

Fiscal Year:	FY 2007	Task Last Updated:	FY 05/09/2007
PI Name:	Serrador, Jorge Manuel Ph.D.		
Project Title:	Vestibular-Cerebrovascular Interactions and Their Contribution to Post-Spaceflight Orthostatic Intolerance		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Physiology		
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	(1) HHC: Human Health Countermeasures		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	serrador@hms.harvard.edu	Fax:	FY 617/632-8685
PI Organization Type:	UNIVERSITY	Phone:	617/632-8843
Organization Name:	Harvard Medical School		
PI Address 1:	BIDMC - Palmer 117		
PI Address 2:	One Deaconess Road		
PI Web Page:			
City:	Boston	State:	MA
Zip Code:	02215	Congressional District:	8
Comments:			
Project Type:	Ground	Solicitation / Funding Source:	2003 Biomedical Research & Countermeasures 03-OBPR-04
Start Date:	08/16/2004	End Date:	08/23/2008
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:	Contact Phone:		
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	None		
COI Name (Institution):	Black, Owen (Legacy Health System) Lipsitz, Lewis (Hebrew Rehabilitation Center for Aged) Schlegel, Todd (NASA Johnson Space Center) Wood, Scott (Naval Aerospace Medical Research Laboratory)		
Grant/Contract No.:	NNJ04HI13G		
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Task Description:	<p>Post-spaceflight orthostatic intolerance, a principal NASA safety concern, is a complex multi-factorial problem that continues to be poorly understood. Recent evidence clearly suggests that the vestibular otolith system, which is directly affected by spaceflight, assists in both autonomic and blood pressure regulation during orthostatic stress. Vestibular activation has also has direct effects on cerebral blood flow suggesting that vestibular inputs also affect the cerebrovascular response to orthostasis. The goal of this research is to examine the role of vestibular inputs in cerebral blood flow regulation and the effect of these inputs on orthostatic tolerance. Our general hypothesis is that otolith mediated vestibular inputs act as a feed forward mechanism causing cerebral vasodilation to compensate for the decrease in cerebral perfusion pressure during the upright posture. This project's four specific aims are to: 1) Determine the effect of tilts in the pitch plane with and without visual feedback on cerebral blood flow and cerebral autoregulation in healthy elderly with and without vestibular hypofunction and healthy young subjects.; 2) Determine the effect of otolith vs otolith and canal stimulation on cerebral blood flow in healthy elderly with and without vestibular hypofunction and healthy young subjects. This aim will be accomplished by varying the radius of rotation of subjects on a short arm centrifuge; 3) Determine the effect of canal vs canal and otolith stimulation on cerebral blood flow in elderly subjects with normal and reduced vestibular function. This aim will be accomplished by using earth vertical axis rotations vs. head tilt while supine or prone; 4) Determine the effect of training subjects to associate otolith input as tilt on cerebral blood flow during orthostatic stress in elderly subjects with intact and impaired vestibular function. This aim will be accomplished by training subjects with tilt or centrifugation to interpret otolith signals as either translation or tilt by providing visual scenes to reinforce this perception. The results of these studies will provide direct evidence on the role of vestibular inputs in cerebrovascular regulation. This work may lead to new methods to diagnose and treat not only post-spaceflight orthostatic intolerance but also the ~500,000 otherwise healthy subjects that are affected by orthostatic intolerance.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>Understanding the causes of orthostatic intolerance will directly benefit two groups of individuals. First, elderly individuals have increased risks of falls which are associated with decreased quality of life and increased mortality. Falls are the leading cause of death for older adults. In fact, Almost 11,000 older adults a year, or 30 each day, die from a falls injury. Half of those who survive a fall never return to their prior level of mobility or independence. By reducing the likelihood that an elderly individual will fall due to light headedness, i.e. orthostatic intolerance, we will be able to improve the quality of life and reduce the rate of fall induced mortality in this group, a significant advance for the aging population. In addition, almost 500,000 Americans suffer from orthostatic intolerance, often with poor treatment outcomes. Currently a possible vestibular role for orthostatic intolerance is not considered. This research could not only highlight a new cause of orthostatic intolerance but lead to new treatments including vestibular rehabilitation, etc.</p>
Task Progress:	<p>To complete the specific aims laid out in the grant, the PI has had three primary goals during the last year of this grant: 1) Complete screening of elderly and young to determine normal and impaired vestibular function 2) Testing the first cohort of subjects for Specific Aim 1 and 2 while preparing for completion of Aims 1, 2 and 3 in year 3 of the grant 3) Beginning data collection in Portland, Oregon for centrifugation studies</p> <p>During this past year we have continued to collect screening data and reached 160 subjects (80% of the total number expected to be enrolled). From this we have found several interesting findings already. In addition our initial data indicates that vestibular function has a direct effect on the initial response to orthostatic stress and thus may be implicated in the orthostatic intolerance problem seen in astronauts. We plan to complete specific aim 1 within the first 3 months of the current funding cycle. We anticipate we will be able to complete Specific Aim 3 by the end of August using the same group of subjects used for the tilt study.</p> <p>We have begun centrifuge testing at Legacy Health Systems in Portland, Oregon (Specific Aim 2) and have present data on 10 subjects to date. As can be seen, these data further support a connection between the vestibular system and cerebrovascular regulation. We plan to complete Specific Aim 2 by the end of the current funding period.</p>
Bibliography Type:	Description: (Last Updated: 10/31/2019)
Abstracts for Journals and Proceedings	<p>Devine ER, Milberg WP, Serrador JM. "Does gravity affect functional cerebral blood flow response? " International Cerebral Blood Flow Meeting, Amsterdam, The Netherlands, June, 2005 Journal of Cerebral Blood Flow & Metabolism 2005 Aug ;25(Suppl 1):S384 -4. http://dx.doi.org/10.1038/sj.jcbfm.9591524.0384 , Aug-2005</p>
Abstracts for Journals and Proceedings	<p>Devine ER, Serrador JM. "Relationship between Stroke Volume and Cerebral Blood Flow During Pressure Changes in Humans." XXXV International Congress of Physiological Sciences, April 2005. FASEB Journal 2005; 19(5) A1257. , May-2005</p>
Abstracts for Journals and Proceedings	<p>Gopalakrishnan GS, Baker E, Serrador JM, Wood SJ. "Impaired Vestibular Function affects Orthostatic Cerebral Blood Flow Response. " Experimental Biology, Washington DC, April 2007. FASEB J, 2007 Apr; 21:A1383-4. , Apr-2007</p>
Articles in Peer-reviewed Journals	<p>Serrador JM, Wood SJ. "Vasopressin: neurohumoral link between nausea and motion sickness. Author reply." Aviat Space Environ Med. 2005 Aug;76(8):805; author reply 805-6. PMID: 16110700 , Aug-2005</p>
Articles in Peer-reviewed Journals	<p>Serrador JM, Schlegel TT, Black FO, Wood SJ. "Cerebral hypoperfusion precedes nausea during centrifugation." Aviat Space Environ Med. 2005 Feb;76(2):91-6. PMID: 15742822 , Feb-2005</p>