Fiscal Year:	FY 2016	**Task Last Updated:**	FY 05/03/2016
PI Name:	Smith, Scott M Ph.D.		
Project Title:	Space Biochemistry Profile		
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) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) **Food and Nutrition**:Risk of Performance Decrement and Crew Illness Due to Inadequate Food and Nutrition (3) **Immune**:Risk of Adverse Health Event Due to Altered Immune Response (4) **Nutrition**:Risk of Inadequate Nutrition (5) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight (6) **Renal Stone**:Risk of Renal Stone Formation		
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:**	281-483-7204
Organization Name:	NASA Johnson Space Center		
PI Address 1:	Biomedical Research and Environmental Sciences Division/SK3		
PI Address 2:	2101 NASA Pkwy		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058-3607	**Congressional District:**	36
Comments:			
Project Type:	FLIGHT	**Solicitation / Funding Source:**	2012 Crew Health NNJ12ZSA002N
Start Date:	08/01/2013	**End Date:**	07/31/2020
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:	Norsk, Peter	**Contact Phone:**	
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Zwart, Sara (Universities Space Research Association) Heer, Martina (University of Bonn)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	As long-duration spaceflights continue and the operational suite of countermeasures is modified, the food system is updated, and the duration of missions lengthens, it will be important to evaluate and monitor a broad set of biomarkers for key physiological systems. The Nutritional Status Assessment Supplemental Medical Objective (aka “Nutrition SMO”) was initiated in 2006, and has yielded significant clinical, operational, and research data. This proposal aims to extend the Nutrition SMO, under the guidelines provided in the NRA (NASA Research Announcement). Nutrition SMO data have been used to help identify or explain medical, scientific, and even engineering issues that have occurred during or after International Space Station (ISS) missions. The data have been used by Medical Operations on multiple occasions, to confirm the effectiveness of vitamin D supplementation, to test for nutrient toxicities (secondary to supplement use), to evaluate blood and urine chemistries after instances of kidney stones and gout symptoms in crewmembers, and to evaluate the effects of using a new exercise device on bone and calcium metabolism. The ISS Program Office has used these data to determine factors contributing to the Urine Processor Assembly failure and to make forward operational decisions. Perhaps most striking, the data provided evidence that one-carbon metabolism may be altered in crewmembers who experienced vision changes post flight, the highest Human Research Program risk. The relationship between nutritional status and 1-carbon metabolism would likely never have been discovered if the Nutrition SMO were not being conducted. The impact of the data collected to date provides a strong rationale for continuing with an updated version of this protocol, eliminating some tests while expanding others, to provide a repository of data to other scientific Disciplines. We have extensive experience with these types of analyses, sample and data management, transfer to data archives, and data reduction for medical, management, and research purposes.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The findings from this study will help us better understand physiological adaptation to spaceflight, and will help evaluate countermeasure effectiveness. These results will also inform the general, medical, and scientific communities on human health and physiological issues in an altered gravity environment. There could be significant potential implications of these findings.
Task Progress:	Sample collection protocols have been well executed on orbit, with subjects completing pre-, in-, and postflight data collections. On orbit time constraints have led to some missing sessions. Sample returns commenced on SpaceX-3. With SpaceX’s return to flight in 2016, we anxiously await the first sample return in more than a year.
Bibliography Type:	Description: (Last Updated: 05/24/2023)
Articles in Peer-reviewed Journals	Smith SM, Heer M, Shackelford LC, Sibonga JD, Spatz J, Pietrzyk RA, Hudson EK, Zwart SR. "Bone metabolism and renal stone risk during International Space Station missions." Bone. 2015 Dec;81:712-20. Epub 2015 Oct 8. https://doi.org/10.1016/j.bone.2015.10.002 ; PubMed PMID: 26456109 , Dec-2015