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Simultaneous AFM topography and recognition imaging at the plasma membrane of mammalian cells

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Abstract

Elucidation the nano-organization of membrane proteins at/within the plasma membrane is probably the most demanding and still challenging task in cell biology since requires experimental approaches with nanoscale resolution. During last decade, atomic force microscopy (AFM)-based simultaneous topography and recognition imaging (TREC) has become a powerful tool to quickly obtain local receptor nano-maps on complex heterogeneous biosurfaces such as cells and membranes. Here we emphasize the TREC technique and explain how to unravel the nano-landscape of mammalian cells. We describe the procedures for all steps of the experiment including tip functionalization with ligand molecules, sample preparation, and localization of key molecules on the cell surface. We also discuss the current limitations and future perspectives of this technique.

Keywords

plasma membrane; ligand-receptor interaction; recognition imaging; atomic force microscopy (AFM)

1. Introduction

The plasma membrane of mammalian cells represents a complex heterogeneous structure composed of a phospholipid bilayer with integrated membrane proteins (MPs), which play vital roles in various biochemical events taking place either on the cell surface or within membrane-bound organelles. MPs work as receptors, enzymes, channels, transporters, cell-cell adhesion molecules, etc. and thus participate in numerous essential cellular functions. Consequently, MPs becomes