Fiscal Year:	FY 2020	**Task Last Updated:**	FY 12/13/2019
PI Name:	Perera, Imara Y Ph.D.		
Project Title:	Transcriptional and Post Transcriptional Regulation of Seedling Development 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 (2) Plant Biology		
Space Biology Cross-Element Discipline:	(1) Developmental Biology		
Space Biology Special Category:	None		
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Zip Code:	27695	**Congressional District:**	4
Comments:			
Project Type:	Flight	**Solicitation / Funding Source:**	2014 Space Biology Flight NNH14ZTT001N
Start Date:	11/01/2014	**End Date:**	06/30/2020
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:	1	**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:	2	**Monitoring Center:**	NASA ARC
Contact Monitor:	Griko, Yuri	**Contact Phone:**	650-604-0519
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Flight Program:	ISS		
Flight Assignment:	NOTE: Extended to 6/30/2020 per F. Hernandez/ARC and NSSC information (Ed., 1/24/2020) NOTE: Extended to 12/31/2019 per F. Hernandez/ARC (Ed., 5/6/19) NOTE: Extended to 4/30/2019 per F. Hernandez/ARC (Ed., 11/2/17)		
Key Personnel Changes/Previous PI:	August 2017: Graduate Research Assistant Eric Land was the technician on the project who carried out flight build and will be involved in all post flight processing.		
COI Name (Institution):			
Grant/Contract No.:	NNX15AB07G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	Plants are a vital part of human life support systems for long-duration spaceflight and habitation. However, the space environment is not optimal for plant growth. Plants grown in space are subject to many unfamiliar stresses (in addition to the lack of gravity) and recent transcriptional profiling studies indicate that there are global changes in gene expression between space and ground controls. Post transcriptional regulation of RNA is emerging as an important mechanism of modulating gene expression under different environmental conditions. To date however, there have been no studies to examine the role of small regulatory RNAs in plant responses to the space environment. We propose to examine the transcriptional and post transcriptional mechanisms that regulate early seedling development in space and microgravity. Our hypothesis is that plant adaptation and response to the space environment will involve novel regulatory small RNAs. Our previous flight experiment has revealed novel regulatory mechanisms and provides the foundation for further investigation and the proposed research. The long term goals of this research are to understand the molecular mechanisms by which plants sense and adapt to changes in their environment and to characterize the regulatory networks that mediate these responses. This knowledge will be valuable for designing plants that are better able to withstand spaceflight, microgravity, and adverse environmental conditions. This project is in alignment with P2, one of the highest priority recommendations of the Space Biology Research focus on Plant and Microbial Biology as outlined in the Decadal Survey Report, “to analyze plant growth and physiological responses to the multiple stimuli encountered in space flight environments.”
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This research will have relevance and Earth benefits on many levels. On a practical level, we will optimize and develop protocols for efficient handling of limited experimental material that has application to many ground based studies. Most importantly, the knowledge gained from this work will provide a framework for designing and improving plants that are better adapted to adverse environments, which has potential benefit on Earth in the face of global climate change. In addition, this work will contribute towards enhancing education by providing ‘hands on’ training to undergraduate students in Science-Technology-Engineering-Math (STEM) programs.
Task Progress:	The major milestones are as follows: 1. The Principal Investigator (PI) and graduate student Eric Land attended the ASGSR (American Society for Gravitational & Space Research) conference in Nov 2018. The PI presented a talk entitled “Uncovering transcriptional responses to fractional g in Arabidopsis roots” and the graduate student presented a poster entitled “Transcriptional Regulation of Seedling Development in Microgravity.” The PI served as a judge for the student poster competition. 2. We received the RNA and small RNA-Seq data from Novogene for the Plant RNA Regulation (PRR) shoot samples. We had 3-4 replicate samples for RNA and 3 replicate samples for sRNA, for "1g" in space, microgravity, and ground control for 6 day old samples and “1g” in space and microgravity for 4 day old samples. Overall, the sequence data was good and we have several interesting findings. A comparison of transcriptional profiles from PRR with our previous spaceflight experiment Plant Signaling, shows a highly significant overlap of genes differentially expressed in microgravity between the two experiments. In addition, we analyzed the sRNA landscape of the 1g and micro g shoot samples from PRR. We identified miRNAs that are upregulated in microgravity while several of their corresponding target genes were found to be downregulated in microgravity. 3. We deposited root and shoot RNA-seq data from Plant Signaling to GeneLab. 4. The PI collaborated with Dr. Sarah Wyatt of Ohio University and jointly submitted a proposal for spaceflight research entitled “ Spaceflight alters post-transcriptional regulation,” which was selected for funding in Oct 2019. 5. The PI and graduate student are scheduled to attend the 2019 ASGSR conference. The PI has been selected for a short talk for her abstract entitled “Conserved plant transcriptional responses to microgravity from two consecutive spaceflight experiments.”
Bibliography Type:	Description: (Last Updated: 05/30/2025)