ESRF	**Experiment title:** Quantitative Control of Membrane-Substrate Interactions by Well Defined Linear Polymer Tethers	**Experiment number**: SI-1600
Beamline: ID10B	**Date of experiment**: from: 30.08.2007 to: 05.09.2007	**Date of report**: 01.03.2008
Shifts: 18	**Local contact(s)**: Dr. Amarjeet SINGH	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

F. Rossetti* (Univ. Heidelberg)

T. Kaindl* (Univ. Heidelberg)

E. Schneck* (Univ. Heidelberg)

M. Tanaka (Univ. Heidelberg)

Report:

During the allocated beamtime at ID10B we were able to clearly observe the formation of lipid membranes on polymer supports (Figure 1). Prior to the beamtime, we carried out neutron reflectivity experiments at ILL (D17). Although we observed a distinct change in the reflectivity before and after the membrane deposition, the limitations of this technique (in particular the limited range of momentum transfer) did not allow us to investigate these systems in sufficient details. Through the use of synchrotron radiation we were able to get quantitative data in the region 0.2 Å^{-1} $< q_z <$ 0.5 Å^{-1}, which corresponds to the range of interest for the study of artificial and native lipid membranes (Figure 1).

We deposited artificial model membranes (zwitterionic SOPC) on hydrated cellulose films with different thicknesses. Before the membrane deposition, we characterized the polymer supports (cellulose films) in the dry state as well as in water. In Figure 1 a and b, we present the results from two types of films: (a) a film with a dry thickness of 4.5 nm (10 monolayers of cellulose deposited by the Langmuir-Blodgett technique), and (b) a thinner film with a dry thickness of 3 nm (6 monolayers). In water, both films were hydrated, showing almost an identical swelling factor (the thickness ratio between the swollen and the dry film) of two, i.e. the thicker film is swollen up to 9 nm, and the thin one to 6 nm, respectively (black squares).

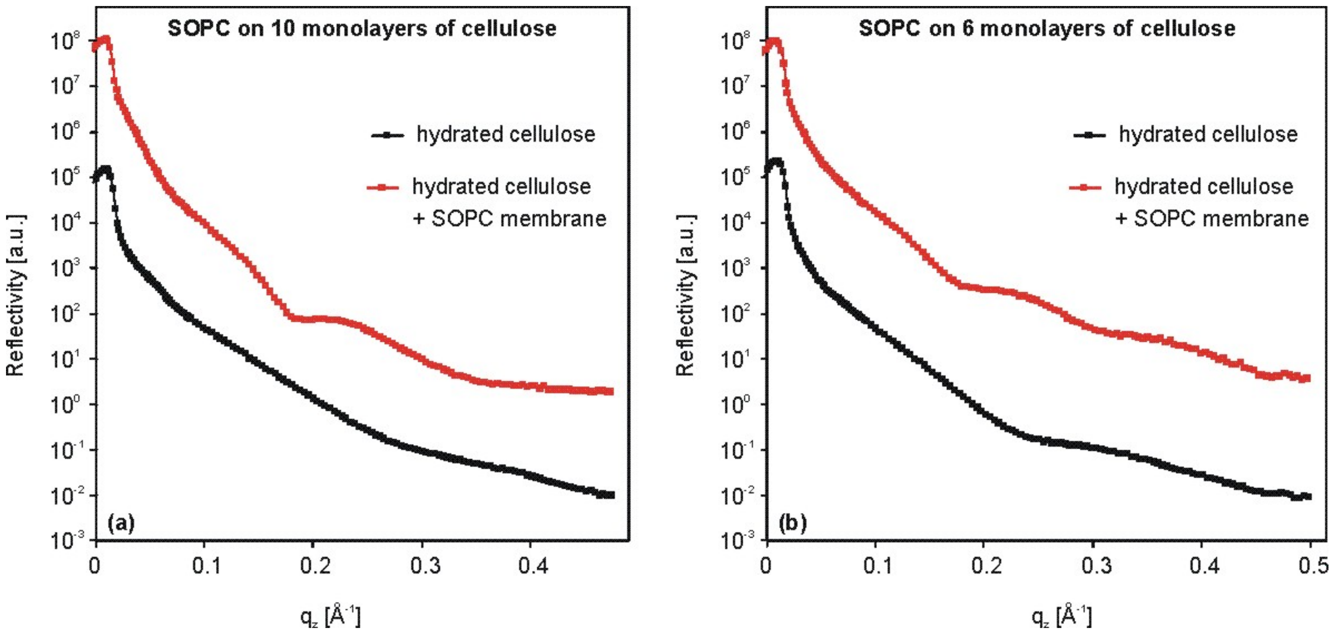

Fig. 1: Reflectivity curves of cellulose films before (black squares) and after (red squares) deposition of lipid membranes, measured in water. The swollen polymer film has a thickness of: (a) 9.0 nm, (b) 6.0 nm.

The deposition of a SOPC membrane resulted in a clear change in the global shape of the reflectivity curves for both thick and thin cellulose supports (red squares, Figure 1): The observed changes coincide with the formation of homogeneous polymer-supported lipid membranes over a macroscopically large area (cm^2 order).

At the end of the beamtime we carried out the first test experiment with a synthetic transmembrane lipid membrane deposited by vesicle fusion onto a silicon substrate in bulk water (Fig. 2). This system mimics membranes of extremophils (archaea). As shown in the figure, the structural characterisation of these exotic membranes seems well feasible by the chosen technique. This promising result encourages to perform systematic studies on transmembrane lipids in the future.

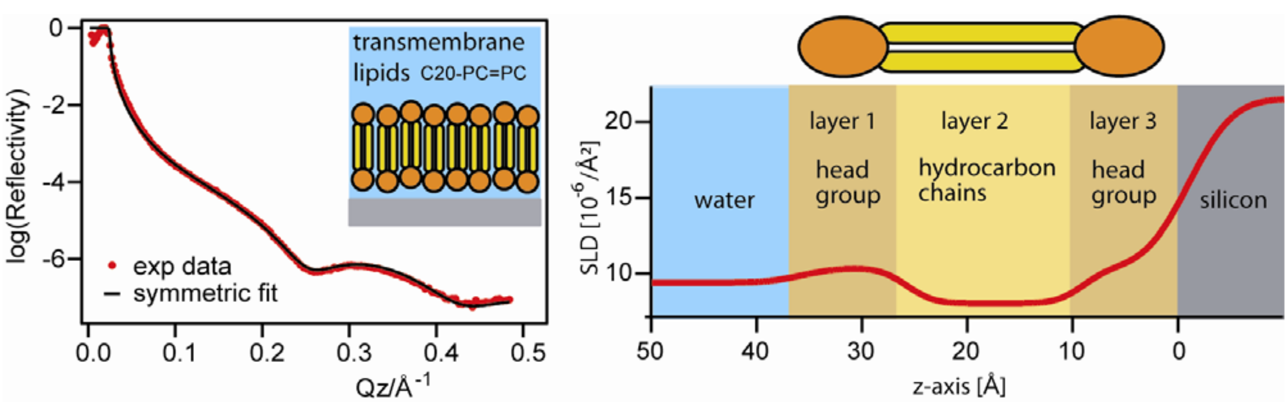

Fig. 2: Reflectivity curve of synthetic transmembrane lipid membrane deposited by vesicle fusion onto a silicon substrate in bulk water (left). Electron density profile according to slab model fitted to the experimental data (right).