# A new toxin in Cholera bacteria discovered

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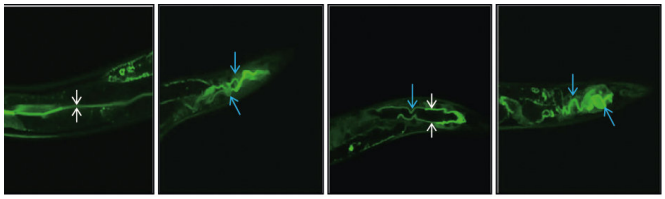

Credit: Umea University

The bacterium Vibrio cholerae was discovered more than 150 years ago, but remains one of the main causes of infectious disease globally, especially in low-income nations where it is endemic, and outbreaks of cholera disease can lead to major epidemics.

In addition to causing cholera, characterized by very severe watery diarrhea, different variants of V. cholerae can cause wound infections and infections in the ear canal. If the infection reaches the bloodstream, it can lead to blood poisoning. Such variants of Vibrio bacteria are common in brackish water, but can be found in both freshwater and saltwater.

Scientists from Umeå University have now discovered and characterised the structure and function of a so far unknown Vibrio toxin. A team led by Professor Sun Nyunt Wai at Department of Molecular Biology and MIMS used the worm Caenorhabditis elegans as a predatory host for the bacteria and identified by molecular genetic analysis the V. cholerae genes required for the production and release of the protein toxin, called MakA.

"In addition to the toxicity of MakA demonstrated with C. elegans, our studies revealed that upon infection of Zebrafish, the toxin caused damage in particular to the intestinal system," explains Sun Nyunt Wai.

Sun Nyunt Wai lrSun Nyunt Wai and her colleagues were also curious about the details of the bacterial release mechanism of the newly discovered toxin from Vibrio cholerae. This is a motile bacterium, able to swim in fluids, driven by a rotating flagellum at the back of the cell. The scientists found that the flagellum of this bacterium is also used for the release of the MakA toxin.

"Using a combination of electron microscopy and light microscopy with molecular genetic methods we obtained evidence that this protein toxin is transported through the channel of the flagellum filamentous structure," Sun Nyunt Wai explains.

This is the first time that scientists determined how the flagellum functions as a secretion apparatus for a toxin from Vibrio cholerae.

Sun Nyunt Wai says, "In order to fully understand the disease-causing properties, and the distinctive ability of V. cholerae to survive and spread in different environments, it is important to study not only factors important for colonization and growth in human infections. Our aim was also to identify factors that may have evolved to be decisive for the environmental impact of the bacterium in competition with other microorganisms and for survival where there are predatory organisms. Our findings about MakA demonstrate that it is a novel cytotoxin affecting both vertebrate and invertebrate hosts."

In the future, Sun Nyunt Wai and her colleagues would like to study also the effects and role of the MakA toxin in natural systems.

"Of course, we also want to find out if MakA might be responsible for some of the fish deaths in natural environments, and e.g in fisheries." An immunization of the breeding fish against MakA would be a good alternative to treating the fish with antibiotics.

**More information:** Mitesh Dongre et al, Flagella-mediated secretion of a novel Vibrio cholerae

cytotoxin affecting both vertebrate and invertebrate hosts, *Communications Biology* (2018). DOI: 10.1038/s42003-018-0065-z

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