



Microscope Illumination

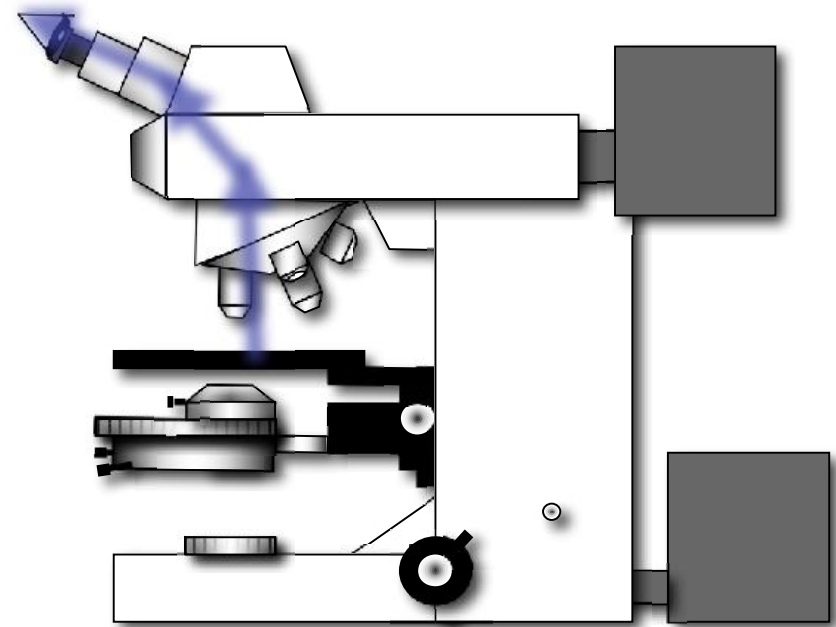
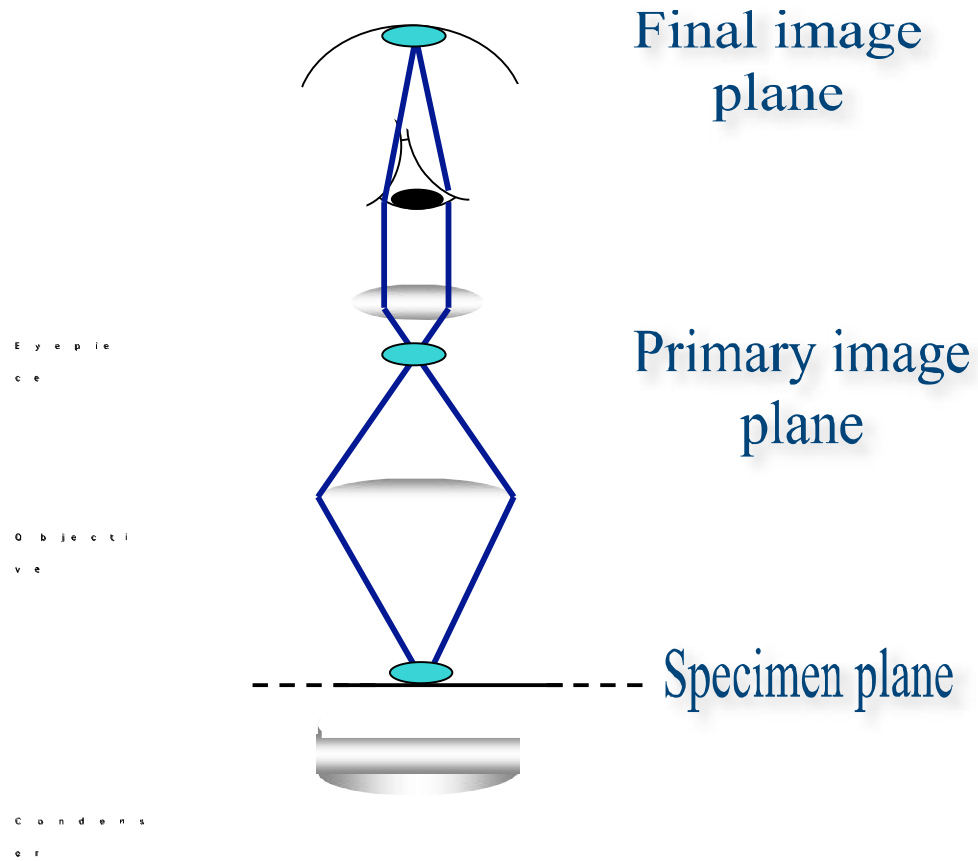
Two basic methods of illumination:

