Microscope 이론 및 LSCM Application

주식회사 제이엔옵틱
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진 재 환

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   - 형광 현미경의 원리 및 구조 등

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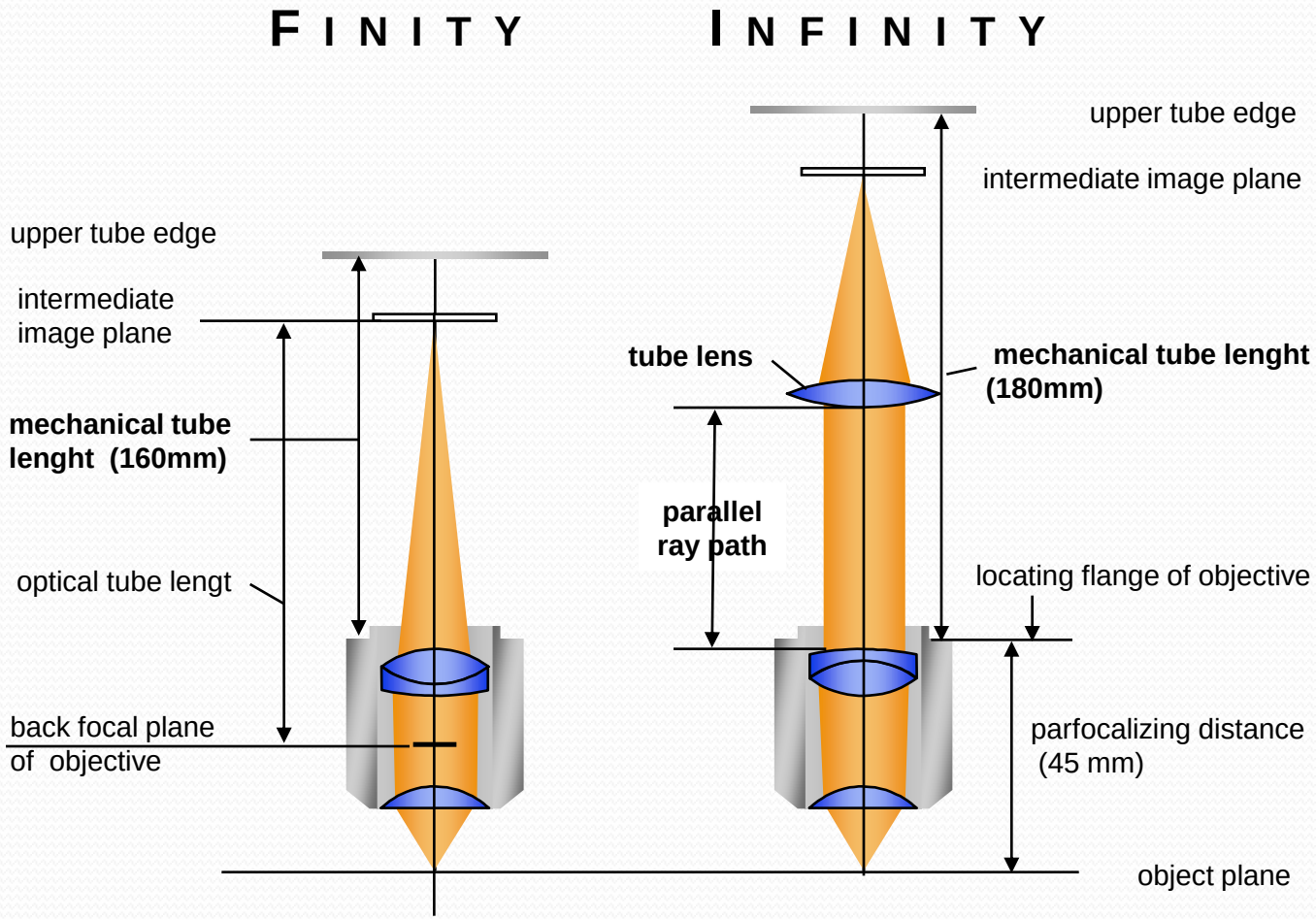
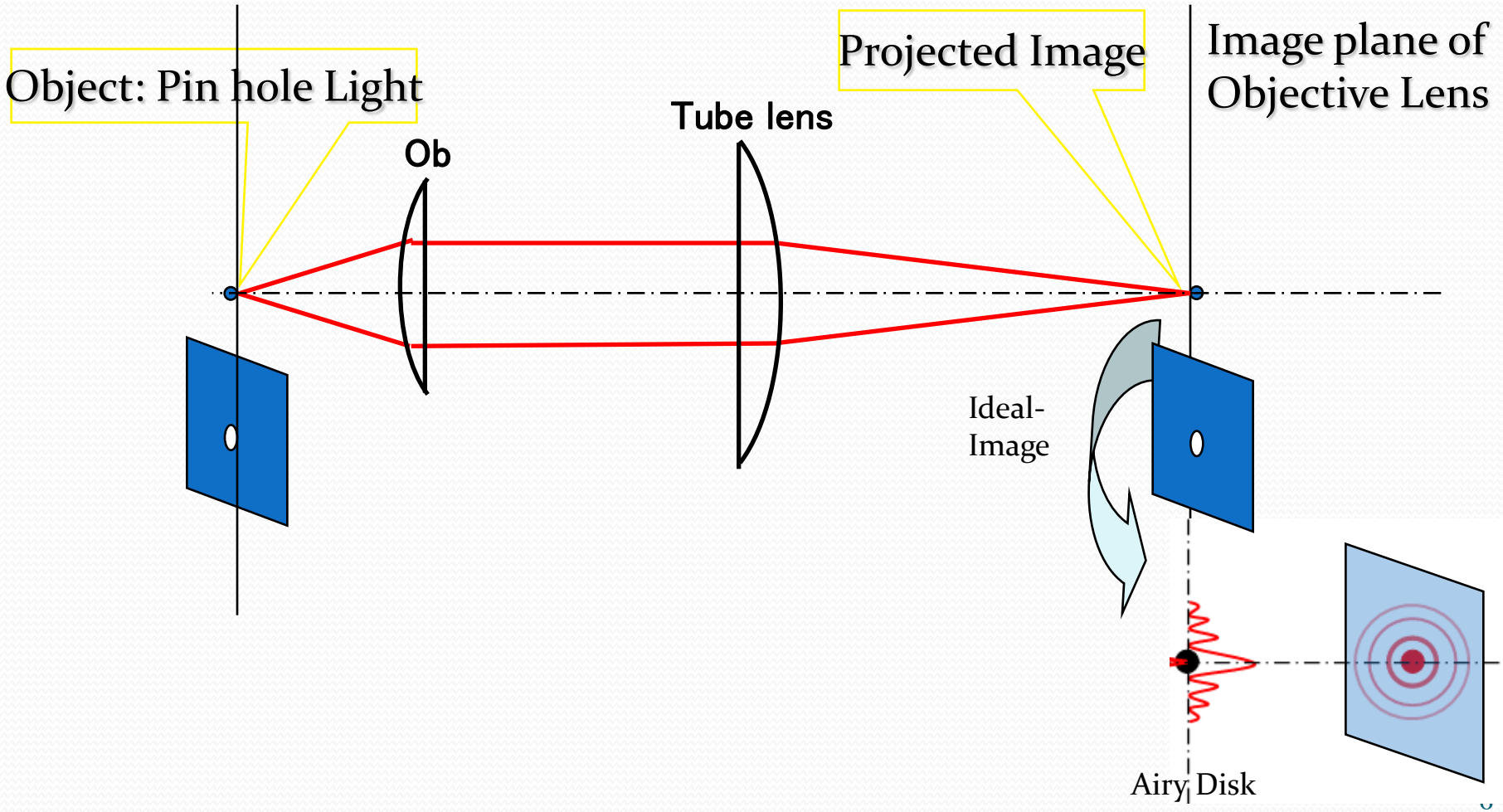
OBJECTIVE UIS

UIS Universal Infinity System(광학계의 변화)

