Challenges with Astronaut’s Health during Spaceflight

This seminar will address two major health challenges faced by astronauts during spaceflight due to microgravity effects.

**Noninvasive Monitoring of Cerebral Blood Flow and Neurophysical Dynamics for Use in Spaceflight**

There is a critical need to understand the underlying neurophysical, neurocognitive, and neuropsychological parameters of spaceflight. Standard brain imaging techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) are not applicable in space due to the payload restrictions of space missions and costs. It is hypothesized that there is a physiological reaction to the weightlessness and increased CO$_2$ levels encountered during spaceflight such that brain hemodynamics change in the microgravity environment and blood is redistributed, resulting in increased blood volume and blood pressure within the head and brain.

**Characterization of Vascular Tissue Functionality in Microgravity using 3D Bioprinted Tissues**

Over the past two decades, research has shown that exposure to microgravity in space leads to post-flight orthostatic intolerance in astronauts and cardiovascular dysfunction is a key mechanism responsible for this occurrence. Microgravity-induced adaptive alterations in vascular structure and function contributes to vascular dysfunction, the main component responsible for cardiovascular problems. Endothelial stress is a phenomenon that has been shown to affect cell growth and organization of the cytoskeletal system due to its exposure to gravitational unloading. Furthermore, cells exposed to microgravity show reorganization of the cytoskeletal system, altered proliferation and increased apoptosis.