Task Book Report Generated on: 03/28/2024

Fixed Years: Pi Name: Abbr. Arie Ph. Project Title: Stable Calcium Isotoppes in Urine as a Biornarder of Bone Mineral Balance in Spaceflight  Burksion Name: Human Research Program/Discipline: Program/Discipline: Program/Discipline: Program/Discipline: Program/Discipline: Program/Discipline: Program/Discipline: Program/Discipline: Program/Discipline: Program Risks: Joint Agency Name: Human Research Program Element: (I) HHC-Human Health Countermeasures Human Research Program Risks: (I) Human Research Program Risks: (I) Human Research Program Risks: (I) Hone Fracture-Risk of Bone Facture due to Spaceflight-induced Changes to Bone (2) Oxtor-Risk Of Early Onset Ostooprossis Due To Spaceflight Space Biology Element: None Space Biology Element: None Space Biology Special Category: None PI Email: Industrial Type: UNIVERSITY None PI Address 1: Program Zisks: School of Earla & Space Exploration PI Address 2: Bateman Physical Sciences Bidg, Box 871404 PI Web Drags: City: Tempe State: AZ Zip Code: SS287 Congressional District: 9 Comments: Project Type: State Date: 1100HT Solicitation / Funding Source: 2012 Crew Health NN112ZSA002N No. of Post Dues: No. of Post Dues: No. of Post Dues: No. of Post Dues: No. of Master' Degress: No. of Master' Scandidates: No. of Master' Scandidates: No. of Master' Candidates: No. of Master' Candidates: No. of Master' Candidates: No. of Master' Scandidates: No.				
Project Title: Subbe Culcium Isotopes in Urine as a Biomarker of Bone Mineral Balance in Spacellight  Program/Discipline: Human Research  Program/Discipline: HUMAN RESEARCH—Biomedical countermeasures  Flement/Subhidopline: HUMAN RESEARCH—Biomedical countermeasures  Flement/Subhidopline: Isotopes in Urine as a Biomarker of Bone Mineral Balance in Spacellight  Jaint Agency Name: Tech Port: Yes  Ilmman Research Program Elements: (I) BIUCILImman Health Countermeasures  Human Research Program Relseits: (I) Bone Freeture-Risk of Bone Frencture due to Spacellight-indused Changes to Bone (2) Ostore-Risk Or Early Onset Ostoporosis Due To Spacellight  Space Biology Element: None  Space Biology Element: None  Space Biology Special Cattegory: None  PI Email: anhanginuseda Fax: FY  PI Organization Type: UNIVERSITY Phone: 480-965-0767  Organization Name: Arizona State University  PI Address 1: School of Earth & Space Exploration  PI Address 2: Bateman Physical Sciences Bidg, Box 871404  PI Web Page:  City: Tempe State: AZ  Zajo Gode: Searcy Congressional District: 9  Comments:  Project Type: FLIGIT Solicition / Funding Source: 2012 Crew Health NN112ZSA002N  Start Date: 1201/2013 End Date: 1130-2017  No. of Pab Decres: 1201/2013 End Date: 1130-2017  No. of Pab Candidates: No. of Bachelor's Degrees:  No. of Pab Candidates: No. of Bachelor's Degrees:  No. of Pab Candidates: No. of Bachelor's Degrees:  No. of Bachelor's Candidates: Sephanne Contact Phone: Contact Mainter: Plogge Sephanne Contact Email: Sephanne Lplonges 27/6/mana 2002  Flight Program: SS  Key Fersonnel Changes/Previous PI:  COI Name (Institution): Science Godon, Onlyneth Ph.D. (Arizona State University)  Science Condon, Contact Changes Previous PI:  COI Name (Institution): Science State Charges Indicates University)	Fiscal Year:	FY 2016	Task Last Updated:	FY 03/08/2016
Division Name: Human Research Program/Discipline: Program/Discipline: Program/Discipline: HUMAN RESEARCH-Biomedical countermeasures Joint Agency Name: Human Research Program Elements: (I) HICHuman Health Countermeasures Human Research Program Elements: (I) Hinder Fracture-Risk of Bone Fracture due to Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (2) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (3) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes to Bone (4) Osteo-Risk Of Early Onset Osteoporosis Due To Spaceflight-induced Changes FY  Proper Type:  Organization T	PI Name:	Anbar, Ariel Ph.D.		
