flight Program:</b>	Shuttle/ISS		
<b>Flight Assignment:</b>	<p>STS-122, STS-123, STS-124, and STS-125  STS-108, -109, -110, -111, -113, -114; -116; -118;  ISS-5, -6</p> <p>In flight development phase (data collection has begun)</p> <p>NOTE: End date is 6/30/2010 per JSC information (2/2010)</p> <p>NOTE: End date changed to 1/22/2010 per J. Dardano/JSC (1/2009)</p>		
<b>Key Personnel Changes/Previous PI:</b>	Raymond Stowe replaced Alan Barrett as PI, effective July 2004 (per info from S. McCollum/M. Anderson, 12/2006). See also Barrett for FY02-04 information/reports.		
<b>COI Name (Institution):</b>	Pierson, Duane L ( NASA Johnson Space Center ) Sams, Clarence ( NASA-Johnson Space Center )		
<b>Grant/Contract No.:</b>	NNJ06HB73A		
<b>Performance Goal No.:</b>			

<b>Performance Goal Text:</b>	
<b>Task Description:</b>	<p>The majority of humans are infected with Epstein-Barr virus (EBV) early in life and thereafter carry the virus in a latent form. Reactivation of latent EBV may be an important threat to crew health during extended space missions. EBV is the causative agent of infectious mononucleosis as well as nasopharyngeal carcinoma, Burkitt's lymphoma, and different kinds of B-lymphocyte lymphomas in immunosuppressed individuals. Control of replication in vivo is mediated primarily by EBV-specific cytotoxic T-lymphocytes, and severe clinical symptoms have been associated with reactivation of latent viruses in patients with defective cellular immunity. Decreased cellular immune function has been reported both during and after space flight. Preliminary studies have demonstrated increased EBV shedding in saliva as well as increased antibody titers to EBV lytic proteins. Based on these observations, we hypothesize that the combined effects of microgravity along with associated physical and psychological stress will decrease EBV-specific T-cell immunity and reactivate latent EBV in infected B- lymphocytes. The specific aims to test this hypothesis are: (1) determine if antibody titers to EBV-specific antigens are increased after space flight; (2) determine T-lymphocyte immunocompetence using a EBV-specific autologous T-cell killing assay; (3) characterize the viral burden and gene expression in peripheral blood cells using PCR/RT-PCR; and (4) measure stress hormones in plasma and urine. To determine the mechanisms underlying altered virus-specific T cell immunity and reactivation of latent EBV in B lymphocytes.</p> <p>See also <a href="http://www.nasa.gov/">http://www.nasa.gov/</a></p>
<b>Rationale for HRP Directed Research:</b>	
<b>Research Impact/Earth Benefits:</b>	<p>This experiment will address fundamental questions on spaceflight and virus-specific immunity. One potential concern is the development of a virally associated disease or lymphoma within an infected individual. In addition, reinfection or transmission to a previously uninfected individual (resulting in primary infection) may be another concern. Thus, spaceflight may result in an increased frequency and/or severity of both primary and reactivated disease. If increased reactivation and clonal expansion of infected B- lymphocytes is detected, then pharmacological measures can be developed and instituted prior to onset of overt clinical disease.</p>
<b>Task Progress:</b>	<p>Since our last task progress report, we have collected samples from an additional 6 Shuttle and 2 ISS crewmembers. We are continuing to observe elevated cortisol levels at landing; the increase is typically more exaggerated for ISS crewmembers. Along with this are increased levels of epinephrine postflight. The typical stress-induced shifts in leukocytes (neutrophilia) and lymphocytes (lymphopenia, decreased NK cells), observed after spaceflight, are consistent with increased stress hormone levels. Many of the astronauts exhibited increased levels of EBV-specific CD8+ T-cells prior to flight, consistent with increased viral reactivation as determined by increased viral load and increased anti-EBV antibodies. In some astronauts, increased levels of IL-10 were observed indicating a Th1-Th2 shift in immunity. In addition, increased IL-6 (a proinflammatory cytokine) was observed in a few crewmembers.</p> <p>Overall, these results are consistent with prior missions and indicate that stress and spaceflight-associated changes (e.g., anticipation of launch, acute changes in g-forces, sleep deprivation, etc.) result in decreased cell-mediated immunity and reactivation of latent EBV. Furthermore, changes in immunity occur prior to launch, presumably due to anticipation of the mission. Therefore, employing interventions (stress reduction, exercise, etc.) in the months prior to launch would be an effective means to counter the effects of spaceflight on the immune system.</p>
<b>Bibliography Type:</b>	Description: (Last Updated: 03/07/2019)
<b>Articles in Peer-reviewed Journals</b>	<p>Crucian BE, Stowe RP, Pierson DL, Sams CF. "Immune system dysregulation following short- vs long-duration spaceflight." Aviat Space Environ Med. 2008 Sep;79(9):835-43. <a href="#">PMID: 18785351</a>, Sep-2008</p>