Report of STSM: AFM studies of radiation damage to DNA

Host: Dr Hauke Clausen-Schaumann (HCS)
Host institution: Munich University of Applied Sciences, Munich, Germany
Visitors: Dr Sharon Moore, Ms Malgorzata Smialek, The Open University (OU) Milton Keynes, UK
Mission date: 20-25th June 2006

Aim: acquisition of reproducible DNA images by AFM.
At the time of the visit the only AFM available and suitable for our work was the JPK AFM. This is a top of the range AFM particularly suited to imaging biological samples in tapping mode either in air or liquid. The tips are mounted in a different manner to the Explorer that we routinely use. The tips come as large wafers which need to be separated manually for mounting. We spent some time learning how to mount the tips and setting up the JPK for tapping mode imaging. The actual set up is very similar to the Explorer

The sample preparation was done using NiCl supplied by HCS at a concentration of 2.5 mM. DNA was diluted to a concentration of 2-5 ng/µl and applied to a mica surface for 1 min and rinsed. The main difference to our sample prep was in the force of the drying procedure. We don't need to be as careful as we had thought.

Mica (GMBH) supplied by HCS was compared with our own (Agar Scientific) and we achieved images similar to those obtained at the OU. The main difference was in the cutting and cleavage of HCS mica which cleaved much more easily than our own.

Tapping mode images were acquired relatively easily in air at 0.5Hz scan rate for a 10x10 µm image. To check for optimum setup a force curve was acquired which should be smooth and no peaks. The optimum setpoint can be determined from the force curve. For DNA samples topography and error signal images were acquired. However, imaging in liquid proved to be more problematic as we have found previously. In air the AFM can be set up and left imaging. In liquid it needs to be constantly monitored and modified to maintain optimum feedback and good images. The quality of the images was much better than that obtained with the Explorer but the maximum scan size was 10 um which will give better resolution than a 100um regardless of anything else.

Conclusions

We appear to be doing everything correctly with regard to sample preparation. The mica source may be a problem so try different suppliers (e.g. GMBH). Some useful points relating to the AFM were learnt particularly the use of force curves to check that the tip and feedback parameters are set correctly.

Future collaboration

Dr Clausen-Schaumann will be happy for either of us to visit in the future to analyse samples by AFM subject to the AFM being available.