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Medical Care for Humans in Space (3)

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EXPERIMENTAL VALIDATION FOR DEVELOPMENT OF MEDICAL TECHNOLOGY OF OXIDATIVE STRESS (LIPID PEROXIDATION) NON-INVASIVE DIAGNOSIS DURING SPACE FLIGHT

Abstract

As human's duration of stay in space will get longer and with perspectives of interplanetary missions, non-invasive online methods of integral diagnosis of crewmember's physiological status will be the basis of space medicine. The goal of this study is to develop a medical technology for non-invasive diagnosis of lipid peroxidation activity during physiological adaptation of human to the conditions of space flight. The basis for this medical technology is research of low-molecular weight metabolites – biomarkers of lipid peroxidation in human's breath which will allow to monitor the molecular metabolites in human's breath during space flight online and to evaluate in real time: the processes of lipid peroxidation by biomarkers in breath and to diagnose functional metabolic status of cosmonauts; activity of lipid peroxidation processes in body before and after extra-vehicular activity and to perform medical correction of oxidative stress in real time (if needed) with estimation of prevention measurements efficiency. Experimental research in order to determine a list of molecular metabolites in breath of volunteers during simulation of lipid peroxidation activity by exposure to normobaric hyperoxygination, zero-g conditions (dry immersion) and graduated exercise. It was shown that during simulation of oxidative stress by stress tests (breathing 100We performed the selection of sorbents, which would allow to identify wider spectra of low-molecular metabolites. Experiments mentioned above allowed to determine the list of volatile metabolites which

showed concentration increase in 90The determined biomarkers were used to develop of the device "E-nose-BG" designed to perform analysis of breath samples during space flight. The device is a multi-sensor analyser consisting of an array of electrochemical sensors and computer system providing analysis of human breath samples by identification of each sensor's response as well as determination of sum concentration of indicated chemical compounds with sensitivity (ppb) sufficient for express analysis of biomarkers. Laboratory and qualification tests of working model of "E-nose-BG" showed positive results and capability to determine the biomarkers in breath samples.