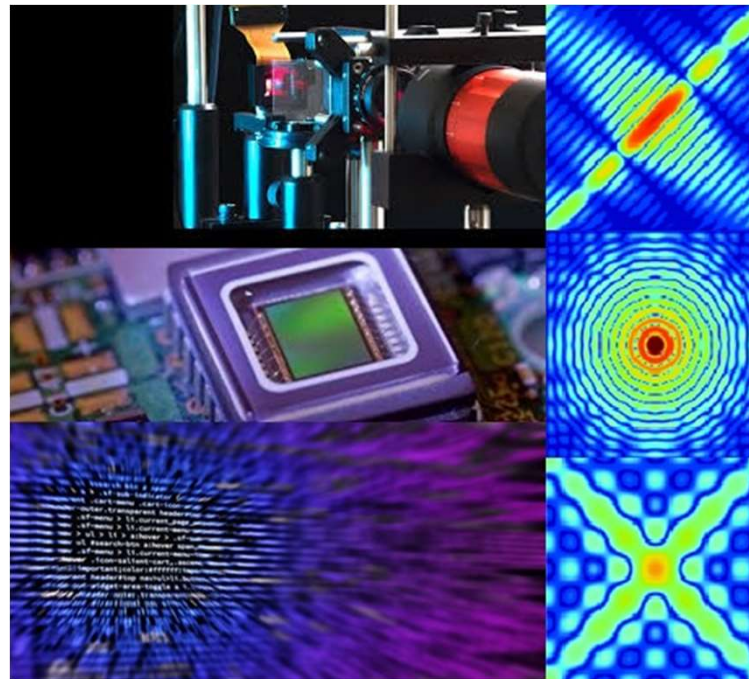




# Imaginería Óptica Computacional: Microscopía.



Segundo semestre 2021

**Dra. Julia Alonso**

*Instituto de Física*

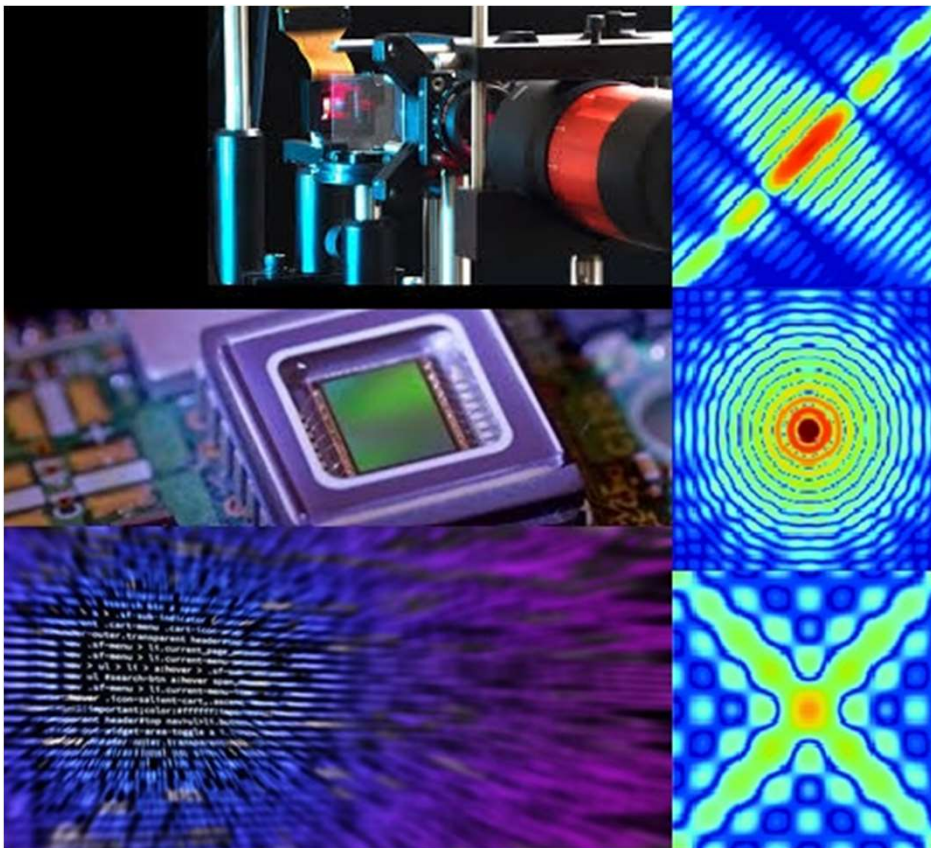


UNIVERSIDAD  
DE LA REPÚBLICA  
URUGUAY





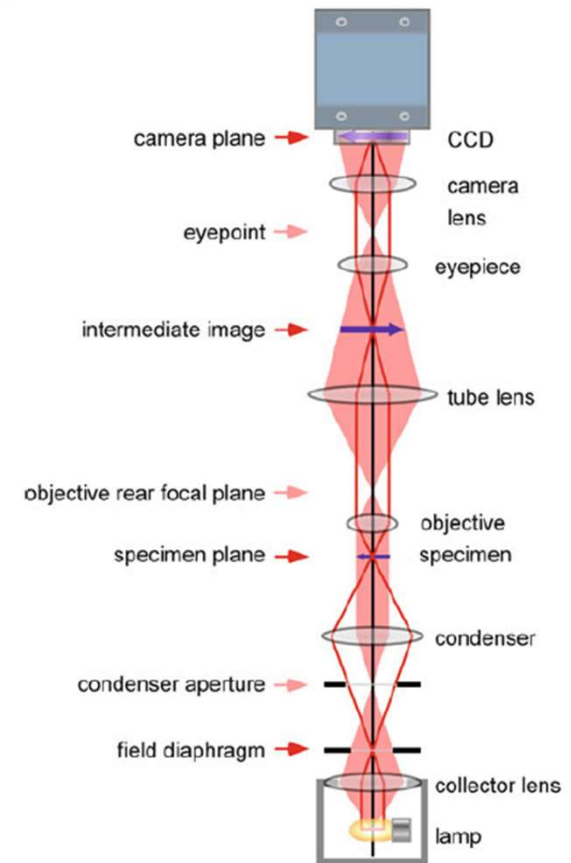
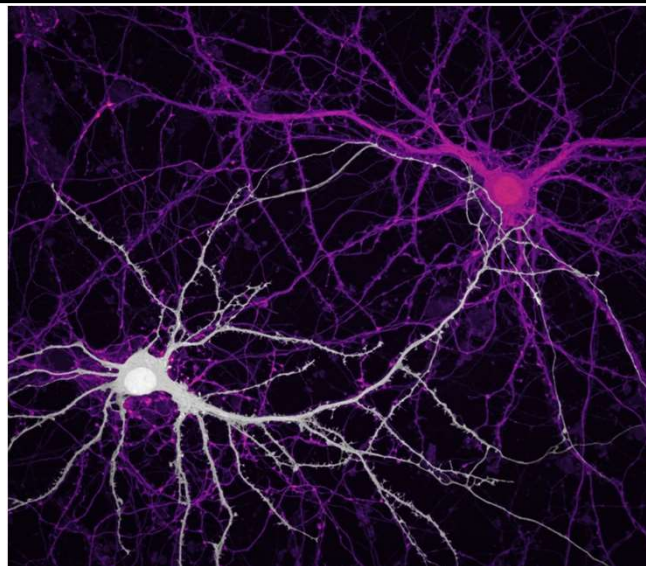
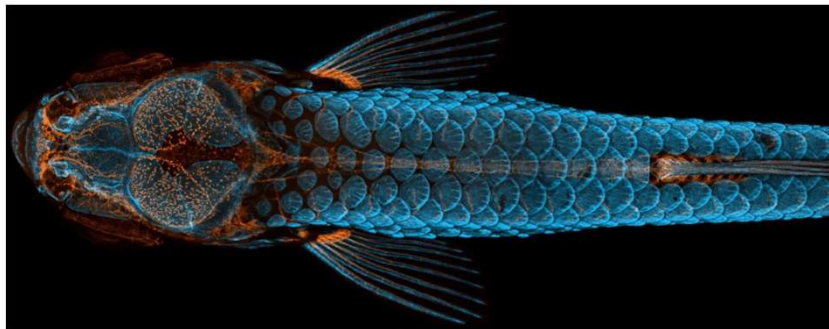
# Imaginería Óptica Computacional



Integración del diseño o modificación de sistemas ópticos con el procesamiento computacional a través de algoritmos para sintetizar imágenes con nuevas características de interés.



