

Microscope 이론 및 LSCM Application

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2016.02.13
진 재 환

목차

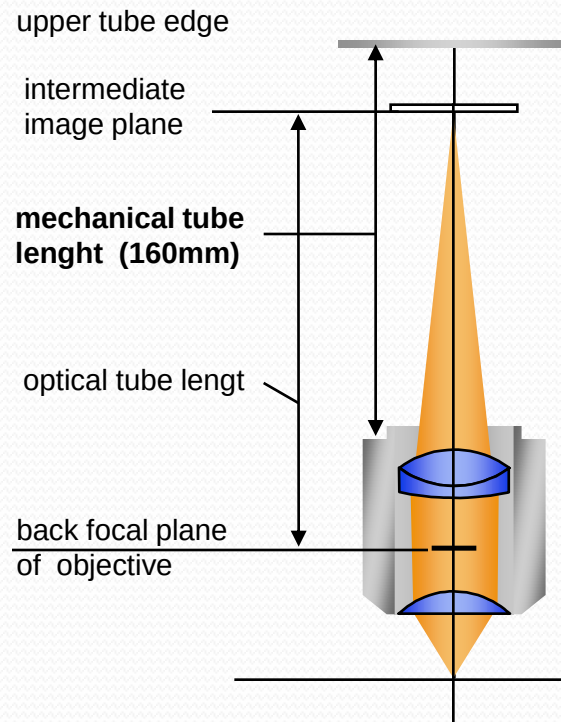
1. 현미경의 기초 용어 설명
 - N.A., Resolving Power, F.N. 등
2. 현미경의 관찰법 – DIC
 - 퀴러 조명 > PO > DIC 등
3. 현미경의 관찰법 – FL
 - 형광 현미경의 원리 및 구조 등
4. LSCM에서의 관찰법 적용(DIC, FL)

OBJECTIVE UIS

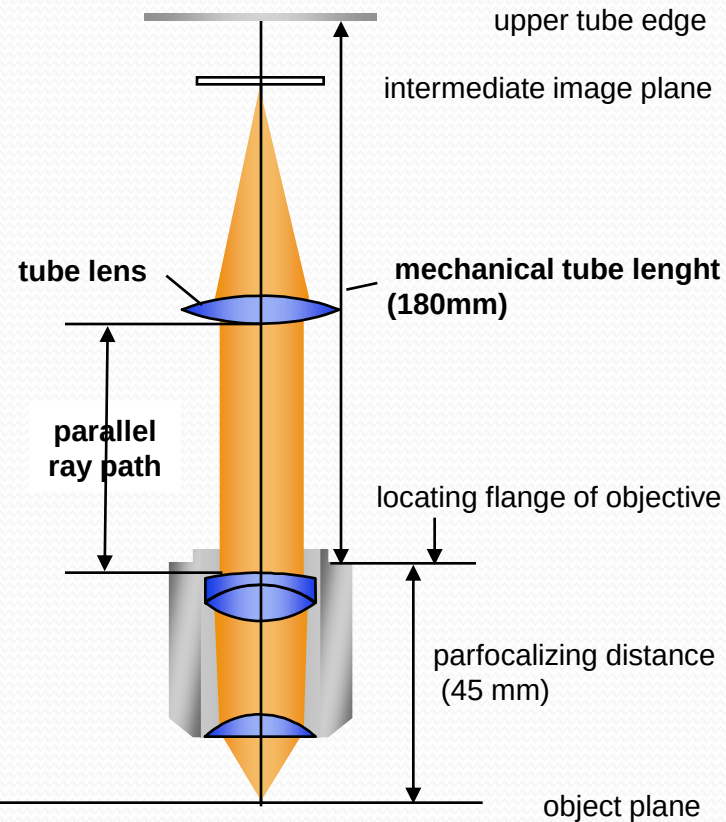


UIS Universal Infinity System(광학계의 변화)

