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The Dispersal of Swimming Microalgae in Viscosity Gradients
MICHAEL R. STEHNACH, NICOLAS WAISBORD, JEFFREY S. GUASTO, Tufts University — Swimming cells often live in fluid environments characterized by spatial gradients of rheological properties, including biofilms and mucus layers. However, our understanding of cell transport in such environments is lacking. In this work, we use microfluidic devices to generate a spatial concentration gradient of a Newtonian polymer suspension – thus creating a viscosity gradient. Video microscopy is used to quantify the viscosity landscape and the cell motility. We demonstrate experimentally that swimming biflagellates (wild-type *Chlamydomonas reinhardtii*) accumulate in high viscosity regions (viscotactic response), stemming from a local reduction in cell swimming speed. A statistical analysis of the cell motility reveals that the viscous slowdown of the microalgae is due to their approximately constant flagellar thrust force in different ambient viscosities. We further demonstrate that this local viscous slowing of cell motility, leading to accumulation, is generalized in highly nonlinear viscosity gradients.

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