Fighting fire with fire: 'Vampire' bacteria has potential as living antibiotic

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A vampire-like bacteria that leeches onto specific other bacteria – including certain human pathogens – has the potential to serve as a living antibiotic for a range of infectious diseases, a new study indicates.

The bacterium, *Micavibrio aeruginosavorus*, was discovered to inhabit wastewater nearly 30 years ago, but has not been extensively studied because it is difficult to culture and investigate using traditional microbiology techniques. However, biologists in the University of Virginia's College of Arts & Sciences, Martin Wu and graduate student Zhang Wang, have decoded its genome and are learning "how it makes its living," Wu said.

The bacterium "makes its living" by seeking out prey – certain other bacteria – and then attaching itself to its victim's cell wall and essentially sucking out nutrients. Unlike most other bacteria, which draw nutrients from their surroundings, *M. aeruginosavorus* can survive and propagate only by drawing its nutrition from specific prey bacteria. This kills the prey – making it a potentially powerful agent for destroying pathogens.

One bacterium it targets is *Pseudomonas aeruginosavorus*, which is a chief cause of serious lung infections in cystic fibrosis patients.

"Pathologists may eventually be able to use this bacterium to fight fire with fire, so to speak, as a bacterium that will aggressively hunt for and attack certain other bacteria that are extremely harmful to humans," Wu said.

His study, detailing the DNA sequence of *M. aeruginosavorus*, is published online in the journal *BMC Genomics*. It provides new insights to the predatory lifestyle of the bacterium and a better understanding of the evolution of bacterial predation in general.

"We used cutting-edge genomic technology in our lab to decode this bacterium's genome," Wu said. "We are particularly interested in the molecular mechanisms that allow it to hunt for and attack prey. This kind of investigation would have been extremely difficult and expensive to do only a few years ago."

He noted that overuse of traditional antibiotics, which work by either inhibiting bacteria propagation or interfering with cell wall formation, are creating so-called "super bugs" that have developed resistances to treatment strategies. He suggests that new approaches are needed for attacking pathogens without building up their resistance.

Additionally, because *M. aeruginosavorus* is so selective a feeder, it is harmless to the thousands of beneficial bacteria that dwell in the general environment and in the human body.

"It is possible that a living antibiotic such as *M. aeruginosavorus* – because it so specifically targets certain pathogens – could potentially reduce our dependence on traditional antibiotics and help mitigate the drug-resistance problem we are now facing," Wu said.

Another benefit of the bacterium is its ability to swim through viscous fluids, such as mucus. *P. aeruginosavorus*, the bacterium that colonizes the lungs of cystic fibrosis patients, creates a glue-like biofilm, enhancing its resistance to traditional antibiotics. Wu noted that the living cells of *M. aeruginosavorus* can swim through mucus and biofilm and attack *P. aeruginosavorus*.

M. aeruginosavorus also might have industrial uses, such as reducing bacteria that form biofilms in piping, and for medical devices, such as implants that are susceptible to the formation of biofilms.

Wu said *M. aeruginosavorus* requires further study for a more thorough understanding of its gene functions. He said genetic engineering would be required to tailor the predatory attributes of the bacterium to specific uses in the treatment of disease.

"We have a map now to work with, and we will see where it leads," he said.

More information: http://www.biomedcentral.com/1471-2164/12/453

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