

# Improving health by nanotechnology

Queensland University of Technology  
Brisbane (Australia)

I part

**Kunle Oloyede, John Bell, Nunzio Motta**

School of Engineering Systems

**Dietmar Hutmacher**

Institute of Health and Biomedical Innovation



a university for the **real** world<sup>®</sup>

CRICOS No. 000213J

# Cell adhesion and growth

- Studies of cell adhesions on flat and nanopatterned surfaces by Atomic Force Microscopy in liquid and SEM
- Cartilage microscopic imaging by AFM in liquid
- Creating new scaffolds for bone cell growth

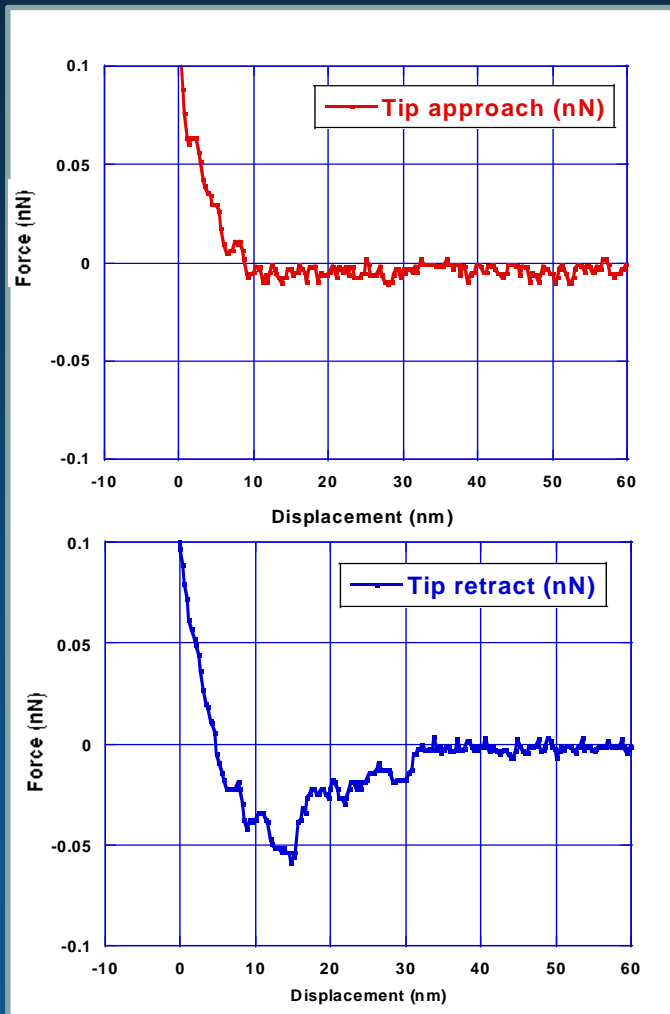
## Instrumentation

- Atomic Force Microscope with liquid head (NT MDT)
- Dual Beam Quanta200 Focused Ion Beam/Scanning Electron Microscope\*
- Environmental SEM\*

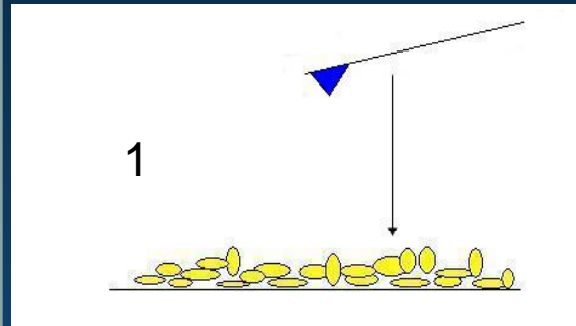
\* Part of AMMRF linked lab facility



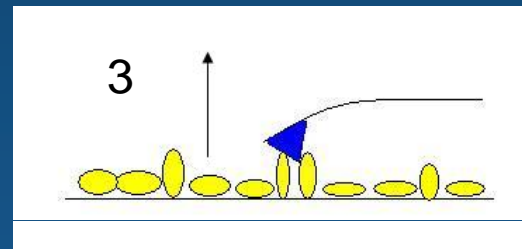
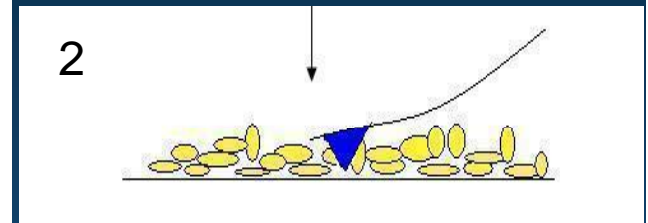
# Adhesion force measurement by AFM



