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ASTROBIOLOGY ON THE INTERNATIONAL SPACE STATION

Abstract

The environment of the International Space Station ISS provides a complex spectrum of physical parameters that are not experienced on Earth and that are of high interest to astrobiology. These parameters have been used in experiments on board of the European EXPOSE facilities attached to the outside of the ISS (Rabbow et al. 2009). The chemical set of experiments has been designed to reach a better understanding of the role of interstellar, cometary and planetary chemistry in the origin of life (Brack et al. 1999, Cottin et al. 2008). From studies on the chemical evolution, survival, destruction and modification of complex organics, e.g., PAHs, fullerenes and complex aromatic networks in outer space, experimental clues are obtained on the photochemistry of these compounds in the interstellar and interplanetary medium. Finally the chemical experiments contribute to the understanding of the chemical processes on Saturn's moon Titan and possible analogies to the prebiotic chemistry on the early Earth. The biology experiments use the full extraterrestrial spectrum of solar UV radiation and suitable cut-off filters to study both, the role of the ozone layer in protecting our biosphere and the likelihood of resistant terrestrial microorganisms and microbial communities to survive in outer space. The latter studies provide experimental data to the hypothesis of lithopanspermia (Nicholson 2009), i.e. the interplanetary transfer of life via meteorites, and they provide basic data to planetary protection issues, i.e. the need to prevent contamination of target planets, e.g. Mars by terrestrial microorganisms. To get better insight into the habitability of Mars, samples are also exposed to simulated Martian conditions (UV-radiation climate, pressure, atmosphere), with and without a protective cover of simulated Martian regolith. The biological test samples selected are hardy representatives of bacteria, Archaea, lichens, fungi and plant seeds, i.e. of various branches of life, also in their natural communities. Most types have already demonstrated their resistance to outer space during short term missions, e.g. on board of the ESA BIOPAN facility (Horneck et al. 2001, Rettberg et al. 2004, Sancho et al.2007) References: Brack A et al. 1999, ESA SP-433, 455-458. Cottin H et al. 2008, Adv. Space Res. 42, 2019-2035. Horneck G et al. 2001, Orig Life Evol Biosph 31:527-547. Nicholson W 2009, Trends Microbiol 641, 243-250. Rabbow E et al. 2009, Orig. Life Evol. Biosph. 39, 581-598. Rettberg P et al. 2004, Adv Space Res 33, 1294-1301. Sancho L et al.2007, Astrobiology, 7, 443-454.