F I N I T Y

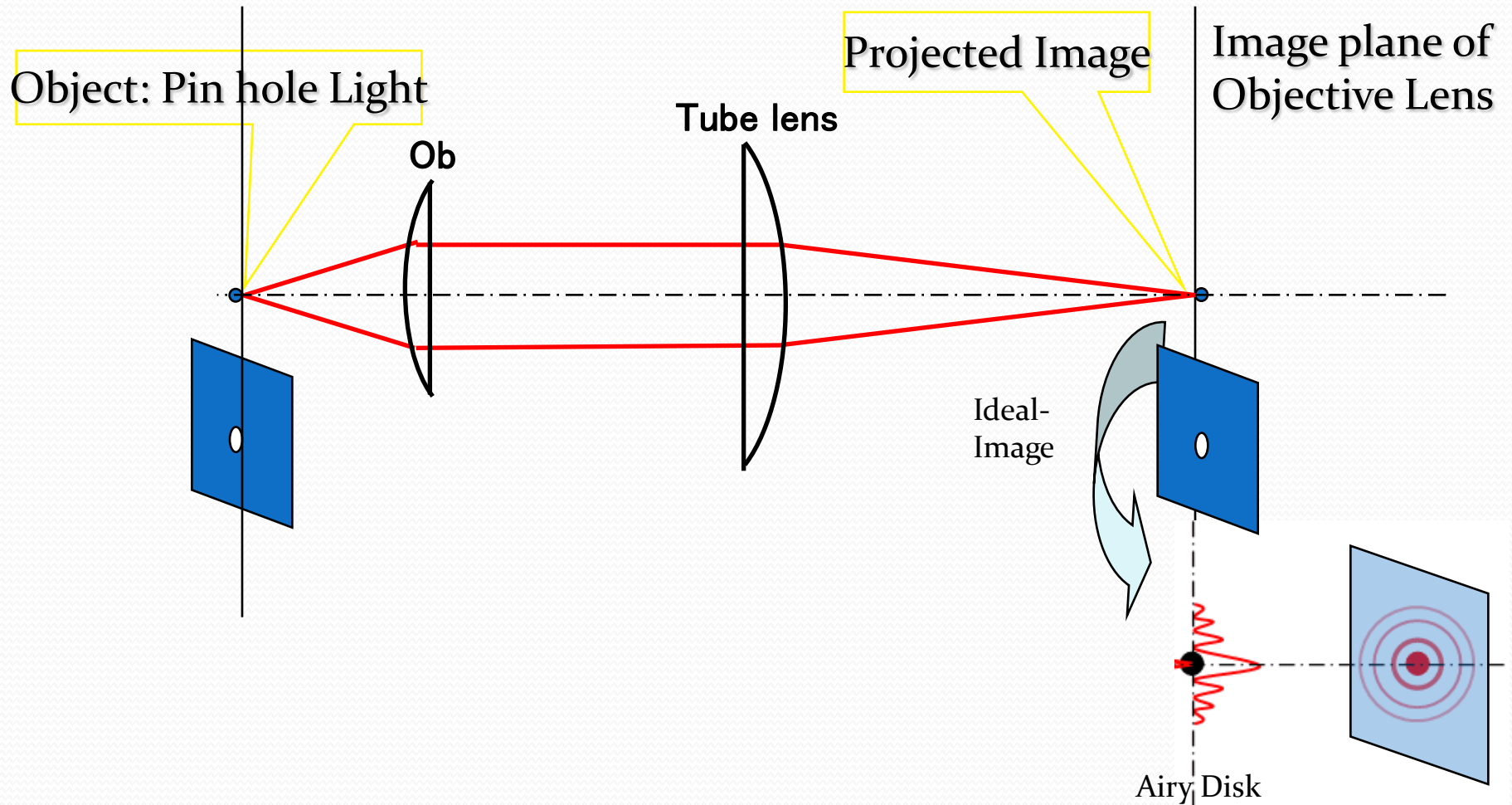


I N F I N I T Y

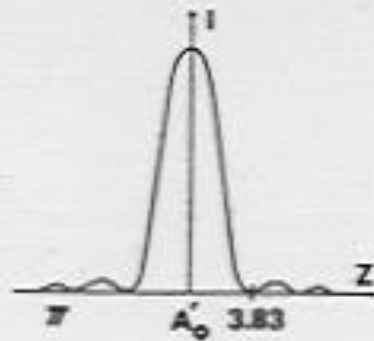
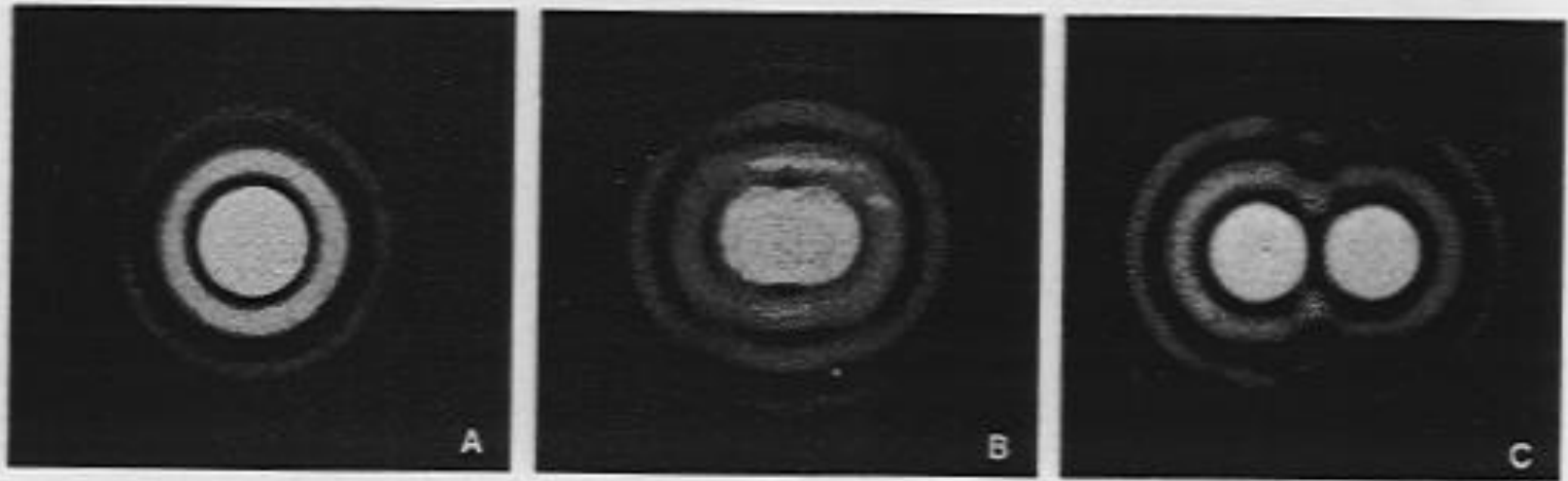


Idealistic None Aberration Lens and Projected Image

- Objective Lens



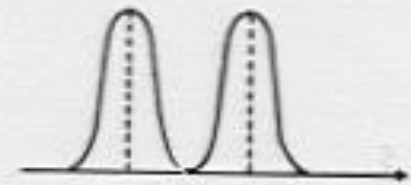
N.A. Numerical Aperture



D



E



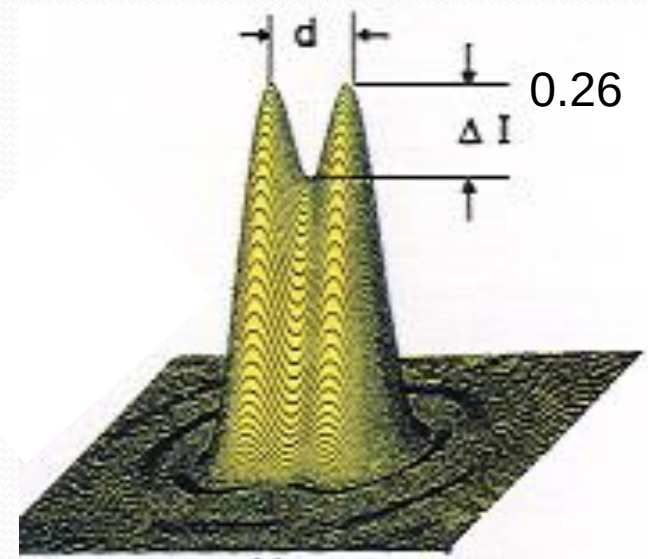
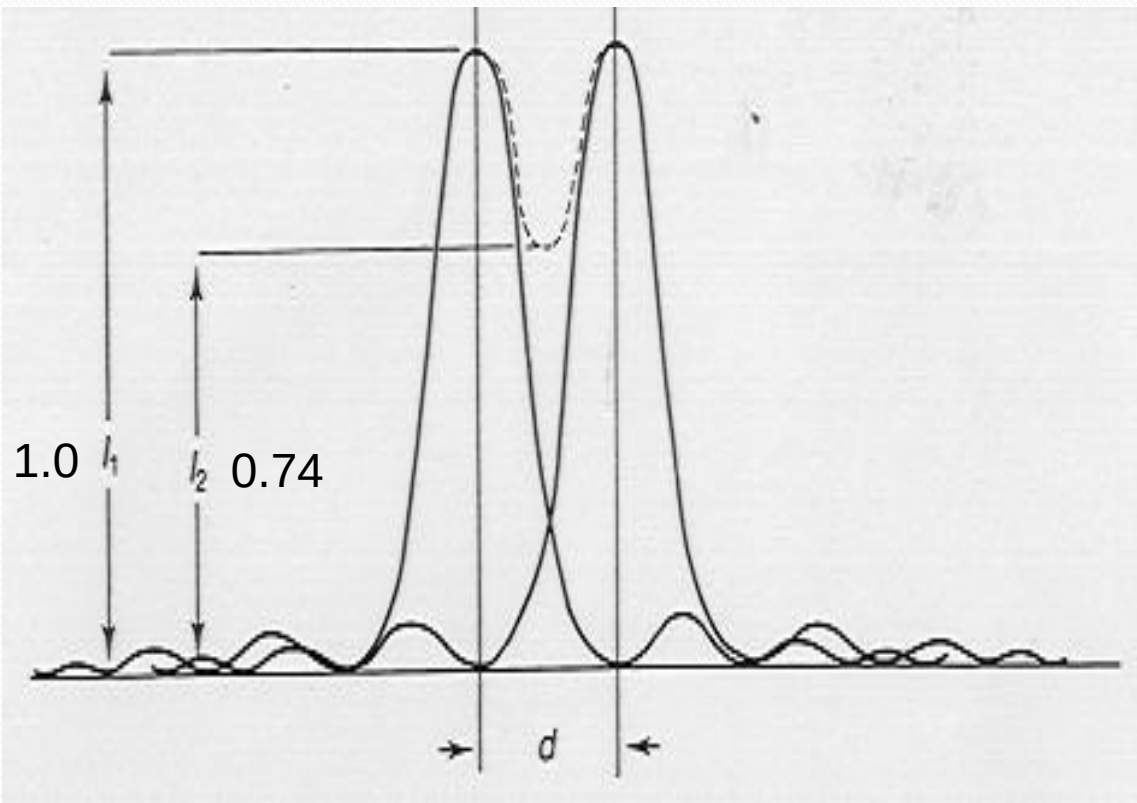
F

Resolving Power (분해능)

