

Microscope 이론 및 LSCM Application

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진 재 환

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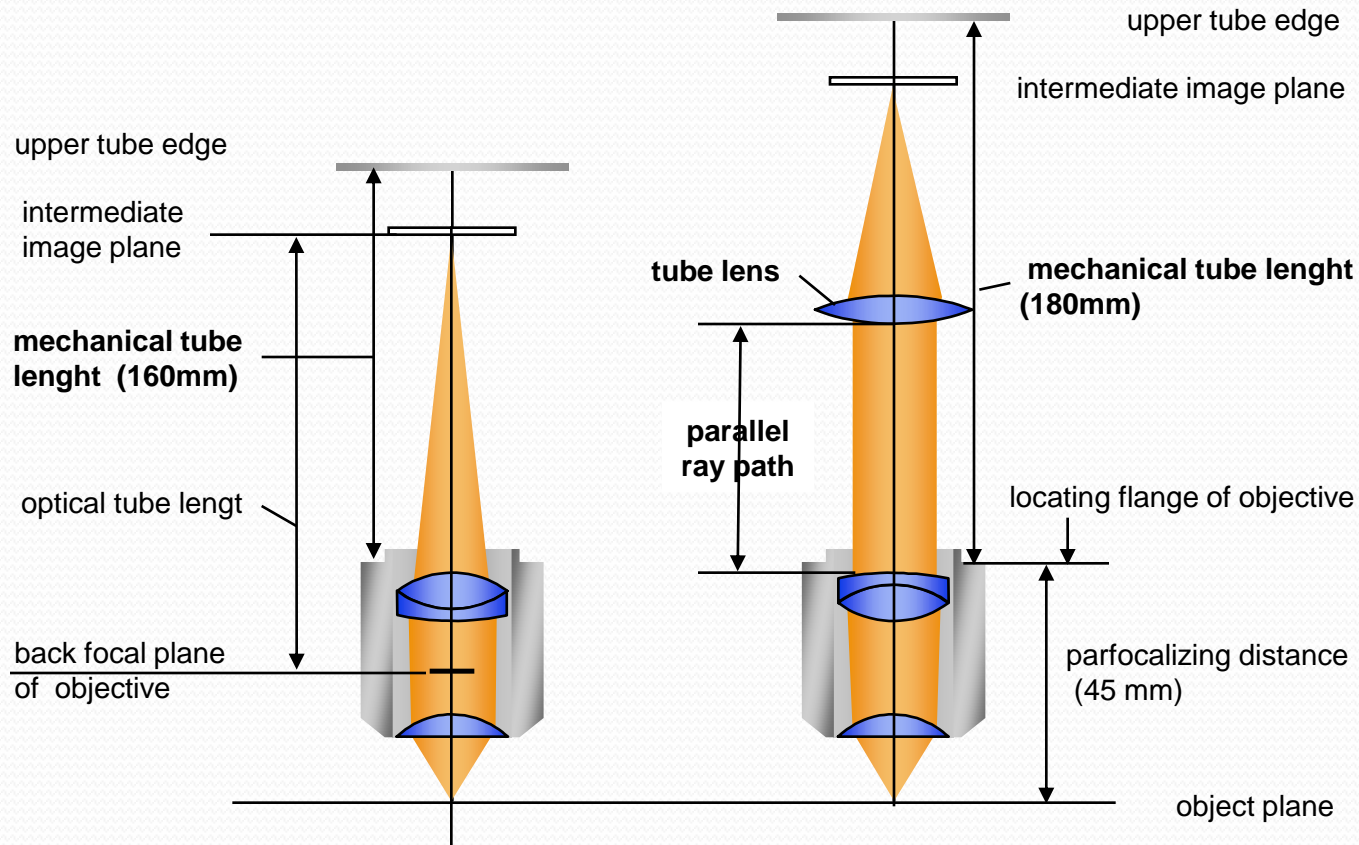
OBJECTIVE UIS



UIS Universal Infinity System (광학계의 변화)

