

Space Research May Help Explain Salmonella Illness

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(PhysOrg.com) -- Salmonella bacteria research from two recent NASA space missions discovered key elements of the bacteria's disease-causing potential that hold promise for improving ways to fight food-borne infections on Earth.

Salmonella is a leading cause of food poisoning and related illnesses. According to the Centers for Disease Control and Prevention, approximately 40,000 cases of [Salmonella](#) infections are reported in the United States each year.

"This research opens up new areas for investigations that may improve [food treatment](#), develop new therapies and vaccines to combat food poisoning in humans here on Earth, and protect astronauts on orbit from infectious disease," said Julie Robinson, program scientist for the International [Space](#) Station at NASA's Johnson Space Center in Houston.

The Salmonella experiments were flown on shuttle missions to the International [Space Station](#) in September 2006 and March 2008. The 2006 experiment results allowed researchers to identify a molecular "switch" that appears to control Salmonella's response to spaceflight in unique ways not observed using traditional experimental approaches on Earth. The 2006 results showed that the space environment causes a short-term alteration in Salmonella virulence -- the [bacteria](#) cultured in space were more virulent than those on Earth.

The 2008 experiment confirmed the 2006 results and demonstrated that

a change in the growth environment of the bacteria controls its virulence. There is no evidence that the space-grown bacteria sustained these effects for long periods after returning to Earth.

In addition to finding a leading candidate as to why the bacteria becomes more virulent in space, results from the 2008 experiment helped researchers identify ways to counter the virulence effect. A research team led by Cheryl Nickerson of the Biodesign Institute at Arizona State University in Tempe found that adjusting the ion content of the bacteria's environment can turn off the rise in virulence caused by spaceflight.

The space experiments helped researchers show that a mechanical force known as "[fluid shear](#)," the motion of fluid that cells sense as fluid passes over their surface, could have a dramatic effect on Salmonella's disease-causing potential.

Lower fluid shear conditions, it turns out, are found both in microgravity and in our intestines. The bacteria cultured in space are more virulent, and Nickerson's work showed that by modifying the medium in which the cells are grown, the virulence could be reduced, or turned off.

In other words, space travel may trick the bacteria into behaving as though they were in the low fluid shear environment of the intestine, essentially turning on a switch inside the microbe that increases virulence. Changing the chemistry of the medium in which the bacteria are cultured reverses this effect.

"To our knowledge, no one had previously looked at a mechanical force like fluid shear on the disease-causing properties of a microorganism during the infection process," Nickerson said. "We can use the innovative research platform of the space station to contribute to new translational advances for the development of new strategies to globally

advance human health."

The experiments were managed by NASA's Ames Research Center at Moffett Field, Calif., in support of NASA's Exploration Systems Mission Directorate. The Nickerson team's initial findings were published in the Proceedings of the National Academy of Sciences, and their most recent findings published in the journal PLoS ONE.

More information: For more about the Salmonella research conducted in space, visit: [nasa.gov/mission_pages/station/science/experiments/MDRV.html](https://www.nasa.gov/mission_pages/station/science/experiments/MDRV.html)"
target="_blank">[www.nasa.gov/mission_ ... xperiments/MDRV.html](https://www.nasa.gov/mission_pages/station/science/experiments/MDRV.html)

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