Behaviors of Motile Bacteria at Interfaces of Lyotropic Liquid Crystals

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Bacteria often inhabit and exhibit distinct dynamical behaviors at interfaces, but the physical mechanisms by which interfaces cue bacteria are still poorly understood. This presentation will describe the use of interfaces formed between coexisting isotropic and liquid crystal (LC) phases to provide insight into how mechanical anisotropy and geometry-induced defects in LC ordering influence fundamental bacterial behaviors. Specifically, we measure motile, rod-shaped \textit{Proteus mirabilis} cells (3 µm in length) to adsorb to interfaces of nematic domains (tactoids), orient under the influence of the nematic elasticity, and then escape via nematic director-guided motion through one of the two boojums (surface topological defects) of the tactoids. For isotropic domains in a continuous nematic phase, escape from the interface occurs through a cooperative, multi-cellular phenomenon that is also mediated by defects. We show that the combined effects of nematic elasticity and topological defects can be thermally tuned to corral and release bacteria from isotropic domains. Overall, the research to be presented in this talk reveals that anisotropic interfacial environments defined by LCs profoundly change dynamical behaviors of motile bacteria.

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