# Microscopios Ópticos





# Microscopios Ópticos - Magnificación

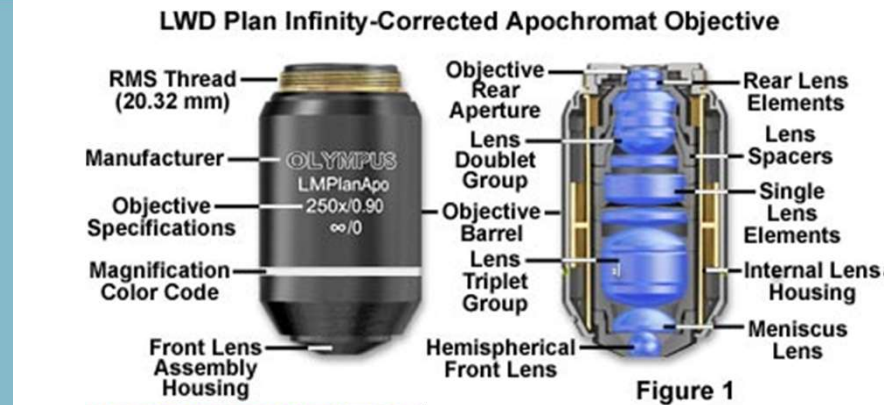
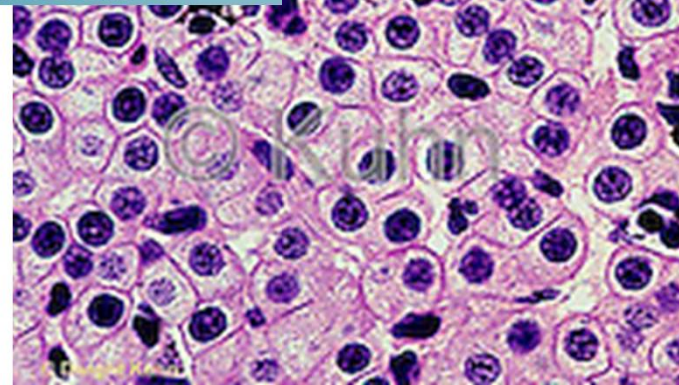
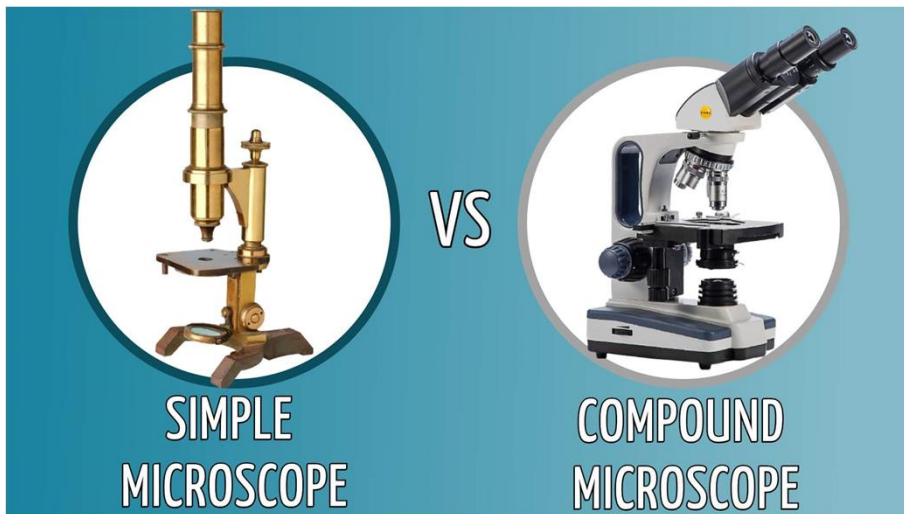
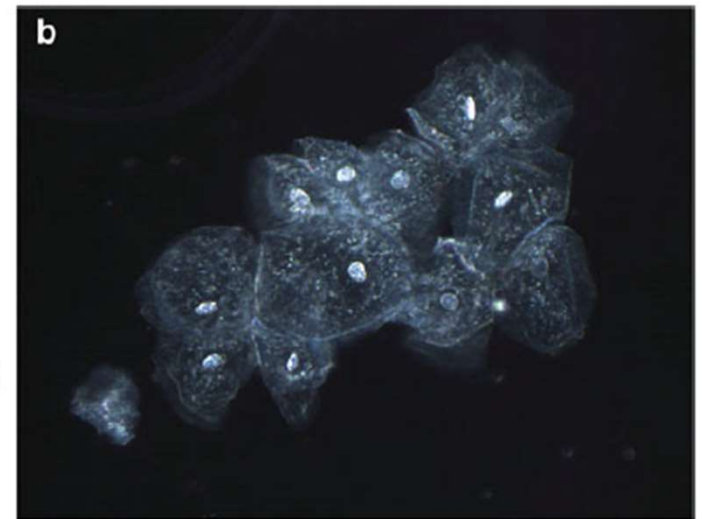
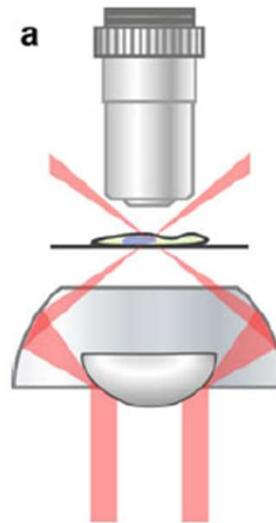
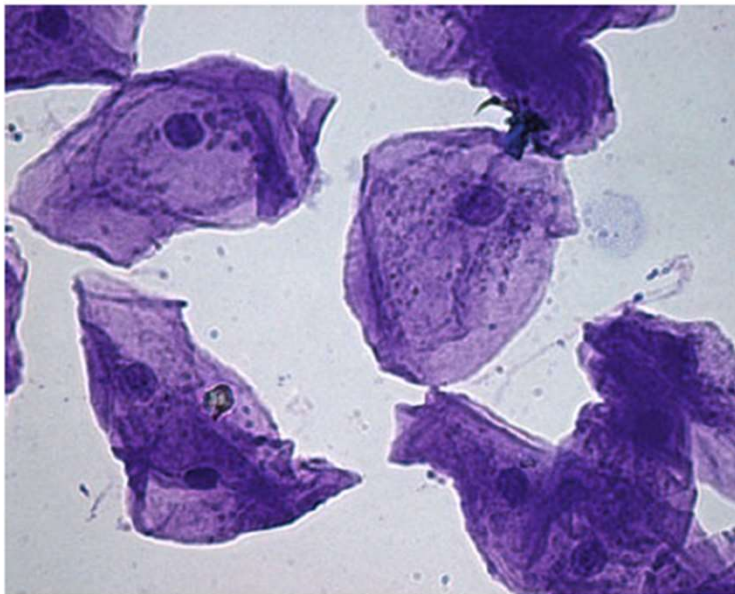


