SPACEFLIGHT EFFECTS ON NEUROCOGNITIVE PERFORMANCE: EXTENT, LONGEVITY AND NEURAL BASES

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ABSTRACT

We are conducting ongoing experiments in which we are performing structural and functional magnetic resonance brain imaging to identify the relationships between changes in neurocognitive function and neural structural alterations following a six month International Space Station mission. Our central hypothesis is that measures of brain structure, function, and network integrity will change from pre to post spaceflight. Moreover, we predict that these changes will correlate with indices of cognitive, sensory, and motor function in a neuroanatomically selective fashion. Our interdisciplinary approach utilizes cutting edge neuroimaging techniques and a broad ranging battery of sensory, motor, and cognitive assessments that are conducted pre flight, during flight, and post flight to investigate potential neuroplastic and maladaptive brain changes in crewmembers following long-duration spaceflight. Success in this endeavor would 1) result in identification of the underlying neural mechanisms and operational risks of spaceflight-induced changes in behavior, and 2) identify whether a return to normative behavioral function following re-adaptation to Earth's gravitational environment is associated with a restitution of brain structure and function or instead is supported by substitution with compensatory brain processes. We have collected data on several crewmembers and preliminary findings will be presented. Eventual comparison to results from our parallel bed rest study will enable us to parse out the multiple mechanisms contributing to any spaceflight-induced neural structural and behavioral changes that we observe.

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