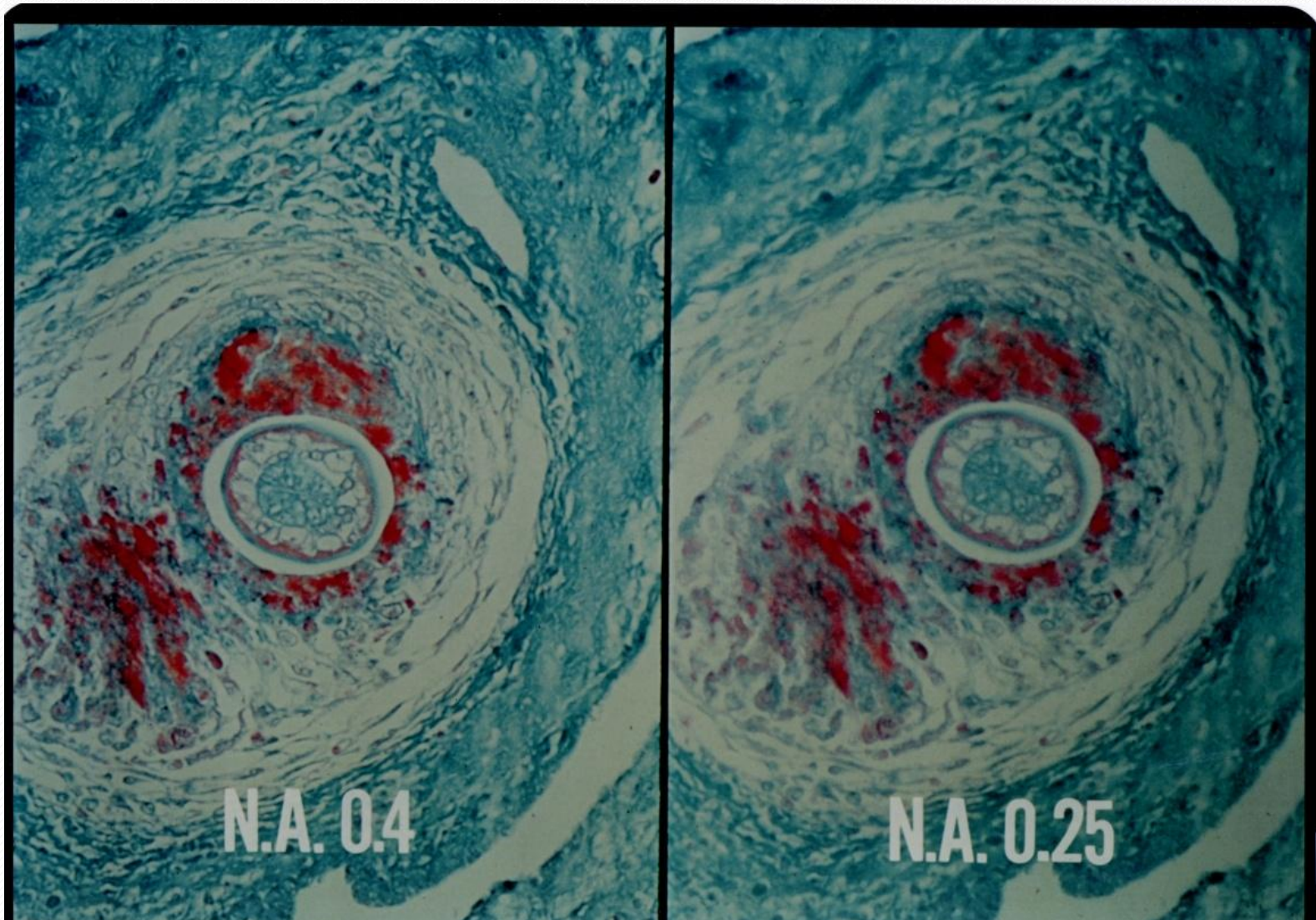
$$d = 0.61 \frac{\lambda}{NA}$$

λ : Wavelength

NA : Numerical Aperture



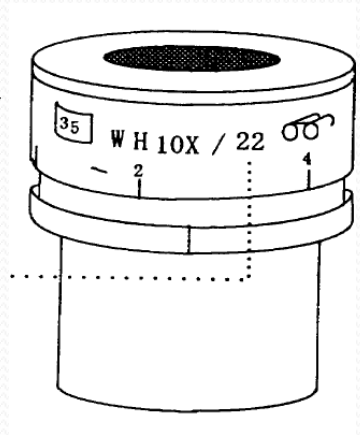
N.A.에 의한 이미지 차이



F.N. Field Number

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

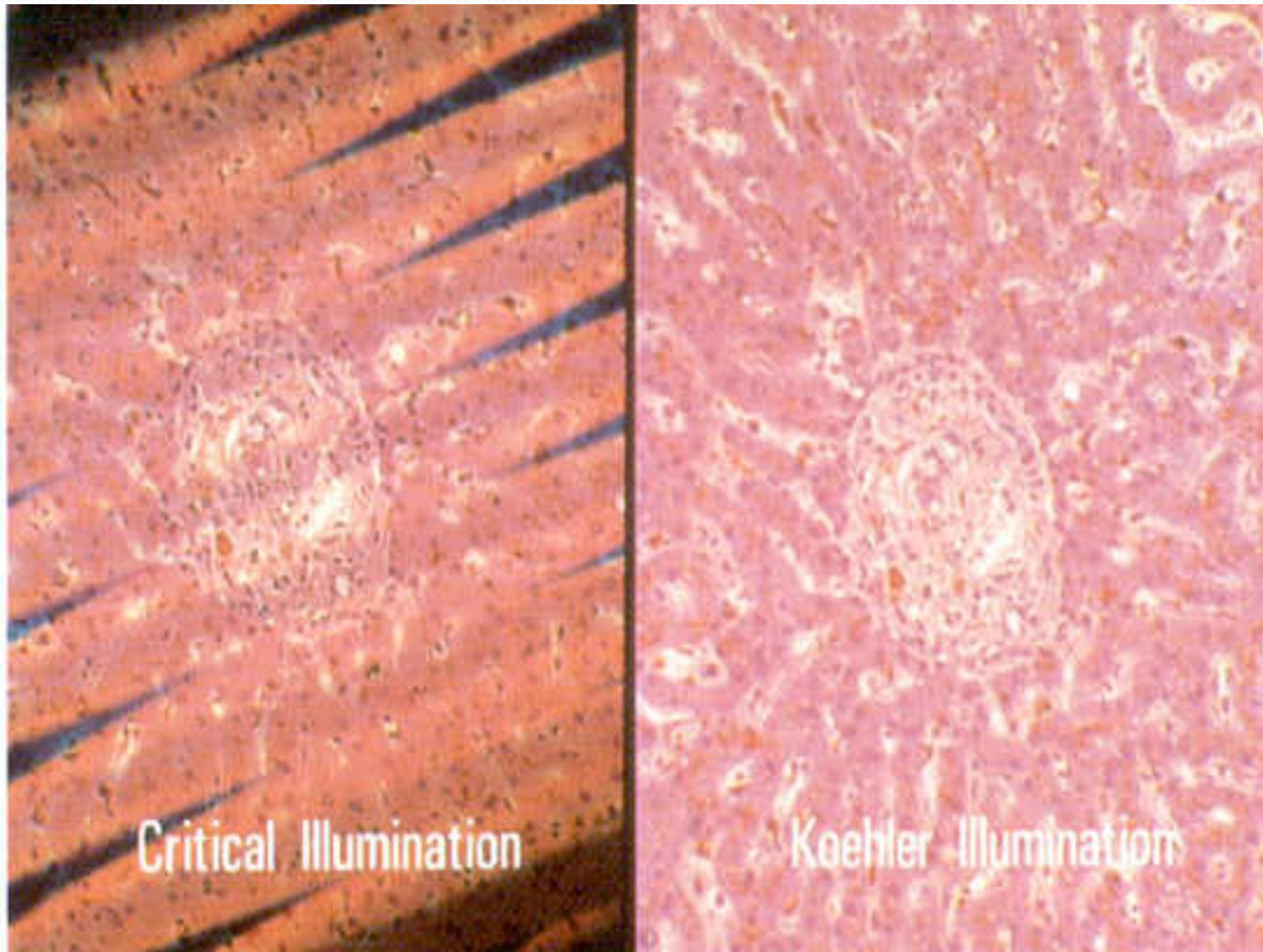
→ 접안렌즈의 표면에 F.N. 표시



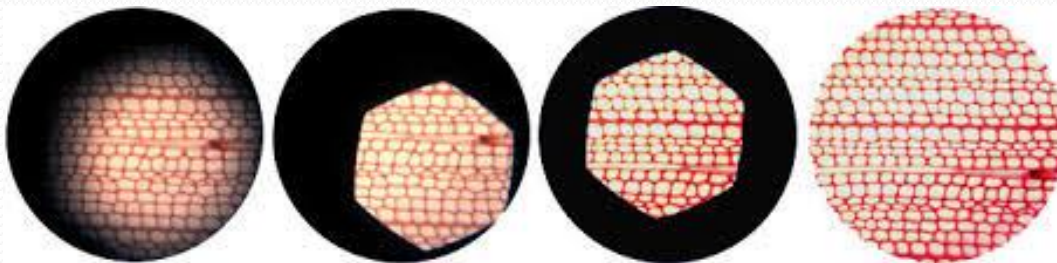
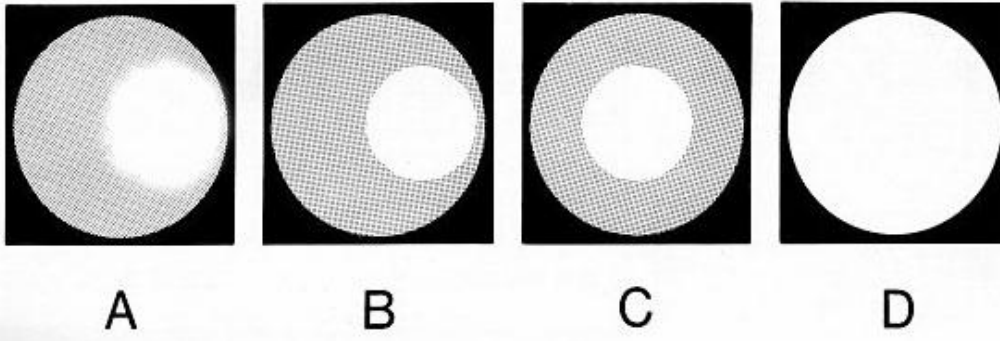
- 계산식

