Nanotuned biomimetic surfaces: lipid-protein monolayers, bilayer assemblies and living cells

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Biological function is very much dependent on the molecular orientation and the supramolecular organisation of the building blocks. Lipid membranes are well-known examples where the lateral organisation into domain structures determines its function to form selective barriers between cellular compartments and lining the cell body itself. Lipid monolayers spread at the air-water-interface are very often used as models for biological membranes although with respect to the original double layer structure they only represent one half of the membrane. However, lipid monolayers are very often the first step to assemble double layers on solid supports to be used in bioanalytics as receptive surfaces. Moreover surface functionalisation is important for cell cultures grown for example on electrodes again build up analytical devices.

The present lecture will scrutinize the following topics:

- Domain structures within lipid monolayers spread at the air-water-interface of a so called film-balance.
- A domain formation in physiologically relevant lipid-protein-monolayers called the alveolar surfactant. This monolayer reduces the surface tension within the lung to a constant low value enabling an energetically favourable breathing process and allowing compression and expansion without loss of surface material.
- Biosensor devices based on receptor containing supported lipid bilayers.
- Barrier forming endothelial cells grown on nanoporeous surfaces as a new high throughput screening system for drug transport to the brain.

A broad range of physical techniques starting from film-balance, video- enhanced epifluorescence microscopy, Scanning Force Microscopy (SFM), Time of Flight-Secondary Ion Mass Spectroscopy (TOF-SIMS) as well as impedance spectroscopy and quartz microbalance will be discussed.

References

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