Fiscal Year:	FY 2020	**Task Last Updated:**	FY 12/15/2019
PI Name:	Zanello, Susana Ph.D.		
Project Title:	Evaluation of Hindlimb Suspension as a Model to Study Ophthalmic Complications in Microgravity: Ocular Structure and Function and Association with Intracranial Pressure		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
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		
PI Email:	susana.b.zanello@nasa.gov	**Fax:**	FY
PI Organization Type:	NASA CENTER	**Phone:**	832-576-6059
Organization Name:	KBR/NASA Johnson Space Center		
PI Address 1:	Human Research Program Chief Scientist Office		
PI Address 2:			
PI Web Page:			
City:	Houston	**State:**	TX
Zip Code:	77058	**Congressional District:**	36
Comments:	NOTE (January 2021): PI now at KBR/NASA JSC as of December 2020. Previously at imec USA from June 2019-November 2020; NASA JSC (KBRwyle) from August 2017 until spring 2019. Prior to August 2017, PI was with Universities Space Research Association.		
Project Type:	Ground	**Solicitation / Funding Source:**	2011 Crew Health NNJ11ZSA002NA
Start Date:	02/01/2013	**End Date:**	01/01/2021
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:	Norsk, Peter	**Contact Phone:**	
Contact Email:	Peter.norsk@nasa.gov		
Flight Program:			
Flight Assignment:	NOTE: End date changed to 1/1/2021; note also with PI move to imec USA-Florida, PI's 3 projects were combined into one grant, 80NSSC19K1666 ; however, reporting will be required individually, per HRP (Ed., 11/4/19) NOTE: End date changed to 9/30/2019 per JSC HRP; PI at Universities Space Research Association for a period; now back at NASA JSC (KBRwyle) (Ed., 11/19/18) NOTE: This project had some delays and is still underway with an end date now of 9/30/2018. It moved from an Internal Project to Grant NNX15AW48G starting 10/1/2015, per A. Allcorn/HRP (Ed., 8/31/16)		
Key Personnel Changes/Previous PI:	November 2019: Corey Theriot, PhD, is now CoInvestigator per HRP; Patricia Chevez-Barrios is also CoInvestigator at this time. January 2014 report: Addition of Patricia Chevez-Barrios (collaborator, The Methodist Hospital, Houston) for ocular pathology		
COI Name (Institution):	Parsons-Wingerter, Patricia Ph.D. (NASA Ames Research Center) Vizzeri, Gianmarco M.D. (University of Texas Medical Branch) Chevez-Barrios, Patricia M.D. (The Methodist Hospital Research Institute) Theriot, Corey Ph.D. (University of Texas Medical Branch-Wyle)		

Grant/Contract No.:	80NSSC19K1666 ; Internal Project ; NNX15AW48G
Performance Goal No.:	
Performance Goal Text:	
Task Description:	An animal ground-analog is being tested as a model to induce cephalad fluid shifts and evaluate whether ocular structural changes similar to those produced in humans after exposure to a microgravity environment occur in rodents subjected to tail suspension. In vivo ocular measures and tissue analysis were be performed in hindlimb suspension (HS) and normal posture control rats. Intraocular pressure (IOP), intracranial pressure (ICP), and optical coherence tomography (OCT) scans of the retina were evaluated before, during, and after HS. Retinal microvascular changes will be evaluated by computerized analysis of retinal flat mounts specifically stained to image the microvasculature. In order to study cellular responses that are possibly associated with the stress of variations in translaminar pressure in the retina due to cephalad fluid shift, whole transcriptome gene expression analysis was performed and immunohistochemistry of specific markers was done on histologic sections. This study will led to better characterization and problem definition of the Spaceflight Associated Neuro-Ocular Syndrome (SANS), and in turn, it will evaluate the need for countermeasures to mitigate the risk. NOTE (Ed., July 2019): PI now with imec USA; PI still resides in Houston and works remotely with FL office. NOTE (Ed., December 2018): PI at Universities Space Research Association for a period; now back at NASA JSC (KBRwyle) as internal project. NOTE (Ed., 8/31/16): This project had some delays and is still underway with an end date now of 9/30/2018. It moved from an Internal Project to Grant NNX15AW48G starting 10/1/2015, per A. Allcorn/Johnson Space Center Human Research Program.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Mechanical and oxidative stress anticipated to occur due to the fluid shift caused by hindlimb suspension are thought to be common occurrences in ophthalmic conditions on Earth, namely glaucoma, diabetic retinopathy, macular degeneration. Molecular pathways implicated in the histopathology of SANS may shed light on common mechanisms shared with the above mentioned Earth-bound diseases, and thus, in future therapies to prevent and/or ameliorate these disease conditions.
Task Progress:	One of the responses to exposure to the microgravity environment is a pronounced cephalic fluid shift. This project tests the hypothesis that this fluid shift is a causative factor of the ocular changes seen in astronauts during and following long-duration spaceflight. We used the well-documented rat hindlimb suspension (HS) model to examine the relationship between cephalic fluid shifts and the regulation of intracranial (ICP) and intraocular (IOP) pressures as well as visual system structure and function. The experimental protocol used HS durations of 7, 14, 28, and 90 days. Subgroups of the 90-day rats were studied for recovery periods of 7, 14, 28, or 90 days. All HS animals had age-matched cage controls. All animals had ad libitum access to food and water and were maintained to a light/darkness 12:12 LD cycle. The following clinical ophthalmic measures were performed at baseline and at the conclusion of HS: IOP (by rebound tonometry), direct and indirect ophthalmoscopy, optical coherence tomography (OCT) and fundus imaging. ICP was recorded by telemetry. Eyes were collected at baseline, 7, 14, 28, and 90 days of HS, and at 7, 14, 28, and 90 days of recovery, for histologic and gene expression evaluations. This work focuses on the gene expression and histologic changes observed in the rat retina in response to HS and their relationship with ICP and IOP. Due to the multiplicity of applications for these rats, the experimental scheme was remarkably complex. This progress report discusses the findings pertaining to the live measures obtained from the animals, namely intraocular pressure (IOP) and intracranial pressure (ICP). Optical Computerized Tomography (OCT) images were received from the collaboration team but as discussed in the previous report, the quality of the images did not allow a proper analysis.
Bibliography Type:	Description: (Last Updated: 09/04/2023)