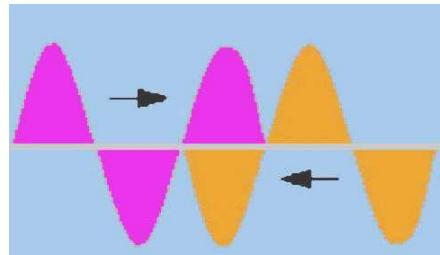
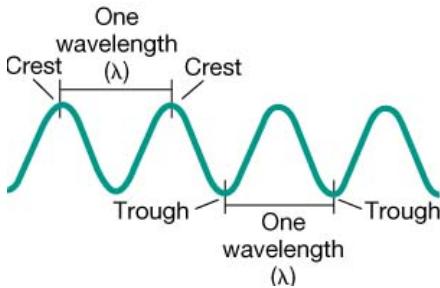
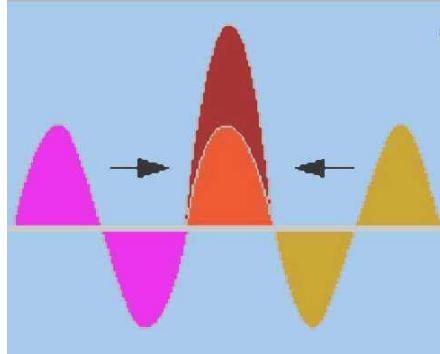


Evolution of Resolution

Under
Optical microscope

Light

- Properties of light



Polarization of Light Waves

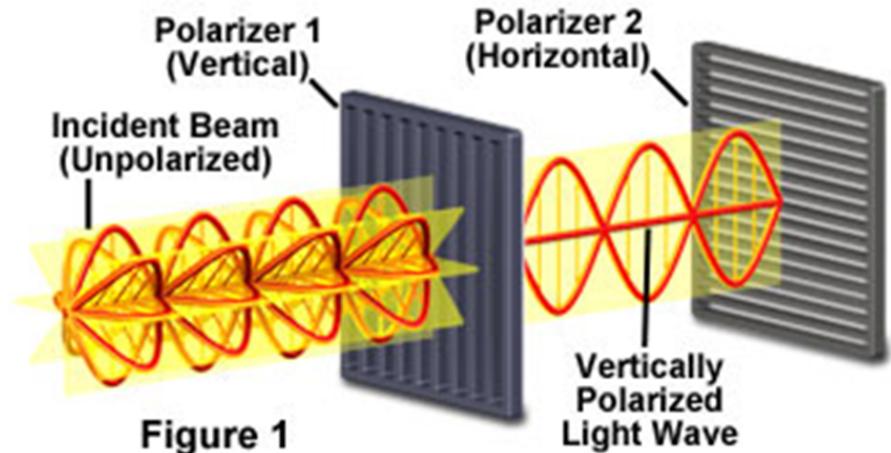
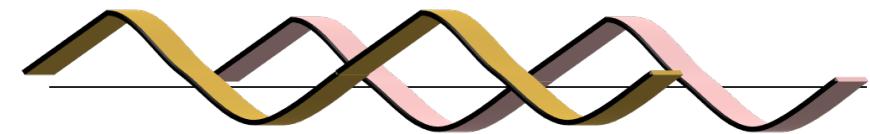


Figure 1



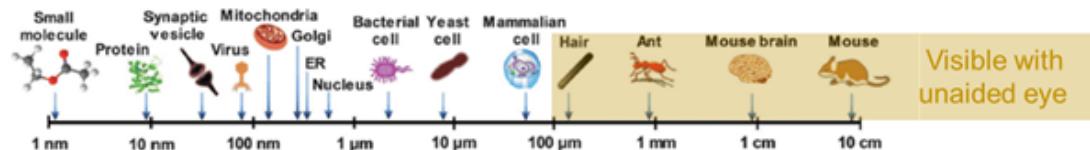
Similar waves with different phases



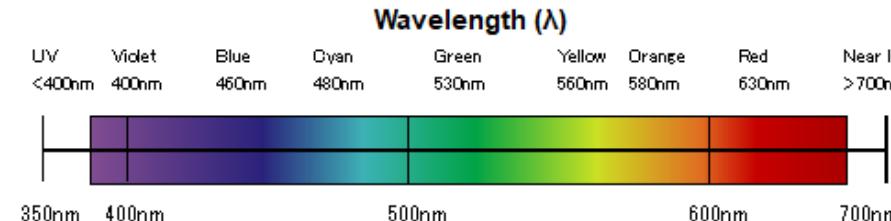
Resolution



Why we need a Microscope ?