Figure 1



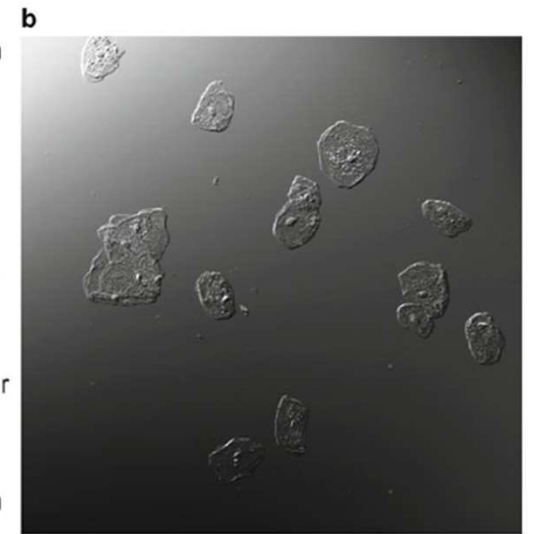
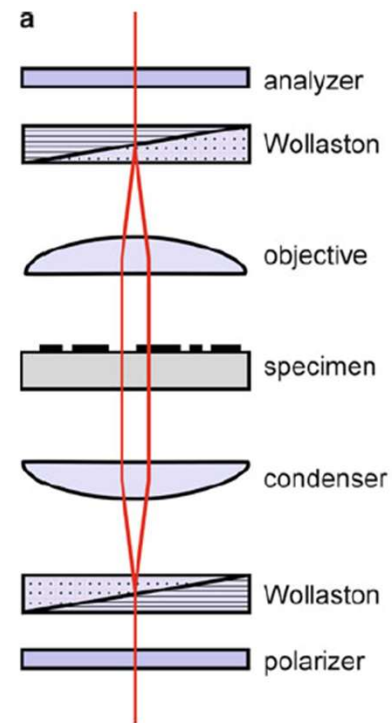
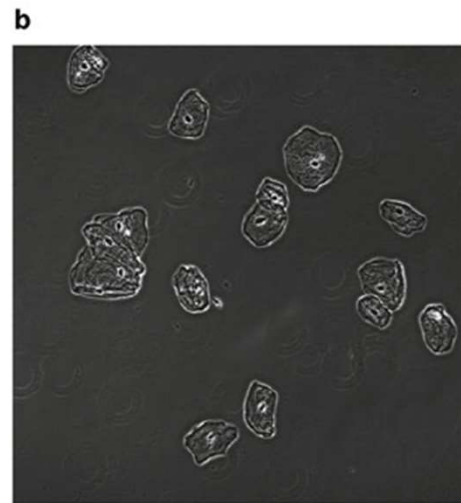
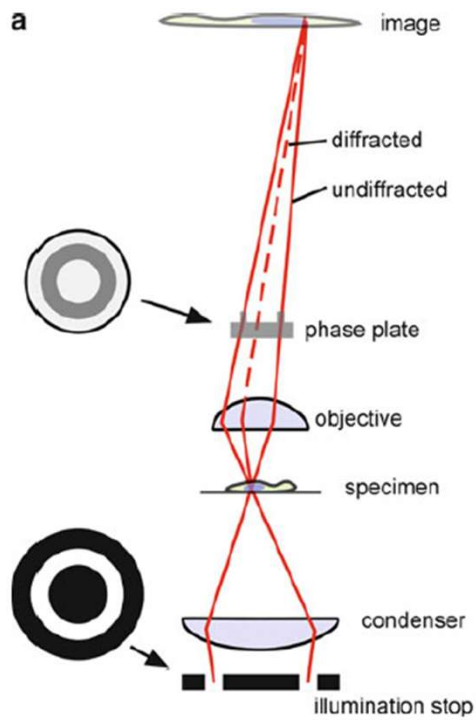
## Bright-field & Dark-field microscopy



M.K. Kim, Digital Holographic Microscopy: Principles, Techniques, and Applications, Springer Series in Optical Sciences 162, DOI 10.1007/978-1-4419-7793-9\_11, # Springer Science+Business Media, LLC 2011



## Zernike Phase Contrast & Differential Interference Contrast Microscopy





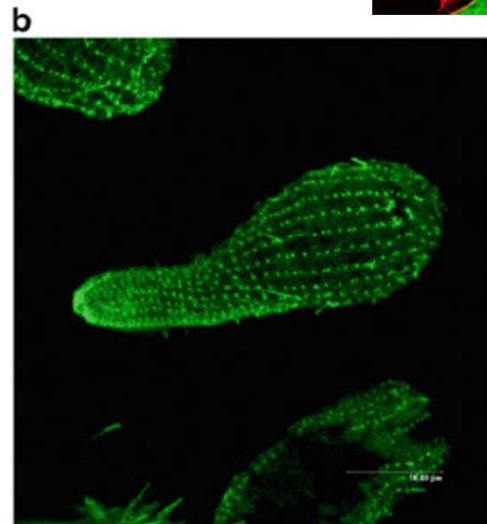
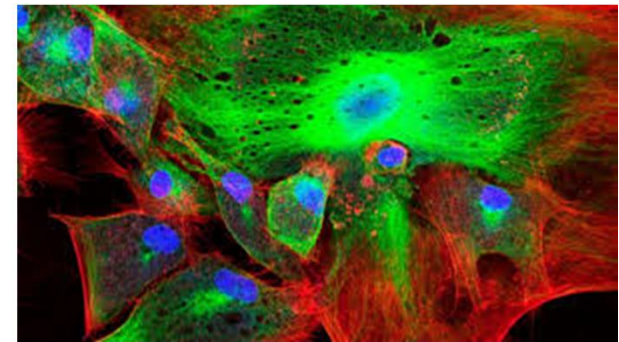
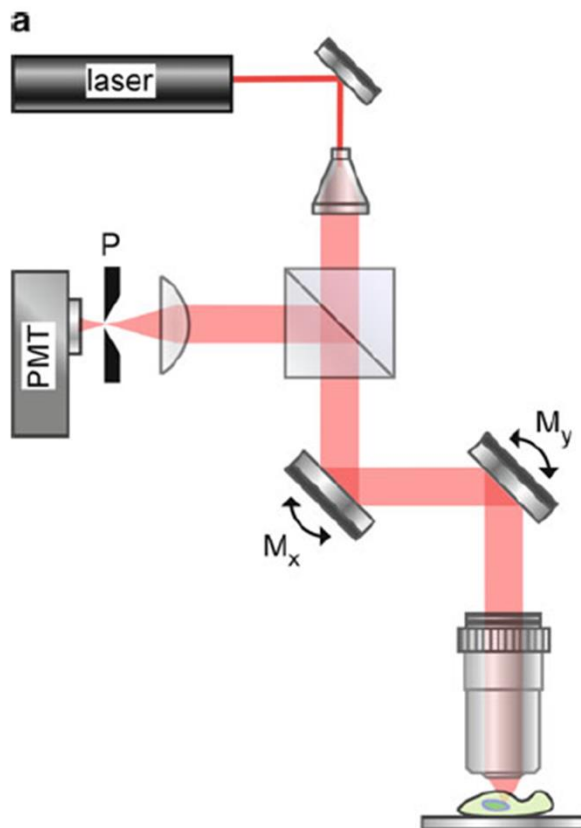
# Polarization Microscopy



<http://www.canadiannaturephotographer.com/>



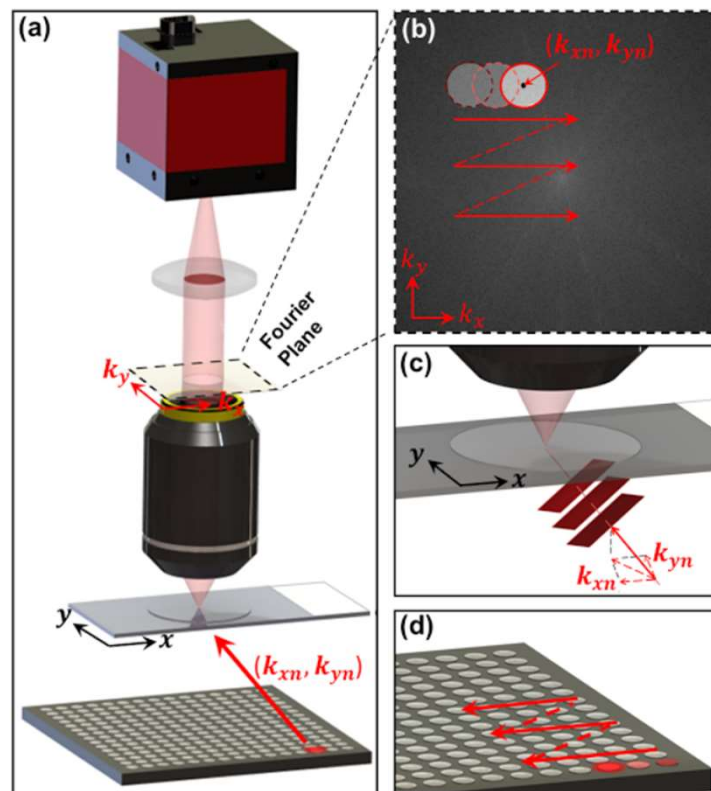
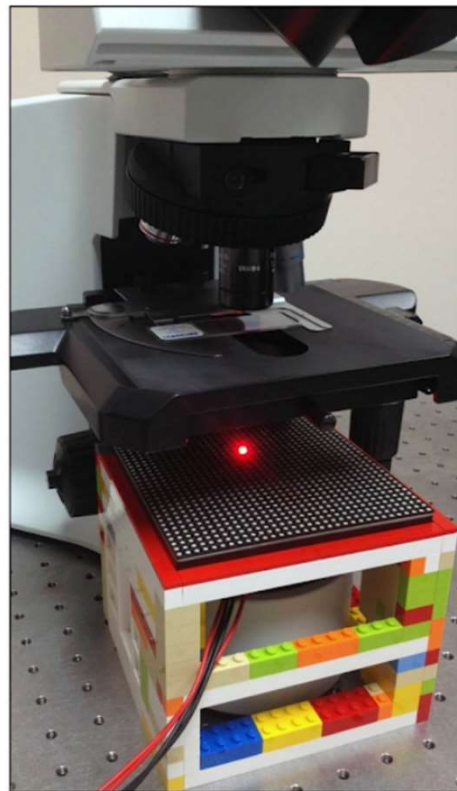
# Fluorescence & Confocal Microscopy



