

Fiscal Year:	FY 2015	Task Last Updated:	FY 11/24/2014
PI Name:	Hammer, Bruce Ph.D.		
Project Title:	Study of Mammalian Pluripotent Stem Cells in Microgravity		
Division Name:	Space Biology		
Program/Discipline:			
Program/Discipline-- Element/Subdiscipline:			
Joint Agency Name:	TechPort:	No	
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Cell & Molecular Biology		
Space Biology Cross-Element Discipline:	(1) Developmental Biology		
Space Biology Special Category:	(1) Cell Culture		
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Zip Code:	55455-3007	Congressional District:	5
Comments:			
Project Type:	FLIGHT	Solicitation / Funding Source:	2014 Space Biology Flight NNH14ZTT001N
Start Date:	11/01/2014	End Date:	10/31/2016
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: NASA ARC		
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Dutton, James Ph.D. (University of Minnesota) Kidder, Louis Ph.D. (University of Minnesota)		
Grant/Contract No.:	NNX15AB38G		
Performance Goal No.:			
Performance Goal Text:	We propose to investigate the effect of gravity on fundamental properties of mammalian stem cells during differentiation of 3-D cultures of induced pluripotent stem (iPS) cells. Experiments aboard the ISS, STS, and ground-based simulations have demonstrated that microgravity influences gene expression, cell proliferation, and differentiation in stem cells. However, the mechanism behind these observations is not clearly understood. In this study we will investigate how exposure to microgravity fundamentally alters the regulation of Oct4, a transcription factor necessary to maintain pluripotency, and how these changes can affect the timing, progression, and outcomes of cell differentiation. Our laboratory has created an Oct4:CreER mTmG transgenic mouse that, for the first time, allows lineage tracing of Oct4 expression in stem cells and their progeny. We will use iPS cells derived from this model to determine the influence of microgravity on the loss of pluripotency and differentiation.		

Task Description:	During the Flight Definition Phase we will use magnetic levitation, a unique ground-based simulation of orbital free fall, to optimize execution of the Spaceflight Experiment Phase. This approach will maximize the success of space-based studies. We propose to investigate the effect of gravity on the timing and spatial arrangement of the loss of Oct4 expression in differentiating iPS cell aggregates. We will also examine the effect of gravity on gene expression in cohorts of Oct4 expressing and non-expressing cells during differentiation by comparing the results of ground-based experiments to those conducted on orbit. Finally, we will explore mechanisms behind the effect of microgravity on both Oct4 gene regulation and control of downstream gene expression by Oct4. This work will determine the effect of spaceflight on changes in Oct4 gene expression during differentiation of pluripotent stem cells and the consequences of these changes on differentiation outcomes. This will increase our understanding of fundamental stem cell behavior in microgravity.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2015.
Bibliography Type:	Description: (Last Updated:)