Bilayers at the ILL

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A model of tethered lipid bilayers using anchor-harpoon surfactants on designed electrodes

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Sparsely tethered bilayer membranes (stBLM) provide a particularly advantageous platform to study membrane proteins' functions, ion transport, pores, and therefore to understand fundamental mechanisms, thanks to their stability and amenability of characterization by a wide range of surface-sensitive techniques[1]. As biosensors, they also provide an outreach to diverse biotechnological applications including the development of supported olfactive sensors, of novel antibacterial treatments to reduce drug resistance[2], of organ-on-chips to mimic human in vitro functions[3]. However, maintaining the membrane hydrated, fluidic and close to the substrate without cumbersome chemistry to synthesize and link the "anchor-harpoon"molecules to the substrate[4] can be a challenge. Here, we develop a new experimental approach where a single model phospholipid bilayer is kept fluid and partially tethered to a flat electrode. We proposed an original anchoring surface functionalization that is highly reactive to –OH terminated molecules[5]. In this way we avoid complex organic chemistry and graft commercial Brij non-ionic surfactants chosen for: i) their appropriate hydrophilic chain length that forms an aqueous cushion for the membrane; ii) their hydrophobic alkyl block that anchors the lipid bilayers by insertion in their core. In this way, we keep the membrane fluidity in full immersion and presence of salts. This method appears to be a simple and cheap way to prepare tethered membranes with tunable anchoring densities on various supporting materials[6]. Electrochemical Impedance Spectroscopy (EIS) has shown that stBLM tethered to Brij58 molecules diluted in PEO9 are well adapted to probe biomimetic or biological membranes under electric fields and the dynamics of surrounding molecules and ions[7]. Using transparent electrodes offers the possibility to simultaneously check the membrane fluidity and lipids dynamics from fluorescence techniques. Functionalized doped silicium enables structural investigations of the stBLM using neutron to shade some light on the role played by the hybrid cushion[8].

1.Florin, E.-L., et al., Painted supported lipid membranes. Biophysical journal 1993, 64 (2), 375-383. / 2.Clausell, A., et al., Gram-negative outer and inner membrane models: insertion of cyclic cationic lipopeptides. The journal of physical chemistry B 2007, 111 (3), 551-563. / 3.Kim, J., et al., Investigations of Water Structure at the Solid/Liquid Interface in the Presence of Supported Lipid Bilayers by Vibrational Sum Frequency Spectroscopy. Langmuir 2001, 17 (23), 7255-7260. / 4.McGillivray, D. J., et al., Molecular-scale structural and functional characterization of sparsely tethered bilayer lipid membranes. Biointerphases 2007, 2 (1), 21-33. / 5.Squillace, O., et al., Grafting Commercial Surfactants (Brij, CiEj) and PEG to Electrodes via Aryldiazonium Salts. ACS applied materials & interfaces 2017, 9 (48), 42313-42326. / 6.Squillace, O., et al., Electrodes for membrane surface science. Bilayer lipid membranes tethered by commercial surfactants on electrochemical sensors. ACS Sensors 2019, 2379-3674. ASAP. / 7.Andersson, J., et al., Synthesis and Characterization of Novel Anchorlipids for Tethered Bilayer Lipid Membranes. Langmuir 2017, 33 (18), 4444- 4451. / 8.Fragneto-Cusani, G., Neutron reflectivity at the solid/liquid interface: examples of applications in biophysics. Journal of Physics: Condensed Matter 2001, 13 (21), 0953-8984.

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