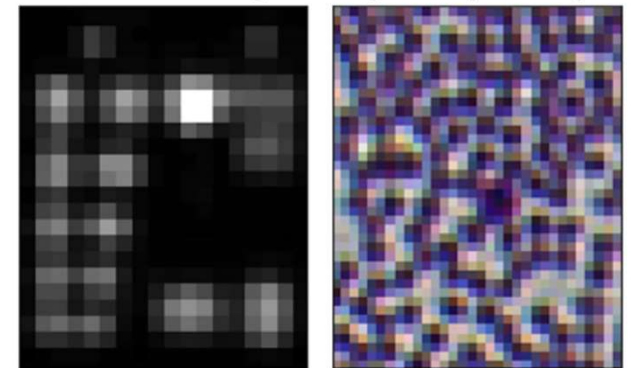




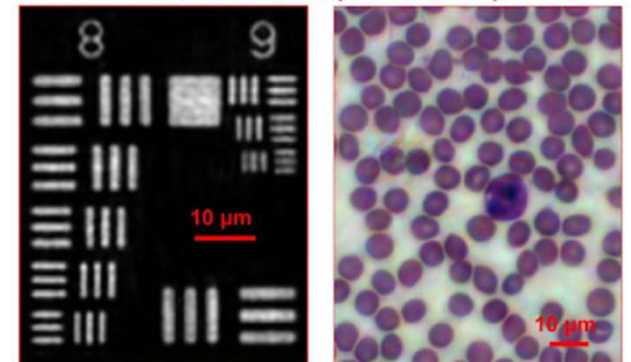
## Ingeniería de la iluminación: Fourier Ptychographic Microscope



Raw data using a 2X objective (0.08 NA)



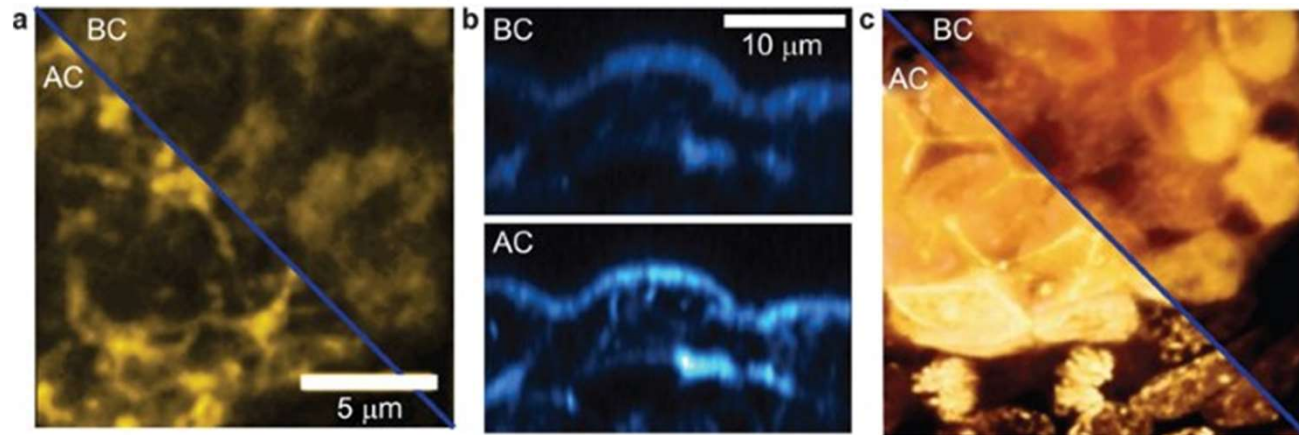
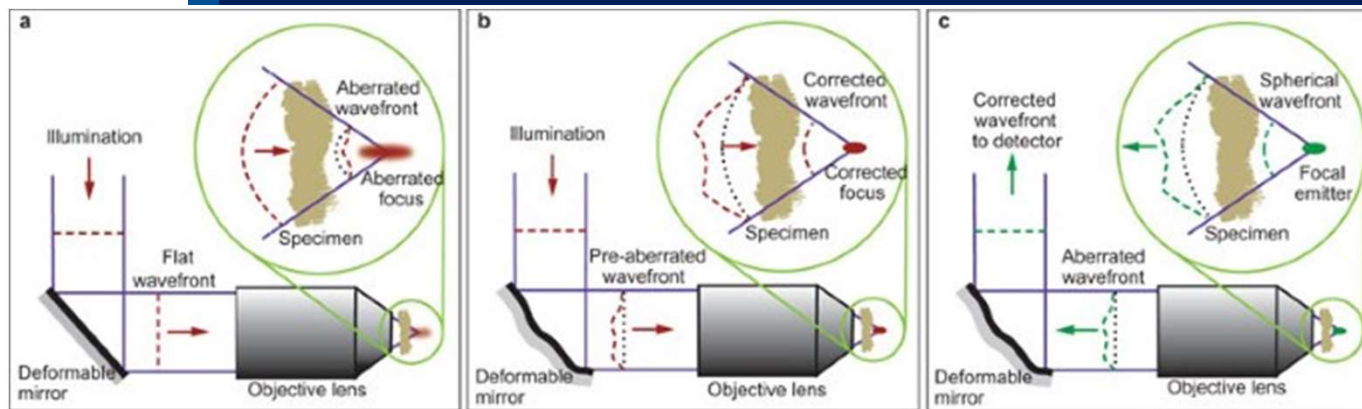
Reconstruction (max 0.5 NA)