$$\text{Resolution } (d) = \lambda / 2 \text{ NA}$$

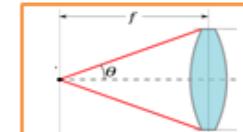


$$\text{Numerical Aperture} = n \sin\theta$$

Refractive index of the medium:

$$n = c/v$$

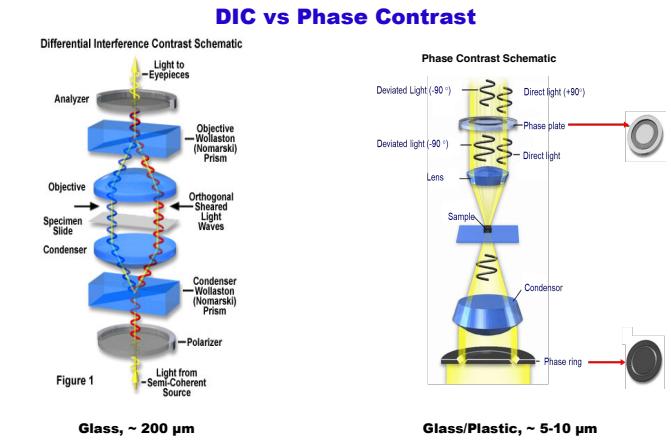
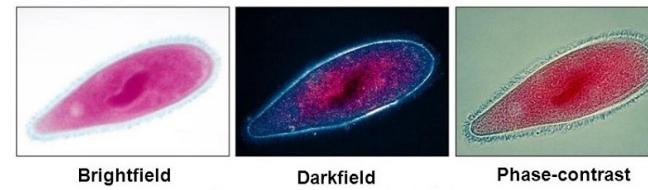
$n \approx 1$ for Air; $n \approx 1.4$ for Oil



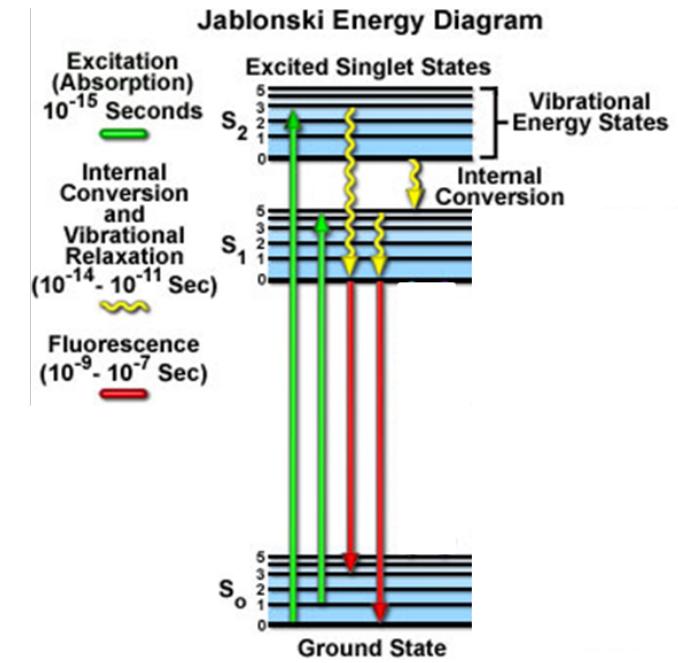
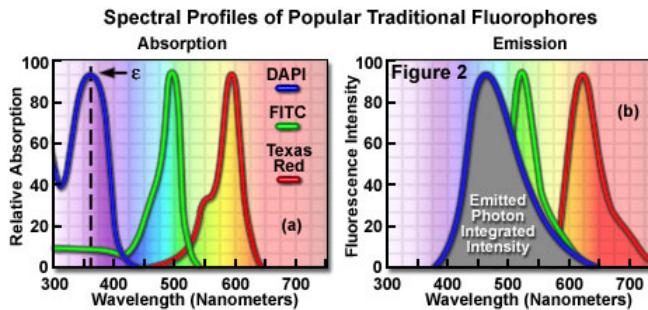
Contrast Methods

- Bright field
- Dark field
- Phase contrast
- DIC
- Hoffman Modulation
- Relief contrast
- Fluorescence

