Why do some infections persist? Blame bacterial socialism, says new study

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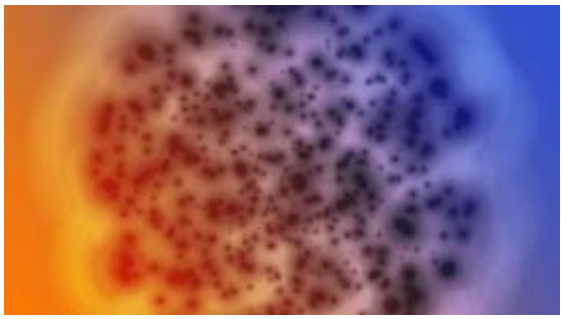

Bacteria

New research to be published January 13 in the journal *Scientific Reports* shows that some bacterial cultures adopt an all-for-one/one-for-all strategy that would make a socialist proud in preparing for the possibility of an antibiotic onslaught.

The findings could have application for how persistent infections like those associated with cystic fibrosis are treated.

The paper, by three researchers at the University of Vermont, uses a series of time-lapse videos to show that single cells within a community of bacteria randomly use a cascade of proteins to become more or less antibiotic resistant, even when the community is not threatened by an antibiotic. A bacterial colony can regenerate if only a few cells survive antibiotic treatment.

"It's costly from a metabolic standpoint for a cell to express the proteins that enable it to be resistant," said Mary Dunlop, assistant professor in the university's College of Engineering and Mathematics Sciences, and the paper's corresponding author. "This strategy allows a colony to hedge its bets by enabling individual cells within a population to assume high levels of resistance while others avoid this extra work."

Previous research has demonstrated that, when exposed to some antibiotics, all the cells within a bacterial population will use the protein cascade strategy, activated by a mechanism called MarA, to become resistant.

But the new study is among the first to show that colonies use the protein cascade strategy even when they are not under threat.

"This transient resistance, distributed in varying degrees among individual cells in a population, may be the norm for many bacterial populations," Dunlop said.

That may explain why infection persists in diseases like cystic fibrosis, she said. For these diseases, clinicians know not to use antibiotics that will stimulate population-level MarA resistance.

But the persistence of a few straggler antibiotic-resistant cells after treatment with the appropriate antibiotic could be enough to keep the infection alive.

The study suggests that altering the frequency and timing of antibiotic treatment could be a way of waiting out an infection as bacteria trade off antibiotic resistance among its members, enabling the drug to kill the entire culture.

Some antibiotic-resistant bacteria, such as MRSA, are resistant due to genetic changes such as mutations. Those studied by Dunlop are her colleagues alter their traits - protein expression, for instance - but not their genomes, making them significantly more difficult to identify since the resistance level of each bacterium changes over time.

More information: Imane El Meouche et al. Stochastic expression of a multiple antibiotic resistance activator confers transient resistance in single cells, *Scientific Reports* (2016). DOI:

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