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► To cite this version:

Helene Yken, Cécile Formosa-Dague, Marion Schiavone, Etienne Dague. The dark side of the wall: atomic force microscopy revelations on drug resistance and adhesion. FEBS Advanced Lecture Course on "Human Fungal Pathogens - Molecular Mechanisms of Host-Pathogen Interactions and Virulence", May 2017, La Colle sur Loup, France. 2017. hal-01608703

HAL Id: hal-01608703

<https://hal.science/hal-01608703>

Submitted on 2 Jun 2020

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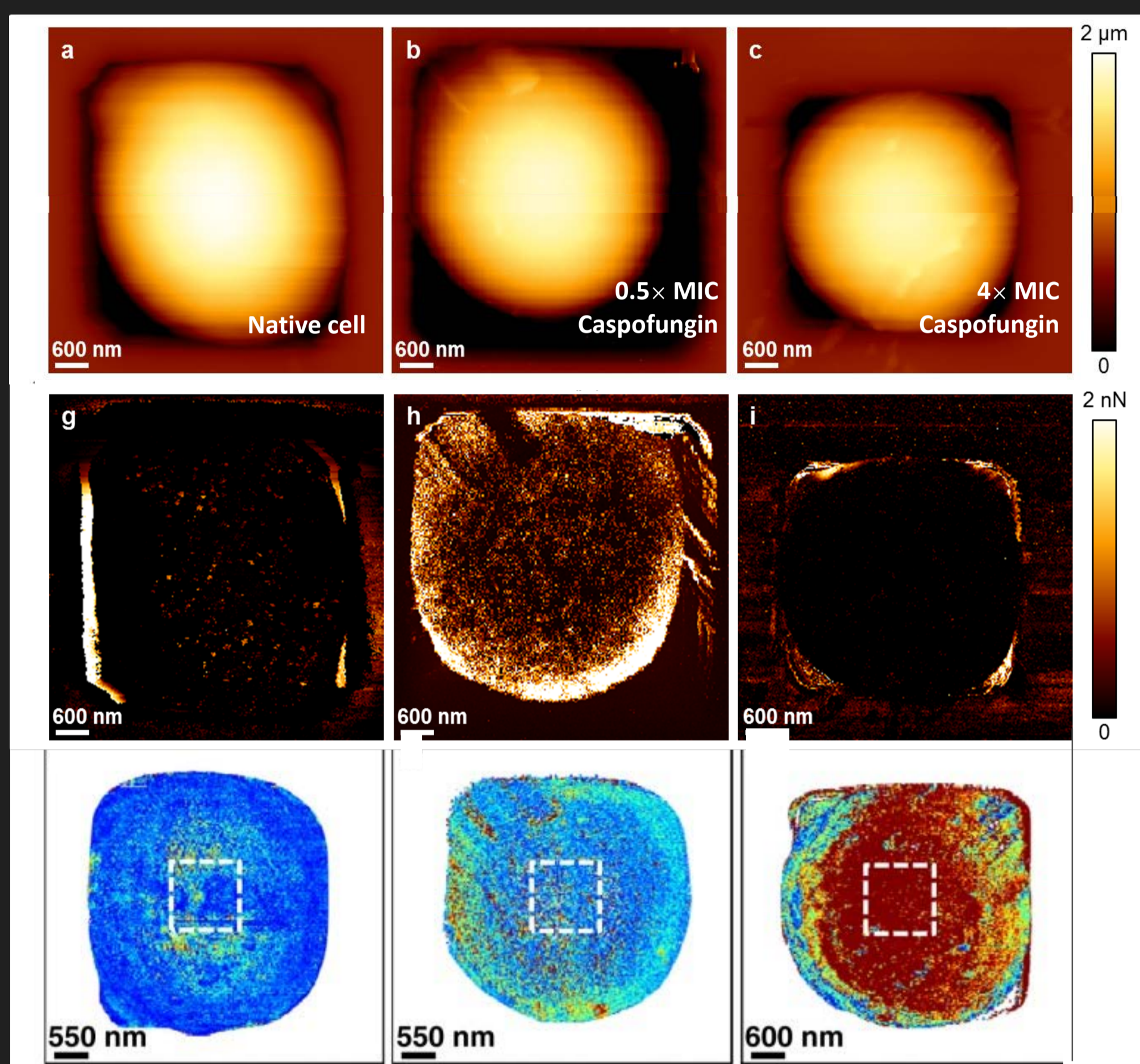
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The Dark Side of the Wall: Atomic Force Microscopy Revelations on Drug Resistance and Adhesion.

