

# **Humans in Space: Artificial Gravity and Artificial Brains**

Russell J Andrews  
Medical Advisor, NASA Ames Research Center

Inhabiting space, unlike earth, must address the problems that lack of gravity present for the various systems of the human body – musculoskeletal system, cardiovascular system, and nervous system to name a few. Two methods for addressing these problems: (1) create artificial gravity; (2) integrate artificial elements into the systems of the human body that are more resistant to the conditions in space.

A novel technique for creating artificial gravity in space entitled “Spacecraft with Artificial Gravity Modules” received a US patent in September 2023. Unlike prior techniques for artificial gravity utilizing a rotating space station, this technique involves a non-rotating circular space station with modules on rails that rotate about the central space station. The speed of individual modules can be adjusted to mimic the gravitational force of Earth, Mars, etc – and temporarily halted to permit transfer of individuals and cargo between the modules, the non-rotating space station, and arriving supply spaceships.

The 21<sup>st</sup> century has seen dramatic progress in techniques to create “replacement parts” not only for the musculoskeletal system (artificial joints) and internal organs (insulin pumps) but also for the nervous system. Nano-level techniques such as electrochemical ion pumps and conducting polymers allow the creation of artificial, biohybrid neurons and synapses. Very recent reports documenting artificial sensory nerves, motor nerves, neurons, and synapses are summarized. One can expect expect the human body with integrated artificial replacement parts – including a neuromorphic nervous system – to be more resilient in the face of the gravity, hypoxia, and radiation challenges that confront humans in space.