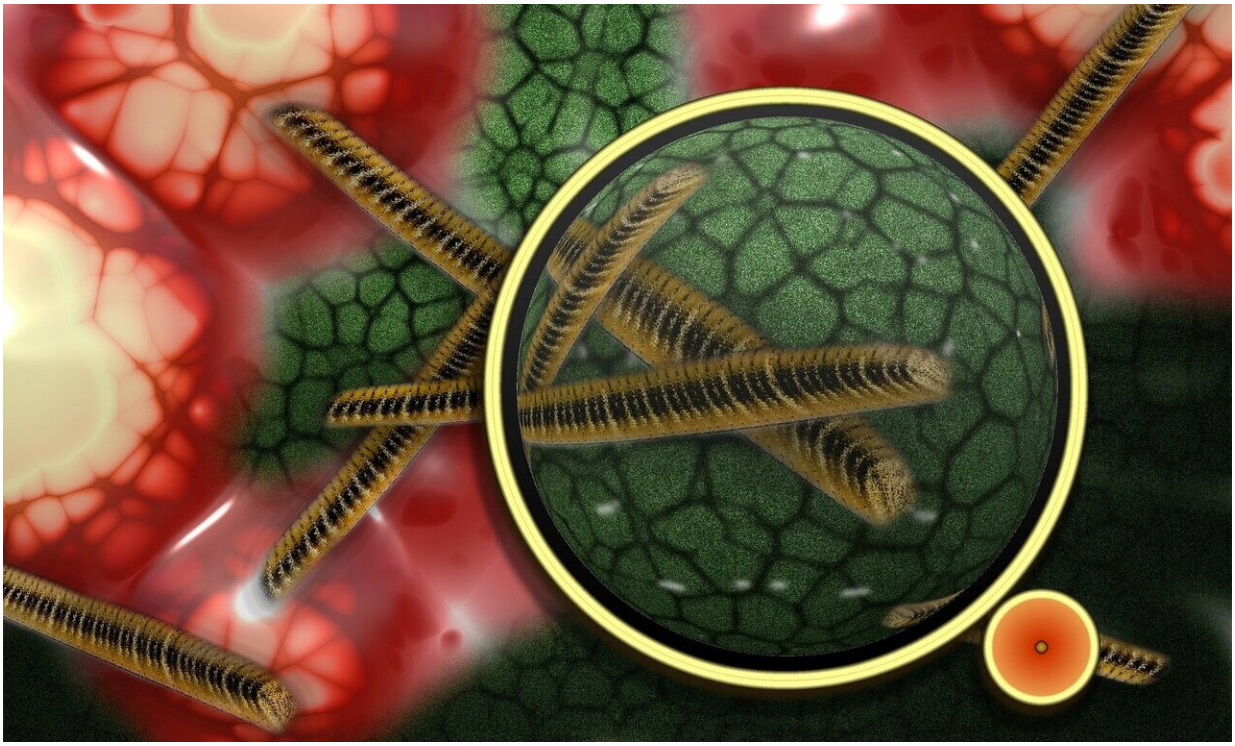
Study shows ribosome-binding antibiotics can help some bacteria survive for longer

September 25 2023



Credit: CC0 Public Domain

Scientists have found a surprising effect of some antibiotics on certain bacteria—that the drugs can sometimes benefit bacteria, helping them live longer.

Until now, it has been widely acknowledged that antibiotics kill bacteria

or stop them growing, making them widely used as blanket medication for bacterial infections. In recent years, the rise of antibiotic resistance has stopped some antibiotics from working, meaning that untreatable infections could be the biggest global cause of death by 2050.

Now, researchers at the University of Exeter have shown for the first time that antibiotics can actually benefit bacteria and protect them from death. In research published today, the team has found that certain antibiotics can alleviate stress and help prevent the decline of bacterial populations when they are dying out. This means more bacteria survive for longer compared to untreated populations.

The paper is titled "Ribosome-binding antibiotics increase bacterial longevity and growth efficiency," and is published in *PNAS*.

Professor Robert Beardmore, lead author from the University of Exeter, said, "The study began when we realized that surprisingly, some bacterial strains didn't grow in the lab until we treated them with antibiotics. As a result, this is the first evidence that antibiotics can promote bacterial survival. To tackle antibiotic resistance worldwide, we need to understand far more about the impact of these drugs on the balance of bacterial ecosystems, like those in the gut microflora, or in rivers that are exposed to antibiotics. Our research is evidence of unseen side effects—we just don't know how drugs are changing the balance of bacterial populations in those contexts."

In real-world environments, bacteria undergo periods of rapid growth, punctuated by periods where growth stops because nutrients are scarce, so the bacteria die off. So far, little has been understood about how antibiotics mediate populations during those periods.

The researchers examined E.coli in lab experiments. They found that antibiotics targeting ribosomes—factories that help cells make protein

from DNA—slowed bacteria down when they were growing but also stopped them from dying, meaning the bacteria survived for longer overall.

Dr. Emily Wood said, "Many antibiotics slow the growth of bacteria, but we show that can help bacteria overcome stresses caused by a lack of nutrients that might otherwise kill them off, ultimately helping them to survive. In our experiments, this comes about because the antibiotics are antioxidants, meaning they help cells deal with some of the waste products they make as they grow. Importantly, the antibiotic-resistant bacteria we tested didn't get the same benefits so in our study, treatment does not promote resistance, which is unusual. Our next step will be to measure how these findings alter the dynamics of multi-species bacterial communities."

More information: Wood, Emily et al, Ribosome-binding antibiotics increase bacterial longevity and growth efficiency, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2221507120. doi.org/10.1073/pnas.2221507120

Provided by University of Exeter