Program/Discipline: Program/Discipline- Element/Suddiscipline- Element/Suddiscipline- Element/Suddiscipline- Element/Suddiscipline- Human Research Program Element:  Unit Agency Name:  One Risk Of Farhy Onset Oscoporosis Due To Spaceflight-induced Changes to Bone Col Ostore Risk Of Farhy Onset Oscoporosis Due To Spaceflight  None  Space Biology Cross-Element None  Space Biology Special Category:  None  Pit Emil:  absorganaced  Pit Agency Pinone:  Arrona State University  Pi Address 1:  School of Farth & Space Epitoration  Pi Address 2:  Bateman Physical Sciences Bidg, Box 871404  Pit Web Page:  City:  Tempe  State: AZ  Zip Code:  State: AZ  Zip Code:  State: AZ  Zip Code:  State:  Congressional District:  Project Type:  FLIGIIT  Solicitation / Funding Source:  2101/2013  End Date:  1201/2013  End Date:  1201/2013  End Date:  1201/2013  End Date:  1300 of Pab Deerces:  No. of Pab Deerces:  No. of Pab Deardidates:  No. of Bachelor's Degrees:  No. of Master's Candidates:  1 No. of Pab Contact Monitor:  Contact Monitor:  Ploeger, Stephanne  Contact Emil:  Stephanne I ploeger/Zefinasa.gov.  Flight Program:  SS  Key Personnel Changes/Previous Pit.  Kry Personnel Changes/Previous Pit.  COI Name (Institution):  Sculan, Joseph Pit.D. (Arizona State University)  Sculan, Joseph Pit.D. (Arizona State University)  Gramt/Contract No.:  NXIAAB78G  Performance Gieal No.:	Project Title:	Stable Calcium Isotopes in Urine as a l	Biomarker of Bone Mineral Balance in	Spaceflight
Fundamental Program   Discipline   Element/Subdicipline   Fundament   Program   Prog	Division Name:	Human Research		
Flement/Subdiscipline:   IOMAN RESEARCH—Bomeducal countermeasures	Program/Discipline:			
Human Research Program Elements: (1) HHC-Human Health Countermeasures    Counter Risk   Counter		HUMAN RESEARCHBiomedical co	ountermeasures	
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 Cross-Element Discipline:  None  None  None  PI Email:  anharizanta edu Pl Organization Type:  UNIVERSITY Phone:  School of Earth & Space Exploration PI Address 1:  School of Earth & Space Exploration PI Address 2:  Bateman Physical Sciences Bldg, Box 871404  PI Web Page:  City:  Tempe State:  AZ  Zip Code:  S287 Congressional District:  Project Type:  FLIGHT Solicitation / Funding Source:  2012 Crew Health NNJ12ZSA002N  Start Date:  1201/2013 End Date:  11/30/2017  No. of Post Docs:  No. of Post Docs:  No. of Post Docs:  No. of Master's Degrees:  No. of Bachelor's Degrees:  No. of Bachelor's Candidates:  1 Contact Monitor:  Ploeger, Stephanne Stephanne Contact Phone:  Contact Email:  Stephanne Lploeger/22@msas.gov  Flight Program:  ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 19/6/16)  NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	Joint Agency Name:		TechPort:	Yes
Space Biology Element:   None   Non	<b>Human Research Program Elements:</b>	(1) <b>HHC</b> :Human Health Countermeasu	ures	
Space Biology Cross-Element Discipline:  None  PI Email: anbar@asu.edu Fax: FY  PI Organization Type: UNIVERSITY Phone: 480-965-0767  Organization Name: Arizona State University  PI Address 1: School of Earth & Space Exploration  PI Address 2: Bateman Physical Sciences Bidg. Box 871404  PI Web Page:  City: Tempe State: AZ  Zip Code: 85287 Congressional District: 9  Comments:  Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N  Start Date: 1201/2013 End Date: 11/30/2017  No. of Post Docs: 1 No. of Master' Degrees:  No. of Master's Candidates: No. of Master' Degrees:  No. of Master's Candidates: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Email: stephanne. I ploeger/22@mass.uov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16)  NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 1/21/4/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Sculan, Joseph Ph.D. (Arizona State University)  Skulan, Joseph Ph.D. (Arizona State University)	Human Research Program Risks:			es to Bone
Discipline:   None	Space Biology Element:	None		
PI Email: anbar@asu.edu Fax: FY Pl Organization Type: UNIVERSITY Phone: 480-965-0767 Organization Name: Arizona State University PI Address 1: School of Earth & Space Exploration PI Address 2: Bateman Physical Sciences Bldg, Box 871404 PI Web Page: City: Tempe State: AZ Zip Code: 85287 Congressional District: 9 Comments: Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N Start Date: 12/01/2013 End Date: 11/30/2017 No. of Post Docs: 1 No. of Master' Degrees: No. of PhD Candidates: No. of Master' Degrees: No. of Master's Candidates: No. of Bachelor's Candidates: 1 Monitoring Center: NASA JSC Contact Monitor: Ploeger, Stephanne Contact Email: stephanne Lploeger/2/@nasa.gov Flight Program: NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 1/21/4/15) Key Personnel Changes/Previous PI: COI Name (Institution): Skulan, Joseph Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University) Grant/Contract No.: NNX14AB78G Performance Goal No.:		None		