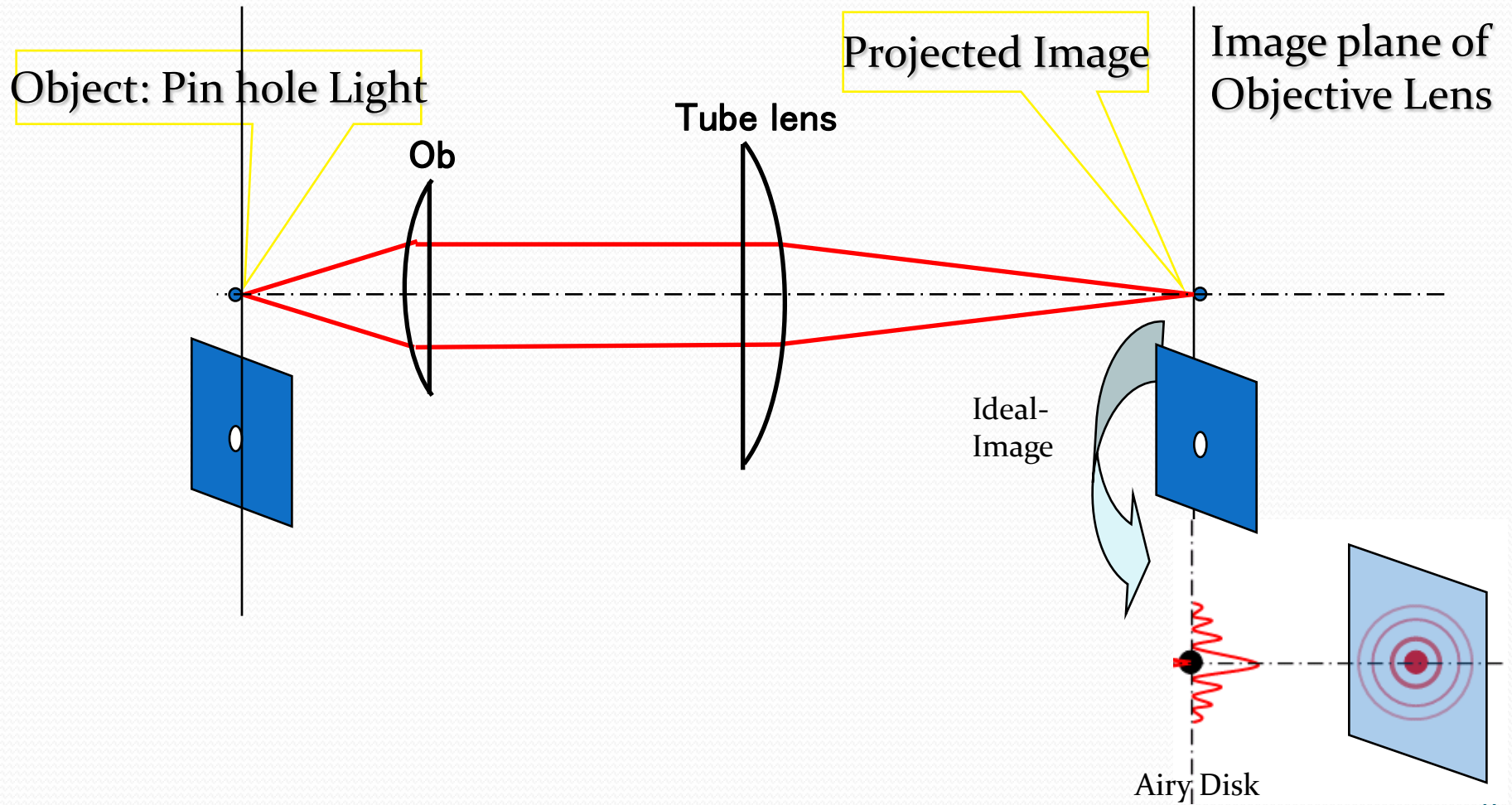
FINITY

INFINITY

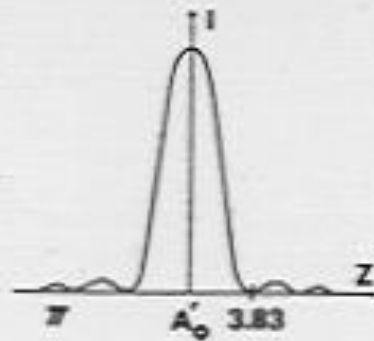
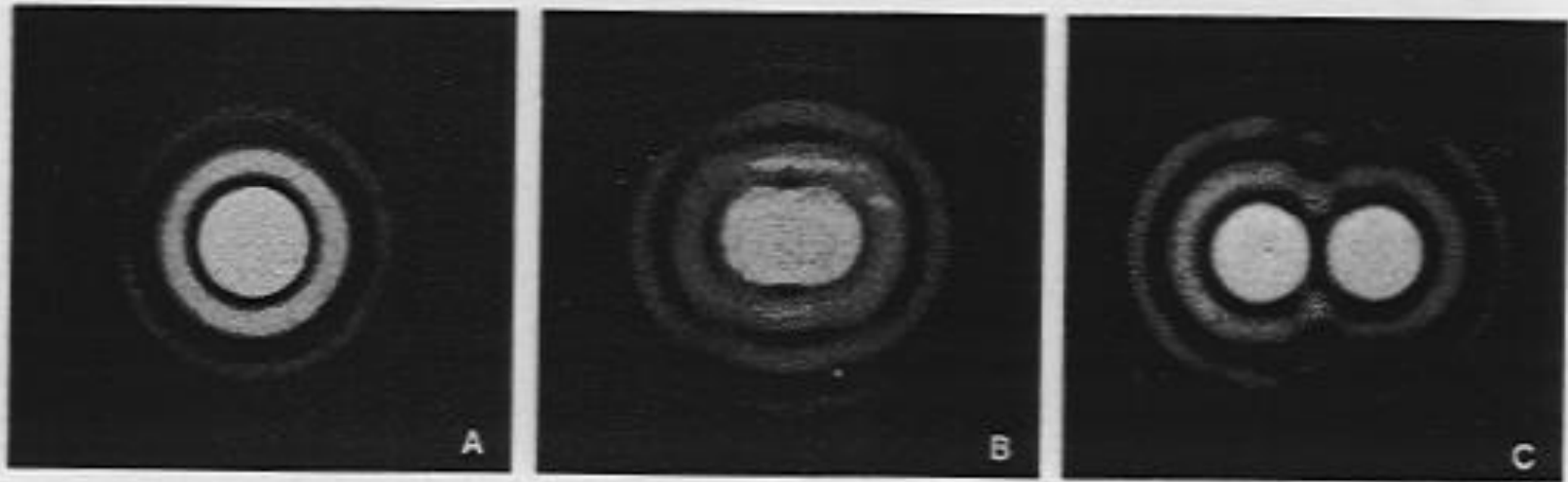


Idealistic None Aberration Lens and Projected Image

- Objective Lens



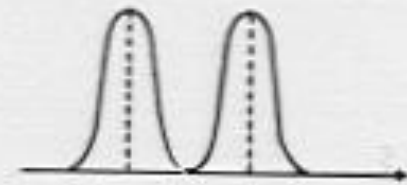
N.A. Numerical Aperture



D



E



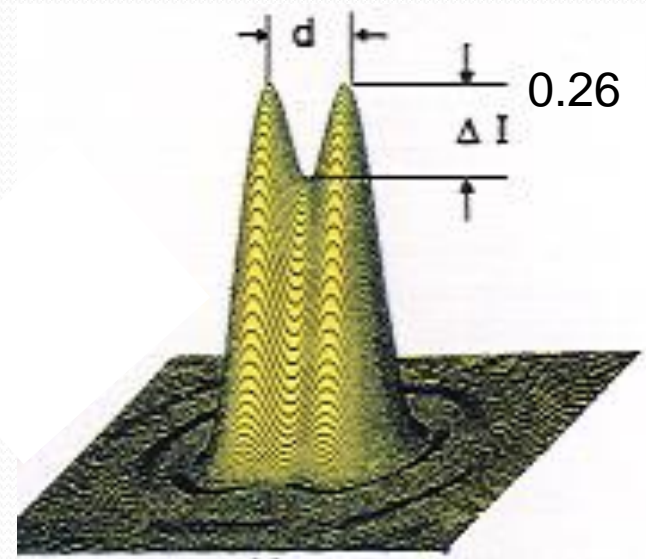
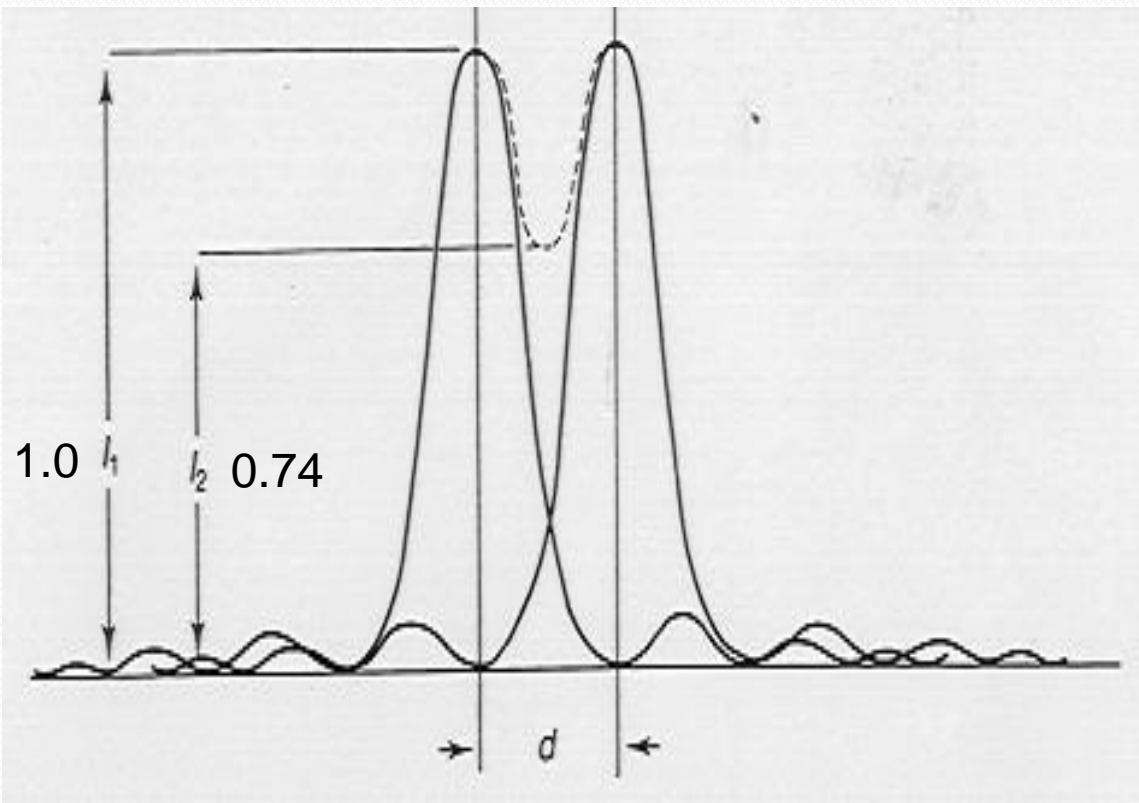
F

Resolving Power (분해능)

