Scanning probes for enzyme nanopatterning and for the spatial mapping of collagen micro-stiffness in tissue sections

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Scanning probe microscopy makes use of small probes, with size from tens of nanometers to few micrometers, scanned over the sample surface to obtain topographical and mechanical information with spatial resolution and force sensitivity. In a different application, scanning probes can be used as nanometric pens to locally modify the sample surface in contact with the probe. This second approach provides lithographic capabilities and it is called scanning probe lithography (SPL)1. In SPL, different inputs are used to generate the desired surface modification. In particular, when heatable cantilevers are employed to locally induce chemical reactions, the technique is called thermochemical nanolithography (tc-SPL)2. Both approaches can be of great interest for biological applications, to provide functional (nano and micro-mechanical) markers in biological surfaces (AFM) or for patterning purposes (tc-SPL). In my presentation, I will show the use of force volume AFM for the spatial mapping of collagen distribution in mammalian tissues with affordable timescales. This study points to the use of AFM as a routine tool in the biomedical research, to provide micromechanical data that correlate with outputs from other (optical, biochemical, histological) techniques3. I will also describe tc-SPL for the fabrication of nanoscale patterns in polymer films. These patterns can be used for enzymes anchoring with high throughput, high reproducibility and spatial control, till the single molecule level. Tc-SPL allows for the fabrication of 3D surfaces with independent control of topography and chemistry, and in my work it is employed to generate pockets (< 10 nm in size) that accomodate single enzymes4,5. References

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FIGURES

Figure 1: Enzyme patterning through tc-SPL.

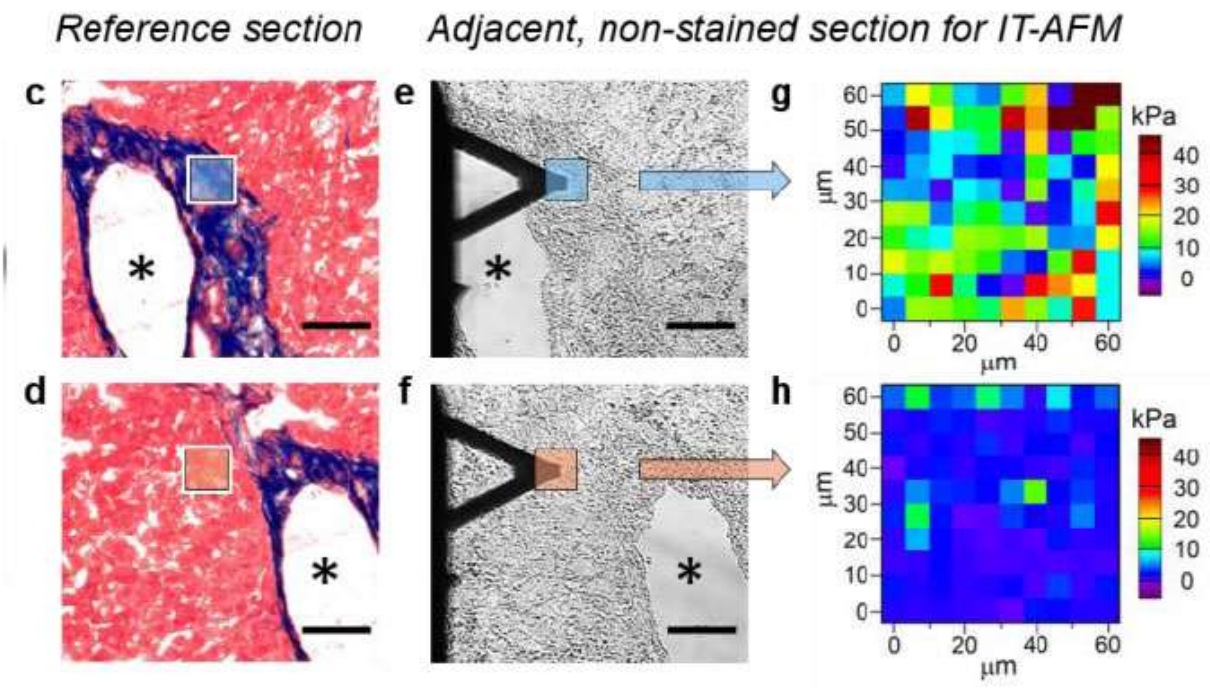

Figure 2: Force volume AFM in tissue sections from human liver.