Does the adaptation of *Bacillius subtilis* to a martian UV climate result in a better survival in space and on Mars? First results of the space experiment ADAPT. P. Rettberg[1], M. Wassmann[1], E. Rabbow[1], R. Moeller[1], G. Horneck[1], C. Panitz[2], T. Douki[3] and J. Cadet[3], [1]DLR, Institute of Aerospace Medicine, Koeln, Germany, petra.rettberg@dlr.de; [2]RWTH Aachen, Institut für Flugmedizin, Aachen, Germany; [3]INaC / SCIB UMR-E3 CEA-UJF / CEA-Grenoble, France

In the space experiment ADAPT the capability of microorganisms to adapt to qualitatively and quantitatively different UV levels like those in space and on Mars were investigated in the ESA facility EXPOSE mounted outside on the European Columbus module on the ISS. The EXPOSE facility offers long-term exposure to space conditions in vented compartments and to Mars conditions in closed compartments with martian atmosphere and pressure and a martian UV climate realised by the use of suitable cut-off filters and extraterrestrial solar UV radiation (Fig. 1). Three highly resistant microorganisms from very distinct terrestrial habitats were selected: *Bacillus subtilis*, a well characterised spore forming soil bacterium (ADAPT I), a natural community of cyanobacteria colonising rocks (ADAPT II) and a species of halophilic archaea, *Halococcus dombrowskii* (ADAPT III).

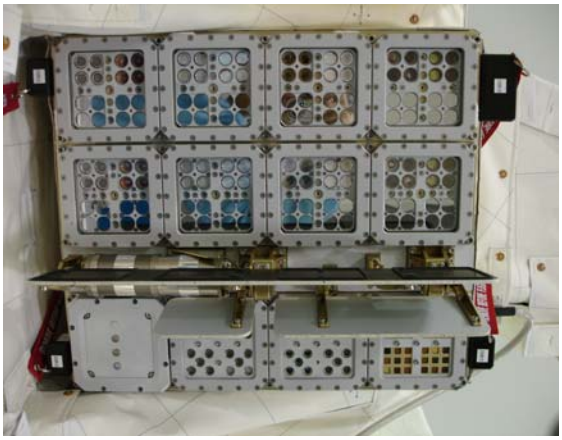

Fig. 1: The ESA facility EXPOSE with a suite of different astrobiological experiments, ADAPT was accomodated in the left compartments of the two upper trays.

In the experiment ADAPT I the model organism *Bacillus subtilis* was used to test the hypothesis experimentally whether longer-lasting selective pressure by UV radiation of different quality results in a higher UV resistance as well as in a higher resistance against the simultaneous action of further extreme environmental factors that exist in space or on Mars like vacuum / low pressure or cosmic radiation. The UV-resistant strain *B. subtilis* MW01 was obtained in the laboratory before by repeated exposure of a continuosly growing culture to mars-like UV radiation. This strain was found to be not only more UV resistant than the ancestral strain (Fig. 2), but also posseses a higher resistance against ionising radiation, increased osmolarity, oxidative stress and moderate wet heat (unpublished results). In the space experiment MW01 spores were immobilized on MgF_2 discs in the samples exposed to space conditions and on quartz discs in the samples exposed to Mars conditions. The effect of shielding by defined layers of spores above each other was investigated by exposing stacks of 3 samples each. In addition to UV exposed samples identical samples without UV exposure were flown as in flight dark controls. On ground the whole space experiment is simulated with identical samples in identical hardware utilising the planetary and space simulating facilties of DLR.

The experiment ADAPT was launched with the EXPOSE facility in February 2008 with STS-122, exposed for 1.5 years on the ISS and brought back to Earth in September 2009 with STS-128. The samples arrived in the PI's lab in December 2009. First results of the survivability of the new UV-adapted *Bacillis subtilis* strain MW01 in space and under martian conditions will be presented.

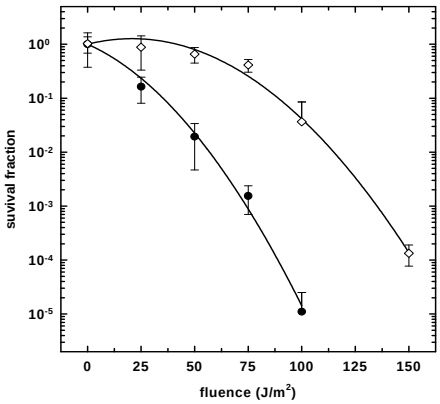

Fig. 2: Fluence survival curves of *Bacillus subtilis* 168 (•) and the UV-adapted strain MW01 (◊) after exposure to UVC of 254 nm