

# MICROPATTERNING OF LIPID BILAYERS AND ITS APPLICATION TO THE BASIC STUDIES OF INTERFACIAL AGGREGATION PHENOMENA

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Solid-supported lipid bilayers have been studied as a simple model of the biological membrane (1). The supported planar bilayer membranes are fluid and can also incorporate membrane proteins, providing possibilities to prepare biosensors based on electrical and optical detection. Patterning of lipid bilayers on the solid surface has attracted considerable interest in recent years (2). It should enable spatially controlled integration of biological components into the artificial membrane system.

In this contribution we present a novel approach for creating patterned lipid bilayers on solid supports. The patterning makes use of lithographic polymerisation of a diacetylene-based phosphatidylcholine (**1**) that polymerises with its neighboring lipids photochemically (Fig. 1).

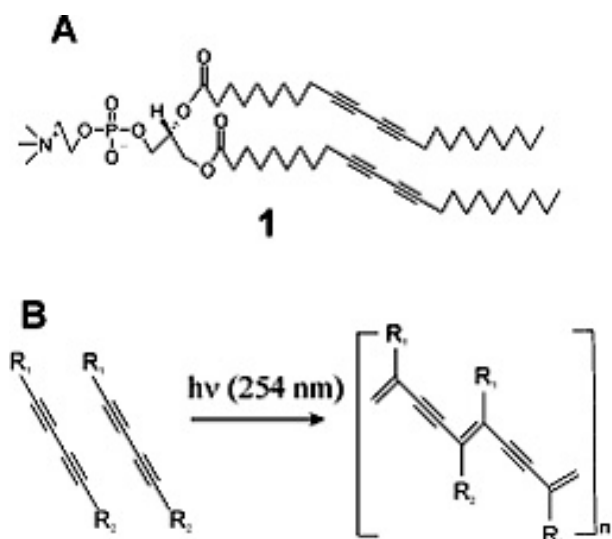


Fig. 1 The chemical structure of the diacetylene phospholipid **1** and its polymerisation scheme.

The formation of a highly conjugated polymer backbone induces strong absorption and fluorescence in UV/ VIS range and we observe the polymerised bilayers by the fluorescence microscope (Fig. 2). Two-dimensional (2D) polymeric network makes the irradiated bilayer insoluble in organic solvents. By removing the monomeric lipids with an organic solvent, one can create a 2D master structure for the incorporation of biologically relevant lipid bilayer membranes. We have fused small unilamellar vesicles of egg yolk phosphatidylcholine doped with 1 % of the

fluorescent lipid, *N*-(7-nitrobenz-2-oxa-1,3-diazol-4-yl)-1,2-dihexadecanoyl-*sn*-glycero-3-phosphoethanolamine (NBD-PE). The newly incorporated bilayers retain their fluidity, whereas the polymerised lipid bilayer functions as an effective barrier for the lateral diffusion of lipids (3).

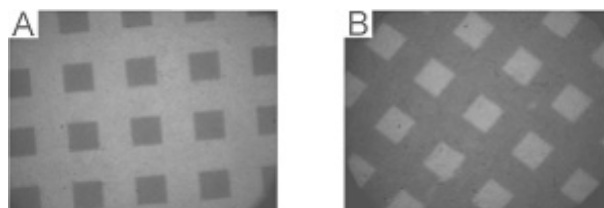


Fig. 2 Fluorescence micrograph of polymerised bilayers. (A) Polymerised bilayer domains are brightly fluorescent because of the conjugated backbone. The dark squares are monomeric bilayers. (B) After removal of the monomeric bilayers, new lipid bilayers were incorporated into the corrals. The corrals are more brightly fluorescent due to the fluorescence marker (NBD-PE).

The micropatterned lipid bilayer membranes should provide new avenues to create complex and mechanically robust biomimetic interfaces. Furthermore, polymerised bilayers could be potentially useful for the basic studies of interfacial amphiphile aggregation phenomena by confining the materials within a defined area. We are currently investigating aggregation behaviours of lipids and surfactants on micropatterned and non-patterned surfaces.

## References:

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