Fiscal Year:	FY 2022	**Task Last Updated:**	FY 09/15/2021
PI Name:	Taylor, W Robert M.D., Ph.D.		
Project Title:	Potential Role of the Endothelium in Internal Jugular Venous Thrombosis due to Abnormal Venous Flow Patterns During Spaceflight		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HHC**:Human Health Countermeasures		
Human Research Program Risks:	(1) **Cardiovascular**:Risk of Cardiovascular Adaptations Contributing to Adverse Mission Performance and Health Outcomes		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2019-2020 HERO 80JSC019N0001-HHCBPSR, OMNIBUS2: Human Health Countermeasures, Behavioral Performance, and Space Radiation-Appendix C; Omnibus2-Appendix D
Start Date:	11/13/2020	**End Date:**	11/12/2022
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA JSC
Contact Monitor:	Stenger, Michael	**Contact Phone:**	281-483-1311
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 11/12/2022 per NSSC information (Ed., 11/18/21)		
Key Personnel Changes/Previous PI:	October 2021 report: None		
COI Name (Institution):			
Grant/Contract No.:	80NSSC21K0251		
Performance Goal No.:			
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Task Description:	The recent report of complete and partial thrombosis of the internal jugular vein in crew members on the International Space Station (ISS) raises concerns for the potential of life threatening pulmonary emboli. There appear to be very abnormal blood flow patterns in the internal jugular vein in zero gravity that may predispose to local thrombus formation. Given that the endothelium is uniquely sensitive to changes in the local flow/shear stress environment, the focus of this proposal is on the potential role of the endothelium in mediating localized thrombus formation. The purpose of this proposal is to identify changes in gene expression in venous endothelium exposed to the same flow patterns as those observed in the ISS crew members using isolated vein organ culture system. These studies will help us to develop a better understanding of the basic mechanisms responsible for thrombosis formation with the ultimate goal of potentially identifying biomarkers that would enable screening and risk stratification of crew members.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This work will help us to better understand the fundamental physiologic impact of altered flow patterns on the venous endothelium. In addition to allowing us to better understand the differences between venous and arterial endothelial responses, the work may have direct applications to helping us to understand the pathophysiology of venous disease. Finally, venous grafts are used in peripheral and coronary artery bypass surgery and we know that they have a limited, useful lifespan. Given that these segments are placed in a flow environment that is different from the natural flow environment, the work in this proposal may provide insight into how venous endothelium responds to non-physiologic flow stimuli.
Task Progress:	Several cases of internal jugular vein thrombosis have been reported in crew members onboard the International Space Station. While these cases were asymptomatic, the presence of a blood clot in the venous circulation poses a potentially very significant health risk for crew members. This risk may be even higher in longer, interplanetary flights. The reason for blood clot formation in the internal jugular vein is unclear. We hypothesize that the changes in blood flow patterns that occur in zero gravity may be the reason for clot formation. In normal gravity, blood drains from the internal jugular vein and flow is more uniform and unidirectional. However, without normal gravitational effects, blood flow patterns can be significantly altered. Previous work from NASA scientists demonstrated that there are several patterns of internal jugular vein blood flow in zero gravity that included stagnant flow as well as oscillatory flow. Previous work from ours and others have shown that the endothelial cells that line the inner wall of blood vessels are uniquely sensitive to changes in flow patterns and that disturbed blood flow can induce and pro-inflammatory and pro-thrombotic phenotype. Therefore, we are determining the impact of the disturbed flow patterns observed in the jugular vein of crew members on the expression of genes in the endothelial cells that could lead to an increased risk of thrombosis. To date, we have established an ex vivo flow system that allows us to recapitulate the flow patterns observed in crew members onboard the International Space Station. We are using this system to perfuse isolate vein segments under the various conditions that will allow us to determine if the observed abnormal flow conditions result in expression of genes and proteins that promote thrombosis. We are studying human saphenous veins as well as a segment of the mouse inferior vena cava. We have optimized techniques for endothelial cell isolation and analysis from these venous segments and we are beginning to collect RNA samples for sequencing. As we are at the beginning of these studies, no results are available at this time as we are in the process of collecting samples for analysis.
Bibliography Type:	Description: (Last Updated:)