❖ 실시야(직경 mm) = $\frac{\text{접안렌즈의 F.N.}}{\text{현미경의 대물렌즈 배율}}$

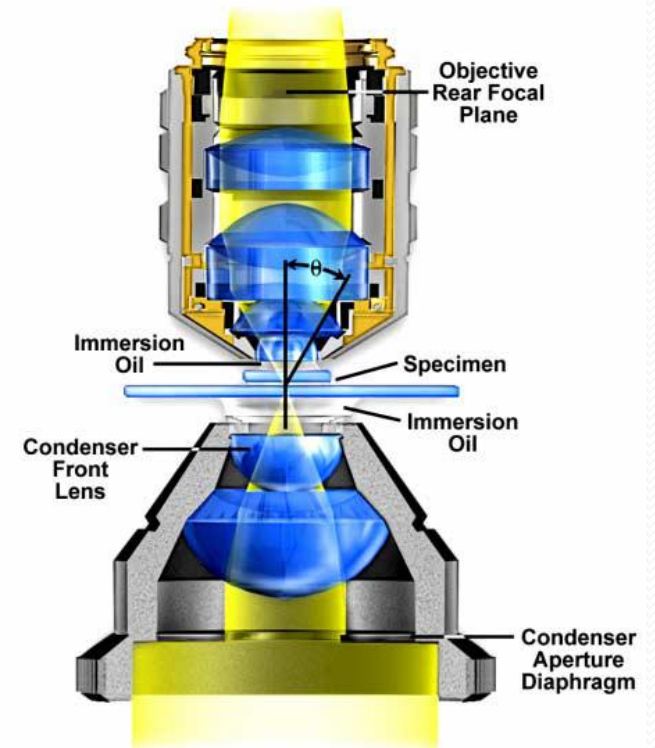
Köhler Illumination (콜러 조명)



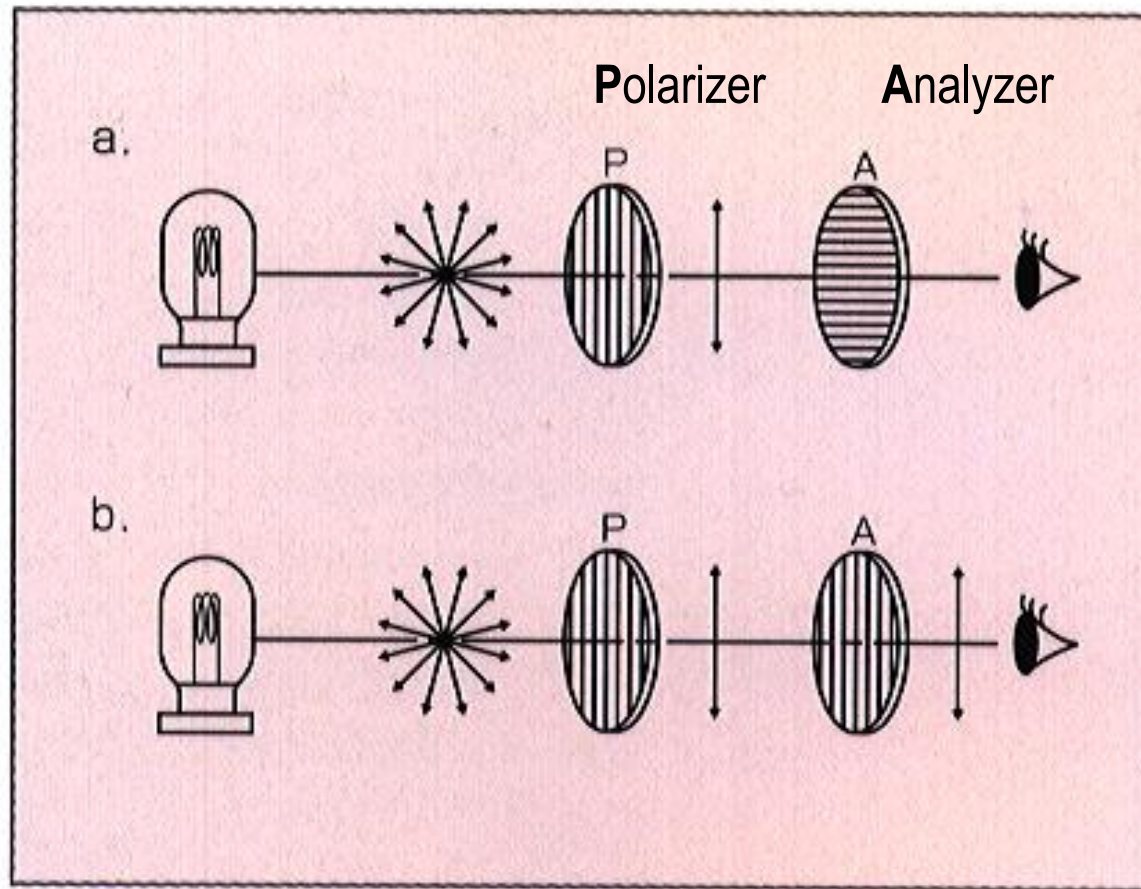
Köhler Illumination (콜러 조명)