Contrast & Color

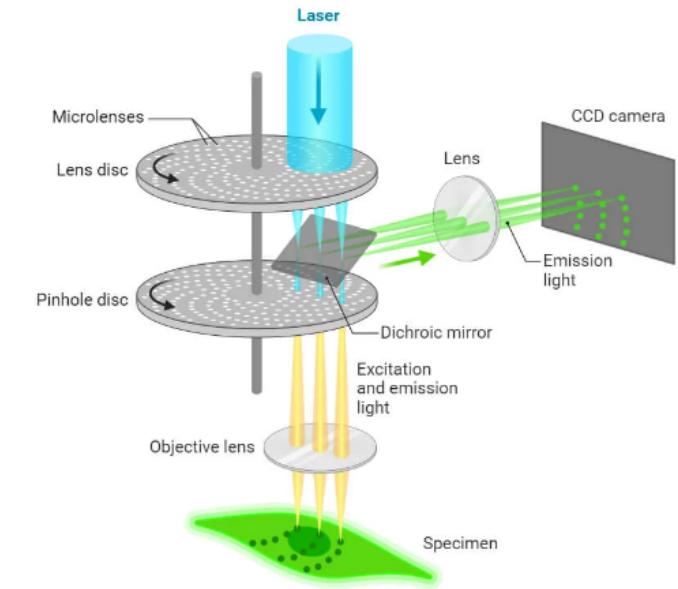
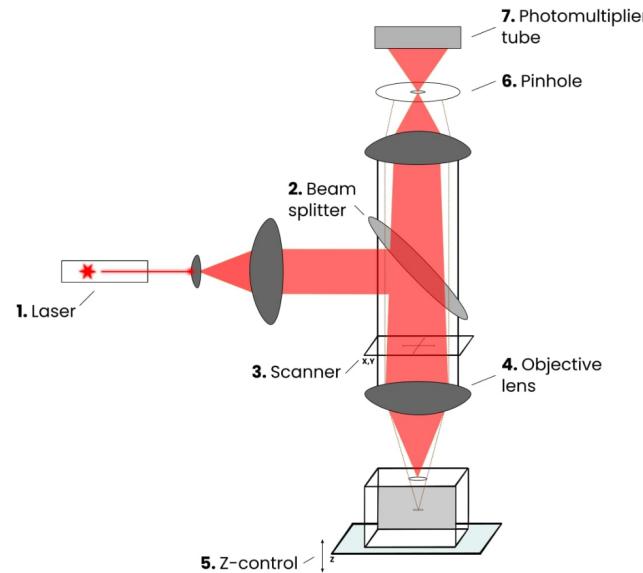


