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Swimming bacteria in liquid crystal[1] ANDREY SOKOLOV, Argonne National Laboratory, SHUANG ZHOU, Kent State University, IGOR ARANSON, Argonne National Laboratory, OLEG LAVRENTOVICH, Kent State University — Dynamics of swimming bacteria can be very complex due to the interaction between the bacteria and the fluid, especially when the suspending fluid is non-Newtonian. Placement of swimming bacteria in lyotropic liquid crystal produces a new class of active materials by combining features of two seemingly incompatible constituents: self-propelled live bacteria and ordered liquid crystals. Here we present fundamentally new phenomena caused by the coupling between direction of bacterial swimming, bacteria-triggered flows and director orientations. Locomotion of bacteria may locally reduce the degree of order in liquid crystal or even trigger nematic-isotropic phase transition. Microscopic flows generated by bacterial flagella disturb director orientation. Emerged birefringence patterns allow direct optical observation and quantitative characterization of flagella dynamics. At high concentration of bacteria we observed the emergence of self-organized periodic texture caused by bacteria swimming. Our work sheds new light on self-organization in hybrid bio-mechanical systems and can lead to valuable biomedical applications.

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Andrey Sokolov
Argonne National Laboratory

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