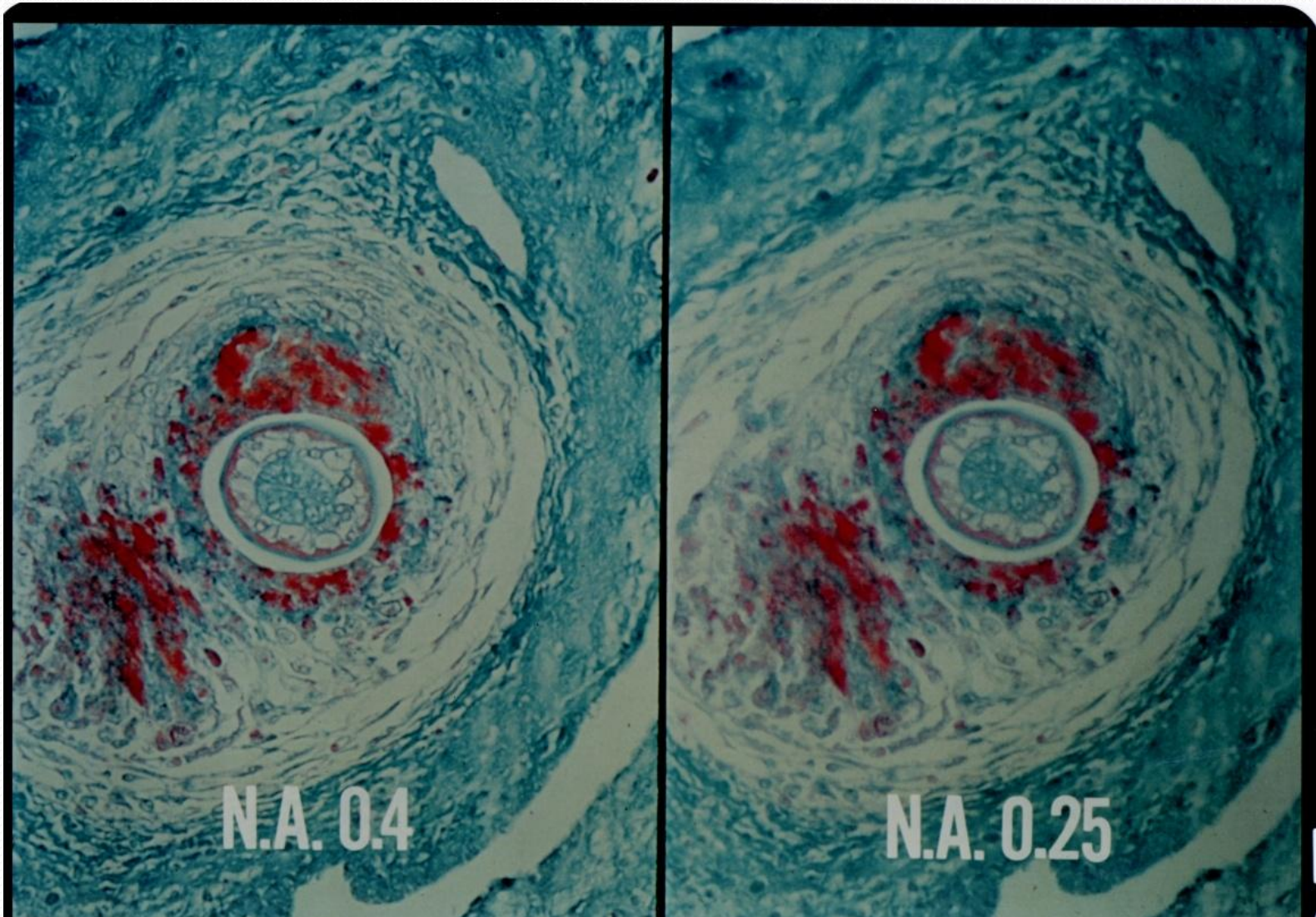
$$d = 0.61 \frac{\lambda}{NA}$$

λ : Wavelength

NA : Numerical Aperture



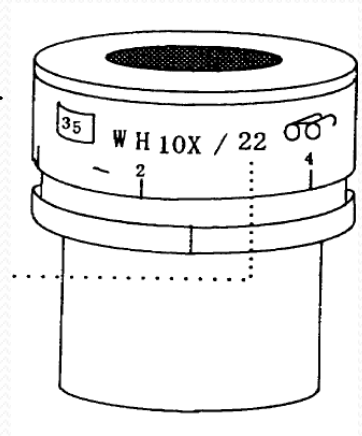
N.A.에 의한 이미지 차이



F.N. Field Number

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

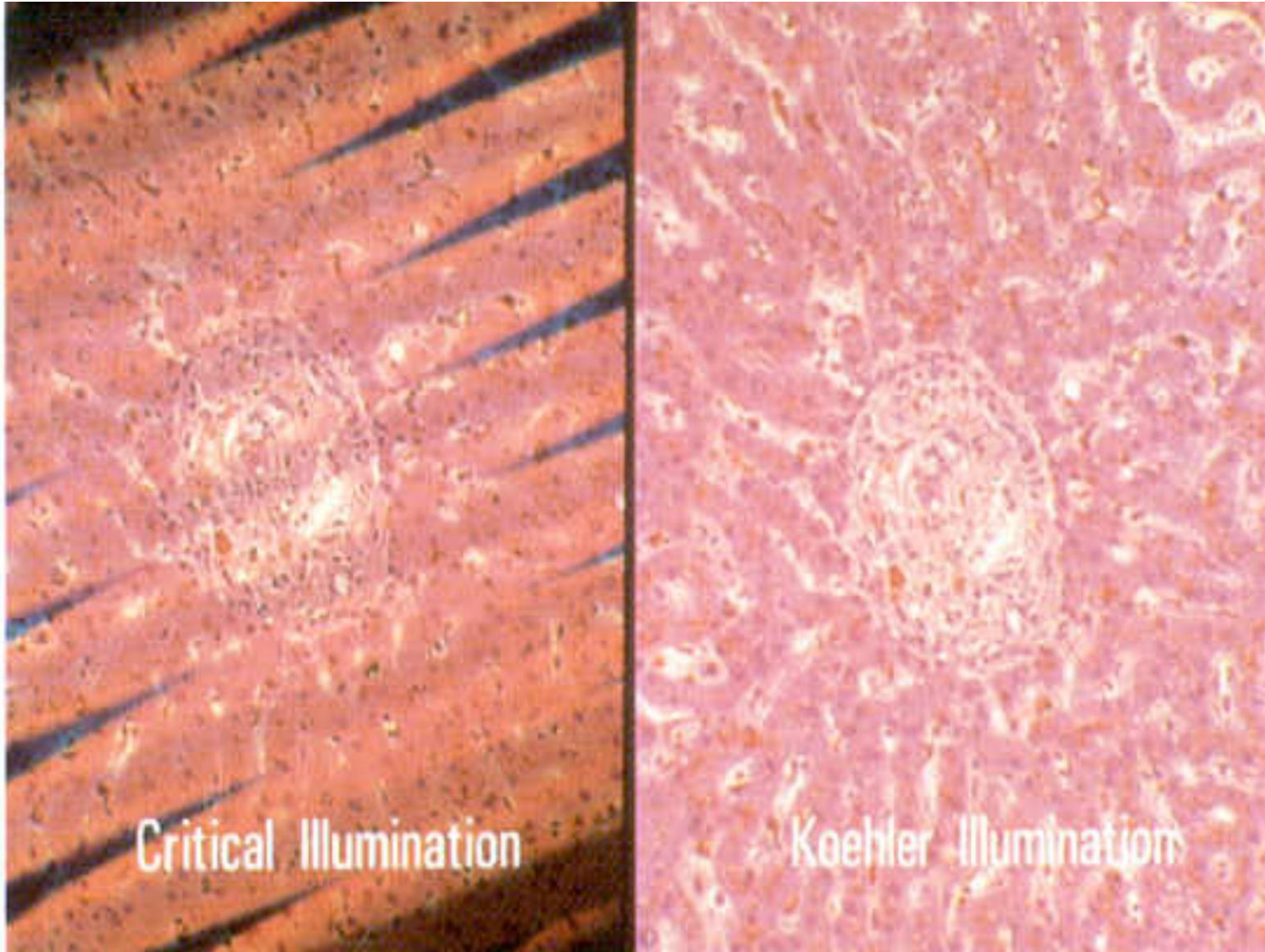
→ 접안렌즈의 표면에 F.N. 표시



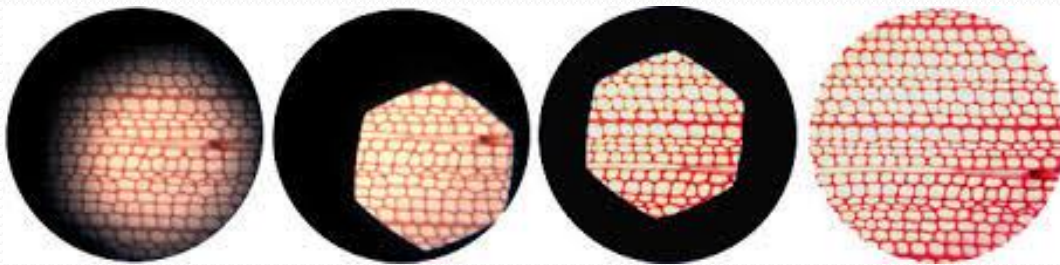
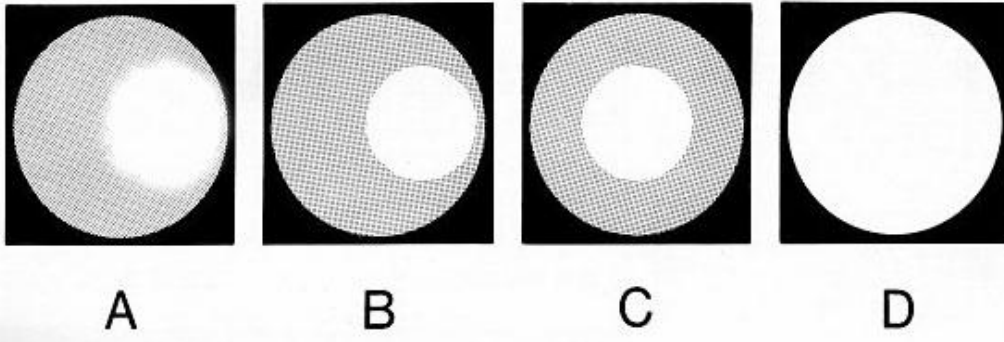
- 계산식

