Seminario Especial

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Dynamically induced spatial segregation in multispecies bacterial bioconvection

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Active matter, from motile bacteria to animals, can exhibit striking collective and coherent behavior. Despite significant advances in understanding the behavior of homogeneous systems, little is known about the self-organization and dynamics of heterogeneous active matter, such as complex and diverse bacterial communities. Under oxygen gradients, many bacterial species swim towards air-liquid interfaces in auto-organized, directional bioconvective flows, whose spatial scales exceed the cell size by orders of magnitude. Here we show that multispecies bacterial suspensions undergoing oxytactic-driven bioconvection exhibit dynamically driven spatial segregation, despite the enhanced mixing of bioconvective flows, and the fact that these species coexist in their natural habitat. Segregation is observed as patterns of spatially interlocked domains, with local dominance of one of the constituent species in the suspension. Our findings suggest that segregation mechanisms are driven by species-specific motile behaviors under conditions of hydrodynamic flow, rather than biochemical repulsion. Thus, species with different motile char[1]acteristics in the same ecological context can enhance their access to limiting resources. This work provides novel insights on the role of heterogeneity in active matter, as well as on the dynamics of complex microbial communities, their spatial organization and their collective behavior.