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Phase separation like dynamics during *Myxococcus xanthus* fruiting body formation GUANNAN LIU, SHASHI THUTUPALLI, MANON WIGBERS, JOSHUA SHAEVITZ, Princeton Univ — Collective motion exists in many living organisms as an advantageous strategy to help the entire group with predation, forage, and survival. However, the principles of self-organization underlying such collective motions remain unclear. During various developmental stages of the soil-dwelling bacterium, *Myxococcus xanthus*, different types of collective motions are observed. In particular, when starved, *M. xanthus* cells eventually aggregate together to form 3-dimensional structures (fruiting bodies), inside which cells sporulate in response to the stress. We study the fruiting body formation process as an out of equilibrium phase separation process. As local cell density increases, the dynamics of the aggregation *M. xanthus* cells switch from a spatio-temporally random process, resembling nucleation and growth, to an emergent pattern formation process similar to a spinodal decomposition. By employing high-resolution microscopy and a video analysis system, we are able to track the motion of single cells within motile collective groups, while separately tuning local cell density, cell velocity and reversal frequency, probing the multi-dimensional phase space of *M. xanthus* development.

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