

Fiscal Year:	FY 2014	Task Last Updated:	FY 10/02/2013
PI Name:	Simpson, Richard Ph.D.		
Project Title:	Effects of Long-Term Exposure to Microgravity on Salivary Markers of Innate Immunity		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline-- Element/Subdiscipline:			
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	(1) HHC: Human Health Countermeasures		
Human Research Program Risks:	(1) Immune: Risk of Adverse Health Event Due to Altered Immune Response		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	rjsimpson@email.arizona.edu	Fax:	FY
PI Organization Type:	UNIVERSITY	Phone:	713-397-0121
Organization Name:	University of Arizona		
PI Address 1:	College of Agriculture and Life Sciences; College of Medicine		
PI Address 2:	1177 E. Fourth Street, Room 308, Shantz Building		
PI Web Page:			
City:	Tucson	State:	AZ
Zip Code:	85721-0001	Congressional District:	3
Comments:	NOTE: Formerly at University of Houston until September 2017 move to University of Arizona.		
Project Type:	FLIGHT	Solicitation / Funding Source:	2010 Crew Health NNJ10ZSA003N
Start Date:	11/03/2011	End Date:	11/02/2015
No. of Post Docs:	1	No. of PhD Degrees:	
No. of PhD Candidates:	3	No. of Master' Degrees:	
No. of Master's Candidates:	1	No. of Bachelor's Degrees:	2
No. of Bachelor's Candidates:	1	Monitoring Center:	NASA JSC
Contact Monitor:	Vos, Jessica	Contact Phone:	
Contact Email:	jessica.r.vos@nasa.gov		
Flight Program:	ISS		
Flight Assignment:	ISS Flight Definition phase NOTE: Gap Immune05 deleted per IRP Rev E (Ed., 3/24/14)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Clarke, Mark Ph.D. (University of Houston) Crucian, Brian Ph.D. (Wyle Laboratories, Inc.) Lowder, Thomas Ph.D. (University of Houston) O'Connor, Dan Ph.D. (University of Houston) Pierson, Duane Ph.D. (NASA Johnson Space Center) Spielmann, Guillaume Ph.D. (University of Houston)		
Grant/Contract No.:	NNX12AB48G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>Immune system dysregulation has been documented during and after spaceflight, but it is not known if these changes increase infection susceptibility or pose a significant health risk to crewmembers. Inherent problems with current in-flight research are small sample sizes and the difficulty to control for the many confounding factors that impact on the immune system. As such, it is not known if changes in immunity are due to the microgravity environment per se, or to the stressors associated with landing and re-adaptation to the 1G environment. The present project proposes a Flight Definition investigation, utilizing a longitudinal repeated measures design to determine the effects of long-term exposure to microgravity on a host of salivary antimicrobial proteins (AMPs) associated with innate host immune defense, whilst also considering the impact of other acute stressors such as launch, Soyuz landing, and EVA. Saliva samples will be collected from crewmembers selected for ISS mission and ground-based controls at bi-weekly intervals for 6 months prior to flight, during the 6-month period on the ISS, and for 1 month on return to Earth. Saliva sampling was selected because it is an excellent biological fluid with which to detect broad-spectrum biomarkers of front-line host immune defense and is suitable for the spaceflight environment. Attempts will also be made to establish relationships between AMPs and other stressors associated with spaceflight (i.e. mood state disturbances, circadian desynchronization, sleep loss/disruption, stress biomarkers) using serial data.</p> <p>Finally, blood samples will be collected before and after the mission to determine the impact of spaceflight on cellular aspects of innate immunity. Given the potential of salivary AMPs to serve as an indicator of weakened immunity during spaceflight, this project will serve as a foundation for future countermeasure developments and technological advances to detect real time changes during subsequent lunar or Mars missions.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>This project will improve our understanding on how acute and long-term stress impacts on multiple aspects of the immune system. These research findings will be useful to determine if any immune related health problems might exist in individuals exposed to stressful environments (i.e. soldiers, caregivers).</p>
