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Stress, Drug Resistance, Adhesion: the dark side of the wall

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Stress, Drug Resistance, Adhesion: the dark side of the wall.



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LISBP

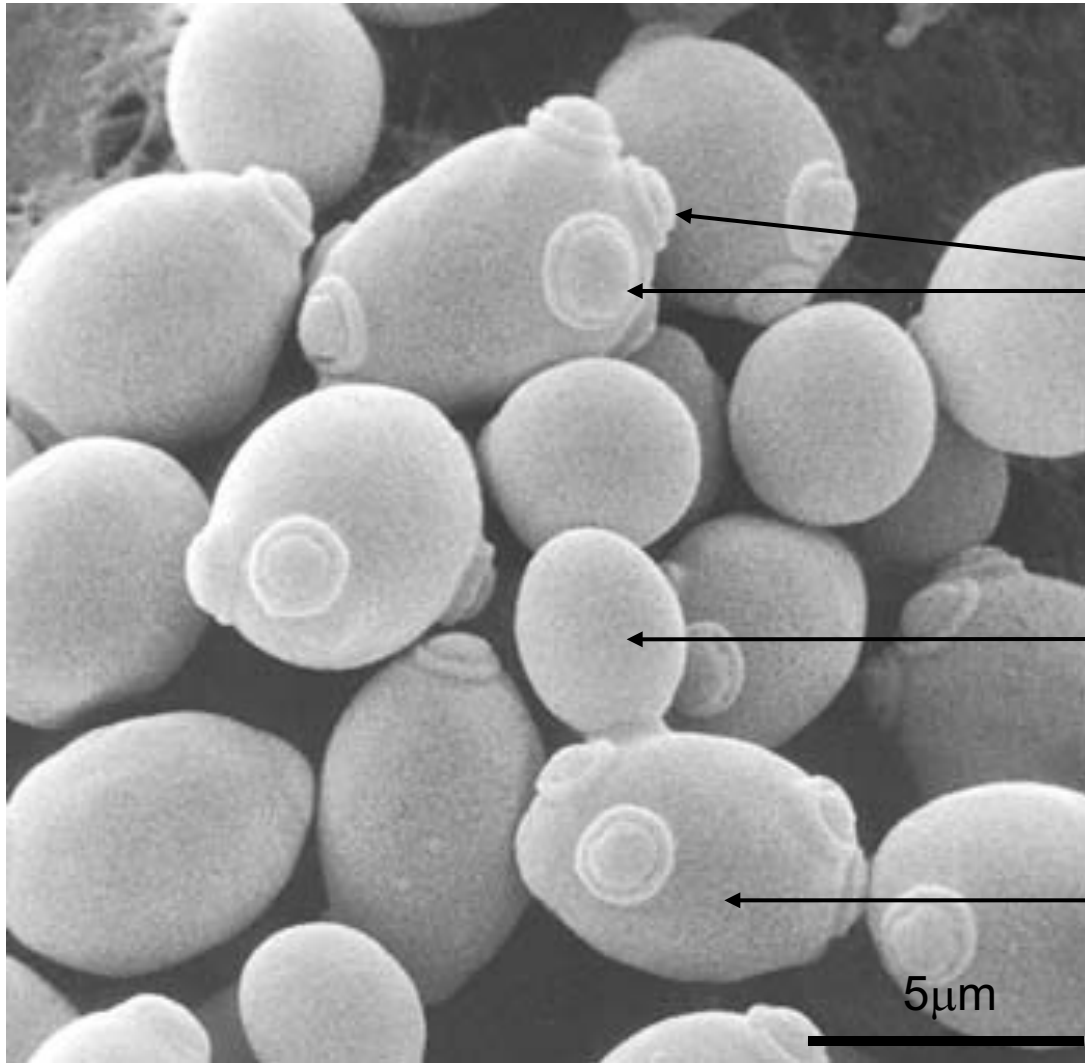
LABORATOIRE D'INGÉNIERIE
DES SYSTÈMES BIOLOGIQUES
ET DES PROCÉDÉS



Yeasts

- **Eukaryotic single-cell** microorganisms, members of the Fungus kingdom.
- Used by mankind for milenia to ferment food, notably ***Saccharomyces cerevisiae***, *S. bayanus*, *Kluveyromyces lactis*...
- Life threatening pathogenic yeast species :
Candida albicans and *Cryptococcus neoformans*.

