# Life Science SPM

## TopoMetrix Scanning Probe Microscopes for Biological Solutions

Explorer Life Sciences AFM interfaced with Zeiss inverted microscope

Scanning Probe Microscopy is a powerful new microscopy technique offering insights into the imaging and measurement of biological systems. A SPM permits visualisation of features that may not observable in other ways. It not only provides three dimensional imaging in air or liquid with nanometre resolution, but also enables measurement of physical and chemical properties of the surface.

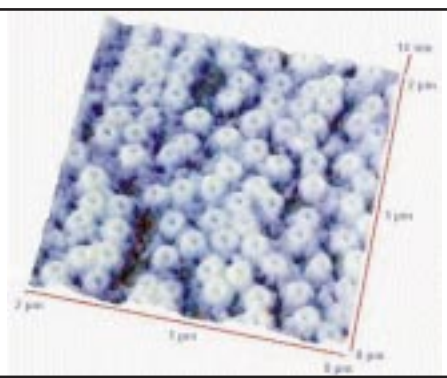
The TopoMetrix™ Explorer LifeSciences SPM™ interfaces with commercial optical microscopes to offer a complete range of optical and SPM imaging modes. It provides researchers with the best of both worlds, the use of their familiar inverted optical microscopes while simultaneously obtaining 3-D images of the same sample to nanometre levels and without special sample preparation.

In contact AFM mode, 3D topographic images can be acquired simultaneously together with force modulation and lateral force images using TopoMetrix SPMLab™ software. In addition, non-contact and Near Contact™ AFM modes allows high resolution imaging of soft biological samples using both amplitude and phase detection methods.

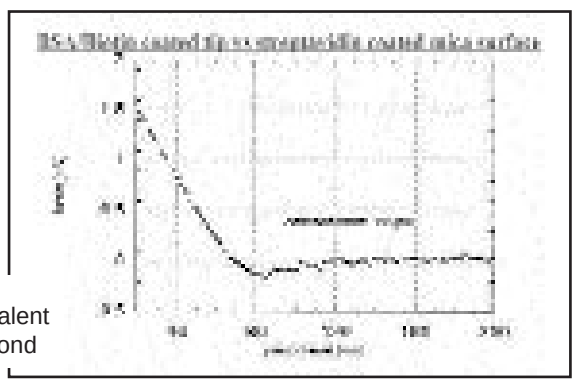
Among its applications in imaging and measuring biological systems, AFM has been shown to be useful for:-

- 3D imaging of cells in a liquid or culture medium while changing buffer or drug concentration to observe reactions, interactions or physical changes such as biodegradation.
- Measurement of molecule:molecule or molecule:receptor binding forces with pico-Newton sensitivity and nanometre spatial resolutions. This enables the measurement of interactions, adhesion forces and even receptor mapping.
- High resolution molecular imaging in a wet or hydrated state without cryo techniques, fixing or coating.
- Surface roughness measurements plus friction, compliance and adhesion measurements of materials such as bio-implanted substrates and surfaces.

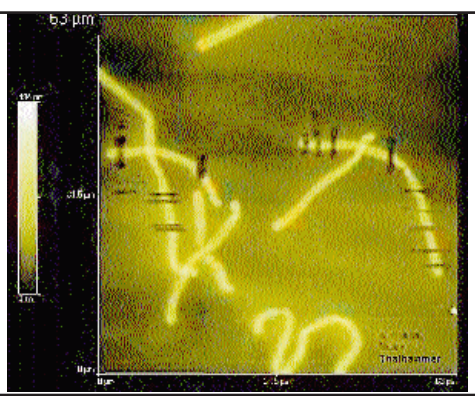
Shown below are some AFM images and measurements of biological materials exhibiting the detail that can be obtained with this new technique.



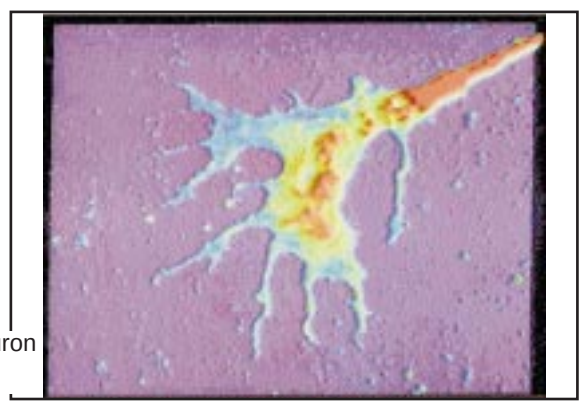
Nuclear pore channels of Xenopus Oocytes (2x2µm)



