NeuroMapping	
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	VERSITY OF CHIGAN
Spaceflight Effects on Neurocognitive Performance: Extent, Longevity, & Neural Bases (NeuroMapping)	
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Science Background

- Spaceflight affects balance, spatial orientation, & motor control
- Rodent models have shown sensorimotor neural structural changes
- This study will address whether these neural structural changes occur in humans and how they impact astronaut functional performance
- We will also investigate whether spaceflight affects sensorimotor adaptation; important for transitioning between varying gravitational environments











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Pre & Post Flight Test Descriptions *Functional Performance*

1. Functional Mobility Test (FMT): navigate obstacle course with foam pylons, a gate, an obstacle, and a 'portal'.

2. Purdue Pegboard test: assemble pegs and washers bimanually and place into

board.





3. Digit symbol substitution test: transcribe symbols to numbers.



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Pre & Post Flight Test Descriptions

4. Postural Stability: Maintain balance on swayreferenced support surface with eyes closed. This test will be performed with and without head movements.



5. Tests of spatial cognition & working memory:

a. Rod & frame- align a rod to perceived vertical



b. Card rotation rotate 2-dimensional
shapes to match



c. Cube rotation rotate 3-dimensional
shapes to match



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Pre & Post Flight Test Descriptions

6. Vestibular stimulation: the vestibular system will be stimulated by either a brief acoustic stimulus or a brief tap to the forehead. Muscle responses will be recorded.



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Pre & Post Flight Test Descriptions

Brain Structural & Functional Assessments

1. Structural MRI: lie still while we take a 3 dimensional image of your brain structure.

GPe GPi





Caudate Putamen.







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Pre & Post Flight Test Descriptions

3. Resting state functional connectivity MRI: lie still while we image functional network interactions.



4. Functional MRI during single and dual task finger tapping: tap buttons bimanually in response to cues on the screen, count # of appearances of a target color, or both simultaneously.







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Pre & Post Flight Test Descriptions

5. Functional MRI during manual sensorimotor adaptation task: move a joystick to hit targets on the computer screen.

6. Functional MRI during spatial working memory task: mentally rotate2-dimensional shapes to match targets.

7. Functional MRI during vestibular stimulation: the vestibular system will be stimulated by either a brief acoustic stimulus or a brief tap to the forehead.





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In Flight Test Descriptions

1. Cube rotation- rotate 3-dimensional shapes to match

2. Single and dual task finger tapping: tap buttons bimanually in response to cues on the screen, count # of appearances of a target color, or both simultaneously.

3. Manual sensorimotor adaptation task: move a joystick to hit targets on the computer screen.



Control Pad (rear view



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Study Relevance

- First interdisciplinary assessment of the effects of space flight on brain structure-function and functional performance changes.
- 2) Will allow us to assess the risk of long duration spaceflight on brain structure / function and impact on performance.