Fiscal Year:	FY 2019	**Task Last Updated:**	FY 10/03/2019
PI Name:	Anderson, Morgan J Ph.D.		
Project Title:	Monitoring Biomarkers for Muscular Atrophy Using Nanoelectronic Chip for Astronaut Health		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	TRISH--TRISH		
Joint Agency Name:		**TechPort:**	Yes
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Zip Code:	94035-0001	**Congressional District:**	18
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2019 TRISH RFA-1901-PD Translational Research Institute for Space Health (TRISH) Postdoctoral Fellowships
Start Date:	09/01/2019	**End Date:**	08/31/2021
No. of Post Docs:	1	**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:		**Monitoring Center:**	TRISH
Contact Monitor:		**Contact Phone:**	
Contact Email:			
Flight Program:			
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Key Personnel Changes/Previous PI:			
COI Name (Institution):	Koehne, Jessica Ph.D. (Mentor: NASA Ames Research Center)		
Grant/Contract No.:	NNX16AO69A-P0404		
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Task Description:	POSTDOCTORAL FELLOWSHIP Skeletal muscle atrophy is a serious health problem for astronauts in long-duration spaceflight under microgravity conditions. Current preventative measures and treatments against muscle atrophy require intense exercise and dietary regimens. Preemptive measurements during the onset of muscle atrophy have the potential to streamline these regimens, decreasing their daily footprint, and increasing the quality of life for astronauts. The objective of our proposed project is (1) to develop a fully integrated disposable nanoelectrode array chip (with the size of a stamp) that can be interfaced with a handheld electronic system for simultaneous detection of a panel of biomarkers to monitor the progression of skeletal muscle atrophy due to disuse under microgravity in long-duration spaceflights; and (2) to use such quantitative information to guide the combined countermeasures of physical exercise and pharmaceuticals (i.e., specific protease inhibitors) so that the intensity, duration, and frequency of exercise can be reduced. The target biomarkers for this research are enzymatic proteases. These proteases have shown to be overexpressed for many illnesses including cancer, human immunodeficiency virus (HIV), and muscular atrophy, and operate by cleaving peptide sequences, effectively destroying critical biological proteins, such as muscle tissues. Monitoring protease biomarkers can serve as a critical early diagnostic tool for conditions specific to long term travel in microgravity. Several key factors currently limit similar healthcare diagnostics during long duration spaceflights. Instrumentation must have a small footprint, minimal power consumption, and must be simple enough for untrained users to operate accurately. Electrochemical sensors, such as the blood glucose monitor, have shown to be robust with a small instrumental footprint. To further decrease this footprint, we will use nanopatterned chips integrated to a microfluidic system to decrease the required amount of sample, minimizing the impact on user. We will use this nanopatterned sensor to profile protease biomarkers known to be relevant to muscular atrophy and test the technique in analogs for human urine. To facilitate these measurements, we will use electrodes decorated with carbon nanofiber arrays which have been previously shown to function in complex biological media. This approach to sample collection and measurement will allow for non-invasive sample collection and will remove the need for additional chemical reagents, further decreasing the footprint of the technique. Additionally, we will use this method to demonstrate the effectiveness of protease inhibitors which may potentially serve as pharmaceutical treatments, further decreasing the need for extensive exercise regimes and dietary restrictions.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2019.
Bibliography Type:	Description: (Last Updated: 04/09/2022)