Yeasts



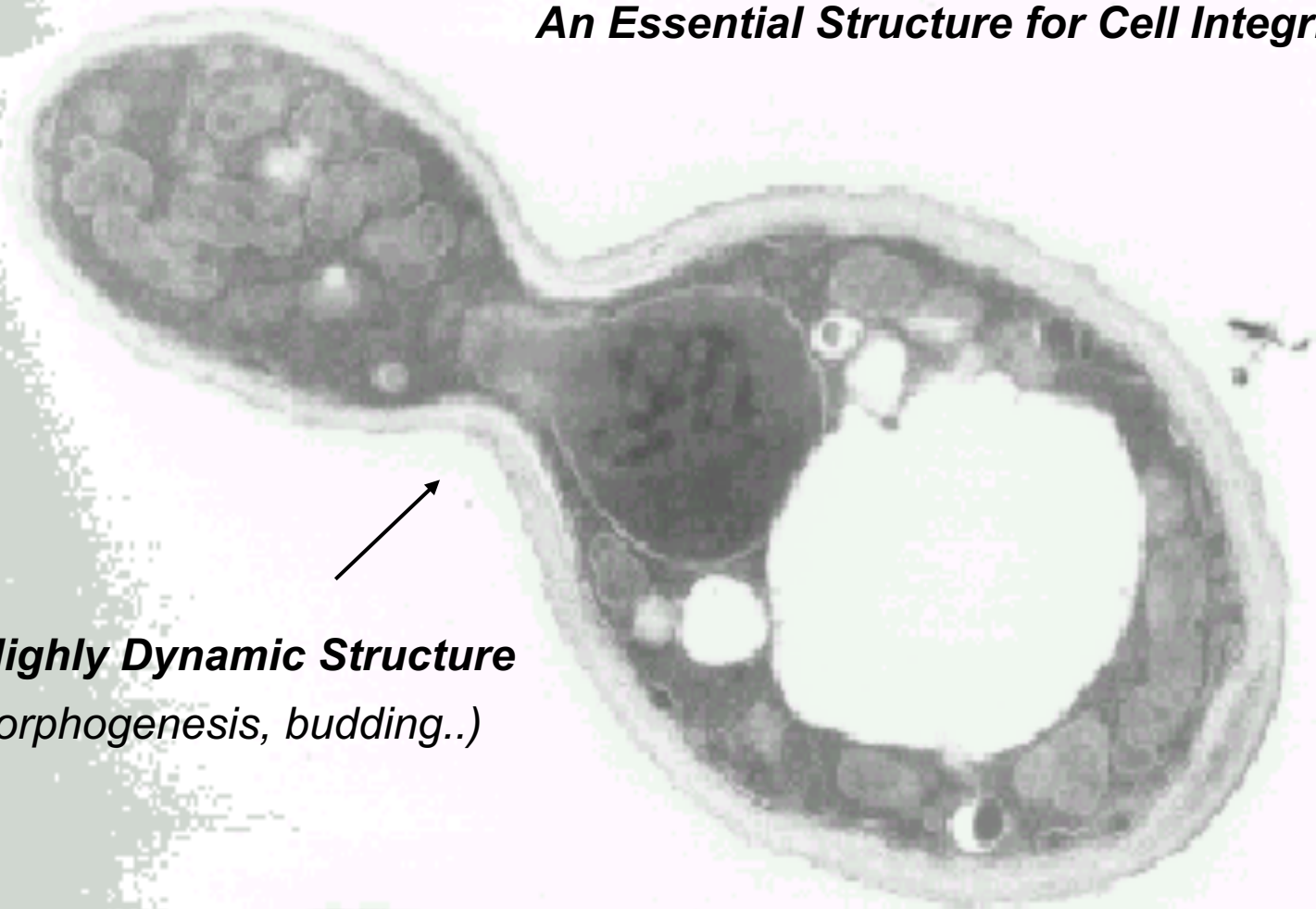
Bud
scars

Daughter cell

Mother cell

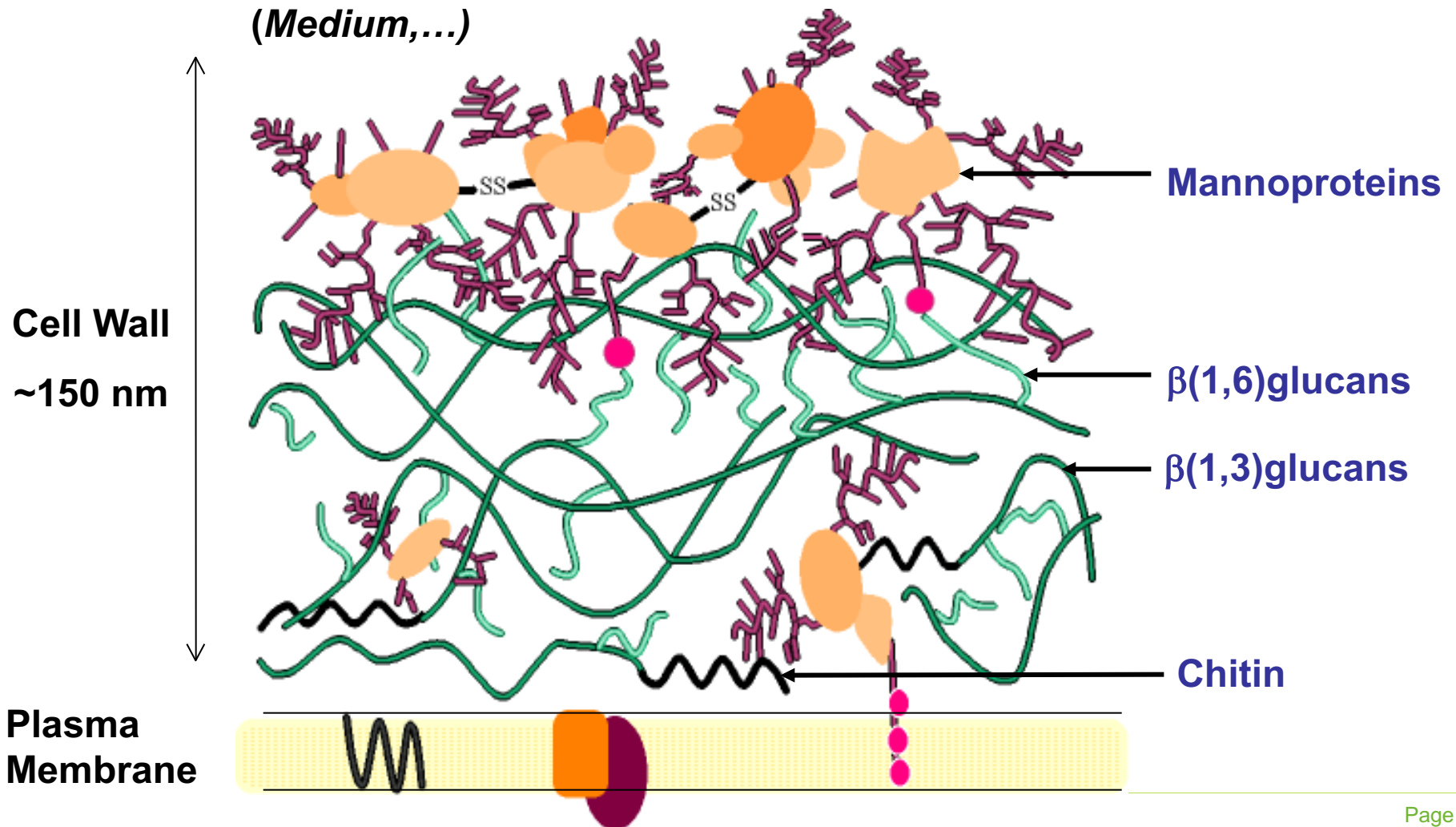
The Yeast Cell Wall

