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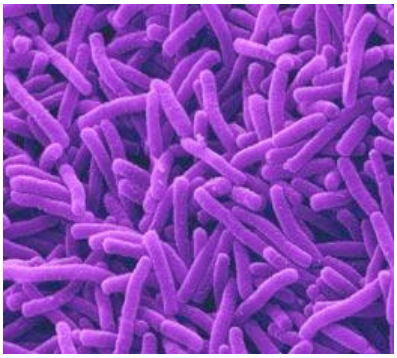
News

Cheating bacteria could treat infections

Freeloaders could help their hosts by undermining microbe cooperation.

Asher Mullard

Infections could be treated by adding more bacteria, say researchers who have shown that cooperation between microbes is undermined outside the bounds of the Petri dish by a few 'cheats'.



Bacterial 'cheats' take advantage of cooperating bacteria.

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Similar to colonies of social creatures such as ants, bacteria can rely on a simple solution to the difficulties of surviving in harsh environments — cooperation. Populations of bacteria can communicate with one another to coordinate their feeding and swarming activity, and sometimes even sacrifice themselves for the greater good. Although cooperators pay a cost, for instance in producing the molecules that enable communication, they thrive because they are stronger as a society than as individuals.

Speaking at a **meeting** hosted by the Royal Society in London, evolutionary biologist Stuart West from the University of Edinburgh, UK, has shown that cooperative behaviour can fall apart in animal infections because of an insidious, but inevitable, element in all societies — cheats.

Such freeloaders can quickly outnumber the cooperators by taking advantage of the hard work of these bacterial good samaritans, causing the cooperative society to crumble — thereby making infections less virulent, he explains. These findings, which suggest that infections could be treated by undermining bacterial social structures with subversive cheaters, are in press with the journal *Current Biology*.

Communication breakdown

Bacterial cooperation often involves a form of communication called quorum sensing. Bacteria release a quorum-sensing molecule that others can detect and use to coordinate their behaviour. Sneakily, some bacteria don't produce these molecules but can still detect their presence and gain the benefits of cooperation without paying any of the costs. Previous work[1] has shown that these cheaters consequently thrive, outnumbering the cooperators and undermining the social order. However, this conflict had previously only been shown in test tubes and Petri dishes, says West.

Now, West and his colleagues have infected mice with the disease-causing bacterium *Pseudomonas aeruginosa* to see if this conflict occurs in a more natural environment. They found that mice infected with cooperating, signal-producing bacteria died within a few days, but those that were infected with bacterial freeloaders had much lower mortality. Mice that were treated with a mixture of cooperators and cheaters, however, had the same high survival rates as those that had been infected with cheaters only.

Evolutionary conflict between these groups of bacteria stops "the harmful toxin-producing virulence of wild-type bacteria", says West. "We could theoretically decrease the virulence of some infections just by adding cheating bacteria into the host."

This approach could be even more powerful if the cheating microbes were engineered to be susceptible to antibiotics.

Natural accuracy

"It would be great if something came out of this," says evolutionary biologist David Queller from Rice University in Houston, Texas, who was also at the meeting. But Queller has his concerns: "The first thing that I think about is 'do you really want to add bacteria to a [sick patient]?'"

For researchers who want to understand the evolutionary history of the genes that drive cooperative behaviour, bacteria offer both promise and problems, says Queller. Bacteria can be grown easily in controlled conditions, allowing scientists to study the effects of just one gene, for example. But looking at them in their natural living conditions is difficult, he says.

"I think it's an important step to try to look at what these things are doing in their natural environment — in this case in mice," adds Queller.

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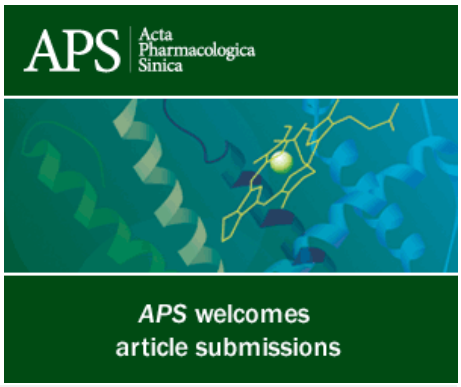

References

1. Diggle, S. P., Griffin, A. S., Campbell, G. S. & West, S. A. *Nature* **450,** 411–414 (2007). | **Article** | **ChemPort** |

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That the presence of 'cheaters' helps rest of the bacteria and the 'cheaters' to survive without getting killed along with the host means cheaters are really not cheaters but they are evolved to help the whole colony survive in the host! In that case, instead of calling them cheaters , they should be treated as helpers! Further, the suggestion that addition of antibiotic sensitve 'cheaters', does not make sense since their demise shoud cause more mortality of the host/patient! May be I got it all wrong. MC Arunan

Posted by: **Arunan MC** | 23 Jan, 2009

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