Source-focused or 'Critical' Illumination:

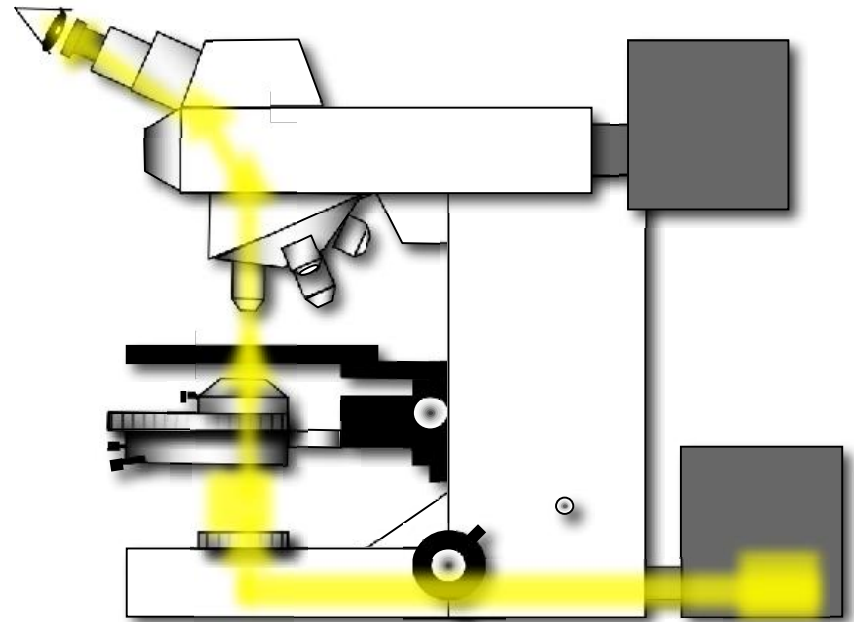
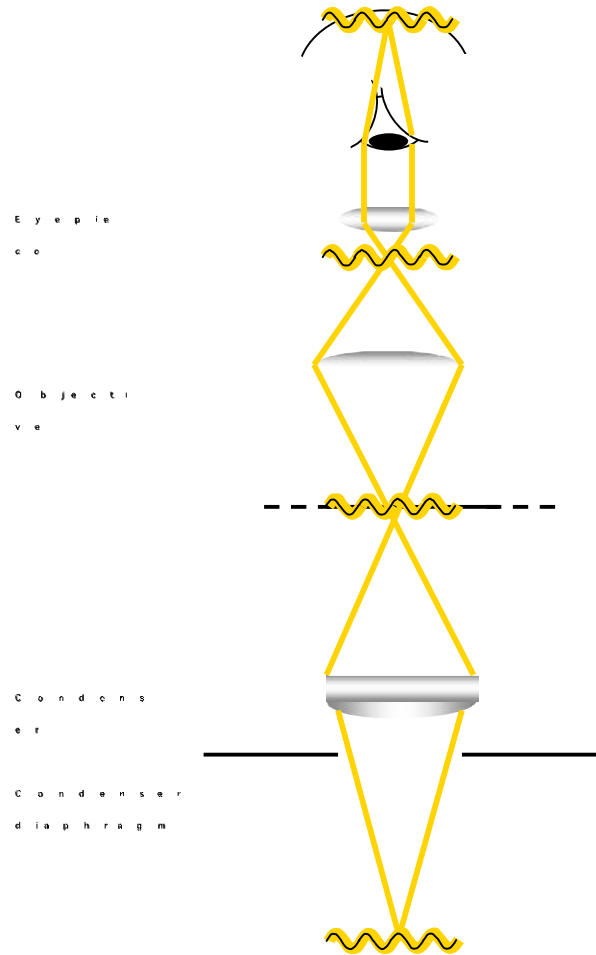
Light-source imaged on to specimen