Pl Organization Name: Arizona State University  Pl Address 1: School of Earth & Space Exploration  Pl Address 2: Bateman Physical Sciences Bldg, Box 871404  Pl Web Page:  City: Tempe State: AZ  Zip Code: 85287 Congressional District: 9  Comments:  Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N  Start Date: 12/01/2013 End Date: 11/30/2017  No. of Post Does: 1 No. of Master' Degrees:  No. of Master's Candidates: No. of Bachelor's Degrees:  No. of Master's Candidates: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Monitor: Stephanne Lploeger/22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per Pl and NSSC information (Ed., 9/6/16)  NOTE: End date changed to 11/30/2016 per Pl and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous Pl:  COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University)  Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.: NNX14AB78G	Space Biology Special Category:	None		
Organization Name:         Arizona State University           PI Address 1:         School of Earth & Space Exploration           PI Address 2:         Bateman Physical Sciences Bldg, Box 871404           PI Web Page:         State: AZ           City:         Tempe         State: AZ           Zip Code:         85287         Congressional District:         9           Comments:         Project Type:         FLIGHT         Solicitation / Funding Source:         2012 Crew Health NNJ12ZSA002N           Start Date:         12/01/2013         End Date:         11/30/2017           No. of Post Docs:         1         No. of Master' Degrees:           No. of Master's Candidates:         No. of Bachelor's Degrees:           No. of Master's Candidates:         No. of Bachelor's Degrees:           No. of Bachelor's Candidates:         1         Monitoring Center:         NASA JSC           Contact Email:         stephanne I ploeger/2/@nasa.gov         Contact Phone:         NOTE: End date changed to 11/30/2017 per Pl and NSSC information (Ed., 9/6/16)         NOTE: End date changed to 11/30/2017 per Pl and NSSC information (Ed., 12/14/15)           Key Personnel Changes/Previous Pl:         COI Name (Institution):         Gordon, Gwyneth Ph.D. (Arizona State University)         Skulan, Joseph Ph.D. (Arizona State University)	PI Email:	anbar@asu.edu	Fax:	FY
PI Address 1: School of Earth & Space Exploration PI Address 2: Bateman Physical Sciences Bldg, Box 871404 PI Web Page: City: Tempe State: AZ Zip Code: 85287 Congressional District: 9 Comments: Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N Start Date: 12/01/2013 End Date: 11/30/2017 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: 1 Monitoring Center: NASA JSC Contact Monitor: Ploeger, Stephanne Contact Phone: Contact Email: stephanne1.ploeger??@nasa.gov Flight Program: ISS NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University) Grant/Contract No: NNX14AB78G Performance Goal No.:	PI Organization Type:	UNIVERSITY	Phone:	480-965-0767
PI Address 2: Bateman Physical Sciences Bldg, Box 871404  PI Web Page:  City: Tempe State: AZ  Zip Code: 85287 Congressional District: 9  Comments:  Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N  Start Date: 12/01/2013 End Date: 11/30/2017  No. of Post Does: 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: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Email: stephanne L.ploeger/27@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University) Grant/Contract No: NNX14AB78G  Performance Goal No:	Organization Name:	Arizona State University		
PI Web Page:  City: Tempe State: AZ  Zip Code: 85287 Congressional District: 9  Comments:  Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N  Start Date: 12/01/2013 End Date: 11/30/2017  No. of Post Docs: 1 No. of PhD Degrees:  No. of PhD Candidates: No. of Master' Degrees:  No. of Master's Candidates: No. of Master' Degrees:  No. of Bachelor's Degrees:  No. of Bachelor's Degrees:  No. of Bachelor's Candidates: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Email: Stephanne L.ploeger22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16)  NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University)  Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.: NNX14AB78G  Performance Goal No.:	PI Address 1:	School of Earth & Space Exploration		
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Zip Code: 85287 Congressional District: 9  Comments:  Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N  Start Date: 12/01/2013 End Date: 11/30/2017  No. of Post Docs: 1 No. of PhD Degrees: No. of PhD Candidates: No. of Master' Degrees: No. of Master's Candidates: No. of Master' Degrees: No. of Master's Candidates: No. of Bachelor's Degrees: No. of Bachelor's Candidates: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Email: stephanne L.ploeger22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University)  Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.: NNX14AB78G  Performance Goal No.:	PI Web Page:			