Zheng et al. Nat. Phot. 2013



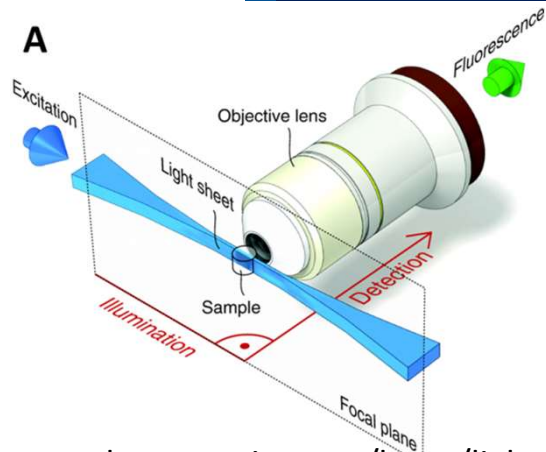
# Adaptive Optics assisted Microscopy



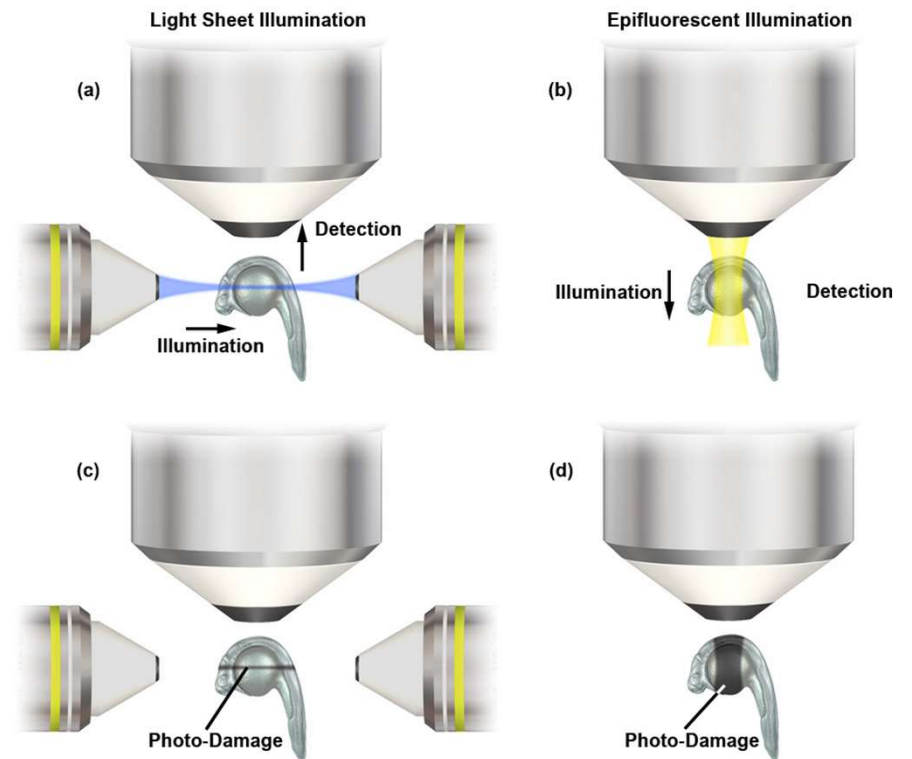
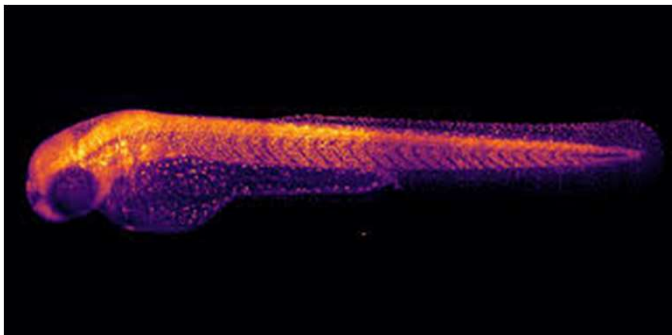
<https://www.nature.com/articles/lisa201446>



# Light-sheet fluorescence microscopy



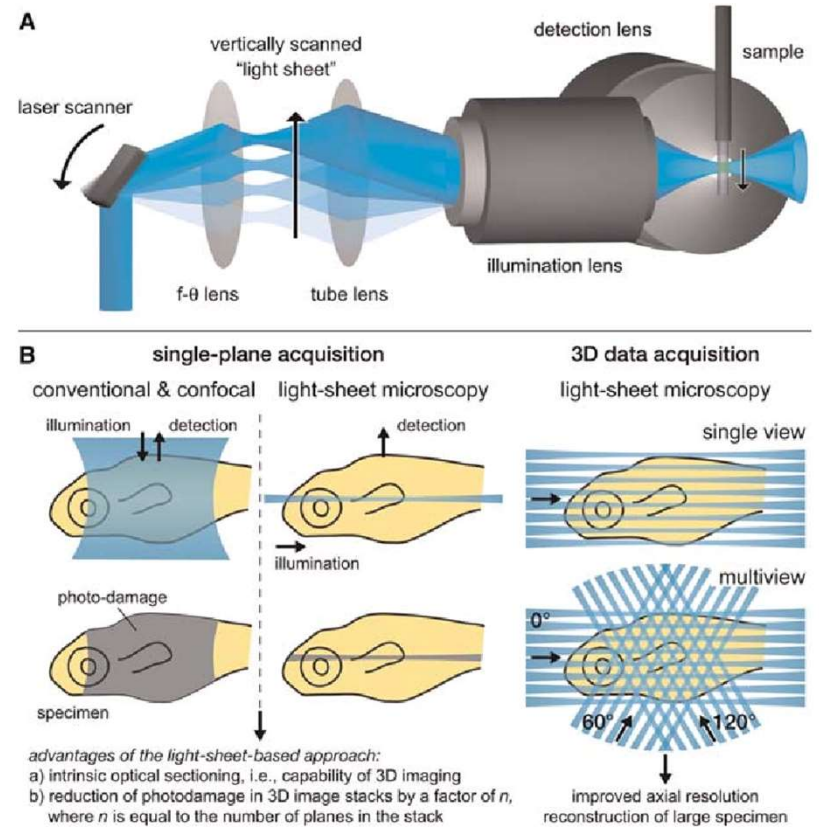
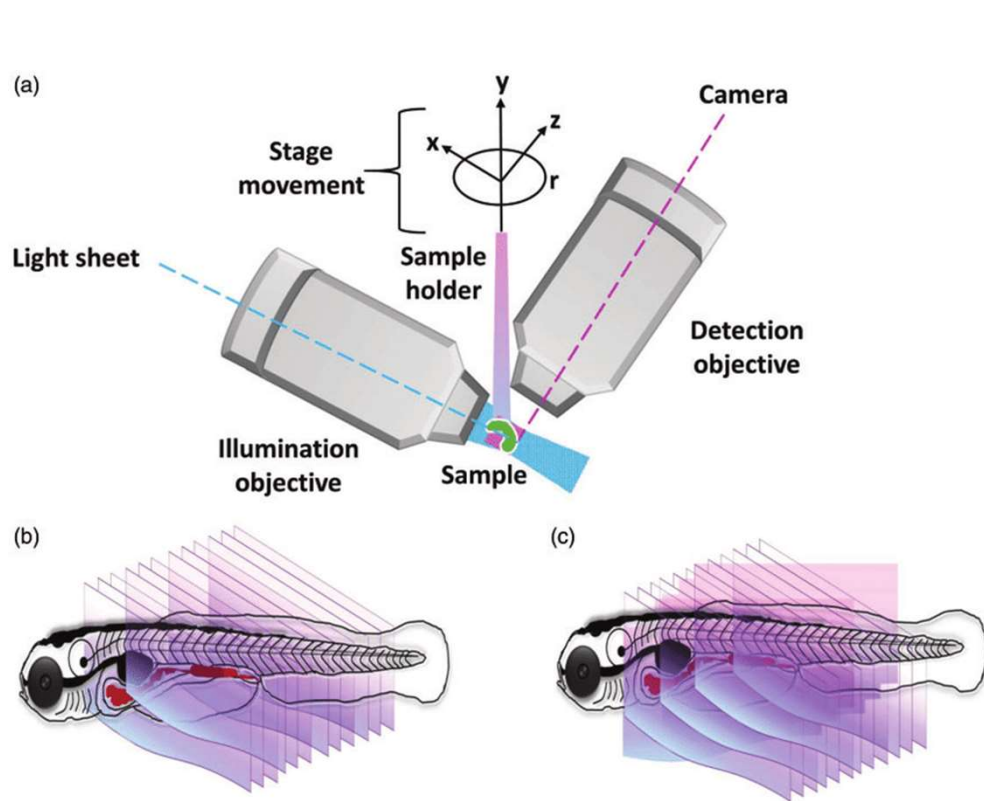
<https://www.photometrics.com/learn/light-sheet-microscopy/introduction-to-light-sheet-microscopy>



<https://www.microscopyu.com/techniques/light-sheet/light-sheet-fluorescence-microscopy>



# Light-sheet fluorescence microscopy



<https://www.osapublishing.org/as/abstract.cfm?uri=as-72-8-1137>

DOI: [10.1101/pdb.prot065839](https://doi.org/10.1101/pdb.prot065839)



