Fiscal Year:	FY 2024	**Task Last Updated:**	FY 04/18/2024
PI Name:	Broddrick, Jared Ph.D.		
Project Title:	Phycoremediation of Lunar Regolith Towards In Situ Agriculture		
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) Plant Biology		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	(1) Bioregenerative Life Support		
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Zip Code:	94035	**Congressional District:**	16
Comments:			
Project Type:	Ground,NASA GeneLab	**Solicitation / Funding Source:**	2022 Space Biology NNH22ZDA001N-SBR: E.9 Space Biology Research Studies
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Flight Program:			
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Key Personnel Changes/Previous PI:			
COI Name (Institution):	Peers, Graham Ph.D. (Colorado State University)		
Grant/Contract No.:	Internal Grant		
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Performance Goal Text:			

Task Description:	NASA and its partners around the world are going back to the Moon to stay. A critical enabler for prolonged presence on the lunar surface is to leverage in situ resources. Of particular interest is to generate stable food sources that reclaim mass and energy in a closed habitation system. The recent effort showing terrestrial plants can be grown in lunar regolith was an important proof of concept for exo-Earth agriculture. However, plants grown in regolith from the Apollo missions showed signs of stress. Plants, particularly promising crops for in situ farming, underproduce when stressed. Thus, to facilitate in situ food production with regolith, additional strategies are required to mitigate the sources of plant stress. Phycoremediation leverages microalgae to remove harmful components from substrates and has been used to treat contaminated soils and wastewater, to include the removal of heavy metals. These microorganisms are powered by photosynthesis, consuming carbon dioxide and generating oxygen in the process, with few other resources required. We hypothesize that heavy metal stress is a primary inhibitor of plant growth in regolith and that this stress can be mitigated by bioremediation with photosynthetic microorganisms. We are proposing a study to assess whether the cyanobacterium Arthrospira platensis (A. platensis; common name: spirulina) can process lunar regolith into a soil suitable for crop production. We intend to combine photosynthetic metabolic modeling to optimize cyanobacterial growth on regolith, assess the ability of A. platensis to capture heavy metals, and evaluate plant growth in the remediated regolith. Our proposed work to render lunar regolith more conducive to in situ agriculture supports NASA's Moon to Mars objectives and NASA's Space Biology Science Plan.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	Plant growth in Apollo regolith samples indicated heavy metal stress. Phycoremediation (bioremediation by cyanobacteria or algae) is highly effective at removing heavy metals. This enables the conversion of regolith to soil via a process that scrubs CO_2 and provides O_2. Cyanobacterial biomass can also be repurposed for other needs (e.g., fuel).
Task Progress:	New Project for FY2024
Bibliography Type:	Description: (Last Updated:)