Fiscal Year:	FY 2014	**Task Last Updated:**	FY 01/07/2014
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:**	09/30/2015
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:	Villarreal, Jennifer	**Contact Phone:**	281-483-7306
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	January 2014 report: Addition of Patricia Chevez-Barrios (collaborator, The Methodist Hospital, Houston) for ocular pathology		
COI Name (Institution):	Parsons-Wingerter, Patricia (NASA Glenn Research Center) Vizzeri, Gianmarco (University of Texas Medical Branch)		
Grant/Contract No.:	Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	An animal ground-analog is proposed for validation as a model to induce cephalad fluid shifts and evaluate ocular structural changes similar to those produced in humans after exposure to a microgravity environment. In vivo ocular measures and tissue analysis will be performed in hindlimb suspension (HS) and normal posture control rats. Intraocular pressure (IOP), intracranial pressure (ICP), fluorescein angiography (FA), optical coherence tomography (OCT) scans of the retina, and ultrasound of the optic nerve will be evaluated before, during, and after HS. Retinal microvascular changes will be evaluated by computerized quantitative analysis of FA and retinal flat mounts. 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, markers of oxidative stress, hypoxia, and cellular death will be investigated by gene expression analysis and immunohistochemistry. This study will lead to better characterization and problem definition of the Visual Impairment and Intracranial Pressure risk, and in turn, it will evaluate the need for countermeasures to mitigate this risk.
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 histopahtology of VIIP 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 diseases conditions.
Task Progress:	Our project investigates whether rodent hindlimb suspension (HS) is a valid model to study the effects of simulated-weightlessness on ocular structures and their relationship with intracranial pressure (ICP). One of the hypotheses to be tested is that HS-induced cephalad fluid shift is accompanied by vascular engorgement that produces changes in retinal oxygenation, leading to oxidative stress, hypoxia, microvascular remodeling, and cellular degeneration. We have optimized the procedure to obtain flat mounts of rat retina, staining of the endothelial lining in vasculature, and acquisition of high quality images suitable for VESsel GENeration Analysis (VESGEN) software, a computational tool that quantifies remodeling patterns of branching vascular trees and capillary or vasculogenic networks. In summary, we have an improved method for studying the retinal microvasculature that will provide an increase in the quality of images captured and will be applied throughout the various animal cohorts of the recently-initiated study that will evaluate rodent HS as a model to study ophthalmic complications in microgravity.
Bibliography Type:	Description: (Last Updated: 09/04/2023)
Articles in Peer-reviewed Journals	Zanello SB, Theriot CA, Prospero Ponce CM, Chevez-Barrios P. "Spaceflight effects and molecular responses in the mouse eye: Observations after Shuttle Mission STS-133." Gravit Space Res. 2013 Oct;1(1):29-46. http://gravitationalandspacebiology.org/index.php/journal/issue/view/49/showToc , Oct-2013
Articles in Peer-reviewed Journals	Zanello S, Nguyen A,Theriot C. "Retinal non-visual photoreception in space." Aviat Space Environ Med. 2013 Dec;84(12):1277-80. http://dx.doi.org/10.3357/ASEM.3762.2013 , Dec-2013
Articles in Peer-reviewed Journals	Taibbi G, Kaplowitz K, Cromwell RL, Godley BF, Zanello SB, Vizzeri G. "Effects of 30-day head-down bed rest on ocular structures and visual function in a healthy subject." Aviat Space Environ Med. 2013 Feb;84(2):148-54. PMID: 23447853 , Feb-2013
Awards	VIIP Group. "NASA Honor Group Achievement Award, August 2013." Aug-2013
NASA Technical Documents	Alexander D GR, Hamilton D, Lee S, Mader T, Otto C, Oubre C, Pass A, Platts S, Scott J, Smith S, Stenger M, Westby C, Zanello S. "Evidence Report: Risk of Spaceflight-Induced Intracranial Hypertension and Vision Alterations." Evidence Book for HRP Roadmap, 2012. http://humanresearchroadmap.nasa.gov/Evidence/ ; accessed 1/7/14. , Jul-2012