How cholera bacteria make people so sick

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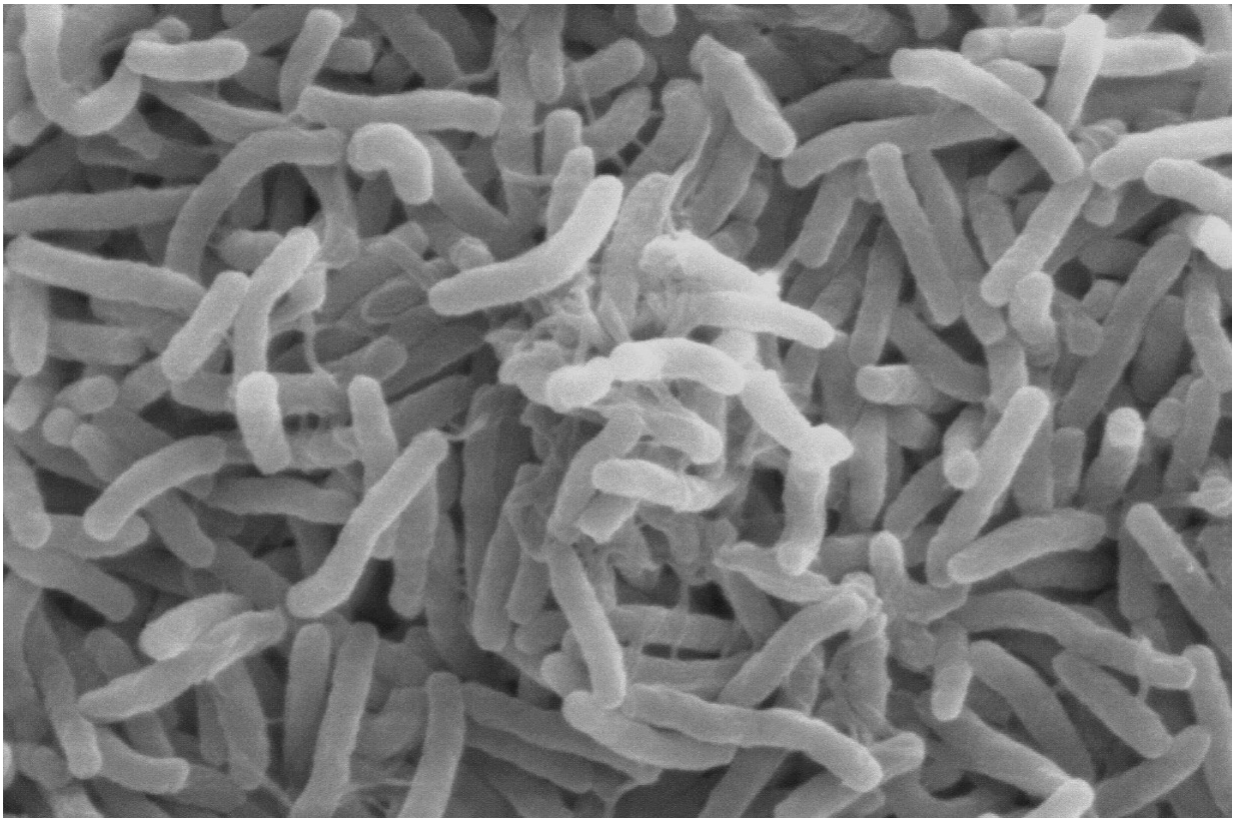

Scanning electron microscope image of Vibrio cholerae. Credit: Wikipedia

The enormous adaptability of the cholera bacterium explains why it is able to claim so many victims. Professor Ariane Briegel from the Leiden Institute of Biology has now discovered that this adaptability is due to rapid sensory changes in the bacterium. Her research has been published in *PNAS*.

The Vibrio cholerae bacterium is the cause of cholera, a devastating illness that affects millions of people every year, particularly in Africa. Victims usually become infected after ingesting contaminated food or waste. The symptoms are severe diarrhoea and vomiting. One particular characteristic of the bacterium is its ability to thrive in very different environments, and to adapt rapidly to these environments. A research team from the Institute of Biology in Leiden and the Max Planck Institute, headed by Leiden Professor of Ultrastructural Biology Ariane Briegel, now states in *PNAS* that this rapid adaptation can be attributed to fast structural changes in the bacteria's sensory organ.

Enormously variable array of molecules

The cholera bacterium can navigate to its preferred environment. It scans the environment constantly and detects changes in the presence of nutrients, after which it moves in the direction of these food sources, using a system of rotating tails, known as flagella. "The bacterium is able to detect nutrients using a highly developed sensory organ made up of thousands of chemo-receptor molecules," Briegel explains. "These molecules are located close together in a hexagonal array." This arrangement, which probably occurs in all bacteria, has been studied for several decades in the E.coli model organism. Using the cryo-electron microscope at NeCEN (the Netherlands Centre for Electron Nanoscopy), we saw that the arrangement of the molecules is more variable in cholera bacteria than in E.coli."

The sensory organ probably also changes structure when the bacteria enter a human cell, or when they infects a person. According to the researchers, this is also the reason why it is so easy for the bacteria to infect its victims. This characteristic explains how the bacteria are able to make so many people throughout the world sick. For some people, especially children, the resulting dehydration can be fatal.

This discovery brings the development of new medicines to combat cholera a step closer, Briegel explains. "There are already medicines, such as antibiotics, but they have a lot of disadvantages. Antibiotics destroy healthy as well as unhealthy bacteria and there is also the problem of immunity. If you know more about the signals and the substances that the bacteria receive and then themselves excrete, you can probably also make substances that make sure that the bacteria are removed from the cell. This could be the basis for new medicines."

More information: Wen Yang et al. Baseplate variability of Vibrio cholerae chemoreceptor arrays, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1811931115

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