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

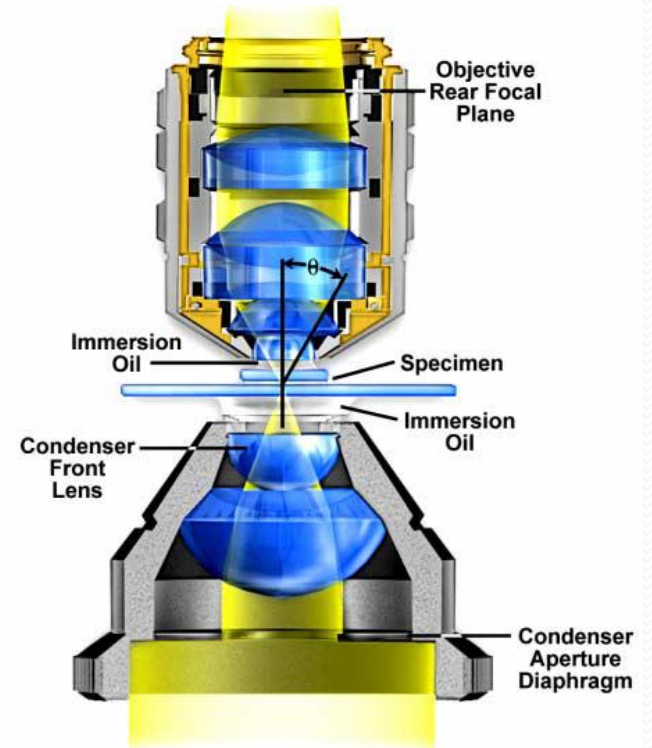
Köhler Illuminaton (꺼러 조명)



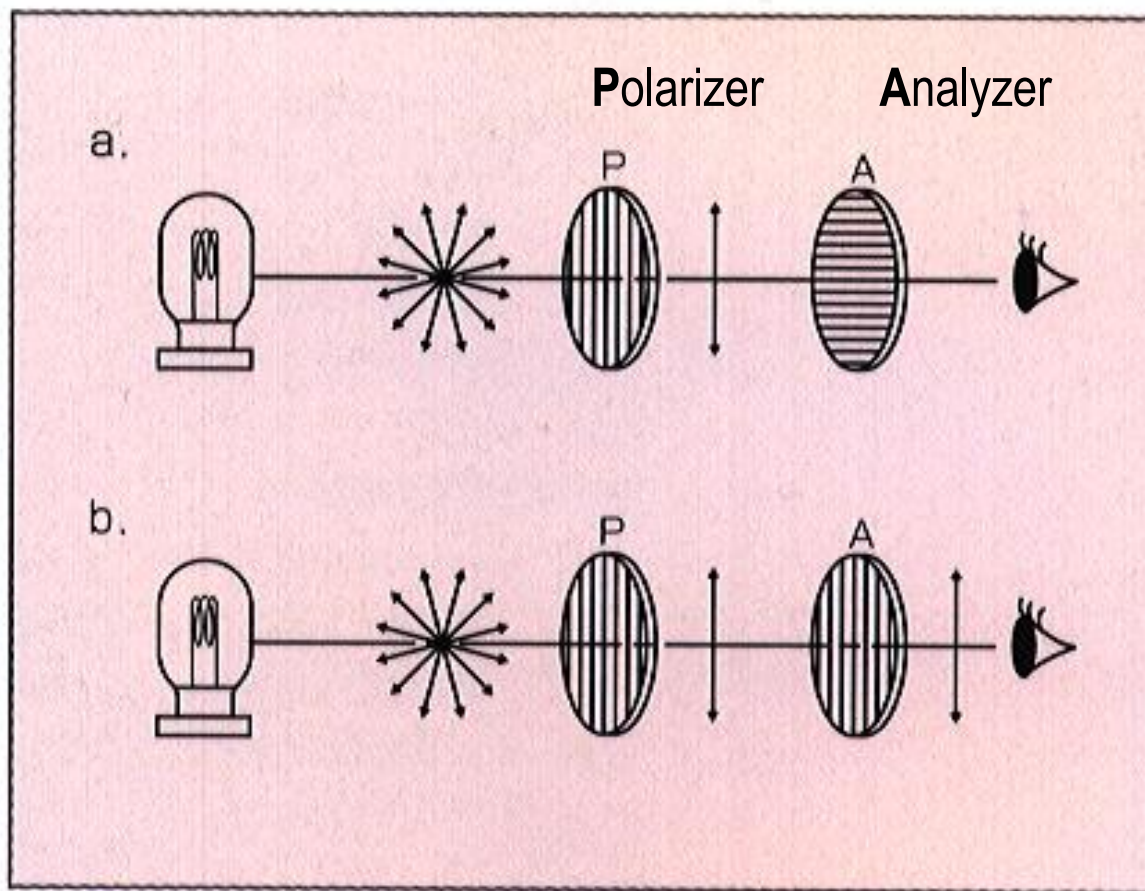
Köhler Illumination (콜러 조명)



