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Inducing morphological changes in lipid bilayer membranes with microfabricated substrates FANGJIE LIU, LIAM F. COLLINS, RANA ASHKAR, FREDERICK A. HEBERLE, BERNADETA R. SRIJANTO, C. PATRICK COLLIER, Oak Ridge National Laboratory — Lateral organization of lipids and proteins into distinct domains and anchoring to a cytoskeleton are two important strategies employed by biological membranes to carry out many cellular functions. However, these interactions are difficult to emulate with model systems. Here we use the physical architecture of substrates consisting of arrays of micropillars to systematically control the behavior of supported lipid bilayers – an important step in engineering model lipid membrane systems with well-defined functionalities. Competition between attractive interactions of supported lipid bilayers with the underlying substrate versus the energy cost associated with membrane bending at pillar edges can be systematically investigated as functions of pillar height and pitch, chemical functionalization of the microstructured substrate, and the type of unilamellar vesicles used for assembling the supported bilayer. Confocal fluorescent imaging and AFM measurements highlight correlations that exist between topological and mechanical properties of lipid bilayers and lateral lipid mobility in these confined environments. This study provides a baseline for future investigations into lipid domain reorganization on structured solid surfaces and scaffolds for cell growth.

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