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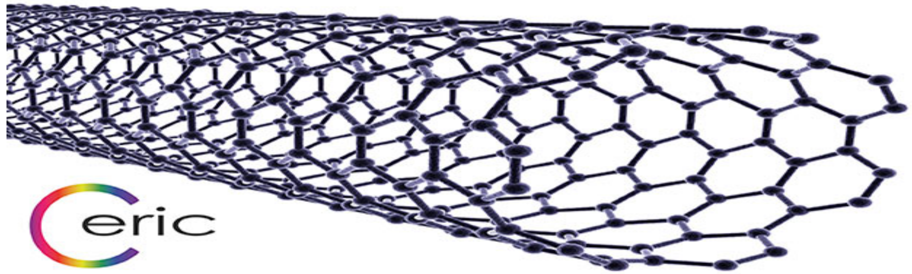

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PaGES
Pianificazione, Gestione ed esecuzione di un Esperimento Scientifico in un centro di ricerca internazionale

Atomic force microscopy (AFM) bio-applications

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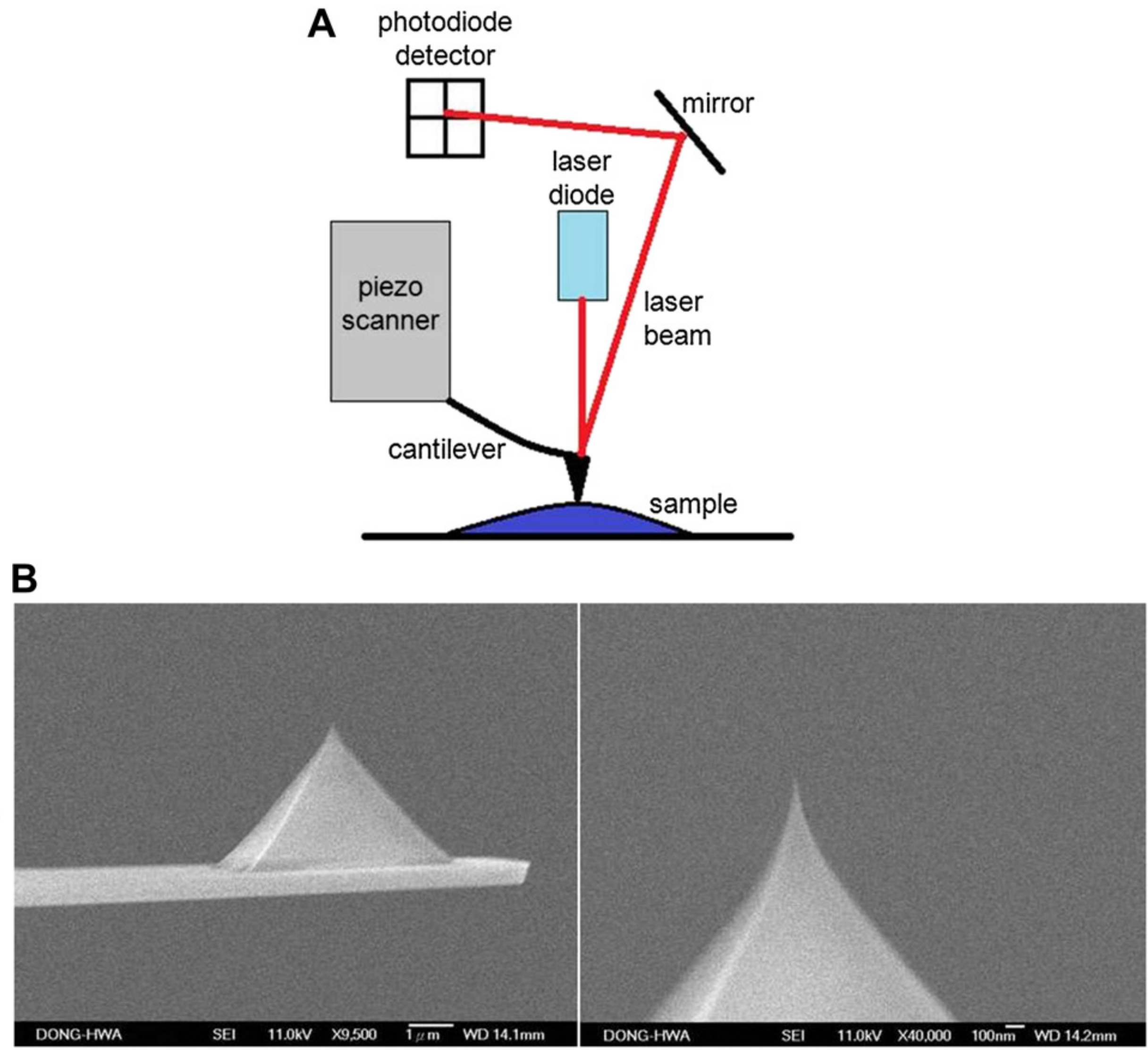
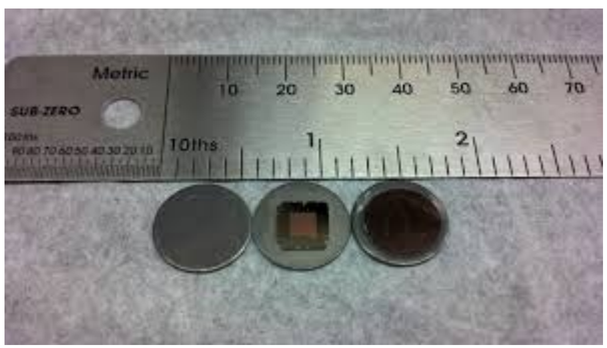
Basics of AFM