Abbe Condenser/Objective Combination

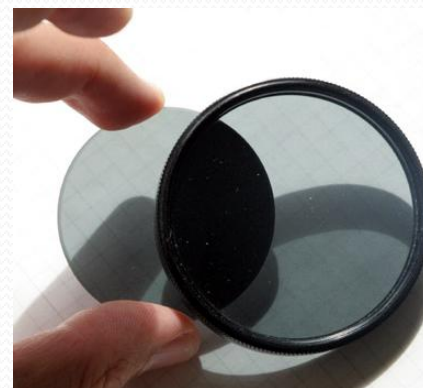


Crossed Nicols 직교 니콜

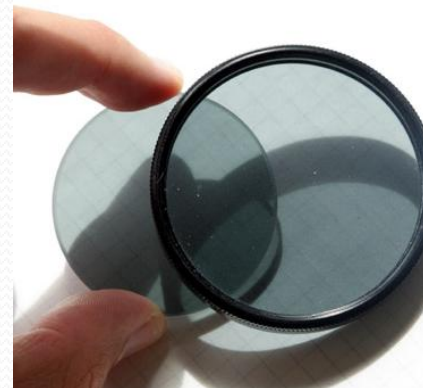


● 図1-3 a. 直交ニコルとb. 平行ニコル ●
P: ポラライザ A: アナライザ

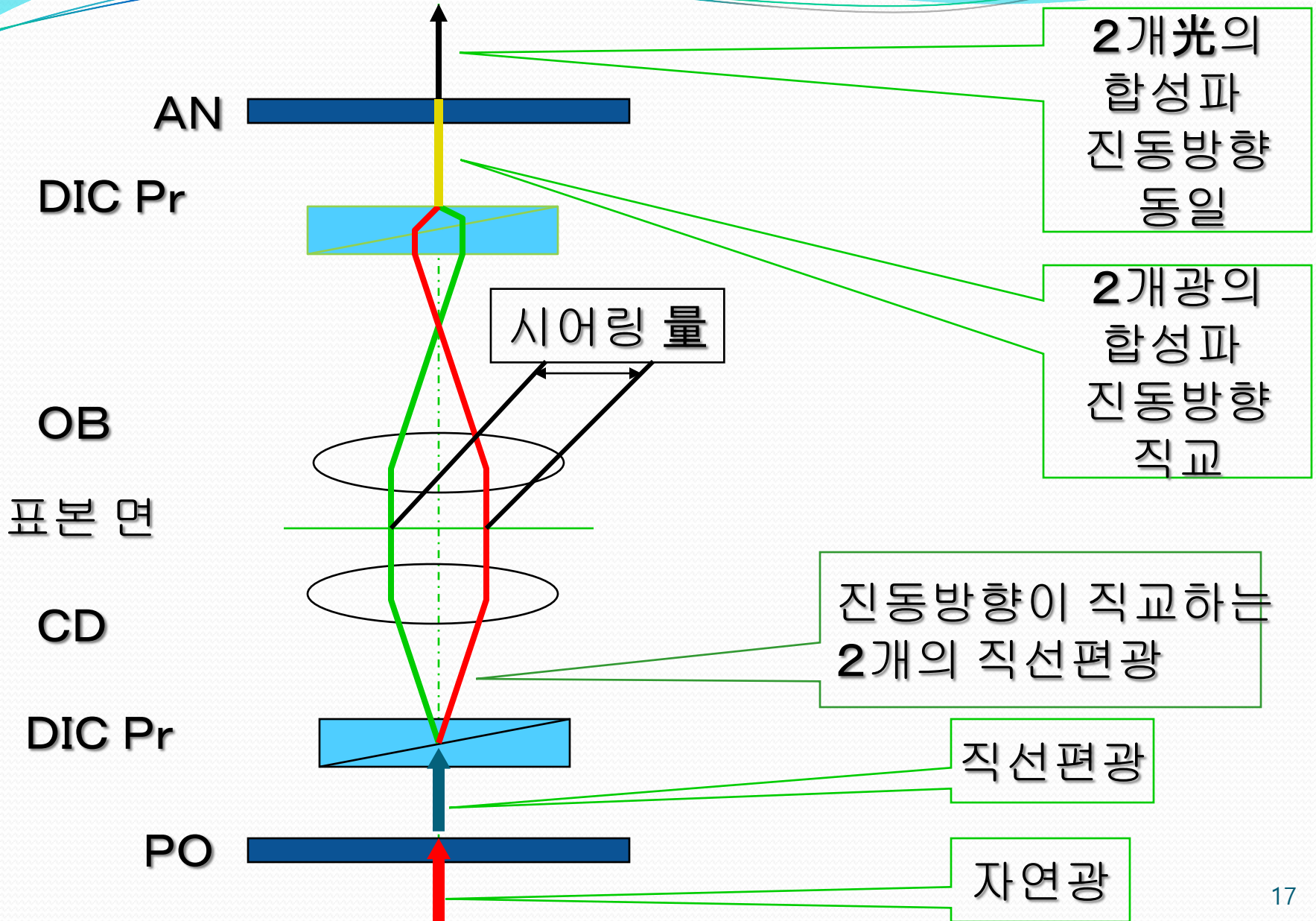
Crossed Nicols



Parallel Nicols



DIC Differential Interference Contrast



2개 광의
합성과
진동방향
동일

2개 광의
합성과
진동방향
직교

시어링 量

진동방향이 직교하는
2개의 직선편광

직선편광

자연광

관찰법에 따른 이미지 비교

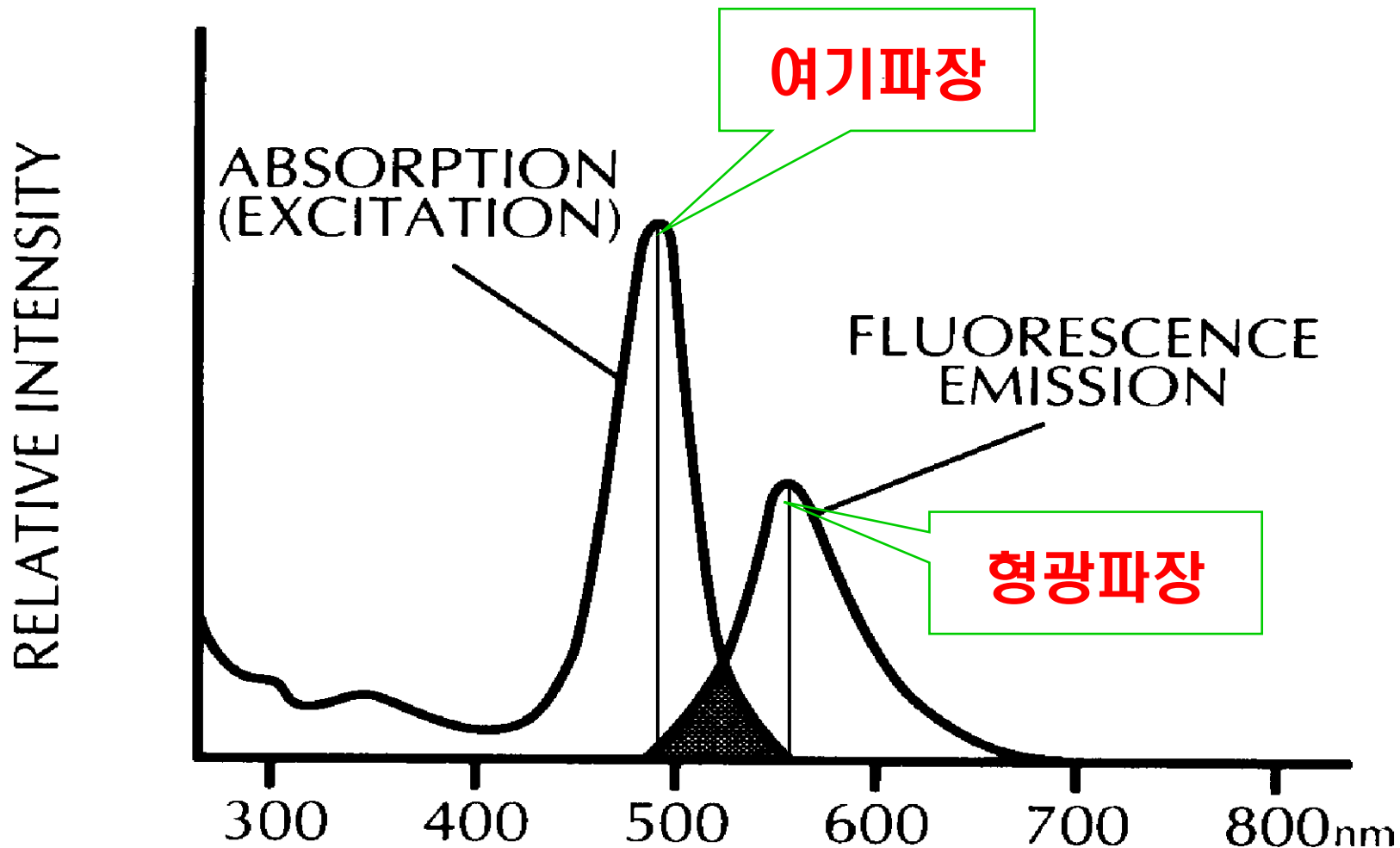


Bright field

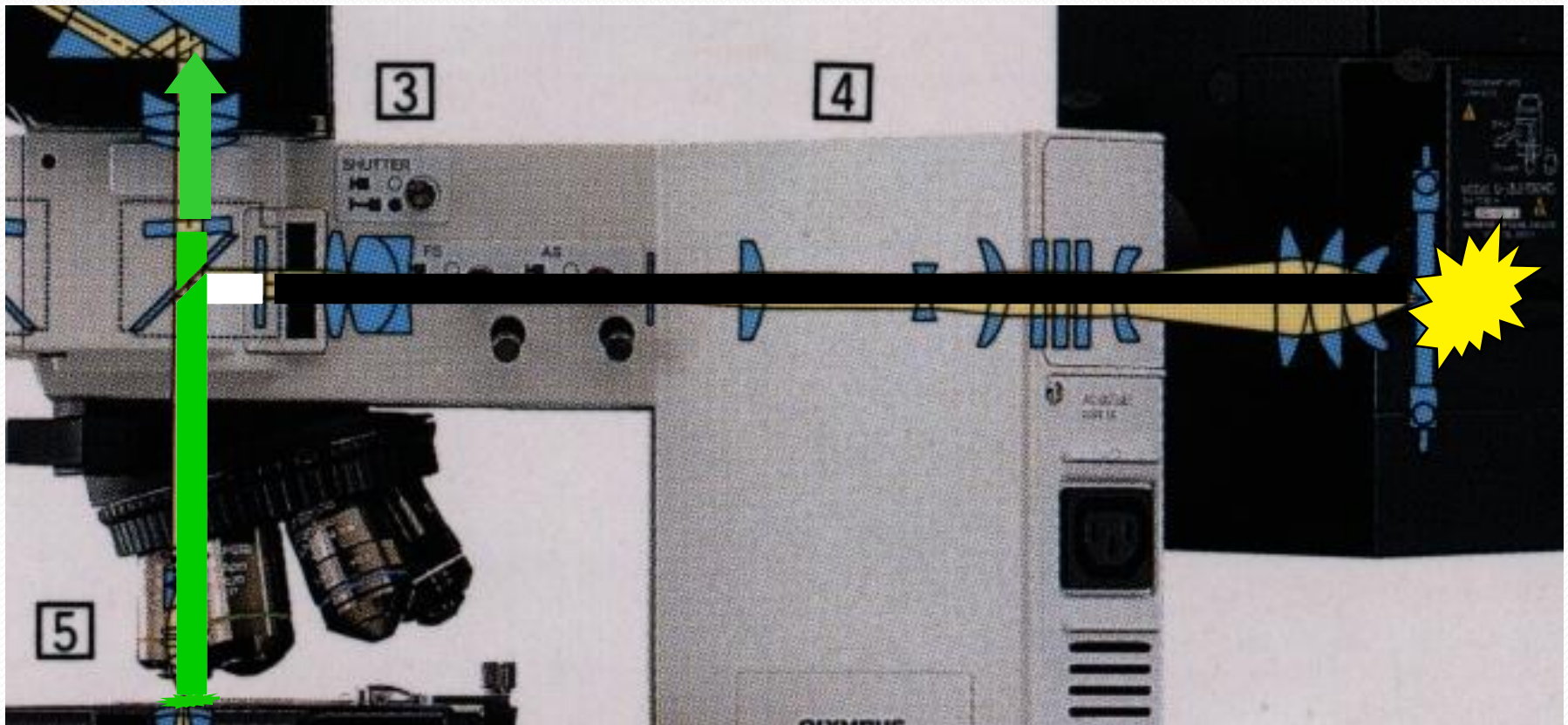
Phase contrast

DIC

Fluorescence Microscopy(FL)