An Essential Structure for Cell Integrity

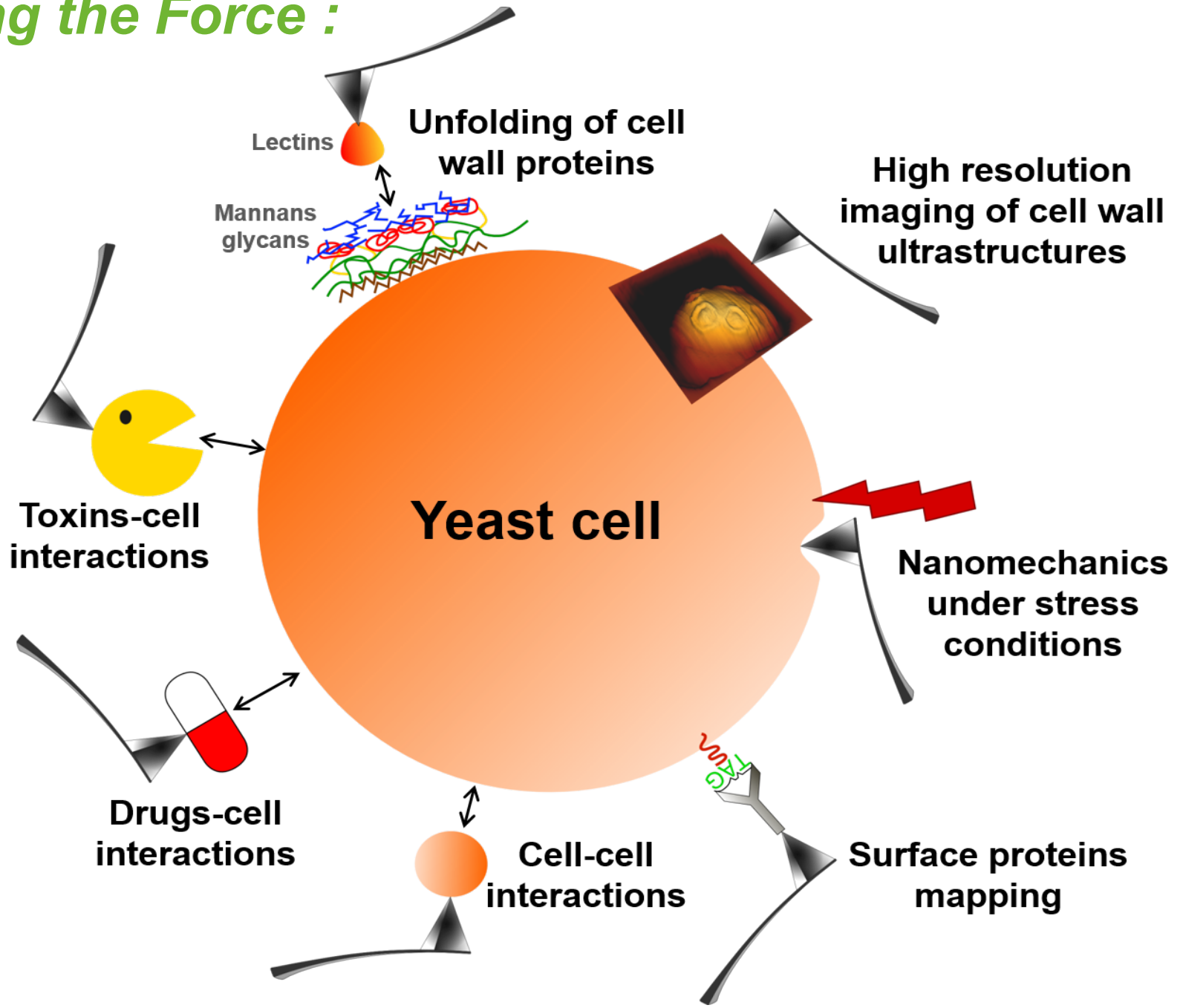


A Highly Dynamic Structure
(Morphogenesis, budding..)