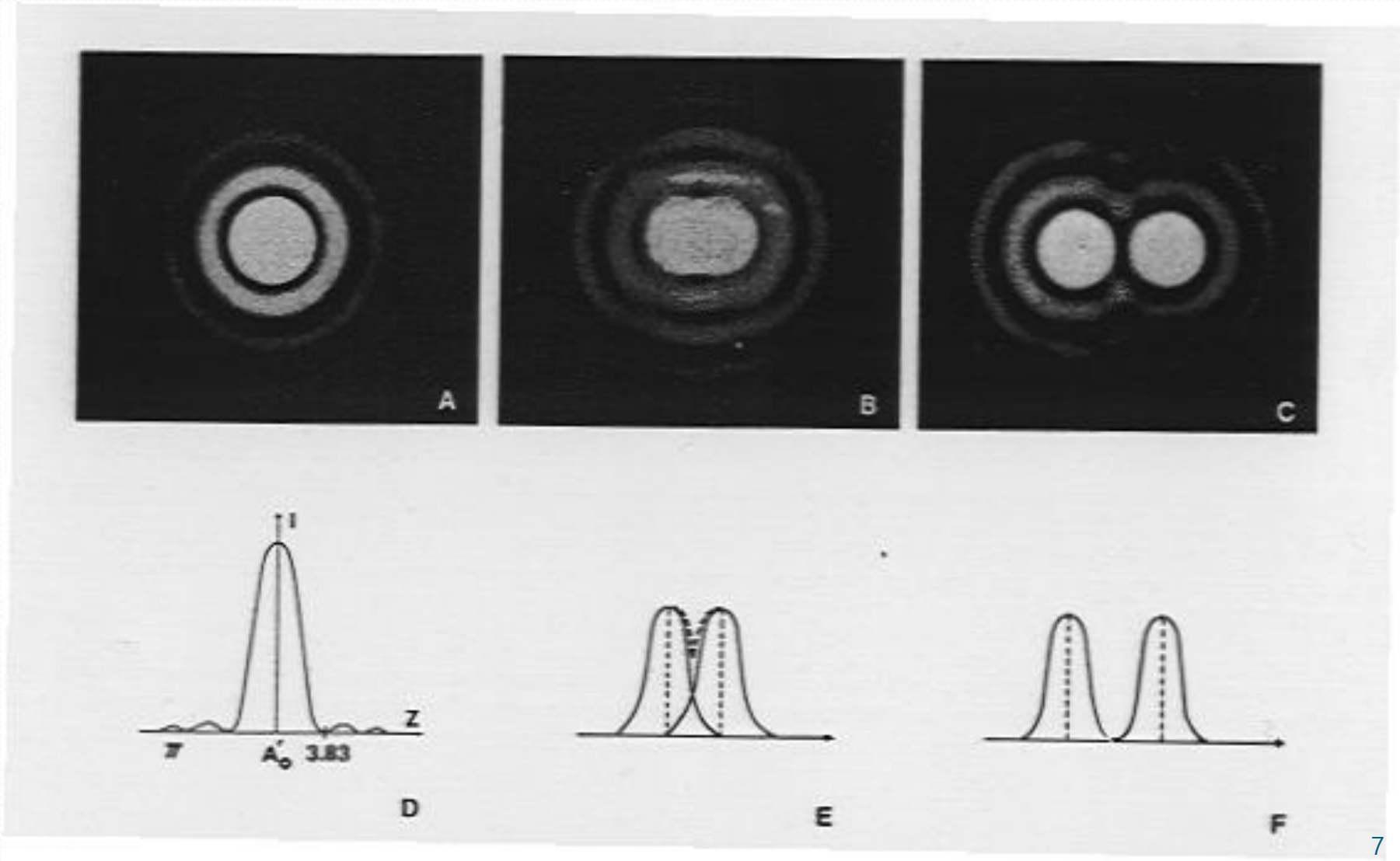


Idealistic None Aberration Lens and Projected Image

- Objective Lens



N.A. *Numerical Apeture*

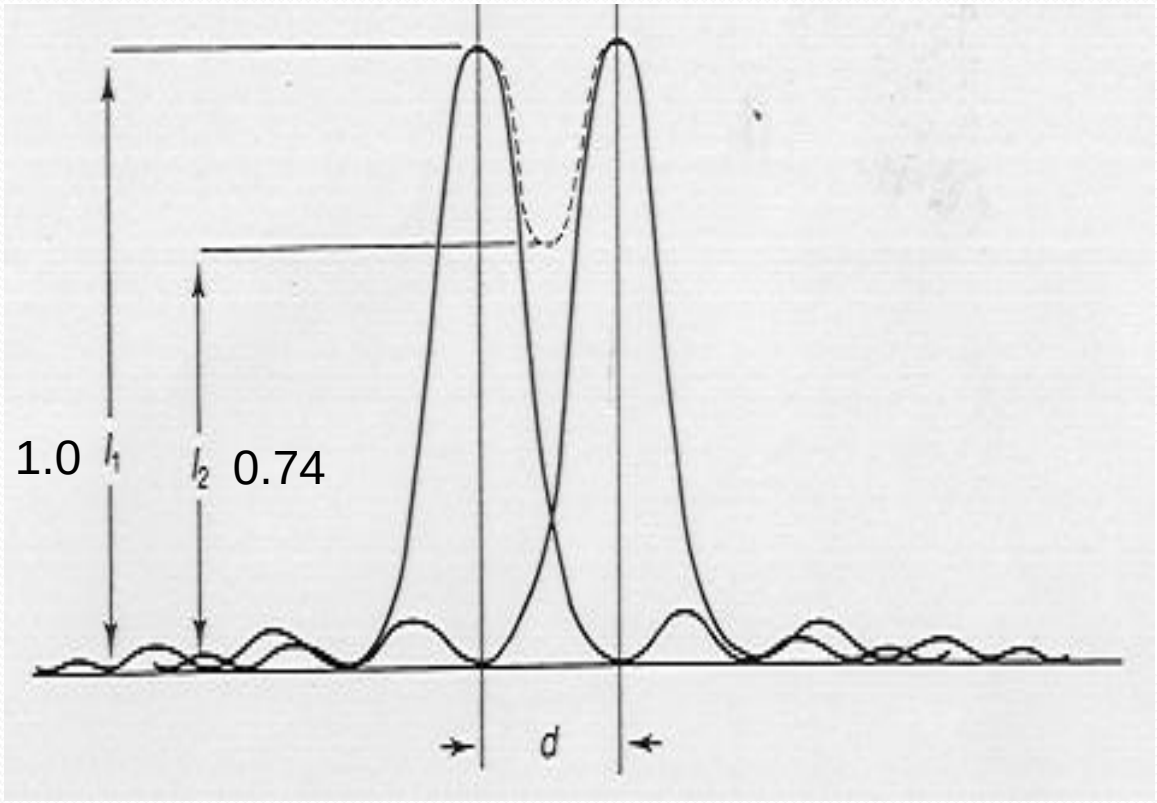


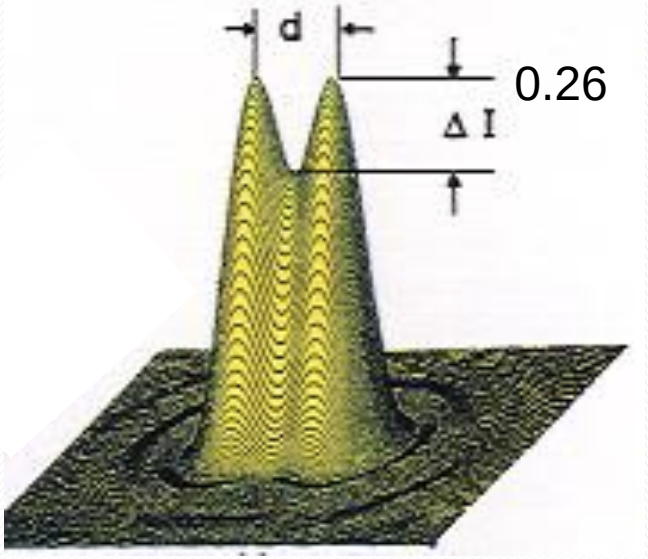
Resolving Power (분해능)