Abbe Condenser/Objective Combination

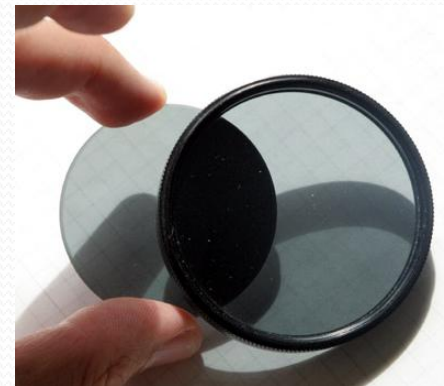


Crossed Nicols 직교 니콜

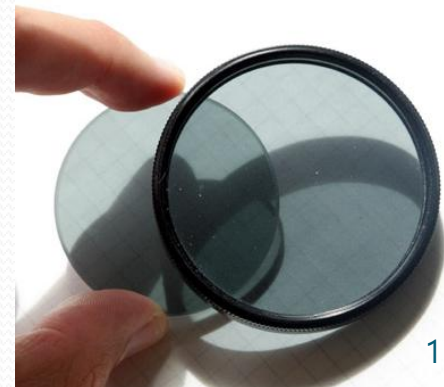


● 図1-3 a. 直交ニコルとb. 平行ニコル ●
P: ポラライザ A: アナライザ

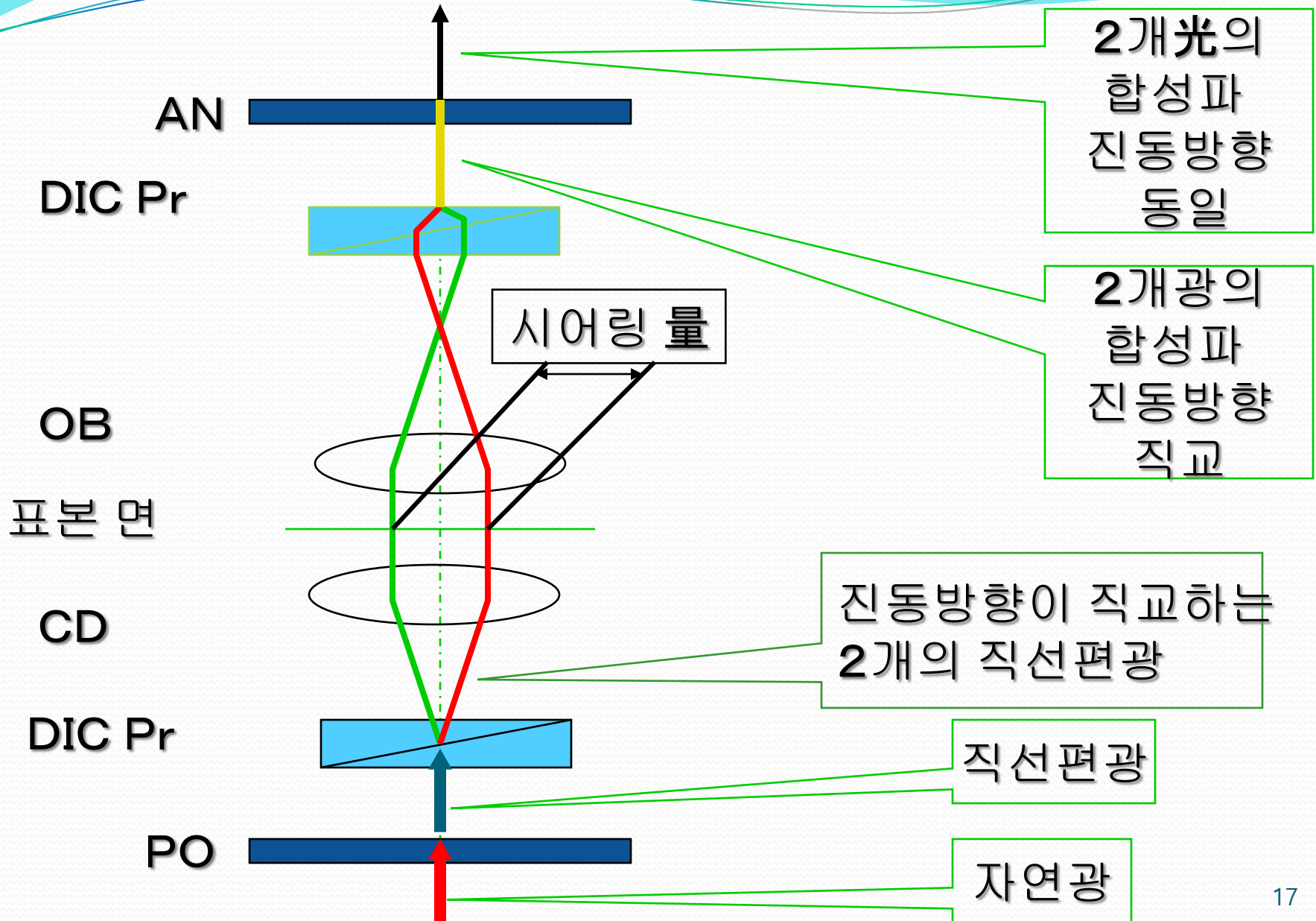
Crossed Nicols



Parallel Nicols



DIC Differential Interference Contrast



관찰법에 따른 이미지 비교

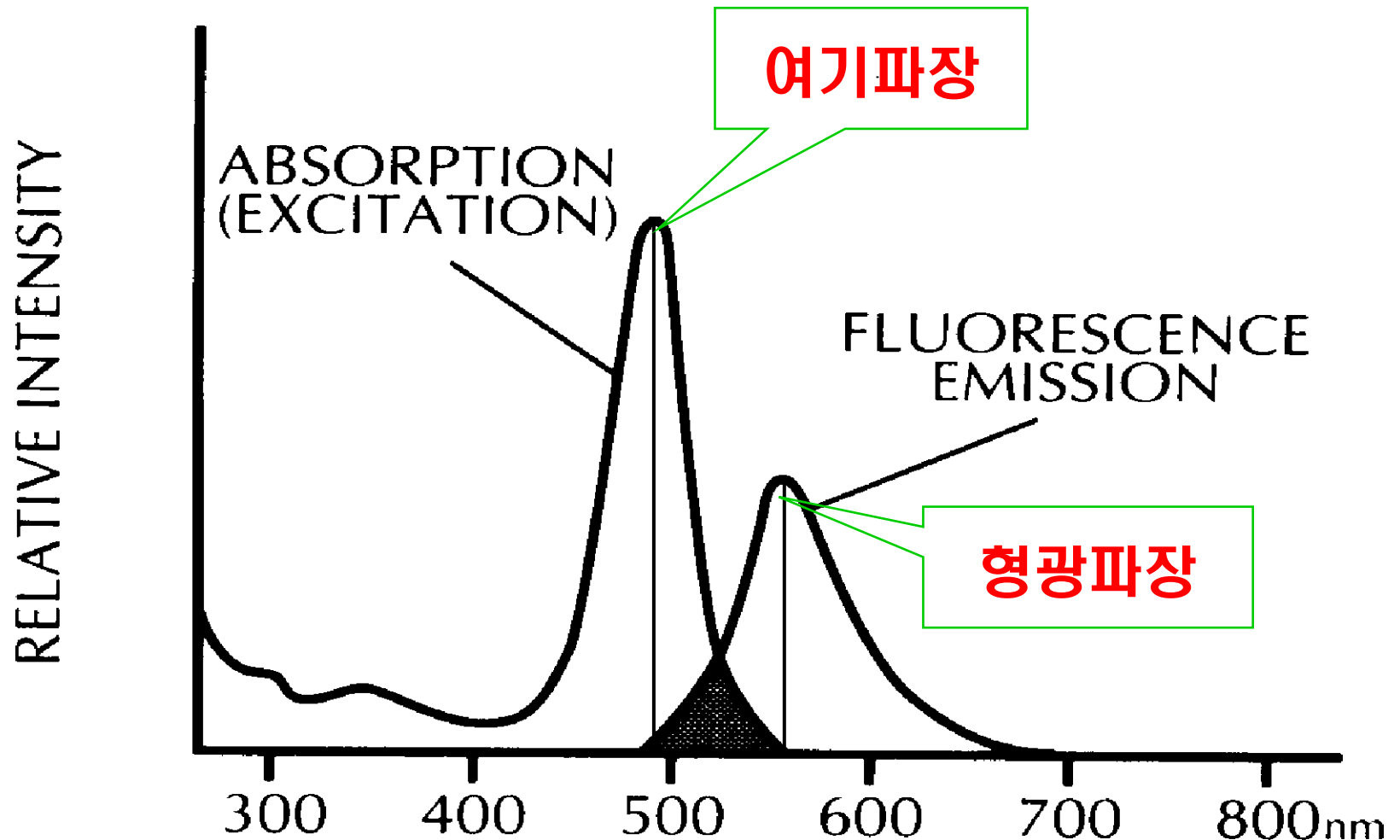


Bright field

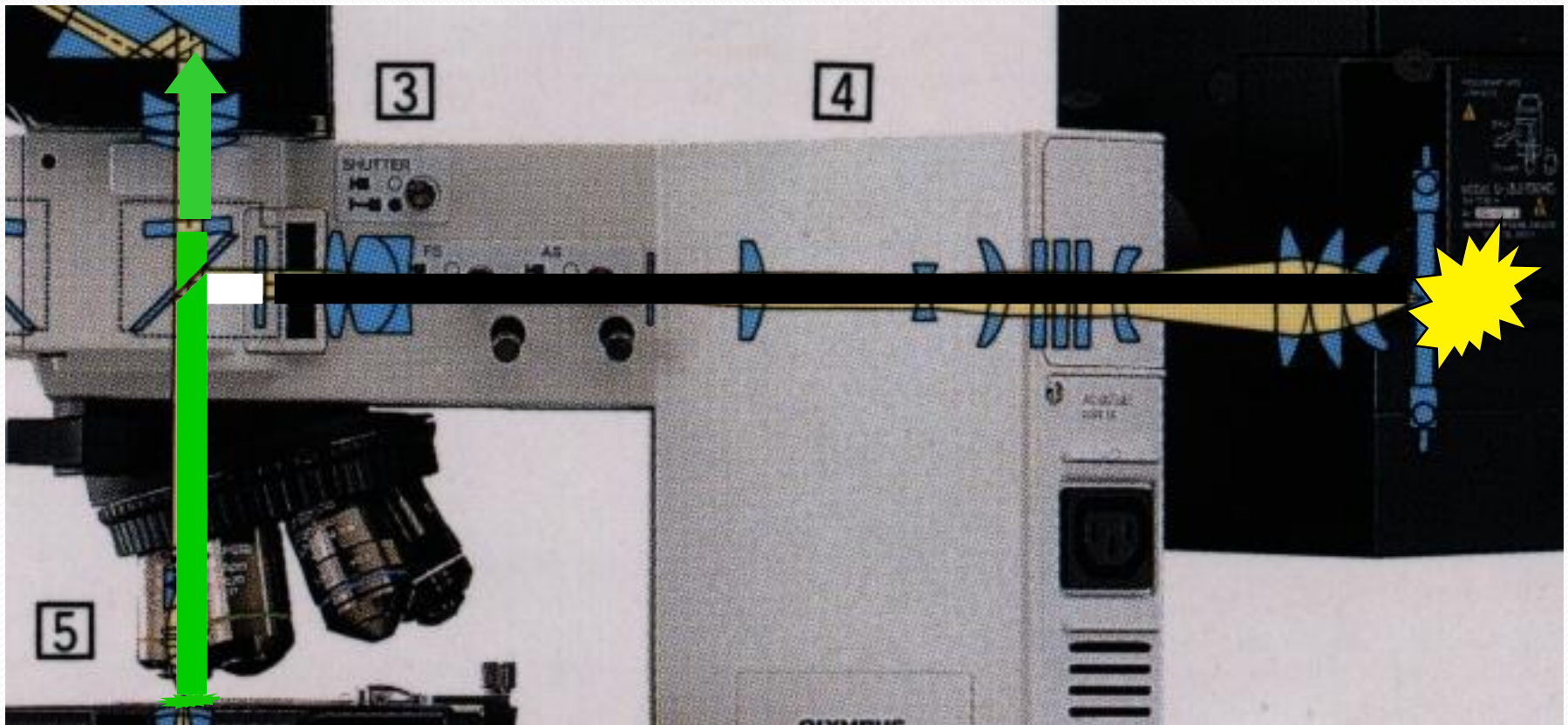
Phase contrast

DIC

Fluorescence Microscopy(FL)

