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The '*Exploration Atmosphere*' Flight Study on ISS: Assessment of Immunity, Oxidative Stress, Vision and Cognition

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Spaceflight is documented to profoundly dysregulate the human immune system. This phenomenon presents in astronauts as altered peripheral leukocyte distribution, depressed T cell function, altered cytokine production profiles, and persistent reactivation of latent alpha and beta herpesviruses. NASA is now constructing vehicles for deep space exploration-class missions which, regardless of destination, would occur beyond low Earth orbit and may take years to complete. Persistent immune dysregulation spanning such missions may increase specific clinical risks for exploration crewmembers. An 'exploration atmosphere' consisting of 8.2 PSI and 34% oxygen has been proposed for sustained habitation. The purpose of the altered atmosphere is to greatly facilitate EVA activities, reducing 'prebreathe' and other required preparations. In various Terrestrial environments persistent hypobaric hypoxia has been demonstrated to negatively influence immune function and result in cardiovascular irregularities in otherwise healthy subjects. Above the already-dysregulated state of the immune system during flight, it is unknown if the proposed atmosphere will further negatively influence crews and possibly enhance crew clinical risk during exploration class deep space missions. The purpose of the flight study is to determine physiological adaptation to the exploration atmosphere during spaceflight. ISS crews will be exposed to the altered atmosphere onboard ISS. The exposure is currently planned to be via an overnight 'campout' in the US Airlock, at an operationally compatible (within the technical limits of the airlock module) atmosphere of 9.2 PSI and 29% oxygen. This atmosphere yields a lung and aveolar exposure nearly equivalent to the proposed exploration atmosphere. This study will assess various hematologic, immunologic (both innate + adaptive), oxidative stress and viral reactivation parameters. Consequently, vision and cogitative parameters will also be assessed simultaneously. Cellular functional measures will be obtained via on-orbit cell culture. Biological sampling or data acquisition will be performed pre-flight, in-flight before atmosphere exposure, in-flight during (near end of) the atmosphere exposure; and post-flight. All sampling, processing and sample preservation have been designed to work within anticipated operational constraints.