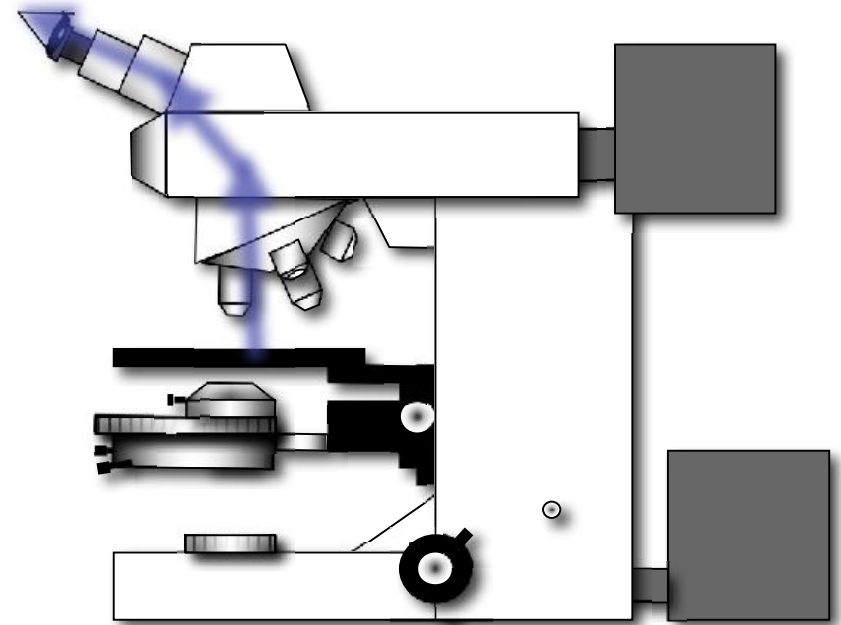
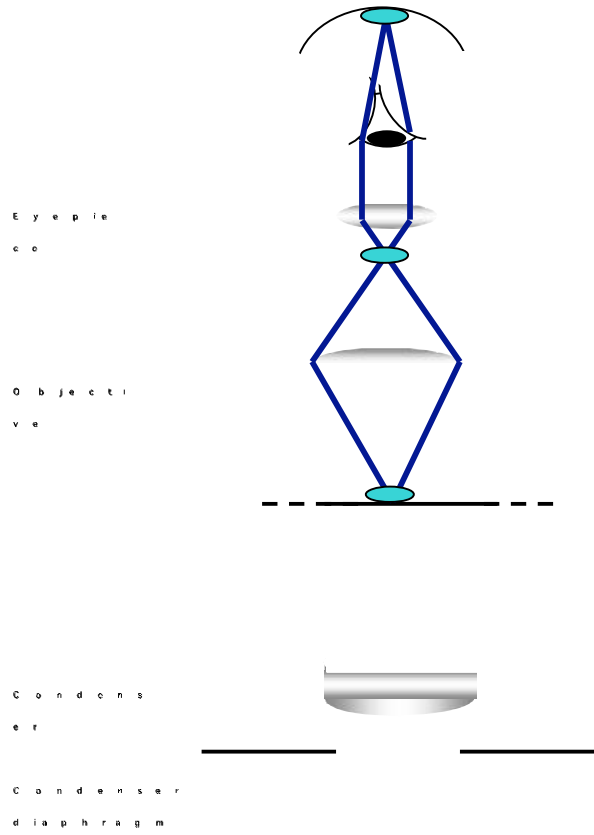
Köhler Illumination:

