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| **Fiscal Year:** | FY 2020 | **Task Last Updated:** | FY 07/15/2020 |
| **PI Name:** | Rana, Brinda Ph.D. | | |
| **Project Title:** | Identification of Functional Metabolomic Profiles Contributing to Physiological Adaptations to Simulated Spaceflight | | |
| **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) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes<br>(2) **Muscle**:Risk of Impaired Performance Due to Reduced Muscle Size, Strength and Endurance | | |
| **Space Biology Element:** | None | | |
| **Space Biology Cross-Element Discipline:** | None | | |
| **Space Biology Special Category:** | None | | |
| **PI Email:** | bkrana@ucsd.edu | **Fax:** | FY |
| **PI Organization Type:** | UNIVERSITY | **Phone:** | 858-822-4010 |
| **Organization Name:** | University of California, San Diego | | |
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| **PI Web Page:** | | | |
| **City:** | La Jolla | **State:** | CA |
| **Zip Code:** | 92093-5004 | **Congressional District:** | 49 |
| **Comments:** | | | |
| **Project Type:** | GROUND | **Solicitation / Funding Source:** | 2015-16 HERO NNJ15ZSA001N-Crew Health (FLAGSHIP, NSBRI, OMNIBUS). Appendix A-Crew Health, Appendix B-NSBRI, Appendix C-Omnibus |
| **Start Date:** | 10/18/2016 | **End Date:** | 03/15/2020 |
| **No. of Post Docs:** | 1 | **No. of PhD Degrees:** | 0 |
| **No. of PhD Candidates:** | 0 | **No. of Master' Degrees:** | 1 |
| **No. of Master's Candidates:** | 1 | **No. of Bachelor's Degrees:** | 1 |
| **No. of Bachelor's Candidates:** | 1 | **Monitoring Center:** | NASA JSC |
| **Contact Monitor:** | Norsk, Peter | **Contact Phone:** | |
| **Contact Email:** | Peter.norsk@nasa.gov | | |
| **Flight Program:** | | | |
| **Flight Assignment:** | NOTE: End date changed to 3/15/2020 per NSSC information (Ed., 4/6/2020) | | |
| **Key Personnel Changes/Previous PI:** | | | |
| **COI Name (Institution):** | Fiehn, Oliver Ph.D. ( University of California, Davis )<br>Lee, Stuart Ph.D. ( KBR/NASA Johnson Space Center )<br>Macias, Brandon Ph.D. ( University of California, San Diego )<br>Patel, Hemal Ph.D. ( University of California, San Diego )<br>Sharma, Kumar M.D. ( University of California, San Diego )<br>Smith, Scott Ph.D. ( NASA Johnson Space Center )<br>Stenger, Michael Ph.D. ( NASA Johnson Space Center ) | | |
| **Grant/Contract No.:** | NNX17AB12G | | |
| **Performance Goal No.:** | | | |

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| **Performance Goal Text:** | |
| **Task Description:** | This study was designed to identify plasma and urine biomarkers that can be used to improve risk prediction for physiological manifestations due to simulated spaceflight (head down tilt bed rest) beyond current clinical measures and predictors. To accomplish this goal, we conducted untargeted and targeted metabolomic assays on archived 24 hour-pooled urine and plasma samples collected longitudinally for the 70 day head down tilt bed rest (HDTBR) study at the University of Texas Medical Branch between June 2011 and May 2014. The samples were obtained from 11 bed rest CONTROL subjects, 10 subjects in the EXERCISE arm of the study, and 8 subjects from the COMBINED EXERCISE AND TESTOSTERONE arm. |
| **Rationale for HRP Directed Research:** | |
| **Research Impact/Earth Benefits:** | The bed rest model allows us to investigate the molecular mechanisms by which physical inactivity leads to the development of Earth based chronic diseases such as type 2 diabetes mellitus, obesity, and cardiovascular disorders. It can also guide us in the mechanisms by which reduced activity with aging or illness can lead to bone and muscle deconditioning. |
| **Task Progress:** | This study was designed to identify molecules in the plasma and urine that are altered in response to a simulated space environment, the head down tilt bed rest (HDTBR). The goal was to identify biomarkers that may be used to predict risk for the physiological manifestations of simulated spaceflight beyond current clinical measures and predictors.<br>To accomplish this goal, we conducted untargeted and targeted metabolomic assays on archived 24 hour-pooled urine and plasma samples collected longitudinally for the 70 day HDTBR study at the University of Texas Medical Branch between June 2011 and May 2014. The samples were obtained from 11 bed rest CONTROL subjects, 10 subjects in the EXERCISE arm of the study, and 8 subjects from the COMBINED EXERCISE AND TESTOSTERONE arm.<br><br>We applied untargeted metabolomics assays on plasma samples at 10- and 3-days pre-bed rest, day 28 of bed rest, return of normal position day 0, and post bed rest day 5 to measure metabolites related to primary metabolism, biogenic amines, and complex lipids. Due to our recent findings of spaceflight related changes in urine proteins, we extended our aims to also apply MS based proteomics on the urine samples at 9 days pre-bed rest, days 29 and 70 of bed rest, and 70 days post-bed rest to identify proteins that are altered in response to HDTBR.<br><br>We identified metabolic pathways related to mitochondrial function that are altered during bed rest. We also identified metabolic pathways that differentiate by study arm. By comparing the results of the present study with metabolomics data from the VaPER study which was done in parallel, we were able to identify metabolic responses that are related to specific factors of simulated spaceflight such as elevated CO2 and physical activity. |
| **Bibliography Type:** | Description: (Last Updated: 07/30/2019) |