Fluorescence

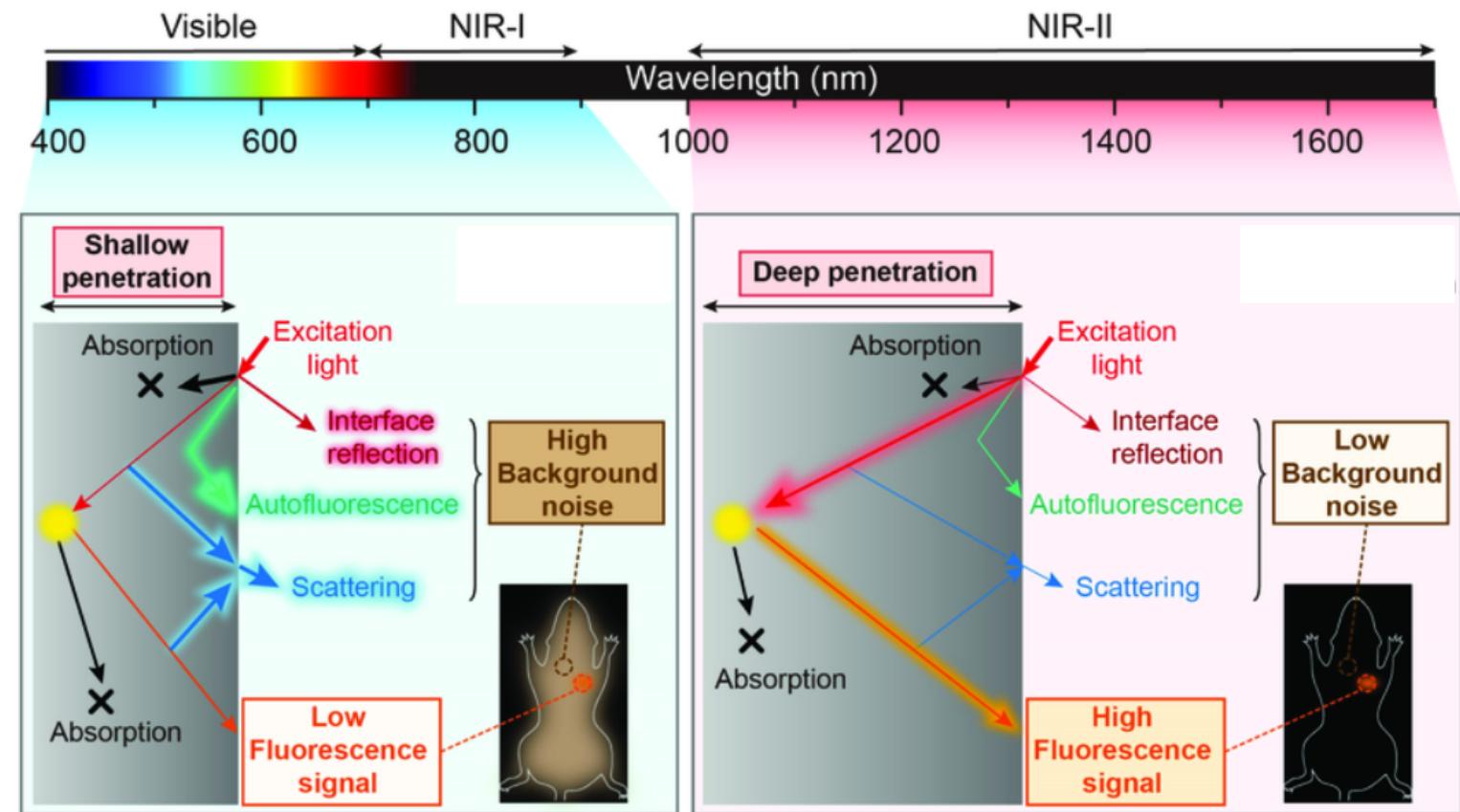


Confocal

LASER SCANNING CONFOCAL SPINNING DISK CONFOCAL

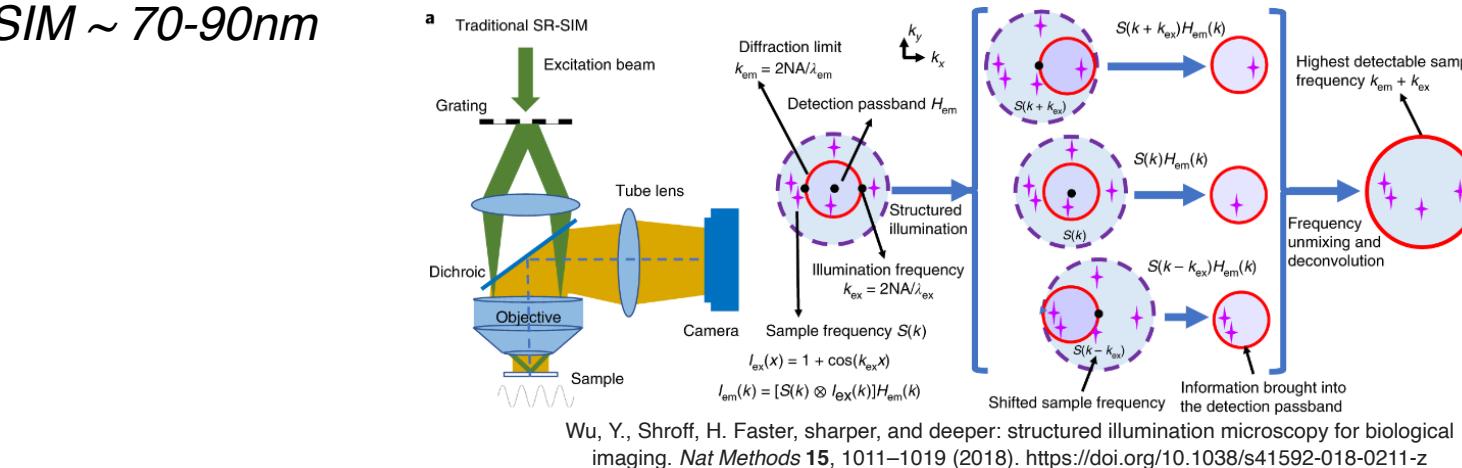


NIR & Two Photon

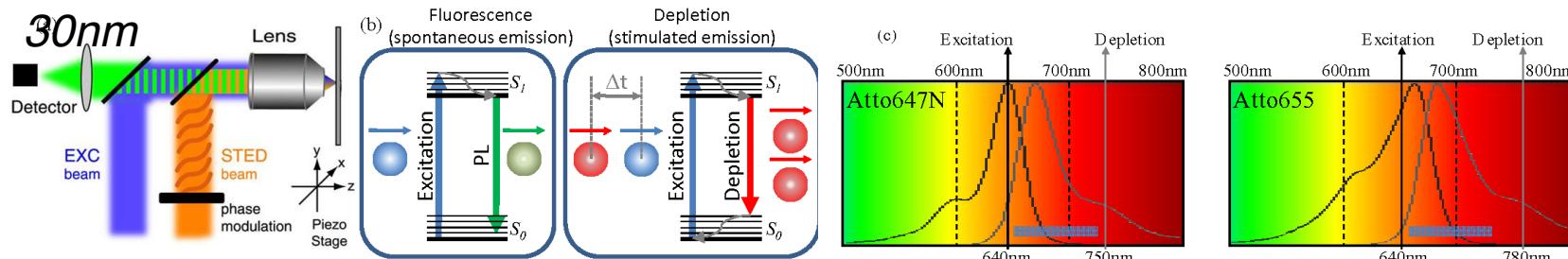