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Stress conditions and antifungal drugs induce significant changes in the cell wall composition of yeasts and fungi. They cause modifications of the cell wall molecular architecture, including nature, repartition and attachment of cell wall proteins to the cell surface. **Atomic Force Microscopy (AFM)** is a powerful tool for studying the morphology, nanomechanical and adhesive properties of live microorganisms under physiological conditions. We imaged and measured the biophysical consequences of various stresses on *C. albicans* cells, focusing on changes in cell surface elasticity and adhesive properties.



Nanoscale effects of Caspofungin on *C. albicans* cell wall

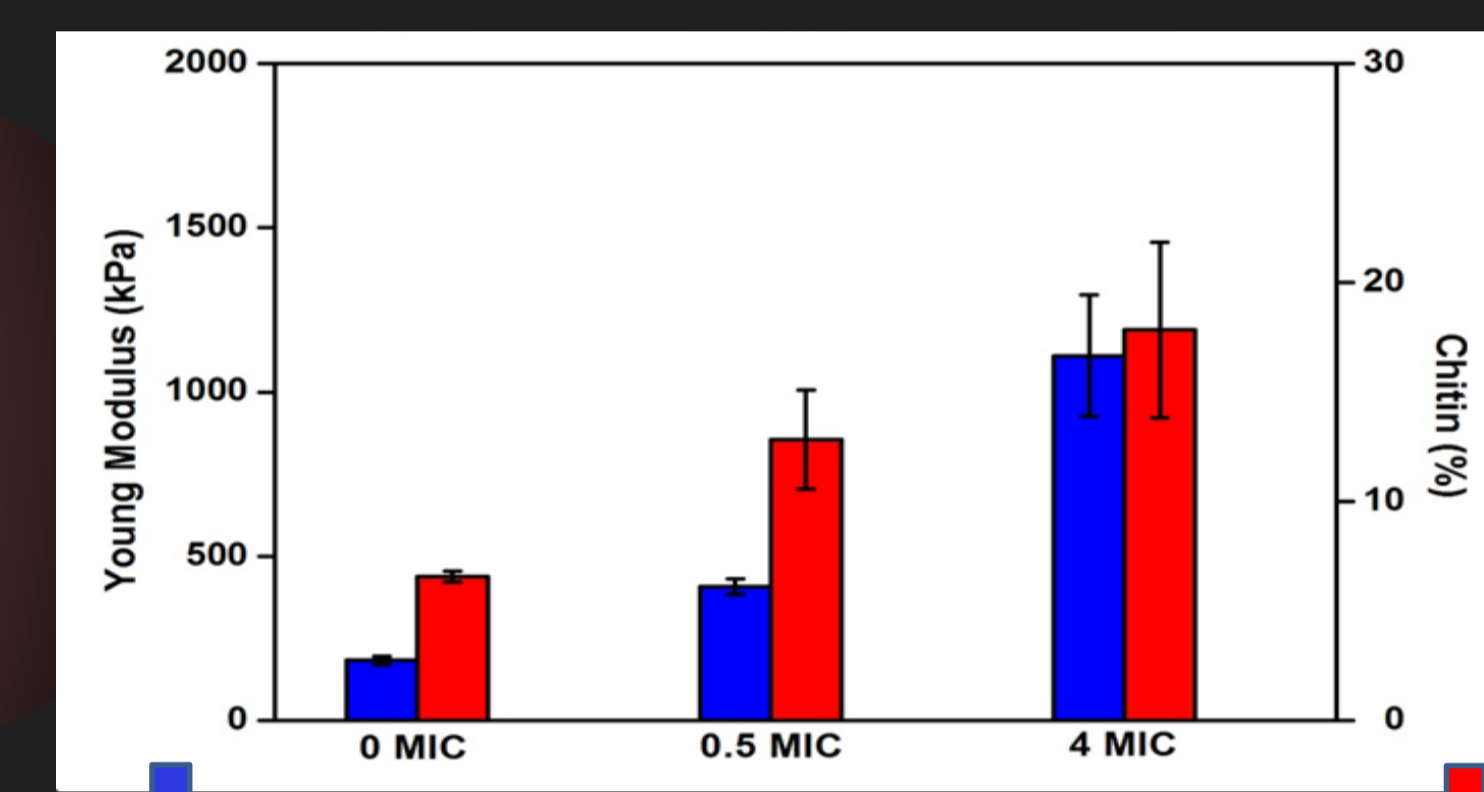
Cell's relief
(= 3D Image)

Adhesion Maps

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

Elasticity maps
(z range = 0.5 MPa)

Caspofungin induces a deep cell wall remodeling, evidenced by nano-mechanical properties and dramatic chitin increase¹.

