Supplementary Material

Group	Sequence	Physics	Characteristics	Utility
Spin Echo	T1-Weighted MRI	Longitudinal, spin-lattice relaxation	Low signal intensity of tissue with high water content, high signal intensity of high fat tissue (white matter) [1]	Good anatomical detail, macroscopic overview of tissue[1]
	T2-Weighted MRI	Transverse, spin-spin relaxation	High signal intensity of tissue with high water content (edema, infarction, inflammation), intermediate intensity of high fat tissue (white matter)[1]	Foundational overview of standard brain anatomy, assists in evaluation of brain pathology[1]
Inversion Recovery	Fluid-attenuated inversion recovery	Selective suppression of fluid (CSF) signal	Reduced intensity of CSF signal, high signal intensity of tissue edema/inflammation[2]	Distinguishes subtle white matter abnormalities[2]
Diffusion Weighted	Conventional Diffusion Weighted Imaging (DWI)	Measures the diffusion of water molecules	Increased signal intensity in areas with restricted diffusion of water[3]	Allows mapping of the diffusion of water within the brain[3]
	Diffusion Tensor Imaging (DTI)	Measures the anisotropic diffusion of water in the brain	Estimation of axonal (white matter) organization within the brain[4]	Assessment of white matter tracts, deformations of white matter secondary to brain pathology
Functional MRI	Blood-oxygen-level-dependent (BOLD) imaging	Measures properties of hemoglobin to assess local changes in blood flow, with correlation to activity	Identification of regions of activity within the brain[5]	Visualization of areas of increased cortical activity during rest or activation[5]

Supplementary Table 1. Overview of MRI sequence types utilized in the studies discussed within this review.

Structure	Function	System	Functional Symptoms
Superior Longitudinal Fasiculus (Right)[6]	Connects the frontal, occipital, parietal, and temporal lobes. Visuospatial attention (goal-directed, stimulus driven) and motor control.[7]	Visual, motor, cognitive, behavioral	Observed: Crewmembers with the largest spaceflight-associated balance disruptions had greater WM structure changes in the SLF[6] Potential: Visuospatial cognitive dysfunction (searching, shifting spatial attention, performing mental rotations, detecting patterns)[7]
Inferior Longitudinal Fasiculus[6]	Connects temporal and occipital lobes. Visual modality, object/face/place processing, emotional processing, visual memory.[8]	Visual, cognitive, behavioral	Potential: Visual neglect, visual amnesia, visual hallucinations, prosopagnosia, visual hypo-emotionality[8]
Inferior Occipitofrontal Fasiculus[6]	Connects frontal and occipital/temporal lobes. Hypothesized role in spatial attention and cognition (non-dominant), goal-oriented behavior, social cognition, attention[9]	Visual, cognitive, behavioral	Potential: Reduced verbal fluency, spatial neglect, anosognosia, potential for inability to identify facial emotions[9]
R. posterior thalamic radiations[10]	Posterior radiations connect thalamus and occipital cortex, contain optic radiations.[11]	Visual	Potential: Visual pathway deficits[11]
Calcarine, middle occipital, inferior occipital gyri[10]	Location of the primary visual cortex and secondary visual association cortex[12]	Visual, cognitive	Potential: Visual hallucinations, visual field cuts[12]
Right fusiform gyrus[10]	Facial and word recognition, within-category identification[13]	Visual, cognitive, behavioral	Potential: Prosopagnosia, dyslexia[13]
Inferior cerebellar peduncle[6]	Connects the cerebellum to the spinal cord and medulla. Carries input from vestibular receptors (afferent and efferent) to help with posture, balance, coordination.[14]	Cerebellar, vestibular	Potential: Vertigo and imbalance mimicking a peripheral vestibular issue, ocular tilt, spontaneous nystagmus[14]
Middle cerebellar peduncle[6]	Afferent pathway from pons to cerebellum. Controls the initiation, planning and timing of volitional motor activity[15]	Cerebellar, motor	Potential: Cerebellar ataxia (limb, gait, speech)[15]
Corticospinal Tract[6]	Efferent motor information from the cerebral cortex to the body[16]	Motor	Potential: Central motor weakness[16]
White matter underlying primary motor and sensory cortices[6]	Afferent and efferent motor and sensory information, sensory integration[17,18]	Motor, somatosensory, vestibular, cognitive	Potential: Impairment in voluntary movement, sensory ataxia, altered sensory perception of somatosensory input and vestibular equilibrium[17,18]
Inferior and posterior parietal lobe[6]	Body spatial representation, central vestibular and proprioceptive processing, vertical upright perception[19]	Somatosensory, vestibular, cognitive	Potential: Sensorimotor deficits, including deficits in perception and spatial memory, inaccurate reaching and grasping, inattention, deficits in trunk and limb orientation[19,20]
Thalamus[10]	Relays information between cortex and subcortical areas.[21]	Visual, somatosensory, cognitive, behavioral	Potential: Neuropsychological disturbances, motor weakness or sensory loss, deficits in episodic memory, executive function, processing speed, directed attention, working memory[21]
Frontal poles[22]	Higher order cognition, emotion, goal directed behavior, task prioritization[23]	Cognitive, behavioral	Potential: Loss of empathy, difficulty re-prioritizing tasks[23]

Temporal Poles[22]	Semantic naming, facial recognition, integration of emotion with sensory information.[24]	Visual, cognitive, behavioral	Potential: Social withdrawal, failure to produce appropriate social signals or recognize them, self-centered, loss of empathy, unstable mood states.[24]
Supplementary Motor Region[25,26]	Self-initiated movement, stimulus-cued movement, speech production, temporal triggering.[27,28]	Motor, visual, cognitive, behavioral	Potential: Akinesia, speech deficits, executive working memory deficits[27,28]
Premotor Region[25]	Integration of visuospatial information for movement planning, both external and internal memory-based[29]	Visual, motor, cognitive, behavioral	Potential: Impaired performance of visually and verbally cued tasks, difficulty initiating memory cued tasks, motor apraxia[30]
Primary Sensorimotor Region[25]	Integration of sensory and motor skills needed for skilled movement[18]	Motor, somatosensory	Potential: Impaired cross motor function and reflexes, impaired fine motor skills, disrupted learning of new motor tasks[18]
Left Caudate Nucleus[25]	Voluntary movement, postural control, cognitive planning of adaptive goal-directed behavior.[31]	Motor, somatosensory, cognitive	Observed: Decrement in postural control on Recovery from Fall/Stand Test, Dynamic Postural Stability Test.[25] Potential: Gait disturbances, slowed walking speed. Impaired visual discrimination, alternation behavior, cognitive-driven strategy switching.[31-33]
Lower Extremity Primary Motor Area/Mid-Cingulate[25]	Motor execution. Processing of internal/external states (emotional states) and translation into motor commands.[34]	Motor, cognitive, behavioral	Potential: Impaired movement[34]

Supplementary Table 2. Correlation between the structure/connectivity alterations seen with neuroimaging after spaceflight, their relationship to major CNS pathways, and the predicted sensorimotor/cognitive/behavioral symptoms associated with deficits within the pathway.

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