Abstract

Living cells readily deform under the minimum force required to perform an AFM measurement precluding the imaging of membrane protein complexes. Attempts to use feedback methods such as Q-control have failed to improve the image quality. I will discuss why Q-control does not provide an advantage for imaging in solution. Instead, the thermal force-noise of the cantilever is the principal limitation to reducing sample deformation. Minimizing a cantilever's cross-section reduces its noise significantly and the minimum size of the cantilever is currently limited by a conventional deflection detection scheme, which requires a large surface area for laser specular reflection. I will present an optical deflection detection technique enabling the use of nanowires as cantilevers and show that we achieve a force noise in water that is orders of magnitude gentler than conventional AFM. This is a significant milestone towards non-invasive scanning probe imaging of biological processes on the surfaces of vesicles and cell membranes. Lastly, I will discuss our use of alternative scan algorithms and data processing for high-speed imaging and the capture of protein dynamics.