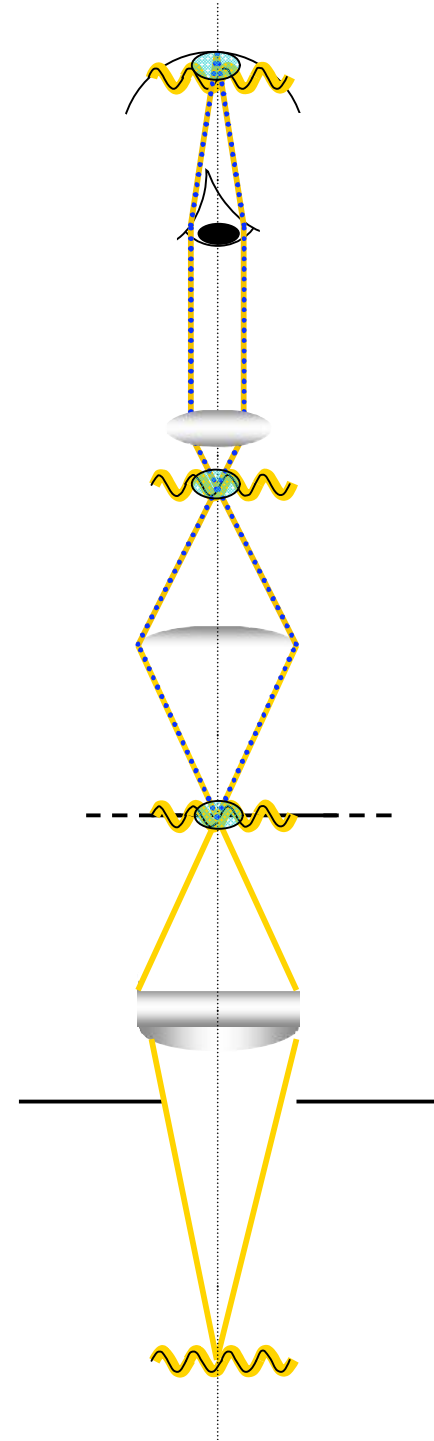
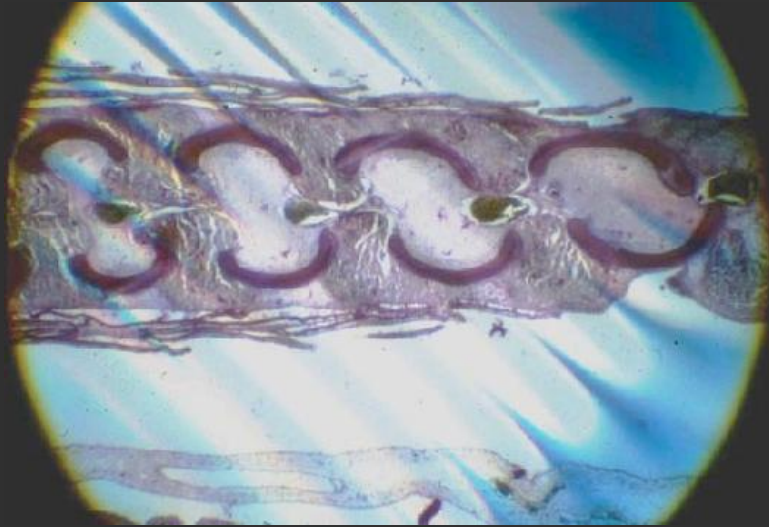
Light-source imaged in the aperture of the condenser

