NANOBIOINTERFACES GROUP

Duncan Sutherland

...from Nanoscale Engineering to Steering Stem Cells.

e-mail: duncan@inano.au.dk
web: nanobiointerfaces.dk

Nanobiointerfaces Group Profile

Nanofabrication
Optical Physics
Surface Chemistry
Materials Science
Protein Biophysics
Stem Cell Biology
Biosensors
Nanotoxicology

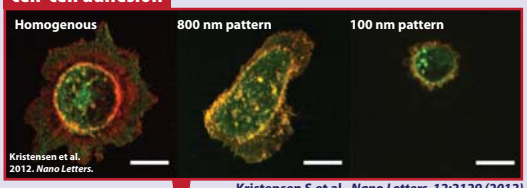
Nanobiointerfaces Group Labs

iNANO House
1592 and 1590

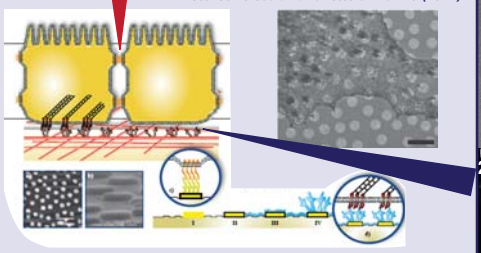
Nanobiointerfaces Group Members

Andreas Andersen, Thea Bøggild, Vladimir Bochenkov, Luisa Filipponi, Joana Guerreiro, Yuya Hayashi, Teodora Micläus, Kasper Runager, Duncan Sutherland, Jing Wang.

cell-cell adhesion



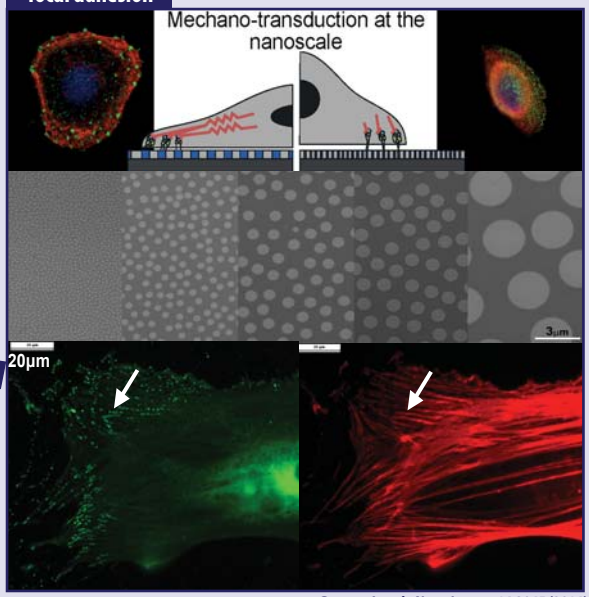
Kristensen S et al. *Nano Letters* 12:2129 (2012)



Within the group we use nanoscale engineering to study cell biology. For example we use nanopatterned proteins to study how many adhesion molecules are required for the formation of cellular adhesions .

Above: E-Cadherin nanopatterns must be above 200 nm to support cell-cell adhesion formation.

focal adhesion



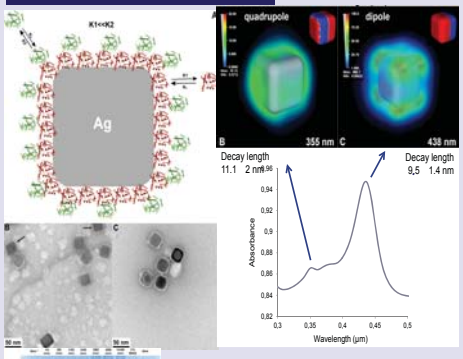
Gautrot J et al. *Nano Letters* 14:3945 (2014)
Cole M et al. *Submitted*

Mechanical surroundings of a cell regulate its differentiation. We use protein nanopatterns to understand how cells sense their surroundings and transduce mechanical force in biochemical signals.

Above: Top - Human Epidermal Stem Cells: Center - Protein nanopatterns formed on nanofabricated substrates: Bottom - Human Mesenchymal Stem Cells (Actin Cytoskeleton in Red, Focal adhesions in Green Nucleus in Blue)

Protein Biology at Nanoparticles

nanoparticle-protein corona



Micläus T et al. *Nano Letters* 14:2086 (2014)

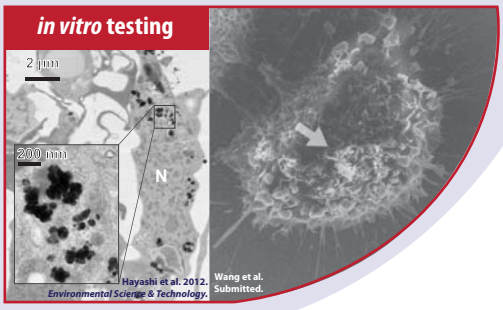
A real worry for the future of nanoscience and nanotechnology is that fear over the dangers posed by nanomaterials may cause the public to reject it.

Here we study the risks for toxic effects from nanoparticles. We focus on how proteins binding at nanoparticles (the protein corona) are involved in determining nanoparticle toxicity.

Left: formation of nanoparticle-protein corona studied using LSPR,TEM and gel electrophoresis.

Right: electron microscopic imaging depicts localisation of nanoparticles in the cells and on the cell surface membranes.

***in vitro* testing**

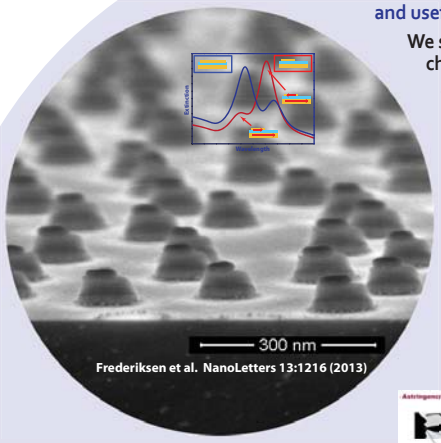


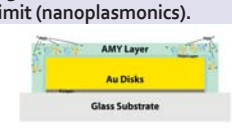
Cell Biology at Nanostructures

Nanostructured materials can have new, interesting and useful properties.

We study the physics and chemistry of nanostructured surfaces and thin films, and apply them to as chemical and biological sensors or as functional materials for energy applications.

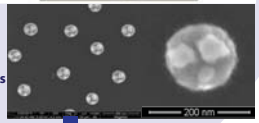
For example metallic nanostructures can trap and focus light below the diffraction limit (nanoplasmonics).





Above: Asymmetrically-stacked gold nanodisks to study hybridisation of plasmon resonances.

Right: Wine Sensors (Astringency) and Chiral Optical Elements Guerreiro JRL et al. *ACS Nano ASAP (2014)*



Matteo Todeschini Masters Thesis

Functional Nanostructures

Potential projects for you

- Nanopatterning proteins for studying cell biology (Cleanroom and cell lab)
- Nanoparticle-protein interaction and toxicity (Cell lab)
- Nano-scale optics for ultrasensitive biosensors (Cleanroom)

Contact Assoc. Prof. Duncan Sutherland (duncan@inano.au.dk)