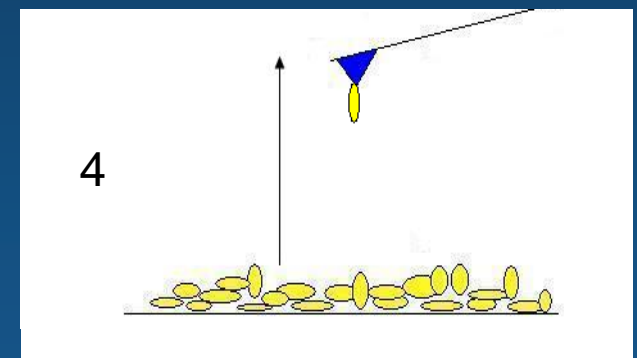
The tip approaches the surface



The tip touches the surface  
The cantilever bends



The tip is leaving the surface  
Stretching BSA molecules



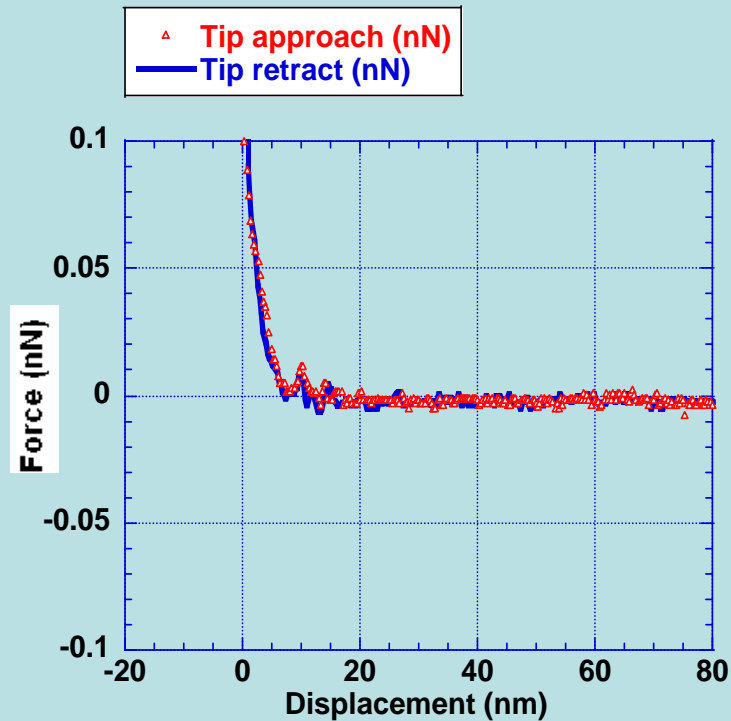
The tip detaches from BSA  
Back to the original position

