Fiscal Year:	FY 2016	**Task Last Updated:**	FY 09/30/2016
PI Name:	Ade, Carl Ph.D.		
Project Title:	Omics and Biochemical Markers of Cardiovascular and Bone Health: Relationship with Bedrest and Standard Physiological Measures		
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) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes (3) **Muscle**:Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance (4) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:	NOTE: formerly at the University of Oklahoma until fall 2016		
Project Type:	GROUND	**Solicitation / Funding Source:**	2014-15 HERO NNJ14ZSA001N-MIXEDTOPICS. Appendix E: Behavioral Health & Human Health Countermeasures Topics
Start Date:	08/24/2016	**End Date:**	08/23/2018
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
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Bemben, Debra Ph.D. (University of Oklahoma, Norman)		
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Task Description:	The long-range goal of our research effort is to identify and characterize the omics and biochemical mechanisms which underlie the changes in cardiovascular and musculoskeletal function following prolonged space flight. It is well established that microgravity elicits central and peripheral decrements within the cardiovascular system. Traditional cardiovascular measurements have demonstrated significant decreases in left ventricular volume and mass within only a few weeks of exposure. Similarly, human and animal models suggest that microgravity exposure significantly alters vasomotor reactivity to various physiologic stressors. However, despite the recognition that cardiovascular function is decreased with prolonged microgravity exposure, the mechanistic underpinnings of these changes are not completely understood. In addition to changes within the cardiovascular system, significant decreases in bone health occur with prolonged microgravity. These changes are mediated, in part, due to general deconditioning and muscular/mechanical unloading that occurs with microgravity. As such, the average monthly rate of loss in areal bone mineral density can reach 1.0-1.5% when measured over a 14 month period. Given the significant and time-dependent changes in cardiovascular function and bone health associated with microgravity exposure, a continued evaluation of these systems is required, particularly within the genomic and biochemical sciences. Using genomic techniques and biochemical markers combined with traditional physiologic parameters provides the opportunity to investigate the mechanisms by which the body responds to the microgravity environment coupled with the identification of new ‘space flight biomarkers’ for early detection of any decrements in cardiovascular and bone health. In the present plan we propose to test the working hypotheses that 30 day six-degree head-down bed rest at an ambient 0.5% CO2, to simulate International Space Station (ISS) Flight will 1) induce endothelial cell activation and apoptosis, as indicated by increases in concentrations of CD62E+ and CD31+/CD42b-, respectively, 2) decrease ventricular mass, volume, and function and that a marker of myocardial injury will be increased (c-miRNA-208) and a marker associated with myocardial mass will be decreased (c-miRNA-1), 3) decrease c-miRNAs associated with anti-angiogenesis, anti-inflammation, and anti-proliferation functions (c-miRNA-126, c-miRNA-146a, c-miRNA-20a, and c-miRNA-133a) and that these will also serve as markers of the expected decrease in aerobic exercise capacity, 4) will induce bone turnover and resorption, as indicated by increases in serum concentrations of Sclerostin and TRAP5b, 5) will upregulate c-miRNA (c-miRNA-21, c-miRNA-100, and c-miRNA-125b) involved in the regulation of bone turnover, and 6) serum concentrations of Sclerostin, TRAP5b, and c-miRNA will be significantly related to dual-energy X-ray absorptiometry (DXA) derived measurements of bone mineral density. To test these hypotheses we will obtain blood, plasma, and serum samples from an already planned 30 day six-degree head-down bed rest platform that will be conducted at the :envihab bed rest facility located at the Institute for Aerospace Medicine in Cologne Germany per the NASA research announcement. The findings from this investigation will establish new biomarkers that can be used to evaluate astronaut health while simultaneously providing novel insight into the cellular and genetic regulation of the myriad responses that accompany the physiological manifestation of space flight deconditioning.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2016.
Bibliography Type:	Description: (Last Updated: 03/12/2021)