

Proposition de sujet de thèse – 2017

Titre : HS-bio-SMM : microwave spectroscopy platform for structural analysis of biosystem

Responsable : E. Lesniewska

Axe(s) scientifique(s) : 1

Equipe(s) de recherche : OSNC

Coresponsable(s): E. Bourillot

Context, positioning and objectives:

This project has been funded by ANR-15-IDEX-03 PIA2/iSite-BFC (Coordinator: E. Lesniewska).

The **HS-bio-SMM** project aims to develop the combination of high speed atomic force microscopy (**HS-AFM**) and scanning microwave microscopy (**SMM**) to extract the supramolecular organization by direct imaging of the structure dynamics and dynamic processes, and the electrical properties of biological specimens in physiological solutions.

In this project, we explore and extend the use of scanning microwave microscopy (SMM) in biological research, and thereby, we improve and then establish this new exciting HS-bio-SMM technology in collaboration with the Institute of Biophysics (Linz University, Austria).

Summary

The objective of **HS-bio-SMM** project is the implementation of scanning microwave microscopy (**SMM**) on high-speed atomic force microscopy (**HS-AFM**) to characterize the morphology and the electrical properties of biological membranes under physiological environment. We expect to answer relevant biological questions about the composition and charge organization of the biochemical components of model and native membranes, without labeling and with a spatial resolution inaccessible to other techniques. We have defined specific aims: (i) **implementation of SMM on tip-scan HS-AFM**, (ii) **application on model membranes**, (iii) **application on cells**. The long term goal of this project is to establish the combined HS-bio-SMM methodology for a systematic characterization of the organization and surface charge density of cell membranes. Our project aims to reveal the variation of electric properties of buccal cells after saliva interactions (coll. INRA Dijon).

Overall strategy:

The objective of this project is the implementation of scanning microwave microscopy (SMM) on tip-scan high-speed AFM (HS-AFM) and to promote the technology by the production of biologically important results worldwide. We expect to be able, using the HS-AFM-SMM, to contribute novel knowledge about dynamic processes and structure-function relationships of individual molecules. In this context, one clearly sees the growing expectation of:

- (i) Improvement of SMM in term of dynamics and resolution;
- (ii) Characterization of supramolecular organization and electrical properties in model or native membranes;
- (iii) Reveal the electric properties (conductivity and capacity) of epithelial cells and the variations at these properties in various physiological conditions.

Knowledges required: AFM, nanosciences, Matlab, Labview.

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