

Fiscal Year:	FY 2013	Task Last Updated:	FY 02/04/2014
PI Name:	Buckey, Jay C. M.D.		
Project Title:	Role of the Cranial Venous Circulation in Microgravity-Associated Visual Changes		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	NSBRI--Cardiovascular Alterations Team		
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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Comments:	Address updated 9/2008		
Project Type:	GROUND	Solicitation / Funding Source:	2012 Crew Health NNJ12ZSA002N
Start Date:	08/01/2013	End Date:	07/31/2016
No. of Post Docs:	No. of PhD Degrees:		
No. of PhD Candidates:	No. of Master' Degrees:		
No. of Master's Candidates:	No. of Bachelor's Degrees:		
No. of Bachelor's Candidates:	Monitoring Center: NSBRI		
Contact Monitor:	Contact Phone:		
Contact Email:			
Flight Program:			
Flight Assignment:	NOTE: Title change to Role of the Cranial Venous Circulation in Microgravity-Associated Visual Changes (original proposal title was "Ocular Venous Contributions to Spaceflight Visual Impairment")--Ed., 2/6/14		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Davis, Brynmor (Creare Incorporated) Deserranno, Dimitri (Creare Incorporated) Kattamis, Nicholas (Creare Incorporated) Knaus, Darrin (Creare Incorporated) Zegans, Michael (Dartmouth College) Phillips, Scott (Creare Incorporated)		
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Performance Goal No.:			
Performance Goal Text:			

Task Description:	As has been seen with other systems and measurements in space (central venous pressure, pulmonary capillary blood volume), it's likely that microgravity has unique effects on the eye that can't be replicated easily on Earth. Microgravity may change how retinal venous pressure, choroidal venous pressure, intraocular pressure (IOP) and intracranial pressure (ICP) respond to a fluid shift compared to the responses when moving to the supine or head-down position on Earth. The visual changes in space may be the interplay between the different factors affecting the eye, rather than the alteration in one particular pressure (e.g., ICP, IOP, retroorbital pressure etc.) or volume (e.g. choroidal volume). For this proposal we will measure intraocular pressure (IOP), retinal vein diameter, axial length, and choroidal volume in different postures on Earth (seated, supine, and 6 degree head down tilt) and with acute microgravity exposure during parabolic flight. These data will establish comparison data for longer-term microgravity exposure, and will also be used as inputs to refine a mathematical model of the eye. The mathematical model will include the ability to alter hydrostatic and tissue pressure values so that microgravity effects can be simulated. We hypothesize that when hydrostatic and tissue pressures are altered in the model, this will produce acute changes in choroidal volume, retinal diameter, venous pressure, and other measurements unlike those that can be measured on Earth. Also, if the microgravity-induced headward fluid shift is the major factor producing visual changes in space, reversing this fluid shift with lower body negative pressure (LBNP) could provide an inflight countermeasure. We will evaluate the effects of LBNP exposure on the eye by making measurements of IOP, axial length, retinal vein diameter, and choroidal volume in supine subjects before, during, and after LBNP exposure. The effects of LBNP on parameters that cannot be easily measured (episcleral vein pressure, vortex vein pressure, and ICP) will be estimated using mathematical modeling. The effects of LBNP in microgravity will also be estimated using mathematical modeling. We hypothesize that LBNP can provide acute changes in ocular and venous pressures. This will provide a basis to study the effect of LBNP on the longer-term changes in ocular structure associated with spaceflight. Lastly, since not all individuals develop significant visual changes in response to microgravity exposure, it's likely that some people are predisposed to develop visual changes in response to spaceflight. Microgravity may affect the physical characteristics of optic tissues, such as the viscoelastic properties of the sclera, and some individuals may be more likely to experience these changes than others. For example, Mader et al. postulated that inter-individual differences in the characteristics of the choroid could explain why some individuals are more susceptible to microgravity-induced vision changes. The model and data from this study will provide the ability to test hypotheses about which tissue and vascular parameters would have the greatest impact on vision. These data could then be used to guide spaceflight experiments.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2013.
Bibliography Type:	Description: (Last Updated: 03/18/2024)