Task Book Report Generated on: 03/29/2024

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Project Title: Notarional Countermeasures to Ameliorate Losses in Muscle Mass and Function  Division Name: Human Research  Program/Discipline: NSBRI  Program/Discipline: NSBRI—Human Factors and Performance Team  Element/Studificipline: NSBRI—Human Factors and Performance Team  Joint Agency Name: TechPort: Yes  Human Research Program Richies: None  Space Biology Stement: None  Space Biology Element: None  Space Biology Stement: None  Space Biology Special Category: None  PI Email: Program/Discipline: Program Richies None  Space Biology Special Category: None  PI Email: Program Richies None  Space Biology Special Category: None  PI Email: Program Richies None  Space Biology Special Category: None  PI Email: Program Richies None  Space Biology Special Category: None  PI Email: Program Richies None  Space Biology Special Category: None  PI Camala: Program Richies None  Space Biology Special Category: None  PI Camala: Program Richies None  University of Arkansas for Medical Sciences  PI Address 1: 4301 W. Markham, Slot 806  PI Address 2: PI Address 2: PI Address 3: PI			Task Last Updated:	FY 10/08/2009
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 Cross-Element:         None           Space Biology Cross-Element:         None           Space Biology Special Category:         None           PI Email:         rewilt?26/manus.edu         Fax:         FY 501-526-5710           PI Organization Type:         UNIVERSITY         Plone:         501-526-5708           Organization Name:         University of Arkanas for Medical Sciences         Plone:         501-526-5708           PI Address 1:         430 IV. Markhum, Slot 806         State:         AR           PI Address 2:         Plone:         State:         AR           PI Address 2:         Little Rock         State:         AR           Zip Code:         22205         Congressional District         2003 Biomedical Research & Content Page 201           Start Date:         070/12004         End Date:         071/12009           No. of Post Dace:         0         No. of Bachelor's Degrees:         0 <td>Project Litle:</td> <td colspan="3">Nutritional Countermeasures to Ameriorate Losses in Muscle Mass and Function</td>	Project Litle:	Nutritional Countermeasures to Ameriorate Losses in Muscle Mass and Function		
Programs   Programs   Programs   Programs   Programs   Programs   Programs   Program	Division Name:	Human Research		
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Human Research Program Elements: (I) HHC-Human Health Countermeasures  Human Research Program Risks: None Space Biology Element: None Space Biology Element: None Space Biology Special Category: None  PI Email: rwolfe/drams.edu Fax: FY 501-526-5710  PI Organization Type: UNIVERSITY Phone: 501-526-5708  PI Organization Type: University of Arkansas for Medical Sciences  PI Address 1: 4301 W. Markham, Slot 806  PI Address 2: FI Address 2: FI Address 2: FI Address 3: A Research Program Bistrict: 2  City: Little Rock State: AR  Zip Code: 72205 Congressional District: 2  Comments: Froject Type: GROUND Solicitation / Funding Source Countermeasures 93-OBPR-04  Start Date: 07/01/2004 End Date: 07/31/2009  No. of Post Docs: 0 No. of Master's Candidates: 0 No. of PhD Degrees: 0  No. of Master's Candidates: 0 No. of Master's Degrees: 0  No. of Master's Candidates: 0 No. of Master's Degrees: 0  No. of Master's Candidates: 0 No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No. of Master's Degrees: 0  No. of Master's Candidates: No		NSBRIHuman Factors and Performance Te	eam	
Human Research Program Risks: None Space Biology Element: None Space Biology Cross-Element Disciplinar: None Space Biology Cross-Element Disciplinar: None Space Biology Special Category: None PI Email: rooffe/Zoums.