Fiscal Year:	FY 2009	**Task Last Updated:**	FY 10/08/2009
PI Name:	Wolfe, Robert R. Ph.D.		
Project Title:	Nutritional Countermeasures to Ameliorate Losses in Muscle Mass and Function		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline--Element/Subdiscipline:	NSBRI--Human Factors and Performance 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		
PI Email:	rwolfe2@uams.edu	**Fax:**	FY 501-526-5710
PI Organization Type:	UNIVERSITY	**Phone:**	501-526-5708
Organization Name:	University of Arkansas for Medical Sciences		
PI Address 1:	4301 W. Markham, Slot 806		
PI Address 2:			
PI Web Page:			
City:	Little Rock	**State:**	AR
Zip Code:	72205	**Congressional District:**	2
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2003 Biomedical Research & Countermeasures 03-OBPR-04
Start Date:	07/01/2004	**End Date:**	07/31/2009
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**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:	NOTE: Added Gap per HRP Master Task List information dtd 3/14/12 (Ed., 4/10/12) NOTE: Received extension to 7/31/2009 per NSBRI (10/09)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Fitts, Robert (Marquette University) Ferrando, Arny (University of Arkansas for Medical Sciences)		
Grant/Contract No.:	NCC 9-58-NPFR00403		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	We have completed this project and have studied the effects of chronically elevated cortisol and hypocaloric diet throughout 14 days of bed rest on muscle protein, lean body mass (LBM), and muscle function. We have completed 13 subjects. Preliminary evidence indicates that combined elevation of cortisol and a hypocaloric diet throughout bed rest increases muscle resistance to the action of insulin and increases the loss of lean body mass. This investigation is relevant to both clinical and astronaut populations, as both are prone to under-nutrition during a stress state. Further, we intend to investigate nutritional and exercise countermeasures with this model to determine an optimal operational countermeasure that can be economically (in terms of crew time and payload) utilized to ameliorate muscle loss during prolonged space flight.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Earth-based Implications: Prolonged inactivity is inherent to trauma, serious injury, or major surgery. These events represent a significant stress to the patient such that the resultant muscle loss and weakness impairs subsequent rehabilitation. The requirement for hospital intensive care often entails hypocaloric intake in the patient, thereby further exacerbating the deleterious effects of hospitalization. This project was designed to investigate countermeasures that will maintain muscle mass and function during periods of prolonged inactivity. The proposed interventions are primarily nutritional, with the idea that minimal activity will enhance nutritional effectiveness. The nutritional intervention is of unique design and composition so as to have a maximal benefit on a gram per gram basis. Thus, these investigations are directly applicable and translatable to patient populations.
Task Progress:	Major Accomplishments This project represents a combination of two NASA-funded protocols, which investigated nutritional countermeasures to activity-induced sarcopenia. Our previous NASA project demonstrated that essential amino acid supplementation (EAA) throughout bed rest preserved lean body mass and reduced the loss of muscle function. However, the supplement we utilized was not feasible for delivery during space flight. The general goal of the current proposal is to reduce the amount of supplement required by optimizing the composition, the amount, and the timing of ingestion in order to effectively minimize the loss of lean body mass and function. Since the protocols of Drs. Wolfe and Ferrando were designed to be complementary, we have included them under one institutional review board (IRB) protocol at University of Arkansas for Medical Sciences (UAMS). Thus, this report will detail progress in both grant projects. Since our move to UAMS, we have completed three important study groups related to the goals of this project. The aims we focused upon represented the testing of a more practical approach to the delivery of EAA in an astronaut population. We have completed the following specific aims: 1. Determine if the addition of 3 g of leucine to meals results in a stimulation of muscle protein synthesis over a 24 hr period. Two groups of subjects were studied during short-term bed rest; a control and a leucine group. In the control group, we enrolled 12 subjects and studied 8, while in the leucine group, we enrolled 8 and studied 8. While analyses are currently underway, preliminary data indicates that muscle protein synthesis was greater during the first day of bed rest with the leucine supplementation. It does not appear; however, that leucine supplementation was effective in stimulating muscle protein synthesis on subsequent days of inactivity. 2. Determine if ingestion of 7.5 g of EAA three times per day between meals will efficiently (gm protein synthesized/gm ingested) stimulate muscle protein synthesis. This group will be compared to a control group consisting of 2-day bed rest alone. We hypothesize that 7.5 g EAA will preserve muscle protein synthesis during bed rest. While 8 control subjects were studied, we also enrolled 10 and studied 7 subjects given 7.5 g of EAA TID (three times a day) throughout bed rest. Based upon our previous work, we anticipate that the addition of 7.5 g of EAA TID will result in an increase synthetic response. While these analyses are ongoing, this dosage allows us to ascertain a dose-response of EAA, given our previous results with the maximal response of 15 g.
Bibliography Type:	Description: (Last Updated: 10/23/2019)
Articles in Peer-reviewed Journals	Cree MG, Paddon-Jones D, Newcomer BR, Ronsen O, Aarsland A, Wolfe RR, Ferrando A. "Twenty-eight-day bed rest with hypercortisolemia induces peripheral insulin resistance and increases intramuscular triglycerides." Metabolism. 2010 May;59(5):703-10. Epub 2009 Nov 17. http://dx.doi.org/10.1016/j.metabol.2009.09.014 ; PubMed PMID: 19919871 , May-2010
Articles in Peer-reviewed Journals	Uchakin PH, Stowe RP, Paddon-Jones D, Tobin BW, Ferrando AA, Wolfe RR. "Cytokine secretion and latent herpes virus reactivation with 28 days of horizontal hypokinesia." Aviat Space Environ Med. 2007 Jun;78(6):608-12. PubMed PMID: 17571663 , Jun-2007