"To boldly go where no microbe has gone before" – fascination and responsible of the research area space microbiology

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Abstract

With international plans being formulated for solar system exploration, either using robotic probes or with human crews, microbiologists are confronted with exciting new opportunities and challenging demands. The search for signatures of life forms on another planet or moon in our solar system is one of the most prominent goals of these enterprises. Our neighbor planet Mars and Jupiter's moon Europa are considered key targets for the search for life beyond Earth. By analogy, with terrestrial extremophilic microbial communities, e.g., those thriving in extreme environments (such as deserts) and/or those exposed to intense UV radiation, additional potential extraterrestrial habitats may be identified. Field studies with microbial communities in those extreme environments as well as microbiological studies under simulated planetary environments - in space as well as in the laboratory - will provide valuable information for preparing the "search-for-life" experiments on missions to those solar system bodies.

Another important role of microbiologists in space exploration concerns the planetary protection initiative. Here robotic orbiters, entry probes, or landers can unintentionally introduce terrestrial microorganisms to a planetary target of interest. This may destroy the opportunity to examine these bodies in their pristine condition. Depending on the target and type of mission, the planetary protection guidelines require cleaning and, in specific cases, sterilization of the spacecraft or components to avoid contamination with terrestrial organisms. The success of the cleaning and/or sterilization measures needs to be controlled by establishing a thorough inventory of the bioload prior to launch. Guidelines for bioload measurements, sterilization procedures, and effective planetary protection protocols must be established and implemented.

The presence of humans on the surface of the Moon or Mars will substantially increase the capabilities of space research and exploration; however, prior to any human exploratory mission, the critical microbial issues concerning human health and wellbeing need to be addressed. Also the need to understand evolutionary pressures exerted on microorganisms by the spaceflight environment represent additional upcoming paramount tasks for microbiologists.

In my talk, I will present data and information on previous, ongoing and future space microbiology/astrobiology activities of the DLR.