The NSOM Technique And It's Significance

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Prior to Near-Field Scanning Optical Microscopy (NSOM) there were two major light microscopy techniques; optical and confocal.

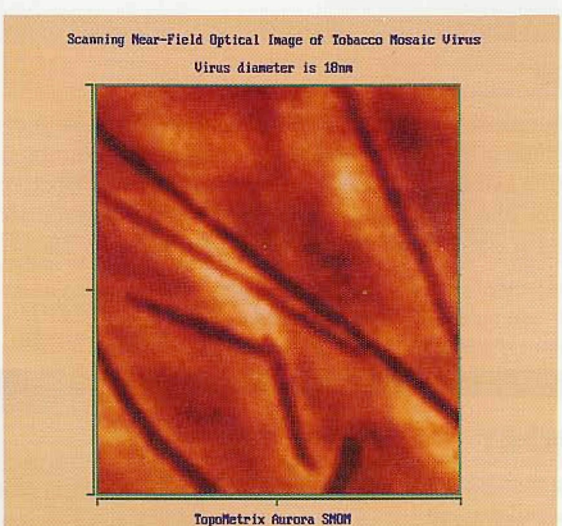
In an optical microscope a sample is illuminated with a flood of light. The lighted area is then imaged and magnified by collecting the light that is either reflected from or transmitted through the sample by a series of glass lenses. A color magnified image of the sample may be seen directly or displayed on a TV screen. Even if the lenses could be made perfectly, the resolution and magnification of an optical microscope are limited by diffraction effects to approximately one half of the wavelength of the light that is used. Optical microscopes are used routinely to image the general shape of samples as small as human chromosomes or compact disk bits.

In a confocal microscope, the sample is illuminated with a focused spot of laser light instead of a flood. This spot is scanned over the sample and the light is collected in a way which allows an image to be displayed on a computer screen. The magnification system is the same as the optical microscope, however, the small laser spot used in a confocal microscope allows about a 40% improvement in image resolution, and the ability to produce a 3-D image. A compact disk bit could be seen and profiled.

In a near-field scanning optical microscope the sample is illuminated with laser light, but the light is confined in a fiber optic guide. The fiber is prepared by tapering one end to allow only an extremely small exit for the light. The final shape looks like a microscopic eye dropper. This fiber guide is no bigger than a human hair and is tapered so that the end is a few atoms wide. Using techniques common for a scanning probe microscope, this fiber end is held very close to a sample surface and scanned. The magnified image of the sample is then displayed on a computer screen. This small, nanoscale, light source allows more than an order of magnitude better resolution that the best optical or confocal microscope. A near-field scanning optical microscope can be used to see extensive details in a chromosome, image much smaller structures such as viruses, and even make meaurements from single molecules. ■

RELATIVE SIZE OF OBJECTS

Object	Size
Small Pin Head	800 µm
Human Egg	100 µm
Human Chromosome	2.5 µm
Compact Disk Bit	1 µm
Virus	05 µm
Large Molecule	007 µm



(For more detailed scientific information see "Super-Resolution Imaging Spectroscopy", T.D. Harris, R.D. Grober, J.K. Trautman and E. Betzig. *Applied Spectroscopy*, Volume 48, Number 1, 1994.)