The Nanomotion Sensor: how AFM Cantilevers can be used as nanosensors for real-time investigations in biomedicine

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Movement is connected to life. Studying living biological systems and their nanoscale movements we can achieve a novel insight in their metabolic status and in how they react to external stimuli. To investigate these movements, we exploited the sensitivity of AFM cantilevers to develop a novel nanoscale sensor, called the nanomotion sensor, which we applied to characterize the innate correlation between life and movement. Due to its sensitivity, the nanomotion sensor can be used to study bacterial species, yeasts and fungi and their response to drugs as well as to chemical or physical stimuli.

We will show how the fast response of the sensor, leads to exciting applications in the medical practice, with evident advantages for patients care. For instance, by combining it with rapid isolation of bacteria from clinical samples, we have optimized a protocol to produce a complete characterization of a bacterial infection directly from a clinical source in few hours.

Finally, we will present the latest results in the nanomotion characterization of single mammalian cells. As an example, we will present our nanomotion investigation of neurons exposed to amyloid proteins, Red Blood Cells aged in starving conditions and the oxidative stress response of a cell model system for Friedrich's ataxia. In very general terms, all these pioneering results indicate that a sensor capable of transducing metabolically-related movements can deliver a new point of view in the analysis of living systems and allow a new means to characterize the metabolic activity. This has also led us to propose this nanomotion sensor as an innovative technique to detect life in extreme environment.