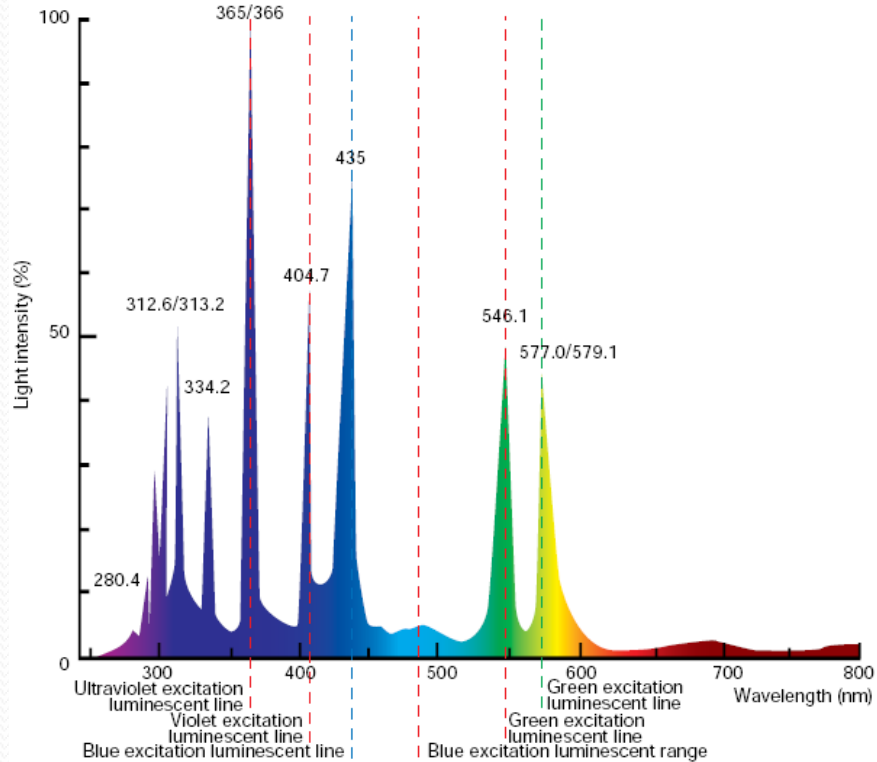


Fluorescence Microscopy(FL)

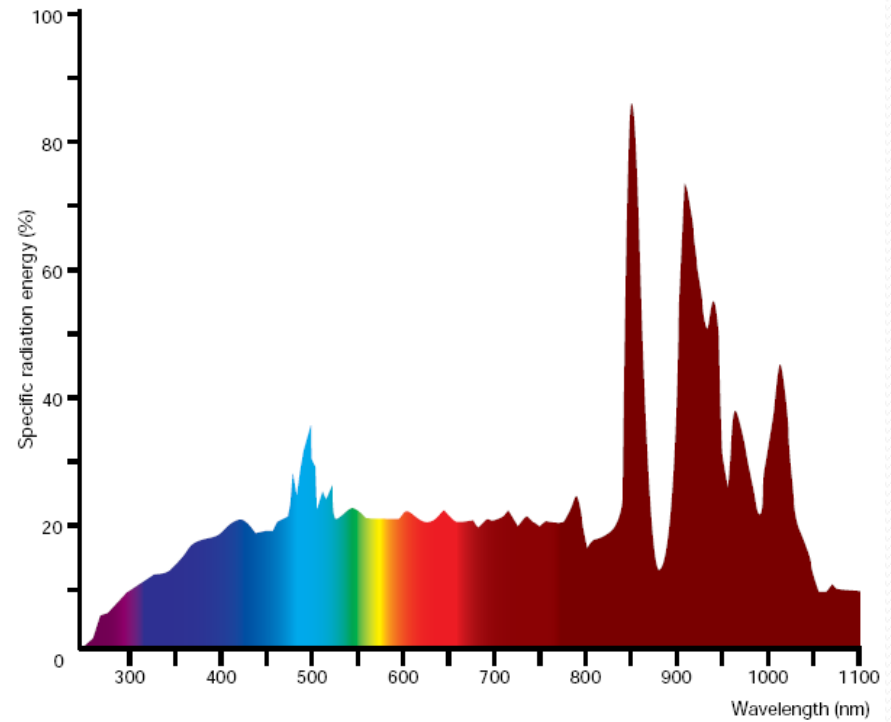


Fluorescence Microscopy(FL)

