OLEG LAVRENTOVICH, Liquid Crystal Institute, Kent State University
"Singularities and Flows in Living Liquid Crystals"

Coupling of activity and orientational order is a quintessential feature of many dynamic out-of-equilibrium systems. We discuss an experimental system, the so-called living liquid crystal, in which the activity and orientational order can be controlled independently of each other. The system represents a dispersion of swimming bacteria (B. Subtilis) in a lyotropic chromonic liquid crystal [1]. The activity of bacteria causes a cascade of orientational instabilities leading to turbulence with nucleating singularities of the director field. In its turn, nematic ordering imposes limitations on the dynamical behavior of the bacteria and their spatial distribution, by concentrating the bacteria around the cores with positive topological charge and depleting the neighborhoods of negative topological charge. Mixed splay-bend director deformations force unidirectional threshold-less flow of bacteria [2]. The work is supported by NSF DMS-1434185, NSF DMR-1507637 and by the Petroleum Research grant PRF 56046-ND7 administered by the American Chemical Society.

1 Zhou, S., Sokolov, A., Lavrentovich, O. D. and Aranson, I. S. Living liquid crystals. P Natl Acad Sci USA 111, 1265-1270, doi:10.1073/pnas.1321926111 (2014). 2 Peng, C., Turiv, T., Guo, Y., Wei, Q.-H. and Lavrentovich, O. D. Command of active matter by topological defects and patterns. Science 354, 882-885, doi:10.1126/science.aah6936 (2016).