The immune system in space

June 1 2017

Credit: CC0 Public Domain

Getting sick when you're far from home is a drag. You'd give anything to crawl into your own soft bed and sleep, but you're stuck in a cookie-cutter hotel room feeling like a sick fish out of water. Well, it could be worse.

You could be an astronaut on the way to Mars—a really long way from mom's chicken soup.

Future space travelers will need to stay healthy to perform well for their own safety and for mission success. So it's important to understand how extended space travel will affect them.

The immune system works unnoticed to protect the body, but even subtle changes in that all-important system may be linked to the onset of illness. Factors like radiation, microgravity, stress, and altered sleep cycles could all affect astronaut immune systems. A new NASA study entitled 'Functional Immune' will investigate the immune system changes that occur in International Space Station (ISS) crewmembers. Understanding these immune system changes may help scientists pinpoint the onset of illness, and suggest monitoring strategies, or treatments, that can boost the immune system and prevent full-blown infections and diseases here on Earth.

Functional Immune builds upon the results of several previous NASA studies of the immune system, which, according to Johns Hopkins University Scientist Dr. Mark Shelhamer "tell us there is no place during spaceflight where we see stabilization of the immune system."

In 2014, NASA's Integrated Immune study showed abnormalities can occur in immune cells in ISS crewmembers' blood during flight. Normally, the immune system attacks and eliminates virus infected cells. When cell activity is depressed, the immune system isn't responding to threats as it should. When cell activity heightens, the immune system

reacts excessively, which can result in illness, increased allergy symptoms, and persistent rashes. ISS crews were also observed to experience reactivation of 'latent' viruses from childhood, a finding directly related to reduced immune function.

The Integrated Immune team, working with the NASA Nutrition Laboratory, also measured the concentration of cytokines in blood plasma – the proteins that "marshal the forces," to an infected or injured body site to defend against invaders. The data indicated that changes can be seen in blood cytokines just as changes can be seen in cell function.

Dr. Brian Crucian of NASA's Johnson Space Center (JSC), principal investigator of the Functional Immune study says, "The immune system is very complex, and several aspects of immunity remain uninvestigated during spaceflight. We now need to delve deeper into the immune system changes that happen in space, and also determine if immune changes during flight elevate clinical risks for astronauts in future deep-space missions. All the factors that change immunity on the ISS will be worse on longer missions to an asteroid or to Mars."

Functional Immune includes NASA scientists and external collaborators at the Johnson Space Center radiation lab, the University of Houston, and the State University of New York. The study will reach beyond any previous space immune study and include exciting newer tests such as transcriptomics and proteomics. These tests will happen in parallel with the assessment of immune cells in blood, stress, and virus reactivation.

Crucian says, "With the ISS, we have a unique opportunity to study very healthy people in a 'quasi-isolation chamber', yet experiencing all the stressors that are specific to spaceflight."

Results should help clarify the influence of spaceflight-specific environmental factors on immunity and identify countermeasures to

mitigate their effects.

These studies could improve scientists understanding of the immune system, making a positive impact on human health at home and while traveling both near and far.

Provided by NASA