Fiscal Year:	FY 2018	**Task Last Updated:**	FY 06/17/2019
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 / Funding Source:**	2012 Space Biology NNH12ZTT001N
Start Date:	09/01/2013	**End Date:**	09/30/2020
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 9/30/2020 per NSSC information (Ed., 9/25/19) NOTE: Extended to 9/30/2019 per F. Hernandez/ARC; previously had been extended to 9/30/2018 (Ed. 9/21/18) NOTE: Extended to 9/30/2018 per F. Hernandez/ARC (Ed., 4/13/18) NOTE: Extended to 6/30/2018 per NSSC information (Ed., 10/10/17) 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:	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 Drosophila model. Drosophila have previously been successfully launched into space and a ground-based Drosophila model for cardiac disease and function has been developed. However, the genetically versatile Drosophila 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. In this proposal we propose to fly groups of Drosophila aboard the International Space Station (ISS) for approximately 30 days, along with identical on-board 1-g controls as well as ground controls. The Drosophila 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. The ultimate goal of this research is to obtain data while validating the Drosophila 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.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	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.
Task Progress:	[Ed. note (June 2019)--compiled from PI's technical progess report covering work done through August 2018] We have finished out functional assessments of Canton S and sei/hERG mutant hearts. Our data confirm a small but significant reduction in heart size of the wildtype space flown flies. They also have disorganized myofibrils (phalloidin stained F-actin, green) and reduced cardiac extracellular skeleton (pericardin/CollagenIV, red). Hearts from space flown sei/hERG mutant flies are also smaller than mutant ground controls and show even more disorganized myofiblils and in particular drastically reduced cardiac extracellular skeleton. We also see significant reductions in the extracellular matrix from other fly lines that we flew. We are currently writing up the data on the Canton S and sei/HERG flies and have begun assessing the data for the w/ KCNQ flies from the latest mission. Analysis of transcriptome (fly hearts and heads) and proteasome (fly heads – gene lab) is currently in progress. We have spent the past 6 months processing neuronal material (heads) from flies. We have established a relatively new capability that allows us to isolate both RNA and protein from the same samples. We have successfully applied this protocol to tissue from Heart Flies and have now uploaded both sets of data to GeneLab servers. It is our intention to ultimately apply this technology to samples from this mission.
Bibliography Type:	Description: (Last Updated: 06/23/2023)