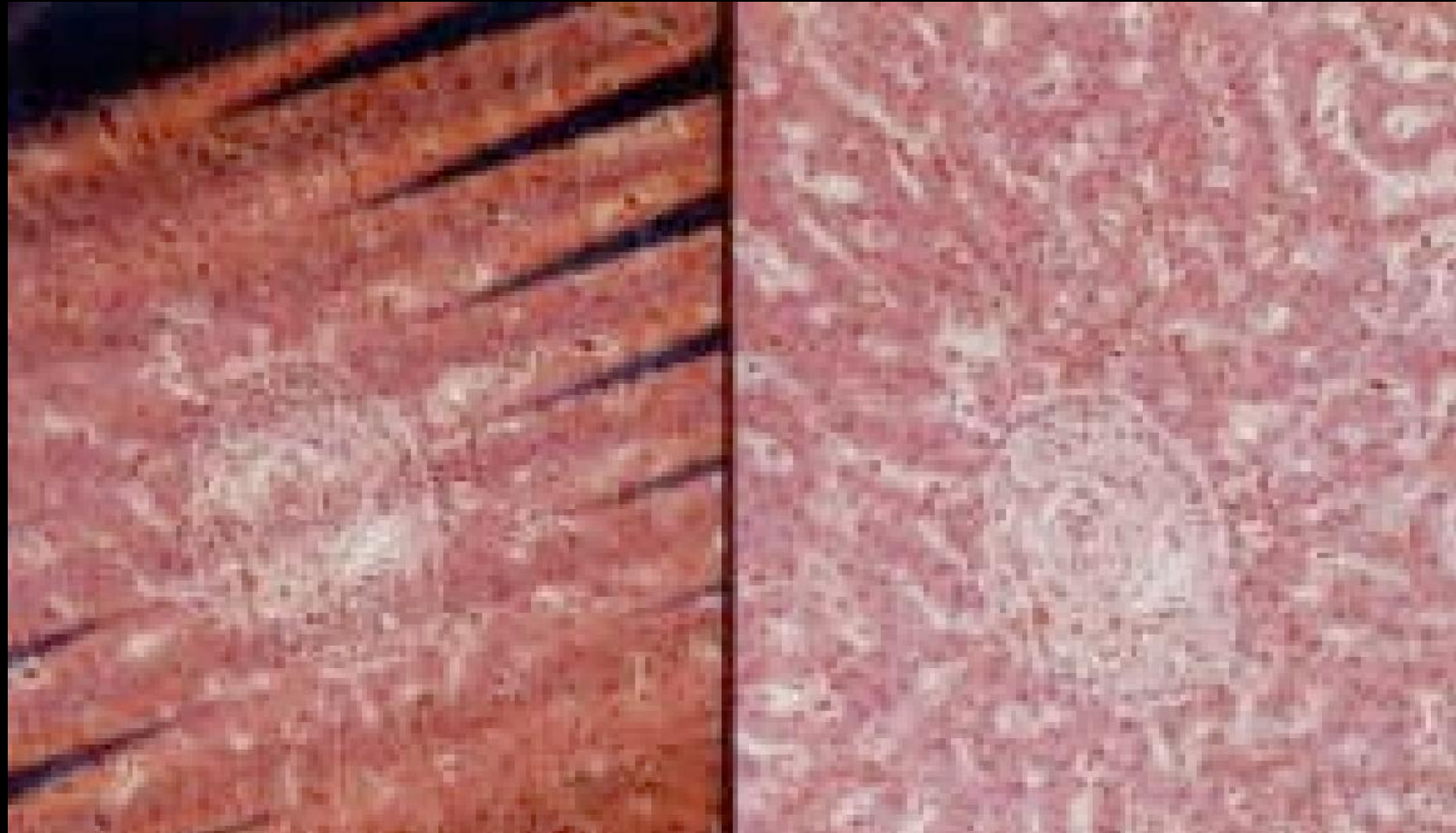


What are conjugated planes?









