

Fiscal Year:	FY 2008	Task Last Updated:	FY 06/02/2008
PI Name:	Midura, Ronald J Ph.D.		
Project Title:	Extent, Causes, and Countermeasures of Impaired Fracture Healing in Hypogravity		
Division Name:	Human Research		
Program/Discipline:	NSBRI		
Program/Discipline-- Element/Subdiscipline:	NSBRI--Musculoskeletal Alterations Team		
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		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	midurar@ccf.org	Fax:	FY 216-444-9198
PI Organization Type:	NON-PROFIT	Phone:	216-445-3212
Organization Name:	The Cleveland Clinic Foundation		
PI Address 1:	Biomedical Engineering - ND20		
PI Address 2:	Lerner Research Institute		
PI Web Page:			
City:	Cleveland	State:	OH
Zip Code:	44195	Congressional District:	11
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2007 Crew Health NNJ07ZSA002N
Start Date:	06/01/2008	End Date:	05/31/2012
No. of Post Docs:	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: NSBRI		
Contact Monitor:	Contact Phone:		
Contact Email:			
Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Globus, Ruth (NASA Ames Research Center) Muschler, George F (Cleveland Clinic) Cavanagh, Peter (Cleveland Clinic) Burr, David (Indiana University School of Medicine) Warden, Stuart (Indiana University) Hill, Esther (Lockheed Martin Mission Services)		
Grant/Contract No.:	NCC 9-58-MA01604		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>Lunar missions will expose astronauts to continuous hypogravity and bouts of strenuous physical exertion. Accidental fractures during missions could present a commander with a potentially life-threatening situation and a serious reduction in team effectiveness. Thus, the scope and extent of bone healing in a space environment needs to be investigated, as well as the development of countermeasures to augment bone healing responses. The healing of fibular fractures in rats during actual spaceflight or under simulated hypogravity conditions is deemed to be impaired. This project continues a previous NSBRI project which found that fibular healing in tail-suspended rats was delayed leading to a significant number of non-unions and was associated with a substantially reduced number of marrow-derived osteoprogenitor cells providing a partial explanation for impaired healing. Also, bone anabolic drugs decreased the incidence of fibular non-unions and improved the number of osteoprogenitor cells. Altogether, this suggests that fracture healing in space is not Earth normal and provides the rationale to further investigate whether impairment of fibular fracture healing would extend to more clinically relevant femoral fractures. Our global hypothesis is that long-duration hypogravity impairs fracture healing.</p> <p>Objectives</p> <ol style="list-style-type: none">1. Determine the scope and extent of femoral fracture healing impairment.2. Determine the underlying biological causes of the impairment.3. Develop countermeasures to prevent fracture healing impairment.4. Determine whether current Earth-based clinical procedures will reverse severely delayed fracture healing situations resulting from hypogravity. <p>Tail-suspended rats will undergo closed femoral fractures and healing will be assessed using: micro-CT bone imaging to evaluate hard callus structure; hard callus strength via torsion testing; callus tissue composition using histomorphometry; colony forming unit assessments of marrow-derived osteoprogenitor cell numbers; and measurements of osteoinductive and angiogenic factor expression during early healing periods.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2008.
Bibliography Type:	Description: (Last Updated: 03/01/2017)