$$d = 0.61 \frac{\lambda}{NA}$$

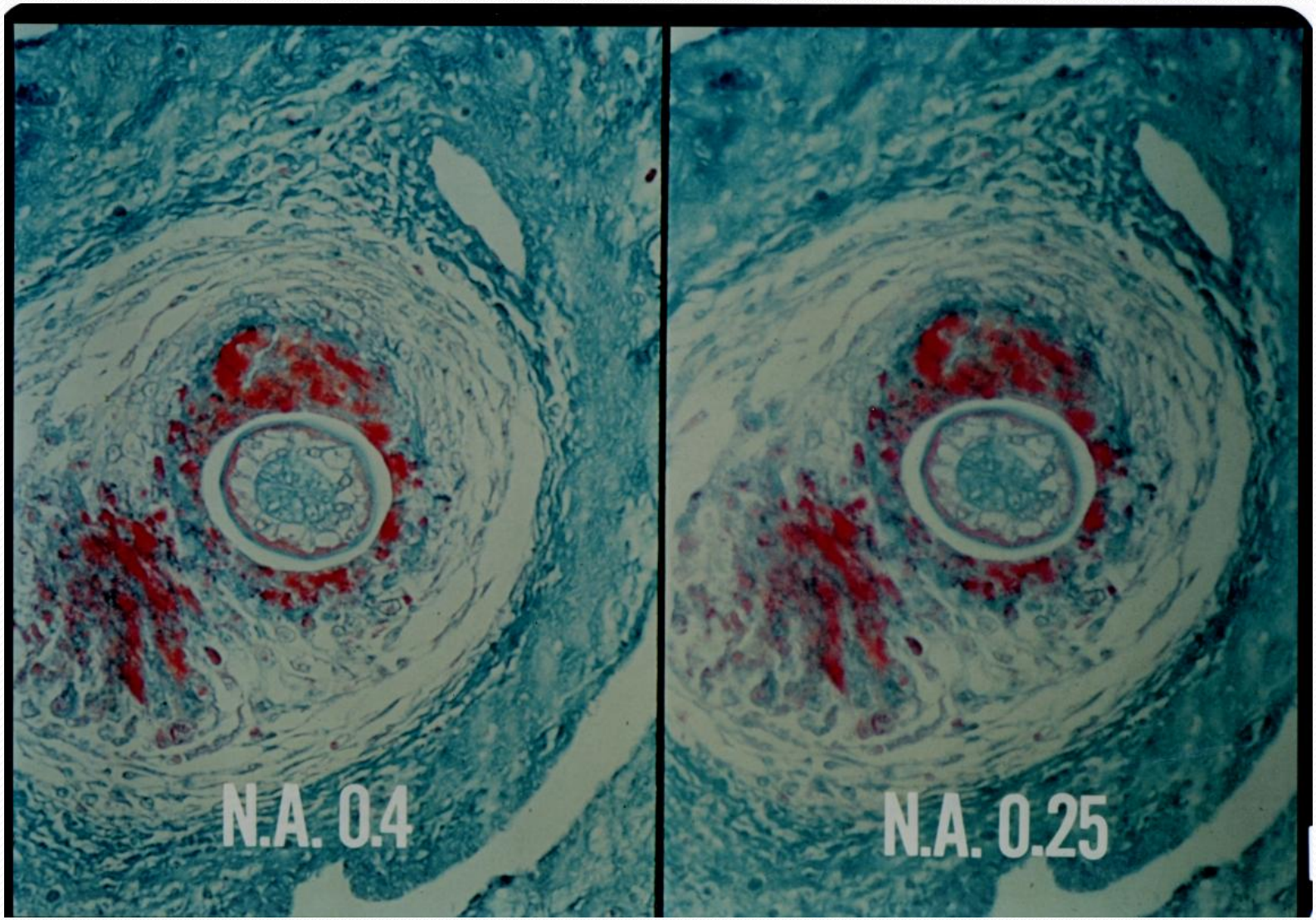
λ : Wavelength

NA : Numerical Aperture





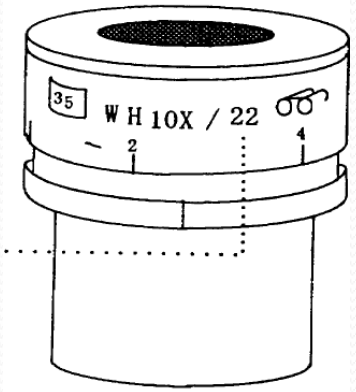
N.A.에 의한 이미지 차이



F.N. Field Number

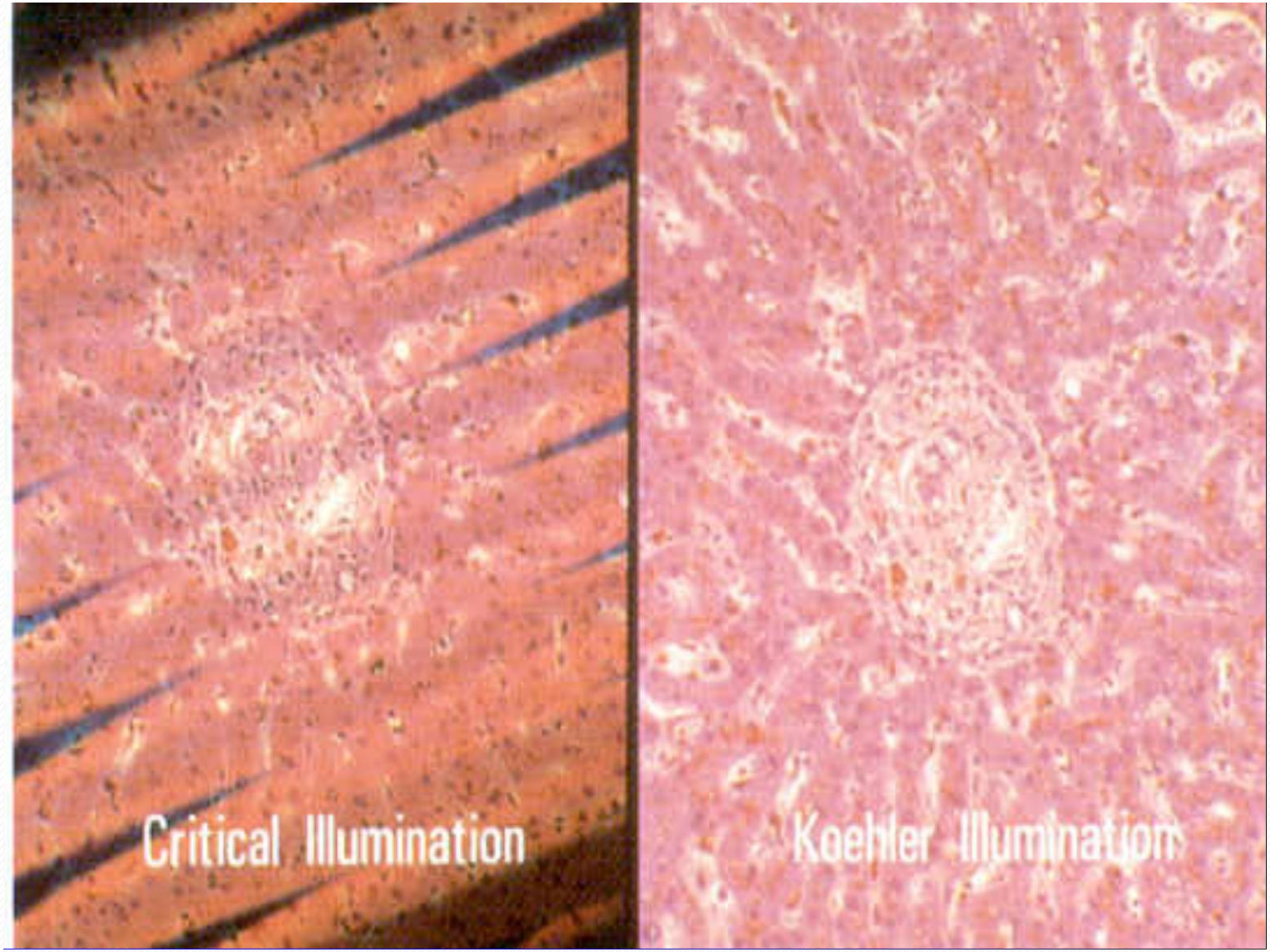
- 접안렌즈를 통해서 어느 정도의 면적을 볼 수 있는지를 판단하는 기준이 된다.

  → 접안렌즈의 표면에 F.N. 표시

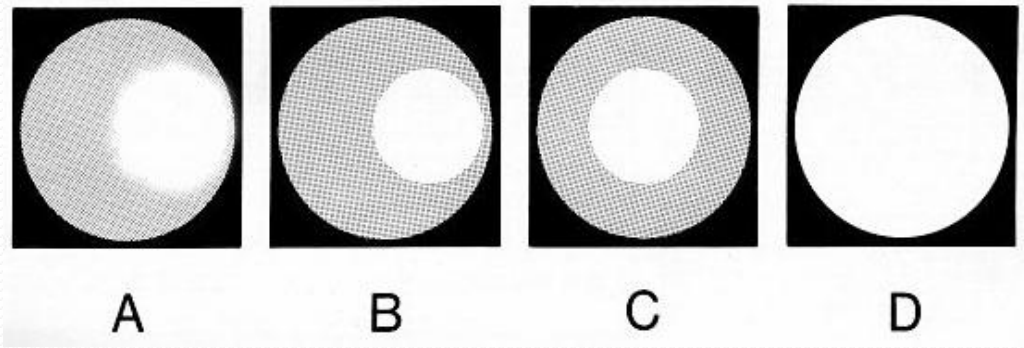


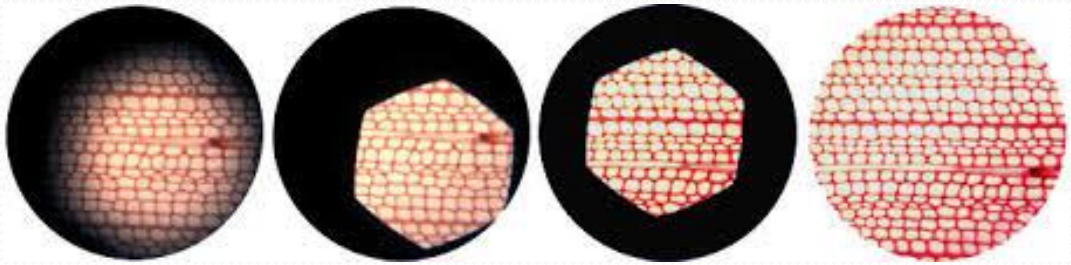
- 계산식
  - ❖ 실시야(직경 ㎜) = 접안렌즈의 F.N. / 현미경의 대물렌즈 배율

