Atomic force microscopy, life sciences and soft matter

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In this contribution, I would like to present the different use and development in atomic force microscopy (AFM) focusing primarily in the fields of life sciences and soft matter. In particular, we will see in which way the AFM is used as an imaging machine to characterize macromolecules at different interfaces or to follow crystallization processes. Furthermore, the use of the AFM as a mechanical machine it will be presented. In this part, I will talk about molecular forces, elasticity of proteins and cell mechanics [1,2]. Finally, different possibilities to combine the scanning probe microscopy with other microscopy techniques such as fluorescence microscopy, RICM and STED will be mentioned [3].

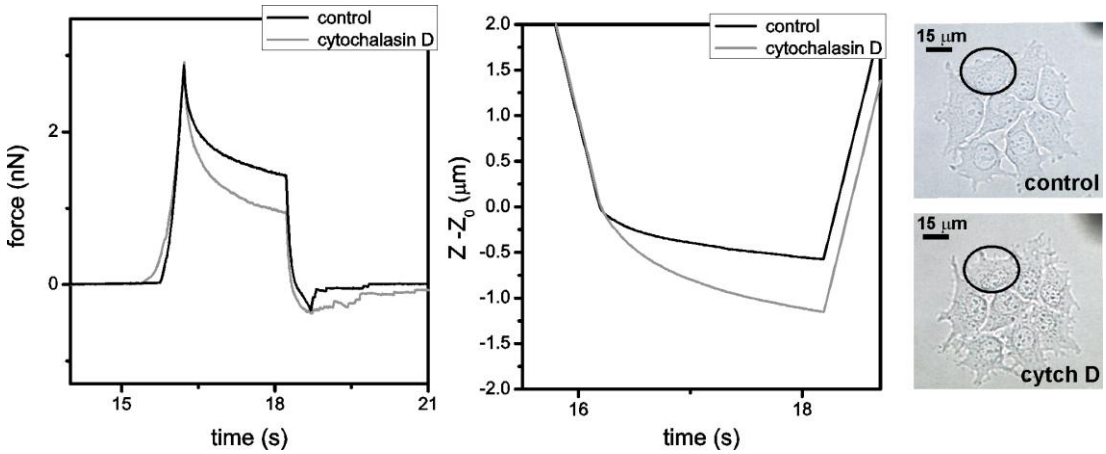

Figure 1. Left: force relaxation experiment after treating the cells with cytochalasin. Note that the grey line (after actin disruption with cytochalasin) decays faster than the black one (control). Middle: creep compliance experiment on the same cell before and after cytochalasin treatment. Note that the deformation of the cell is larger (grey line) after cytochalasin treatment. Right (above): optical image of the control MCF-7 cells. Right (below): optical image of the cells treated with cytochalasin. Figure adapted from [2].

References:

[1]. S. Moreno-Flores, R. Benitez, M. dM Vivanco and J. L. Toca-Herrera. Stress relaxation and creep on living cells with the atomic force microscope: a means to calculate elastic moduli and viscosities of cell components. Nanotechnology 21 (2010) 445101.

[2]. K. A. Melzak, G. R. Lazaro, A. Hernandez-Machado, I. Pagonabarraga, J. M. Cardenas Dıaz de Espada and J. L. Toca-Herrera. AFM measurements and lipid rearrangements: evidence from red blood cell shape changes. Soft Matter, 8 (2012) 3716.

[3]. S. Moreno-Flores and J. L. Toca-Herrera. Hybridizing Surface Probe Microscopies: Toward a Full Description of the Meso- And Nanoworlds. CRC Press. 2013. Boca Raton. FL.