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Kinetic Description for Formation and Dissolution of Living Colonies CHRISTOPH WEBER, YEN TING LIN, Max Planck Institute for the Physics of Complex Systems, NICOLAS BIAIS, Brooklyn College and The Graduate Center, VASILY ZABURDAEV, Max Planck Institute for the Physics of Complex Systems, COLLECTIVE DYNAMICS OF CELLS TEAM, BIOLOGY DEPARTMENT COLLABORATION — Pathogen bacteria, such as N. gonorrhoeae or N. meningitidis form colonies due to encounters of nearby individuals while the effect of cell division is in general negligible. They use long and thin filaments, called pili, which attach to a substrate, retract and thereby pull the cell forward. Even though it is known that these bacteria interact by pili and adhesion, the question of how single cell motility and cell-cell interactions affect the process of colony formation is poorly understood. To bridge this gap we propose a kinetic description that keeps track of the length scales related to the underlying interactions between the cells and with the substrate. We derive the corresponding hydrodynamic equation and find an ordering instability leading to the formation of colonies. However, colonies can also dissolve which is a key survival mechanism in rapidly deteriorating environmental conditions. Recent experimental studies indicate that colonies can dissolve by switching off either the adhesive or pili-mediated interaction. Remarkably, within the same framework we can show that dissolution is possible, however, there is a region in parameter space where it is precluded. Both scenarios can be explained in terms of the underlying microscopic interactions.

Chris Weber
Max Planck Institute for the Physics of Complex Systems

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