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Collective Motion in Bacterial Populations with Mixed Phenotypic Behaviors[1] KENTARO HOEGER, BEN STRICKLAND, DANIEL SHOUP, TRISTAN URSELL, Univ of Oregon — The motion of large, densely packed groups of organisms is often qualitatively distinct from the motion of individuals, yet hinges on individual properties and behaviors. Collective motion of bacteria depends strongly on the phenotypic behaviors of individual cells, the physical interactions between cells, and the geometry of their environment, often with multiple phenotypes coexisting in a population. Thus, to characterize how these selectively important interactions affect group traits, such as cell dispersal, spatial segregation of phenotypes, and material transport in groups, we use a library of *Bacillus subtilis* mutants that modulate chemotaxis, motility, and biofilm formation. By mixing phenotypes and observing bacterial behaviors and motion at single cell resolution, we probe collective motion as a function of phenotypic mixture and environmental geometry. Our work demonstrates that collective microbial motion exhibits a transition, from 'turbulence' to semiballistic burrowing, as phenotypic composition varies. This work illuminates the role that individual cell behaviors play in the emergence of collective motion, and may signal qualitatively distinct regimes of material transport in bacterial populations.

[1]University of Oregon

Kentaro Hoeger
Univ of Oregon

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