Fiscal Year:	FY 2008	**Task Last Updated:**	FY 11/29/2007
PI Name:	Bateman, Ted A. Ph.D.		
Project Title:	Space Radiation and Bone Loss: Lunar Outpost Mission Critical Scenarios and Countermeasures		
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 (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		
PI Email:	bateman@unc.edu	**Fax:**	FY
PI Organization Type:	UNIVERSITY	**Phone:**	720-810-3626
Organization Name:	University of North Carolina at Chapel Hill		
PI Address 1:	152 MacNider Hall, CB 7575		
PI Address 2:	Dept of Biomedical Engineering		
PI Web Page:			
City:	Chapel Hill	**State:**	NC
Zip Code:	27599	**Congressional District:**	4
Comments:	Previous affiliation was Clemson University; PI moved to UNC in fall 2010.		
Project Type:	GROUND	**Solicitation / Funding Source:**	2007 NSBRI-RFA-07-01 Human Health in Space
Start Date:	10/01/2007	**End Date:**	09/30/2011
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):	Jones, Jeffrey (NASA JSC) Midura, Ronald (The Cleveland Clinic Foundation) Nelson, Gregory (Loma Linda University)		
Grant/Contract No.:	NCC 9-58-BL01302		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Crews on exploratory missions will face complex radiation from cosmic and solar sources with components ranging from protons to iron. We have identified trabecular bone loss in mice after exposure to a 2 Gy dose of multiple radiation types, suggesting space radiation may increase bone loss from reduced gravity during exploratory missions. An increase in serum markers of bone resorption in rats three days post-exposure to 2 Gy indicates bone loss may be rapid. The impact of radiation on bone quality and fracture healing in reduced gravity is unknown and must be studied to understand effects of space radiation on bone health. The long-term objective of this project is the development of countermeasures to prevent bone loss during missions and thus reduce fracture risk. To define the risks associated with space radiation-induced bone loss, the following aims will examine effects of modeled space radiation using scenarios applicable for Lunar Outpost missions: 1. Examine combined effects of a modeled solar particle event and unloading on bone, and subsequent recovery during reloading. Hypothesis: Proton radiation with unloading will induce a more severe bone loss than unloading alone. 2. Examine initiation of osteoclast activation and subsequent bone loss following exposure to several types of modeled space radiation, including acute proton exposure, low-dose-rate proton exposure and mixed radiation types (proton and HZE). Understanding underlying molecular causes is critical to developing countermeasures for radiation-induced bone loss. Hypothesis: The initiating mechanism of bone loss is radiation-induced inflammation, increasing RANKL production due to damaged marrow, causing early osteoclast activation. 3. Test the efficacy of three countermeasures for bone loss caused by proton exposure: a) The bisphosphonate zoledronate; b) The RANKL blocking protein osteoprotegerin; and c) An antioxidant agent, -lipoic acid. Hypothesis: Potent inhibitors of bone resorption, both zoledronate and osteoprotegerin will prevent the bone loss caused by radiation. Antioxidants will address multiple radiation-induced problems; -lipoic acid decreases osteoclast differentiation and activity.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2008.
Bibliography Type:	Description: (Last Updated: 11/12/2020)