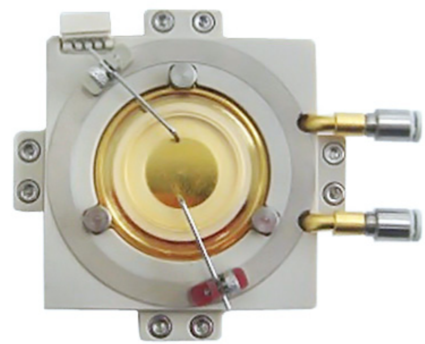


Advantages of AFM

- **Sample do not require any treatment** (freezing, metal coating, vacuum or dye)

- AFM imaging both **in air and liquid environment**

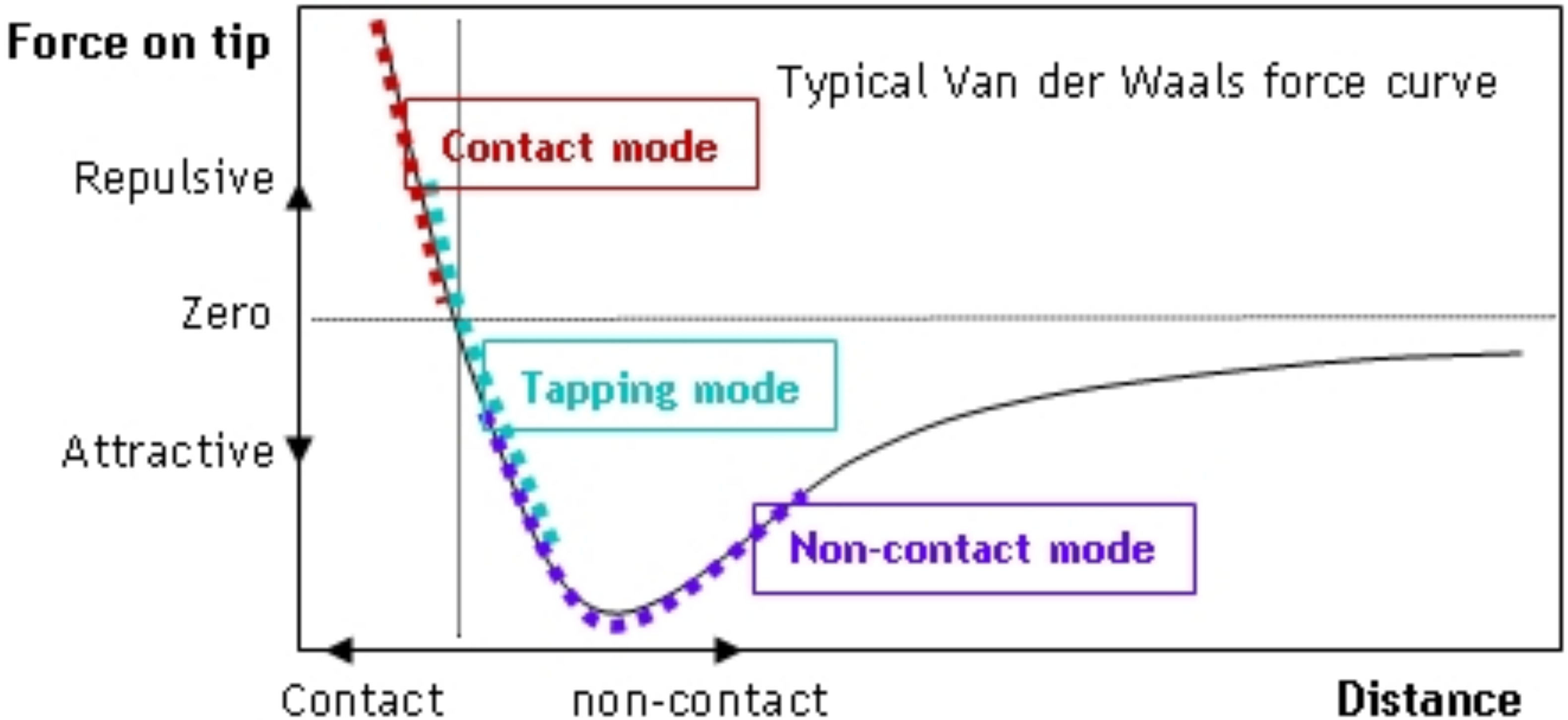




- **High resolution**

AFM working modes

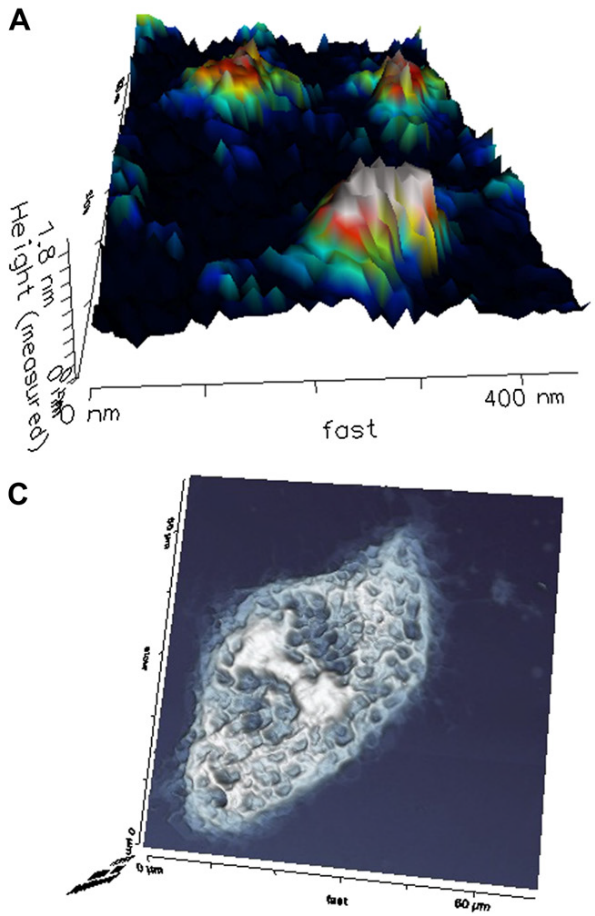
<u>Contact mode vs. Non-contact mode</u>