The Yeast Cell Wall Architecture

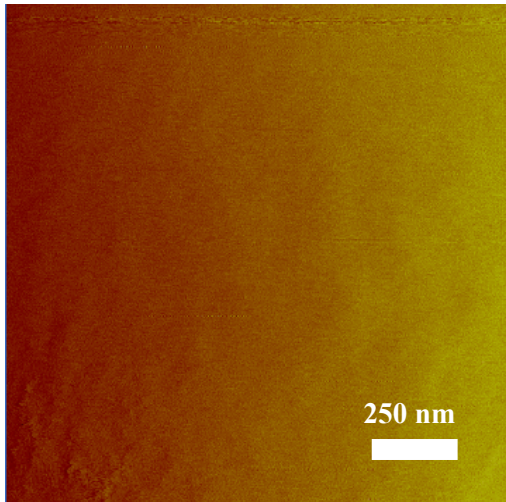


Using the Force :

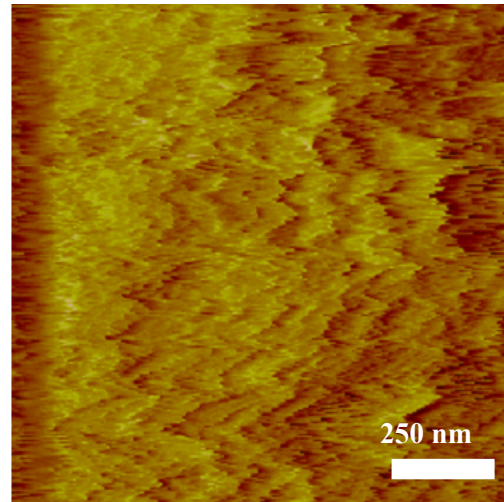


AFM : imaging and nano-mechanics of the cell wall

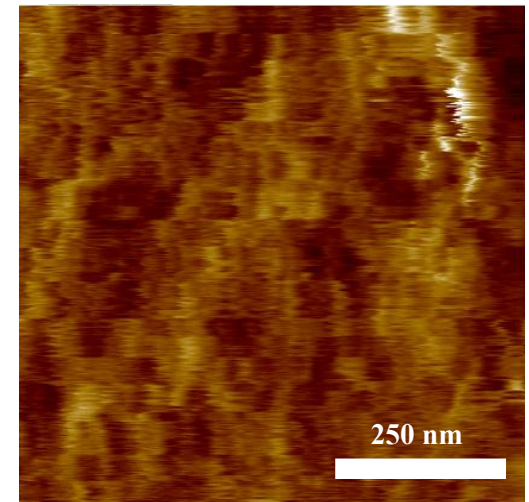
Control strain



mnn9 (affected in mannan synthesis)



fks1 (affected in β -glucan synthesis)



Young's modulus 1.62 ± 0.22 (MPa)

