
Spreading strategies and morphology of bacterial colonies: interplay between passive physico-chemical effects and bioactive growth

Sarah Trinschek¹, Karin John^{*2}, Sigolène Lecuyer³, and Uwe Thiele¹

¹Westfälische Wilhelms-Universität Münster – Germany

²Laboratoire Interdisciplinaire de Physique Grenoble – CNRS : UMR5588, Université Grenoble Alpes – France

³Laboratoire de Physique de IÉNS Lyon – Centre National de la Recherche Scientifique : UMR5672 – France

Abstract

The spreading of bacterial colonies at solid–air interfaces is determined by the physico-chemical properties of the involved interfaces and bioactive growth processes. The production of surfactant molecules by bacteria is a widespread strategy that allows the colony to efficiently expand over the substrate. On the one hand, surfactant molecules lower the surface tension of the colony, effectively increasing the wettability of the substrate, which facilitates spreading. On the other hand, gradients in the surface concentration of surfactant molecules result in Marangoni flows that drive spreading. These flows may cause an instability of the circular colony shape and the subsequent formation of fingers. In this work, we study the effect of bacterial surfactant production and substrate wettability on colony growth and shape within the framework of a hydrodynamic thin film model. We show that variations in the wettability and surfactant production are sufficient to reproduce four different types of colony growth, which have been described in the literature, namely, arrested and continuous spreading of circular colonies, slightly modulated front lines and the formation of pronounced fingers.

*Speaker