# Resolución: límite de Abbe y criterio de Rayleigh

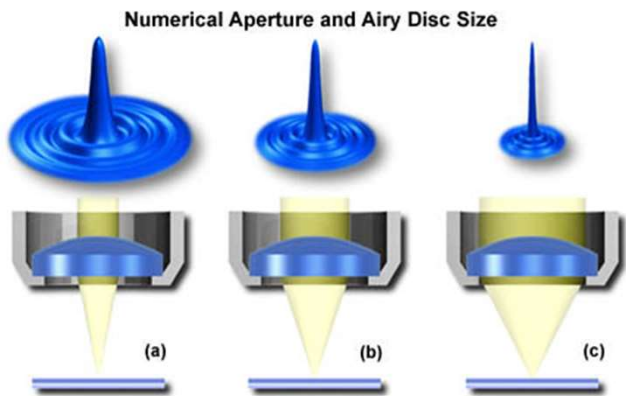
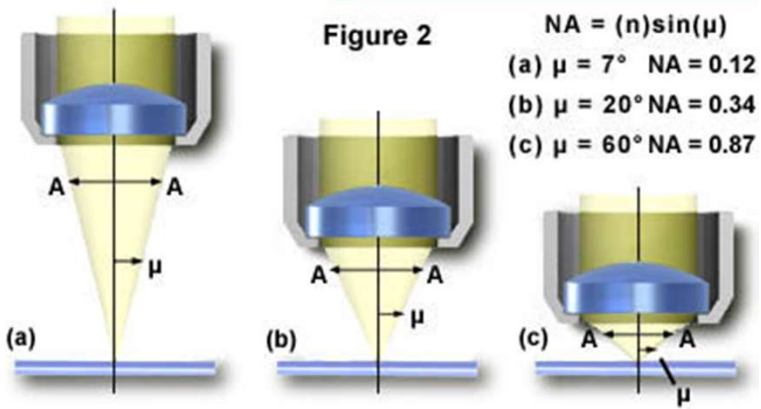
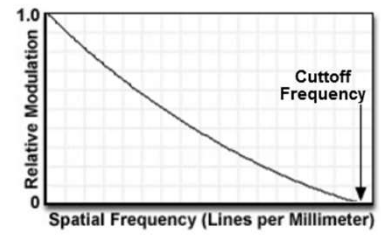
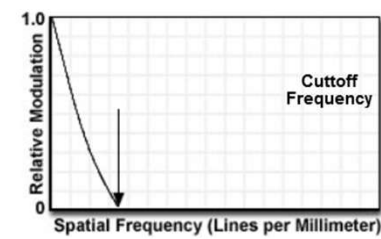
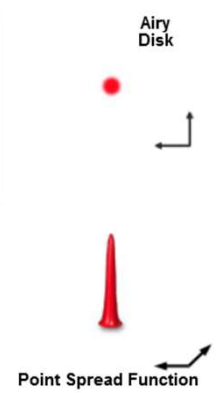


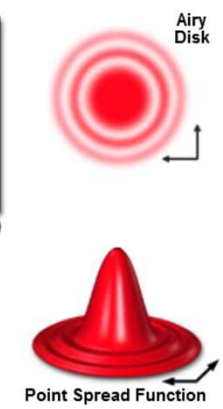
Figure 4



Cutoff  
5000 Lines/mm



Cutoff  
500 Lines/mm



<https://www.olympus-lifescience.com/es/microscope-resource/primer/anatomy/objectives/>



# Resolución: límite de Abbe y criterio de Rayleigh

Fourier Relationship between MTF and PSF

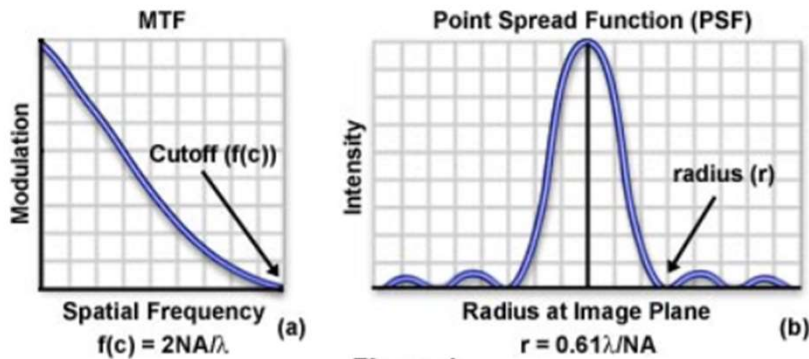
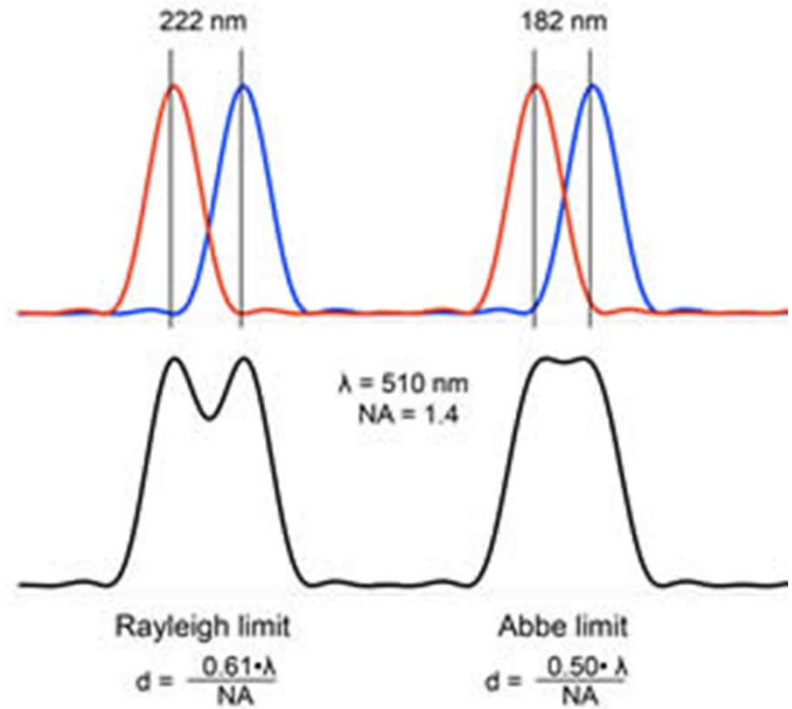
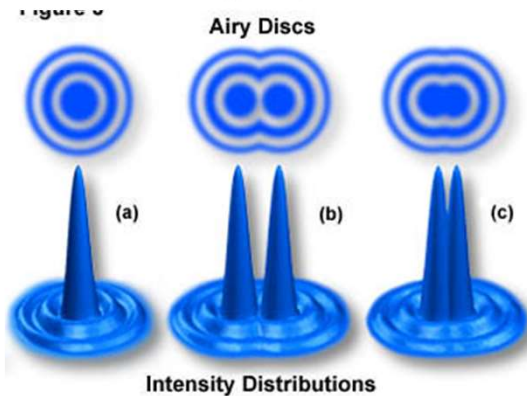


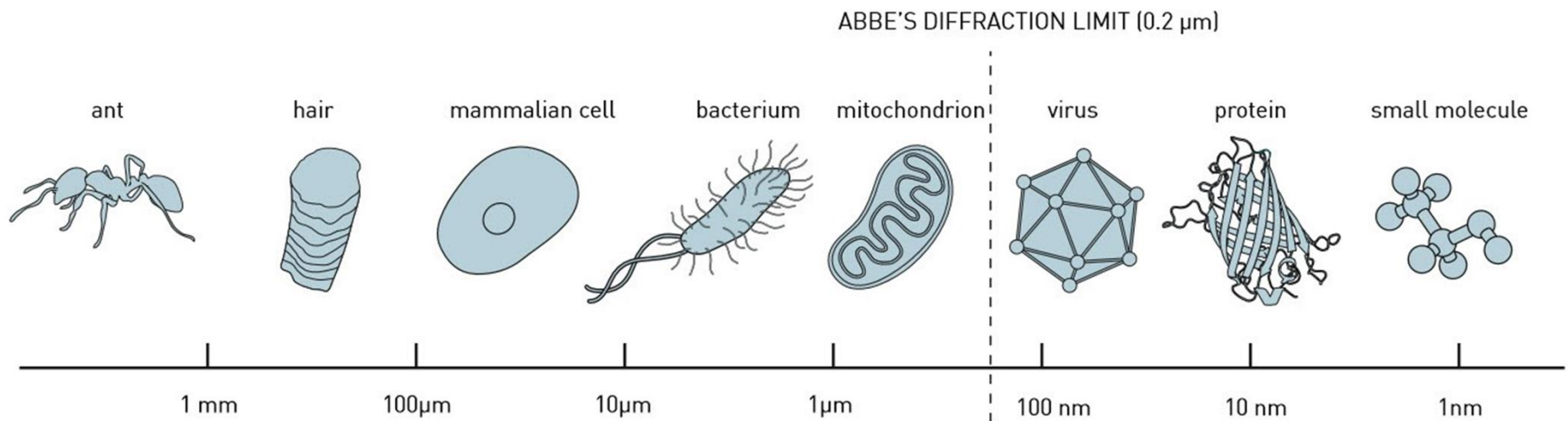
Figure 1



<https://www.olympus-lifescience.com/es/microscope-resource/primer/java/mtf/airydiscsize/>



