Fiscal Year:	FY 2016	**Task Last Updated:**	FY 08/28/2015
PI Name:	Willey, Jeffrey S. Ph.D.		
Project Title:	Exercise Countermeasures for Knee and Hip Joint Degradation during Spaceflight		
Division Name:	Space Biology		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	SPACE BIOLOGY--Developmental biology		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Cell & Molecular Biology (2) Animal Biology: Vertebrate		
Space Biology Cross-Element Discipline:	(1) Musculoskeletal Biology		
Space Biology Special Category:	(1) Translational (Countermeasure) Potential		
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Zip Code:	27157-0001	**Congressional District:**	5
Comments:	NOTE: PI formerly at Clemson University when NSBRI Postdoctoral Fellow Feb 2008-Oct 2010 (Ed., 12/18/2014)		
Project Type:	Flight	**Solicitation / Funding Source:**	2014 Space Biology Flight NNH14ZTT001N
Start Date:	10/28/2014	**End Date:**	10/27/2017
No. of Post Docs:	1	**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA ARC
Contact Monitor:	Taylor, Elizabeth	**Contact Phone:**	650.604.1783
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Smith, Thomas Ph.D. (Wake Forest University Health Sciences)		
Grant/Contract No.:	NNX15AB50G		
Performance Goal No.:			
Performance Goal Text:			
	This project will study the risk of damaging both the hip and knee joints because of exposure to weightlessness during long spaceflights. The knee joint contains cartilage lining the bone, the meniscus which distributes weight through the joint, and the ligaments which join the bones. The hip joint contains cartilage lining the bone. Weightlessness during long spaceflights has the potential to damage these structures, increasing the risk of developing arthritis or bone fractures either during spaceflight or after returning to Earth. However, the extent and cause of damage to these joint structures during spaceflight has not been studied. It is also not known if these joint tissues can recover from weightlessness-related damage. To study these problems, we will determine the hip and knee joint damage that occurs in mice that will fly in space on the International Space Station for 30 days. This joint damage will be compared to the hip and knee joint damage in		

Task Description:	another group of mice kept on Earth that also will not have weight on the hip and knee joints for 30 days. Damage to the hip and knee joint structures will be determined using imaging techniques, engineering devices to measure tissue strength, stained tissue sections, and identification of the molecules that cause the damage. The ability to walk normally after 30 days of weightlessness will also be determined. Finally, we will determine if treadmill running or climbing can reverse any of the hip and knee joint damage caused by being in the weightless space environment. Our goal is to determine, 1] if hip and knee joint damage occurs in the weightless space environment, and 2] if recovery from this damage is possible with exercise. From these studies, we also will gain insights into how arthritis develops in wheel-chair bound spinal cord injury patients or after limb surgery, and how it can be prevented.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	From these studies, we also will gain insights into how arthritis develops in wheel-chair bound spinal cord injury patients or after limb surgery, and how it can be prevented.
Task Progress:	The progress on our grant was limited during the past year as full funding was not made available. The funding that was made available permitted us to travel to NASA Ames and present our work to other investigators funded in this soliciation and to the management team. However, a positive outcome from this meeting was the formation of a new collaboration between my lab and two other funded investigators, specifically Dr. Michael Pecaut and Dr. Vivien Mao, both from Loma Linda Medical Center. We have enrolled in a tissue sharing opportunity, in which I am now analyzing the knee joints from mice enrolled in their studies examining the consequences of spaceflight on other body systems (e.g., immune system). We are using our unique small animal imaging approach to describe the arthritis in these joints, and thus we will maximize the productivity, publications, and impact through collaborative work.
Bibliography Type:	Description: (Last Updated: 01/22/2025)