Fiscal Year:	FY 2017	**Task Last Updated:**	FY 05/20/2019
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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City:	La Jolla	**State:**	CA
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:**	09/30/2019
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
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:	ISS		
Flight Assignment:	ISS 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 (March 2019)--compiled from PI's technical progress report covering work done through October 2017] A total of 8 Vented Fly Boxes (VFBs) were received from NASA-Ames personnel on July 4, 2017. These included VFB001–VFB006 that had been flown to the International Space Station (ISS) on June 3, 2017 aboard SpaceX CRS-11 and returned to Long Beach Port on July 4, 2017. In addition, we received two VFBs with the synchronous ground controls, which we designated VFB007 (adult sample) and 008 (egg lay sample). The VFBs were opened and photos of all vials and VFBs were obtained. All space flown samples returned with varying amounts of visible fungal contamination. As a result of the fungal contamination we chose to use minimal numbers of these flies from the egg lay samples for our studies. Consequently we significantly revamped our workflow to harvest almost all the samples we needed from primarily the two Adult Fly VFBs. Preliminary assessment shows that there were sufficient samples collected from the space flown flies to conduct most of the science assays listed in the original science proposal, and definitely all the critical assays. It should be noted that because we could not use the flies from VFBs stored in the Space Automated Bioproduct Laboratory (SABL) in the intended fashion, we did not achieve the optimal age grouping that was desirable for our heart function assays. In addition, we did not receive enough adult flies to follow any of these returning adults fo recovery after a week (one of the experiments outlined in our proposal). However, we were able to recover ISS born embyos and larvae from the VFBs stored in SABL that were later analyzed after reaching 2-3 weeks of adulthood. We are currently awaiting receipt of the asynchronous ground controls.
Bibliography Type:	Description: (Last Updated: 06/23/2023)
Articles in Peer-reviewed Journals	Hateley S, Hosamani R, Bhardwaj SR, Pachter L, Bhattacharya S. "Transcriptomic response of Drosophila melanogaster pupae developed in hypergravity." Genomics. 2016 Oct;108(3-4):158-67. Epub 2016 Sep 10. https://doi.org/10.1016/j.ygeno.2016.09.002 ; PubMed PMID: 27621057 , Oct-2016
Articles in Peer-reviewed Journals	Hosamani R, Leib R, Bhardwaj SR, Adams CM, Bhattacharya S. "Elucidating the 'gravome': Quantitative proteomic profiling of the response to chronic hypergravity in Drosophila." J Proteome Res. 2016 Dec 2;15(12):4165-75. Epub 2016 Oct 10. https://doi.org/10.1021/acs.jproteome.6b00030 ; PubMed PMID: 27648494 , Dec-2016