1.86 ± 0.58

2.02 ± 0.43

Roughness 1.21 ± 0.30

2.95 ± 0.65

5.76 ± 1.8

Elasticity \rightarrow

Elasticity \searrow

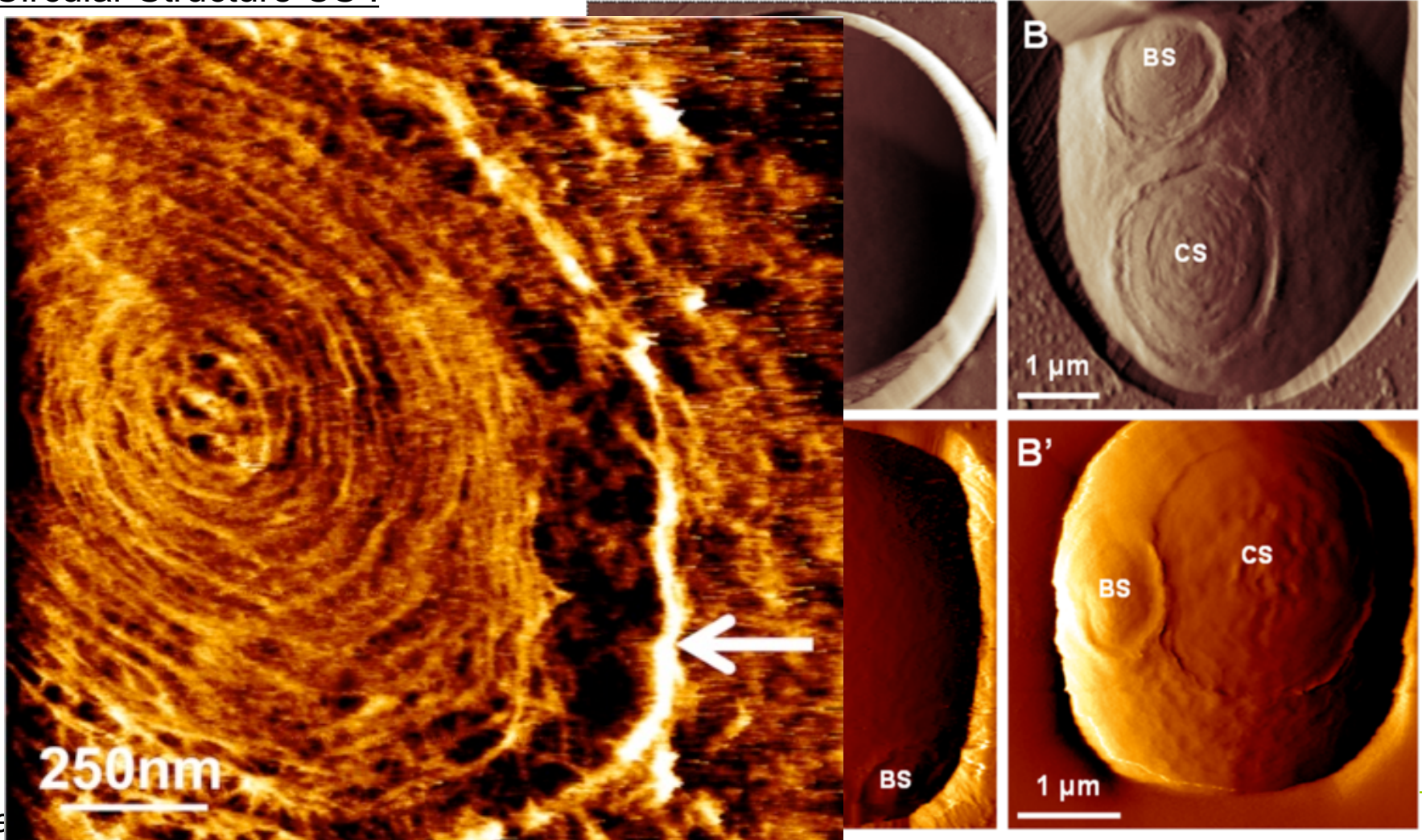
Rugosity \nearrow

Rugosity \nearrow

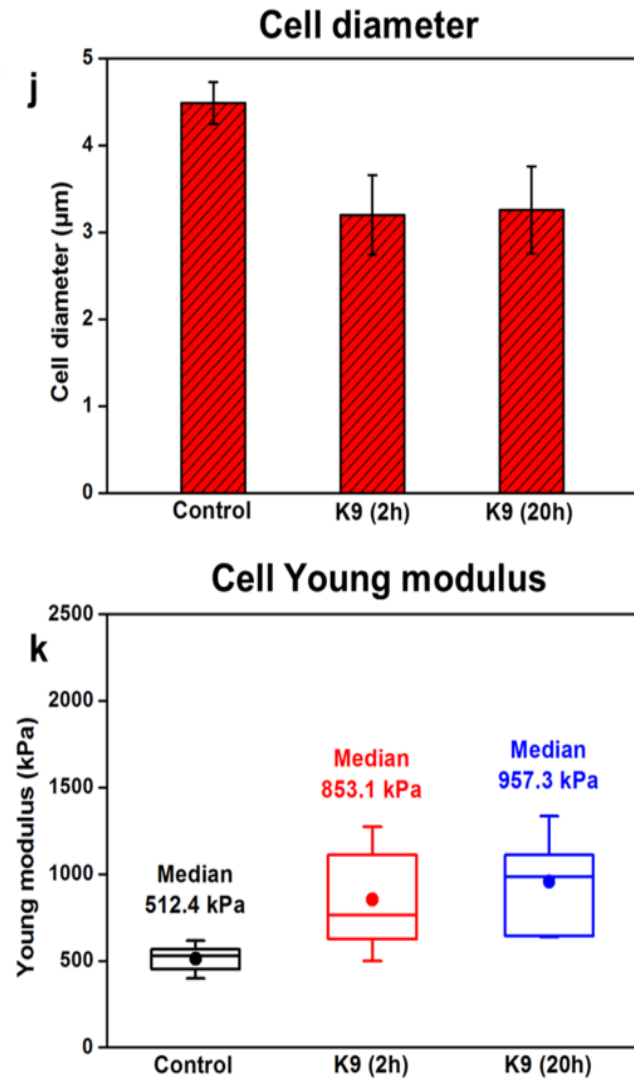
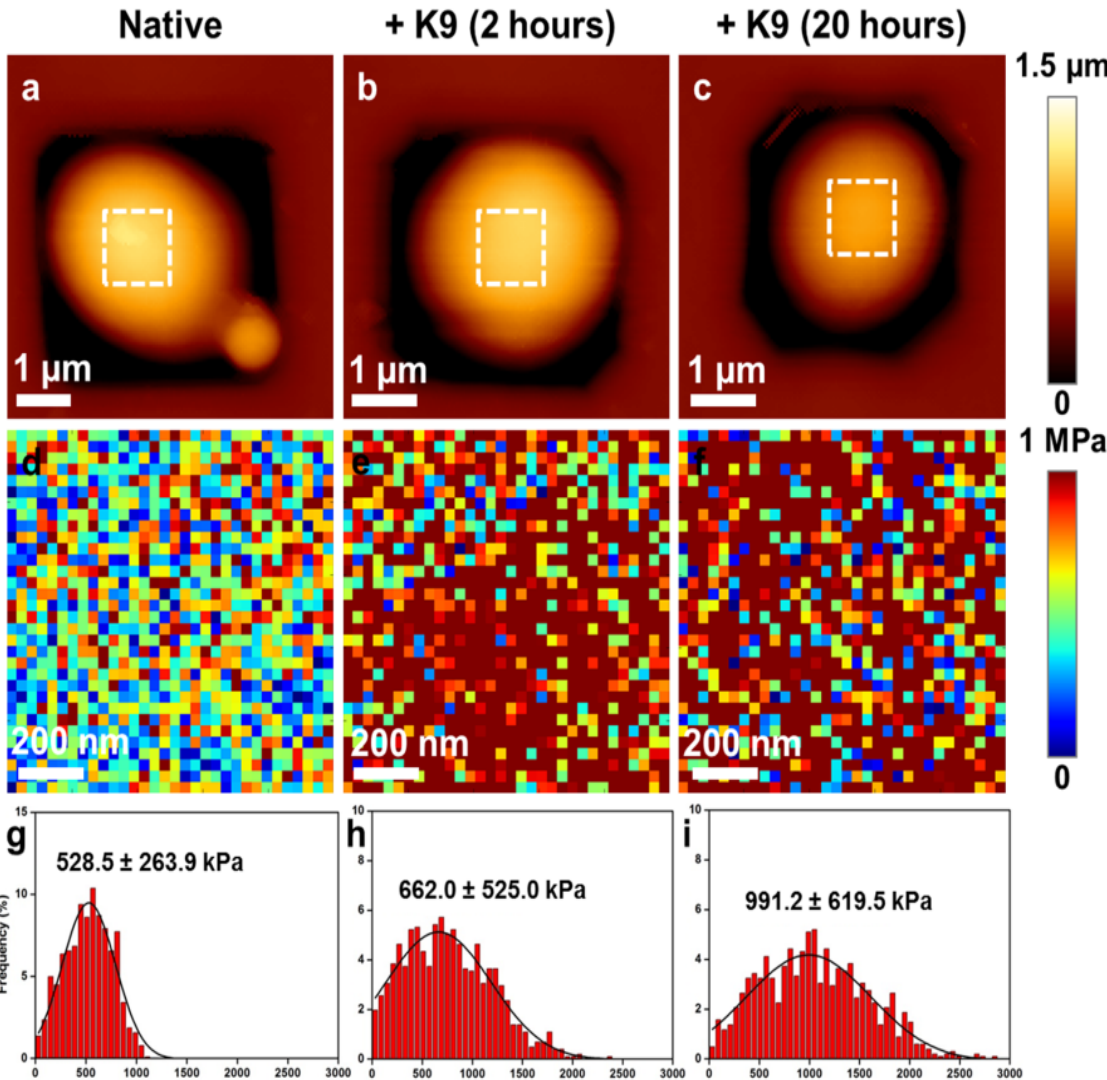
Ultrastructure of the Circular Structure CS :