AFM force-distance curve measures covalent Biotin-Streptavidin bond



Laser cuts in Chromosomes imaged with AFM (63x63µm)



Rat hipocampal neuron growth cell culture

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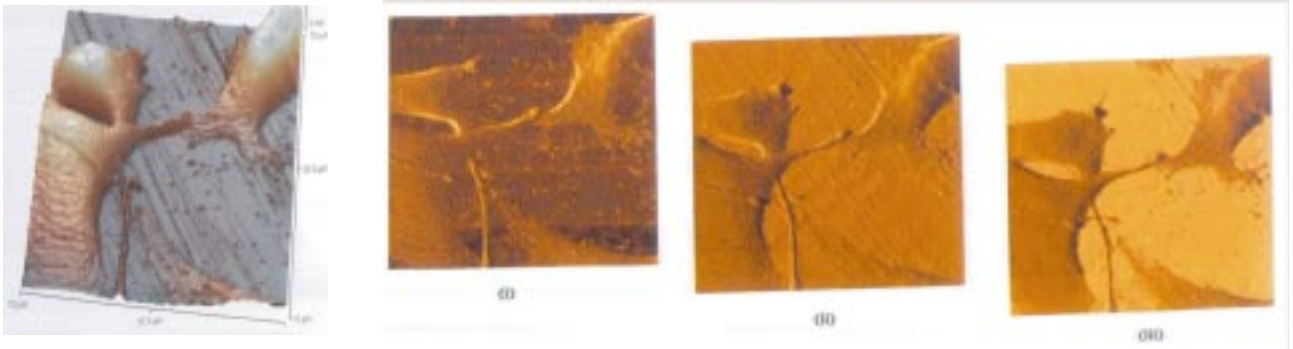
More AFM images of Biological materials:- these images are of a fibroblast cell mounted on a glass cover slip. The image on the left shows the normal topographic display of the cell taken in contact mode.The other images were acquired using the technique of Layered Imaging where the probe builds up a series of images at different interaction forces. This reveals detail below the cytoplasm showing the cytoskeleton in (iii) without any treatment or staining.

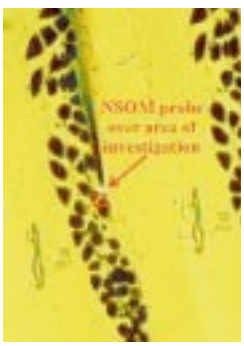


## NSOM Combining Optical Microscopy, AFM & Near-Field Scanning Optical Microscopy

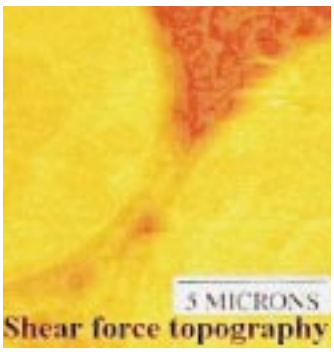
Near-Field Scanning Optical Microscopy (NSOM) breaks the optical diffraction barrier to enable optical properties of biological materials to be studied with a resolution of 50 nm. When a small-aperture tapered optical fibre is placed in close proximity (the near-field) to the sample, sub-diffraction optical resolution can be obtained. Fluorescence, luminescence, and spectroscopy experiments with single molecule sensitivity can be performed with a resolution unmatched by any other technique.

TopoMetrix Lumina™ interfaces with inverted optical microscopes to combine optical microscopy with Atomic Force and Near-Field Scanning Optical Microscopy. Using a unique integrated design, all three techniques can be applied to the same sample area in a matter of minutes. TopoMetrix NSOM probes mount on unique tuning fork sensors allowing imaging to be performed without the need for laser alignment, thus simplifying the setup process.

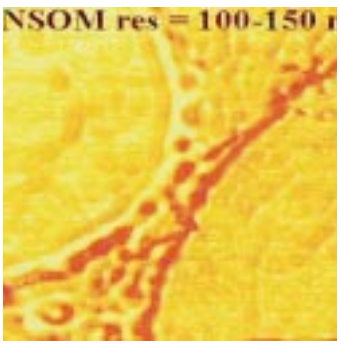
These images of heart muscle tissue show how Lumina's inverted optical microscope is used to locate an area of interest on which simultaneous AFM topographic and near field NSOM images are obtained at high-resolution.




Optical Image




AFM image




NSOM image

If you'd like to find out more about these exciting techniques and how TopoMetrix SPM products can give biologists new insight into the nano world of your materials, contact us by phone, fax or EMail. Why not visit our Website where further information on our products and their application may be found? **http://www.topometrix.com**

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VISUALIZING THE MICRO WORLD

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