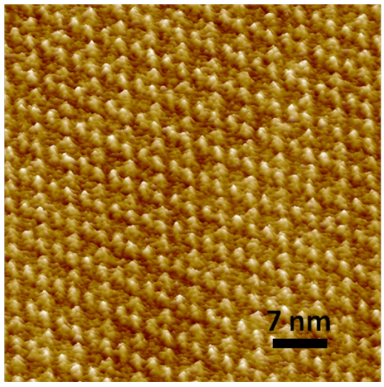
Visualising and probing biomolecular machines by Atomic Force Microscopy

PhD studentships at the London Centre for Nanotechnology



The living cell relies on intricate biomolecular machinery to perform its functions, whether it is to grow, specialise, move or simply to persist in spite of the disordering thrust of thermal fluctuations. Biomolecules behave according to physical principles that are very different from the machines and motors that we know in our daily-life experience. In addition, basically any disease has its origin in the perturbation of their normal operation. Nevertheless, for most molecular machines in the cell, our understanding is at best fragmentary. We use Atomic Force Microscopy (AFM) to provide a nano-scale and life access to biomolecular machines at work, and focus on three different strategies to unravel structure, physical properties and function of biomolecules:

- Real-time visualisation of opening and closing of membrane proteins under native conditions. To this end, we develop technology to enhance imaging speed, as well as methods (sample preparation, mutants) to bring the time-scale of conformational changes within an experimentally accessible range.

- Probing and subsequent modelling of visco-elastic properties of sub-cellular machines, with nuclear pore complexes as a particular example. We image and probe larger molecular complexes, and use physical modelling (polymer physics, e.g.) to interpret the results in terms of structural and functional information.

- Imaging structure and electrical charge density biomolecules. We use Kelvin probe techniques to obtain a measure of the surface charge density on biomolecules in air, and currently develop methods to measure screened charges in aqueous environments as well. This enables us to access physically and biologically interesting electrostatic interactions at sub-molecular scale.

This work is carried out in Dr. Bart Hoogenboom's interdisciplinary research group, where we develop and use some of the most advanced methods for high-resolution AFM in aqueous environment. We are well embedded in London's strong biomedical research community and are based in the London Centre for Nanotechnology, on the campus of University College London (central London).

We currently have two PhD studentships available for highly motivated, experimentally and analytically skilled students. Interested candidates with a background in experimental physics, engineering, or molecular biology are invited to contact Dr Bart Hoogenboom (b.hoogenboom@ucl.ac.uk) for more details and project descriptions.

For more information, see also:
http://www.london-nano.com/content/contactlcn/lcndirectory/hoogenboombart