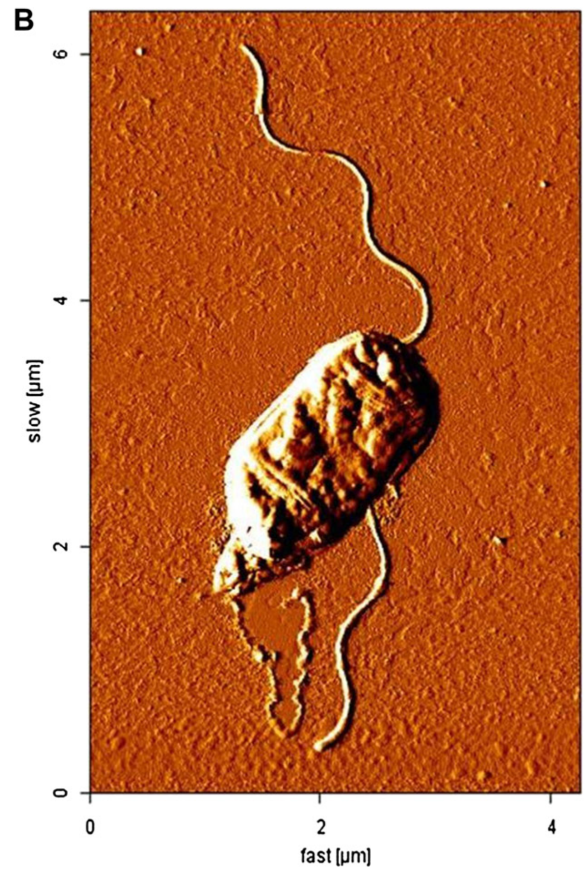
Application in biology and biomedicine

Imaging of biological samples

Hepatitis C virus



Cancer cell

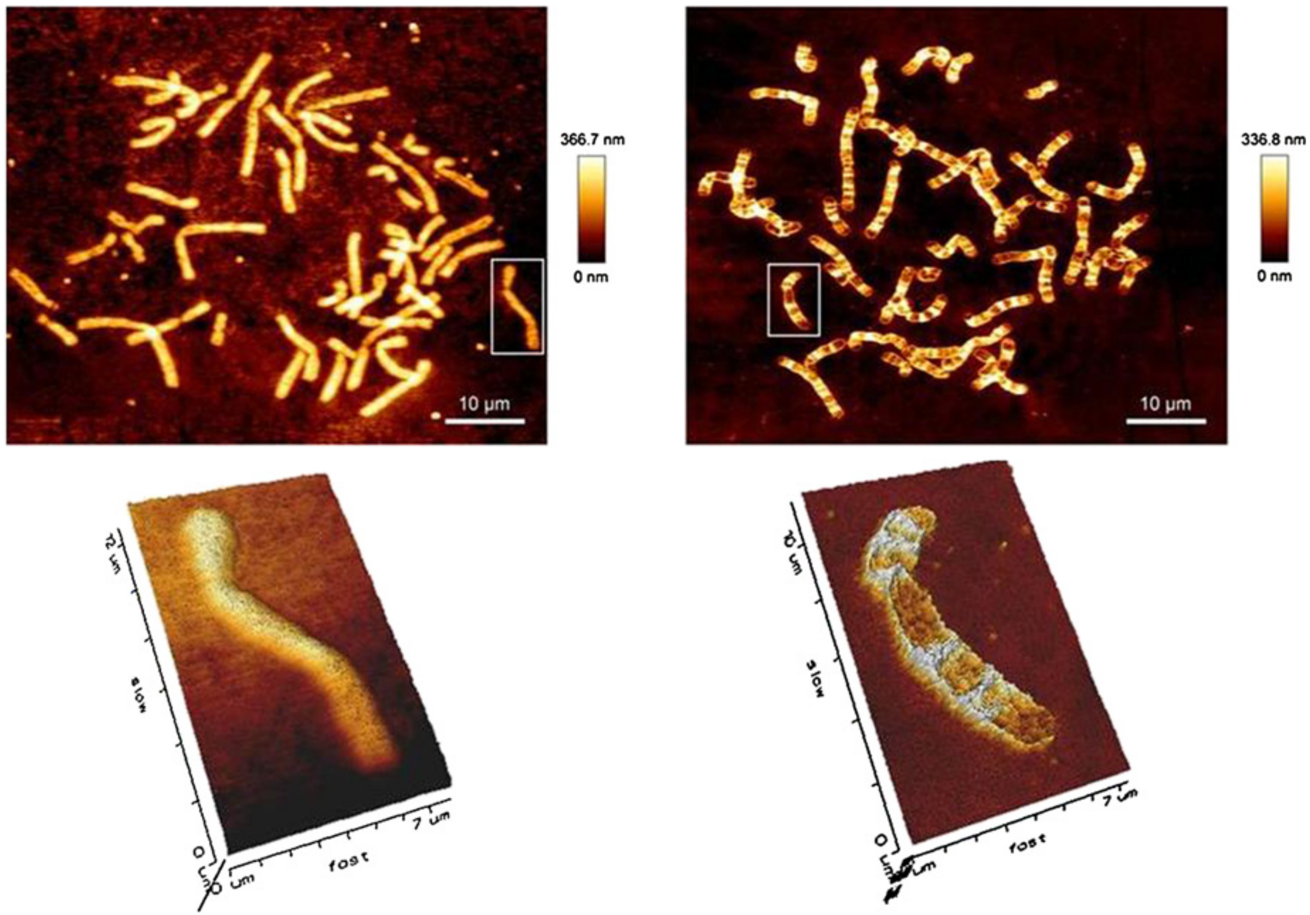


E. coli cell

KC Chang et al. Tzu Chi Medical Journal 24 (2012). 162-169

Application in biology and biomedicine

Imaging of biological samples

