

When bacteria get hungry, they kill — and eat — their neighbors

New study uncovers brutal microbial strategy with big implications for climate, health and medicine

By David Rozul, ASU News
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Bacteria are microscopic murderers.

We've long known that bacteria kill each other; it's part of microbial life. But new research from Arizona State University and an international team of scientists reveals something even more gruesome: Some bacteria don't just kill their neighbors.

They eat them.

Published June 12 in the journal *Science*, the study shows that, under nutrient-scarce conditions, certain bacteria use a brutal molecular weapon — Type VI secretion system (T6SS) — to stab, kill and consume their neighbors as a survival strategy.

"The punchline is: When things get tough, you eat your neighbors," said [Glen D'Souza](#), senior author, assistant professor in ASU's [School of Molecular Sciences](#) and core faculty member at the [Biodesign Center for Fundamental and Applied Microbiomics](#).

"We've known bacteria kill each other; that's textbook. But what we're seeing is that it's not just important that the bacteria have weapons to kill, but they are controlling when they use those weapons specifically for situations to eat others where they can't grow themselves."

Understanding these microbial weapons could help researchers design smarter probiotics, improve models of Earth's climate system and develop new disease-fighting tools.

(Video: https://www.youtube.com/watch?v=_yVzmEr9G5I)

"Most bacteria quietly gather nutrients from their surroundings, but a few are known to be specialist hunters, killing and consuming other organisms or cells," said [Ferran Garcia-Pichel](#), Regents Professor and director of the Biodesign Center for Fundamental and Applied Microbiomics. "This study and Dr. D'Souza's team reveal that even so-called harmless bacteria can become killers under stress. When resources run low, even seemingly harmless bacteria can flip — a microbial

Jekyll and Hyde. Their beauty, it turns out, is only skin-deep.”

A microscopic harpoon gun

The T6SS is like a microscopic harpoon gun. A bacterium fires a needle-like weapon into nearby cells, injecting toxins that fatally rupture them.

Historically, scientists thought this system was mainly for competition, clearing out rivals to make space, but the multi-institutional research team, which includes researchers from ETH Zurich and Eawag (Swiss Federal Institute of Aquatic Science and Technology), discovered that bacteria aren’t just killing for territory, they’re strategically killing for dinner and to help themselves grow.

Using time-lapse imaging, genetic tools and chemical labeling, the scientists watched in slow-motion the microscopic assassins at work.

In both ocean bacteria and human gut microbes, bacteria equipped with T6SS attacked neighbors when starved of nutrients, and then grew by feeding off the deceased’s leaking remains.

Why this research matters

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Eating to survive

To prove this wasn’t just coincidence, the team then genetically “turned off” the T6SS in some strains. When these genetically edited bacteria were placed in a nutrient-poor environment with potential prey, they couldn’t grow. But the unedited bacteria, the ones still able to kill, thrived.

Their survival depended on murder.

The team also analyzed bacterial genomes across marine environments and found that these killing systems are widespread.

“This isn’t just happening in the lab,” D’Souza said. “It’s present in many different environments, and it’s operational and happening in nature, from the oceans to the human gut.”

Tiny battles, big impact

Much remains to be discovered about the hidden worlds of bacteria, but by uncovering the strategies they use to survive, scientists are beginning to rewrite the rules of microbial life.

“Watching these cells in action really drives home how resourceful bacteria can be,” said Astrid Stubbusch, first author of the study and former doctoral student at ETH Zurich. “By slowly releasing nutrients from their neighbors, they maximize their nutrient harvesting when every molecule counts — revealing a new link in the microbial food web that we’ve not appreciated before.”

That insight has wide-ranging implications.

If scientists can better understand how and why these bacterial weapons work, they can begin to design smarter probiotics, ones that don't just coexist in your gut, but actively protect it by taking out harmful microbes.

It could also lead to new antibiotics, at a time when drug resistance is on the rise. The same harpoon that bacteria use to extract nutrients from competitors could be harnessed to deliver drugs directly into problem pathogens — offering a new frontier in targeted, resistance-proof therapies.

And beyond our bodies, in the ocean, bacteria help regulate the planet's carbon cycle. When killer bacteria wipe out the microbes that break down algae and recycle carbon, it changes how we think about where that carbon ends up — in the ocean or back in the air.

By decoding how microscopic bacteria kill and consume each other, this research could reshape how we think about ecosystems — from the human gut to the vast oceans that regulate Earth's climate.

For now, one thing's certain: When food runs out, bacteria don't just compete.

They hunt.

Glen D'Souza is actively recruiting undergraduate, graduate and postdoctoral students to participate in similar projects and join his lab. If interested, email Glen D'Souza at glen.dsouza@asu.edu.

This story originally appeared on [ASU News](#).

Key takeaways

Survival cannibalism: When starved, some bacteria stab and eat their neighbors using a microscopic harpoon-like weapon.

Global strategy: This behavior is widespread across ecosystems, from ocean microbes to gut bacteria.

Why it matters: Understanding how and why bacteria do this could help scientists create better medicines and understand the planet's climate.

Main image



Glen D'Souza is an assistant professor in Arizona State University's School of Molecular Sciences and a core faculty member at the Biodesign Center for Fundamental and Applied Microbiomics. Photo by EJ Hernandez/ASU News