Fiscal Year:	FY 2020	**Task Last Updated:**	FY 01/30/2020
PI Name:	Stahn, Alexander Ph.D.		
Project Title:	Hyper.Campus - Effects of Artificial Gravity on Structural and Functional Plasticity During Head-Down Tilt Bed Rest		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **HFBP**:Human Factors & Behavioral Performance (IRP Rev H)		
Human Research Program Risks:	(1) **BMed**:Risk of Adverse Cognitive or Behavioral Conditions and Psychiatric Disorders		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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City:	Philadelphia	**State:**	PA
Zip Code:	19104-4865	**Congressional District:**	3
Comments:			
Project Type:	GROUND	**Solicitation / Funding Source:**	2015-16 HERO NNJ15ZSA001N-AGBR. Appendix G: Physiological & Behavioral Responses in Humans to Intermittent Artificial Gravity during Bed Rest
Start Date:	04/10/2018	**End Date:**	08/31/2021
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:	2	**No. of Master' Degrees:**	1
No. of Master's Candidates:	1	**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:	Williams, Thomas	**Contact Phone:**	281-483-8773
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Flight Program:			
Flight Assignment:	NOTE: End date changed to 8/31/2021 per NSSC information (Ed., 1/11/21)		
Key Personnel Changes/Previous PI:	February 2019 report: Two PhD students, who are critical to the study, are included as key to study implementation: • Anika Werner, Charite - Universitatsmedizin Berlin, Institute of Physiology, Center for Space Medicine and Extreme Environments Berlin, CharitéCrossOver (CCO), Charitéplatz 1, Virchowweg 6, 10117 Berlin, Email: anika.werner@charite.de, and Katharina Brauns, Charite - Universitatsmedizin Berlin, Institute of Physiology, Center for Space Medicine and Extreme Environments Berlin, CharitéCrossOver (CCO), Charitéplatz 1, Virchowweg 6, 10117 Berlin, Email: Katharina.brauns@charite.de		

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Grant/Contract No.:	80NSSC18K0765
Performance Goal No.:	
Performance Goal Text:	
Task Description:	The Human Factors and Behavioral Performance (HFBP) Element of the NASA Human Research Program (HRP) defines the prevention of adverse health consequences including neurocognitive impairment as one of the key milestones of Artificial Gravity (AG) countermeasure developments. Remarkably, the neurophysiological correlate of cognitive performance changes (especially spatial cognition) associated with AG has received little attention. In fact, research on the effects of intermittent AG on structural and functional changes of the brain is presently lacking completely. While the entire brain may be prone to structural and functional changes as a result of body unloading and AG, the hippocampal formation -- a key area for the brain for memory formation and spatial navigation and one of the only two human brain areas exhibiting neurogenesis -- is expected to be highly vulnerable to stress and a key target for mitigating neurocognitive impairments. The overarching goal of the present proposal is therefore to quantify the effects of different protocols of intermittent AG during 60 days of HDBR (head down bed rest) on cortical neuroplasticity related to behavioral outcomes associated with neural control of the cardiovascular system and spatial cognition, and biochemical correlates. Using state-of-the art neuroimaging, ultrasound imaging, and cognitive tools, measures made in HDBR participants will be contrasted with a control group matched for gender, age, and educational background. The data will also be compared to data from two additional European Space Agency (ESA) HDBR studies of the same length, as well as data obtained from long-duration International Space Station (ISS) missions, Antarctic expeditions, and Human Exploration Research Analog (HERA) isolation studies. These studies employ very similar procedures that allow comparing the effectiveness of AG to exercise as well as to nutritional countermeasures. At the end of the project, we will have a clear understanding whether, and to what extent, any effects on neuroplasticity and behavioral health associated with HDBR can be augmented by a centrifugation countermeasure.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	With the proposed work we will relevantly contribute to the goal of the Human Research Program (HRP) to provide human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration. This work will also help to identify and validate measures (1) that can be used for the selection of individuals that are highly resilient to the key behavioral health and performance threats and (2) to monitor behavioral health and performance during exploration class missions that can be used for the selection of individuals. Combing neuroimaging, biochemical, and behavioral data our results will relevantly contribute to the development of countermeasures and provide mission planners and system developers with strategies for monitoring and mitigating crew health and performance risks during long-duration space missions. Moreover, exploring the neurobehavioral effects of bed rest and their mechanisms will promote research on the role of inactivity in health and disease on Earth. This could have implications for situations or conditions in which physical activity levels become severely restricted, including medical conditions like myotonic dystrophy and fibromyalgia, prolonged physical inactivity due to confinement to bed rest in clinical settings, and a lack of inactivity due to sedentary lifestyles.
Task Progress:	In the past 12 months we implemented and performed the study at the DLR :envihab. Specifically, we (1) shipped and implemented the hardware at DLR (German Aerospace Center), (2) trained DLR staff to successfully collect all data, and (3) acquired the data in N=24 participants (16 men, 8 women). Overall, data acquisition rates and data quality were excellent, exceeding 98% for all measures. Preliminary data analyses of the structural imaging data were presented at the Investigators' Workshop (HRP IWS 2020) meeting.
Bibliography Type:	Description: (Last Updated: 02/16/2022)
Abstracts for Journals and Proceedings	Stahn A, Dinges DF, Roalf D, Gur R, Brauns K, Werner A, Gunga HC, Riecke B, Wolbers T, Hartley T, Buchert R, Basner M, Kühn S. "Hyper.Campus - Effects of Artificial Gravity on Structural and Functional Brain Plasticity During Head-Down Tilt Bed Rest." Presented at the "Human Exploration Small Steps Lead to Giant Leaps: Translating Research into Space Exploration." 2020 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 27-30, 2020. Detailed Program. 2020 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 27-30, 2020. , Jan-2020
Abstracts for Journals and Proceedings	Stahn A, Dinges DF, Roalf D, Gur R, Brauns K, Werner A, Gunga HC, Riecke B, Wolbers T, Hartley T, Buchert R, Kühn S, Basner M "Hyper.Campus - Effects of Artificial Gravity on Structural and Functional Brain Plasticity During Head-Down Tilt Bed Rest" Presented at the "Human Exploration and Discovery: the Moon, Mars, and Beyond." 2019 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2019. Detailed Program of the 2019 NASA Human Research Program Investigators' Workshop, Galveston, TX, January 22-25, 2019. , Jan-2019