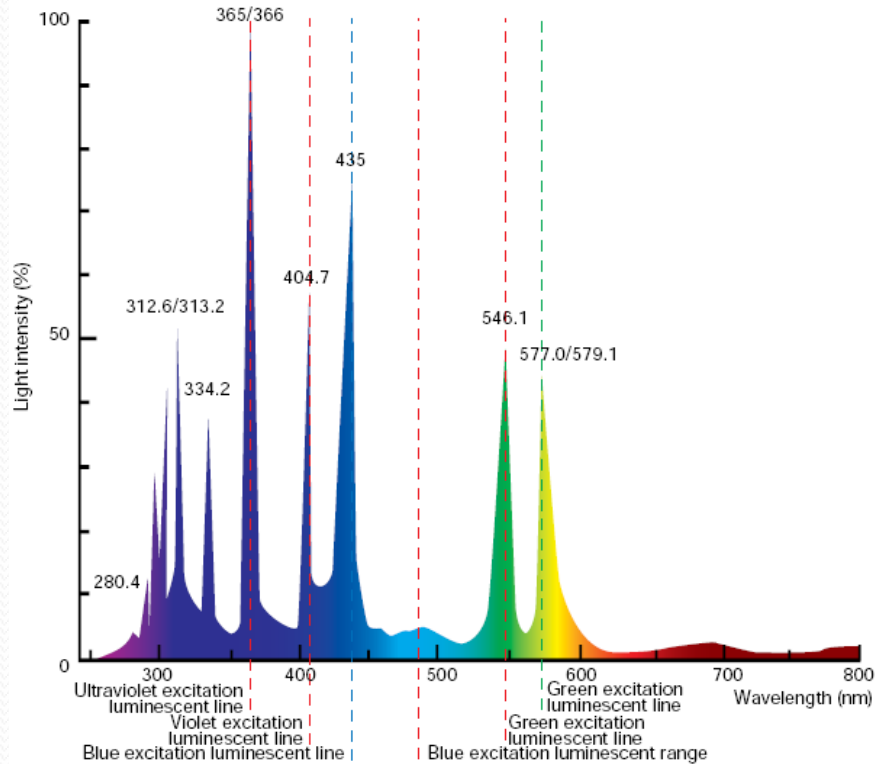


Fluorescence Microscopy(FL)

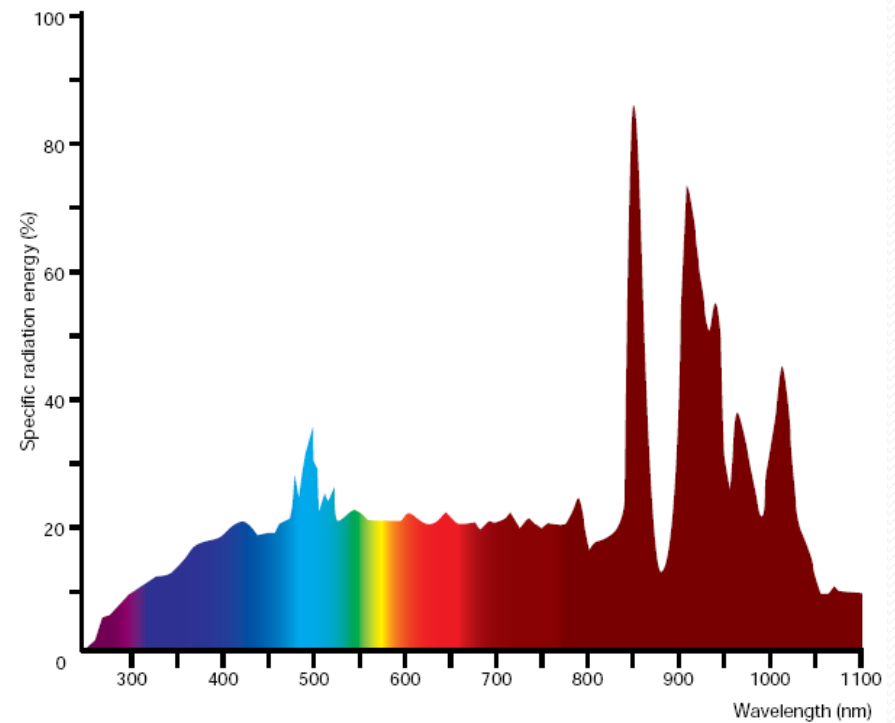


Fluorescence Microscopy(FL)

