

Fiscal Year:	FY 2024	Task Last Updated:	FY 11/01/2023
PI Name:	Ocorr, Karen Ph.D.		
Project Title:	Integrated Physiological Responses of CNS and Muscle in Drosophila and C. elegans Along a Gravity Continuum		
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 (2) Animal Biology: Invertebrate		
Space Biology Cross-Element Discipline:	(1) Musculoskeletal Biology (2) Neurobiology		
Space Biology Special Category:	None		
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Zip Code:	92037-1005	Congressional District:	49
Comments:			
Project Type:	FLIGHT,GROUND	Solicitation / Funding Source:	2020 Space Biology NNH20ZDA001N-SB E.12. Flight/Ground Research
Start Date:	01/01/2022	End Date:	12/31/2024
No. of Post Docs:	1	No. of PhD Degrees:	0
No. of PhD Candidates:	0	No. of Master' Degrees:	0
No. of Master's Candidates:	1	No. of Bachelor's Degrees:	1
No. of Bachelor's Candidates:	1	Monitoring Center:	NASA ARC
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:	None		
COI Name (Institution):	Iyer, Janani Ph.D. (NASA Ames Research Center) Szewczyk, Nathaniel Ph.D. (Ohio University) Costes, Sylvain Ph.D. (NASA Ames Research Center) Mhatre, Siddhita Ph.D. (NASA Ames Research Center)		
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Performance Goal No.:			
Performance Goal Text:			

Task Description:	Our studies will use the fruit fly <i>Drosophila</i> and the worm <i>Caenorhabditis elegans</i> (<i>C. elegans</i>) to identify conserved mechanisms underlying the oxidative stress response to altered gravity. Spaceflight induces alterations in somatic/cardiac muscle, as well as in the brain. Many of these changes mirror those induced by long-term bed-rest on Earth and with age. We will use functional, structural, and molecular biological techniques to identify common genetic and molecular components that mediate the effect of microgravity, lunar gravity, and Mars gravity on organ function. The use of two different genetic model organisms will allow us to identify common targets across species that can be exploited to mitigate negative health effects of long duration space habitation and perhaps provide therapies to combat muscle wasting and neurodegeneration on Earth. We will also compare the changes in these organisms with published changes in humans subjected to bed-rest and spaceflight.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Understanding the effects of reduced gravities on mitochondrial structure/function and protein homeostasis will provide insights into the cellular mechanisms underlying sarcopenia and muscle wasting. Thus providing targets for counter measures and clinically relevant therapies.
Task Progress:	We have met with our NASA managerial team. We have now worked through three changes of project managers and set up; recently (October 2023), we got Redwire on contract so we can move forward with hardware testing. Preliminary testing of the original fly lines that we had hoped to use showed insufficient expression of the incorporated mitochondrial Green Fluorescent Protein (Mito-GFP) reporter. We have developed several new fly lines with both Mito-GFP and Atg8a mCherry reporters. This entailed first engineering a universal driver (Actin-Gal4) in a fly line expressing UAS-Mito-GFP. We then incorporated the ATG8a-mCherry into this line by recombination. We now have 7 lines expressing both markers that appear stable and viable. We are starting lifespan studies to document viability. These lines have been sent to NASA Ames Research Center (NASA-Ames) for additional testing. In collaboration with Assistant Professor (Asst. Prof.) Caroline Kumsta at Sanford Burnham Prebys Medical Discovery Institute (SBP), we have generated a <i>C. elegans</i> line with Mito-GFP and Atg8-mCherry reporters. These are being tested at Ohio for compatibility with the <i>C. elegans</i> Maintenance Medium (CEMM) that will be used on the International Space Station (ISS). We now, in collaboration with Research Asst. Prof. Georg Vogler, have a good method for frozen tissue preparation for single nuclear RNA sequencing technology that is becoming the new standard for gene expression technology.
Bibliography Type:	Description: (Last Updated: 11/22/2023)
Abstracts for Journals and Proceedings	Tasoula A, Iyer J, Costes S, Mhatre S, Bodmer R, Ocorr K, Szewczyk NJ. "Integrated physiological responses of CNS and muscle in <i>Drosophila</i> and <i>C. elegans</i> along a gravity continuum." 39th Annual Meeting of the American Society for Gravitational and Space Research, Washington, DC, November 13-18, 2023. Abstracts. 39th Annual Meeting of the American Society for Gravitational and Space Research, Washington, DC, November 13-18, 2023. , Nov-2023
Articles in Peer-reviewed Journals	Slade L, Bollen SE, Bass JJ, Phillips BE, Smith K, Wilkinson DJ, Szewczyk NJ, Atherton PJ, Etheridge T. "Bisphosphonates attenuate age-related muscle decline in <i>Caenorhabditis elegans</i> ." <i>J Cachexia Sarcopenia Muscle</i> . 2023 Sep 18. https://doi.org/10.1002/jcsm.13335 ; PMID: 37722921 , Sep-2023
Articles in Peer-reviewed Journals	Vintila AR, Slade L, Cooke M, Willis CRG, Torregrossa R, Rahman M, Anupom T, Vanapalli SA, Gaffney CJ, Gharahdaghi N, Szabo C, Szewczyk NJ, Whiteman M, Etheridge T. "Mitochondrial sulfide promotes life span and health span through distinct mechanisms in developing versus adult treated <i>Caenorhabditis elegans</i> ." <i>Proc Natl Acad Sci USA</i> . 2023 Aug 8;120(32):e2216141120. https://doi.org/10.1073/pnas.2216141120 ; PMID: 37523525; PMCID: PMC10410709 , Aug-2023