Chapter 11
Space Travel and the Nervous System

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ABSTRACT

Space travel has long fascinated humanity, but poses significant risks to human physiology, including the nervous system. Neurological integrity, vital for managing the complex visual and motor interplay in space, is compromised during spaceflight. The brain and vestibular organs are particularly affected as they must adapt to different phases of space travel. One major concern is spaceflight-associated changes in brain white matter and intracranial fluid redistribution. Astronauts may experience both short- and long-term effects, such as space motion sickness, spatial perception loss, neuro vestibular anomalies, impaired sleep and wake cycles, altered mood and attention, spaceflight-associated neuro-ocular syndrome (SANS),

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and increased risk of brain malignancies and neurodegeneration. Gaze stability, essential for operating spacecraft controls, is compromised by high acceleration and vibration during ascent. This chapter outlines neurological concerns during spaceflight and discusses potential countermeasures, including lower body negative pressure for SANS.

INTRODUCTION

Life has been wired to exist within the narrow canopy of the biosphere. However human beings, through relentless efforts and fueled by the quest for the unknown have developed protective gears and equipment that have helped them to explore unknown horizons denying the vertical limits of ~16,500 feet above sea level (a.s.l). However, when reaching such limits it requires adaptation at both physiological and psychological levels to stretch the limits of survivability (Kourtidou-Papadeli, 2021). Nevertheless, humans have stretched their domain of existence to a wider larger environmental condition. However, setting foot and being stable in an environment completely beyond physiological standards, in the so-called 'extreme flights', is challenging, as evidenced by a plethora of issues such as excursions due to pressure, respiratory changes in controlled breathing sources, and the requirement of supportive systems for survival (Tays et al., 2021). Moreover, the clinical problems related to space travel are so complex, that the commonality of symptoms in many cases makes the differential diagnosis challenging. Thus, the clinical features that are unique to space travel, abbreviated as *RIDGE* [Figure 1], should be addressed in light of physiological (such as neurological), neurolo and psychological adaptations when adapting to such alterations (Cranford et al., 2024; Abade, et al., 2024; Asrar et al., 2021).

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