Drastic Conditions Call for Drastic Measures: The Viability of Terrestrial Extremophiles in Simulated Martian UV Radiation

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The harsh ultraviolet (UV) radiation at the Martian surface prevents viability of life as we know it by causing potentially lethal single and double-stranded DNA breaks. However, there are a few organisms on Earth that could survive in the low wavelength and high intensity radiation of Mars. This experiment tested the radioresistant properties of Halobacterium salinarum, a halophile, and Deinococcus radiodurans, a radioresistant extremophile. The organisms were exposed to simulated Martian UV radiation under 3 different conditions: unshielded, shielded with a physical shield consisting of powdered meteorite and simulated Martian soil (artificial meteorite), or shielded with NaBr in growth media (salt shield). The unshielded radiation resistance of D. radiodurans was much higher than that of H. salinarum; however, with the artificial meteorite shield, the survival ratios of the two species were not significantly different. The salt shield showed a positive trend in survival ratio for H. salinarum, but a negative trend for that of D. radiodurans, most likely caused by inhibited growth. There was a significant difference among shields ($p = 0.0007$), with results indicating that the artificial meteorite shield ameliorated the effects of the UV radiation in both species, leading to survival rates indistinguishable from those of the no-radiation control. This suggests that the soil on Mars could potentially shield terrestrial organisms from the UV radiation. Overall, the results of this experiment can be used to further develop radiation shielding techniques in the pursuit of one day allowing terrestrial life to survive on Mars.

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