



NASA SBIR 2015 Phase I Solicitation

H12.03 Technology for Monitoring Muscle Protein Synthesis and Breakdown in Spaceflight

Lead Center: JSC

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Post flight decrements in skeletal muscle size and function are well documented, however, the true time course of muscle adaptations during long duration spaceflight have thus far been unaddressed. This information is of importance because it can help to identify:Â

- When the most critical stages of adaption to space are occurring.
- Whether changes are occurring at a constant rate or if they begin to plateau, and if so when.
- Targeted muscle countermeasures to mitigate true muscle loss.

Muscle protein synthesis and breakdown are typically measured via invasive biopsy which will not be feasible during space flight missions. Current terrestrial assays for protein synthesis involve use of stable isotopes to measure incorporation of amino acids into muscle and are determined in muscle biopsy samples. Markers for protein degradation (e.g., MuRF1, Atrogen-1) in muscle biopsy samples are often determined by real time PCR (mRNA expression) or Western blot analysis (protein expression), though these results are primarily qualitative. This subtopic seeks novel, non- or minimally-invasive technologies to measure muscle protein turnover for use in subsequent research studies. The most important measurement would be a synthesis: breakdown ratio indicative of the state of muscle balance (formation, breakdown or stability) as opposed to exact protein synthetic rates. However, absolute protein synthesis and breakdown rates are highly desirable.

This Subtopic addresses the following Human Research Program requirements:Â

- Risk of Impaired Performance Due to Reduced Muscle Mass, Strength and Endurance
- Gap M24. Characterize the time course of changes in muscle protein turnover, muscle mass and function during long duration space flight.

The technology developed should accurately be able to quantify protein synthesis, breakdown and total turnover.

A successful proposal will include the technologies being considered and detailed test plan for evaluating them during Phase I. A vision for miniaturizing the device and operating the device in microgravity is required.

Phase I Deliverables - Test results and plan for developing a low volume, low mass, easy-to-operate prototype. The expected TRL resulting from the Phase I effort should be 4.

Phase II Deliverables - Prototype in year 1 with minimal human testing in year 2 to demonstrate efficacy.Â Â

