Abstract Submitted
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Hydrodynamic shear dissipation and transmission in lipid bilayers[1] GUILLERMO AMADOR, Wageningen University Research, DENNIS VAN DIJK, ROLAND KIEFFER, MARIE-EVE AUBIN-TAM, DANIEL TAM, Delft University of Technology — Vital biological processes, such as trafficking, sensing, and motility, are facilitated by cellular lipid membranes and often involve mechanical interactions, especially with the surrounding fluid. Such lipid membranes are comprised of a nanometer-thick, liquid crystalline structure known as the lipid bilayer. In this study, we use optical tweezers to both apply and measure local forces on free-standing lipid bilayers within microfluidic channels. This technique is the first to combine multiple optical tweezers probes with planar free-standing lipid bilayers accessible on both sides. We quantify fluid slip close to the bilayer surface and transmission of shear forces across the structure. Through numerical simulations of the hydrodynamics, we determine monolayer viscosity and intermonolayer friction, and find these properties are highly dependent on lipid composition. Our study sheds light on the physical principles governing the transfer of shear forces by and through lipid membranes, which underpin cell behavior and homeostasis.

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