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Synthetic Quorum Sensing and Induced Aggregation in Model Microcapsule Colonies with Repressilator Feedback HENRY SHUM, VICTOR YASHIN, ANNA BALAZS, University of Pittsburgh — We model a system of synthetic microcapsules that communicate chemically by releasing nanoparticles or signaling molecules. These signaling species bind to receptors on the shells of capsules and modulate the target shells permeability, thereby controlling nanoparticle release from the target capsule. Using the repressilator regulatory network motif, whereby three species suppress the production of the next in a cyclic fashion, we show that large amplitude oscillations in nanoparticle release can emerge when many capsules are close together. This exemplifies quorum sensing, which is the ability of cells to gauge their population density and collectively initiate a new behavior once a critical density is reached. We present a physically realizable model in which the oscillations exhibited in crowded populations induce aggregation of the microcapsules, mimicking complex biological behavior of the slime mold *Dictyostelium discoideum* with only simple, synthetic components. We also show that the clusters can be dispersed and reformed repeatedly and controllably by addition of chemical stimuli, demonstrating possible applications in creating reconfigurable or programmable materials.

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