Fiscal Year:	FY 2021	**Task Last Updated:**	FY 09/08/2021
PI Name:	Bershad, Eric M. M.D.		
Project Title:	SPACE-CENT: Studying the Physiological and Anatomical Cerebral Effects of CENTrifugation and Head Down Tilt Bed Rest		
Division Name:	Human Research		
Program/Discipline:			
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) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS) (2) **Sensorimotor**:Risk of Altered Sensorimotor/Vestibular Function Impacting Critical Mission Tasks		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	bershad@bcm.edu	**Fax:**	FY 713-798-3091
PI Organization Type:	UNIVERSITY	**Phone:**	713-504-0223
Organization Name:	Baylor College of Medicine		
PI Address 1:	Department of Neurology, 1 Baylor Plaza		
PI Address 2:	Section of Vascular Neurology and Neurocritical Care		
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77030-3411	**Congressional District:**	9
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2015-16 HERO NNJ15ZSA001N-AGBR. Appendix G: Physiological & Behavioral Responses in Humans to Intermittent Artificial Gravity during Bed Rest
Start Date:	01/09/2017	**End Date:**	07/31/2021
No. of Post Docs:	1	**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:	Stenger, Michael	**Contact Phone:**	281-483-1311
Contact Email:	michael.b.stenger@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: Extended to 7/31/2021 per L. Barnes-Moten/JSC and NSSC information (Ed., 3/18/21) NOTE: Extended to 3/31/2021 per D. Risin/JSC and NSSC information (Ed., 8/26/20) NOTE: Extended to 9/30/2020 per NSSC information (Ed., 10/18/19)		
Key Personnel Changes/Previous PI:	November 2019 update: Bryn A. Martin, Ph.D., Associate Professor of Biological Engineering at University of Idaho, added to team. He will apply automated imaging to analysis structural changes of the globe in MRI imaging acquired in our study. This quantitative data will be useful to determine whether the artificial gravity protects the eye from structural changes from the 60 days of 6 degree head down tilt exposure.		

COI Name (Institution):	Clark, Jonathan M.D. (Baylor College of Medicine) Cohen, Helen Ed.D. (Baylor College of Medicine) Kramer, Larry M.D. (University of Texas, Houston) Marshall-Goebel, Karina Ph.D. (KBR/NASA Johnson Space Center) Rittweger, Joern M.D. (Deutsches Zentrum Fuer Luft- Und Raumfahrt E.V.) Sangi-Haghpeykar, Haleh Ph.D. (Baylor College of Medicine) Stern, Claudia M.D. (German Aerospace Cente (DLR)) Strangman, Gary Ph.D. (Massachusetts General Hospital) Venkatasubba Rao, Chethan M.D. (Baylor College of Medicine) Damani, Rahul M.D. (Baylor College of Medicine) Laurie, Steven Ph.D. (KBR/NASA Johnson Space Center) Martin, Bryn Ph.D. (University of Idaho)
Grant/Contract No.:	NNX17AE04G
Performance Goal No.:	
Performance Goal Text:	
Task Description:	This project will assess the physiological and anatomical effects of two different regimens of intermittent centrifugation induced artificial gravity (AG) with focus on the brain, eye, and vestibular system responses. The specific aims include: 1. Integrative evaluation of the cerebral physiological effects of AG during the 60 day bed rest period using between group and within group comparisons, and 2. Assessment of the acute dynamic changes in the human body systems related to the centrifugation regimen. The methods and techniques used to achieve these objectives include: non-invasive assessment of ICP (intracranial pressure), cerebral blood flow, cerebral blood volume, CSF (cerebrospinal fluid) flow and volumes, ocular anatomy and physiology, and neurovestibular function. This proposal will deliver an integrated view of the physiological, anatomical, and functional effects of intermittent centrifugation (artificial gravity) on the cerebrovascular, oculoarm, and vestibular systems. This will provide important insights into the effectiveness of this form of artificial gravity to counteract the headward fluid shifting of head down tilt, which may yield important knowledge about the future utility of this method as a countermeasure for the spaceflight-induced headward fluid shifts and the Spaceflight Associated Neuro-ocular Syndrome (SANS).
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This project will implement a wide array of non-invasive monitoring technologies for the brain, vascular system, eye, and sensorimotor system. Some of these technologies are commercially available for Earth based medicine in a variety of health care settings including the intensive care unit, emergency room, and may be implementable in rural and/or remote settings, and could be monitored by clinicians via telemedicine.
Task Progress:	The following key tasks were accomplished in 2020-2021: 1) Completion of subject enrollment and procedures. 24 of 24 total subjects were enrolled with successful completion of all study procedures 2) Data analysis completed for the eye measures including: - Optical coherence tomography based total retinal nerve fiber layer thickness; - Optical biometry; - Intraocular pressure; - Chorioretinal folds and thickness; - Refractive error; - Automated perimetry derived axial length; - Posterior globe flattening; - Eye movement measurements 3. Data analysis completed for the following brain measures: - Near infrared spectroscopy derived cerebral blood volumes, arterial blood pulsatility - MRI structural measures including lateral ventricular volumes, total brain volume - MRI flow measures included CSF flow, cerebral arterial flow - Transcranial doppler derived cerebral blood flow velocities and cerebral autoregulation - cFLOW cerebral blood flow index - Internal jugular vein cross sectional areas. Several manuscripts are under preparation for posterior globe deformation, near infrared spectroscopy, internal jugular vein area, transcranial Doppler blood flow, and MRI brain.
Bibliography Type:	Description: (Last Updated: 11/05/2023)
Articles in Peer-reviewed Journals	Laurie SS, Greenwald SH, Marshall-Goebel K, Pardon LP, Gupta A, Lee SMC, Stern C, Sangi-Haghpeykar H, Macias BR, Bershad EM. "Optic disc edema and chorioretinal folds develop during strict 6° head-down tilt bed rest with or without artificial gravity." Physiol Rep. 2021 Aug 6;9(15):e14977. https://doi.org/10.14814/phy2.14977 ; PMID: 34355874; PMCID: PMC8343460 , Aug-2021
Articles in Peer-reviewed Journals	Sater SH, Conley Natividad G, Seiner AJ, Fu AQ, Shrestha D, Bershad EM, Marshall-Goebel K, Laurie SS, Macias BR, Martin BA. "MRI-based quantification of posterior ocular globe flattening during 60 days of strict 6° head-down tilt bed rest with and without daily centrifugation." J Appl Physiol (1985). 2022 Dec 1;133(6):1349-55. https://doi.org/10.1152/japplphysiol.00082.2022 ; PMID: 36326472; PMCID: PMC9744655 , Dec-2022