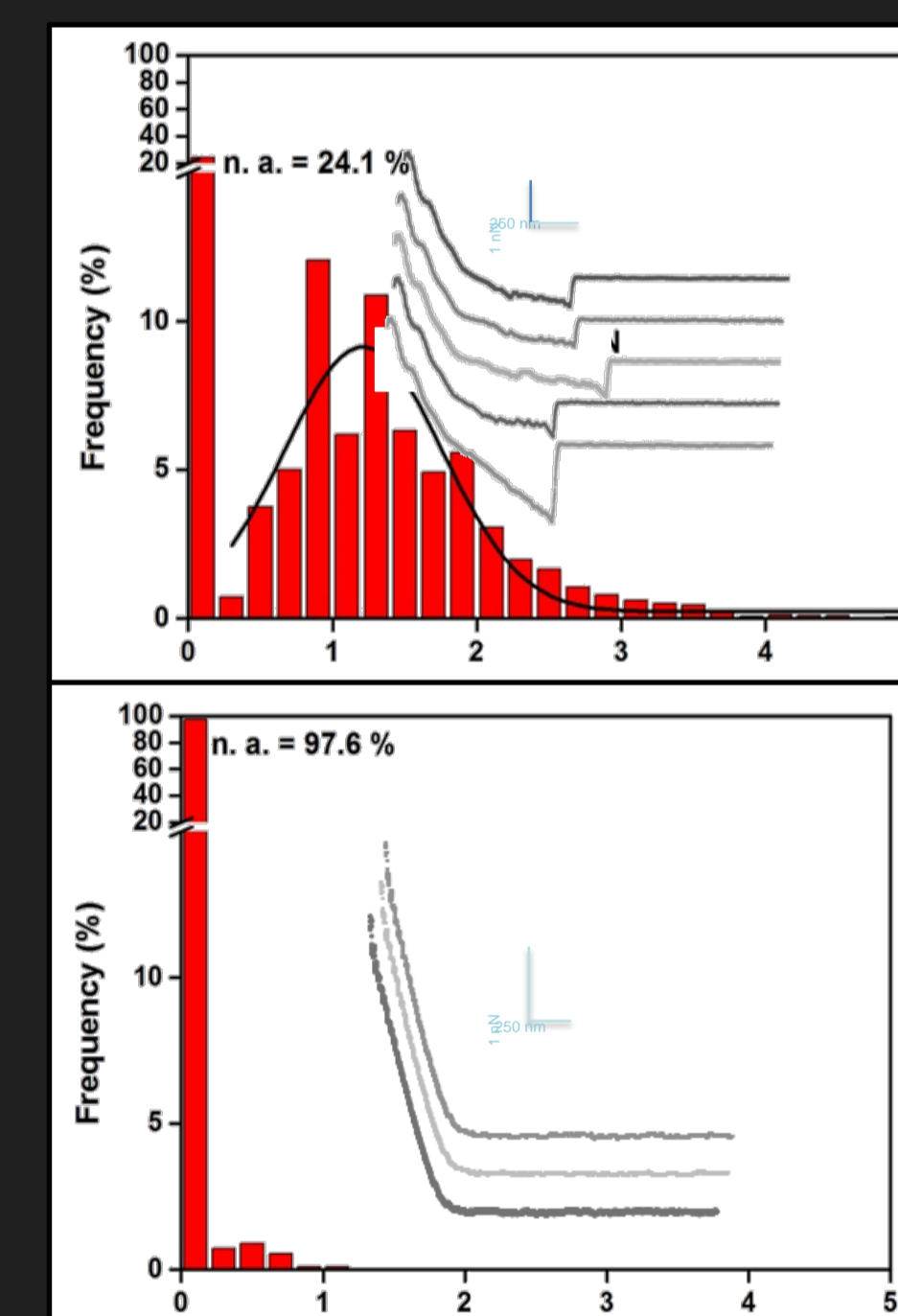