A, A' : unstressed (30°C)

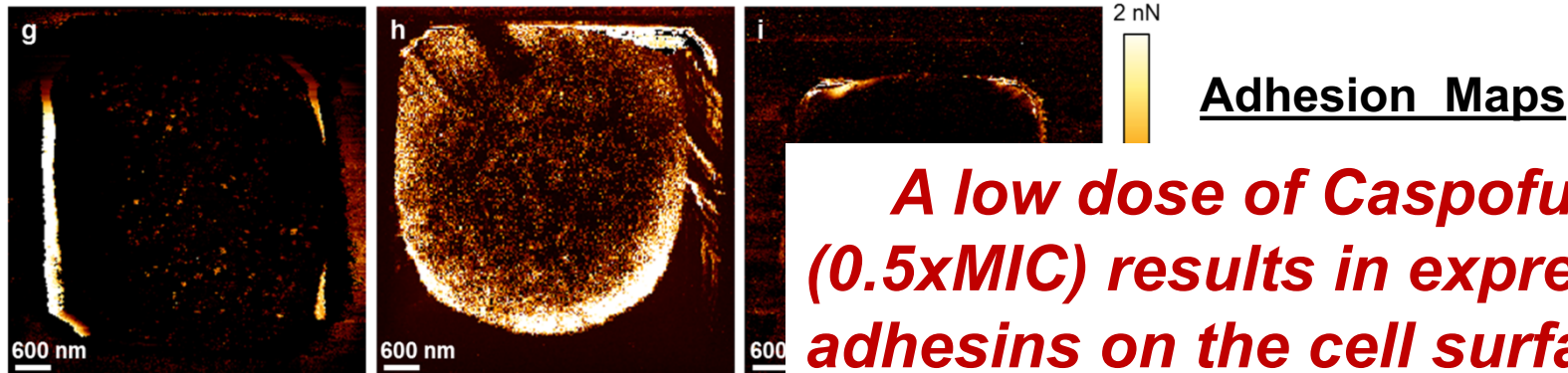
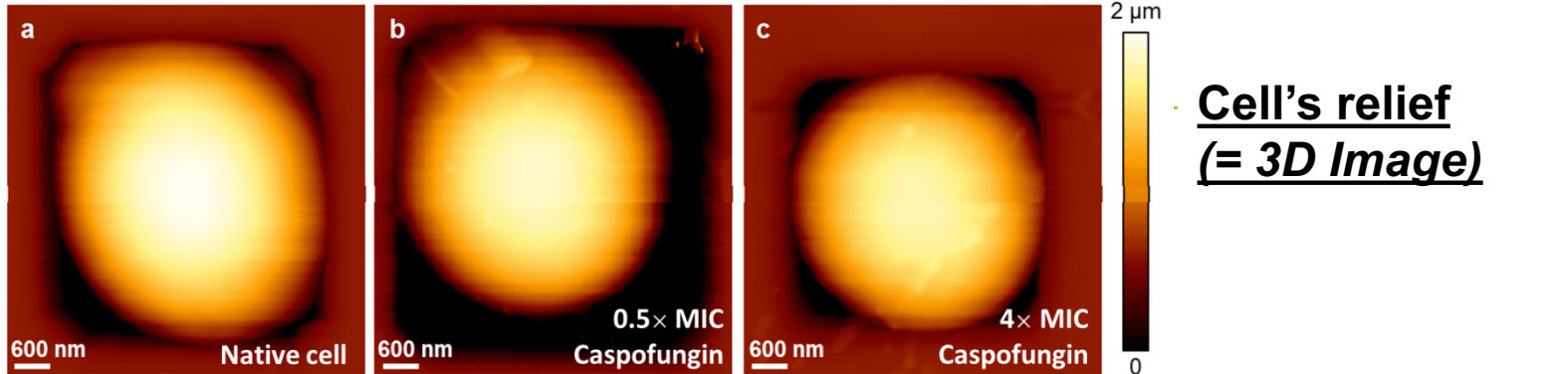
B, B' : 1 h at 42°C