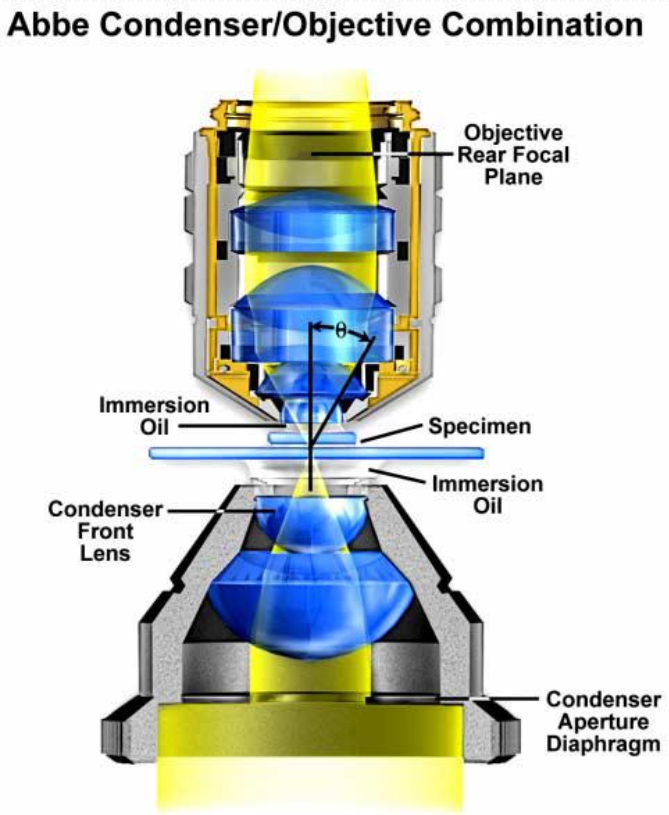
Köhler Illuminaton (쾰러 조명)



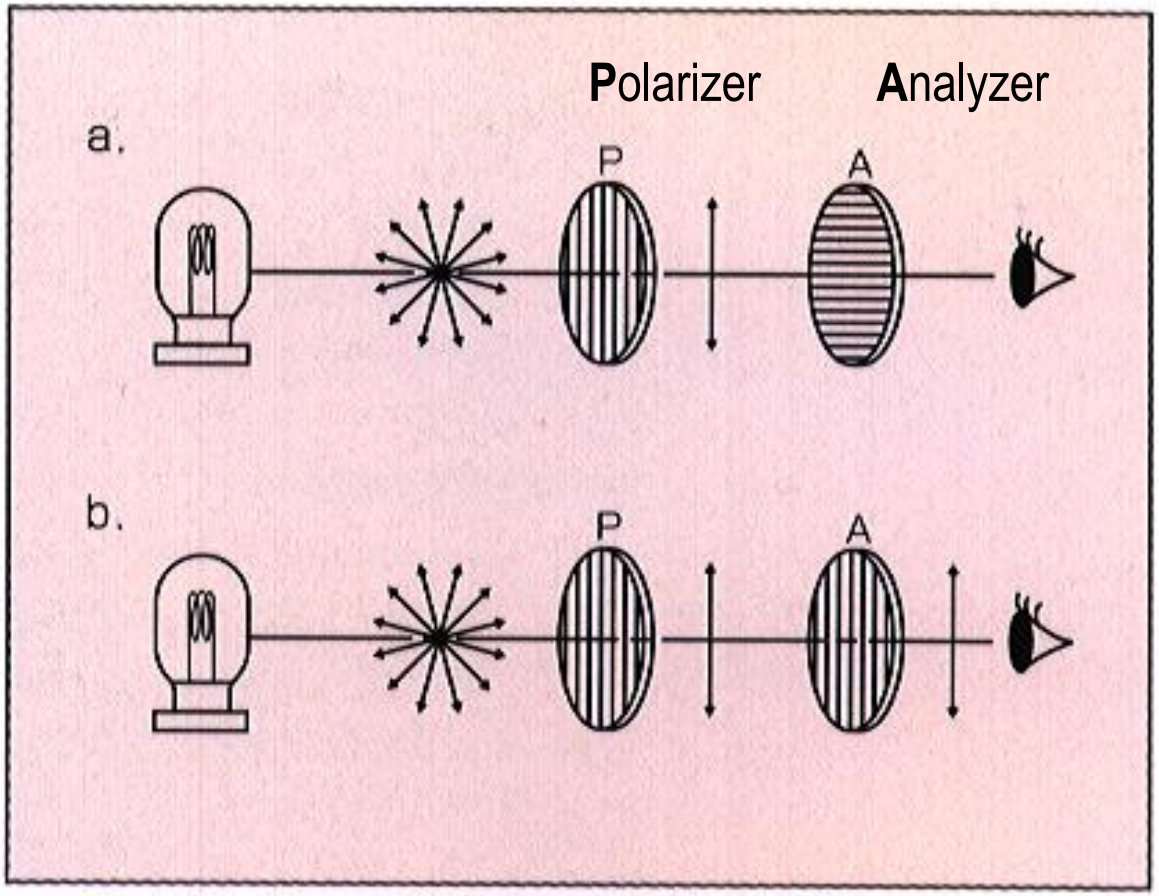
Köhler Illuminaton (쾰러 조명)