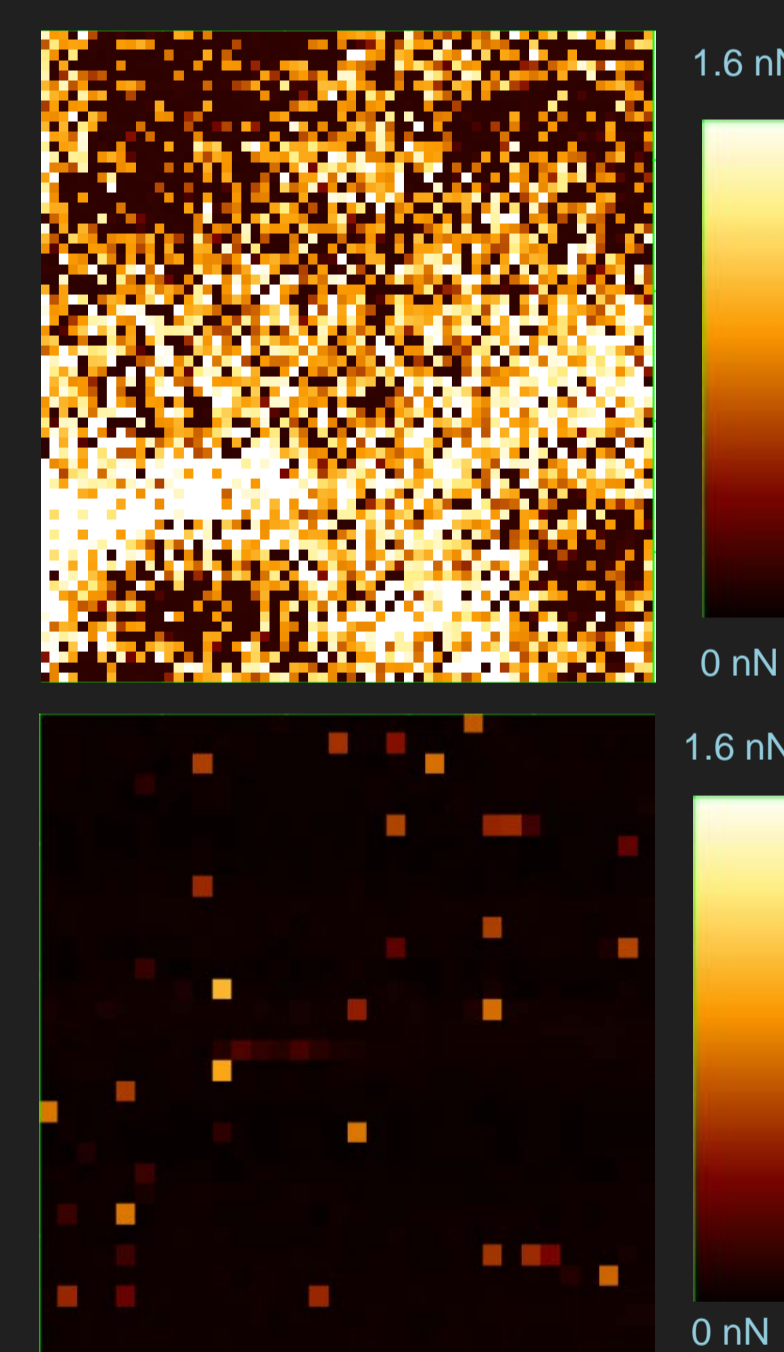