August Köhler

1866 - 1948

Published

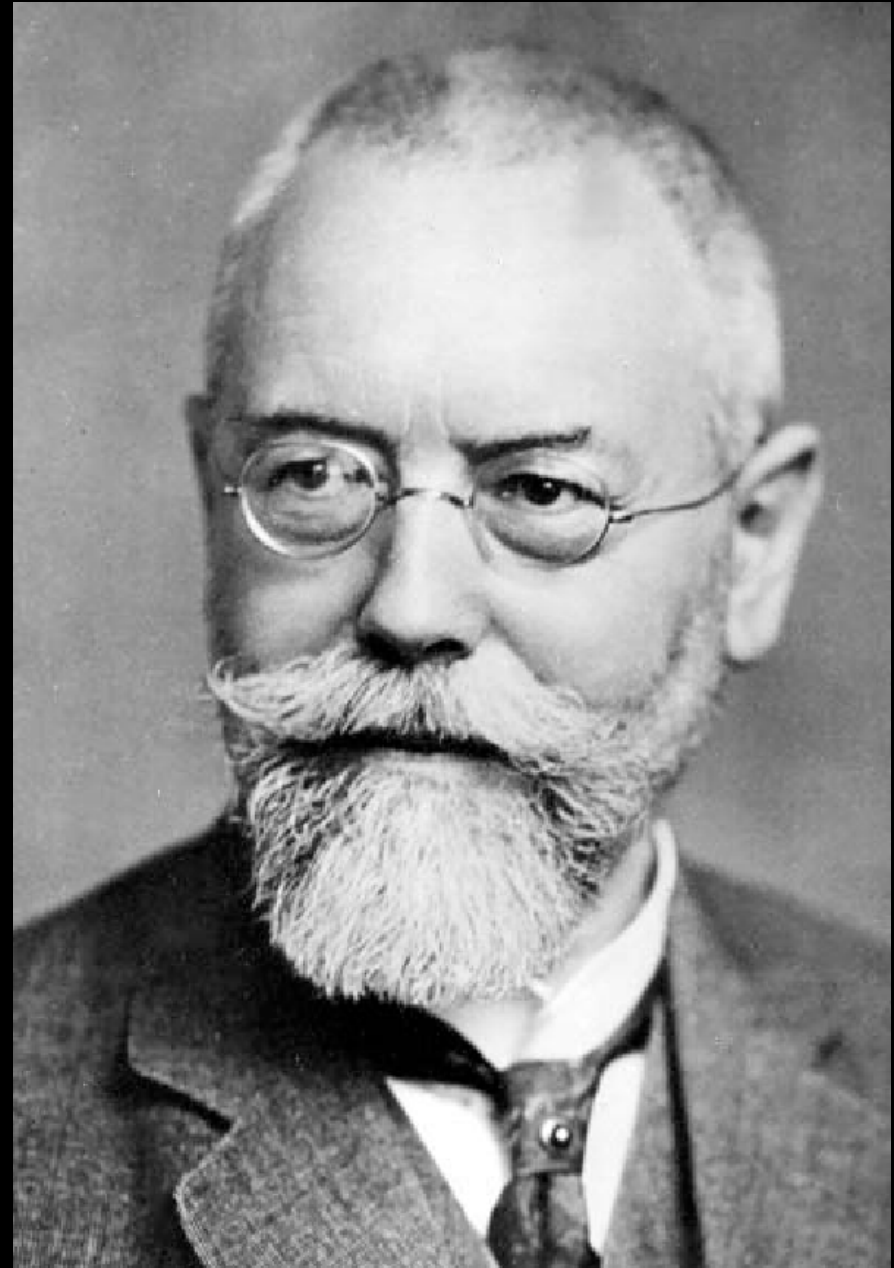
*A new system of illumination for
photomicrographic purposes
(in German) in 1893.*

