Fiscal Year:	FY 2022	Task Last Updated:	FY 03/08/2022
PI Name:	Zhang, Quan Ph.D.		
Project Title:	Characterizing the Baselines of Sleep Quality, Cognitive / Operational Performance, Immune Function, and Intracranial Fluids for Deep Space Expeditions		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline Element/Subdiscipline:			
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	(1) HFBP:Human Factors & Behaviora	al Performance (IRP Rev	vH)
Human Research Program Risks:	(1) BMed:Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	<u>qzhang@nmr.mgh.harvard.edu</u>	Fax:	FY
PI Organization Type:	UNIVERSITY	Phone:	617-724-9608
Organization Name:	Massachusetts General Hospital		
PI Address 1:	Harvard Medical School, Biomedical Engineering Lab		
PI Address 2:	13th Street Building 149, Rm 2651		
PI Web Page:			
City:	Charlestown	State:	MA
Zip Code:	02129-2020	Congressional District:	7
Comments:			
Project Type:	Flight	Solicitation / Funding Source:	2017-2018 HERO 80JSC017N0001-BPBA Topics in Biological, Physiological, and Behavioral Adaptations to Spaceflight. Appendix C
Start Date:	04/22/2019	End Date:	05/31/2026
No. of Post Docs:	0	No. of PhD Degrees:	0
No. of PhD Candidates:	1	No. of Master' Degrees:	0
No. of Master's Candidates:	3	No. of Bachelor's Degrees:	7
No. of Bachelor's Candidates:	10	Monitoring Center:	NASA JSC
Contact Monitor:	Whitmire, Alexandra	<b>Contact Phone:</b>	
Contact Email:	alexandra.m.whitmire@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 05/31/2026 per NSSC information (Ed., 2/3/2020) NOTE: End date changed to 9/30/2020 per NSSC information (Ed., 2/3/2020)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	<ul> <li>Kimberly, William M.D., Ph.D. (Massachusetts General Hospital)</li> <li>Vujovic, Nina Ph.D. (Brigham And Women's Hospital, Inc.)</li> <li>Spielmann, Guillaume Ph.D. (Louisiana State University and A&amp;M College)</li> <li>Strangman, Gary Ph.D. (Massachusetts General Hospital)</li> <li>Ivkovic, Vladimir Ph.D., Sc.D. (Massachusetts General Hospital)</li> </ul>		
Grant/Contract No.:	80NSSC19K0925		
Performance Goal No.:			

Performance Goal Text:

Task Description:	Sleep is a central physiological regulator of cognitive / behavioral, neurophysiological, and immune functions. The study of sleep quality and duration on orbit may thus yield important insights into etiology and mechanisms of adverse cognitive/behavioral, Spaceflight Associated Neuro-ocular Syndrome (SANS), and immunological responses during long duration deep space exploration missions. We will investigate these relationships via an integrated approach combining assessments of (1) sleep duration and quality, (2) cognitive performance, and (3) immunological response. We will collect data on crewmembers participating in integrated one-year mission project (CIPHER), including flyers on short-duration (<3 months), nominal-duration (~6 months) and long-duration (~12 months) missions aboard the International Space Station (ISS). We also plan to study demographically matched control subjects in Earth-based analogs (e.g., the Human Exploration Research Analog, or HERA) during missions of similar duration. Our specific aims are: (SA1) Characterize behavioral performance changes during the integrated 1 Year Mission Project (1YMP) on the ISS; (SA2) Characterize the relationship between sleep duration and quality on cerebral physiology on the ISS. and (SA4) Characterize the relationship between sleep duration and quality on immune response on the ISS. The outcomes of the study will contribute to quantification of crew health and performance risks associated with human spaceflight, and aid in development of technologies for monitoring and mitigating crew health and performance.		
Rationale for HRP Directed Research:			
Research Impact/Earth Benefits:	Successful completion of this project will be a milestone in spaceflight behavioral, neurophysiological, and immune investigation. It will be the largest study of operational performance in space, and would be the first to conduct in-flight resting-state and task-related functional brain imaging. In addition, it will be the first study to probe the relationships and interactions between behavioral, neurophysiological, and immune functioning. The use of three different length missions will further enable us to extrapolate any effects towards longer missions. The findings will be important on Earth as well, by helping to better understand the complex inter-relationships between sleep, brain physiology, immune function, and cognitive performance.		
Task Progress:	PROJECT OVERVIEW Sleep is a central physiological regulator of cognitive / behavioral, neurophysiological, and immune functions. The study of sleep quality and duration on orbit may thus yield important insights into etiology and mechanisms of adverse cognitive/behavioral, Spaceflight Associated Neuro-ocular Syndrome (SANS), and immunological responses during long duration deep space exploration missions. We will investigate these relationships via an integrated approach combining assessments of (1) sleep duration and quality, (2) cognitive performance, and (3) immunological response. We will collect data on crewmembers participating in the integrated one-year mission project (CIPHER), including flyers on short-duration (<3 months), nominal-duration (~6 months) and long-duration (-12 months) missions aboard the International Space Station (ISS). We also plan to study demographically matched control subjects in Earth-based analogs (e.g., the Human Exploration Research Analog/HERA) during missions of similar duration. Our specific aims are: (SA1) Characterize behavioral performance changes during the integrated one-year mission project (CYPHER) in the SS; (SA2) Characterize the relationship between sleep duration and quality on cerebral physiology on the ISS. and (SA4) Characterize the relationship between sleep duration and quality on immune response on the ISS. The outcomes of the study will contribute to quantification of crew health and performance risks associated with human spaceflight, and aid in development of technologies for monitoring and mitggating crew health and performance. [Ed. Note: CIPHER is the short title for a set of 14 studies sponsored by NASA and international partner agencies ( <a mef="https://www.nasa.gov/feature/experiments-to-unlock-how-human-bodies-react-lo-long-space-journeys" target="&gt;statistic studies&lt;/a&gt; sponsored by NASA and international partner agencies ( &lt;a target=&gt; blank">https://statistic.gov/statistic.gov/statistic.gov/statistic.gov/statistic.gov/statistic.gov/statistic.gov</a>		
Bibliography Type:	Description: (Last Updated: 04/12/2022)		
Abstracts for Journals and Proceedings	Zhang Q, Ivkovic V, Spielmann G, Kimberly WT, Vujovic N, Strangman GE. "NINSCAN: Characterizing the baselines of sleep quality, cognitive/operational performance, immune function, and intracranial fluids for deep space expeditions." 2022 NASA Human Research Program Investigators' Workshop, Virtual, February 7-10, 2022. Abstracts. 2022 NASA Human Research Program Investigators' Workshop, Virtual, February 7-10, 2022. , Feb-2022		

Abstracts for Journals and Proceedings Ivkovic V, Peters D, Schenkel M, White BM, Cumani J, Zhang Q, Spielmann G, Strangman GE. "CIPHER-NINSCAN-PNI: Quantifying facial deformation in HUT/HDT for assessing psychoneuroimmunological contribution to risks of adverse cognitive/behavioral conditions in spaceflight." 2022 NASA Human Research Program Investigators' Workshop, Virtual, February 7-10, 2022. Abstracts. 2022 NASA Human Research Program Investigators' Workshop, Virtual, February 7-10, 2022.