Task Progress:	<p>The study was initiated in September 2012 and data collection started in March 2013. We continued to develop our assays for NK-cell function and the detection of viral specific T-cells. Our validation/feasibility work, using exercise as a stress analog, contributed to the publication of two peer-reviewed publications (Spielmann et al., 2013; LaVoy et al., 2013) with another in revision (Bigley et al. In Revision). NASA funding was acknowledged in all of these publications. CPHS approval for the study was renewed in July 2013.</p> <p>To date, 4 crewmembers and 2 backup crewmembers have agreed to participate in the study and have provided informed consent. Baseline blood, urine, and saliva samples have been collected from 4 crewmembers and 4 ground-based control subjects. All cellular blood products have been processed and analyzed. Saliva, urine, and blood plasma samples have been stored at -80°C until analysis.</p> <p>Archived plasma samples from 20 crewmembers that participated in the 'Integrated Immune' study were analyzed for a range of antimicrobial proteins. A scientific manuscript is currently being prepared with these data. We expect to submit the paper to a scientific journal by the end of the 2013 calendar year. Dr. Guillaume Spielmann presented the work at the International Society of Exercise Immunology (ISEI) meeting in Newcastle, Australia in poster form. For this work he was awarded the New Investigator prize for best presentation. He also presented work on the effects of latent viral infections, age, and acute stress on immune cell distribution. This work was supported by our validation experiments and Dr. Spielmann was also awarded the New Investigator prize for best oral presentation. It was first time in ISEI history that a single investigator was awarded both prizes.</p>
Bibliography Type:	Description: (Last Updated: 09/27/2023)
Abstracts for Journals and Proceedings	<p>Spielmann G, Crucian BE, Mehta SK, Kunz H, Pierson DL, Simpson RJ. "The impact of long duration spaceflight on plasma Antimicrobial Proteins." Presented at the International Society of Exercise Immunology Symposium, Newcastle, Australia, September 9-12, 2013.</p> <p>International Society of Exercise Immunology Symposium, Newcastle, Australia, September 9-12, 2013. International Journal of Exercise Science. , Sep-2013</p>
Abstracts for Journals and Proceedings	<p>Spielmann G, Bollard CM, Bigley AB, Hanley PJ, Blaney JW, Lavoy ECP, Pircher H, Simpson RJ. "CMV-specific T-cells mobilized with exercise have broad epitope specificity and a high-differentiated effector memory phenotype." Presented at the International Society of Exercise Immunology Symposium, Newcastle, Australia, September 9-12, 2013.</p> <p>International Society of Exercise Immunology Symposium, Newcastle, Australia, September 9-12, 2013. International Journal of Exercise Science , Sep-2013</p>
Articles in Peer-reviewed Journals	<p>Lavoy EC, Bigley AB, Spielmann G, Rector JL, Morrison MR, O'Connor DP, Simpson RJ. "CMV amplifies T-cell redeployment to acute exercise independently of HSV-1 serostatus." Medicine and Science in Sports and Exercise. 2014 Feb;46(2):257-67. http://dx.doi.org/10.1249/MSS.0b013e3182a5a0fb ; PubMed PMID: 23877375 (Originally reported as Epub ahead of print. July 19, 2013.) , Feb-2014</p>
Articles in Peer-reviewed Journals	<p>Spielmann G, Bollard CM, Bigley AB, Hanley PJ, Blaney JW, Lavoy EC, Pircher H, Simpson RJ. "The effects of age and latent cytomegalovirus infection on the redeployment of CD8+ T cell subsets in response to acute exercise in humans." Brain, Behavior and Immunity. 2014 Jul;39:142-51. Epub 2013 May 15. http://dx.doi.org/10.1016/j.bbi.2013.05.003 ; PubMed PMID: 23684819 (Originally reported as Epub ahead of print--May 15, 2013) , Jul-2014</p>
Articles in Peer-reviewed Journals	<p>Mehta SK, Crucian BE, Stowe RP, Simpson RJ, Ott CM, Sams CF, Pierson DL. "Reactivation of latent viruses is associated with increased plasma cytokines in astronauts." Cytokine. 2013 Jan;61(1):205-9. Epub 2012 Oct 26. http://dx.doi.org/10.1016/j.cyto.2012.09.019 ; PubMed PMID: 23107825 , Jan-2013</p>
Awards	<p>Spielmann G, Crucian BE, Mehta SK, Kunz H, Pierson DL, Simpson RJ. "Guillaume Spielmann wins New Investigator Award for best poster presentation: 'The impact of long duration spaceflight on plasma Antimicrobial Proteins' at the International Society for Exercise Immunology Symposium, Newcastle, Australia, September 2013." Sep-2013</p>

Awards	Spielmann G, Bollard CM, Bigley AB, Hanley PJ, Blaney JW, Lavoy EC, Pircher H, Simpson RJ. "Dr Spielmann wins the New Investigator Award for best oral presentation at the International Society of Exercise Immunology Symposium, Newcastle, Australia, September 2013: 'CMV-specific T-cells mobilized with exercise have broad epitope specificity and a high-differentiated effector memory phenotype.' " Sep-2013
Significant Media Coverage	RIA Novosti. "Simpson, R.J. Article entitled: 'Space weakens human immune system – study' in the Russian press features Dr. Simpson's work." RIA Novosti, April 2013. http://en.ria.ru/science/20130424/180828103.html , Apr-2013
Significant Media Coverage	Mulvaney E. "UH study aims to find out why astronauts get sick. Article on Dr. Simpson's flight experiment appears in the Houston Chronicle." Houston Chronicle, April 24, 2013. http://www.chron.com/default/article/UH-study-aims-to-find-out-why-astronauts-get-sick-4460457.php , Apr-2013
Significant Media Coverage	Ramirez M. "Student Martin Castaneda's PURS research project featured in UH moment: 'Undergraduate research (PURS)' . " University of Houston's online info, January 23, 2013. http://app1.kuhf.org/articles/1358944298-UH-Moment-Undergraduate-Research-PURS.html , Jan-2013