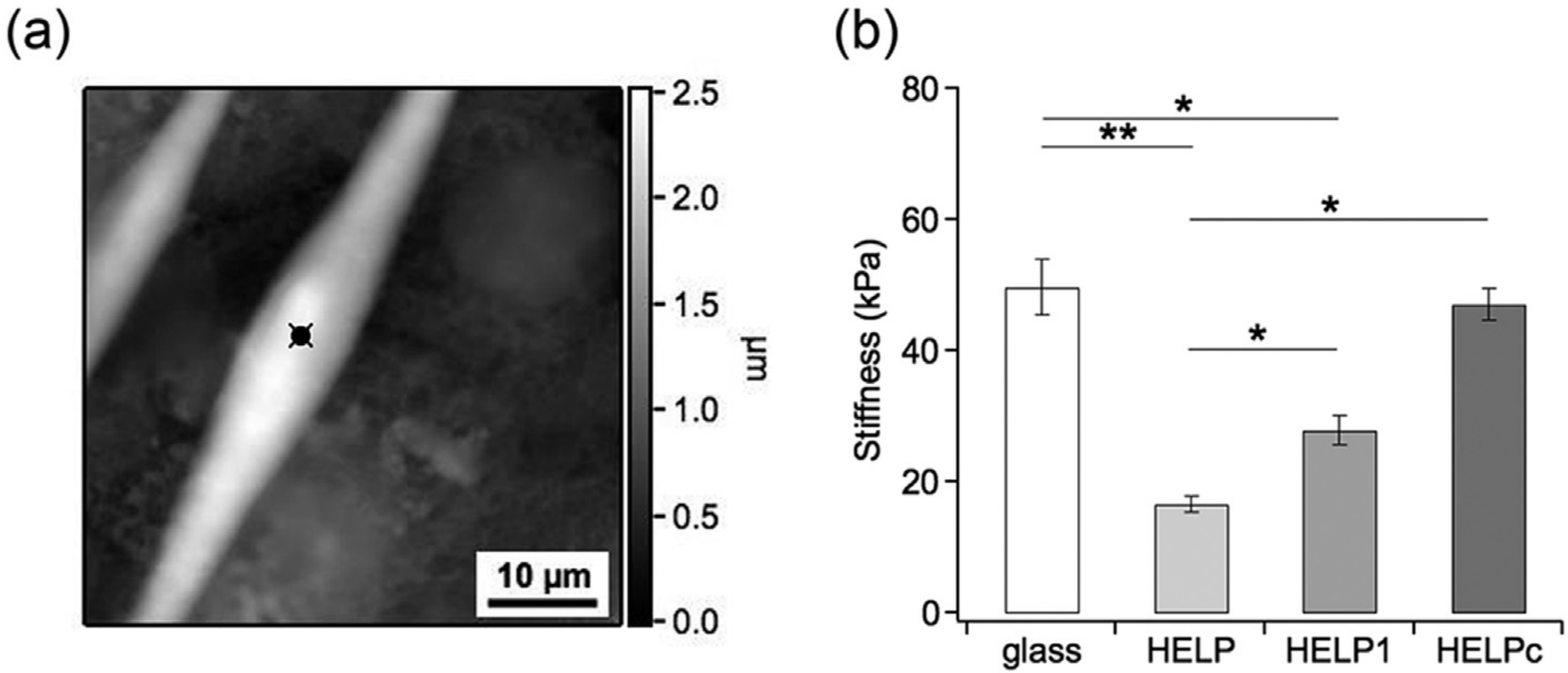


Human chromosomes before and after Giemsa-trypsin-Giemsa treatment

KC Chang et al. Tzu Chi Medical Journal 24 (2012). 162-169

Application in biology and biomedicine

AFM mechanical characterization



Elastic moduli of **myotube cells** grown on control (glass) and HELP substrates (**Human Elastin-Like Polypeptides**)

