

PATTERNING OF LIPID MEMBRANES BY SELF-ORGANIZATION OR MICROCONTACT PRINTING OF LIPOPOLYMERS

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INTRODUCTION: Recently, the patterning of lipid membranes gained interest, as the mimic of different, separate addressable cell membranes on a single substrate would lead to novel integrated bio-devices [1-3].

Different approaches have been presented to form patterns on a solid substrate, which all suffer from the fact of their complex preparation. Within this study we compare two simple methods, patterning on a LB-trough and microcontact printing (μ CP). Investigations of the phase separation of a lipid mixture on a LB-trough showed a pattern formation [4]. Furthermore a regular pattern could be prepared using microcontact printing on solid substrates [5]. However, to stabilize such a pattern in a lipid membrane, further efforts like the polymerization of lipids on a trough, or the stabilization of microcontact printed areas on a substrate have to be made.

METHODS: On a LB-trough a mixture of stearic acid and amphiphilic monomer **1**, together with a dye is spread on a water subphase. The phase separation is visualized using a fluorescence microscope. Polymerization of the monomer **1** is carried out by illumination with a UV-lamp for 10 minutes. μ CP of the lipopolymer **P2** [6] has been performed using a water/THF solution. The carefully loaded stamp has been transferred onto a gold substrate. Dewetting has been performed by dip-coating the substrate into a polystyrene solution. Drying of the substrate resulted in a patterned substrate.

RESULTS: The fluorescence image in figure 2, left, shows the phase separation in stearic acid enriched crystal analogous domains (dark) and a monomer **1** enriched area (bright). UV-polymerization of monomer **1** results in a highly decreased fluidity of the monolayer, which results in a stabilization of the pattern formed. Thereby, a patterned lipid monolayer with long term stability is created.

Microcontact printing of **P2** resulted in a pattern on a solid substrate. This pattern could be stabilized by controlled dewetting of polystyrene, as it is shown in figure 2 on the right side. Afterwards, the dewetted

areas can be filled with a lipid bilayer by a vesicle fusion process.

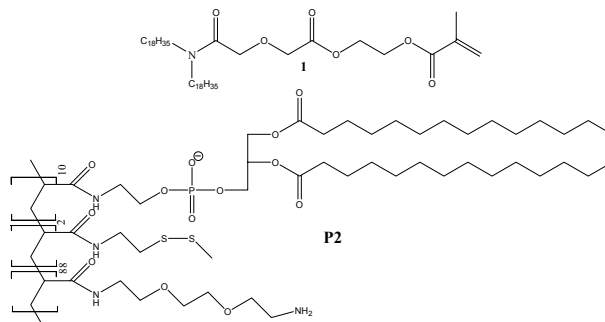


Fig. 1: Structures of used compounds.

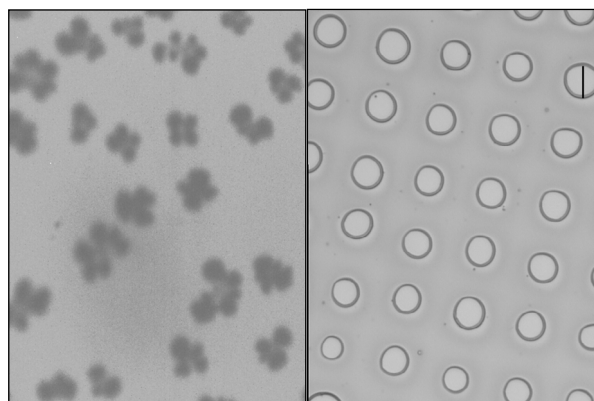


Fig. 2: Left: Fluorescence image of a mixture of monomer **1** and stearic acid (3:2) at $\pi=15\text{mN/m}$. Right: PS dewetted pattern of lipopolymer **P2**.

CONCLUSIONS: We could present two different ways to pattern lipid membranes. In each case the fluid lipid layer was surrounded by a polymer. Thereby, a regular array of lipid membranes was assembled.

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