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 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 Post Docs: 0 No. of Master's Degrees: 0 No. of Master's Candidates: 0 No. of Master's Degrees: 0 No. of Master's Candidates: 0 No. of Master's Degrees: 0 No. of Bachelor's Candidates: 0 No. of Master's Degrees: 0 No. of Bachelor's Candidates: 0 No. of Master's Degrees: 0 No. of Master's Candidates: 0 No. of Master's Degrees: 0 No. of Bachelor's Candidates: 0 No. of Master's Degrees: 0 No. of Master's Candidates: 0 No. of Master's Degrees: 0 No. of Master's Candidates: 0 No. of Master's Degrees: 0 No. of Master's Candidates: 0 No. of Bachelor's Degrees: 0 No. of Sachelor's Candidates: 0 No. of Master's Degrees: 0 No. of Master's Candidates: NoTE: Added Gap per HRP Matter Tack List information dtd 3/14/12 (Ed., 4/10/12) NOTE: Received extension to 7/31/2009 per NSBRI (10/09) Fight Assignment: NOTE: Added Gap per HRP Matter Tack List information dtd 3/14/12 (Ed., 4/10/12) Fight Assignment: NOTE: Added Cap per HRP Matter Tack List information dtd 3/14/12 (Ed., 4/10/12) Fight Assignment: NOTE: Added Cap per HRP Matter Tack List information dtd 3/14/12 (Ed., 4/10/12) Ferrando, Arny (University of Arkansus for Medical Sciences) Fight Note: Arkansus for Medical Sciences (Cap Perromance Goal No.:	Joint Agency Name:		TechPort:	Yes
Space Biology Element:         None           Space Biology Cross-Element Discipliner         None           Space Biology Special Category:         None           PI Email:         poolfe2@inums.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 03-0BPR-04           Start Date:         07/01/2004         End Date: 07/31/2009           No. of Post Does:         0 No. of Master' Degrees: 0           No. of PhD Candidates:         0 No. of Master' Degrees: 0           No. of Bachelor's Candidates:         0 No. of Master' Sperges: 0           No. of Bachelor's Candidates:         0 Monitoring Center: NSBRI           Contact Email:         Flight Program:           Flight Program:         Contact Phone: Contact Phone: NOTE: Added Gap per HRP Master Task List information did 3/14/12 (Ed. 4/10/12) NOTE: Received extension to 7/31/2009 per NSBR	<b>Human Research Program Elements:</b>	(1) <b>HHC</b> :Human Health Countermeasures		
Space Biology Cross-Element   Space Biology Special Category:   None	Human Research Program Risks:	None		
Discipline:   None   None	Space Biology Element:	None		
PI Email:		None		
Pl Organization Type: UNIVERSITY Phone: 501-526-5708 Organization Name: University of Arkansas for Medical Sciences Pl Address 1: 4301 W. Markham, Slot 806 Pl Address 2: Pl Web Page: City: Little Rock State: AR Zip Code: 72205 Congressional District: 2 Comments: Project Type: GROUND Solicitation / Funding Source: 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 Email: Flight Program:  NOTE: Added Gap per HRP Master Task List information did 3/14/12 (Ed., 4/10/12) NOTE: Received extension to 7/31/2009 per NSBRI (10/09) Fersando, Arny (University of Arkansas for Medical Sciences) Grant/Contract No.: NCC 9-58-NPFR00403 Performance Goal No.:	Space Biology Special Category:	None		
Organization Name:         University of Arkansas for Medical Sciences           PI Address 1:         4301 W. Markham, Slot 806           PI Address 2:	PI Email:	rwolfe2@uams.edu	Fax:	FY 501-526-5710
PI Address 1:	PI Organization Type:	UNIVERSITY	Phone:	501-526-5708
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 Candidates: 0 No. of Master' Degrees: 0  No. of Master's Candidates: 0 No. of Master' Degrees: 0  No. of Bachelor'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:  NOTE: Added Gap per HRP Master Task List information did 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, Army (University of Arkansas for Medical Sciences)  Grant/Contract No.: NCC 9-58-NPFR00403  Performance Goal No.:	Organization Name:	University of Arkansas for Medical Sciences		
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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 PhD Degrees:  0  No. of PhD Degrees:  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 Email:  Flight Program:  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, Army (University of Arkansas for Medical Sciences)  Performance Goal No.:	Zip Code:	72205	<b>Congressional District:</b>	2
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Ferrando, Arny (University of Arkansas for Medical Sciences )  Grant/Contract No.: NCC 9-58-NPFR00403  Performance Goal No.:	Key Personnel Changes/Previous PI:			
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Task Book Report Generated on: 03/29/2024

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.

## 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:

### Task Progress:

- 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. <a href="http://dx.doi.org/10.1016/j.metabol.2009.09.014">http://dx.doi.org/10.1016/j.metabol.2009.09.014</a>; PubMed <a href="https://pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmiles.com/pmile

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