Fiscal Year:	FY 2019	**Task Last Updated:**	FY 03/29/2019
PI Name:	Zawieja, David Ph.D.		
Project Title:	Effects of Microgravity on Ocular Vascular Hydrodynamics		
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) **SANS**:Risk of Spaceflight Associated Neuro-ocular Syndrome (SANS)		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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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:	12/21/2018	**End Date:**	12/20/2022
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
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No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 12/20/2022 (original end date was 12/20/2021) per NSSC information (Ed., 1/4/22)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Loerch, Linda M.S. (NASA Johnson Space Center) Tharakan, Binu Ph.D. (Scott & White Memorial Hospital) Macias, Brandon Ph.D. (Wyle Laboratories, Inc./NASA Johnson Space Center) Lee, Stuart Ph.D. (Wyle Laboratories, Inc./NASA Johnson Space Center) Hein, Travis Ph.D. (Texas A&M University System) Gashev, Anatoliy M.D., Ph.D. (Texas A&M University System) Bagher, Pooneh Ph.D. (Texas A&M University System)		
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Task Description:	Spaceflight Associated Neuro-ocular Syndrome (SANS) is reported to affect ~40% of astronauts completing long-duration spaceflights (as of May 2017) and has been characterized as the development of one or more findings: optic disc edema, hyperopic shifts, globe flattening, cotton-wool spots, or choroidal folds. The leading hypothesis for the development of ocular changes is that prolonged exposure to the headward fluid shift that occurs in weightlessness is the primary instigating factor, and additional factors such as genetic disposition, ambient CO2 on the International Space Station, or on-orbit exercise countermeasures may augment or diminish the development of ocular symptoms. However, the pathophysiology of SANS remains unclear. Evidence for the contribution of intracranial pressure alone in SANS is controversial. Therefore, studies of ocular vascular hydrodynamics are required to clarify if chronic mild elevations of ocular pressure variables compromise ocular structure and function. Since all blood and lymph vessels are compliant, fluid-filled structures whose pressures are strongly influenced by gravity, we propose to focus our studies on the potential changes directly to the ocular vasculature caused by microgravity. Perfusion of the optic nerve and inner retina for sufficient delivery of oxygen and nutrients is dependent on retinal blood flow. The pressure gradient for driving blood flow through the inner retina begins with the arterial pressure in the feed artery, which is the central retinal artery in humans. Changes in retinal blood flow or pressure may contribute to the formation of cotton wool spots and optic disc edema. Optic disc edema, choroidal folds, and optic nerve thickening may also result from ocular venous congestion and/or elevated venous compliance, disruption of the blood-retinal barrier, and/or reduction in ocular lymph flow. There has been no systematic analysis of the ocular vascular changes in microgravity. We have assembled a team of experts in SANS and all 3 main vascular types (arteries, veins, and lymphatics) to address this information gap. Thus, the objective of this application is to determine whether microgravity alters the structure and function of the ocular vasculature at the level of feed arteries, venous exchange and capacitance vessels, and lymph vessels. This provides a novel comprehensive evaluation of the ocular vascular elements. The central hypothesis of this proposal is that microgravity/spaceflight-induced changes in the structure/function of the ocular vasculature lead to alterations in ocular hydrodynamics and promote symptoms of SANS. We will accomplish this objective using in vivo measures of vascular function (retinal artery blood flow, retinal arteriole and venular diameter measurements, and retinal venular permeability measures) and in vitro studies of freshly isolated vascular structure and function (vessel/tissue histology, arterial vasomotor regulation, venous compliance measures, and lymphatic transport characteristics). These studies will be conducted in mice flown in space and the corresponding ground controls to address the following specific aims: 1: Evaluate the effects of microgravity on ocular artery structure/function. 2: Evaluate the effects of microgravity on ocular vein structure/function. 3: Evaluate the effects of microgravity on ocular lymphatic structure/function. Information from these novel studies will provide the first comprehensive analysis of the effects of microgravity on ocular vascular function where the predominant changes associated with SANS in astronauts occur. It will also help define the roles these may play in the etiology of SANS and could lead to the development of countermeasures for SANS.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2019.
Bibliography Type:	Description: (Last Updated: 04/24/2019)