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Microbial stowaways to Mars identified

Bacteria found on the Curiosity rover reveal the types of microorganisms that spacecraft carry.

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Dozens of microbial species may have accompanied the Curiosity rover to Mars, where it landed in August 2012. The stowaways withstood spacecraft cleaning methods before the rover's launch, although no one knows for sure whether the bacteria survived the inter-planetary ride.

A study that identified 377 strains found that a surprising number resist extreme temperatures and damage caused by ultraviolet-C radiation, the most potentially harmful type. The results, presented today at the annual meeting of the American Society for Microbiology, are a first step towards elucidating how certain bacteria might survive decontamination and space flight.

The work tells scientists a lot “about the kind of microbes that could be space explorers”, says evolutionary ecologist John Rummel of East Carolina University in Greenville, North Carolina, who was not involved in the research.

Swabs of Curiosity’s surfaces before it was launched, including its heat shield and flight system, revealed 65 species of bacteria. Most were related to the genus *Bacillus*. In the lab, scientists exposed the microbes to desiccation, UV exposure, cold and pH extremes. Nearly 11% of the 377 strains survived more than one of these severe conditions. Thirty-one per cent of the resistant bacteria did not form tough, protective spore coats; the researchers suspect that they used other biochemical means of protection, such as metabolic changes.

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Planetary scientists worry that rovers such as Curiosity will transport microbes from Earth to Mars.

“When we embarked on these studies there wasn’t anything known about the organisms in this collection,” says microbiologist Stephanie Smith of the University of Idaho in Moscow, who is the lead author on the work. The group now plans to study how the most resilient of the identified bacteria survive in extreme environments.

Curiosity's flora

Earlier work has focused on microbes isolated from spacecraft assembly facilities or ground support hardware. This project, done in collaboration with NASA’s Jet Propulsion Laboratory in Pasadena, California, is the first to examine the entire archive of microbes collected from Curiosity.

Identifying resilient microbial species helps to gauge actual levels of contamination on such spacecraft. Planetary scientists worry that hitchhiking microbes could, in principle, contaminate Mars soil, or possibly taint rock samples collected as part of future missions — hence providing false signs of life on the red planet.

Although spacecraft go through multiple cleaning steps to ensure that they bear no biological contaminants, previous reports suggest that Curiosity project developers did not follow these planetary protection protocols to the letter. The regulations are a safeguard; whether microbes can tolerate conditions on the surface of Mars is still unknown.

“We don’t know yet if there’s really a threat,” says Smith. “Until we know, it’s important to take a precautionary approach.”

The data presented by Smith and her team may help mission scientists to evaluate cleaning procedures. The data also indicate a need for more research on planetary protection, according to Smith. Knowing which species might stow away on space missions could be critical for a planned 2020 NASA mission that will use a rover almost identical to Curiosity to bring samples of Martian soil and rock back to Earth.

“This can keep us from identifying dead bugs from a sample return mission as something that originated on Mars,” says Rummel. “We could be sure that they’re not Martians.”

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