Fiscal Year:	FY 2021	Task Last Updated:	FY 02/02/2021
PI Name:	Levine, Benjamin D M.D.	×	
Project Title:	Coronary Anatomy and Physiology During 1 Year in Space		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline Element/Subdiscipline:			
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	(1) HHC:Human Health Countermeasures		
Human Research Program Risks:	(1) <b>Cardiovascular</b> : Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	benjaminlevine@texashealth.org	Fax:	FY 214 345-4618
PI Organization Type:	UNIVERSITY	Phone:	214-345-4619
Organization Name:	The University of Texas Southwestern Medical Center at Dallas		
PI Address 1:	Institute for Exercise and Environmental Medicine (IEEM)		
PI Address 2:	7232 Greenville Ave, Suite 435		
PI Web Page:			
City:	Dallas	State:	TX
Zip Code:	75231-5129	Congressional District:	5
Comments:			
Project Type:	Flight	Solicitation / Funding Source:	2019 HERO 80JSC018N0001-HHCHFBP: Human Health Countermeasures, Human Factors, Behavioral Performance. Appendix D
Start Date:	04/20/2020	End Date:	04/19/2034
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:	Brocato, Becky	<b>Contact Phone:</b>	
Contact Email:	becky.brocato@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date is now 4/19/2034 per HHC element	ent and NSSC information	on (Ed., 6/21/21)
Key Personnel Changes/Previous PI:	PI Benjamin D. Levine, MD ; CoI Michael W. Bungo, MD ; CoI Jonathan R. Lindner, MD [Note Linda Loerch is no longer CoI]		
COI Name (Institution):	Bungo, Michael M.D. (University of Texas Health Science Center at Houston) Lindner, Jonathan R. M.D. (Oregon Health & Science University)		
Grant/Contract No.:	80NSSC20K0987		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Since the majority of experienced astronauts are middle aged, they are at risk for developing serious cardiovascular events such as a myocardial infarction or sudden cardiac death, especially during high intensity exertion. Studies led to the current flight medicine practice of screening all astronaut candidates (and following all active crew members) with coronary artery calcium (CAC) scoring. However, atherosclerosis is a progressive process. The development of vascular calcification may be preceded by substantial non-calcified plaque, which may be most prone to rupture and cause an acute coronary syndrome. Radiation and inflammation may exacerbate this natural history. Coronary atherosclerosis impairs coronary endothelial function which can then both initiate and stimulate progression of atherosclerosis. Recent flight studies have suggested that non-coronary vascular beds may stiffen with reduced vascular reserve during 6-month International Space Station (ISS) missions, and ground-based studies have identified the surprising capacity for coronary atherosclerosis to evolve rapidly under extreme stress. In addition, the Principal Investigator (PI) team recently completed the Integrated CardioVascular (ICV) study that demonstrated: a) although cardiac arrhythmias did not increase in space in most astronauts, unexpectedly, left atrial (LA) size increased out of proportion to the changes in left ventricular (LV) size; and b) there was a subset of crew (1/13 or 8%) who had substantial increases in both ventricular and atrial arrhythmias. These data raise the specter of increased risk for atrial fibrillation (AF), the most common arrhythmia in the US which occurs a decade earlier in astronauts than in the general population. We speculate that the combination of spaceflight plus exercise countermeasures could magnify LA dilation and lead to AF during a 2-3 yr Mars mission. AF in astronauts is a particular concern with prolonged spaceflight because of limited access to care and the risk of impaired exercise performa	
Rationale for HRP Directed Research:		
Research Impact/Earth Benefits:	Learning more about the natural progression of atherosclerosis in the spaceflight environment may have "spin-off" benefits for characterizing these processes in terrestrial populations. In addition, out exploratory aim in this project is to determine if a blood biomarker panel might be predictive of alterations in the atherosclerotic process. Should this prove useful, the direct benefit to clinical care on Earth would be significant.	
Task Progress:	It is anticipated that the results of this study will provide foundational data for exploration class missions to improve "personalized" risk assessment through high resolution multimodality phenotyping of cardiovascular structure and function. The study aims directly address Gaps CVD-101 (To determine whether long-duration weightlessness induces cardiovascular structural and functional changes and/or oxidative stress & damage (OSaD)/inflammation, that can contribute to development of disease)) and CVD-102 (To determine whether space radiation induces cardiovascular structural and functional changes and/or oxidative stress & damage (OSaD)/inflammation, that can contribute to development of disease)). At this point in time we have completed the first year of definition phase and are awaiting flight assignment to begin data collection. It is anticipated that baseline data collection will occur during 2021 with the first participating +flight crewmembers launching circa January 2022.	
Bibliography Type:	Description: (Last Updated: 05/20/2025)	
Articles in Peer-reviewed Journals	Wu MD, Hodovan J, Kumar K, Moulton B, Olson S, Gilbert A, Wood MD, Lindner JR. "Ponatinib coronary microangiopathy: Novel bedside diagnostic approach and management with N-acetylcysteine." Blood Adv. 2020 Sep 8;4(17):4083-5. <u>https://doi.org/10.1182/bloodadvances.2020002644</u> ; <u>PMID: 32870969</u> ; <u>PMCID: PMC7479961</u> , Sep-2020	
Articles in Peer-reviewed Journals	Lindner JR. "Limb perfusion imaging in peripheral artery disease." JACC Cardiovasc Imaging. 2020 Nov 13:S1936-878X(20)30921-9. Editorial Available online 18 November 2020. <u>https://doi.org/10.1016/j.jcmg.2020.10.011</u> ; <u>PMID: 33221233</u> , Nov-2020	