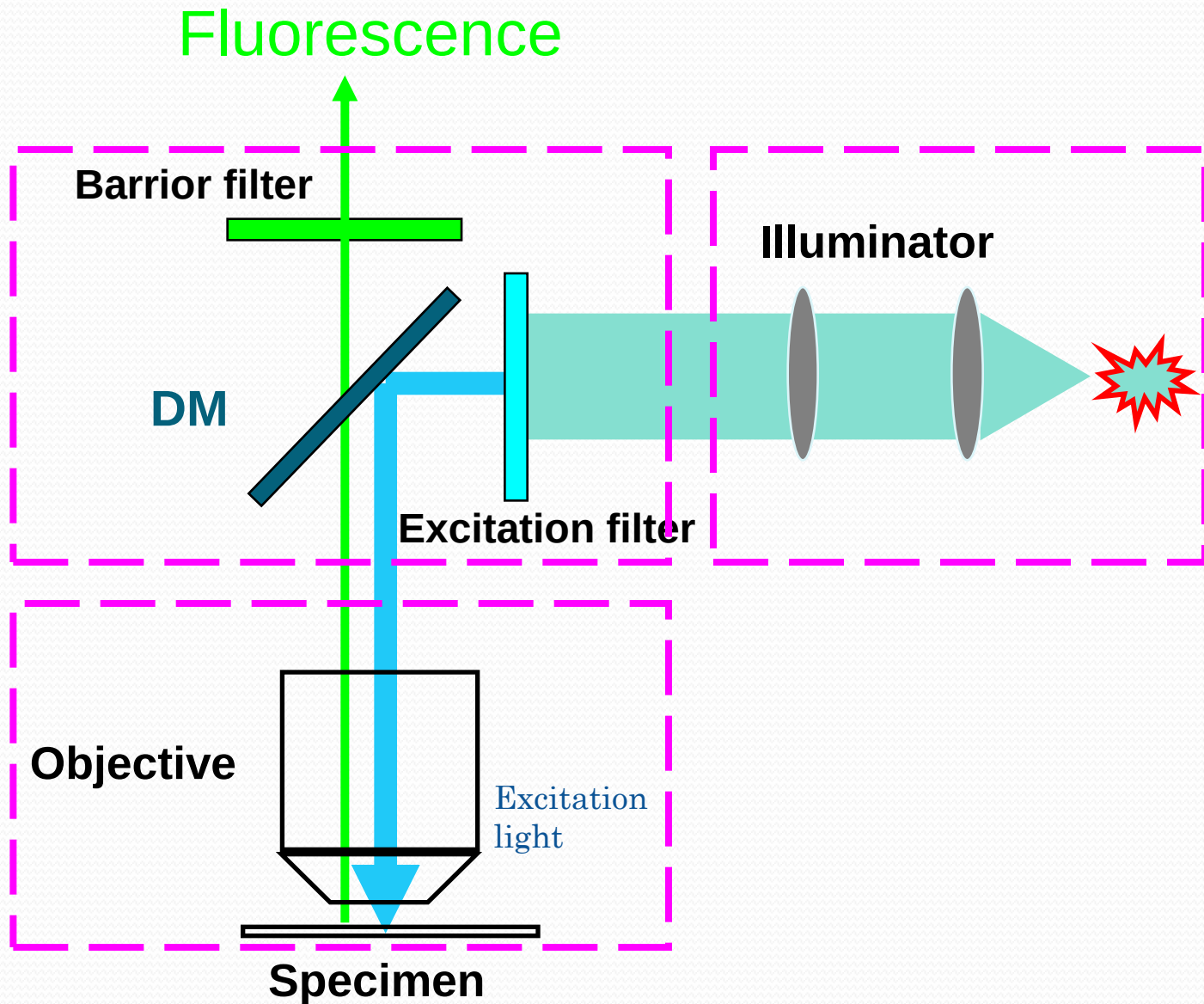
Mercury lamp



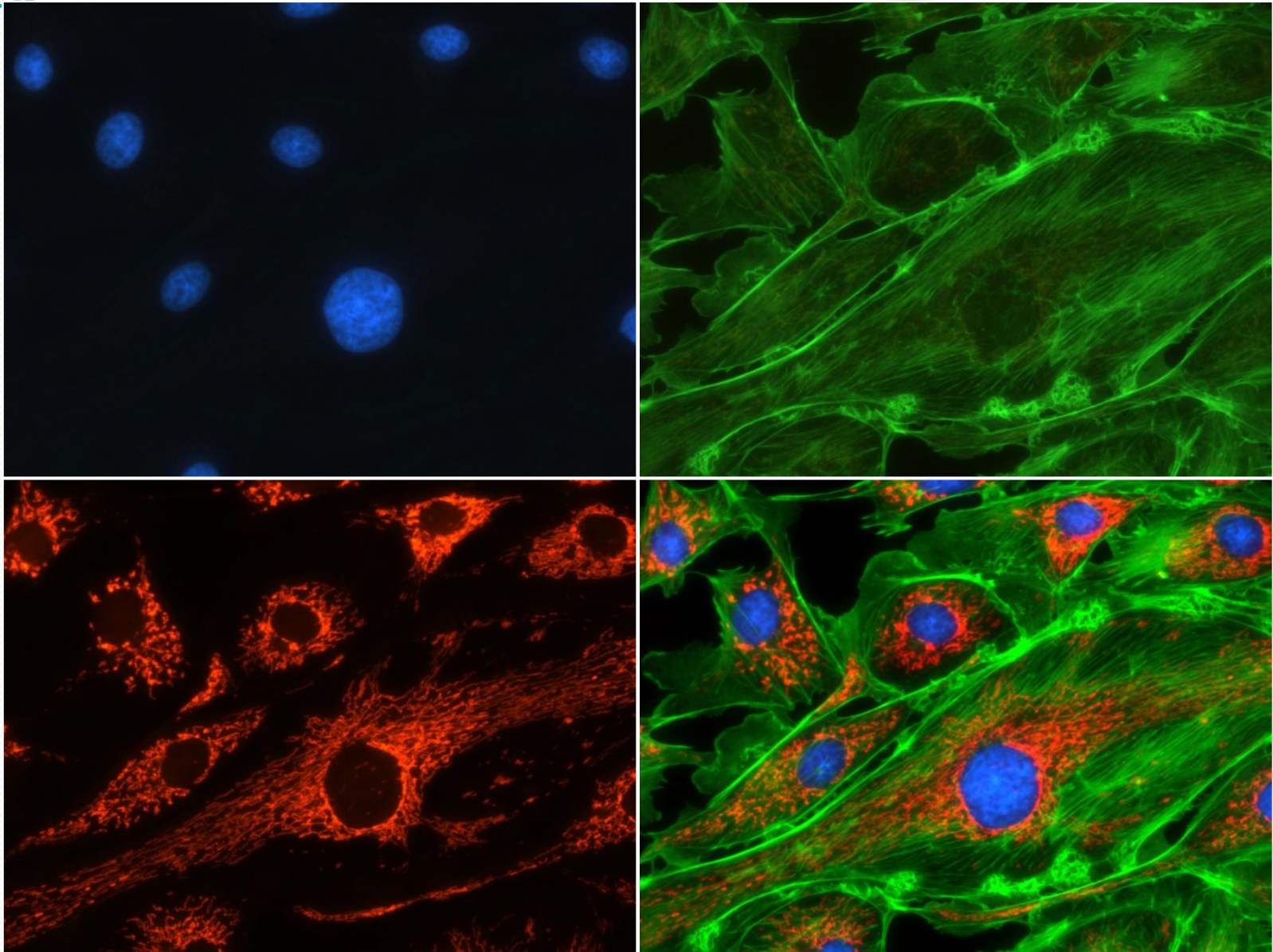
Xenon lamp



Fluorescence Microscopy(FL)

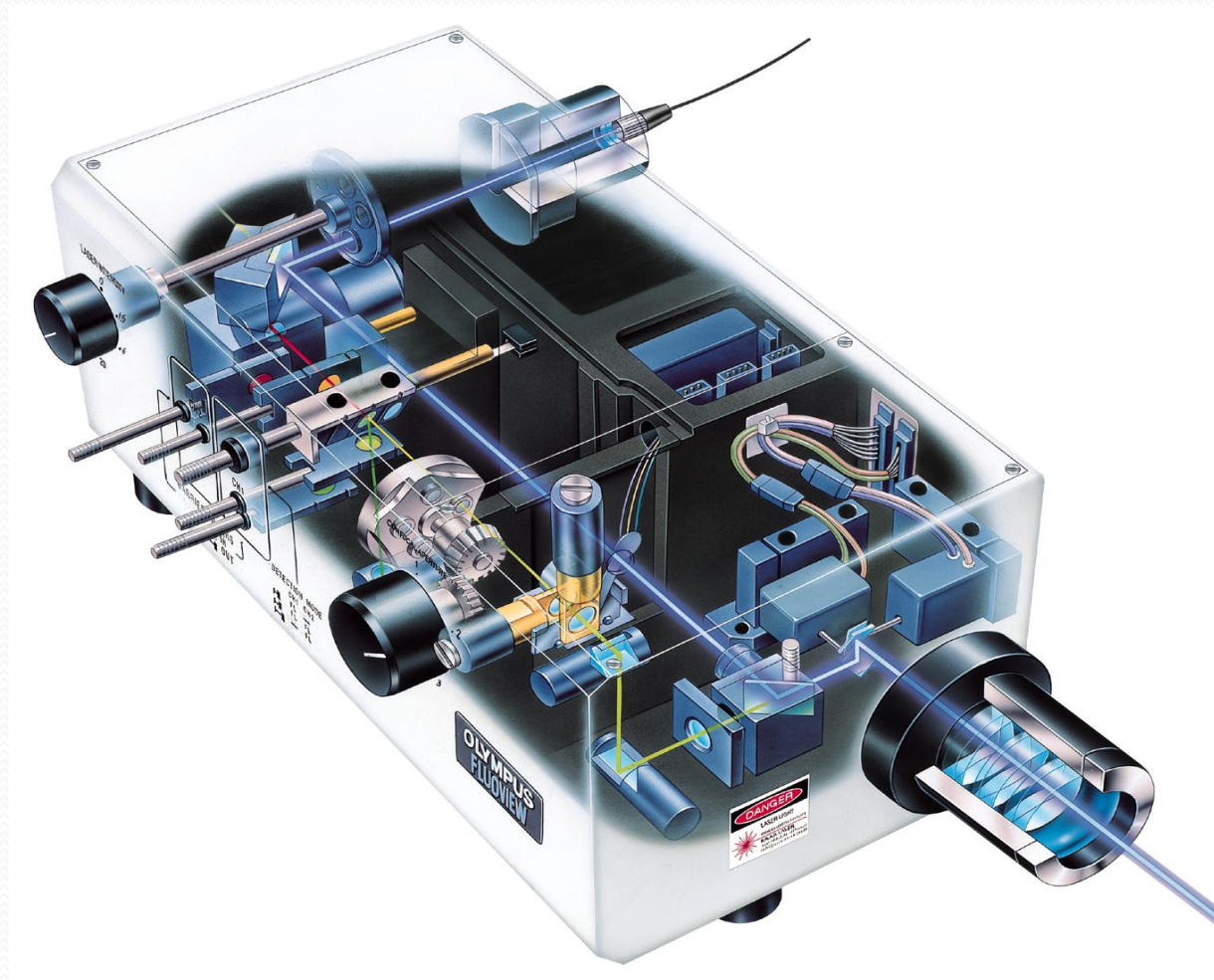


Fluorescence Microscopy(FL)



