Elongated particle aggregates structures due to the competition between lengthening and diffusion

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A 3D model for the development of bacterial colonies has been studied by computer simulation. Two principal ingredients lead the evolution of the system. First, the bacteria are modeled as prolate spherocylinders. These particles undergo polar lengthening and division when they reach a critical elongation. Besides this, the particles diffuse by means of Brownian motion. With these ingredients, the number of individuals increases over time. Simulation results show that the shape and structure of the aggregates in the simulation, which mimic a 3D bacterial biofilm softly attached to a hard wall, depends on the competion between the growth rate and Brownian diffusion of the particles. Observables regarding shape, correlation between particles and permeability have been computed to characterize the system.