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Task Description:	 Because all parts of human physiology are affected by microgravity, an integrative countermeasure strategy is needed. Loss of muscle and bone mass along with deconditioning of the heart and vessels are well described effects of microgravity. More recently structural and functional changes of the eye, experienced by some astronauts during long-term missions, have been described and summarized in the Spaceflight Associated Neuro-ocular Syndrome (SANS). While the exact teiology of SANS remains unknown, the microgravity induced headward fluid shift is likely part of the pathophysiology and countermeasures that can reverse this fluid shift are prioritized. Based on our experimental data from short-term microgravity by parabolic flights and 24-hour simulated microgravity, we suggest that fluid redistribution in space may not give rise to a pathological increase in intracnanial pressure, but rather the lack of diurnal fluctuations in intracranial volume and pressures may be responsible for the remodeling of the eye. In ambulatory neurosurgical patients with pressure sensors inserted in the brain tissue, we therefore demonstrated the feasibility of lower body negative pressure to reduce intracranial pressure as means of re-introducing diurnal pressure variability. Extending on this, in a recent 3-day, 6 head-down tilt bedrest trial we applied lower body negative pressure to re-introduce an Earth-like fluid shift while at the same time inducing a ground reaction force at the bottom of the fet and a mechanical load along the entire body axis. Preliminary tests involving healthy human subjects in simulated microgravity have demonstrated the efficacy of 20 mmHg lower body negative pressure to re-introduce an Earth-like fluid shift while at the same time inducing a ground reaction force at the bottom of the fet and a mechanical load along the entire body axis. Preliminary tests involving healthy human subjects in simulated microgravity have demonstrated the efficacy of 20 mmHg lower body negative p		
	proposal will bring our Gravity Suit to Countermeasure Readiness Level 7.		
Rationale for HRP Directed Research:			
Research Impact/Earth Benefits:	While designed as a countermeasure for use in space, LBNP may hold benefits for life on Earth. One specific example is reduction of pressure inside the brain which may hold potential for patients on Earth with elevated intracranial pressure.		
Task Progress:	The project met all outlined aims and included significant technology development and validation in human subjects. Main deliverable is a functional, wearable and mobile LBNP-suit (GravitySuit) which is comfortable enough to wear for several hours of use and compatible with most everyday activities.		
Bibliography Type:	Description: (Last Updated: 03/21/2025)		
Articles in Peer-reviewed Journals	Petersen L. "Arterial and intracranial hypotension during and following exercise." Physiology. 2023 May;38(S1):5793685. <u>https://doi.org/10.1152/physiol.2023.38.S1.5793685</u> , May-2023		
Articles in Peer-reviewed Journals	Harris KM, Arya R, Elias A, Weber T, Green DA, Greaves DK, Petersen LG, Roberts L, Kamine TH, Mazzolai L, Bergauer A, Kim DS, Olde Engberink RH, Zu Eulenberg P, Grassi B, Zuccarelli L, Baldassarre G, Tabury K, Baatout S, Jordan J, Blaber AP, Choukér A, Russomano T, Goswami N. "Pathophysiology, risk, diagnosis, and management of venous thrombosis in space: Where are we now?" npj Microgravity. 2023 Feb 16;9:17. Review. https://doi.org/10.1038/s41526-023-00260-9; PMID: 36797288; PMCID: PMC9935502, Feb-2023		
Articles in Peer-reviewed Journals	Harris K, Laws JM, Elias DA, Green A, Goswami N, Jordan J, Kamine TH, Mazzolai L, Petersen LG, Winnard AJ, Weber T. "Search for venous endothelial biomarkers heralding venous thromboembolism in space: A qualitative systematic review of terrestrial studies." Front Physiol. 2022 Apr 27;13:885183. https://doi.org/10.3389/fphys.2022.885183; PMID: 35574486; PMCID: PMC9092216, Apr-2022		
Articles in Peer-reviewed Journals	Petersen LG, Whittle RS, Lee JH, Sieker J, Carlson J, Finke C, Shelton CM, Petersen JCG, Diaz-Artiles A. "Gravitational effects on ocular pressure and perfusion pressure." J Appl Physiol (1985). 2022 Jan 1;132(1):24-35. <u>https://doi.org/10.1152/japplphysiol.00546.2021</u> ; <u>PMID: 34762525</u> , Jan-2022		
Articles in Peer-reviewed Journals	Whittle RS, Stapleton LM, Petersen LG, Diaz-Artiles A. "Indirect measurement of absolute cardiac output during exercise in simulated altered gravity is highly dependent on the method." J Clin Monit Comput. 2022 Oct;36(5):1355-66. <u>https://doi.org/10.1007/s10877-021-00769-y</u> ; <u>PMID: 34677821</u> , Oct-2022		
Articles in Peer-reviewed Journals	Bailey DM, Ainslie PN, Petersen L, Eulenburg PZ. "Jumping at a chance to control cerebral blood flow in astronauts." Exp Physiol. 2021 Jul;106(7):1407-09. <u>http://doi.org/10.1113/EP089648</u> ; <u>PMID: 33998091</u> , Jul-2021		