Challenges of Life Support - Medical Support for Manned Space Exploration (9)
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OVERVIEW OF HUMAN-ENVIRONMENT INTERACTIONS STUDY IN 180-DAY INTEGRATED EXPERIMENT ON CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEM (CELSS)

Abstract

In order to investigate the key technology of life support and health maintenance in the deep space

exploration, a controlled ecological life support system (CELSS) with 370m2 and 1049m3 mock-up spacecraft consist of four Plant modules, two Habitable modules, one Life Support module, and one Resource module was built in Shenzhen. Based on the platform, a cluster of research projects were integrated in 180-day integrated experiment on Controlled Ecological Life Support System (CELSS) to study the Human-environment Interactions. As of January 14, we obtained more than one thousand data, 251 psychology test software results, 742 psychological questionnaire, 694 physiological test, 96 clinical medicine test results. The data shown that the change of Personal Emotional State of four crew members have no significant differences. Work environment may have influence on crew members' risk decision-making. The teamwork ability of the crew had a tendency to increase with the time of entering the cabin, but fluctuated in the middle and later period. During the experiment, four crew members had a good nutritional status and the weight had no significant change. In behavior, actigraphy of the four crew members exhibited a circadian period of 24.67 hours from the 71th day to the 108th day, which is consistent with the pre-scheduled sleep-wakefulness and light-dark cycles during 36 Mars solar days. In comparison, the circadian period of actigraphy during the Earth day stably showed as 24 hours. In physiology, the changed acrophase of core body temperature and heart rate variability shown in preliminary data may serve as the main cause to the disturbed sleep quality and the changed rhythmicity of visual analogue scale of mood in some crew members. Study on crew cardiovascular function adaptability and the relationship with behavior and metabolism under long-term confinement. The maximum oxygen consumption of crew members fluctuated in the normal range, indicating that the crew members' physical fitness to maintain a good level. Dynamic modeling of epigenomic patterns following the environmental exposure could be established. In this experiment, we expect to access the changes of epigenetic information by technologies of gene chip, deep sequencing and mass spectrometry, meanwhile modeling the relevance of blood cell DNA methylation and environment, rhythm, diet, movement parameters and other health indicators, evaluating its potential values on environmental exposure monitoring and health prediction. We will have a series report about psychology, physiology, sleep, rhythm, metabonomics, etc. during 180 days confinement.