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Pattern formation in a growing bacterial colony facilitated by extra-cellular polymeric substances PUSHPITA GHOSH, Center for Theoretical Biological Physics, Rice University, Texas, 77005, USA, JAGANNATH MONDAL, Department of Chemistry, Columbia University, New York 10027, USA , ESHEL BEN-JACOB, HERBERT LEVINE, Center for Theoretical Biological Physics, Rice University, Texas, 77005, USA — Self-organization in bacterial colony is quite pervasive and diverse phenomena. Bacteria are known to self-organize into multicellular communities, commonly known as biofilms, in which microbial cells live in close association with a solid surface and are embedded in a self-produced extracellular polymeric substances(EPS). In such dense systems mechanical interactions among the structural components can be expected to significantly contribute to the morphological properties. By a simple particle-based simulation model of nonmotile rod-shaped bacterial cells and EPS secreted in a growing colony, we investigate how the combined mechanical effects can give rise naturally spatial heterogeneity observed in a biofilm. In our individual-based simulation model all the components interact mechanically via repulsive forces by pushing each other away as bacterial cells grow and divide consuming diffusing nutrient and produce EPS. We show that mechanical interactions control the collective behavior of the system, particularly, we show that the presence of non-adsorbing EPS leads spontaneous aggregation of bacterial cells by depletion attraction and generates phase separated patterns in a nonequilibrium growing colony.

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