NASA-HRP Workshop 2010

CHOICE – Directed Study: Consequences of longterm-*C*onfinement and *H*ypobaric Hyp*O*xia on *I*mmunity in the Antarctic *C*oncordia *E*nvironment

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Concerning ground-based space physiological research, the choice of analog must carefully match the system of interest. For spaceflight-associated immune dysregulation (SAID), Antarctica winter-over has emerged as potentially the best terrestrial analog. The prolonged mission durations, extreme/dangerous environment, station-based lifestyle, isolation from outside world, disrupted circadian rhythms, and other psychological aspects make this analog extremely high fidelity for exploration-class space missions (long duration lunar, Mars). NASA, ESA and RSA are currently investigating SAID, with NASA currently operating the Integrated Immune flight study. It is desirable to have a ground analog for SAID validated, so that potential countermeasures might be validated terrestrially prior to during flight. This will be particularly true in the post-Shuttle era, where experiment up/down mass will be tightly constrained.

The CHOICE study (Alexander Chouker, P.I.), is currently being implemented by ESA and NASA, as a validation of Antarctica winter over for SAID. The study is being implemented at the new Concordia Antarctica Station, on Dome C, Antarctica. Concordia Station is located 1,100 km from the Antarctica coast, at an elevation of 3,233 m above sea level. Crewmembers at this station experience persistent hypobaric hypoxia, extreme isolation, and a persistent dangerous environment. The ESA portions of the CHOICE study consist of measurements of innate immunity, granulocyte function, physiological stress, integrin measurements and DTH. The NASA portion of the CHOICE study assesses general T cell immunity, cytokine production profiles, viral specific immunity, latent herpesviral reactivation (see accompanying *Integrated Immune* abstract). Participating crewmembers are sampled at L-30, early deployment, monthly during winter over, late deployment, and R+60. The full immune component was planned be conducted at all timepoints except during winter over (including early, late deployment at Concordia). During winter over, only limited sample collection and preservation were planned. Unexpectedly, an opportunity arose to leave the flow cytometer deployed at Concordia (to support early deployment testing) for the *entire* winter over 2009 period, allowing some additional mid-winter phenotype measurement possible. The deployed ESA Scientist, Dr. Alex Salam, performed the sample analysis during the winter over period. .LMD data were returned via email. Plasma, saliva and culture supernatants for secreted cytokine analysis were also collected during the winter over period.

For this presentation, NASA data collected on the winterover 2009 crewmembers, baseline through early deployment will be presented. Through early deployment (approximately 2-3 weeks at Concordia), phenotypic alterations included increased levels of memory T cells, shifts among the CD8+ T cell compartment to a more mature phenotype, and increases in constitutively activated T cells. CD8+/IFNg+ T cell percentages, and T cell blastogenesis functional responses were depressed early deployment as compared to healthy controls. In four compatible subjects, secreted T cell Th1/Th2 cytokines were measured following culture stimulation, and a Th2 shift was observed as compared to controls. Post-winter over frozen sample return will be required to determine if this shift persisted during the winter over period. Additionally, circadian rhythms remained altered compared to baseline, as determined through 5x daily cortisol measurements. Latent viral reactivation will not be determined until frozen sample return occurs.