Fiscal Year:	FY 2015	**Task Last Updated:**	FY 10/28/2014
PI Name:	Hayman née Anderson, Allison Ph.D.		
Project Title:	Feasibility of DPOAE Mapping as an In-Flight Measure of Intracranial Pressure in Space		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	NSBRI--Smart Medical Systems and Technology Team		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:	NOTE: name change to Hayman née Anderson (Ed., March 2025). PI moved to University of Colorado from Dartmouth College in early 2017.		
Project Type:	Ground	**Solicitation / Funding Source:**	2014 NSBRI-RFA-14-02 First Award Fellowships
Start Date:	11/01/2014	**End Date:**	10/31/2016
No. of Post Docs:	1	**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:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Buckey, Jay M.D. (MENTOR/ Dartmouth College)		
Grant/Contract No.:	NCC 9-58-PF04103		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	POSTDOCTORAL FELLOWSHIP Upon entering microgravity, astronauts experience a headward fluid shift, which could increase intracranial pressure (ICP) above seated levels. For long duration space flight, the interaction between ICP and intraocular pressure (IOP) is suspected to cause the visual acuity changes found in approximately 50% of astronauts. Distortion product otoacoustic emissions (DPOAEs) may be a noninvasive, easy-to-perform, assessment technique of ICP in-flight, using hardware that will be sent to the International Space Station. But, DPOAEs have not been rigorously evaluated to determine their effectiveness as a proxy measure for ICP. Although studies have shown DPOAEs are altered with postural and ICP changes on Earth, the contribution of the removal of all hydrostatic gradients in microgravity has not been determined. Also, studies to date have focused on a narrow set of test conditions, rather than optimizing the DPOAE testing parameters. This proposal seeks to address these limitations by evaluating subjects under test conditions that isolate the effects of fluid shifts and alterations in hydrostatic gradients. We will use unique measurement hardware that allows us to collect DPOAEs over a broad spectrum of frequencies and frequency ratios to create a response map of both DPOAE amplitude changes and phase shifts over the entire cochlear. We propose to perform this evaluation in conjunction with an existing NSBRI funded grant: Cranial Venous Modeling (CA03401) to gather a richer set of data. Objective: To evaluate the contribution of fluid shifts and alterations in hydrostatic gradients to changes in DPOAE amplitude and phase across the cochlea to assess DPOAE level/phase mapping as a possible in-flight intracranial pressure assessment technique. Hypotheses: Both fluid shifts and changes in hydrostatic gradients will alter DPOAE level/phase maps. Each will have different signatures present in map data. Specific Aim 1: Create DPOAE level/phase maps to characterize changes as a result of the isolated effects of fluid shifts and alterations in hydrostatic gradients. Overview: Subjects will be evaluated under seven experimental conditions to isolate the effects of hydrostatic gradients and fluid shifts: seated baseline, prone, supine, supine with LBNP, prone with LBNP, supine LBPP, and prone with LBPP. DPOAE level/phase maps will be created over a range of frequencies and ratios. Specific Aim 2: Statistically evaluate changes in DPOAE level/phase mapping to determine response signature of fluid shifts and hydrostatic gradient changes. Overview: Maps from experiment 1 will be statistically analyzed to determine map regions where response is altered under each experimental condition. Regression, machine learning, and spatial analysis statistics will be used. Data will be analyzed within subjects to characterize individual changes and across subjects to determine signatures associated with changes in fluid shifts and alterations in hydrostatic gradients. Specific Aim 3: Explore the relationship between ocular and cranial vascular measurements to changes seen in DPOAE level/phase maps. Overview: Subjects from experiment 1 will be placed in each of the seven experimental conditions described previously. Magnetic resonance imaging (MRI), optical coherence tomography (OCT), tonometry, and optical biometry will be used to measure cranial fluid flow and subject ocular anatomy. These parameters will be inputs to cerebral and ocular models to calculate several additional metrics, such as ICP. Each of these parameters will be statistically evaluated for correlations to changes in DPOAE level/phase maps. Conclusion: these set of experiments and statistical analyses will allow us to evaluate the feasibility of DPOAE level/phase maps as an in-flight assessment of ICP by isolating and evaluating the effects of fluid shifts and hydrostatic gradient changes and connecting the results to a rich set of ocular and cerebral hemodynamic measures.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2015.
Bibliography Type:	Description: (Last Updated: 03/26/2025)