Fiscal Year:	FY 2012	**Task Last Updated:**	FY 05/28/2013
PI Name:	Sams, Clarence Ph.D.		
Project Title:	Consequences of Long-Term Confinement and Hypobaric Hypoxia on Immunity in the Antarctic Concordia Environment (CHOICE)		
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) **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		
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PI Organization Type:	NASA CENTER	**Phone:**	281-483-7160
Organization Name:	NASA Johnson Space Center		
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City:	Houston	**State:**	TX
Zip Code:	77058-3607	**Congressional District:**	22
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	Directed Research
Start Date:	10/01/2008	**End Date:**	09/30/2012
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Baumann, David	**Contact Phone:**	
Contact Email:	david.k.baumann@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date is 9/30/2012 per CoI and HRP Master Task List dtd 7/12/2011 (Ed., 8/8/2011)		
Key Personnel Changes/Previous PI:	Alexander Choukèr, Department of Anaesthesiology, Hospital of the Ludwig-Maximilians-University of Munich, Germany, is the European (ESA) PI. Clarence Sams is the U.S. PI. Dr. Duane Pierson, Dr. Satish Mehta, and Dr. Brian Crucian are NASA Co-Investigators.		
COI Name (Institution):	Chouker, Alexander (Co-PI: Hospital of the Ludwig-Maximilians-University, Munich, Germany) Baatout, Sarah (SCK-CEN, Belgium) Campolongo, Patricia (University of Rome “La Sapienza”, Italy) Crucian, Brian (NASA Johnson Space Center) Duchamp, Claude (Université Claude Bernard, Lyon, France) Gunga, Hanns-Christian (University of Berlin, Charité, Germany) Kaufmann, Ines (Ludwig-Maximilians-University of Munich, Germany) Kreth, Simone (Ludwig-Maximilians-University of Munich, Germany) Pierson, Duane (NASA Johnson Space Center) Praun, Siegfried (V&F Medical, Austria) Raccurt, Mireille (Université Claude Bernard, Lyon, France) Schachtner, Thomas (Ludwig-Maximilians-University of Munich, Germany) Schelling, Gustav (Ludwig-Maximilians-University of Munich, Germany)		

	Thiel, Manfred (Ludwig-Maximilians-University of Munich, Germany) Mehta, Satish (EASI, Houston, Texas)
Grant/Contract No.:	Directed Research
Performance Goal No.:	
Performance Goal Text:	
Task Description:	The vulnerability of totally isolated wintering groups in Antarctica is a concern alike of those needing major consideration when planning health care and health monitoring during long-term space flights, manned lunar exploration and potential future extraterrestrial settlement. The recently published medical statistics of Antarctic wintering-over teams in the last decades and new research reports indicate that the health and the immune system are affected under the conditions of confinement in the pole regions. Apart from the consequences of confinement on stress-dependent immune-modulation, hypobaric hypoxia may add to modulate immunity and potentially aggravate immune suppression. Therefore, this protocol seeks to investigate the consequences of long-term confinement in a space-analog deployment and hypobaric hypoxia using the opportunity of research on the CONCORDIA station. To delineate the consequences of confinement from hypoxia, this study is designed to allow for comparison of results of several earth-bound (e.g. Antarctic Georg Neumayer Station) and space-flight control groups in former and ongoing scientific studies. NASA participation in this study consisted of monitoring immune system dysregulation, virus specific immunity and latent viral reactivation. This panel of assays, by design, was similar to those used to monitor astronauts who participated in the Integrated Immune in-flight study. This homology allowed a direct flight data to ground data comparison, to facilitate validation of Concordia as a ground-based spaceflight analog for immune dysregulation. Crews deployed to winter-over at the Concordia Station (Dome C, Antarctica) during the 2009 and 2010 seasons were subjects for this study. Typical winter-over is a 1 year deployment. Blood, saliva and urine samples were collected for analysis at Concordia Station within the first few weeks of deployment, and within a few weeks before departure. Other overwinter samples were planned to be minimal, primarily collection and freezing of blood and saliva samples. Availability of a flow cytometer at Concordia Station allowed additional mid-winter samples to be collected and added to the data set, allowing a complete profile of the overwinter period to be determined. Mission data was compared to pre-mission baseline, and post-mission recovery data, both collected in Germany. A subsequent smaller-scope Phase II study is ongoing examine a subset of parameters at a coastal Antarctic station (Neumayer III, Germany), to control for the effects of hypoxia.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This study has assessed immune system, stress, and viral reactivation alterations in a high-fidelity ground-based spaceflight analog. Missions consist of Antarctic winterover, a 1 year deployment consisting of extreme temperatures, risk, stress, isolation, and disrupted circadian rhythms. These data should be applicable to other similar terrestrial situations, such as undersea naval missions or government/scientific deployment to extreme environment stations. Thus, the monitoring strategy developed by this study, and any future countermeasures development, should have terrestrial benefit for these analogous situations.
