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Environment

Kangaroo faeces transplants may cut cow emissions

Saugat Bolakhe

BACTERIA from kangaroo faeces transplanted into cow stomachs might reduce the massive amount of methane the ruminants produce.

Methane has a warming effect in the atmosphere that is almost 30 times more potent than that of carbon dioxide. About half of global methane emissions come from ruminants like cows, which harbour bacteria called methanogens in their stomachs. These bacteria consume hydrogen gas – produced by the digestion of sugars – and use it to make methane, which is then released from the animal's body.

People have tried various feed additives for reducing methanogens in ruminants, such as antibiotics and plant extracts. However, the bacteria were either too robust to be replaced or the antibiotics upset the animals' digestion.

To look for alternatives, Birgitte Ahring at Washington State University and her colleagues turned to kangaroos, whose gut microbiota contain bacteria that use hydrogen and carbon dioxide to make acetic acid instead of methane.

The researchers collected droppings from baby kangaroos and grew the microorganisms present in them in the lab. They then placed the faecal culture in a bioreactor designed to mimic the contents of a cow stomach.

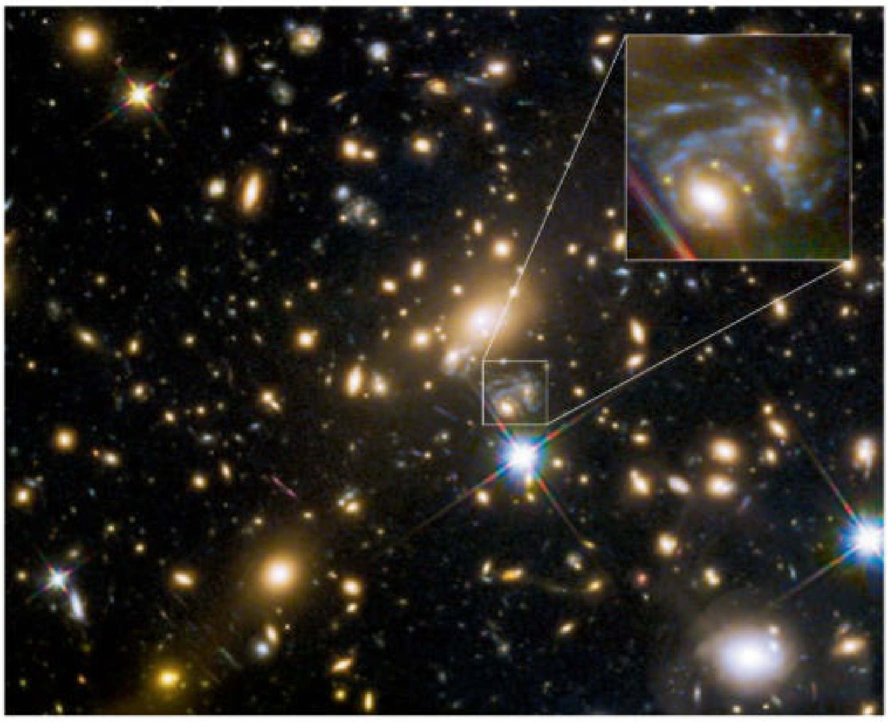
Use of baby kangaroo faeces alone didn't result in reduction of methanogens. However, the researchers found that adding a chemical that inhibits methanogens allowed the acetic acid-producing bacteria to outcompete the other bacteria. Over a 12-day test period, the artificial rumen didn't produce any methane (*Biocatalysis and Agricultural Biotechnology*, doi.org/grr82n).

Ahring now wants to investigate doing faecal microbiota transplants with live animals to see if the technique works outside the lab.

Space

Odd supernova defies our understanding of the cosmos

Leah Crane



NASA/ESA/STSCI

Four images of supernova Refsdal appear around a galaxy cluster as yellow dots

A DISTANT supernova has been used to measure the expansion of the universe, and the result adds an unexpected twist to a long-standing tension.

The supernova was spotted through a quirk of a phenomenon called gravitational lensing. This occurs when the light from a distant object is bent and warped by the gravity of a massive and relatively nearby object. It can result in several images of the distant object appearing around the nearer one, similar to the patterns you might see when looking through a warped lens, such as the bottom of a water glass.

Because the light from the background object takes a different path to form each image, those images can appear to us at different times.

Patrick Kelly at the University of Minnesota and his colleagues have used this strange effect to calculate the Hubble constant, a measure of the universe's rate of expansion. They did so with the light from supernova Refsdal, which is gravitationally lensed by a nearby galaxy cluster.

Refsdal was first discovered in 2014, and a new image of it was captured in 2015, allowing the researchers to use the time delay between the images to calculate the rate at which the universe's expansion is carrying the supernova away from Earth.

There are two main ways of measuring the Hubble constant. The first, called the cosmic distance ladder, relies on measurements of relatively nearby objects to determine how fast they are moving away from Earth.

> **"If the value of the Hubble constant is 73, there is something faulty in our models of the universe"**

The second uses observations of the cosmic microwave background (CMB), which is relic light left over from the big bang, so the measurements of it need to be extrapolated forwards in time using cosmologists' best models of the universe.

The two methods have disagreed for decades, in what is called the Hubble tension: the distance ladder results in a Hubble constant of 73 kilometres per second per megaparsec (km/sec/mpc), and the CMB method gives a value of about 67 km/sec/mpc.

Physicists have long hoped that independent methods could resolve this tension, but haven't been successful yet.

The new measurement using Refsdal gives a value of about 67 km/sec/mpc (*Science*, doi.org/j9mr). This agrees with the CMB method despite being based on observations of an individual object like the distance ladder method.

The new result doesn't rule out the higher value, but it does mean that the models used to study gravitationally lensed objects hang in the balance. "If the value of the Hubble constant turns out to be 73 like the local measurements would indicate at the moment, then there has to be something faulty in our understanding of galaxy cluster lenses, and these models are used routinely to study the distant universe," says Kelly.

The researchers are now looking at other lensed supernovae to see if they can get more measurements using this method, and other teams are hard at work with other independent ways of measuring the Hubble constant.

If the researchers don't find a way to make the measurements agree with one another, we may need new models of exotic physics to explain what is really going on.