New Scientist

WEEKLY 31 August 2024

CAN WE STOP MPOX BECOMING A GLOBAL PANDEMIC?

THE SURPRISING TRUTH ABOUT ONLINE PROPAGANDA

QUANTUM TRICK LETS YOU COOL OBJECTS USING NOTHING

ERADICATING DEMENTIA

How revolutionary vaccines that clean out the brain could end Alzheimer's

PLUS
ATLANTIC COOLING COULD CHANGE WORLD'S WEATHER /
THE SCIENCE OF LAUGHTER / GLOB OF JELLY PLAYS PONG

No3506 £6.95 CAN$9.99

9 770262 407374 35

Biotechnology

Bacteria destroy antibiotic resistance genes in wastewater

Grace Wade

MORE than 99 per cent of genes in wastewater that confer antibiotic resistance can be removed by bacteria engineered to destroy DNA. Treating wastewater with this method could help slow the spread of antibiotic resistance.

Disease-causing bacteria can absorb resistance genes that damaged or dead bacteria have released into the environment. This makes wastewater one of the largest environmental reservoirs for antibiotic resistance genes, says James Tiedje at Michigan State University. Affected microbes can spread to people through water, food or livestock.

Tiedje and his colleagues have developed a way to remove this threat by genetically engineering the common bacterium *Shewanella oneidensis* to churn out enzymes that break bonds in free-floating DNA strands. "It just basically chops it up into pieces, so it is no longer able to be transferred to other organisms," says Tiedje.

They tested the microbe in wastewater samples from different stages of treatment. After 4 hours, the engineered microbes destroyed more than 99.9 per cent of genetic material in all the samples, and after 6 hours, all of the antibiotic resistance genes were destroyed (*Nature Water*, doi.org/ndrx).

Current strategies for removing genetic material from wastewater are costly and can come with environmental trade-offs, says Anthony McDonnell at the Center for Global Development in London. For instance, chemical disinfectants can produce harmful by-products. Genetically modified microbes are a promising alternative, he says.

The microbes produce no by-products and can be cheaply grown even without high-tech equipment, says Tiedje. It would cost about £0.08 to treat a litre of water with this strategy, he says. ▮

Space

SpaceX tweaks Starlink to save radio astronomy from satellites

Jeremy Hsu

RADIO telescopes observing the cosmos face growing challenges because of electromagnetic interference from thousands of satellites in low Earth orbit. Now, experiments involving SpaceX's Starlink satellites have shown how to virtually eliminate part of this problem.

As satellites like this hurtle around the planet, they send so-called downlink signals to Earth to provide internet and communication services. When they pass through areas of the sky where radio telescopes are observing, the temporary blips from those signals can potentially impact hours of data collected by instruments that cost millions or even billions of dollars to build and run.

In 2023 and 2024, SpaceX worked with the US National Science Foundation's National Radio Astronomy Observatory (NRAO) to test a potential solution: Starlink satellites could temporarily redirect or switch off their downlink transmissions while moving through the line of sight of an active radio telescope.

This represents "one of many possible solutions for a pressing problem", says Bang Nhan at the NRAO. "The number of satellites is going to increase exponentially in the coming years, which would mean radio astronomers will see more interference more often."

"The number of satellites is going to increase exponentially in the coming years"

Avoiding this is particularly important when radio telescopes are doing what are known as calibration scans, lasting a few minutes. Interference then could negatively affect hours-long observation runs, says Nhan. He also says extreme interference could potentially damage some radio telescopes' electronic components.

Nhan and his NRAO colleagues coordinated tests with SpaceX that involved the Green Bank Observatory in West Virginia pointing its radio telescope, one of the largest in the world, towards parts of the sky crisscrossed by dozens of Starlink satellites. SpaceX set these satellites to redirect their downlink signals to avoid the observatory site. Satellites passing near the telescope's line of sight temporarily disabled these signals entirely, reducing interference (*The Astrophysical Journal Letters*, doi.org/ndsb).

The beam avoidance demonstrations seem to have achieved a "noticeable impact", says Federico Di Vruno at the International Astronomical Union's Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference. "If the method is implemented in all telescopes, this would be a huge step forward," he says.

Follow-up tests of the beam avoidance measure have shown similar success at the Very Large Array (VLA) radio telescope in New Mexico, says Nhan. SpaceX voluntarily activated the protective measure for the VLA starting in August and is planning to do the same for the Green Bank Observatory.

But this measure only helps radio astronomers avoid one type of potential interference. Other problems arise when downlink transmissions leak into frequency bands that are protected for radio astronomy or satellite signals fill up parts of the radio spectrum that are passively observed by these telescopes, says Di Vruno.

The work is still helpful, however, and Di Vruno and Nhan hope that such measures can also be implemented by other satellite companies too. ▮

A group of Starlink satellites leaving a trail across part of the Milky Way over Uruguay

MARIANA SUAREZ/AFP VIA GETTY IMAGES