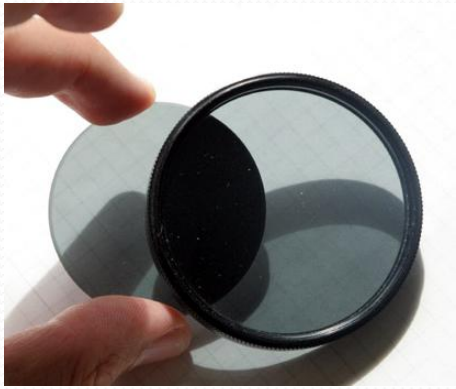


Crossed Nicols 직교 니콜

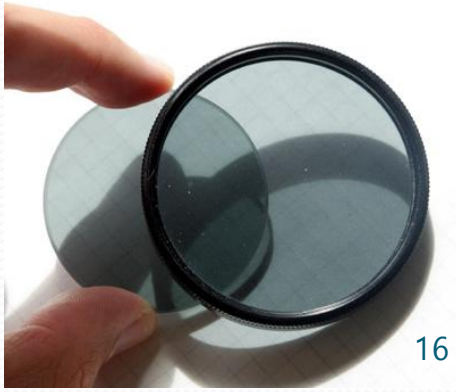


● 図1-3　a. 直交ニコルとb. 平行ニコル ●
P：ポラライザ　A：アナライザ

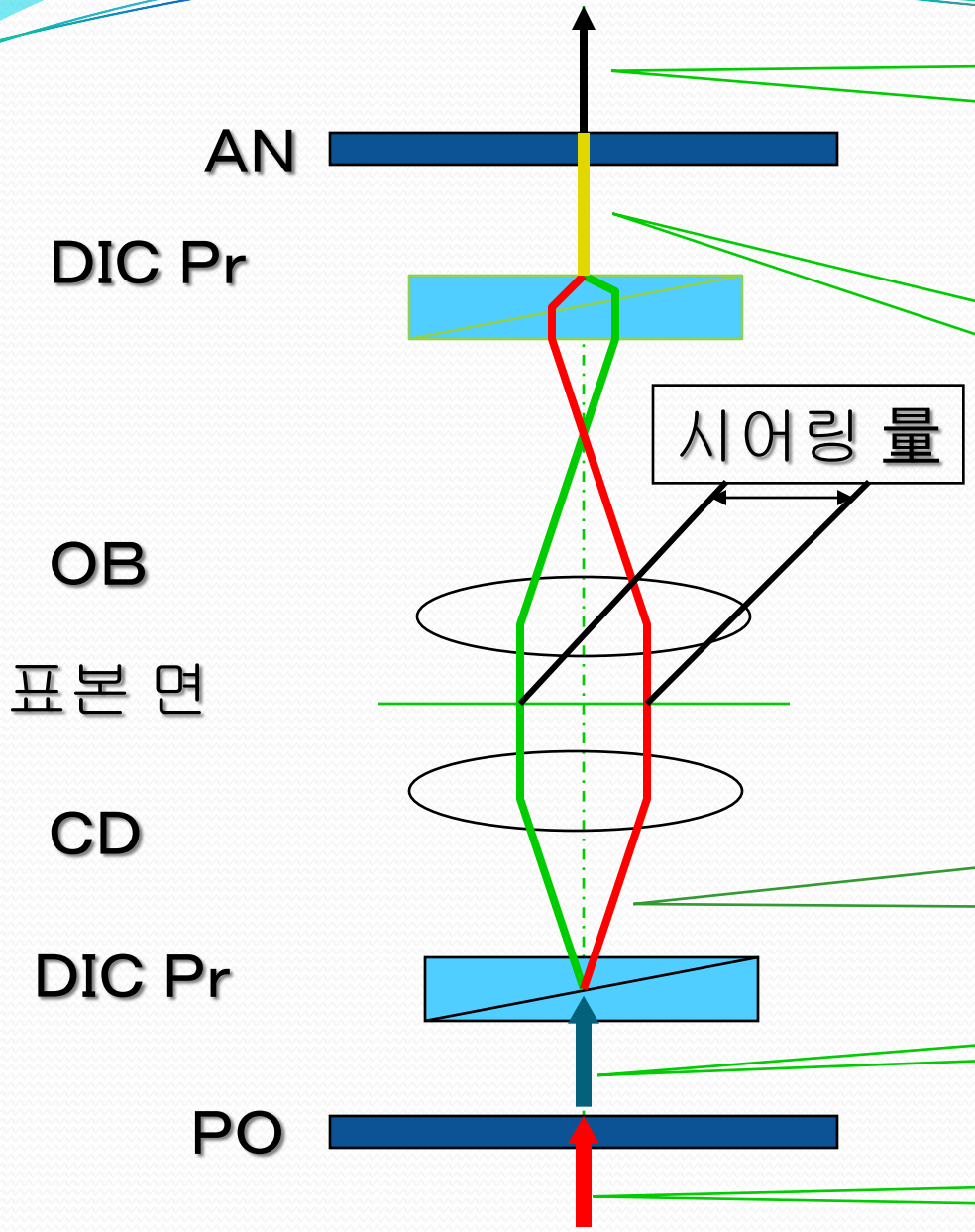
Crossed Nicols



Parallel Nicols



DIC Differential Interference Contrast



2개光의 합성파 진동방향 동일

2개광의 합성파 진동방향 직교

