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Swimming dynamics of flagellated bacteria in liquid crystal[1]

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A flagellated bacterium swimming in water generates a flow with a typical scale of its body length. Anisotropy of the surrounding liquid significantly affects the swimming dynamics of bacteria and modifies the flow pattern created by a single bacterium. Using the particle tracking technique and flow reconstruction method we investigated the structure of the flow generated by bacteria and pairwise interactions between bacteria in liquid crystals. We demonstrated that while the rotation rate of bacterial flagella is reduced by an order of magnitude due to increased viscosity, the bacteria swimming speed is slowed only by 25-30%. Due to the strong anisotropy of viscosity in liquid crystal the bacteria-induced flow is localized along a bacterial body: the flow along a line coaxial with the bacterial body is much stronger than in perpendicular direction and decays rather slowly. We found that interaction between flagella bundles of two close-by bacteria is negligible and the observed convergence of the swimming speeds and flagella waves may occur due to viscoelastic interaction between bacterial bodies.

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