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A Computational Study of Phenotype Switching in Bacillus Subtilis Biofilm HOWARD SMITH, Georgia State Univ, XIAOLING WANG, Harvard University, YI JIANG, Georgia State Univ — Bacillus Subtilis (B. Subtilis), is known to differentiate into three main phenotypes during biofilm growth. Novel techniques to track the spatial and temporal evolution of the three main phenotypes exhibited by B. Subtilis have been developed. However, the techniques do not explain the environmental causes of the phenotype switching and how this leads to the spatiotemporal organization of the biofilm. We hypothesize that cells switch their phenotype according to nutrients and autoinducer levels. We test the hypothesis using a hybrid agent-based and continuous model. The bacteria in our model are individual cells that can (i) grow and divide by the intake of nutrients, (ii) produce and secrete EPS, (iii) form spores and (iv) produce an auto inducer. Using a threshold for nutrient and thresholds for autoinducers, we were able to reproduce the experimental spatiotemporal dynamics. From our simulations we observed that in order to reproduce experimental results, two different autoinducers were necessary. The results also suggest that low-EPS producing biofilms generally obtained higher cell populations. Furthermore, most of the cells that become spore forming cells arise from matrix producing cells.

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