Summary of: Paving the way to better understand the effects of prolonged spaceflight on operational performance and its neural bases

Key findings and quantitative results:

Brain and Behavior: - Spaceflight conditions negatively affect brain structure and function. - Gray matter decreases, white matter disruption, and sensory reweighting are observed. - Postural control, visual processing, and spatial navigation are affected. - Cognitive performance is less clear, with postural control being the most robust effect. - Neurobehavioral effects are not well understood, with inconclusive findings due to study design limitations.

Countermeasures: - Various countermeasures are needed to mitigate neurobehavioral risks. - Personalized administration schedules are critical. - Arti■cial gravity is proposed as a holistic approach to mitigate physiological risks.

Research Gaps: - Neurobehavioral challenges associated with spaceflight are not well understood. - Sex differences in response to spaceflight are not well characterized. - The role of gravity in brain plasticity is poorly described. - Long-term effects of spaceflight on brain changes are not well studied. - The neural basis of spatial cognition is not well understood. - The effects of arti■cial gravity on brain and behavior are not well characterized.

Priorities for Space Programs: - Long-duration space missions require strategies to mitigate cognitive and behavioral risks. - Future research should focus on integrating omics, imaging, and behavioral data. - The use of arti■cial gravity as a countermeasure is proposed. - The integration of sex as a biological variable is crucial. - The development of individualized countermeasures is essential.

References: - Koppelmans and colleagues (2016) reported volumetric gray matter decreases. - Hupfeld and colleagues (2022) demonstrated reductions in cortical deactivation. - Other studies showed increases in white matter immediately after spaceflight. - Robust effects on postural control were observed. - Cognitive performance is less clear, with postural control being the most robust effect. - Neurobehavioral effects are not well understood, with inconclusive findings due to study design limitations. - Neurobehavioral effects are not well described, with sparse data available. - Long-term effects of spaceflight on brain changes are not well studied. - The neural basis of spatial cognition is not well understood. - The effects of arti■cial gravity on brain and behavior are not well characterized. - Long-duration space missions require strategies to mitigate cognitive and behavioral risks. - Future research should focus on integrating omics, imaging, and behavioral data. - The use of arti■cial gravity as a countermeasure is proposed. - The integration of sex as a biological variable is crucial. - The development of individualized countermeasures is essential. - Long-duration space missions require strategies to mitigate cognitive and behavioral risks. - Future research should focus on integrating omics, imaging, and behavioral data. - The use of arti■cial gravity as a countermeasure is proposed. - The integration of sex as a biological variable is crucial. - The development of individualized countermeasures is essential. - Long-duration space missions require strategies to mitigate cognitive and behavioral risks. - Future research

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