

Fiscal Year:	FY 2016	Task Last Updated:	FY 09/01/2015
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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Comments:			
Project Type:	FLIGHT	Solicitation / Funding Source:	2014 Space Biology Flight NNH14ZTT001N
Start Date:	11/01/2014	End Date:	10/31/2017
No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		No. of Master' Degrees:	
No. of Master's Candidates:		No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:	1	Monitoring Center:	NASA ARC
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:	September 2015 report: Research Associate Eric Land.		
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 space flight 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		

	<p>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 which are better able to withstand space flight, 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.”</p>
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	<p>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 which 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.</p>
Task Progress:	<p>The major focus for the past year was with ground studies in preparation for the flight experiment. The work was carried out in the Principal Investigator’s lab as well as in collaboration with the scientists and engineers at NASA-AMES Research Center.</p> <p>The major milestones are as follows:</p> <ol style="list-style-type: none"> 1. Research associate Eric S. Land was recruited to work on this project. 2. The PI team has carried out several ground studies to select new seed stock with good germination and establish the time line for the experiment. Studies have been underway to test the experimental conditions including day length and CO2 concentration as well as long term storage and viability of the seed. 3. The PI and research associate visited NASA Ames Research Center in May 2015. The purpose of the visit was two-fold. The first was to carry out an experiment verification test (EVT) in the ERM-2 module at NASA Ames. The EVT is a ground-based simulation of the conditions of the experiment in space, and in particular the ERM-2 allowed for simulating the lighting, temperature, day length, and CO2 concentration as the flight experiment. The EVT was performed in the ERM-2 module from May 12-18, 2015. Excellent germination and growth of the seedling were confirmed through imaging of the specimens during and at the end of the test. The second objective was to sterilize and mount the seeds and prepare 20 seed cassettes for the Operations Verification Test (OVT) to be performed at N-USOC (Norwegian User Support and Operations Centre) in Norway. 4. The OVT was carried out in June 2015. Specific issues that needed to be tested included the staggered hydration and 4 versus 6 days of growth. Overall, the operations were successful. 5. The PI team has participated in several teleconferences with NASA Ames as well as N-USOC during the OVT and to discuss the experimental procedures/requirements. 6. The PI attended the American Society for Plant Biology (ASPB) meeting in July 2015 and presented a poster on the first flight experiment (Plant Signaling) and the PI team will attend the American Society for Gravitational and Space Research (ASGSR) meeting in November 2015.
Bibliography Type:	Description: (Last Updated: 01/26/2024)