

BACTERIAL SECRETION

Vibrio cholerae beats the competition

The *Vibrio cholerae* type VI secretion system can target both eukaryotic and bacterial cells.



Several bacterial systems have been described that secrete effector proteins into the extracellular milieu or directly into host cells. The type VI secretion system (T6SS) was recently discovered, and its main role is still unclear, as only some T6SSs seem to contribute to pathogenesis. Now, MacIntyre and colleagues report that the T6SS of *Vibrio cholerae* can kill both eukaryotic and bacterial cells on contact.

Previous research had shown that the T6SS of *V. cholerae* str. V52, which is in the O37 serogroup, conferred virulence against the phagocytic amoeba *Dictyostelium discoideum* and against mouse macrophages. MacIntyre and colleagues found that wild-type *V. cholerae*

str. V52 can also kill a range of Gram-negative bacteria, including *Escherichia coli*, *Salmonella enterica* subsp. *enterica* serovar Typhimurium and *Citrobacter rodentium*. This effect was shown to be dependent on a functional T6SS, as it was abolished in a T6SS-defective mutant of *V. cholerae* str. V52. Moreover, the authors demonstrated that cell–cell contact was required, as killing was abrogated by placing a 0.22 µm filter (which would allow the diffusion of any secreted substances) between predator and prey. Interestingly, Gram-positive bacteria and other serogroups of *V. cholerae* were unharmed by *V. cholerae* str. V52.

T6SS-dependent killing of eukaryotic cells is mediated by the

actin cross-linking domain (ACD) of the *V. cholerae* T6SS protein VgrG1. Given that *E. coli* possesses the actin homologue MreB, the authors analysed the effects on *E. coli* of a *V. cholerae* str. V52 mutant in which the ACD had been deleted from VgrG1. The mutant, which had previously been shown to be harmless to eukaryotic cells, retained full virulence against *E. coli*, indicating that MreB is unlikely to be the target. This suggests that the *V. cholerae* T6SS might kill eukaryotic and bacterial cells by different mechanisms.

T6SS-encoding genes are widespread among *V. cholerae* strains. Hence, the T6SS could be used by these organisms to outcompete other bacteria and evade predation by phagocytic cells in both the host gut and the aquatic environment. However, the pandemic serogroups of *V. cholerae* do not show toxicity against *E. coli* or *D. discoideum* under laboratory conditions, which suggests that the T6SS might be tightly regulated in these strains. Future work will determine whether this secretion system has a role in the pathogenesis or transmission of cholera.

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ORIGINAL RESEARCH PAPER MacIntyre, D. L., Miyata, S. T., Kitaoka, M. & Pukatzki, S. The *Vibrio cholerae* type VI secretion system displays antimicrobial properties. *Proc. Natl Acad. Sci. USA* **107**, 19520–19524 (2010)