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Rapid Formation of Supported Lipid Bilayers on Unfavorable Surfaces under AC-Electric Fields BENXIN JING, Y. ELAINE ZHU — Lipid vesicles and supported bilayers have been studied as model systems to understand the structures, transport and biological function of cell membranes. In this work, we investigate the AC-electric field induced instability and supported bilayer formation of lipid vesicles on unfavorable solid surfaces by fluorescence microscopy. We have designed a microchannel fluid cell with embedded asymmetric electrode surfaces to apply non-uniform AC-electric fields across lipid vesicle thin films and control the formation of supported lipid bilayers of mixed egg PC/1,2-dioleoyl-3-trimethylammonium-propane(DOTAP) on solid substrates. In the absence of applied AC-fields, we observe no formation of supported lipid bilayers of egg PC/DOTAP on a quartz surface coated with a monolayer of 11-Mercaptoundecanoic acid. In contrast, we observe the rapid spreading of egg PC/DOTAP lipids from the edge of the gold electrode to the thiol-treated quartz surface to form lipid bilayers of varied morphology under applied AC-fields of varied frequency from 1-100 kHz. A strong dependence of AC-field frequency and strength on the lipid spreading velocity and resulting morphology of lipid bilayers is quantified. The mechanism involving AC- induced counterion redistribution and lipid segregation is also experimentally explored.

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