Long-term bedrest study and Astronaut training

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In the context of space physiology, research is being conducted to understand the physiological effects from radiation, hypogravity, spaceflight and planetary environments. The goal is to identify new methods to address the unique challenges in medical treatment, human factors, and behavioral health support on future exploration missions. As crew size is small and time is limited during actual missions, space agencies resort to addressing the effects of space travel in analog environments that have features similar to those of spaceflight. Head-down tilt bed rest (HDBR), for instance, is one of the established terrestrial models used to simulate some of the physiological changes experienced during spaceflight under weightless conditions and is therefore considered a valuable testbed to prepare for future long-duration exploration missions. HDBR studies are performed in extremely-well controlled laboratory settings, offering the possibility to test the effects of – what is in essence - physical inactivity and fluid shift. However, HDBR studies have a dual purpose, as they are also invaluable for the development, testing and validation of countermeasures aimed at mitigating microgravity-induced changes to the human body. With respect to the latter, the consensus is that short-term bed rest studies (< 14 days) serve foremost as a first screening of potential promising countermeasures, particularly for the cardiovascular system. Screening of preventative procedures and protocols for the muscular system requires at least mid-term (14 -28 days), whereas studies aiming to validate countermeasures for bone require long-term HDBR studies, in the order of 60-90 days. Hitherto the preferred countermeasure during spaceflight has been physical exercise. The presentation will therefore provide a short overview of the current onboard exercise regimen and will, in light of this, outline the scientific background and aims of the ongoing 60-day HDBR study at the :envihab (from the words ‘Environment’ and ‘Habitat’), the DLR Institute of Aerospace Medicine’s state-of-the-art research facility.