Task Progress:	It was recently established that immune dysregulation occurs during spaceflight (Crucian 2012 JCI) and persists for the duration of a 6 month ISS mission (Crucian et al., and Mehta et al., NASA HRP Workshop, February 2013). During exploration class space missions, immune dysregulation may pose a unique clinical health risk to astronauts. A validated ground analog for this in-flight phenomenon would have utility for basic research and possible countermeasures evaluation. It has been speculated that Antarctica winterover may be a potential analog for in-flight immune dysregulation. Among all Antarctica bases, it is thought that Concordia Station might serve as the closest analog to exploration class deep space missions. This is due to the extremely harsh environment in the Antarctic interior (much worse than coastal stations), and the spaceflight-similar environment/lifestyle experienced at Concordia Station (referring to both interior station lifestyle and the exterior EVA conditions). The intent of this study was to assess immunity, viral reactivation, stress and adverse clinical outcomes during Antarctica winterover at Concordia Station. These parameters have been shown to be significantly altered during spaceflight (HRP reference). The battery of assays was similar to those used for the Integrated Immune flight study, to therefore allow a straightforward comparison of in-flight and overwinter data. Due to fortuitous scheduling, the flight and ground studies actually operated in parallel. Integrated Immune ISS astronauts were actually able to hold teleconferences with winterover participants at Concordia Station. Following study completion and full sample analysis, the data showed that immune system changes did manifest during the overwinter period at Concordia Station. These changes consisted of alterations in the distribution of the peripheral blood immune cells, alterations in the plasma concentration of various cytokines (proteins that regulate immunity), alterations in T cell function. Parallel with the alterations in immunity, the consistent reactivation of latent herpesviruses was observed, as was alterations in various stress hormones. The circadian rhythm of the overwinter participants also appeared to be misaligned. An increase in constitutively activated T cells is thought to correlate with in-vivo immune activation or illness. During winterover, an increase in activated T cells was observed only during early deployment, which correlated with clinical incidence data showing at least three periods of endemic clinical illness. These overall clinical findings correlate perfectly with the elevation in constitutively activated T cells for the CHOICE subjects. NASA study data was presented at the NASA HRP Investigators' Workshop, February 2012 and February 2013. Joint NASA-ESA investigator meetings were held in early 2013 to review all participant data (both NASA and ESA), and a publication strategy was planned for this data set. References B. E. Crucian, S. Mehta, R. P. Stowe, P. Uchakin, H. Quiriarte, D. Pierson, C. F. Sams. Immune System Dysregulation Persists During Long-Duration Spaceflight. 2013 Human Research Program Investigators Workshop, Galveston, Texas, February 11-14, 2013. S. K. Mehta, B. E. Crucian, R. P. Stowe, C. Sams, V. A. Castro, C. M. Ott, and D. L. Pierson. Viral reactivation in the International Space Station Crew. 2013 Human Research Program Investigators Workshop, Galveston, Texas, February

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Bibliography Type:	Description: (Last Updated: 06/29/2023)
Abstracts for Journals and Proceedings	Crucian BE, Mehta S, Stowe RP, Uchakin P, Quiriarte H, Pierson D, Sams CF. "Immune System Dysregulation Persists During Long-Duration Spaceflight." 2013 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-14, 2013. 2013 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-14, 2013. , Feb-2013
Abstracts for Journals and Proceedings	Mehta S, Crucian BE, Stowe RP, Sams CF, Castro VA, Ott CM, Pierson D. "Viral reactivation in the International Space Station Crew." 2013 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-14, 2013. 2013 NASA Human Research Program Investigators' Workshop, Galveston, TX, February 12-14, 2013. , Feb-2013
Articles in Peer-reviewed Journals	Feuerecker M, Crucian B, Salam AP, Rybka A, Kaufmann I, Moreels M, Quintens R, Schelling G, Thiel M, Baatout S, Sams C, Choukèr A. "Early adaption to the Antarctic environment at dome C: consequences on stress-sensitive innate immune functions." High Alt Med Biol. 2014 Sep;15(3):341-8. Epub 2014 Aug 6. https://doi.org/10.1089/ham.2013.1128 ; PubMed PMID: 25099674 , Sep-2014
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