The BIOMEX Experiment on-board the International Space Station: Biomolecular- and Bio-geochemical changes of lichens exposed to space- and to Mars-like conditions

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Exploration of the solar system is a priority research area of the AstRoMap European Astrobiology Roadmap (Horneck et al., 2015) [1], focused on various research topics, one of them is "Life and Habitability" and an other one is "Biomarkers for easy the detection of life". Therefore "space platforms and laboratories" are necessary, such as EXPOSE, to gain more knowledment of space- and extraterrestrial habitats, eventually for human interplanetary exploration (Space, Moon, Mars, Encedalus, Titan, Europa). At the exposure platform EXPOSE-R2 on ISS (2014-2016), samples of the astrobiological model system *Circinaria gyrosa gyrosa* [3,4,5,6], belonging to the BIOMEX experiment [2], (Biology and Mars Experiment, ESA), were exposed during 18 months to space and to a Mars simulated environment, to study Mars habitability and resistance to space conditions. The data obtained by the investigation on biomarkers after being exposed to Mars-like conditions will support the analysis of data obtained during future instrumental detection operations in future space missions on Mars (i.e. ExoMars). After the return of the samples in June 2016, the first preliminary analysis showed a quick and complete recovery of metabolic activity of the control samples exposed to space vacuum and Mars-like atmosphere. In contrast, the samples directly exposed to extraterrestrial UV solar radiation showed slow recovery, in reference to their observed original activity. Here we expose the last results that show the biomolecular changes of the DNA analized by PCR and complementary sequencing techniques, in correlation with the previous results supporting changes in metabolic activity, and changes in viability (Electron- and fluorescence microscopy techniques), as well as in morphology/ultrastructure due to space vacuum and Mars atmosphere. Additionaly, the biogeochemical variations have been examined with spectroscopic analyses (Raman) to look for possible degradation of cell surfaces and pigments which were in contact with terrestrial rocks, and Martian analogue regolith. Moreover, differences were observed between samples irradiated with extraterrestrial UV solar radiation and samples positioned below defined as dark-control samples. These experiments will contribute to answer questions on the habitability of Mars, on the likelihood of the Lithopanspermia Hypothesis and will be of relevance for planetary protection issues.

References

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