Researchers discover new structures in bacteria, seek to determine function

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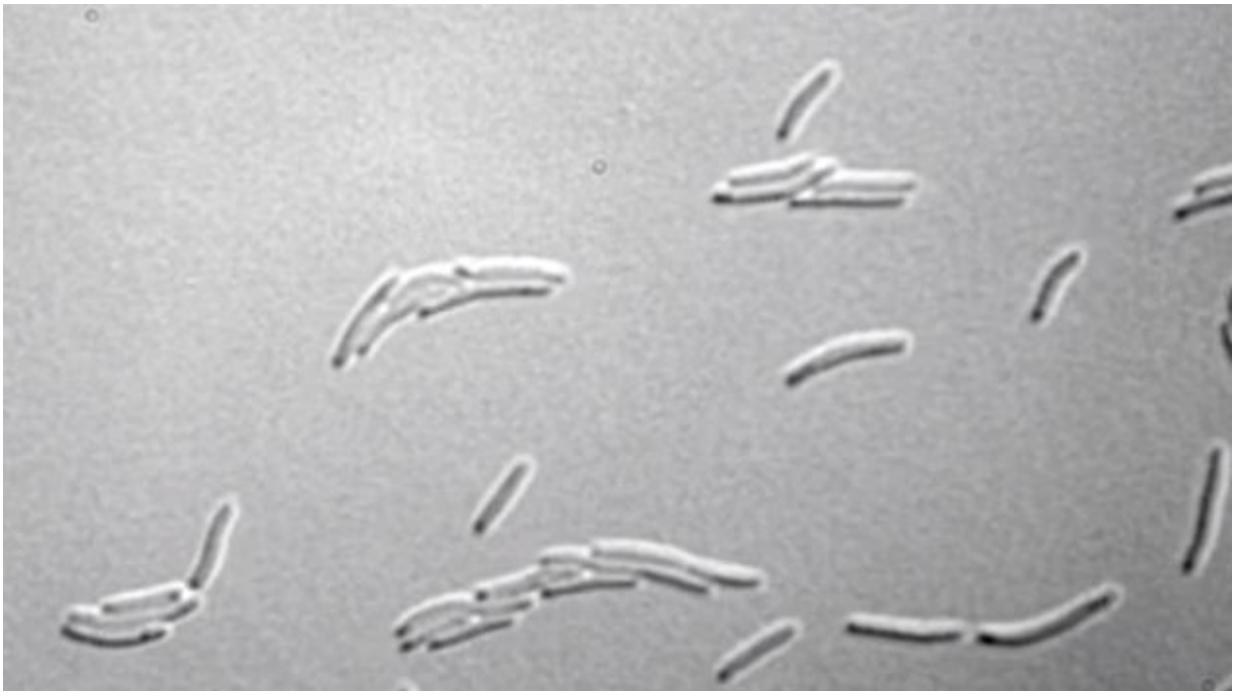

Using high magnification imaging, a team of researchers has identified several never before seen structures on bacteria that represent molecular machinery. The research is published this week in the *Journal of Bacteriology*, published by the American Society for Microbiology.

"The study drives home the point that a wealth of information remains to

be discovered even about the fraction of bacteria that we know about," said Catherine Oikonomou, PhD, a research scientist in Grant J. Jensen's laboratory at the California Institute of Technology, Pasadena. "Even well-studied species contain prominent structural features that we didn't know about before, whose function is still unknown."

The study grew out of a chance observation of previously unknown appendages on the bacterium, Prosthecobacter debontii. "We couldn't find any clues about their identity in the literature," said Oikonomou.

Following that discovery, the investigators, led by Megan Dobro, PhD, assistant professor of human biology at Hampshire College, Amherst, MA, conducted a visual survey of 3D electron cryotomograms of intact cells from 88 species of bacteria, all culled from a database that included 15,000 of these images, that had been collected by the Jensen laboratory. (This technique provides 3D views of macromolecules and cells.)

The study's purpose in publishing what is essentially a catalog of these novel structures is to generate research into their structure and function, by sharing them with a broad audience of bacterial cell biologists, said Oikonomou.

During the 20th century, the interior of bacterial cells had been viewed as relatively simple, unlike the more complex eukaryotic cells of all multicellular organisms. "But in the last ~20 years, electron cryotomography has allowed us to visualize bacterial cells in an intact, fully-hydrated state, preserving their internal structures," said Oikonomou.

"We are learning that bacteria contain an organized battery of macromolecular machines that carry out the specialized functions that allow them to thrive in their diverse environments. Our work underscores the diversity and complexity of bacterial cells. And it

reminds us that many structures still remain to be seen."

Understanding these newly observed structures will help microbiologists understand pathogens, such as Vibrio cholerae, the causative agent of cholera, and carcinogenic bacteria, such as Helicobacter pylori, as well as environmentally important species, such as Azospirillum brasilense, said Oikonomou. The latter is an important player in the nitrogen cycle, as it helps circulate this ecologically critical element.

Thus, the research is likely to lead to improvements in medicine, environmental science, and multiple additional fields where bacteria play a critical role.

More information: Megan J. Dobro et al, Uncharacterized bacterial structures revealed by electron cryotomography, *Journal of Bacteriology* (2017). DOI: 10.1128/JB.00100-17

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