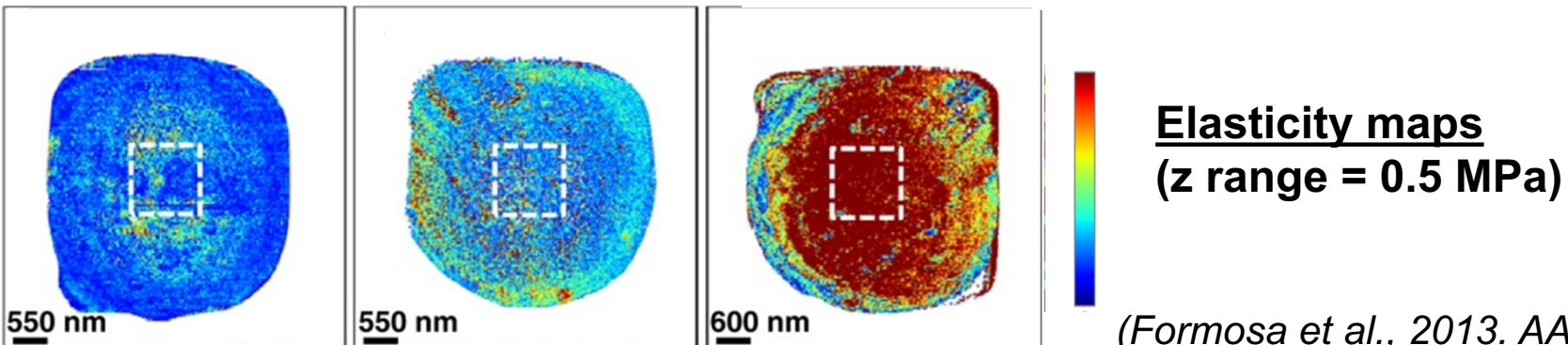
Killer toxin K9



Effect of Caspofungin on *C. albicans*



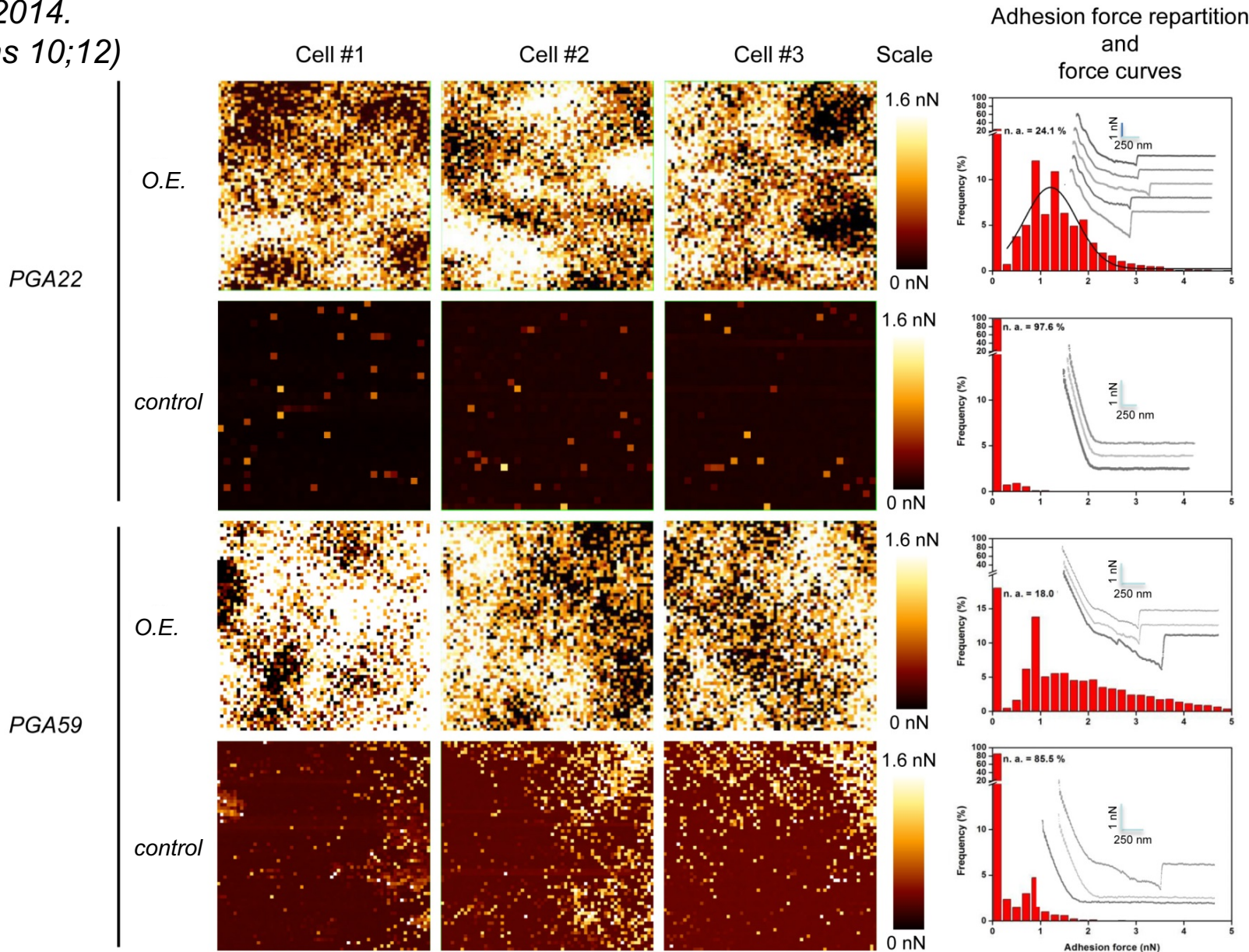
A low dose of Caspofungin (0.5xMIC) results in expression of adhesins on the cell surface !!!