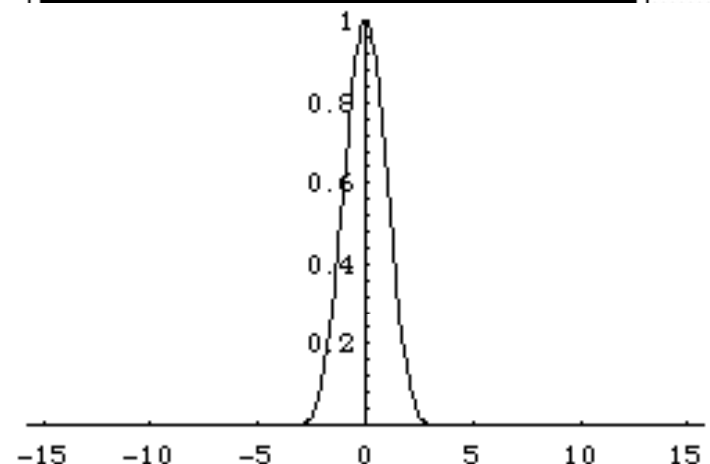
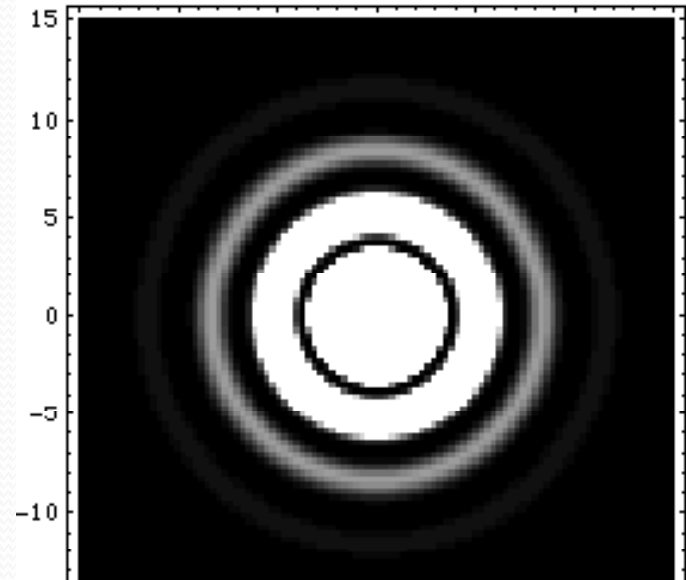
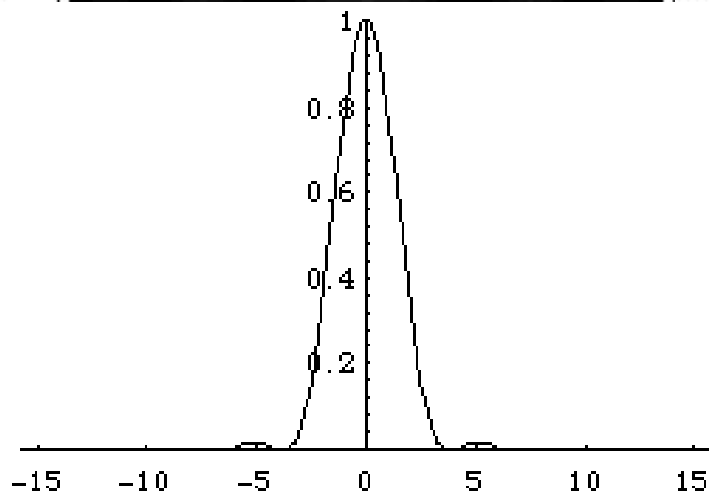
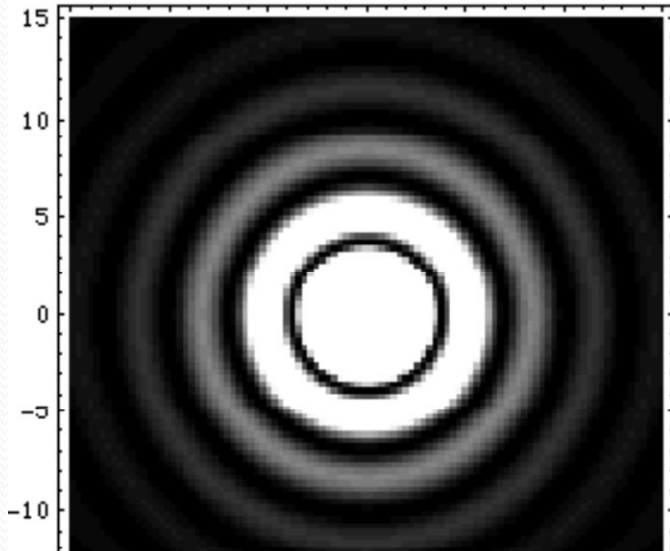
Microscope: BX53 , Imaging Camera: AcquCAM ProG3

Inside Scanning Unit of CLSM



CLSM

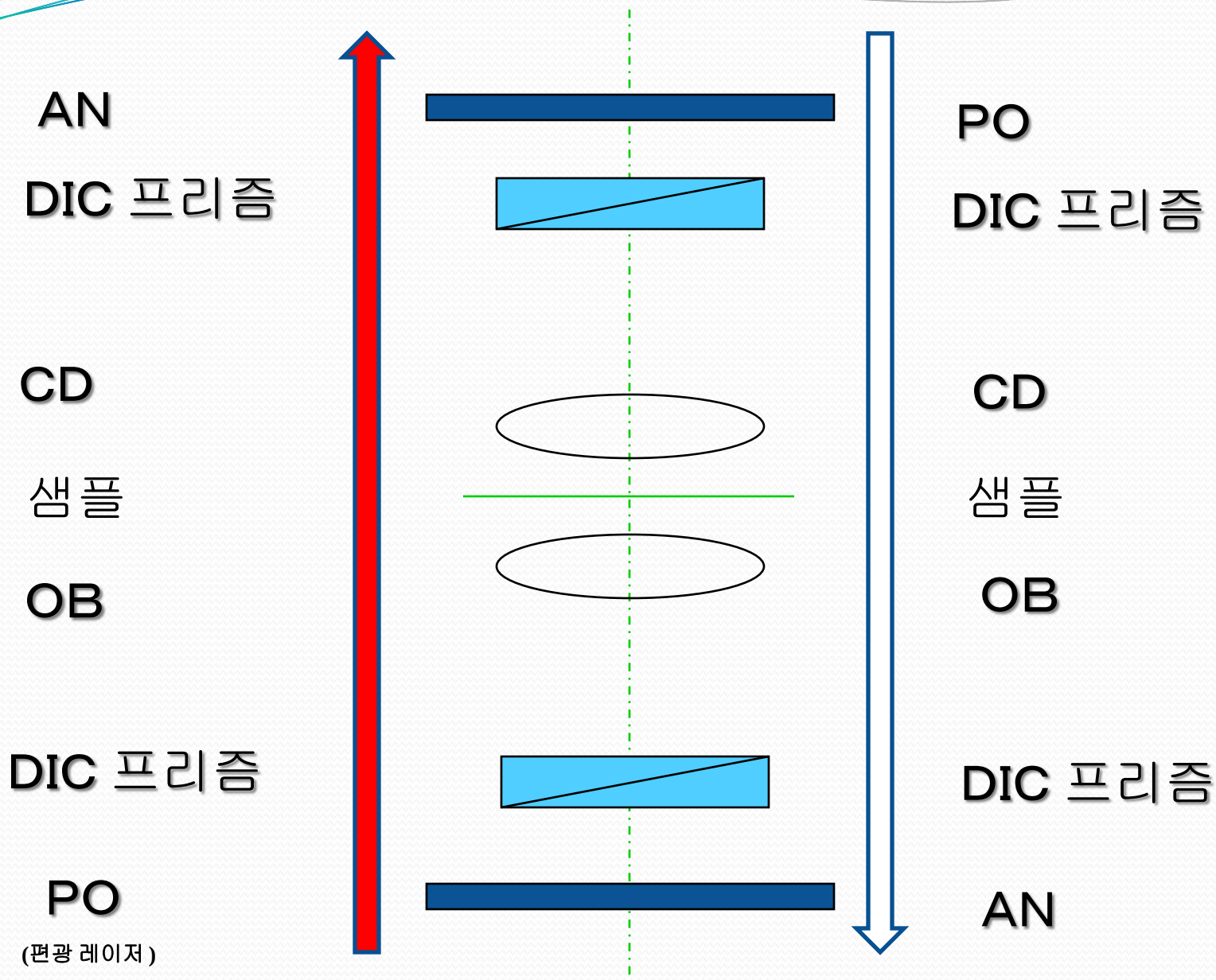
- Diffraction pattern at the focus spot



The resolution of CLSM

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

DIC_일반현미경 DIC 및 LSCM DIC





감사합니다