

Fiscal Year:	FY 2015	Task Last Updated:	FY 11/28/2014
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		
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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		
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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:	09/30/2018
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:	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:	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) Chevez-Barrios, Patricia (The Methodist Hospital Research Institute)		
Grant/Contract No.:	NNX15AW48G ; Internal Project		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>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.</p> <p>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</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>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 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.</p>
Task Progress:	<p>One of the responses to exposure to the microgravity spaceflight environment is a pronounced cephalic fluid shift. This project tests the hypothesis that this fluid shift is a causative factor in the ocular changes seen in astronauts during and following long-duration spaceflight. The study uses the well-documented rat hindlimb suspension (HLS) 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 uses HLS durations of 7, 14, 28, and 90 days. Subgroups of the 90-day animals are studied for recovery periods of 7, 14, 28, or 90 days. All HLS animals have age-matched cage controls. All animals have ad lib access to food and water. A 12:12 LD cycle is present. Eyes are collected at baseline, 7, 14, 28, and 90 days of HLS, and at 7, 14, 28, and 90 days of recovery, for histologic and gene expression evaluations. The study has started with the young adult male and young adult female cohorts. Comparing data between these cohorts will allow to determine if there is a gender difference in the responses. Following completion of these two groups, there will be two additional cohorts: older middle-age adult males and a group exposed to elevated CO₂ levels similar to those experienced on ISS. This last group will allow to determine if a mild (~1%) hypercapnic environment plays a role in the cephalic shift response and possible development of VIIP (Vision Impairment and Intracranial Pressure).</p> <p>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.</p>
Bibliography Type:	Description: (Last Updated: 09/04/2023)
Abstracts for Journals and Proceedings	<p>Glass A, Theriot C, Lam C-W, James J, Zanello S. "Wound healing response to lunar dust exposure in the rat cornea." Presented at 65th International Astronautics Congress (IAC 2014), Toronto, Canada, September 29-October 2, 2014. 65th International Astronautics Congress (IAC 2014), Toronto, Canada, September 29-October 2, 2014. , Sep-2014</p>
Articles in Peer-reviewed Journals	<p>Theriot C, Zanello S. "Molecular effects of spaceflight in the mouse eye after Shuttle Mission STS-135." Gravitational and Space Research. 2014 Aug;2(1):3-14. http://gravitationalandspacebiology.org/index.php/journal/article/view/643 ; accessed 12/3/14. , Aug-2014</p>
Articles in Peer-reviewed Journals	<p>Taibbi G, Cromwell RL, Zanello SB, Yarbough PO, Ploutz-Snyder RJ, Godley BF, Vizzeri G. "Ocular outcomes evaluation in a 14-day head-down bed rest study." Aviation, Space, and Environmental Medicine. 2014 Oct;85(10):983-92. PubMed PMID: 25245897; PubMed Central PMCID: PMC4240225 , Oct-2014</p>
Journal/Magazine covers	<p>Theriot C, Zanello S. "Cover in journal Gravitational and Space Research for article, 'Molecular effects of spaceflight in the mouse eye after Shuttle Mission STS-135.' " Gravitational and Space Research. 2014 Aug;2(1):3-14. http://gravitationalandspaceresearch.org/index.php/journal/issue/view/51 ; accessed 4/1/21. , Aug-2014</p>