Efficient crowd control in bacterial colonies

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Bacterial cells form colonies with complex organization (aka biofilms), particularly in response to hostile environmental conditions. Recent studies have shown that biofilm development occurs when bacterial cells seek out small cavities and populate them at high densities. However, bacteria in cavities may suffer from poor nutrient supply, waste removal, or disorganized expansion, leading to blockage of cell escape.

In a new study published online this week in the open-access journal PLoS Biology, HoJung Cho and colleagues at Johns Hopkins University combined experimental and computational approaches to investigate how bacterial cell colonies gradually self-organize in response to these environmental challenges.

The scientists used a microfluidic device to observe, with real-time microscopy at single-cell resolution, the growth and development of E. coli colonies in micro-chambers of different shapes and sizes through multiple generations. They found that there was a high degree of correlation between the directions of cell orientation and growth of collective cell movement.

They also found that this self-organization can significantly facilitate efficient escape of cells from the confines of cavities where they reside, while improving the access of nutrients into the colony interior. The authors also suggest that the shape of E. coli and other bacteria might be optimized to maximize self-organization while minimizing the potential for stampede-like exit blockage.

Source: Public Library of Science