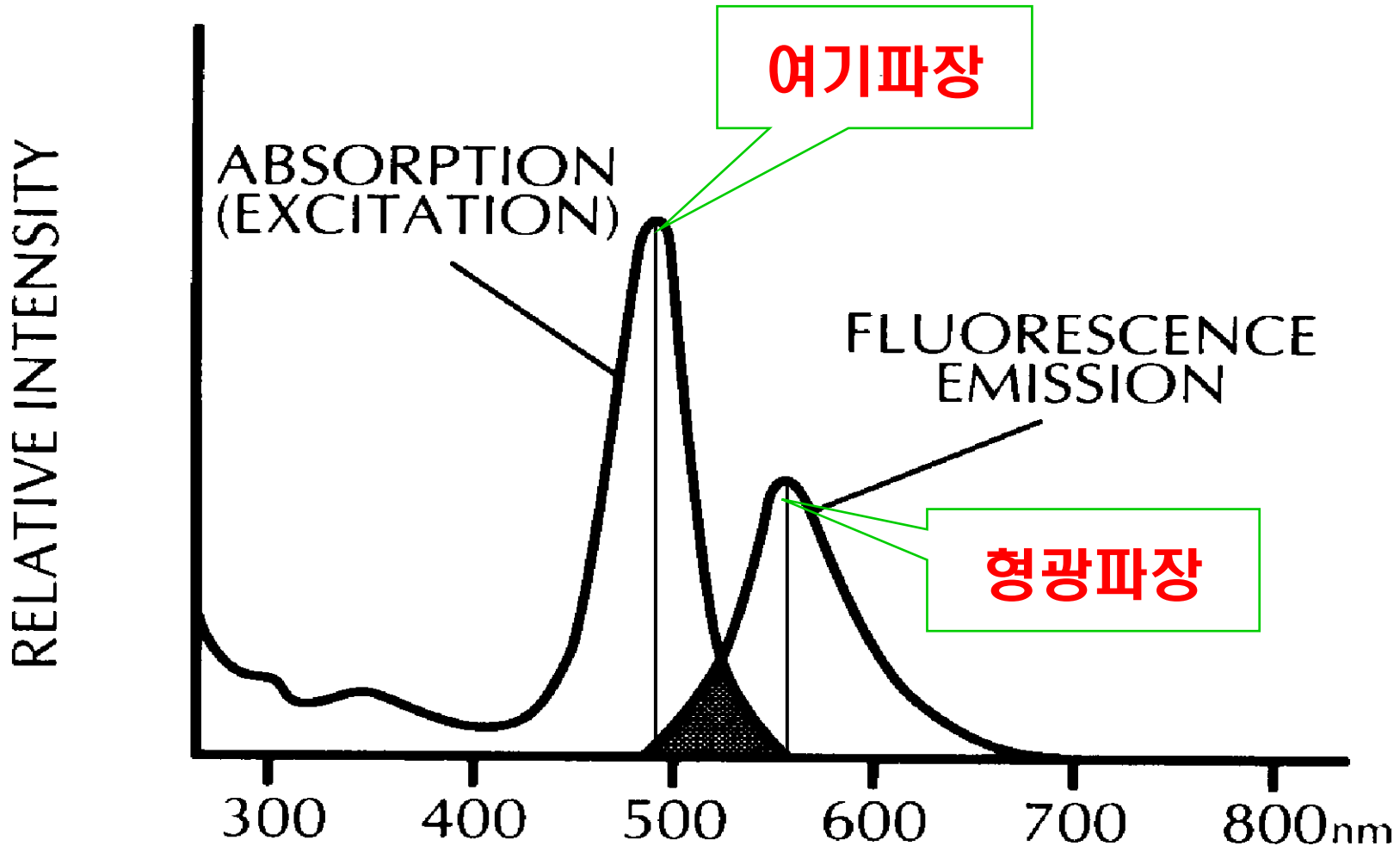
진동방향이 직교하는 2개의 직선편광

직선편광

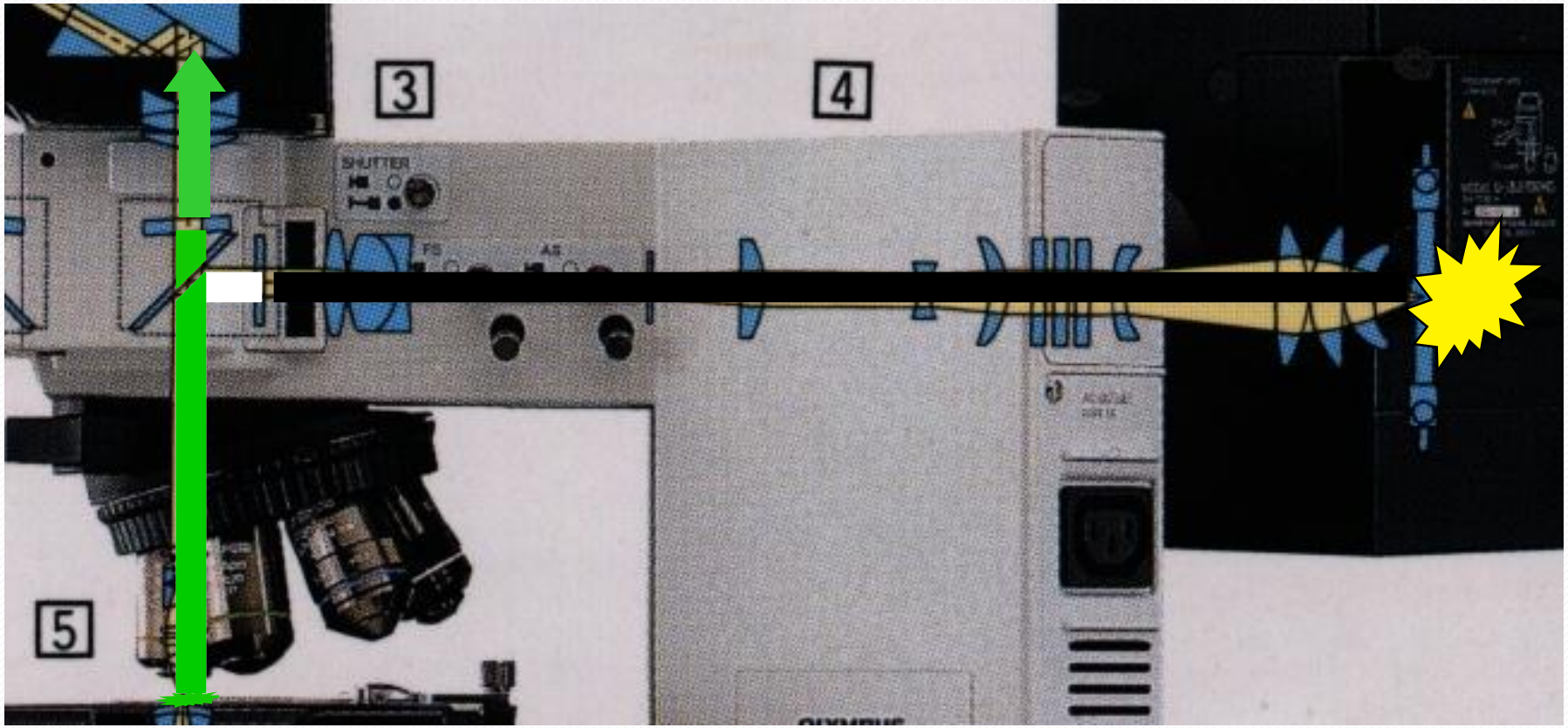
자연광

관찰법에 따른 이미지 비교

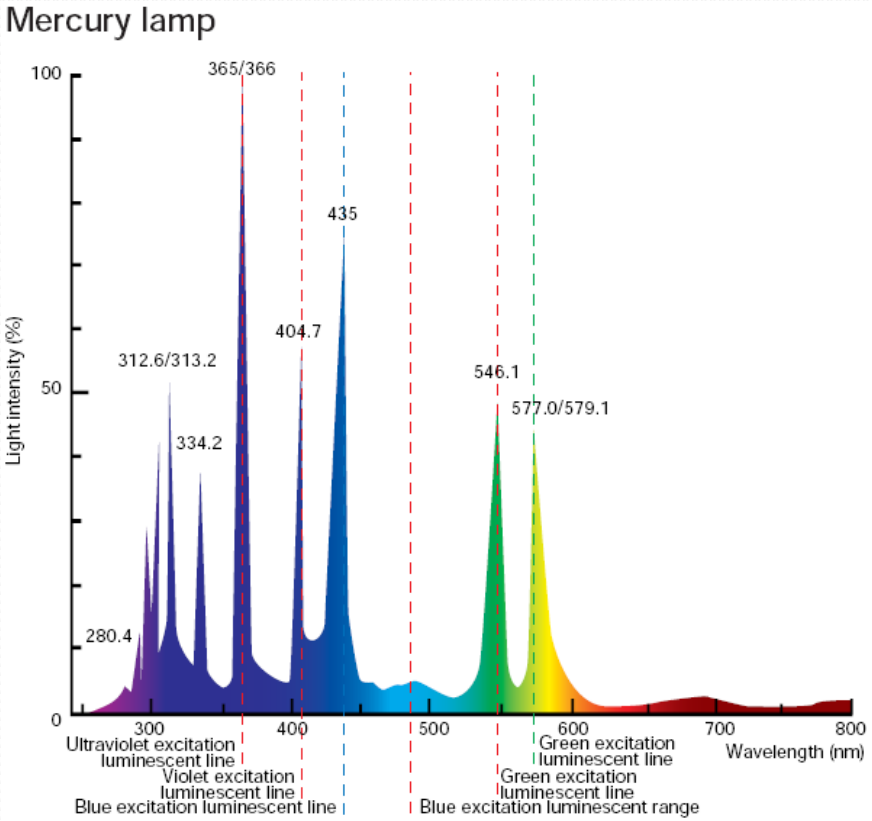
Fluorescence Microscopy(FL)

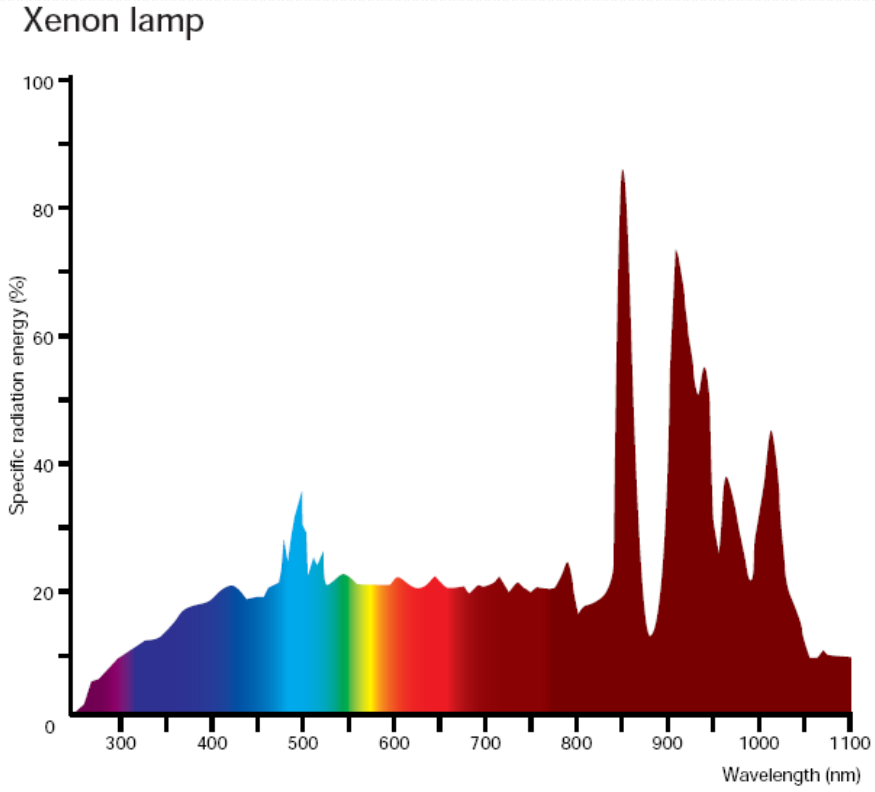


Fluorescence Microscopy(FL)

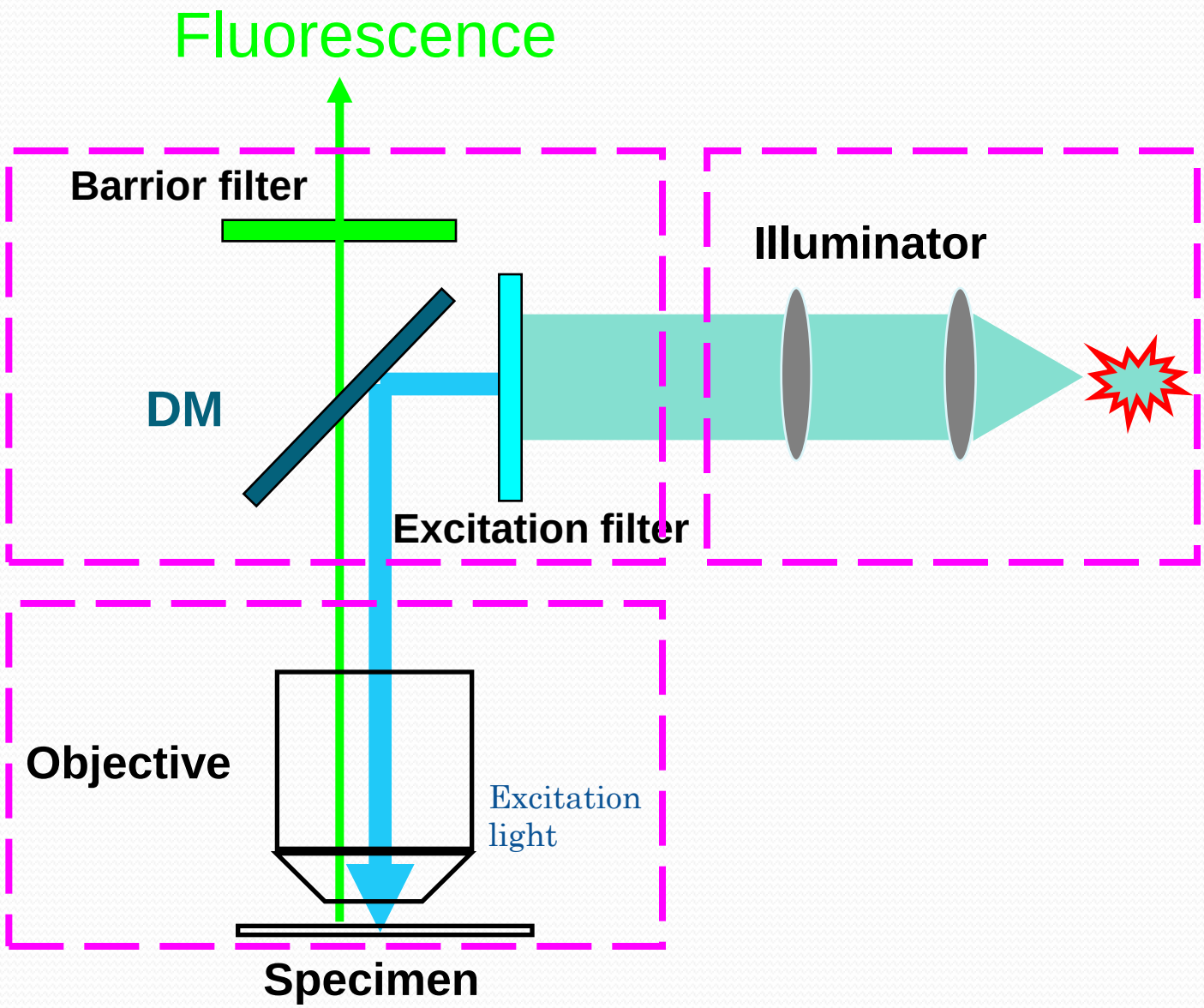


Fluorescence Microscopy(FL)

