Fiscal Year:	FY 2015	**Task Last Updated:**	FY 10/29/2014
PI Name:	Parsons-Wingerter, Patricia Ph.D.		
Project Title:	Mapping by VESGEN of Blood Vessels in the Human Retina Undergoing Bed Rest for Improved Understanding of Visual Impairments and Increased Intracranial Pressure		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
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) **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:**	(650) 604-1729
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City:	Moffet Field	**State:**	CA
Zip Code:	94035-1000	**Congressional District:**	18
Comments:	NOTE: Formerly at NASA Glenn Research Center until summer 2014		
Project Type:	FLIGHT,GROUND	**Solicitation / Funding Source:**	2012 Crew Health NNJ12ZSA002N
Start Date:	10/01/2013	**End Date:**	01/08/2017
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:	Pre/Post Flight		
Flight Assignment:	NOTE: End date changed to 1/08/2017 (originally 9/30/2014 and subsequently 9/22/2015 and 10/1/2016 and 4/8/2017, which is actually supposed to be due date for final reporting), per PI (Ed., 5/17/16) NOTE: End date changed to 4/08/2017 (originally 9/30/2014 and subsequently 9/22/2015 and 10/1/2016), per PI (Ed., 10/20/15) NOTE: End date changed to 10/01/2016 (originally 9/30/2014 and subsequently 9/22/2015), per PI (Ed., 10/20/15) NOTE: End date changed to 9/22/2015 (originally 9/30/2014), per R. Brady/HRP (Ed., 7/17/14) NOTE: Gap change per IRP Rev E (Ed., 3/19/14)		
Key Personnel Changes/Previous PI:	No changes to research team personnel.		
COI Name (Institution):	Vizzeri, Gianmarco (University of Texas Medical Branch) Ploutz-Snyder, Robert (Universities Space Research Association) Zanello, Susana (Universities Space Research Association)		

Grant/Contract No.:	Internal Project
Performance Goal No.:	
Performance Goal Text:	
Task Description:	Accelerated, high-priority NASA studies recently established that the adverse effects of cephalad fluid shifts incurred by microgravity spaceflight, especially by long-duration missions, are associated with significant risks for ocular and visual impairments and increased intracranial pressure (VIIP), including decreased near visual acuity, choroidal flattening, and optic disc edema (papilledema). However, much remains to be learned about the etiology of VIIP before effective countermeasures can be developed. Contributions of remodeling retinal blood vessels to the etiology of VIIP have not yet been investigated, primarily due to the current lack of ophthalmic tools for precisely measuring progressive remodeling of the vascular architecture. We hypothesize that the fluid shifts resulting in VIIP ocular and visual impairments are mediated in part by the retinal blood vessels, and that such vascular involvement requires the significant, progressive remodeling of retinal vascular architecture. To test our hypothesis, retinal blood vessels will be mapped and quantified using the innovative VESsel GENeration Analysis (VESGEN), a mature, beta-level software developed at NASA as a translational and basic research discovery tool for biomedical vascular applications, particularly for retinal vascular disease. Modified retinal vascular patterning may provide early prediction of future decreased visual acuity. Novel insights provided by VESGEN into progressively pathological and blinding vascular remodeling in the human retina are currently guiding other NIH- and NASA-supported therapeutic development for retinal disease and modeling of the VIIP risk. Our new VESGEN project addressing the VIIP risk will be conducted as a straightforward add-on study that synergistically leverages ophthalmic clinical imaging currently scheduled for ongoing bed rest studies at NASA Johnson Space Center (JSC). The VESGEN analysis can also be applied to ophthalmic images of astronauts undergoing long-duration spaceflight, should such images become available.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Results of VESGEN research on retinal vascular remodeling will contribute to better understanding and preventive treatments of the (VIIP) syndrome. Such innovations will help improve the health and well being of astronauts, and consequently their ability to successfully perform and complete future long-duration missions such as lunar and asteroid colonization and Mars explorations. Moreover, the increased medical knowledge and technical innovations required to successfully complete our VESGEN medical research project for astronaut health will benefit similar studies for vascular-based terrestrial diseases such as diabetic retinopathy (DR), the major blinding retinal disease of working-aged adults in industrialized countries, cancer, heart disease, and regenerative medicine. NASA’s VESGEN technology is simultaneously being developed to map and quantify vascular remodeling in major experimental organisms on the International Space Station (ISS) that also support future human space exploration and medicine. These ISS model organisms and tissues include the mouse, fruitfly (Drosophila melanogaster), and even leaf venation of the plant Arabidopsis thaliana.