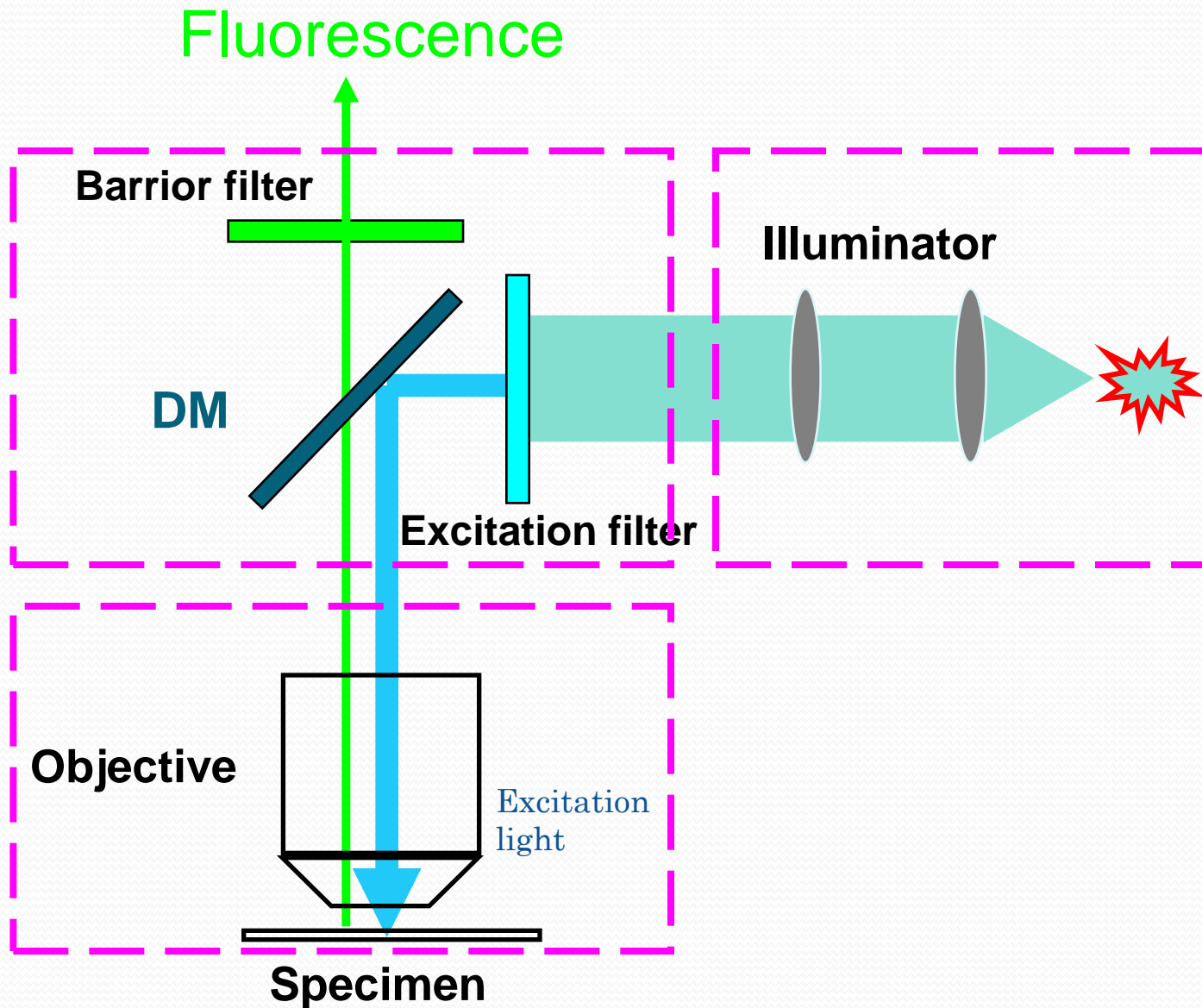
Mercury lamp



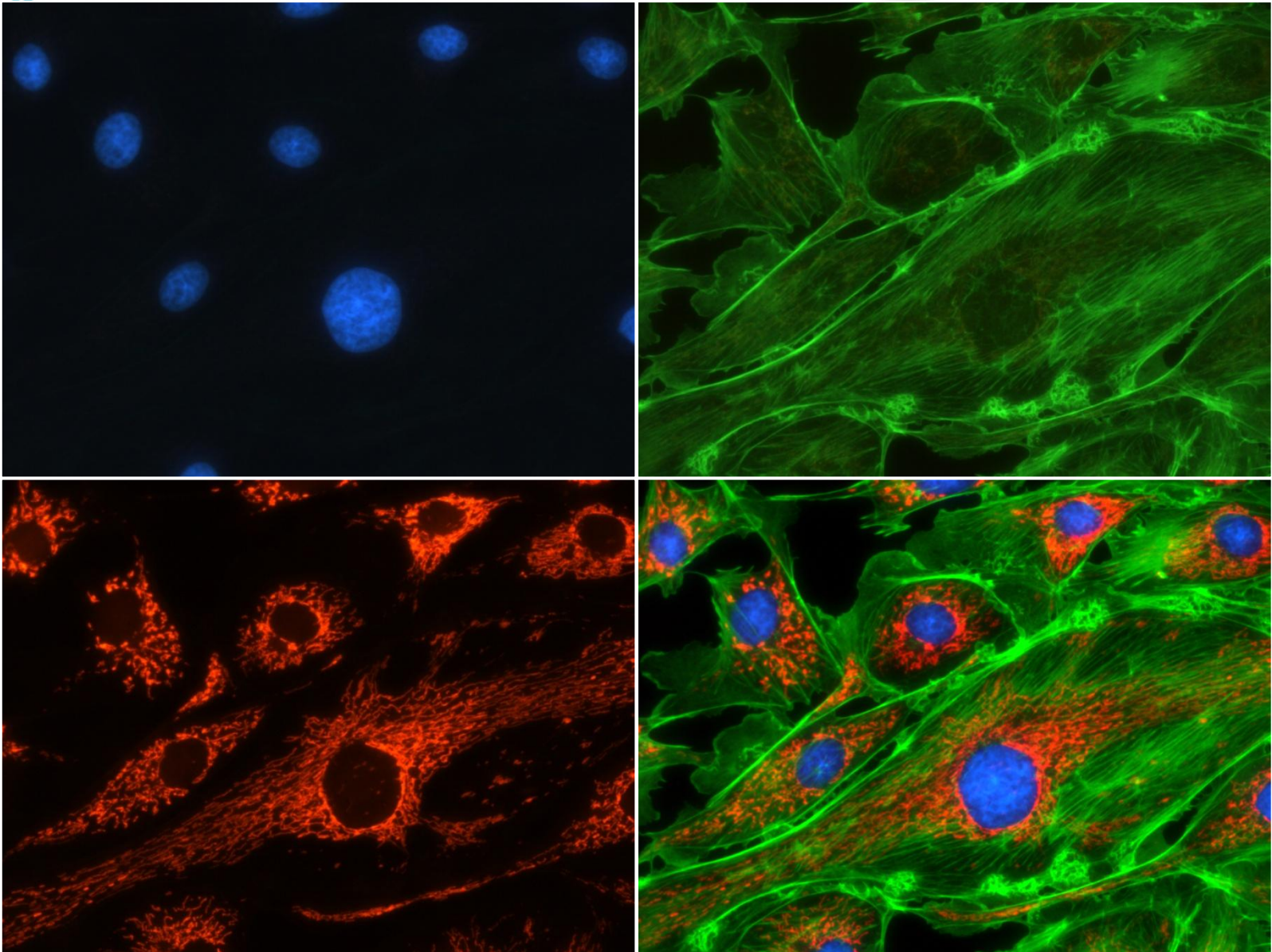
Xenon lamp



Fluorescence Microscopy(FL)

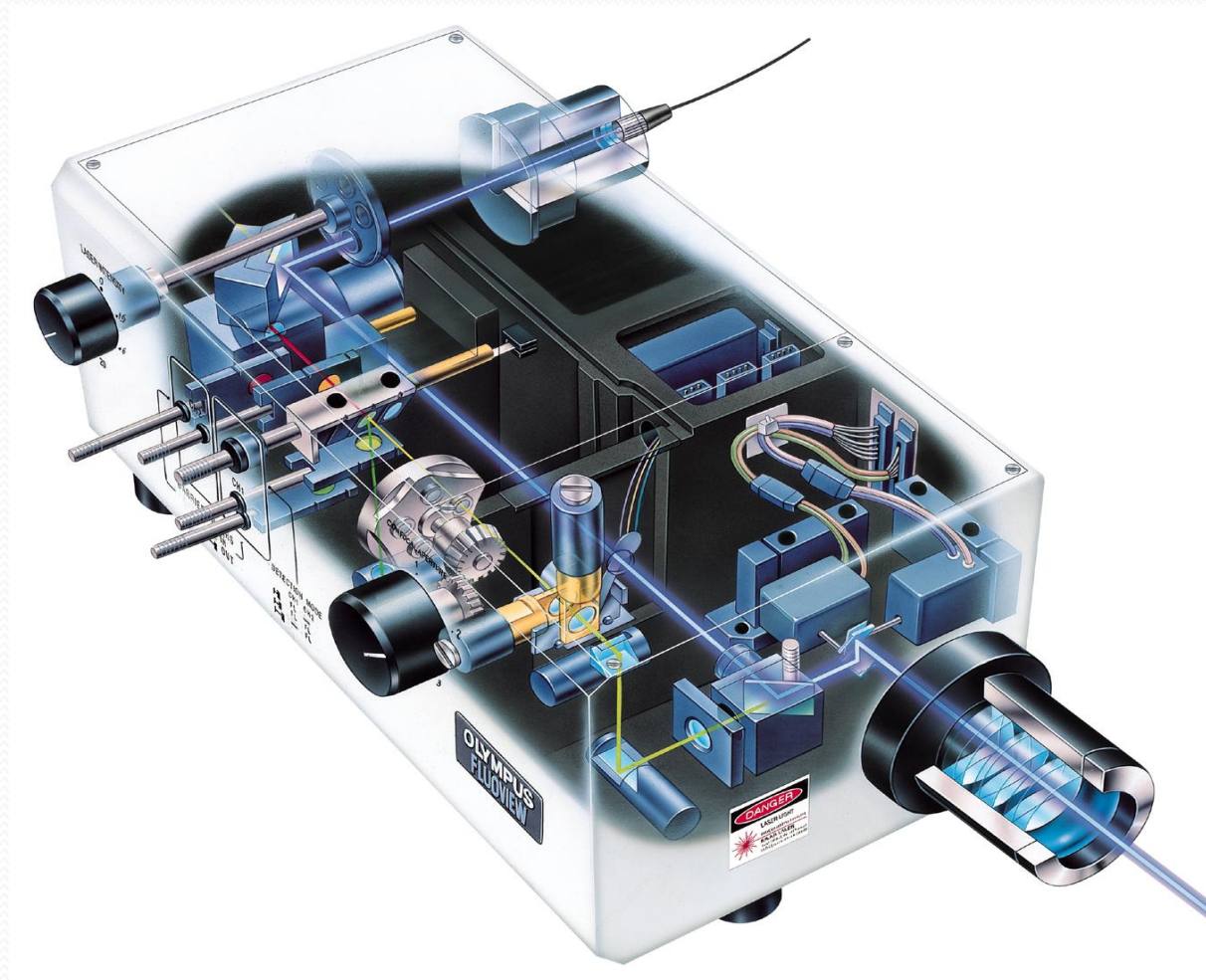


Fluorescence Microscopy(FL)



