

Life support Challenges for Human Space Exploration (10)  
Supporting Crews for Exploration Missions (2)

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ALTERATIONS OF CELLULAR IMMUNE REACTIONS IN CREW MEMBERS OVERWINTERING  
IN THE ANTARCTIC RESEARCH STATION CONCORDIA

**Abstract**

Background: Concordia Station is located inside Antarctica about 1000km from the coast at an altitude of 3200m (Dome C). Hence, individuals living in this harsh environment are exposed to two major conditions: 1.) hypobaric hypoxia and 2.) confinement and extreme isolation. Both hypoxia and confinement can affect human immunity and health, and are likely to be present during exploration class space missions. This study focused on immune alterations measured by a new global immunity test assay, similar to the phased out delayed type hypersensitivity (DTH) skin test. Methods: After informed written consent 14 healthy male subjects were included to the CHOICE- study (Consequences-of-longterm-Confinement-and-Hypobaric-HypOxia-on-Immunity-in-the Antarctic-Concordia-Environment). Data collection occurred during two winter-over periods lasting each one year. During the first campaign

6 healthy male were enrolled followed by a second campaign with 8 healthy males. Blood was drawn monthly and incubated for 48h with various bacterial, viral and fungal antigens followed by an analysis of plasma cytokine levels (TNF- $\alpha$ , IL2, IFN- $\gamma$ , IL10). As a control, blood was incubated without stimulation ("resting condition"). Goals: The scope of this study was to assess the consequences of hypoxia and confinement on cellular immunity as assessed by a new in vitro DTH-like test. Results: Initial results indicate that under resting conditions the in vitro DTH-like test showed low cytokine levels which remained almost unchanged during the entire observation period. However, cytokine responses to viral, bacterial and fungal antigens were remarkably reduced at the first month after arrival at Concordia when compared to levels measured in Europe prior to departure for Antarctica. With incrementing months of confinement this depressed DTH-like response tended to reverse, and in fact to show an "overshooting" immune reaction after stimulation. Conclusion: The reduced in vitro DTH-like test response in the early phase of Antarctic wintering over confirms distinct immune suppressive effects seen after (sub-)acute hypobaric hypoxia. The reversal and overshooting reaction of cellular immune responses upon stimulation, but not the resting state, indicate either a) priming of immune answers and/or b) an uncoupled or disregulated control of cellular immune answers by auto-, para- and endocrine pathways. Further analyses and correlations are warranted. Acknowledgement: Supported by the European Space Agency (ESA), the French (IPEV) and Italian (PNRA) polar institutes, the German National Space Program (DLR, 50WB0719/WB0919), by BELSPO/PROEDEX/ESA (C90-380/-391), NASA and by the Concordia crews who have participated with great enthusiasm.