

Instrument Types

Different microscopes have different uses.

Wide Field Microscope

Wide field microscopes illuminate the whole field of view at one time. Imaging is fast, but out of plane information is included as blur. There are computational methods that can reduce, but not eliminate the blur (e.g., deconvolution and extended depth of focus).

The Cell Imaging Core has wide field imaging systems. These include:

- EVOS Auto Color and Fluor
- Nikon Automated Widefield
- DeltaVision Widefield
- Axio Scan.Z1 Slide scanner ([details](#))
- Axioscan 7 Slide scanner

Confocal Microscope

Laser Scanning Confocal

A scanning confocal illuminates one spot at a time and scans across the field of view. There is also a pinhole to limit out of focal plane blur. The result is a sharper image. Further, they can be used to image the sample in 3 dimensions. This does come at the expense of a much longer imaging time than wide field.

- Zeiss 700 Confocal ([details](#))
- Nikon A1R Confocal
- Leica SP8 Confocal
- Zeiss 880 Airy Scan
- Olympus FV1000

Spinning Disk Confocal

A spinning disk confocal uses several pinholes to gather data from multiple spots at one time. Like a wide field, the spinning disk confocal uses a camera instead of a single point detector. These two changes greatly reduce the imaging time, making them suitable for live cell imaging.

- Leica Spinning Disk
- Nikon Ring TIRF or Spinning Disk Confocal

Multi-Photon

2-photon/multi-photon microscopes rely on 2 or more simultaneous lower energy photons to stimulate fluorescence. One of the main advantages of this method is that the lasers can penetrate deeper into the sample. It does require a more powerful laser and working in the IR. Applications include samples up to a few mm thick and intravital microscopy.

- Prairie Multi-Photon Confocal
- Prairie Ultima InVivo 2 Photon GaSP

Super Resolution

Resolution in microscopy is diffraction limited to roughly half the wavelength of the light being detected. Super resolution methods use additional information to break through the diffraction limit. This can be extra spatial or temporal information and may require additional data collection as well as additional computation to generate the high resolution image.

Airy Scan

In an Airy scan microscope, multiple detectors are used to interrogate the spatial blur or Airy pattern. This additional information is then used to reduce the blur, achieving higher resolution than normal confocal.

- Zeiss 880 Airy Scan

STED

STimulated Emission Depletion uses a laser to deplete emission around the focal spot. This provides much higher lateral resolution. This is one of a few super-resolution microscopy methods.

- StedyCon

Structured Light

If several images are made with known patterns of light, the images can be combined to create a higher resolution image.

The Nikon Spinning Disk uses structured light to in its LiveSR unit.

- Nikon Ring TIRF or Spinning Disk Confocal

TIRF

Total Internal Reflection Fluorescence microscopy achieves thin Z sectioning at the expense of only being able to image the first thin ($<200\text{nm}$) layer of the sample. It does have a high signal to noise ratio because there is very little out of plane fluorescence. This makes the method useful for for events in cellular surfaces.

- Nikon Ring TIRF or Spinning Disk Confocal

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