Measuring and mapping Cellular Adhesion

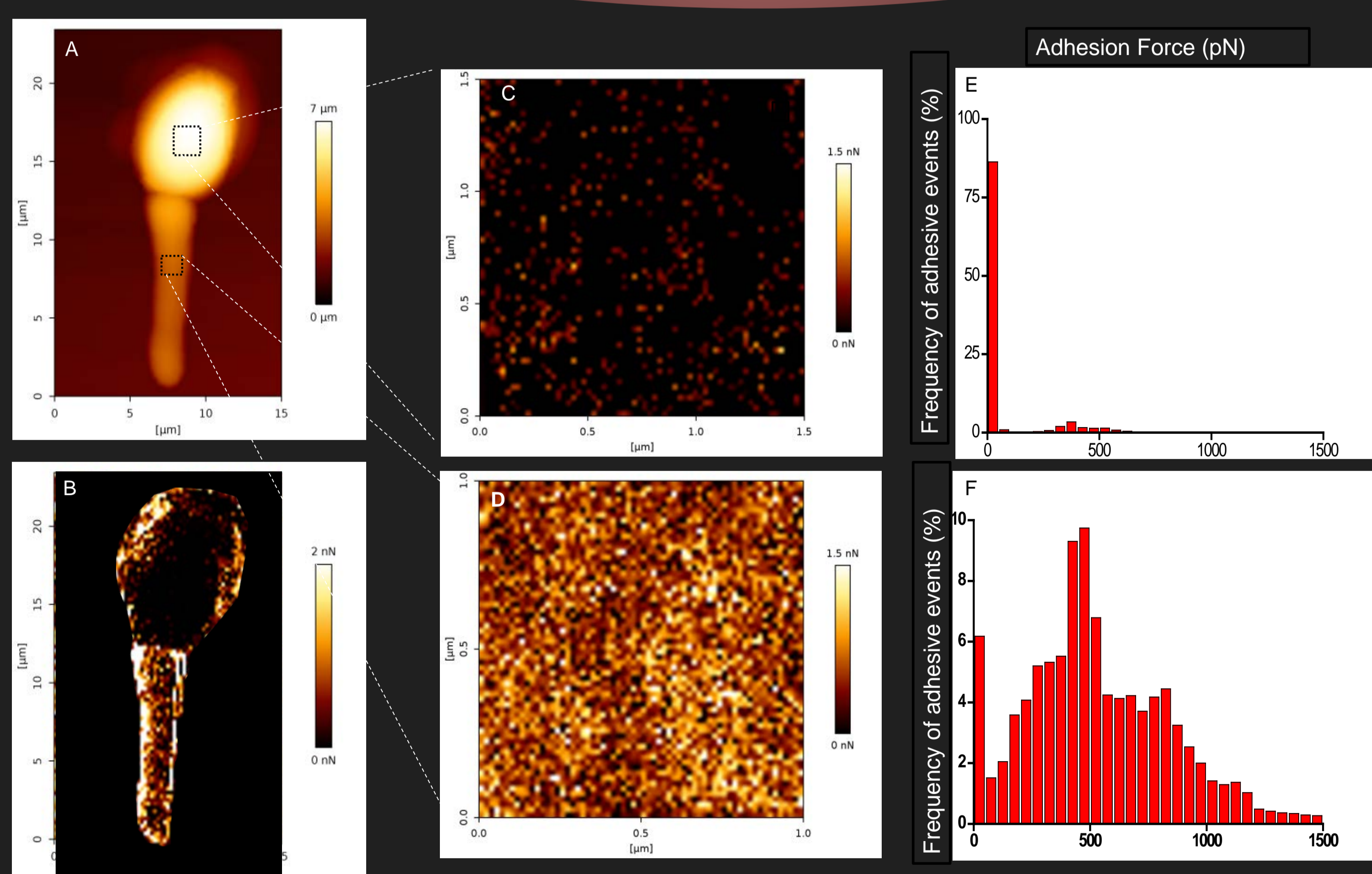
AFM combined with molecular biology enable us to precisely map *C. albicans* adhesins².

PGA22
Over-expressed

Control -



Adhesion force Maps of 1µm², Corresponding histograms representing the adhesion force repartition, and a few representative force curves.



A: AFM height image recorded in QI mode, color scale gives the z range.
B: Adhesion Map of the same cell, recorded with anti-Hwp1 antibody functionalized AFM tip, color scale gives the adhesion force range.
C: Adhesion map recorded on the 1.5µm x 1.5µm dashed square represented on the round cell surface.
D: Adhesion map recorded on the 1µm x 1µm dashed square represented on the germ tube surface
E: Repartition of the maximum adhesion measured on the 4096 force curves corresponding to C map.
F: Repartition of the maximum adhesion measured on the 4096 force curves corresponding to D map

Conclusions and outlook

AFM allow us to unravel morphological effects of stress such as Caspofungin exposure or Osmotic Shock³ on *C. albicans* cells. Moreover, using Single Molecule Force Spectroscopy (SMFS) we can now explore the organization of adhesins, quantify their adhesion forces and map them on the cell surface, including on developing germ tubes.