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Project Type: FLIGHT Solicitation / Funding Source: 2012 Crew Health NNJ12ZSA002N  Start Date: 12/01/2013 End Date: 11/30/2017  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: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Email: stephanne.l.ploeger22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University)  Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.: NNX14AB78G  Performance Goal No.:	Zip Code:	85287	<b>Congressional District:</b>	9
Start Date: 12/01/2013 End Date: 11/30/2017  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: 1 Monitoring Center: NASA JSC  Contact Monitor: Ploeger, Stephanne Contact Phone: Contact Email: stephanne.l.ploeger/22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI: COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University) Grant/Contract No.: NNX14AB78G  Performance Goal No.:	Comments:			
No. of Post Docs:  1	Project Type:	FLIGHT	<b>Solicitation / Funding Source:</b>	2012 Crew Health NNJ12ZSA002N
No. of PhD Candidates: No. of Master's Candidates: No. of Bachelor's Candidates: No. of Bachelor's Candidates: I Monitoring Center: NASA JSC Contact Monitor: Ploeger, Stephanne Contact Phone: Contact Email: stephanne.l.ploeger22@nasa.gov Flight Program: ISS NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI: COI Name (Institution): Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University) Grant/Contract No.: NNX14AB78G Performance Goal No.:	Start Date:	12/01/2013	End Date:	11/30/2017
No. of Master's Candidates:  No. of Bachelor's Degrees:  No. of Bachelor's Candidates:  I Monitoring Center: NASA JSC  Contact Monitor:  Ploeger, Stephanne Contact Email:  Stephanne.l.ploeger22@nasa.gov  Flight Program:  ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution):  Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	No. of Post Docs:	1	No. of PhD Degrees:	
No. of Bachelor's Candidates:  Contact Monitor:  Ploeger, Stephanne  Contact Phone:  Contact Email:  stephanne.l.ploeger22@nasa.gov  Flight Program:  ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution):  Gordon, Gwyneth Ph.D. ( Arizona State University ) Skulan, Joseph Ph.D. ( Arizona State University )  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	No. of PhD Candidates:		No. of Master' Degrees:	
Contact Monitor: Ploeger, Stephanne Contact Phone:  Contact Email: stephanne.l.ploeger22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. ( Arizona State University ) Skulan, Joseph Ph.D. ( Arizona State University )  Grant/Contract No.: NNX14AB78G  Performance Goal No.:	No. of Master's Candidates:		No. of Bachelor's Degrees:	
Contact Email: stephanne.l.ploeger22@nasa.gov  Flight Program: ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution): Gordon, Gwyneth Ph.D. ( Arizona State University ) Skulan, Joseph Ph.D. ( Arizona State University )  Grant/Contract No.: NNX14AB78G  Performance Goal No.:	No. of Bachelor's Candidates:	1	<b>Monitoring Center:</b>	NASA JSC
Flight Program:  ISS  NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution):  Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	Contact Monitor:	Ploeger, Stephanne	<b>Contact Phone:</b>	
NOTE: End date changed to 11/30/2017 per PI and NSSC information (Ed., 9/6/16) NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution):  Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	Contact Email:	stephanne.l.ploeger22@nasa.gov		
Flight Assignment:  NOTE: End date changed to 11/30/2016 per PI and NSSC information (Ed., 12/14/15)  Key Personnel Changes/Previous PI:  COI Name (Institution):  Gordon, Gwyneth Ph.D. (Arizona State University)  Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	Flight Program:	ISS		
COI Name (Institution):  Gordon, Gwyneth Ph.D. (Arizona State University) Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	Flight Assignment:			
Skulan, Joseph Ph.D. (Arizona State University)  Grant/Contract No.:  NNX14AB78G  Performance Goal No.:	Key Personnel Changes/Previous PI:			
Performance Goal No.:	COI Name (Institution):			
	Grant/Contract No.:	NNX14AB78G		
Performance Goal Text:	Performance Goal No.:			
	Performance Goal Text:			