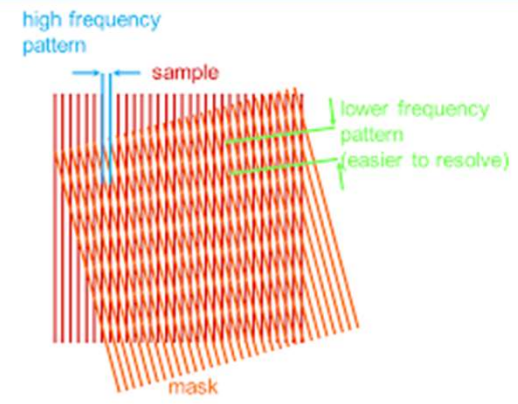
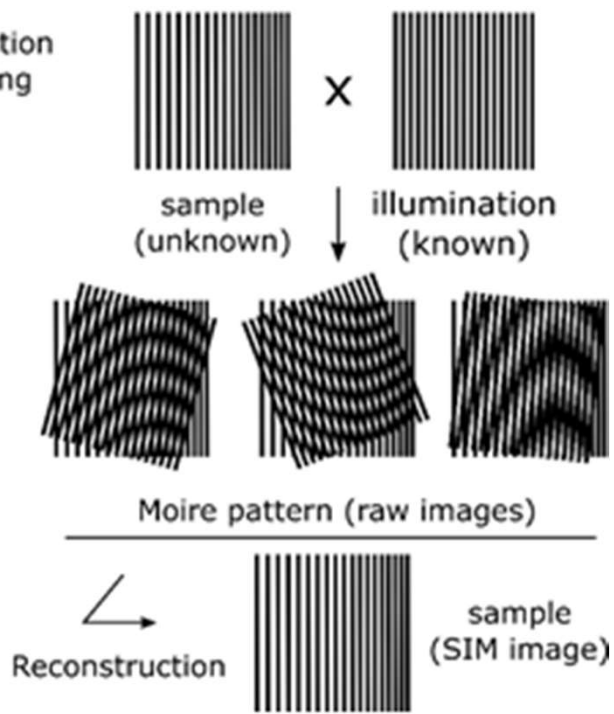
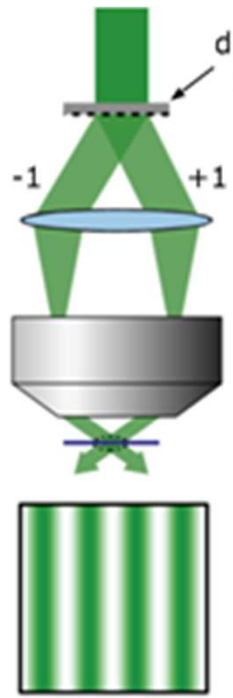
# Límite difractivo



Abbe's diffraction limit (© Johan Jarnestad/The Royal Swedish Academy of Sciences)



# Structured Illumination Microscopy (SIM)



Reconstruction of High Frequency Specimen Information in Reciprocal Space

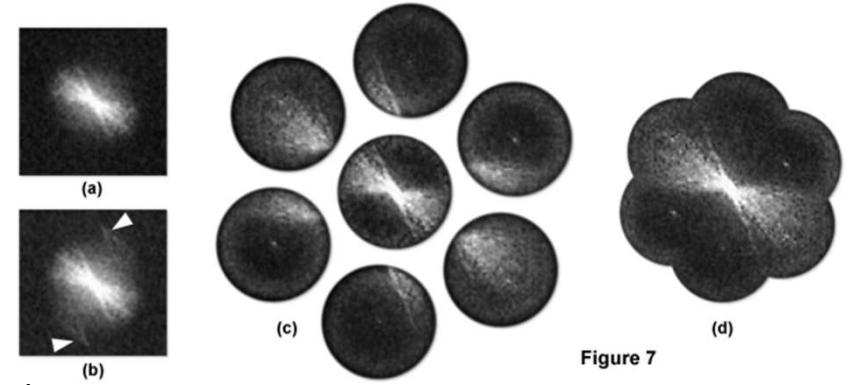


Figure 7

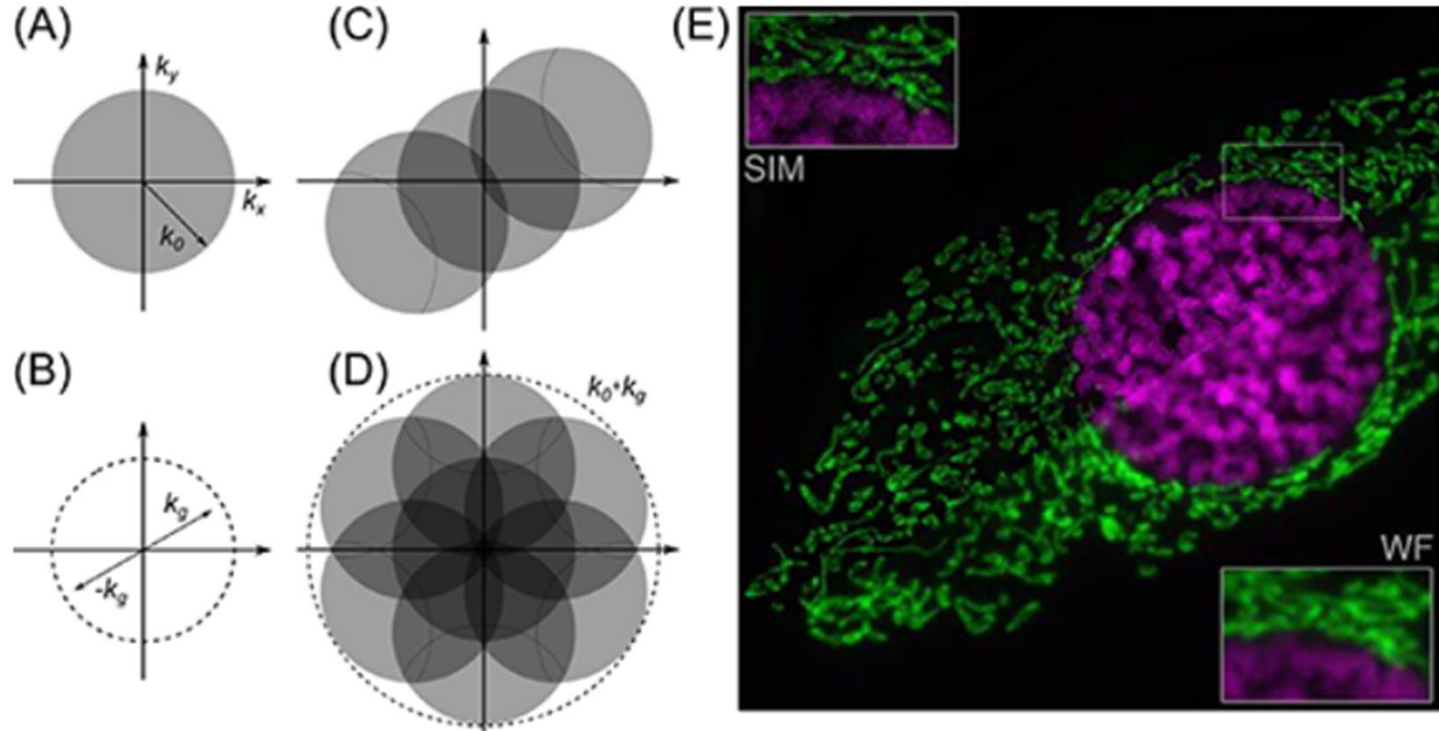
<https://andor.oxinst.com/learning/view/article/super-resolution-imaging-structured-illumination-microscopy>

