Biomedical Applications of Atomic Force Microscopy

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Atomic Force Microscopy is now widely used to explore biological questions[1].
In this presentation, we will focus on 3 applications of AFM in life science and medicine. The first one is related to yeast cells. *C. albicans* is a human opportunistic pathogen responsible for benign to dreadful infections. Using AFM, we have explored its' adhesive properties and discovered the formation of adhesive nanodomains made of aggregated proteins[2] (see left panel of figure 1). We also tested the effect of caspofungin (a last chance drug against *C. albicans)* on the cells nanomechanical and adhesive properties[3].

In the second application, *Pseudomonas aeruginosa* cells were treated with 2 major antibiotics: ticarcillin (figure 1 center panel) and tobramycin. We have demonstrated that treated cells present an altered shape, roughness and elasticity[4]. Moreover, we took advantage of force spectroscopy to study the cell wall of a multi resistant strain, and we unravelled the mechanism of action of an innovative molecule: CX1, efficient against this multi resistant strain[5].

Finally, I will deal with exciting results obtained on living cardiomyocytes (CM). The cells were extracted from mice heart, adhered to laminin coated petri dish and kept alive during the AFM experiments using the perfusing cell from Brucker (figure 1 right panel). Combining AFM and electron microscopy, we have demonstrated a dramatic morphological modification of the CM after heart failure that is correlated with the modification of the nanomechanical properties of the cells[6]. We have also studied the role of the protein ephrin B1 in CM elasticity and shape[7].

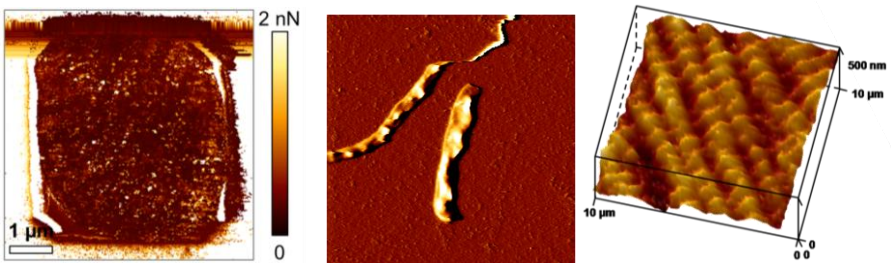

Figure 1: from left to right: AFM adhesion image obtained on *Candida albicans,* AFM deflection image of *Pseudomonas aeruginosa* treated by ticarcillin, AFM 3D image of a living cardiomyocyte.

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