Task Book Report Generated on: 03/28/2024

Task Description:

Long duration human spaceflight leads to loss of bone mass. As a consequence, there is a need for techniques to sensitively detect changes in the net rate of bone formation or resorption (i.e., changes in "bone mineral balance") and to assess the effectiveness of countermeasures. We have documented, in bed rest experiments, that measurements of the Ca isotope composition of urine using mass spectrometry can be used to monitor rapid changes in net bone mineral balance that are not directly observable by other means (1, 2). We propose to extend these experiments to the International Space Station (ISS), in order to demonstrate the utility of Ca isotopes as a tool for monitoring bone mineral balance and countermeasures to bone resorption in space. This proposal builds on a successful existing collaboration between researchers at Arizona State University (ASU) and Johnson Space Center (JSC) to study and apply the Ca isotope method as a bone biomarker (2, 3). The proposed project paves the way for future development of capability to measure Ca isotopes in-flight, to monitor bone health during exploration-class space missions where in situ evaluation of countermeasure effectiveness will be required to assure crew health and safety. The project will also have broad clinical application for Earth-based populations. Our proposal falls under the Spaceflight Biochemical Profile Human Research Program (HRP) research emphasis, and addresses Integrated Research Plan (IRP) Gap N3: How do nutritional status/nutrition requirements change during spaceflight?

- (1). Morgan JL, Skulan JL, Gordon GW, Romaniello SJ, Smith SM, Anbar AD (2012). Rapidly assessing changes in bone mineral balance using natural stable calcium isotopes. Proc. Natl. Acad. Sci. USA 109, 9989-9994;
- (2). Skulan J, Bullen T, Anbar AD, Puzas JE, Shackelford L, LeBlanc A, Smith SM (2007). Natural calcium isotopic composition of urine as a marker of bone mineral balance. Clin. Chem. 53,1155-1158;
- (3). Morgan JLL, Skulan JL, Gordon GW, Romaniello SJ, Smith SM and Anbar AD (2011). High-precision measurement of variations in calcium isotope ratios in urine by multiple collector inductively coupled plasma mass spectrometry. Anal. Chem. 83, 6956–6962.

## Rationale for HRP Directed Research:

Our research has demonstrated that changes in the natural Ca isotope composition of blood and urine reflect changes in net bone mineral balance (BMB) within days of the onset of disruption of BMB. By contrast, changes in BMB require months or years to produce changes in bone mineral density large enough to be detected by radiological techniques such as DXA, which currently are the only clinically practical methods of determining BMB. By permitting rapid measurements of changes in BMB, Ca isotopes allow disruptions in BMB to be detected before they have caused significant skeletal damage, and the effectiveness of countermeasures to abnormal bone loss or gain to be quickly evaluated in individual people.