P D'Andrea et al. Biomaterials 67 (2015). 240-253

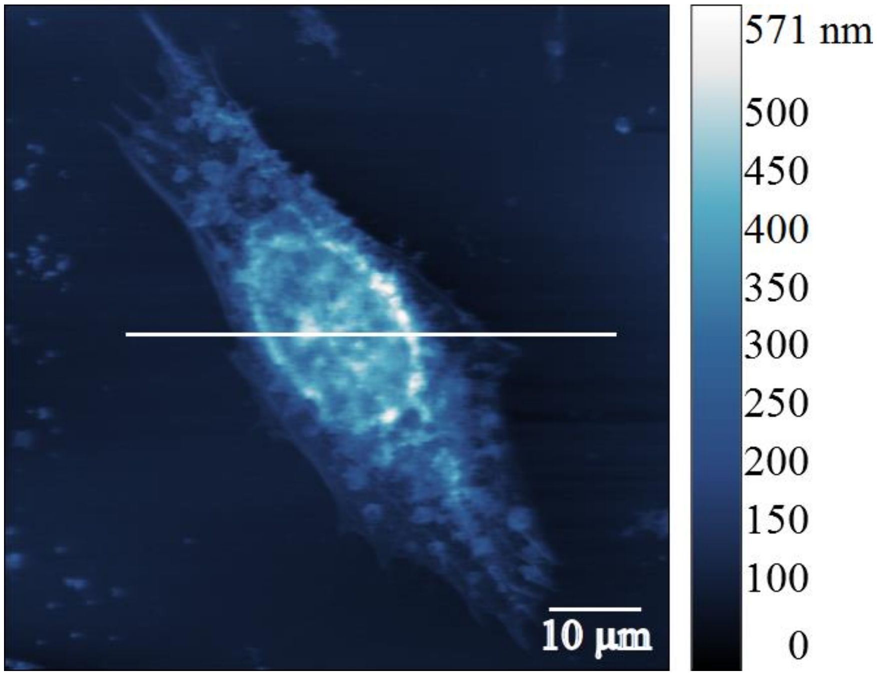
Experimental set-up

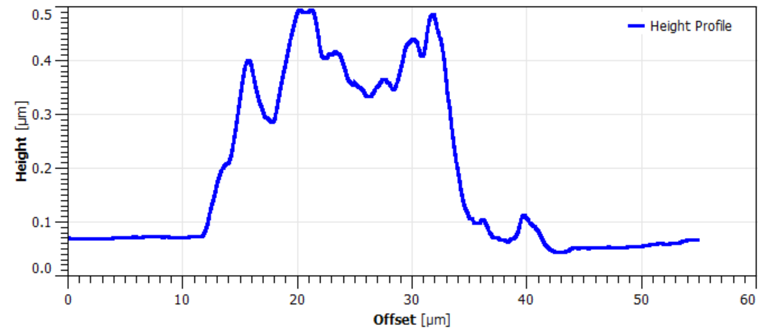
1. Sample preparation

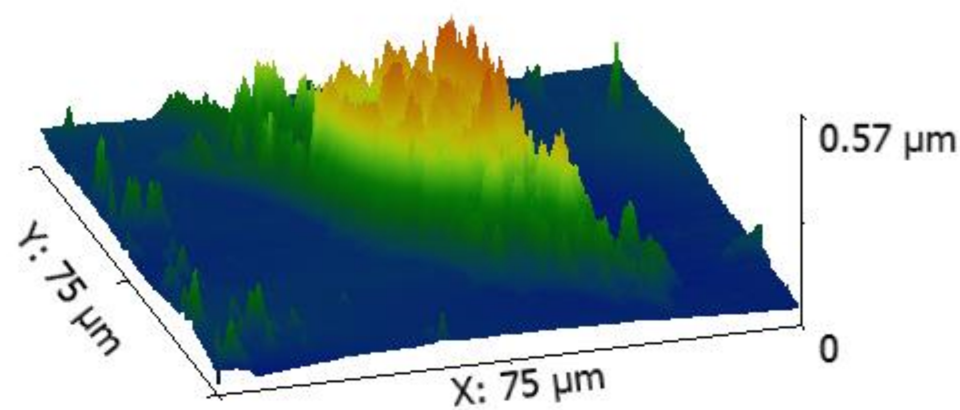
2. AFM investigation

3. Data analysis

AFM analysis of Glioma cells deposited on carbon nanotubes

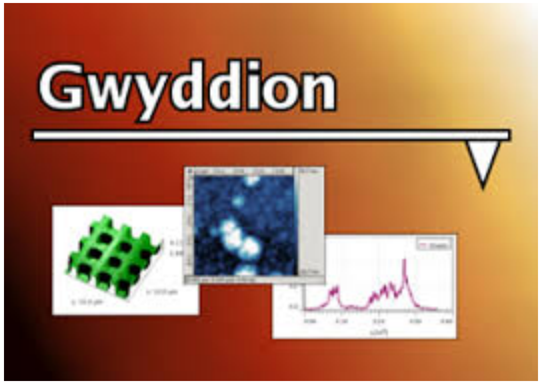


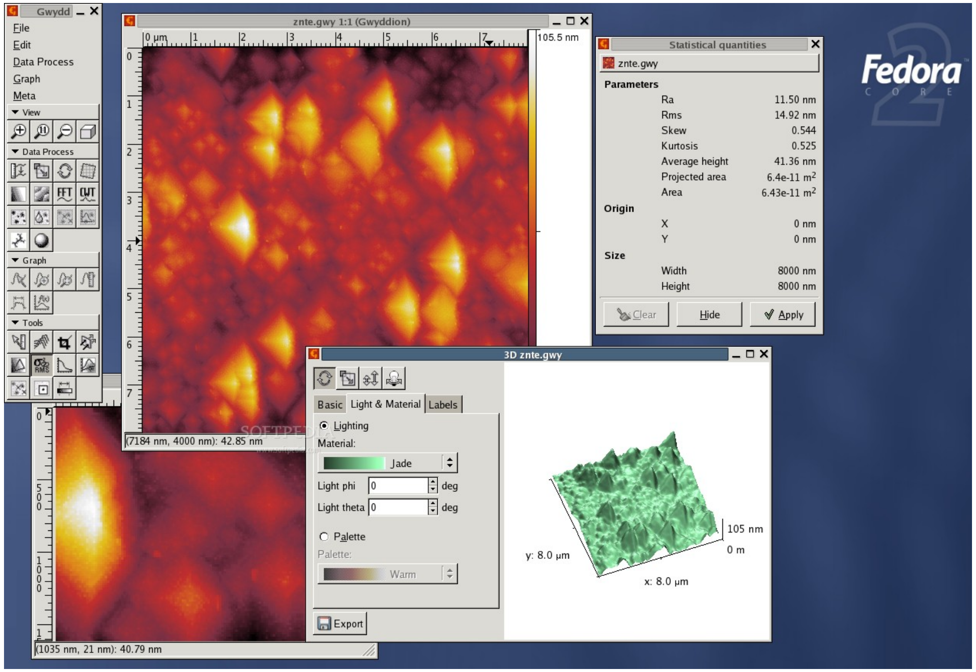


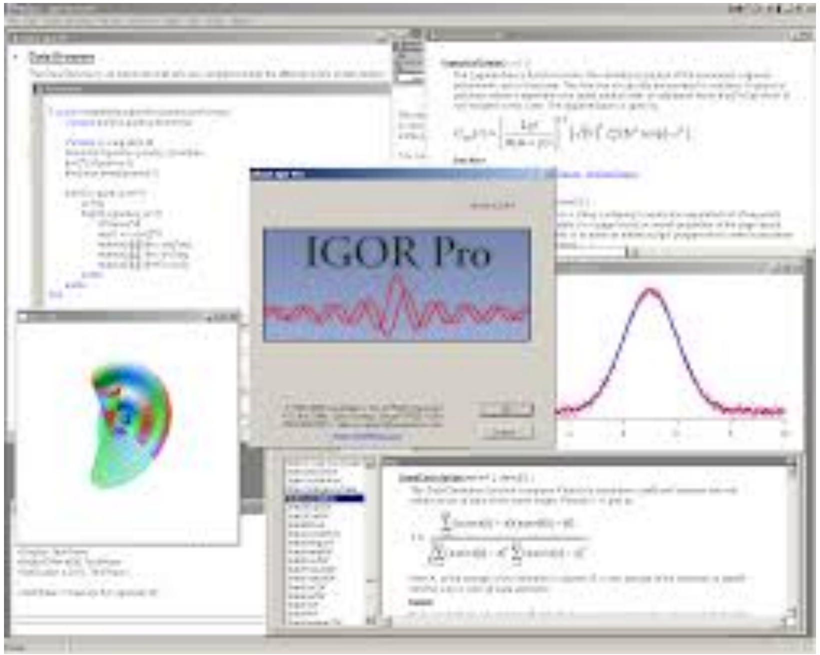


- AFM scanning in air, in contact mode

AFM data analysis







What is the ultimate goal of producing scientific data??

….writing a paper

J Nanopart Res (2008) 10:89–96
DOI 10.1007/s11051-008-9435-7

RESEARCH PAPER

A comparison of atomic force microscopy (AFM) and dynamic light scattering (DLS) methods to characterize nanoparticle size distributions

Christopher M. Hoo · Natasha Starostin · Paul West · Martha L. Mecartney

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Abstract This paper compares the accuracy of conventional dynamic light scattering (DLS) and atomic force microscopy (AFM) for characterizing size distributions of polystyrene nanoparticles in the size range of 20–100 nm. Average DLS values for monosize dispersed particles are slightly higher than the