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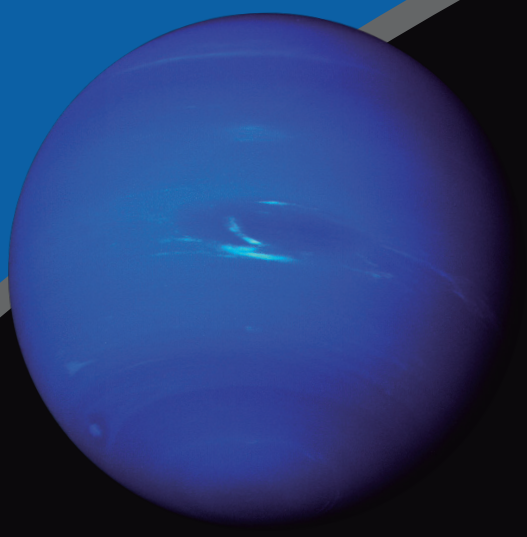

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CENTRO DE ASTROBIOLOGÍA
ASOCIADO AL NASA ASTROBIOLOGY INSTITUTE
EXCELENCIA MARÍA DE MAEZTU

The BIOMEX experiment on-board the International Space Station: limits of life and detection of biomarkers after exposure to space- and to Mars-like conditions

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To explore the limits of terrestrial life in space, we have to understand the effects of the space environment on unprotected biological and chemical material, and on the degradation of organic molecules or biomarkers. The exposure platform EXPOSE-R2 on the ISS offer a suitable facility for the exposure of samples of the astrobiological model lichen *Circinaria gyrosa*, included in the BIOMEX experiment (Biology and Mars Experiment, ESA). During 18 months (2014-2016), the lichens lived in a latent state at space and at simulated Mars-like conditions, to study Mars' habitability and resistance to space conditions. After the return of the samples in June 2016, initial analysis showed rapid recovery of photosystem II (PSII) activity in the samples exposed exclusively to space vacuum and to Mars-like atmosphere. In contrast, the samples directly exposed to solar UV radiation showed a slow and a lower recovery, in reference to their observed original activity. This tendency was corroborated with the complementary morphological/ultrastructural and biomolecular analyses. Complementary, the biogeochemical variations have been examined with Raman spectroscopy to assess the possible degradation of cell surfaces and pigments which were in contact with terrestrial rocks, and Martian analogue regolith. Identification of the biomarker whewellite (calcium oxalate) and other organic compounds and mineral products of the biological activity of *Circinaria gyrosa* were detected by Raman Laser. These findings contribute to answer questions on the habitability of Mars, the likelihood of the Lithopanspermia Hypothesis, the capability to detect biomolecules exposed to an extraterrestrial environment by life-detection instruments and will be of relevance for planetary protection issues.