Super Resolution

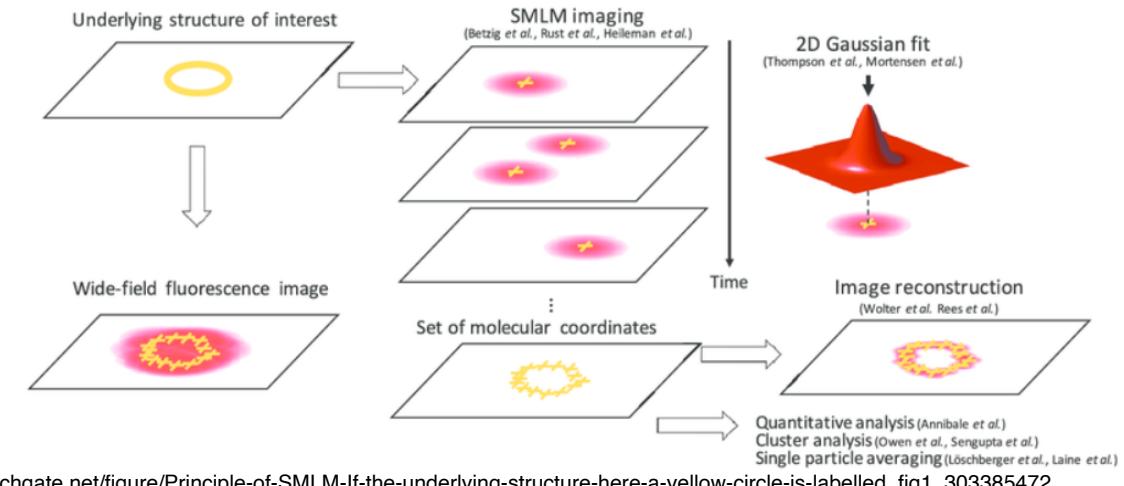
$SIM \sim 70-90\text{nm}$



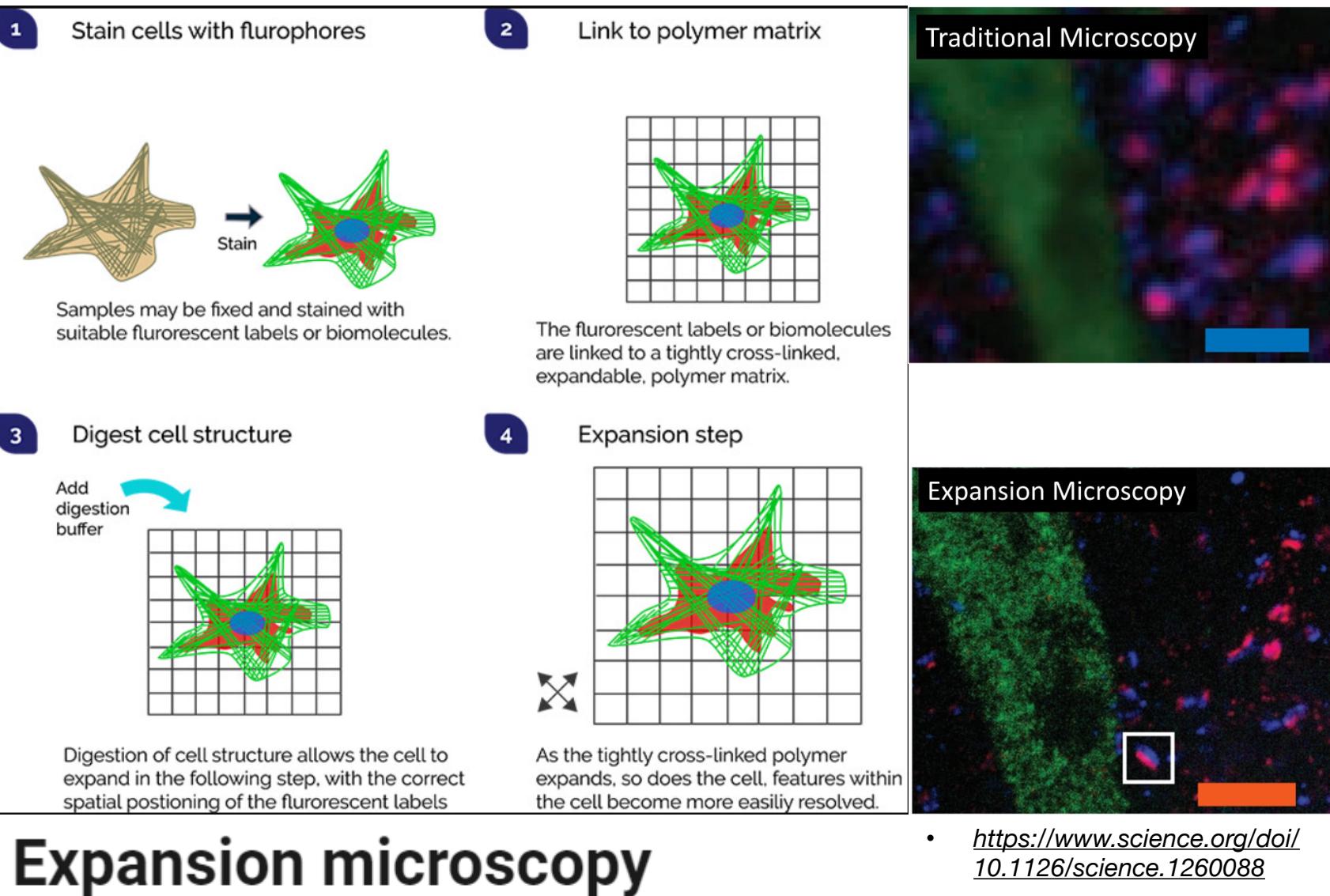
$STED \sim 30\text{nm}$



$SMLM \leq 20\text{nm}$
Localization Precision
STORM, PALM...