# Adhesion Force results

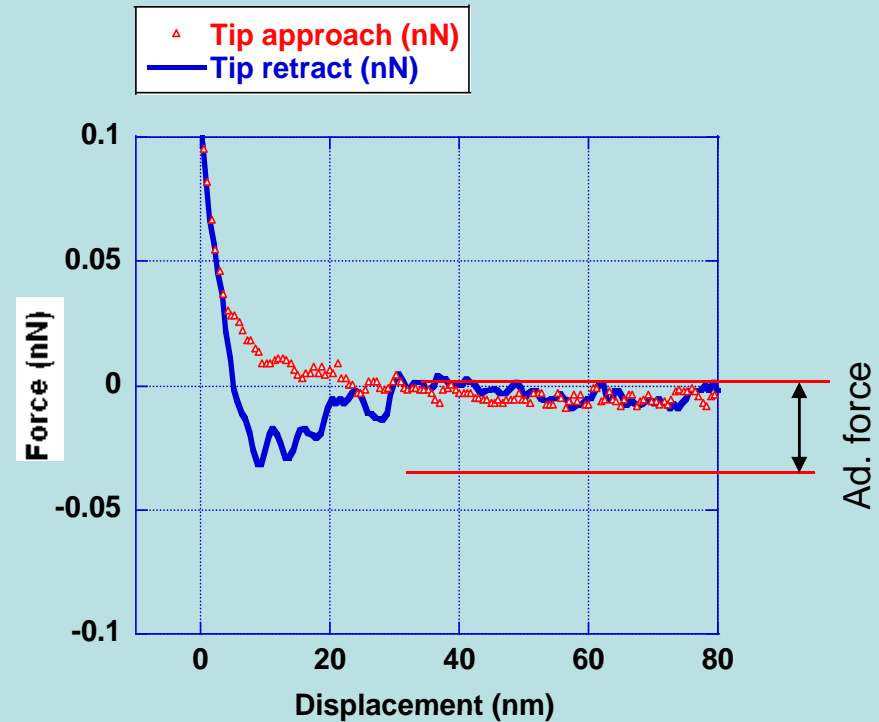
Bare mica

In PBS solution

BSA on mica

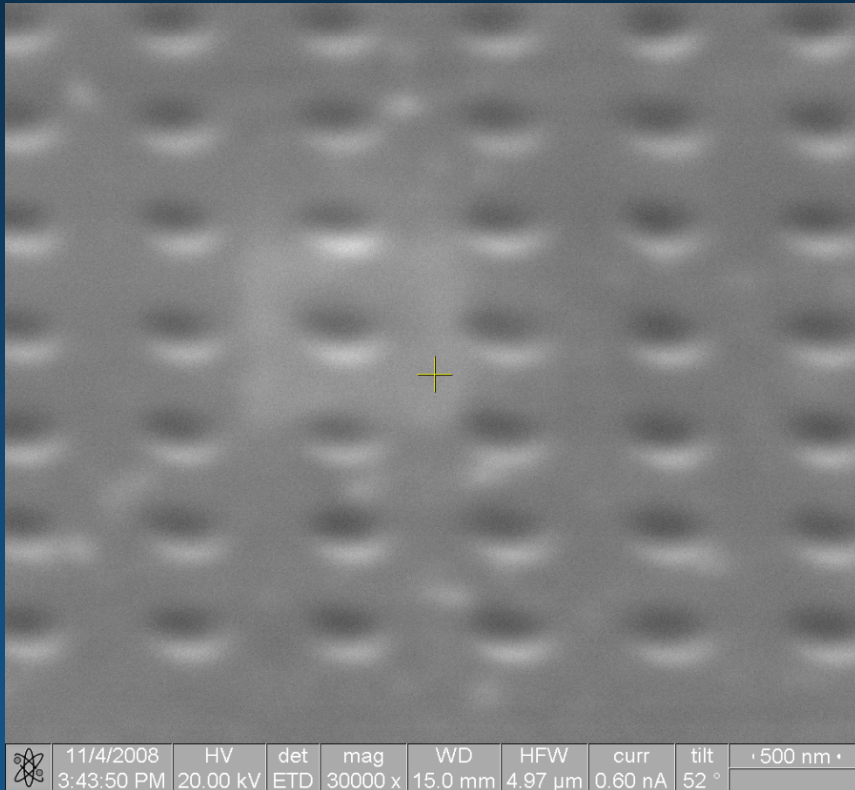


No attractive interactions.

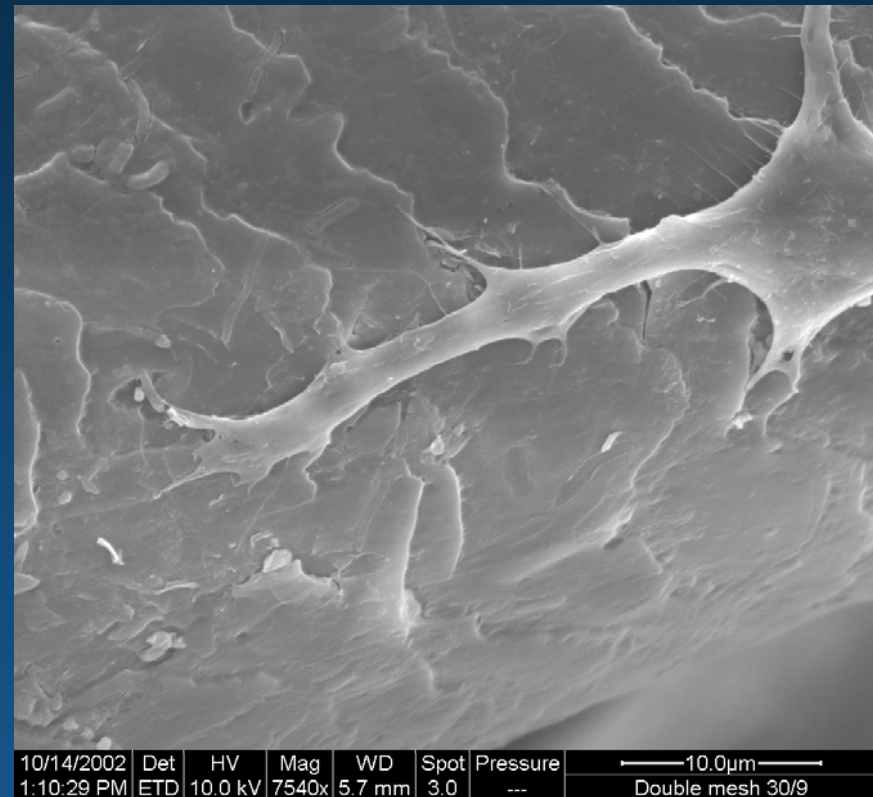


Average adhesion force:  
 $0.036 \pm 0.007$  nN.