Task Progress:	Our VESGEN research project was re-designed during 2014 by the VIIP VESGEN project team and NASA to address the VIIP risk more quickly and effectively. Our study will be conducted as a straightforward add-on study that synergistically leverages state-of-the-art ophthalmic clinical imaging, the Heidelberg Spectralis imaging of retinal blood vessels, that was established by NASA during 2013 for routine crew health surveillance. A preliminary study during 2014 demonstrated that VESGEN can successfully analyze and discriminate among subtle differences in arterial and venous patterning in the Spectralis images. We therefore now will analyze retinal vascular images of astronauts acquired before and after spaceflight missions to the International Space Station (ISS). The Spectralis ophthalmic retinal vascular images of human volunteer subjects before and after bed rest accompanied by head-down tilt (HDT), a well-established model of microgravity fluid shifts, will also be analyzed. Because the VESGEN study of astronaut and HDT IR images uses the same ophthalmic imaging modality, our study will quickly and optimally assess the usefulness of VESGEN for monitoring crew health, and for developing improved countermeasures and diagnostics for the VIIP risks. Mapping and quantification by VESGEN of retinal vascular remodeling will therefore contribute to the increased understanding of VIIP, may provide early prediction of VIIP when the syndrome is still reversible, and may help to guide the successful development of future countermeasures and therapies.
Bibliography Type:	Description: (Last Updated: 11/30/2021)
Abstracts for Journals and Proceedings	Theriot CA, Parsons-Wingerter P, Vizzeri G, Zanello SB. "Hindlimb Suspension as a Model to Study Ophthalmic Complications in Microgravity Status Report: Optimization of Rat Retina Flat Mounts Staining to Study Vascular Remodeling." 2014 NASA Human Research Program Investigators’ Workshop, Galveston, TX, February 12-13, 2014. 2014 NASA Human Research Program Investigators’ Workshop, Galveston, TX, February 12-13, 2014. http://www.hou.usra.edu/meetings/hrp2014/pdf/3104.pdf , Feb-2014
Abstracts for Journals and Proceedings	Parsons-Wingerter P, Vizzeri G, Taibbi G, Zanello SB, Ploutz-Snyder R. "Mapping by VESGEN of Blood Vessels in the Human Retina Undergoing Bed Rest for Increased Understanding of VIIP." 2014 NASA Human Research Program Investigators’ Workshop, Galveston, TX, February 12-13, 2014. 2014 NASA Human Research Program Investigators’ Workshop, Galveston, TX, February 12-13, 2014. http://www.hou.usra.edu/meetings/hrp2014/pdf/3115.pdf , Feb-2014
Abstracts for Journals and Proceedings	Parsons-Wingerter P, Pinhas A, Dubow M, Shah N, Gan A, Razeen M, Chui T, Dubra A, Rosen RB. "VESGEN analysis of human macular microvasculature in venous occlusive disease imaged in vivo using AOSLO FA." Program 5754, Session 517:A272, Vascular Mechanisms in Diabetic Retinopathy Session 382, Retinal and Choroidal Vascular Diseases, 2014 Vision and Ophthalmology (ARVO) Annual Meeting-- 'Leading Eye and Vision Research,' Orlando FL, May 4-8, 2014. Invest Ophthalmol Vis Sci (ARVO Meeting Abstracts). 2014 Apr 30;55:3880. (2014 Vision and Ophthalmology (ARVO) Annual Meeting, Orlando FL, May 4-8, 2014. Presentation 3880-C0182.) http://iovs.arvojournals.org/article.aspx?articleid=2269344 ; accessed 11/16/15. , Apr-2014

Abstracts for Journals and Proceedings	Radhakrishnan K, Parsons-Wingerter P, Chalam KV, Mames R, Kay C, Grant MB. "VESGEN Analysis of Fractal-Based Branching in Arterial and Venous Trees for Investigating Diabetic Retinopathy with Spectralis® Angiographic Imaging." Presentation 275-B0083, Session 109, Retinal Imaging, 2014 Association for Research in Vision and Ophthalmology (ARVO) Annual Meeting--'Leading Eye and Vision Research,' Orlando FL, May 4-8, 2014. Invest Ophthalmol Vis Sci. (ARVO Meeting Abstracts) 2014 Apr;55: E-Abstract 275. (2014 Vision and Ophthalmology (ARVO) Annual Meeting, Orlando FL, May 4-8, 2014. Presentation 3880-C0182.) http://iovs.arvojournals.org/article.aspx?articleid=2268105 ; accessed 11/16/15. , Apr-2014