

Biohazard potential of putative Martian organisms during missions to Mars.

Warmflash D, Larios-Sanz M, Jones J, Fox GE, McKay DS.

Department of Biology and Biochemistry, University of Houston, TX, USA.
dwarmfla@ems.jsc.nasa.gov

Exploration Class missions to Mars will require precautions against potential contamination by any native microorganisms that may be incidentally pathogenic to humans. While the results of NASA's Viking biology experiments of the 1970s have been generally interpreted as inconclusive for surface organisms, and attributed to active but nonbiological chemistries, the possibility of native surface life has never been ruled out completely. It is possible that, prior to the first human landing on Mars, robotic craft and sample return missions will provide enough data to know with certainty whether future human landing sites harbor extant life forms. If native life were found to exist, it would be problematic to determine whether any of its species might present a medical danger to astronauts. Therefore, it will become necessary to assess empirically the risk that the planet contains pathogens based on terrestrial examples of pathogenicity and to take a reasonably cautious approach to biohazard protection. A survey of terrestrial pathogens was conducted with special emphasis on those whose evolution has not depended on the presence of animal hosts. The history of the development and implementation of Apollo anti-contamination protocol and recommendations of the National Research Council's Space Studies Board regarding Mars were reviewed. Organisms can emerge in Nature in the absence of indigenous animal hosts and both infectious and non-infectious human pathogens are therefore theoretically possible on Mars. Although remote, the prospect of Martian surface life, together with the existence of a diversity of routes by which pathogenicity has emerged on Earth, suggests that the probability of human pathogens on Mars, while low, is not zero. Still, since the discovery and study of Martian life can have long-term benefits for humanity, the risk that Martian life might include pathogens should not be an obstacle to human exploration. As a precaution, it is recommended that EVA (extravehicular activity) suits be decontaminated when astronauts enter surface habitats upon returning from field activity and that biosafety protocols approximating laboratory BSL 2 be developed for astronauts working in laboratories on the Martian surface. Quarantine of astronauts and Martian materials arriving on Earth should also be part of a human mission to Mars, and this and the surface biosafety program should be integral to human expeditions from the earliest stages of the mission planning.

PMID: 17511302 [PubMed - indexed for MEDLINE]