Fiscal Year:	FY 2015	**Task Last Updated:**	FY 04/26/2016
PI Name:	Hargens, Alan R. Ph.D.		
Project Title:	Spinal Structure and Function after 90 Days Long-Duration Simulated Space Flight and Recovery		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Bone Fracture**:Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) **Osteo**:Risk Of Early Onset Osteoporosis Due To Spaceflight		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	La Jolla	**State:**	CA
Zip Code:	92037-0863	**Congressional District:**	52
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2013 HERO NNJ13ZSA002N-Crew Health (FLAGSHIP & NSBRI)
Start Date:	08/01/2014	**End Date:**	07/31/2017
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:	2	**Monitoring Center:**	NASA JSC
Contact Monitor:	Norsk, Peter	**Contact Phone:**	
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Ferguson, Adam Ph.D. (University of California at San Francisco) Lotz, Jeffrey Ph.D. (University of California at San Francisco) Macias, Brandon (NASA-JSC) Masuda, Koichi M.D. (University of California at San Diego)		
Grant/Contract No.:	NNX14AP25G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The vertebral bodies and flexible intervertebral discs are important, weight-bearing tissues that have adapted to gravitational stress. Consequently, the absence of gravitational axial loads during exposure to microgravity likely disrupts normal spine physiology. Throughout longer space flight missions, deconditioning of the intervertebral discs and spinal muscles poses a serious injury risk upon re-exposure to upright posture in a gravitational environment. We will use state-of-the-art technologies to quantify morphology, biochemistry, and kinematics of spines (including the vertebrae, intervetebral discs, and spinal muscles) of rats at defined time points as described in the NASA research announcement. After successful completion of our investigation, we will deliver a comprehensive database of simulated microgravity-induced spinal adaptations (type and magnitude). The overarching goal of these proposed studies are to develop a long-duration space flight ground based model of spine function and structure. In addition, this research project will afford the opportunity to examine possible gender differences in spinal structure and function. Our research group is in a unique position to leverage our past rodent space flight experience on STS-131, STS-133, STS-135, and BION M-1 missions and directly compare to this ground based model of simulated microgravity. Moreover, we are also uniquely positioned to compare this 90-days hind-limb suspension model to those changes that occur in our currently-funded project to test crew members before and after 6-month ISS missions. Our project directly addresses Critical Path Roadmap Risks and Questions regarding disc injury (IRP Gap-B4): Is damage to joint structure, intervertebral discs, or ligaments incurred during or following microgravity exposure? Our research will improve understanding of the underlying pathophysiology of spinal deconditioning induced by simulated microgravity, and mechanisms of spinal adaptation following re-exposure to 1-G. Our long-term goal is to prevent such spinal deconditioning with exercise or other physiologic countermeasures. The goal of this research is to comprehensively characterize 90-days simulated space-flight and recovery induced changes in spinal tissue morphology, biochemistry, and biomechanics.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	To our knowledge, this study is the first to examine the effects of 90-days simulated space flight on spinal deconditioning in rats. The vertebral bodies and flexible intervertebral discs are important, weight-bearing tissues that have adapted to gravitational stress. Our research will aid understanding of spinal deconditioning during simulatee microgravity and of the higher incidence of disc prolapse or herniation following re-exposure to 1-G with a long-term view to prevent such spinal deconditioning with exercise or other physiologic countermeasures. This research may aid understanding of spinal deconditioning during inactivity such as after spinal cord injury and bed rest in human patients on Earth.
Task Progress:	Limited progress has been made because we are just now receiving spine samples from the Body Parts Program at UC-Davis/NASA Ames Research Center.
Bibliography Type:	Description: (Last Updated: 10/31/2023)