New Scientist

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Space

Asteroids could take us to Mars

Travelling inside space rocks would shield astronauts from harmful radiation

Jonathan O'Callaghan

ASTRONAUTS could travel to Mars and Venus by hitching a ride on asteroids, burying themselves under the surface to avoid damage from radiation.

High levels of harmful radiation from the sun and galactic cosmic rays would be a major concern for humans making long journeys beyond Earth's protective magnetic field.

"Going to Mars and coming back again is going to double or triple the amount of time people are exposed to radiation [compared with an International Space Station mission]," says Matthew Gill at Space Radiation Services in the UK. "We're not talking Chernobyl levels of radiation sickness, but there is going to be a higher probability of getting cancer in their lifetime."

One way to protect against this radiation is to build spacecraft with additional shielding. But Arsenii Kasianchuk and Volodymyr Reshetnyk at Taras Shevchenko National University of Kyiv in Ukraine have proposed an alternative: travelling inside an asteroid. "It is more cost-effective to use an alternative material that is already floating in space," says Kasianchuk.

The pair studied 35,000 known asteroids near Earth's orbit to see if any could be used for interplanetary missions between now and 2120. Specifically, they looked for asteroids that passed close enough to Earth and Mars or Venus that a spacecraft could easily land on and depart, and were also large enough to house a spacecraft.

"There's a whole world of things that are challenging about digging holes in the middle of asteroids"

That gave them a list of 120 asteroids, some of which fly past the planets regularly every two to three years, while others are less frequent, with only one pass in a century (arXiv, doi.org/np4c).

The idea is that astronauts would ride one asteroid to one destination, such as Earth to Mars, and then wait for another asteroid to pass in the other direction for their return journey. "The asteroids in this case are really like trains," says Kasianchuk. The journey times were up to 180 days for missions to Mars or Venus.

One asteroid will fly from Earth to Venus to Mars in 230 days in 2079 and another will come back in the other direction in 2080, providing an opportunity to visit both planets in one mission. Although Venus's orbit is closer to the sun than the two other planets, an asteroid can pass it in the middle when Earth and Mars are on opposite sides of the sun.

Colin Snodgrass at the University of Edinburgh in the UK says there are some practical challenges to the idea. For one thing, matching the speed of a passing asteroid to land on its surface would be very difficult. "They're talking about velocities of up to 30 kilometres a second," he says – about 67,000 miles per hour – requiring a "crazy amount of fuel".

Finding a way to bury into the surface of an asteroid would also be extremely difficult. "There's a whole world of things that are technologically challenging about digging holes in the middle of asteroids," says Snodgrass.

Kasianchuk says this could be done by firing an uncrewed device ahead of the rendezvous to excavate a cylindrical tunnel into the asteroid that a spacecraft could then fly into.

He hopes that more asteroids might be found in the coming years that could be used for such voyages. "More and more near-Earth asteroids are discovered every year," he says. "The number of candidates for interplanetary transfers will continue to grow." ▮

Health

Antibiotics change your gut microbiome for many years

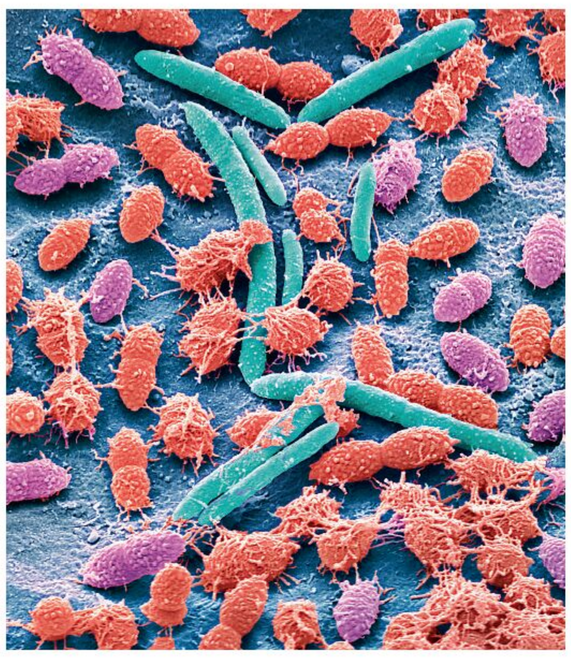
TAKING antibiotics can be life-saving, but a course lasting less than two weeks may also reduce the diversity of your gut microbiome for many years.

Gabriel Baldanzi at Uppsala University in Sweden and his colleagues analysed data from more than 5700 adults who took part in three studies in which stool samples were collected.

Based on their medical records, more than 1400 of the participants had taken a course of antibiotics, lasting less than two weeks, between four and eight years before they provided a stool sample. The remaining participants had taken no antibiotics in the eight years before providing a sample.

The researchers found that participants who had taken antibiotics called macrolides, which are commonly used to treat skin and lung infections, had 56 fewer bacterial species in their gut, on average, four to eight years later, compared with those who took no antibiotics (medRxiv, doi.org/np3x).

Those who took antibiotics called cephalosporins – which are used against urinary tract infections and meningitis – had 43 fewer bacterial species in their gut, on average, up to eight years later. The same was true for those who took a course of the antibiotic clindamycin, which treats certain skin infections. The team accounted for differences that could affect the results, such as age and sex.



STEVE GSCHMEISSNER/SPL/ALAMY

Scanning electron micrograph of bacteria from a sample of human faeces

Researchers already knew that antibiotics can lower the diversity of bacterial species in the gut for up to two years, but this work makes it clear that this effect can be even longer lasting.

Most people have at least several hundred bacterial species in their gut. Losing around 50 species may make them more vulnerable to infections, such as *Clostridium difficile*, says Ines Moura at the University of Leeds in the UK. If the balance of microorganisms in the gut becomes disrupted after someone takes antibiotics, this bacterium can dominate, which can lead to diarrhoea. ▮

Carissa Wong