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Microbial Response to Spaceflight Conditions

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Space radiation, including Galactic Cosmic Rays (GCR) and Solar Particle Events (SPE), represents a major hazard for biological systems beyond Earth. Spores of *Bacillus subtilis* have been shown to be suitable dosimeters for probing extreme terrestrial and extraterrestrial environmental conditions in astrobiological and environmental studies. During dormancy spores are metabolically inactive; thus substantial DNA, protein, tRNA and ribosome damage can accumulate while the spores are incapable of repairing and/or degrading damaged DNA and proteins. We used different genotypes of *B. subtilis* to study the effects of extraterrestrial conditions in both space and ground-based experiments. Spore survival was strongly dependent on the functionality of all of the structural components, with small acid-soluble spore proteins, coat layers, and dipicolinic acid (DPA) and the interaction of several DNA repair mechanisms. I will present results from physiological and genetic studies regarding spore resistance to spaceflight conditions as well as data from the transcriptome analyses of germinating *B. subtilis* spores. Our ultimate goal is to obtain a complete model describing spore persistence and longevity in high radiation-exposed environments, with implications for future life detection missions and human spaceflight.

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