

Fiscal Year:	FY 2015	Task Last Updated:	FY 10/22/2015
PI Name:	Bodmer, Rolf Ph.D.		
Project Title:	The Effects of Microgravity on Cardiac Function, Structure and Gene Expression using the Drosophila Model		
Division Name:	Space Biology		
Program/Discipline:	SPACE BIOLOGY		
Program/Discipline--Element/Subdiscipline:	SPACE BIOLOGY--Cellular and molecular biology		
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Animal Biology: Invertebrate		
Space Biology Cross-Element Discipline:	(1) Reproductive Biology (2) Developmental Biology (3) Musculoskeletal Biology		
Space Biology Special Category:	(1) Translational (Countermeasure) Potential		
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Zip Code:	92037-1005	Congressional District:	49
Comments:			
Project Type:	FLIGHT	Solicitation:	2012 Space Biology NNH12ZTT001N
Start Date:	09/01/2013	End Date:	09/30/2017
No. of Post Docs:		No. of PhD Degrees:	0
No. of PhD Candidates:	1	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:	ISS NOTE: Extended to 9/30/2017 per NSSC information (Ed., 7/18/16) NOTE: Extended to 12/31/2015 per NSSC information (Ed., 2/18/16) NOTE: Extended to 10/31/2015 per NSSC information (Ed., 9/15/15)		
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Bhattacharya, Sharmila Ph.D. (NASA Ames Research Center) Ocorr, Karen Ph.D. (Burnham Institute for Medical Research)		
Grant/Contract No.:	NNX13AN38G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	<p>The detrimental effects of spaceflight on the cardiovascular system are well known. It is believed that these effects may lead to clinically significant risks to astronauts on long duration space missions as well as to the success of these missions themselves. Current studies are limited primarily to human studies and rodent experiments. However, these model systems and human studies have significant limitations that may be addressed by using the well-established <i>Drosophila</i> model. <i>Drosophila</i> have previously been successfully launched into space and a ground-based <i>Drosophila</i> model for cardiac disease and function has been developed. However, the genetically versatile <i>Drosophila</i> model has yet to be used for studying the effects of spaceflight on the cardiovascular system. We are currently preparing flies for a scheduled launch in Sept. 2015 and analyzing data from a preliminary space flown test of our experimental system.</p> <p>In this proposal we propose to fly groups of <i>Drosophila</i> aboard the International Space Station for approximately 30 days, along with identical on-board 1-g controls as well as ground controls. The <i>Drosophila</i> will require minimal astronaut intervention involving changing feeding trays on 1 or 2 occasions. The samples will be retrieved post-flight and analyzed using established methods. Heart function, including measurements of diastolic and systolic intervals, heart rate, heart diameters, contractility, and arrhythmias will be recorded. Microscopic and immunohistochemical evaluations of heart morphology will also be carried out. We will also conduct intracellular membrane potential recordings of the heart. Finally, we will analyze mRNA expression with a microarray.</p> <p>The ultimate goal of this research is to obtain data while validating the <i>Drosophila</i> model for studying the effects of spaceflight on cardiac disease and function. The development of such a model would be a potentially significant advancement in the study and understanding of how spaceflight affects the cardiovascular system, and may ultimately lead to countermeasures to prevent them.</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>Information about cardiac muscle function in microgravity is also expected to provide insights on genetic and molecular changes that occur with muscle atrophy on Earth. For example, we expect to identify basic molecular alterations that are associated with muscle atrophy that occurs during prolonged bed rest or muscle disuse in muscular dystrophies.</p>
Task Progress:	<p>The Space Florida Prize allowed us to launch fly groups of <i>Drosophila</i> aboard the April 18, 2014 Space-X3 mission. We received approximately 277 live adult flies and numerous pupae and larva when the box was returned to us on May 21, 2014. This was a pilot feasibility experiment to test if the fly might prove a useful model for microgravity effects on the heart and to determine if we would get sufficient live flies back. Now we are ready to perform the fully controlled experiments on approved Space-X11, tentatively scheduled for July 2016.</p> <p>Our very positive preliminary results indicate that the responses of the fly heart to microgravity are similar to human responses. However, there were some problems that prevented us from obtaining optimal data and from obtaining full statistical power in our analyses. By refining the onboard protocol and by using multiple VFBs we will obtain sufficient material to perform numerous molecular biological and physiological experiments.</p>
Bibliography Type:	Description: (Last Updated: 05/20/2019)
Articles in Peer-reviewed Journals	<p>Martinez-Morentin L, Martinez L, Piloto S, Yang H, Schon EA, Garesse R, Bodmer R, Ocorr K, Cervera M, Arredondo JJ. "Cardiac deficiency of single cytochrome oxidase assembly factor <i>scox</i> induces p53-dependent apoptosis in a <i>Drosophila</i> cardiomyopathy model." <i>Hum Mol Genet.</i> 2015 Jul 1;24(13):3608-22. Epub 2015 Mar 19. http://dx.doi.org/; PubMed PMID: 25792727; PubMed Central PMCID: PMC4459388, Jul-2015</p>