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Swarming in the bacterium Pseudomonas aeruginosa

JOAO XAVIER, Memorial Sloan-Kettering Cancer Center

The fields of systems and synthetic biology have made great progress towards understanding and engineering biological systems while having the living cell as their central focus. However, many biological functions are multicellular and depend on interactions, both physical and chemical, between cells. We investigate organizing principles of multicellular systems using a prokaryotic model: swarming in Pseudomonas aeruginosa. Swarming is a collective form of surface motility that enables P. aeruginosa colonies to migrate over surfaces. We investigate the molecular mechanisms that confer robustness to swarming using a multidisciplinary approach that combines mathematical modeling, quantitative experiments, microbial genetics and comparative genomics to identify and characterize organizing principles of bacterial multicellularity. These "design principles" may inspire the development of robust synthetic multicellular systems that utilize emergent collective behaviors of cell populations to perform functions that individual cells cannot.