Expansion Microscopy



Expansion microscopy

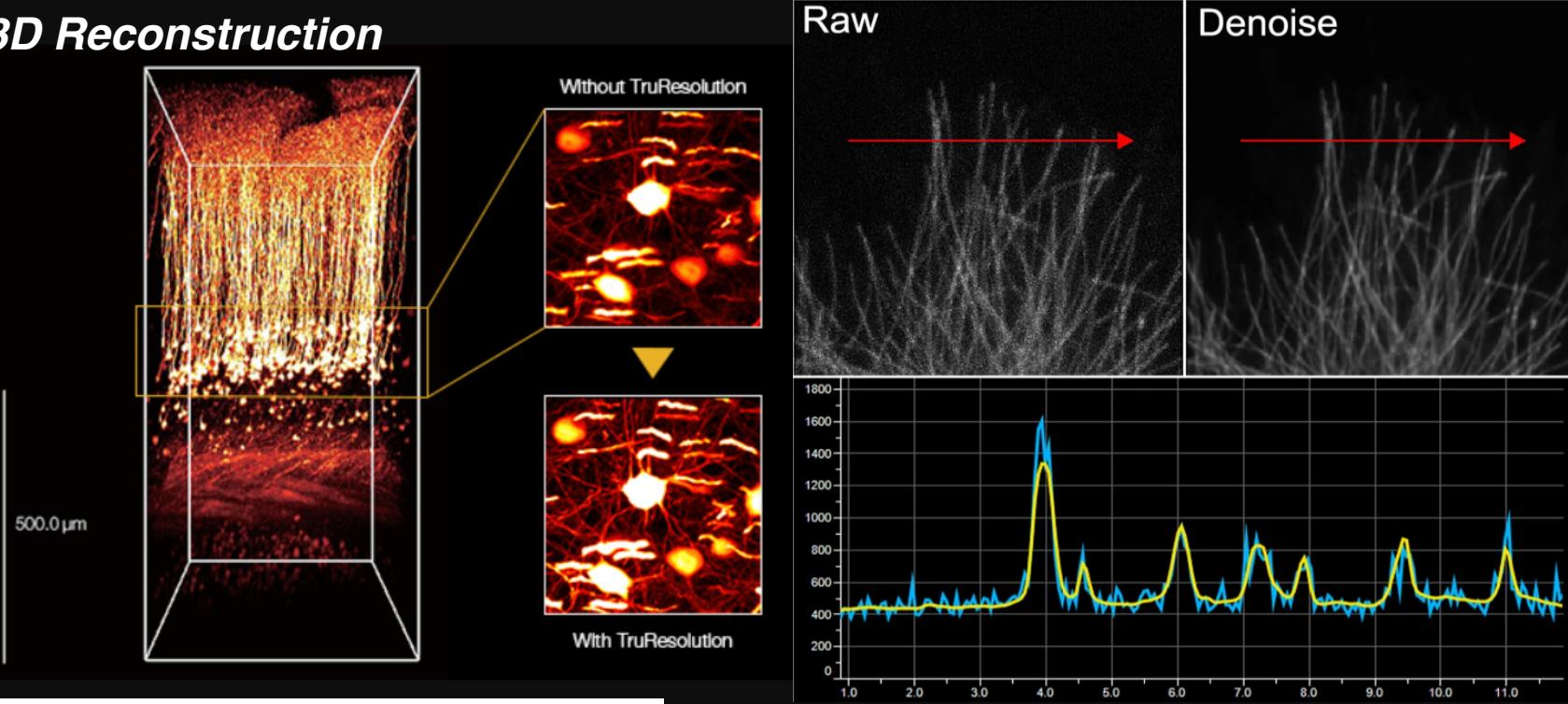
FEI CHEN, PAUL W. TILLBERG, AND EDWARD S. BOYDEN [Authors Info & Affiliations](#)

SCIENCE • 30 Jan 2015 • Vol 347, Issue 6221 • pp. 543-548 • DOI: 10.1126/science.1260088

