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| **Fiscal Year:** | FY 2019 | **Task Last Updated:** | FY 09/11/2019 |
| **PI Name:** | Ethier, Christopher Ph.D. | | |
| **Project Title:** | Changes of the Optic Nerve Dura Mater in Astronauts and SANS (OPTIMA) | | |
| **Division Name:** | Human Research | | |
| **Program/Discipline:** | | | |
| **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 (IRP Rev I) | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
| **PI Email:** | ross.ethier@bme.gatech.edu | **Fax:** | FY |
| **PI Organization Type:** | UNIVERSITY | **Phone:** | 404-385-0100 |
| **Organization Name:** | Georgia Institute of Technology | | |
| **PI Address 1:** | Biomedical Engineering | | |
| **PI Address 2:** | 315 Ferst Drive | | |
| **PI Web Page:** | http://ethier.gatech.edu/ | | |
| **City:** | Atlanta | **State:** | GA |
| **Zip Code:** | 30332-0363 | **Congressional District:** | 5 |
| **Comments:** | | | |
| **Project Type:** | GROUND | **Solicitation:** | 2018 HERO 80JSC018N0001-Crew Health and Performance (FLAGSHIP, OMNIBUS). Appendix A-Flagship, Appendix B-Omnibus |
| **Start Date:** | 07/17/2019 | **End Date:** | 07/16/2020 |
| **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:** | NASA JSC |
| **Contact Monitor:** | Norsk, Peter | **Contact Phone:** | |
| **Contact Email:** | Peter.norsk@nasa.gov | | |
| **Flight Program:** | | | |
| **Flight Assignment:** | | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Laurie, Steven Ph.D. ( Wyle Laboratories/NASA Johnson Space Center )<br>Lee, Stuart Ph.D. ( Wyle Laboratories/NASA Johnson Space Center )<br>Loerch, Linda M.S. ( NASA Johnson Space Center )<br>Macias, Brandon Ph.D. ( Wyle Laboratories/NASA Johnson Space Center )<br>Martin, Bryn Ph.D. ( University of Idaho, Moscow ) | | |
| **Grant/Contract No.:** | 80NSSC19K1298 | | |
| **Performance Goal No.:** | | | |
| **Performance Goal Text:** | | | |

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| **Task Description:** | Astronauts experience multiple physiological changes during spaceflight. One such potential change is spaceflight associated neuro-ocular syndrome (SANS), a spectrum of ocular alterations that can affect sight. We do not understand why this occurs or how to prevent it. One hypothesis is that changes in the mechanical properties of the tissue sheath surrounding the optic nerve (the dura mater) can affect a sensitive region of the eye (the optic nerve head) where many alterations are observed in astronauts. Another hypothesis is that thickening of the choroid, a tissue within the eye that is known to swell during spaceflight, leads to abnormally large mechanical strains on the anterior part of the optic nerve head.<br>Our central objective is to use existing, novel methods that we have developed to evaluate these hypotheses. First, we will compute the mechanical properties of the dura mater in astronauts, see whether these properties are different than in subjects who have not been in space, and see whether they correlate with the severity of SANS. To do so, we will use existing sets of magnetic resonance (MR) scans: one taken when the astronaut is lying supine, and the other taken when the astronaut is lying in 15 degree head-down tilt. By analyzing these images, and building a computational model of how the optic nerve sheath expands as fluid pressure changes within it due to head-down tilt, we can obtain a parameter of the dura mater known as the structural stiffness. Second, we will use an existing computational model to determine strains in the optic nerve head due to choroidal swelling, see if these strains are larger than those which occur on Earth, and see if they are related to the severity of SANS in astronauts. Choroidal swelling in space has already been measured using optical imaging technology, and thus we can immediately use our modeling approach with this data set.<br><br>This work directly addresses the following stated goal of the Request for Applications (RFA): Quantification of the crew health and performance risks associated with human spaceflight for the various exploration missions. More specifically, it addresses two needs identified by NASA related to SANS. First, we do not know the etiological mechanisms and contributing risk factors for ocular structural and functional changes seen inflight and postflight, and this work could help determine such factors. Second, we need a set of validated and minimally obtrusive diagnostic tools to measure and monitor changes in intracranial pressure, ocular structure, and ocular function. The tools we propose to use will measure the function of a key ocular structure, namely the optic nerve sheath. |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | |
| **Task Progress:** | New project for FY2019. |
| **Bibliography Type:** | Description: (Last Updated: 07/30/2019) |