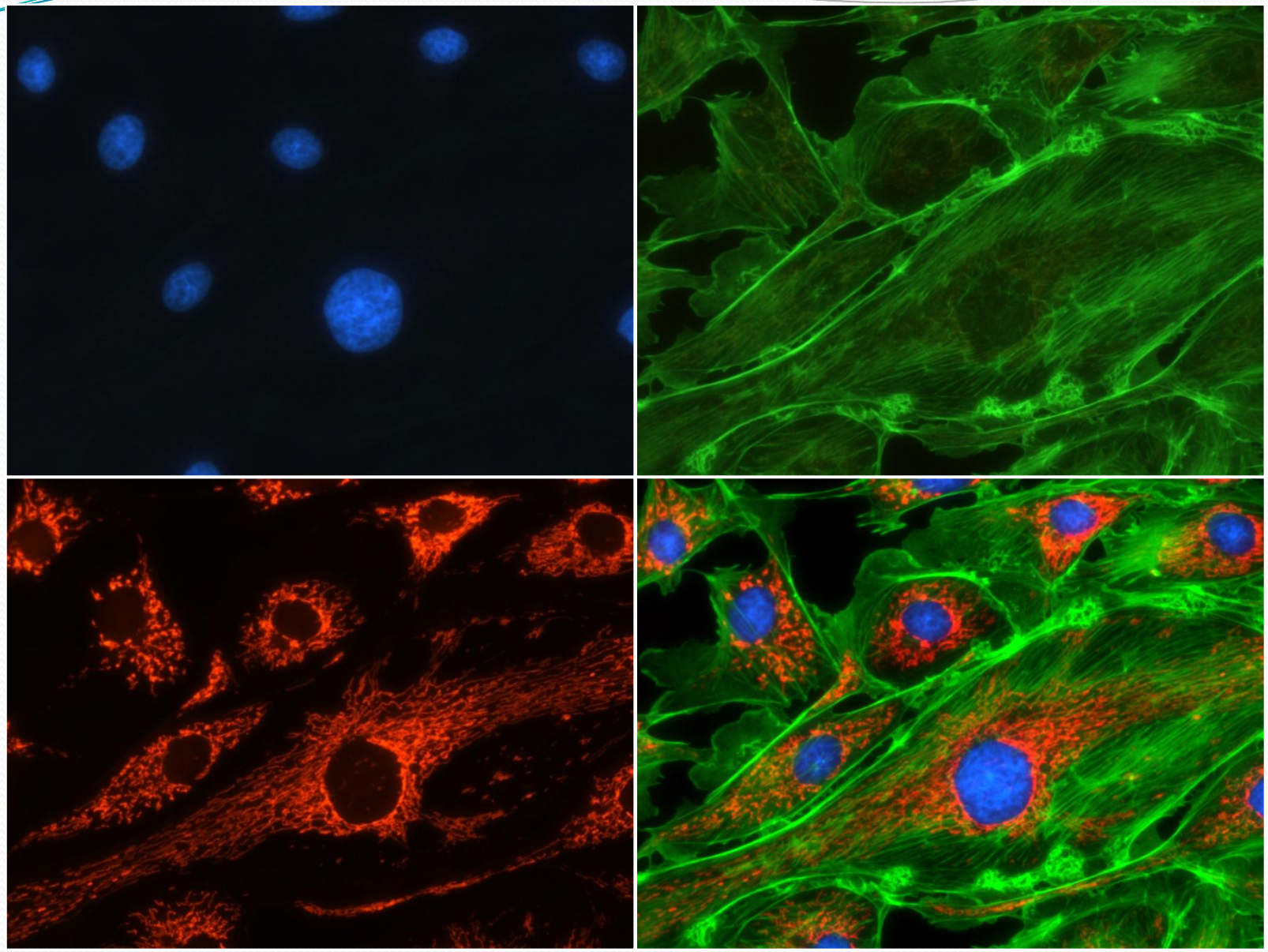




Fluorescence Microscopy(FL)

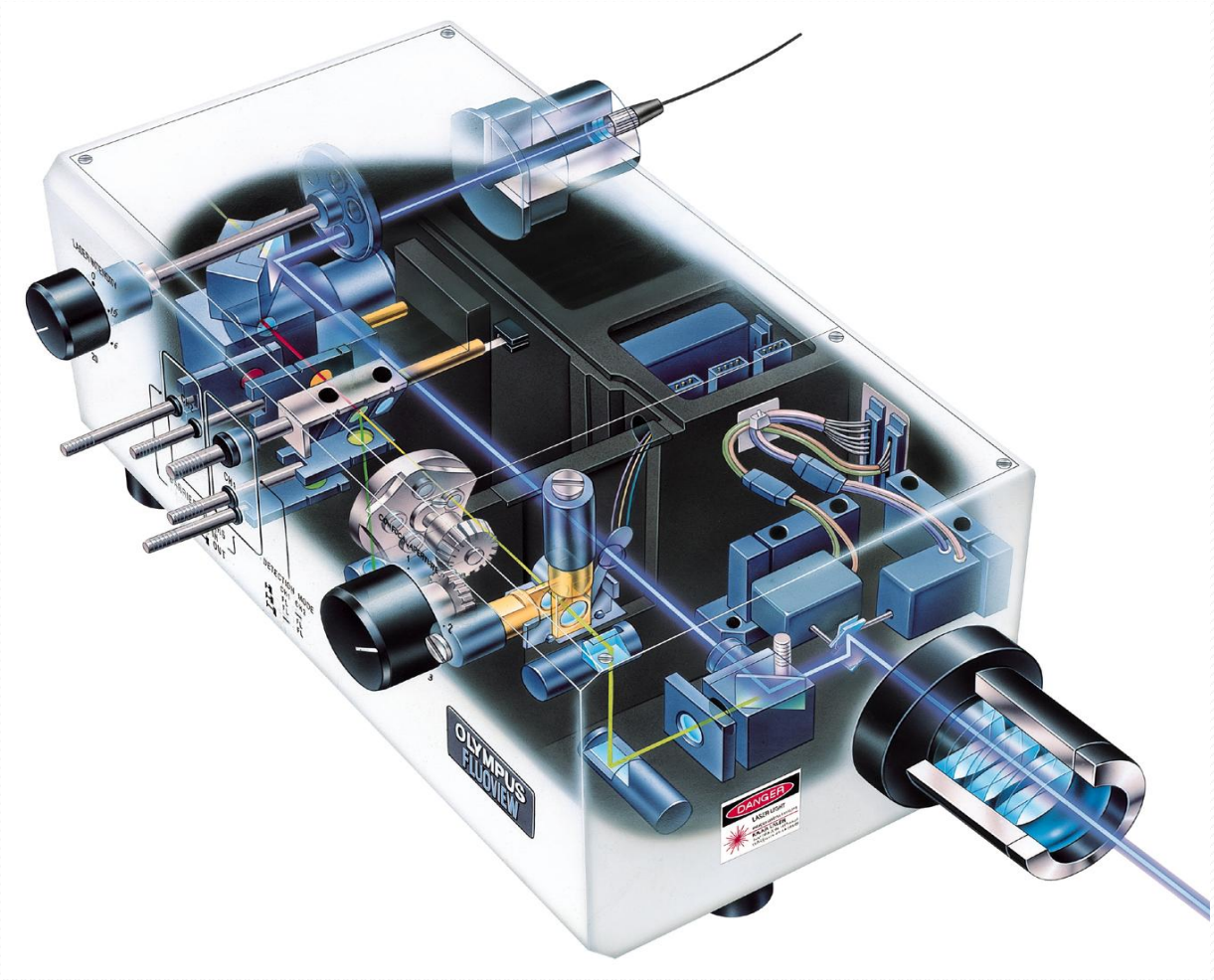


Fluorescence Microscopy(FL)



