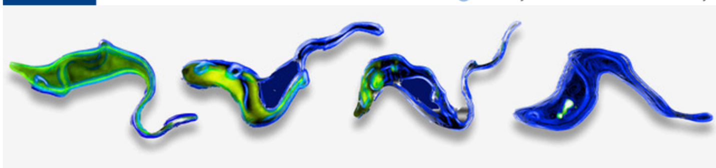

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Bacterial glass transition in Pseudomonas aeruginosa

Motile bacteria self-organize in numerous collective phases, such as orientationally ordered phase or swarming state. These collective phases result from properties and activities at the single cell scale, such as growth rate, swimming speed and cell-cell interactions. Understanding how individual properties can trigger emergence of long range order is a crucial aspect of biological and physical studies on bacteria, and can lead to better understanding of the mechanisms of colonies and biofilms formation. Here we study the properties of the 2D swarming state of an elongated motile bacteria, Pseudomonas aeruginosa, in growing colonies. We are able to obtain large and dense bacterial monolayers at the edge of 3D colonies expanding on agar gels. We perform the detection of bacterial trajectories from high-speed movies through the use of an innovative deep learning technique that compute segmentation and tracking altogether, taking advantage of temporal information. As density increases in bacterial monolayers, P. aeruginosa undergoes kinetic arrest, and collectively transitions from a liquidlike state to a glassy state. We show that this transition does not only affect the scales of the system's relaxation times, but also the very nature of the dynamics at play. We reproduce the analysis to several P. aeruginosa mutants of different shapes and single-cell motion properties, and show that all flagellated mutants exhibit a similar glass transition. The critical surface density to trigger the transition does not depend on single-cell motion properties, and seems to only depend on the aspect ratio of cells.

Primary author: MALIET, Martin (Sorbonne University)

Co-author: Dr DEFORET, Maxime (Sorbonne University)

Presenter: MALIET, Martin (Sorbonne University)