<http://zeiss-campus.magnet.fsu.edu/articles/superresolution/supersim.html>





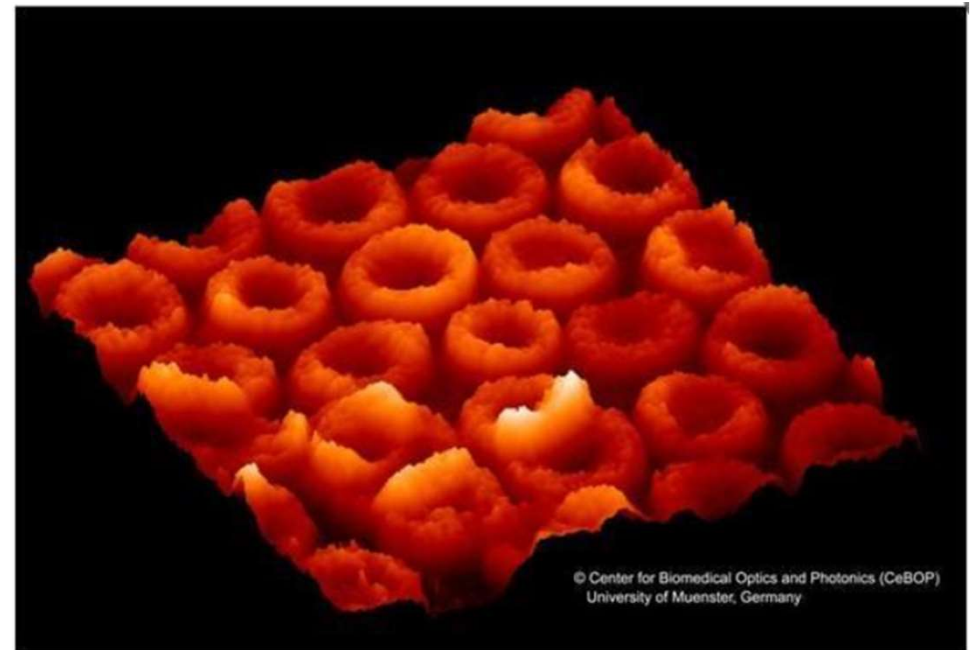
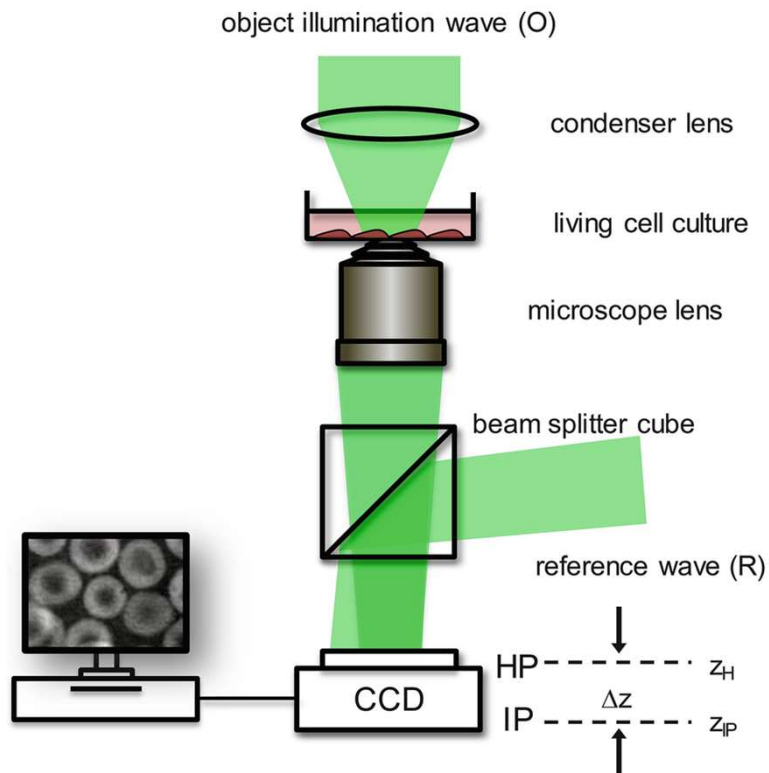
# Structured Illumination Microscopy (SIM)



<https://iopscience.iop.org/article/10.1088/2515-7647/abdb04>



# Digital Holography

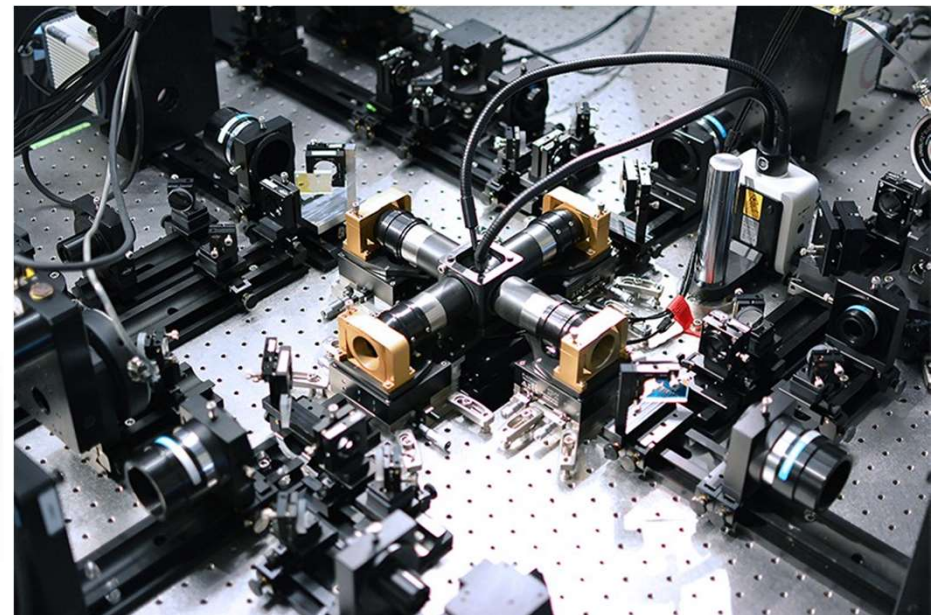
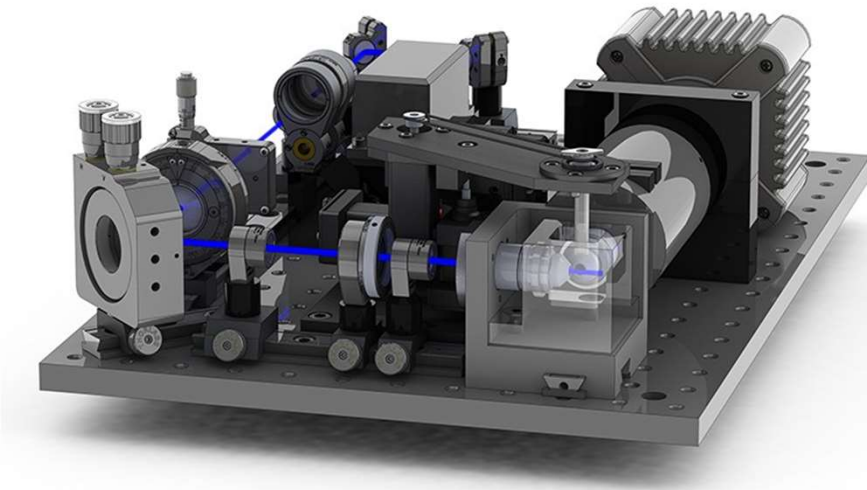


[https://link.springer.com/chapter/10.1007/11663\\_2019\\_6](https://link.springer.com/chapter/10.1007/11663_2019_6)



## Custom-built microscopes

Cuando la herramienta para el trabajo no existe... hazla tú mismo.



<https://www.nature.com/articles/d41586-017-07528-7>