

# What to Know If the Pandemic Came From Extraterrestrial Sources

Bacteria are not only able to survive in harsh conditions, but can also travel great distances in space, hiding on spacecraft or space debris.

When you think of threats from space, you might picture deadly solar storms, asteroids destroying each other, or even an alien invasion. But scientists warn that the biggest danger may be much smaller and invisible to the naked eye. It's **bacteria**. These microscopic organisms are not only able to survive in extreme conditions, but can also travel vast distances in space, hiding on spacecraft or space debris.



Understanding their potential impacts is becoming increasingly important as humanity ventures further into space and more missions leave Earth. Even the smallest microbes can have impacts that ripple across the globe and last for decades, making studying these threats a top priority for space agencies.

## The universe is vast and full of potential for life.

There are between 100 and 200 billion galaxies in the observable universe, each with countless planets. Although humans have yet to discover life beyond Earth, the sheer number of planets that could support life makes contamination a serious concern. Space agencies take great care to prevent cross-contamination, because the last thing we want is to accidentally introduce life from Earth to other planets or bring alien life back here. Even seemingly inhospitable planets may harbor microbial life in underground oceans or beneath icy crusts, so precautions are absolutely necessary.

The discovery of alien life could reshape human understanding of biology and evolution, making preventing contamination a top priority for scientific integrity.



## **Remote Pollution Could Spread Life on Earth Across Space**

Remote contamination occurs when terrestrial microbes get onto spacecraft and colonize other planets, moons, or asteroids. Missions to Mars or Jupiter's moon Europa, where conditions could support life, follow the most stringent protocols to avoid this. Without careful cleaning and disinfection, we could inadvertently seed another planet with Earth-based organisms. Once introduced, microbes could adapt to the alien environment, evolving in ways we could never predict.

Not only does this threaten the integrity of future scientific research, it could also permanently alter the ecosystems of other planets before humans even know of their existence.

## **Reverse pollution could bring alien bacteria to Earth**

Reverse contamination is the return of foreign microbes to our planet. Life could also spread naturally via meteorites, comets or space dust, a theory known as panspermia. If foreign microbes survive their journey to Earth, they could carry pathogens for which the human immune system is not prepared, posing potentially catastrophic risks.

Even a single strain of bacteria can disrupt ecosystems, compete with native species, or cause rapidly spreading disease.

## **Some bacteria are almost impossible to kill.**

Even tiny organisms can survive in extreme conditions. Tardigrades, for example, are known to be able to withstand the freezing temperatures, intense radiation, and vacuum of space. When an Israeli lunar lander crashed on the Moon in 2019, it took thousands of these microscopic creatures with it. They may still be there, surviving in ways we can't fully predict. Their resilience highlights the difficulty of keeping spacecraft completely sterile, and demonstrates that even accidental contamination can have lasting consequences.

Some experiments have shown that these organisms can even adapt to microgravity or survive for years in space, making them a potential long-term source of extraterrestrial contamination. Understanding how microbes survive in such extreme conditions could help scientists design better safety protocols for future missions.



## **Alien bacteria could threaten life on Earth**

If alien pathogens were to make it to Earth, they could act as extremely dangerous invasive species. Some could reproduce silently in their hosts, resist our immune systems, and eventually spread rapidly. In the worst case, these microbes could cause the extinction of plants, animals, and even humans.

Scientists warn that the introduction of alien microbes is not a hypothetical danger, but a risk that must be proactively managed to avoid catastrophic consequences. The risks are global, and understanding them is a key part of planning any mission that might bring samples back to Earth.

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