(Formosa et al., 2013. AAC 57(8))

Single Molecule Force Spectroscopy (SMFS) by AFM to measure cellular Adhesion

(Cabral et al., 2014.
PloS Pathogens 10;12)



AFM allowed us to unravel the morphologic effect on yeast cells of Heat Shock, Osmotic Shock, exposure to toxins and drugs.

New projects include effect of mycotoxins on yeast cells, and molecular determinants of cell adhesion,

- at the molecular scale with AFM and Optical Tweezers,**
- at the population scale with the Sheer Flow Chamber.**



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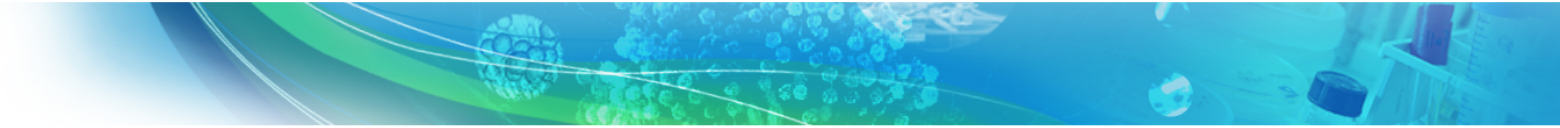


Cécile *Fantastique*
Formosa-Dague,
UCL Louvain la neuve

And...
THE FORCE !!!!!

Pr Jean-Marie François,
INSA





Thank you for your attention !

Fig.1 (François et al)

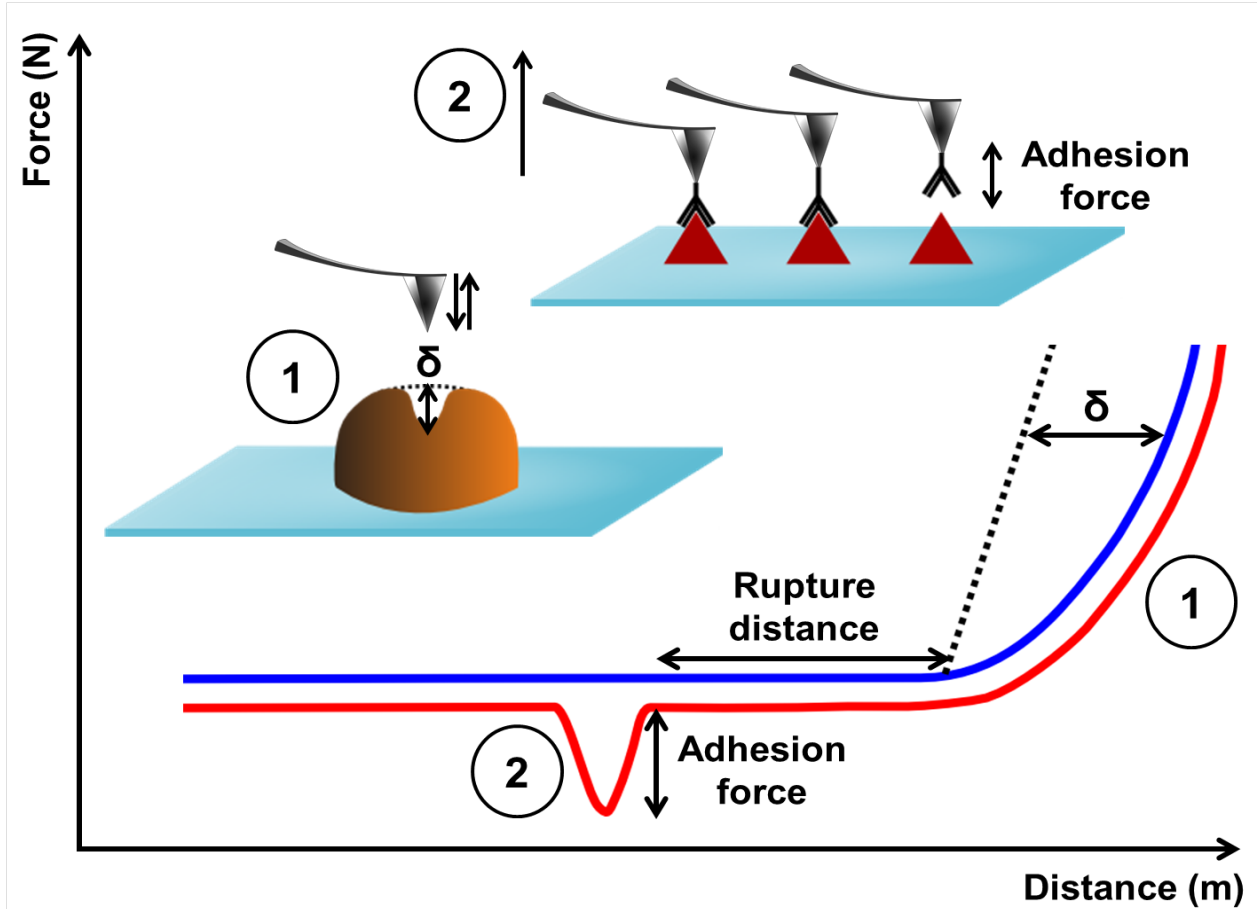


Fig.2(François et al)

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