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Study by UC Santa Barbara Researchers Suggests That Bacteria Communicate by Sense of Touch

What if bacteria could talk to each other? What if they had a sense of touch? A new study by researchers at UC Santa Barbara suggests both, and theorizes that such cells may, in fact, need to communicate in order to perform certain functions. The findings appear today in the journal *Genes & Development*.

Christopher Hayes, UCSB associate professor of molecular, cellular, and development biology, teamed with graduate students Elie Diner, Christina Beck, and Julia Webb to study uropathogenic *E. coli* (UPEC), which causes urinary tract infections in humans. They discovered a sibling-like link between cell systems that have largely been thought of as rivals.

The paper shows that bacteria expressing a contact--dependent growth inhibition system (CDI) can inhibit bacteria without such a system only if the target bacteria have CysK, a metabolic enzyme required for synthesis of the amino acid cysteine. CysK is shown to bind to the CDI toxin -- an enzyme that breaks RNA ó and activate it.

For a cell system typically thought of as existing only to kill other bacteria -- as CDIs have largely been -- the results are surprising, said Hayes, because they suggest that a CDI+ inhibitor cell has to get permission from its target in order to do the job.

"This is basically the inhibitor cell asking the target cell, 'Can I please inhibit you?'" he explained. "It makes no sense. Why add an extra layer of complexity? Why add a permissive factor? That's an unusual finding.

"We think now that the [CDI] system is not made solely because these cells want to go out and kill other cells," Hayes continued. "Our results suggest the possibility that these cells may use CDI to communicate as siblings and team up to work together; for example, in formation of a biofilm, which lends bacteria greater strength and better odds of survival."

The study points to the enzyme CysK as the potential catalyst to such bacterial communication -- like a secret handshake, or a password. In simpler terms, said Hayes, "If you have the right credentials, you're allowed into the club; otherwise you're turned away. There's a velvet rope, if you will, and if you're not one of the cool kids, you can't get in."

Although only UPEC was studied for this paper, Hayes said that the findings hold potential implications for pathogens from bacterial meningitis to the plague, as well as for plant-based bacteria that can devastate vegetation.

David Low, a UCSB professor of molecular, cellular, and developmental biology and secondary author on the paper, described the work by Hayes's laboratory as potentially groundbreaking for its insights into how bacteria communicate -- and the practical applications that could someday result.

"We are just starting to get some clues that bacteria may be talking to each other with a contact-dependent language," said Low. "They touch and respond to one another in different ways depending on the CDI systems and other genotypic factors. Our hope is that ultimately this work may aid the development of drugs that block or enhance touch-dependent communication, whether the bacteria is harmful or helpful."

The work was supported by grants from the National Institutes of Health and the National Science Foundation.

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