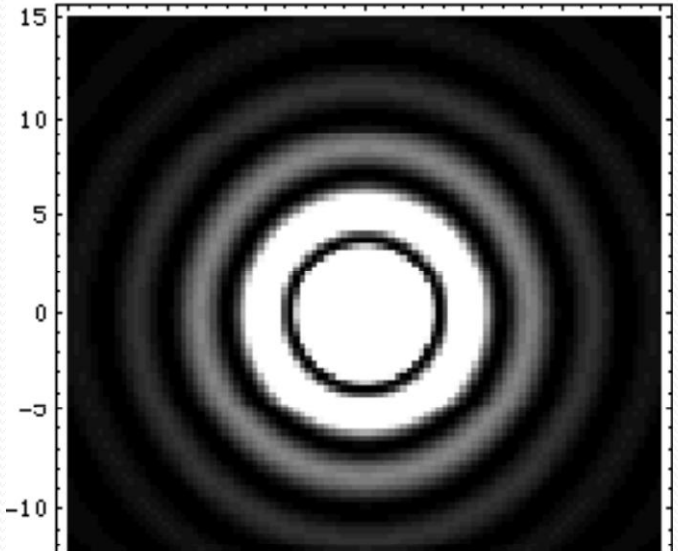
Microscope: BX53 , Imaging Camera: AcquCAM ProG3

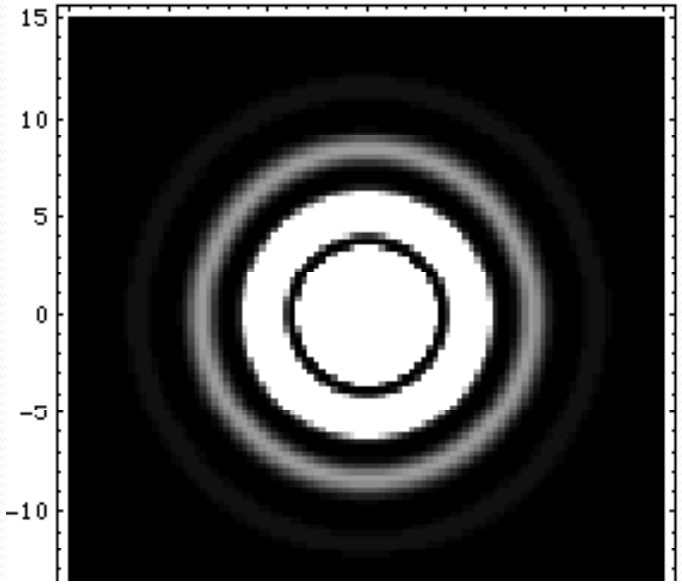
Inside Scanning Unit of CLSM

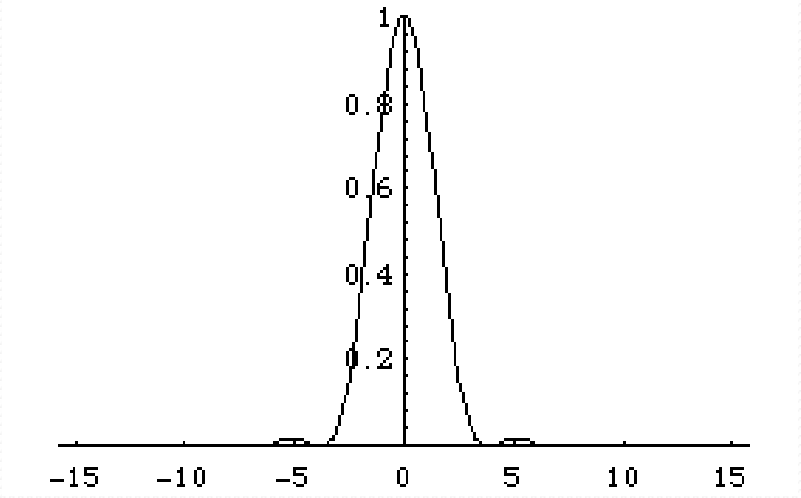


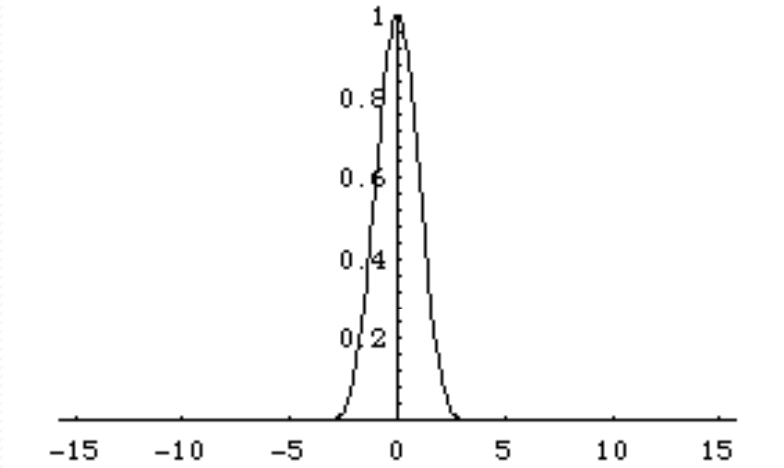
CLSM

- Diffraction pattern at the focus spot





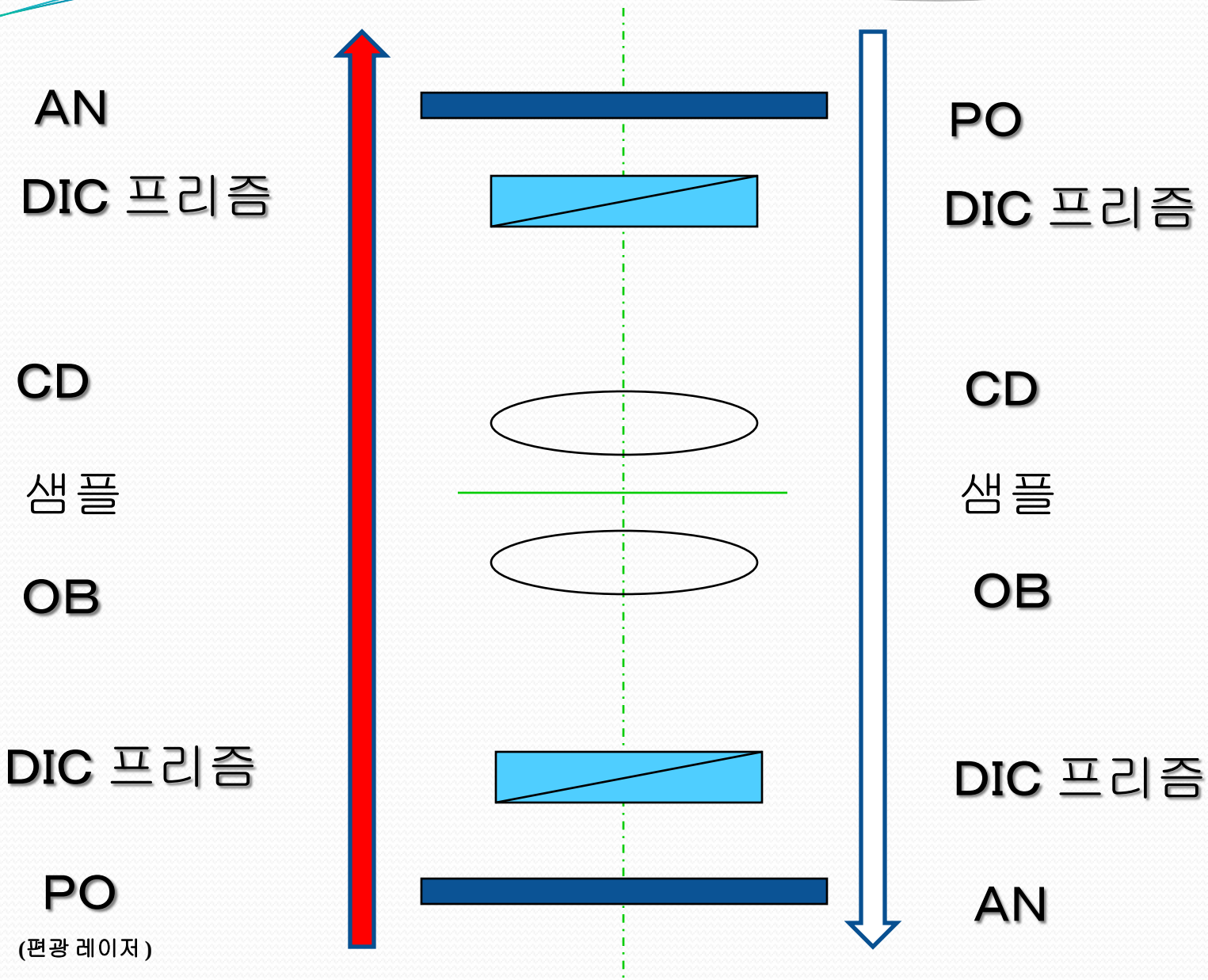




The resolution of CLSM

- High Resolution on Horizontal Axis
  - Microscope $\varepsilon = 0.61\,\lambda / NA$
  - CLSM $\varepsilon = 0.55\,\lambda / NA$
    - Confocal aperture cuts-off light out of focus

DIC_ 일반현미경 DIC 및 LSCM DIC



감사합니다