Fiscal Year:	FY 2010	**Task Last Updated:**	FY 08/06/2010
PI Name:	Paddon-Jones, Douglas Ph.D.		
Project Title:	An Integrated Low-Volume Nutritional Countermeasure to Maintain Muscle Mass and Function During Space Exploration		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Musculoskeletal Alterations Team		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	77555-1124	**Congressional District:**	14
Comments:			
Project Type:	Ground	**Solicitation / Funding Source:**	2008 Crew Health NNJ08ZSA002N
Start Date:	07/01/2009	**End Date:**	06/30/2013
No. of Post Docs:	2	**No. of PhD Degrees:**	0
No. of PhD Candidates:	1	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NSBRI
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
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Performance Goal No.:			
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Task Description:	Our long-term goal is to identify, prevent and remedy defects in the metabolic pathway that contribute to the loss of muscle mass and function during exposure to microgravity. Demographic data indicate that the average age of shuttle crew members has increased from 40.7 yrs in 1995 to 46.7 yrs in 2007 with an increasing number of astronauts over 50 yrs of age. We contend that the loss of muscle mass and function during spaceflight is facilitated by an age-associated, progressive impairment in the ability to mount an anabolic response to standard mixed nutrient meals. We propose that enriching daily meals with a low-volume leucine supplement will reduce the deleterious effects of microgravity on skeletal muscle and facilitate recovery during rehabilitation. We will employ our established 14 day bed rest protocol to model the skeletal muscle unloading that occurs during microgravity. We will also examine recovery of muscle mass and functional capacity during a 7 day rehabilitation period. We will study 2 groups: CON (Bedrest/Recovery + Placebo; n=15), LEU (Bedrest/Recovery + Leucine; n=15). We will assess a) markers of translation initiation, b) muscle protein synthesis, c) muscle mass and body composition and d) strength and aerobic capacity. We will test the following hypotheses: 1. Bedrest will blunt the anabolic response to a mixed nutrient meal, facilitating a loss of muscle mass and functional capacity that is only partially restored during rehabilitation. 2. Enriching daily meals with leucine will promote protein synthesis and maintain the anabolic response to mixed nutrient meal ingestion. This will preserve lean muscle mass and function during bedrest and facilitate the recovery of functional and metabolic capacity during rehabilitation. This project builds on our recent series of bed rest studies and seeks to provide a refined and practical countermeasure that is supported by comprehensive mechanistic evidence.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Our long-term goal is to identify, prevent and remedy defects in the metabolic pathway that contribute to the loss of muscle mass and function during exposure to microgravity. Protein catabolism and muscle loss occurs in many circumstances. The regulatory mechanisms controlling protein turnover are particularly sensitive to a reduction in the neuromuscular stimulus that occurs during physical inactivity or exposure to microgravity and it is clear that muscle loss is greatly exaggerated with increasing age. Demographic data indicate that the average age of shuttle crew members has increased from 40.7 yrs in 1995 to 46.7 yrs in 2007 with an increasing number of astronauts over 50 yrs of age. We contend that the loss of muscle mass and function during spaceflight is facilitated by an age-associated, progressive impairment in the ability to mount an anabolic response to standard mixed nutrient meals. Protein supplementation is routinely employed to combat inactivity and age-related muscle loss. However, aggressive supplementation regimens are often impractical or ineffective due to issues including increased satiety, poor palatability, cost and compliance. We propose that enriching daily meals with a low-volume leucine supplement will reduce the deleterious effects of microgravity on skeletal muscle and facilitate recovery during rehabilitation. This supplement has the potential to also benefit individuals whose ability to perform physical activity is compromised (e.g., hospitalized patients, frail elders).
Task Progress:	The study "An integrated low-volume nutritional countermeasure to maintain muscle mass and function during space exploration" is progressing well. Bed rest studies are complex and require substantial start up efforts; however, recruitment and analysis procedures have been established. We have hired two post-doctoral fellows and a research coordinator to assist with the project. Subject screening have enrollment efforts have been successful to date. Three subjects have successfully completed the study; approximately 5 others are in queue. The study remains blinded and blood and muscle samples are being batched and will be analyzed in groups of 3-4 to avoid wasteful laboratory supply costs. Subjects are tolerating bed rest and the study procedures very well. We have had no complaints or adverse events.
Bibliography Type:	Description: (Last Updated: 09/28/2016)
Articles in Peer-reviewed Journals	English KL, Paddon-Jones D. "Protecting muscle mass and function in older adults during bed rest." Curr Opin Clin Nutr Metab Care. 2010 Jan;13(1):34-9. http://dx.doi.org/10.1097/MCO.0b013e328333aa66 ; PMID: 19898232 , Jan-2010
Awards	Paddon-Jones D. "Health Professions Award for Scholarship Excellence, December 2009." Dec-2009