nominal values whereas AFM values were slightly lower than nominal values. Bimodal distributions were easily identified with AFM, but DLS results were skewed toward larger particles. AFM characterization of nanoparticles using automated analysis software provides an accurate and rapid analysis for nanoparticle characterization and has advantages over DLS for non-monodispersed solutions.

Keywords Atomic force microscopy · Dynamic light scattering · Polystyrene nanoparticles · Size analysis · Nanotechnology · Instrumentation

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Introduction

Nanoparticles display a number of unique properties that directly correlate to their size. It has been found that properties such as melting temperature (Dick et al. 2001) and dissolution rate (Meulenkamp 1998) are dictated by the size of nanoparticles. The increased surface to volume ratio of nanoparticles is a key property that makes them ideal for nanosensors that depend on surface reactions. As a result, it is important to be able to accurately characterize size distributions within nanoparticle suspensions. While it has been shown that atomic force microscopy (AFM) and dynamic light scattering (DLS) can analyze complex colloidal systems such as latex colloids (Cadene et al. 2005), this study compares AFM and DLS measurements against reported NIST traceable polystyrene nanoparticle size distributions in order to determine an optimal method for size distribution characterization.

Atomic force microscopy

The atomic force microscope (AFM), developed in 1986 by Binnig et al. (1986), enables users to characterize nanoscale objects. The AFM utilizes piezoelectric ceramics to move a specimen in nanoscale increments in the *X*, *Y*, and *Z* directions. An AFM tip mounted on a cantilever is positioned above the specimen at a distance where the tip is repelled or attracted by the forces due to the interaction with the

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Paper Structure

- **Title , author**
- **Abstract**

Used for bidding
Firts impression

- **Introduction** ➡

What is it important/ interesting?
What is the problem
Why is it hard
what;'s wrong with existing solutions?
Why is your approach is 'better'

- **Paper body**

(background, aaproach, validation, discussion)

- **Related work** ➡

Be explicit on the relation with your work (competing, complementary, overlapping)

- **Conclusion**
- **Acknowledgement**
- **References**