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Rupture and Spreading Dynamics of Lipid Membranes on a Solid Surface ANTONIO PERAZZO, Department of Mechanical and Aerospace Engineering, Princeton University, SANGWOO SHIN, Department of Mechanical Engineering, University of Hawaii at Manoa, CARLOS COLOSQUI, Department of Mechanical Engineering, Stony Brook University, YUAN-NAN YOUNG, Department of Mathematical Sciences, New Jersey Institute of Technology, HOWARD A. STONE, Department of Mechanical and Aerospace Engineering, Princeton University — The spreading of lipid membranes on solid surfaces is a dynamic phenomenon relevant to drug delivery, endocytosis, biofouling, and the synthesis of supported lipid bilayers. Current technological developments are limited by an incomplete understanding of the spreading and adhesion dynamics of a lipid bilayer under different physicochemical conditions. Here, we present recent experimental and theoretical results for the spreading of giant unilamellar vesicles (GUVs), where the vesicle shell consists of a lipid bilayer. In particular, we study the effect of different background ion concentrations, osmolarity mismatches between the interior and the exterior of the vesicles, and different surface chemistries of the glass substrate. In all of the studied cases, we observe a delay time before a GUV in contact with the solid surface eventually ruptures. The rupture kinetics and subsequent spreading dynamics is controlled by the ionic screening within the thin film of liquid between the vesicle and the surface. Different rupture mechanisms, mobilities of the spreading vesicle, and degrees of substrate coverage are observed by varying the electrolyte concentration, solid surface charge, and osmolarity mismatch.

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