Research Impact/Earth Benefits:

The usefulness of this technique extends beyond measuring bone loss in spaceflight to the detection and evaluation of treatment for any disease involving disruption in BMB, including osteopenia/osteoporosis, cancer, and Paget's disease. For example, we currently are exploring the application of the Ca isotope technique to the early detection of osteolytic lesions in multiple myeloma. The potential usefulness of Ca isotopes supports their widespread clinical application. We are exploring the possibility of using laser fluorescence, rather than conventional mass spectrometry, to build small, compact Ca isotope measurement instruments suitable to both spaceflight and clinical use.

Beyond the numerous potential clinical applications of Ca isotopes per se, our research on Ca isotopes has been a driving force behind international research into biomedical application of other isotope and elemental systems, including Fe, Zn, and Cu. Collectively, these efforts hold the promise of the development of an entirely new and powerful class of disease biomarkers.

The primary goal of this project was to demonstrate whether the relationship between bone mineral balance (BMB) and changes in the natural isotope composition of blood and urine observed in Earth-based bed rest studies could also be observed in crewmembers in spaceflight, providing the basis for inflight measurements of BMB and evaluation of effectiveness of bone loss countermeasures in individual crewmembers.

We have achieved this goal. Although not all of our analyses are completed, analysis of archived urine samples from 32 crewmembers from previous ISS missions clearly shows the same pattern of change in Ca isotope composition observed in bed rest and predicted in spaceflight. More specifically, the 44Ca:42Ca ratio in urine (expressed as d44/42Ca) typically drops to below each crewmember's individual average pre-flight value shortly after spaceflight begins, remains low during spaceflight, and returns to pre-flight values upon return to Earth. This is the pattern expected in crewmembers transitioning to more negative BMB in microgravity, and a confirmation of our ability to detect this change using Ca isotopes.

A great deal more information can be extracted from the Ca isotope data we have gathered, a task that we have begun and will be our primary activity during the remainder of the project. Changes in Ca isotope composition are revealing details of the dynamics of BMB on previously inaccessible timescales, and offer new insights into bone biology. In particular, while on Ca isotopes show what on average crewmembers lose bone during spaceflight, our data reveal striking differences between the responses of individual crewmembers. Some of these differences are related to countermeasures. For example, crewmembers treated with both bisphosphonate and Advanced Resistive Exercise (ARED) uniformly showed not bone loss, while the response of crewmembers treated with exercise alone was more variable: most lost bone, some did not. Variations in response to treatment do not appear to be related to age, sex, or BMI (body mass index). The cause of these variations is of great interest, and we hope that further analysis will shed light on this and other questions. We do anticipate, however, that the answers to many questions will require more data from future projects.

A secondary goal of our project was to increase the speed with which samples could be processed and analyzed. This goal is, of course, a moving target. Processing speed can always be increased, but we have made substantial improvements over where we were at the start of the project. We designed and validated an automated column chromatography procedure for faster and cleaner sample purification prior to analysis, and have validated a new microwave digestion system for improved sample digestion is now 80% complete. In addition, we are in the process of developing an improved mass spectrometric analytical procedure using a 46Ca-43Ca double spike, which should improve data quality, accuracy, and precision.

**Task Progress:** 

Task Book Report Generated on: 03/28/2024

	Finally, we have begun exploring new technology to measure Ca isotope ratios using laser fluorescence rather than conventional mass spectrometry. Conventional mass spectrometers are not suited to either inflight or widespread clinical use. Such instruments are large, difficult or impossible to miniaturize, complex, and expensive, problems that could be overcome by using laser fluorescence. Whether a practical laser fluorescence device can be built remains to be seen, but preliminary results are promising, and efforts to build small and simple devices for measuring other isotopes (C and O) have been successful.
Bibliography Type:	Description: (Last Updated: 10/09/2019)
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