Simulation of the Martian UV radiation climate and its effect on Deinococcus radiodurans

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The question of putative life on Mars has been the topic of several studies. Early works had to rely on the physical data that have been gained during the 1970s with the help of the Viking missions. More recently several Mars-related missions have provided numerous and more precise data to establish a realistic simulation of the Martian climate. Our focus is directed at the diurnal temperature variations and the atmospheric pressure and composition, the so called thermo-physical conditions, which are typical for the Martian mid- and low latitudes.

The resistance of terrestrial microorganisms under the thermo-physical conditions on Mars was studied for the understanding and assessment of potential life processes on Mars. In order to accomplish a targeted search for life on other planets, e.g. Mars, it is necessary to know the limiting physical and chemical parameters of terrestrial life. Therefore the polyextremophile bacterium *Deinococcus radiodurans* was chosen as test organism for these investigations. For the simulation studies at the Planetary and Space Simulation Facilities (PSI) at DLR, Cologne, Germany, conditions that are present during the southern summer at latitude of 60˚ on Mars were applied.

We could simulate several environmental parameters of Mars: vacuum/low pressure, anoxic atmosphere and diurnal cycles in temperature, energy-rich UV radiation as well as shielding by different Martian soil analogue materials. These parameters have been applied both single and in different combinations in laboratory experiments. Astonishingly the diurnal Mars-like cycles in temperature affected the viability of *Deinococcus radiodurans* cells quite severely. But the Martian UV climate turned out to be the most deleterious factor. By mixing the bacteria with nano-sized hematite the bacteria could be shielded from UV radiation and provided the cells with an additional protection.