# Growth of osteoblasts on patterned substrates

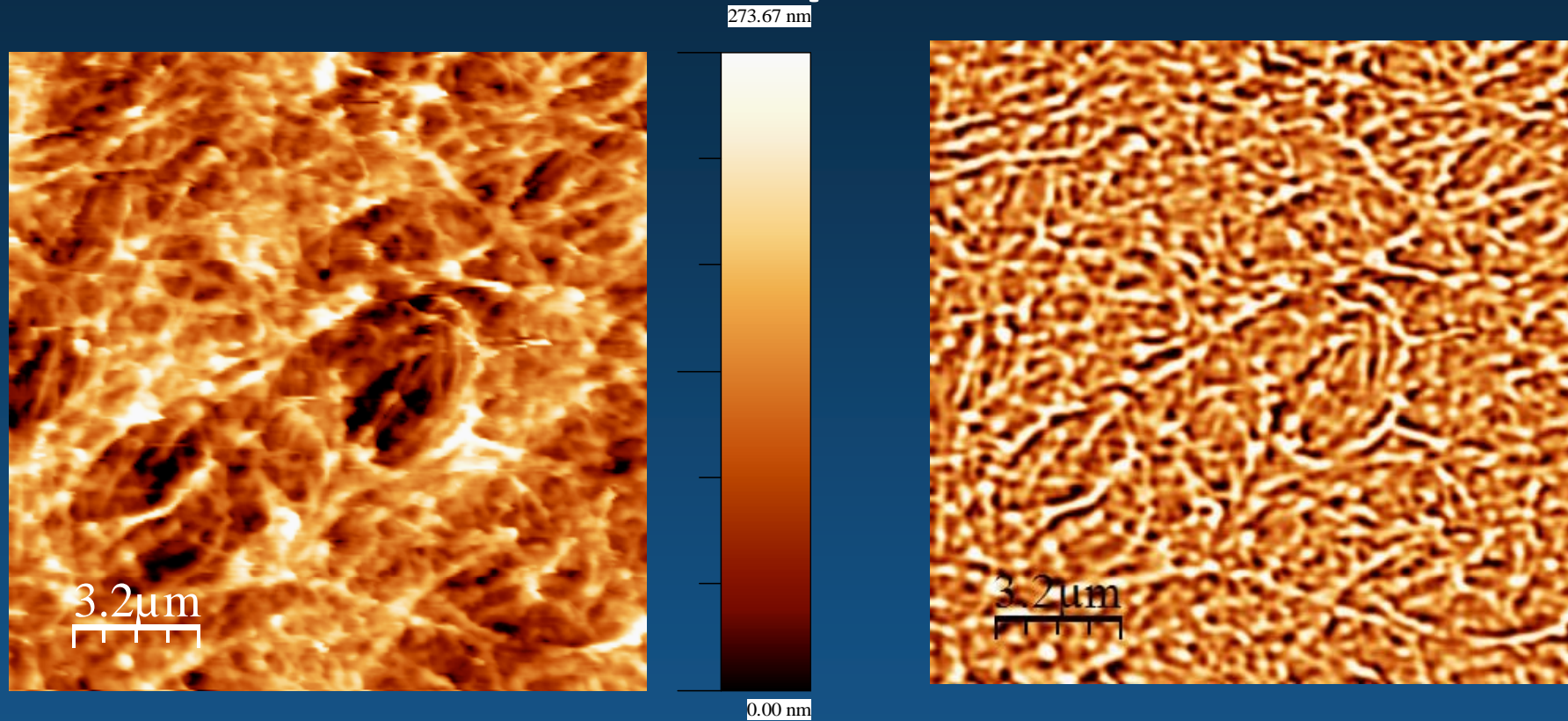


FIB patterned surface



Natural patterned surface

# AFM of cartilage in liquid



AFM topography 16x16  $\mu$ m

Gradient image showing fibres

Cartilage fibrous structure is visible by AFM    Fibre thickness 100-300 nm

# Capabilities

- **Atomic force microscopy**
  - Adhesion of proteins
  - Structure of cartilage
- **Focused Ion beam**
  - Surface patterning
  - Increase adhesion of cells to surfaces
- **Scaffolds for tissues growth**