

Fiscal Year:	FY 2009	Task Last Updated:	FY 04/01/2010
PI Name:	Anbar, Ariel Ph.D.		
Project Title:	Rapid measurements of bone loss using tracer-less calcium isotope analysis of blood and urine		
Division Name:	Human Research		
Program/Discipline:	HUMAN RESEARCH		
Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Biomedical countermeasures		
Joint Agency Name:	TechPort:	Yes	
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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Zip Code:	85287	Congressional District:	9
Comments:			
Project Type:	GROUND	Solicitation / Funding Source:	2007 Crew Health NNJ07ZSA002N
Start Date:	05/20/2008	End Date:	05/19/2011
No. of Post Docs:	No. of PhD Degrees:		
No. of PhD Candidates:	No. of Master' Degrees:		
No. of Master's Candidates:	1	No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:	Monitoring Center: NASA JSC		
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):			
Grant/Contract No.:	NNX08AQ36G		
Performance Goal No.:			
Performance Goal Text:	<p>We propose to develop a method to rapidly detect changes in bone mineral balance by measuring the natural (i.e., tracer-less) isotope composition of calcium in blood and/or urine. This method would provide a way to detect incipient bone loss before changes in bone density are detectable by conventional X-Ray methods.</p> <p>The resorption of bone when astronauts are exposed to microgravity is a major challenge for NASA's plans for human exploration of the Moon and Mars. Our proposed technique would be immediately valuable in ground-based studies of countermeasure strategies, accelerating the pace of discovery of countermeasures to bone loss. In the long run, flight-qualified versions of mass spectrometric or other systems for Ca isotope characterization could accompany astronauts on long-duration missions.</p> <p>Precise measurements of the calcium isotope composition in blood or urine provide information about bone mineral</p>		

Task Description:	<p>balance because the isotopic composition of calcium in human soft tissues is naturally affected by the relative rates of bone formation and resorption. Specifically, lighter calcium isotopes are preferentially incorporated into bone during formation. Because of the short residence time of calcium in soft tissues, calcium isotope ratios should change rapidly in response to changes bone gain or loss. These changes, while small, can be measured by multiple collector inductively coupled plasma mass spectrometry (MC-ICP-MS) or thermal ionization mass spectrometry (TIMS).</p> <p>The proposal team recently demonstrated the promise of this method in a published pilot study in which we measured calcium isotopes in a small suite of urine samples from a bed rest study. Here, we propose an expanded examination of bed rest samples, involving a larger number of subjects, measurements of blood and dietary samples as well as urine, and daily or even sub-daily sampling. This research would address critical questions unresolved by the pilot study.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	<p>The project efforts have developed in accordance with the Year 1 goals of implementing the established protocols for MC-ICP-MS analysis of Ca isotopes, exploring ideas to optimize protocols to increase sample throughput, and helping design bed rest studies to obtain samples. Three ASU scientists are heavily involved in accomplishing the above goals (the PI, Professor Ariel Anbar; Assistant Research Scientist Dr. Gwyn Gordon; and graduate student Jennifer Morgan). Consultant J. Skulan and collaborator S. Smith developed the bed rest protocols.</p>
Bibliography Type:	Description: (Last Updated: 10/09/2019)