Background

Acquired (or adaptative) immunity relies on the capacity of cells from the immune system to create an immunological memory after exposure to exogeneous antigens. This process is activated by the uptake of an antigen by a dedicated immune cell (Antigen presenting cell, APC) which will present the antigen on its surface via the major histocompatibility complex (MHC) class II. Antigen presentation is followed by the activation of T-lymphocytes through cell-cell contact involving the formation of a so-called immunological synapse between the membranes of APC and T-cells. (Figure left) [1]

Glass-supported planar lipid bilayers have been proposed as promising tools to study and model cell-cell interactions. In this approach a lipid bilayer is deposited onto a sensor support to mimic the surface of a target cell and to study it with surface sensitive techniques. [2] In our lab, we have recently proposed a new and simple method to produce lipid bilayers on glass surfaces that contain native membrane components from the cell of origin and retain transmembrane protein mobility.

Project goal

The aim of this project is to investigate formation of an immunological synapse using surface sensitive techniques and a sensor-supported native cell membrane. More specifically, we will deposit onto a glass substrate a supported lipid bilayer generated from membrane material extracted from APCs and will probe the attachment, recognition and stimulation of a relevant T-cell line. (Figure right)

Tasks & techniques

This project is based on an in vitro assay established by our collaborators at Sahlgrenska University Hospital. Stimulated and non-stimulated APCs will be lysed and the plasma
membrane components will be purified. Native-like supported lipid bilayers will be produced from the native membrane vesicles using a protocol recently developed in our lab [3]. Fluorescence (and in particular total internal fluorescence microscopy) will be used to characterize fluidity and quality of the deposited bilayer. Using relevant antibodies, you will also assess the presence, activity and mobility of the antigen-MHC complex and other relevant biomolecules within the bilayer. You will then follow in-situ the formation of the immune synapse in time-lapse fluorescence microscopy measurements. Depending on the duration of the project, T-cell activation by this platform will be further investigated and ascertained. 

Taken together these findings will make it possible to evaluate the suitability of the new platform as a bioanalytical tool to probe cell-cell interactions and to gain important insights into the processes underlying the immune response.

Project environment: The proposed project will be carried out at the division of Biological Physics (dep. of Applied Physics), in collaboration with the Institute of Biomedicine (Sahlgrenska University Hospital).

Project duration: The project is suitable for a 60 hp Master project but can also be shortened to 30 hp.

Qualifications: The applicant should preferably study biotechnology, biochemistry or biomedical engineering but other backgrounds will also be considered.

Starting Date: As soon as possible, to be discussed

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References