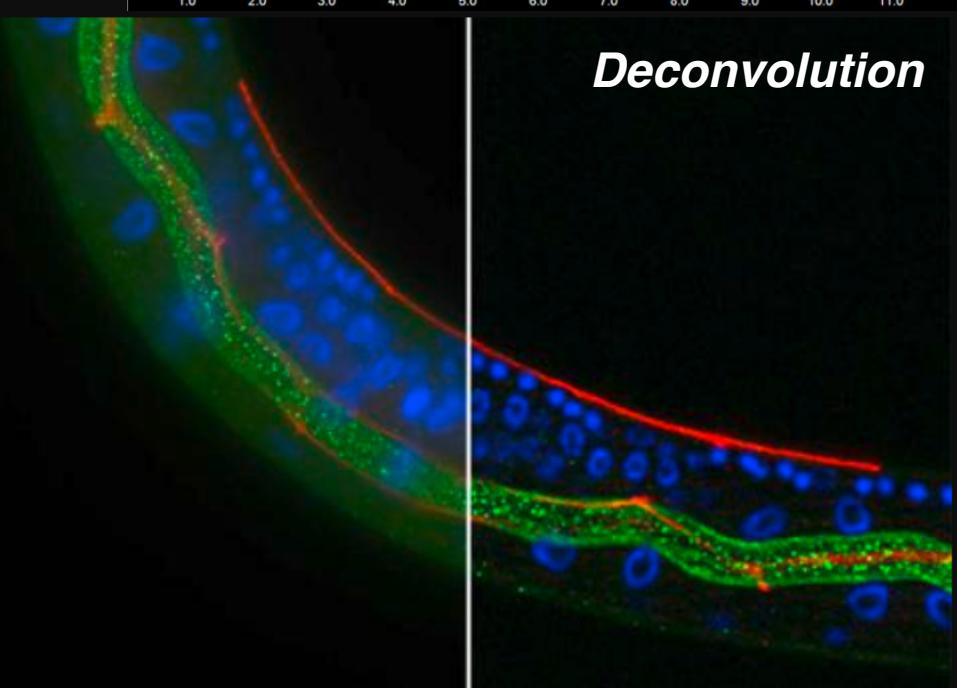
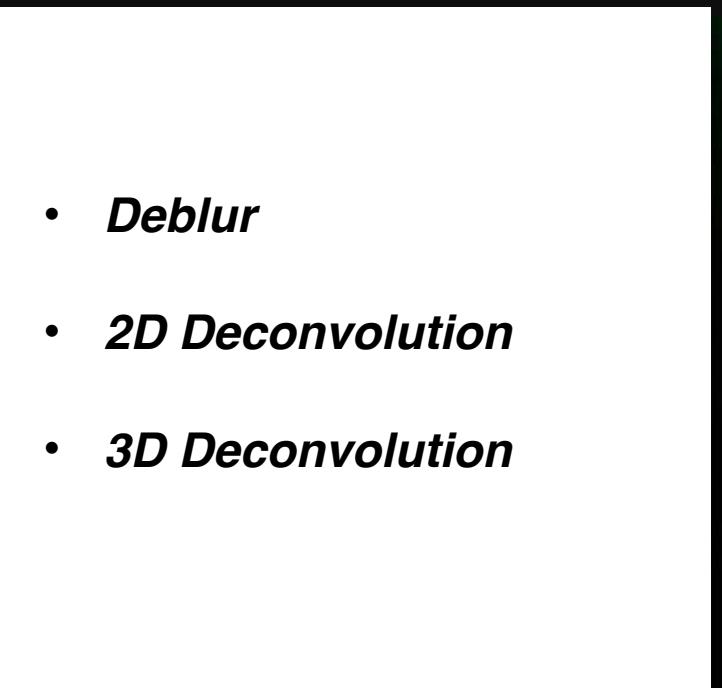
- <https://www.science.org/doi/10.1126/science.1260088>

- Strack, R. Expansion microscopy. *Nat Methods* **14**, 32 (2017). <https://doi.org/10.1038/nmeth.4113>