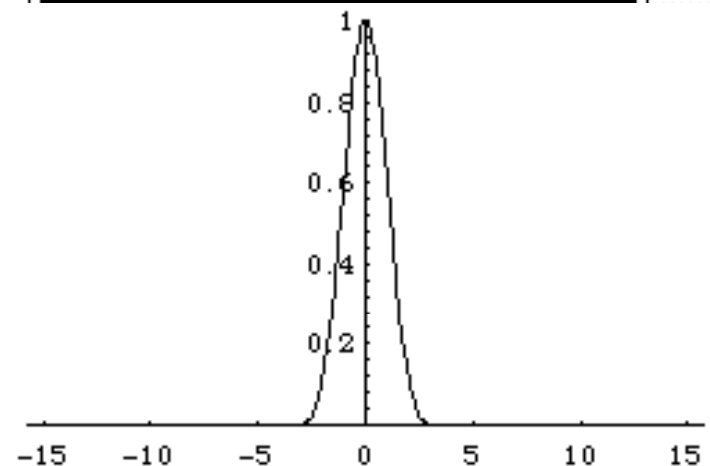
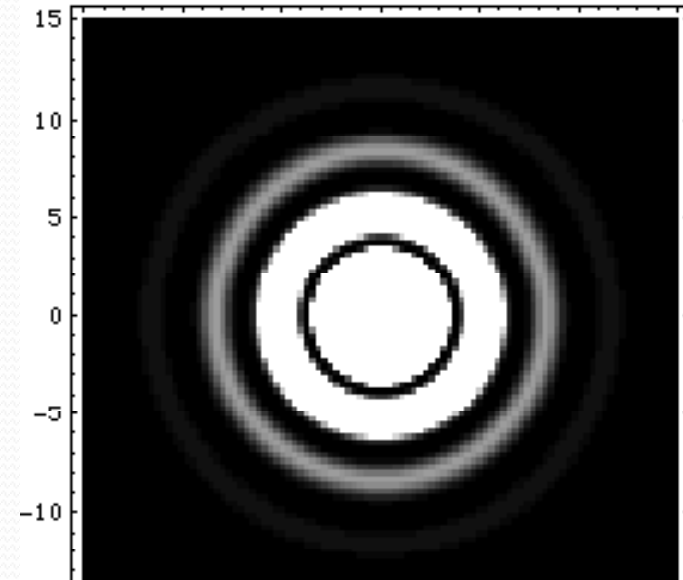
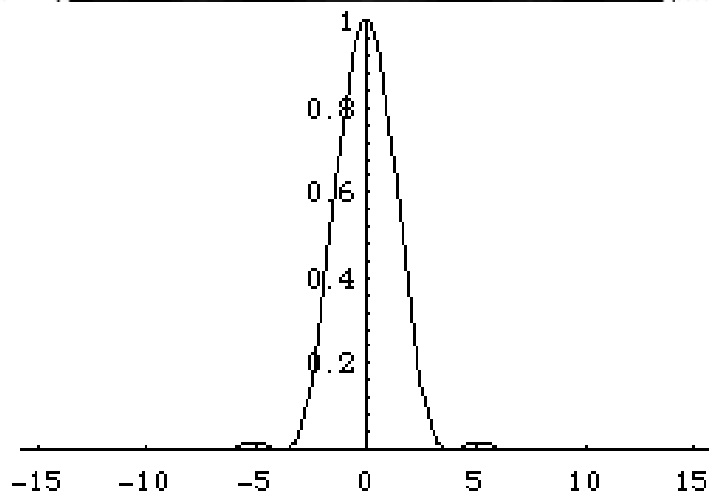
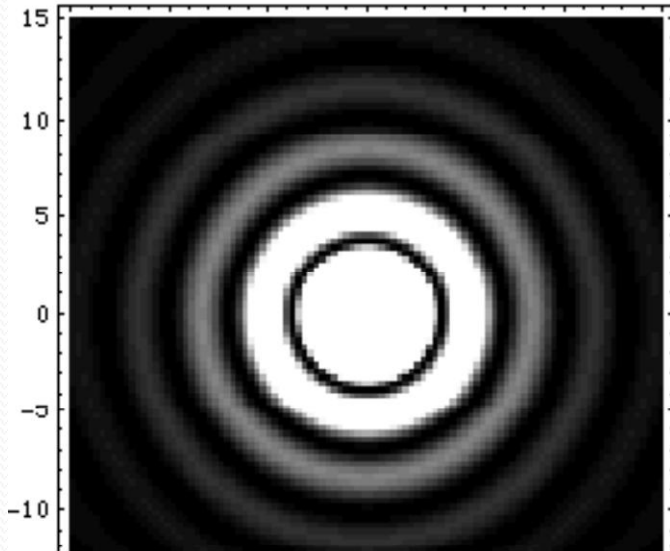
Microscope: BX53 , Imaging Camera: AcqUCAM ProG3

Inside Scanning Unit of CLSM



CLSM

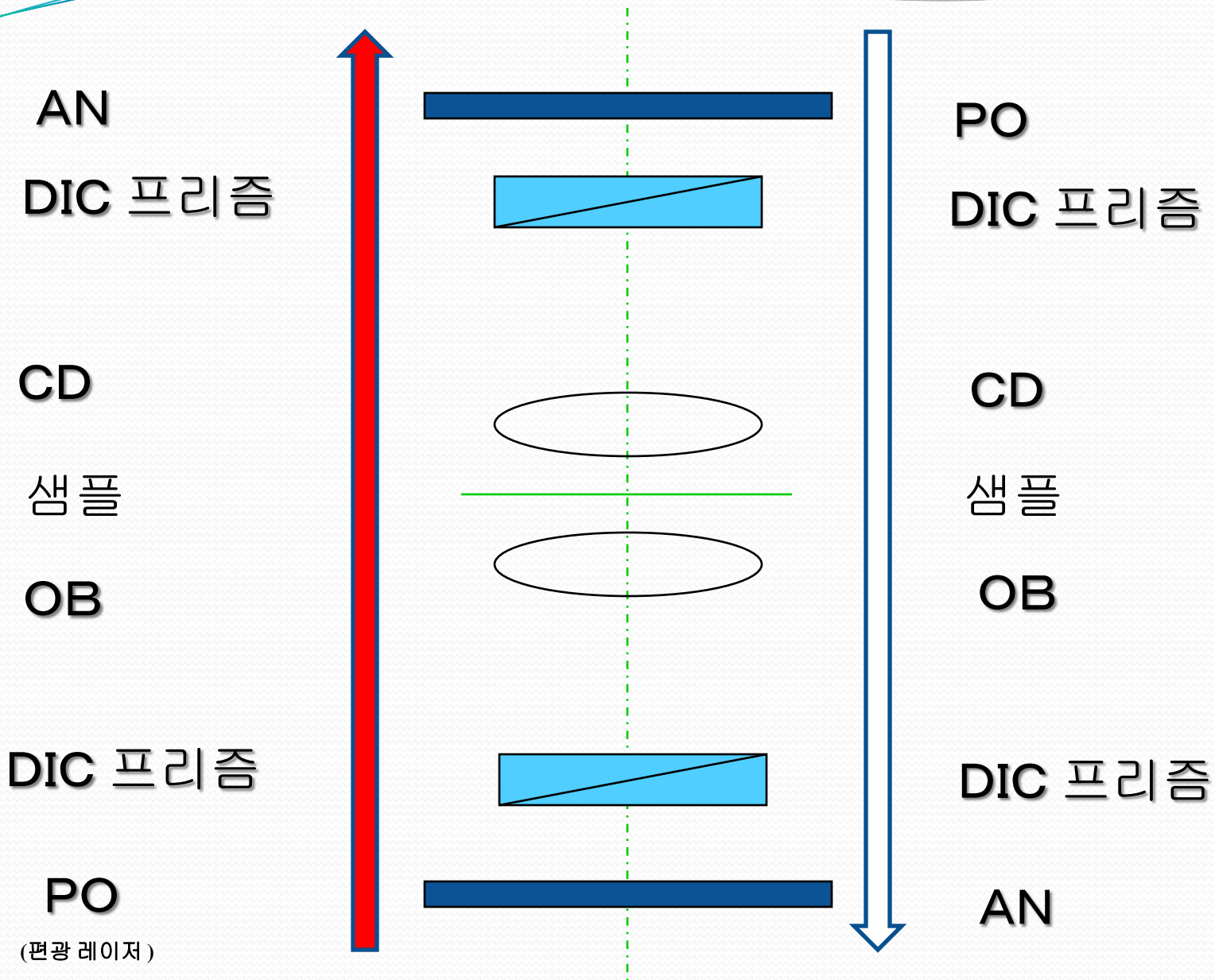
- Diffraction pattern at the focus spot



The resolution of CLSM

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

DIC_일반현미경 DIC 및 LSCM DIC





감사합니다