A never-before-seen way bacteria infect cells

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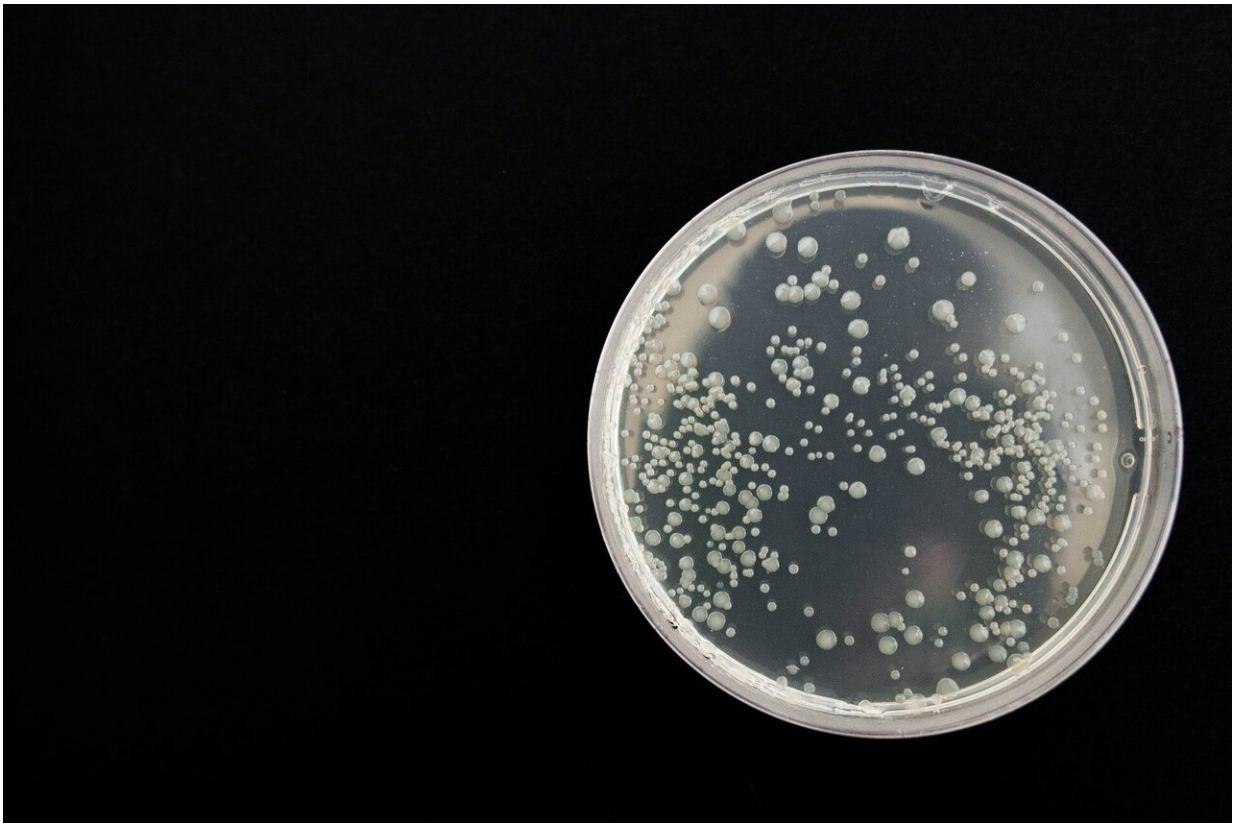

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Zombie bites and airborne transmission are some of the fictional and all-too-real methods that pathogens like bacteria and viruses use to infect new hosts. Biologists from San Diego State University have identified a new way that one type of bacteria invades multiple cells within a living organism.

The study, published this week in *Nature Communications*, describes how a new species of bacteria, *Bordetella atropi*, which the researchers named for the Greek fate Atropos responsible for cutting the threads of life, invades its roundworm host.

And it is aptly named because the bacteria changes its shape into a long thread, growing up to 100 times the usual size of one bacterium in the span of 30 hours without dividing.

By altering the genes of *Bordetella atropi*, the research team discovered that this invasive threading relies on the same genes and molecules that other bacteria use when they are in a nutrient-rich environment. However, these other bacteria only use this pathway to make subtly larger cells, whereas the *B. atropi* bacteria grows continuously.

Other bacteria often transform into threads, called filamentation, in response to dangerous environments or damage to their DNA. This lets them continue to grow in size, but delay dividing into new bacterial cells until they fix the damage caused by the stress.

Here, however, the researchers were the first to observe filamentation as a way of spreading from cell to cell in a living organism for a purpose other than the stress response. They believe that instead the new species is invading the host cells, detecting this rich environment and triggering filamentation in order to quickly infect more cells and access additional nutrients for their growth.

"We went from finding the worm in the ground, finding the bacteria, and carrying it all the way to the molecular mechanism of how the bacteria infects the worm," said Robert Luallen, biology professor and principal investigator of the study. "We're seeing things that no one's ever seen before."

Although neither the bacteria nor the roundworm that Luallen studies infects humans, it is possible that the spreading mechanism may also be used by human pathogens. Separately, the nutrient-induced filamentation process might be used by other bacteria to form biofilms, which can coat the tubing of catheters and lead to complications for patients.

More information: Tuan D. Tran et al, Bacterial filamentation as a mechanism for cell-to-cell spread within an animal host, *Nature Communications* (2022). DOI: 10.1038/s41467-022-28297-6

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