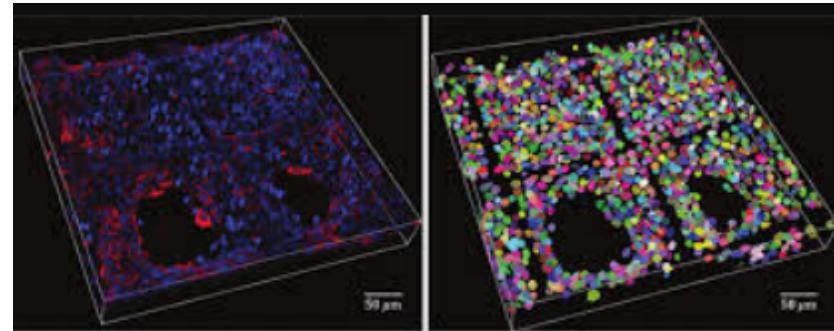
Image Processing



- ***Deblur***
- ***2D Deconvolution***
- ***3D Deconvolution***

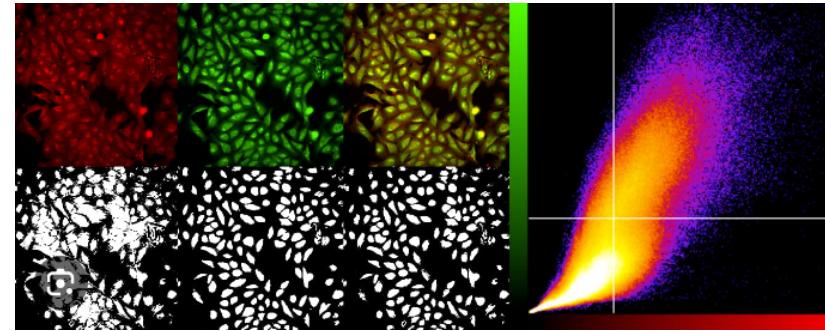


Data Analysis

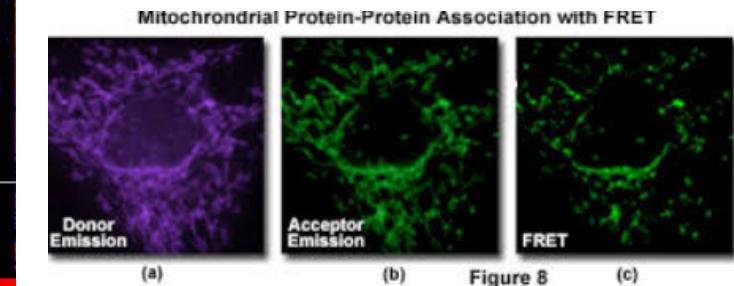


Original 3D CLSM Image

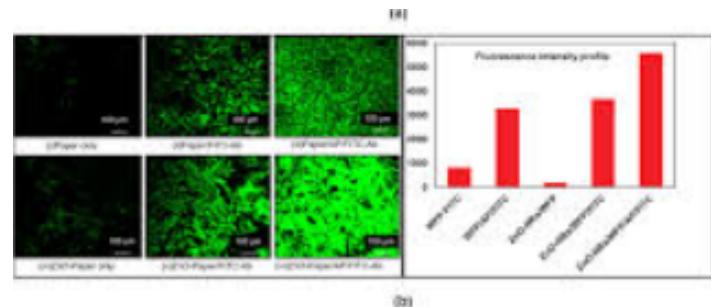
3D Nuclei Segmentation from AD-GAN



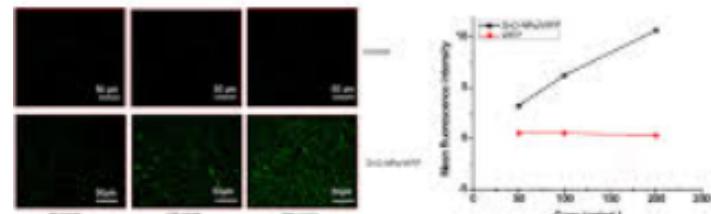
Colocalisation scatter plots



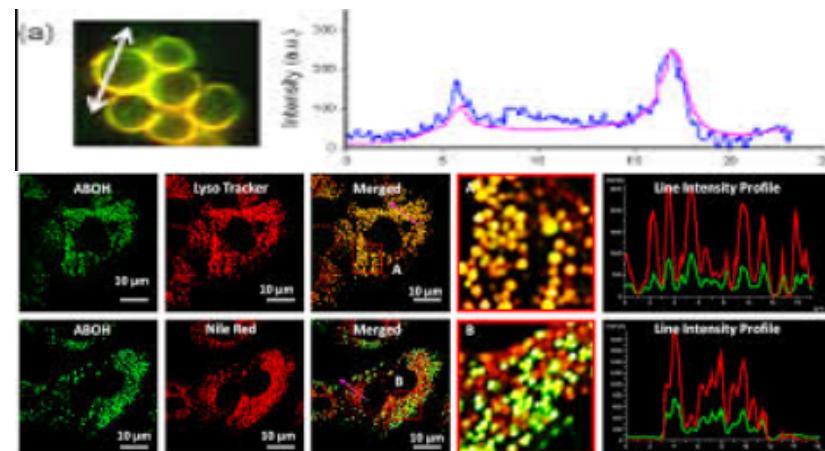
FRET – Molecular Interaction



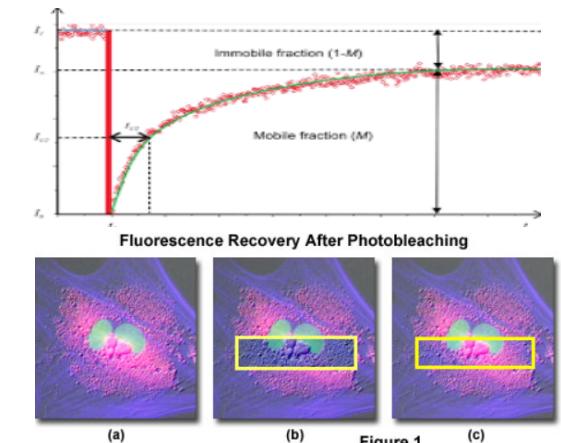
(a)



Intensity Profiling



Line Profiling



FRAP

AI and Imaging

- AI based Denoising
- AI based Image segmentation & Measurement
- AI based – Label imaging
- AI based 3D image analysis