

NASA HRP Immunology Discipline – Use of Terrestrial Analogs

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Due to the cost and operational constraints, as well as technical implementation limitations, it is desirable to perform relevant space physiology investigations first in terrestrial ‘space analogs’. This is particularly true for initial investigations, which may then provide appropriate focus for subsequent flight investigations, or for mechanistic investigations that simply cannot be performed during spaceflight. Appropriate analog choice is extremely important. There are a wide variety of terrestrial space analogs, each relevant to a particular physiological discipline (or disciplines) and each with a particular fidelity (or lack thereof) to spaceflight, and each with unique operational constraints. The HRP Immunology Discipline is tasked with managing the HRP Risk concerning clinical risk for Astronaut crews related to spaceflight-associated immune dysregulation. Such dysregulation has been documented to occur during spaceflight, and found to persist for the duration of a 6-month ISS mission. Studies continue to characterize the on-orbit phenomenon, but it generally consists of diminished immunocyte function, dysregulated cytokine profiles, and persistent herpesvirus reactivation. Causes are thought to synergistically include microgravity, psychological or physiological stress, radiation, and/or circadian misalignment. An appropriate terrestrial analog for immune dysregulation would replicate as many of these influences as possible. Such analogs may include clinostat or bioreactor cell culture (microgravity), hindlimb suspension (stress, fluid shifts, hypokinesia), or human deployment to remote or extreme environments (isolation, stress, circadian). Also, the laboratory setting may be used as an analog, or to augment analogs, such as sleep deprivation/misalignment or human centrifugation to replicate gravitational stress. As an appropriate example of a NASA Discipline’s use of Terrestrial space analogs, this talk will discuss spaceflight associated immune dysregulation, terrestrial immune analogs, and recent analog investigations.