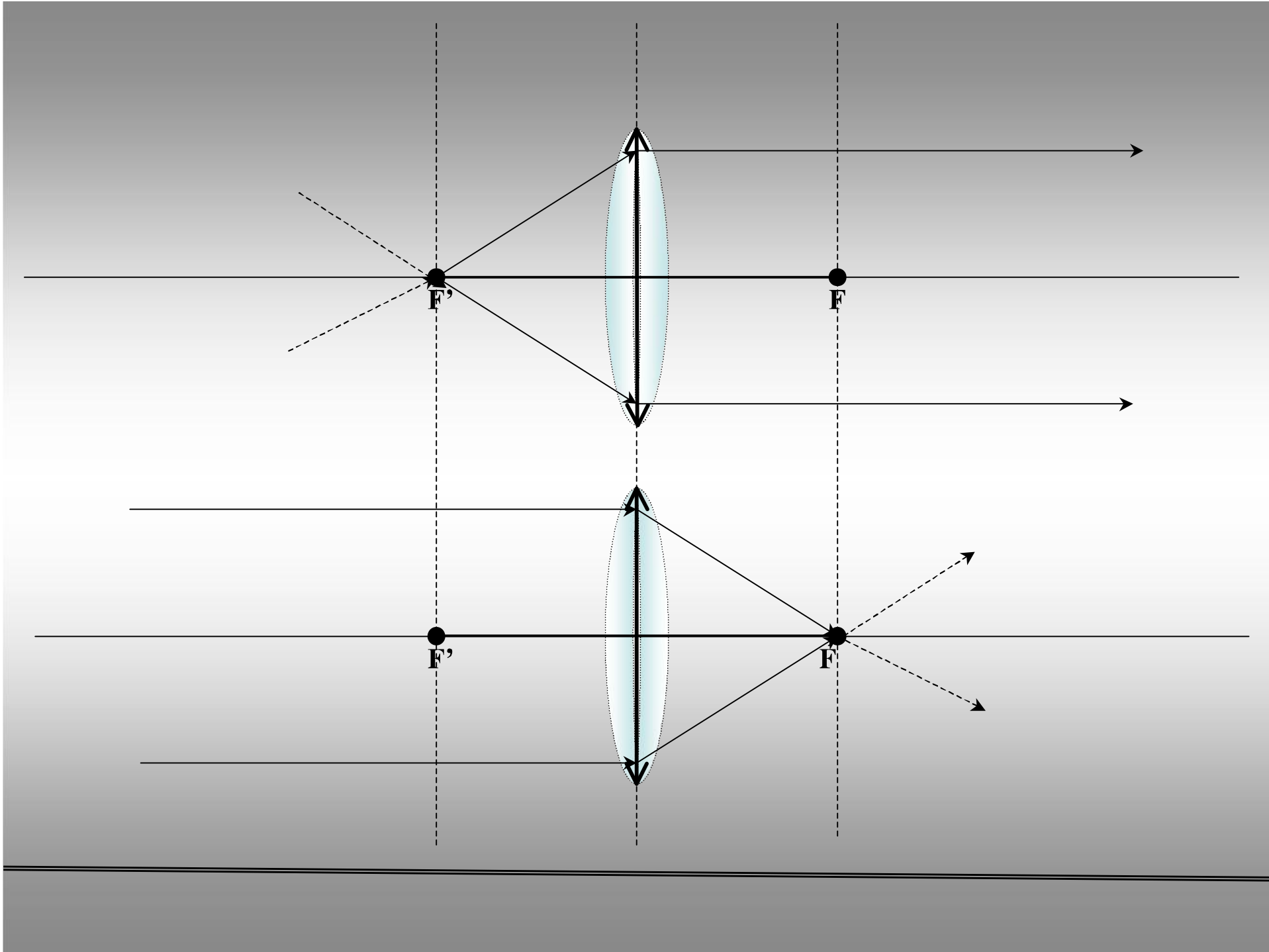
Köhler illumination

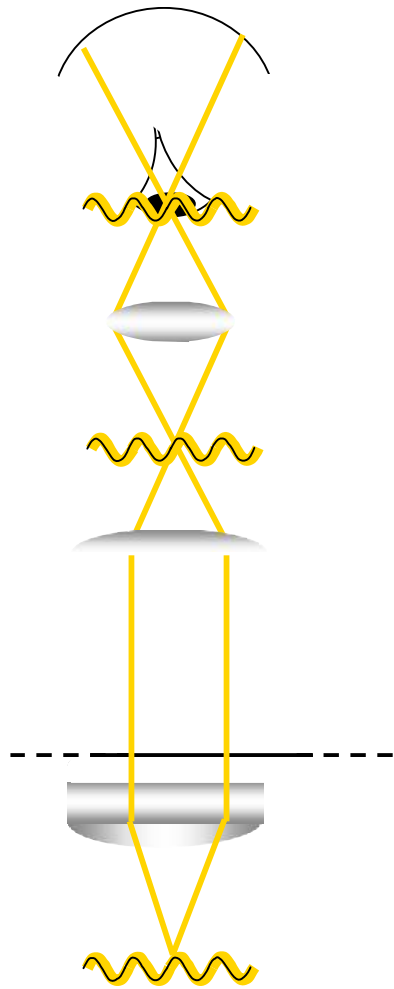
Köhler alignment

Microscope alignment

Did you.....Köhler??





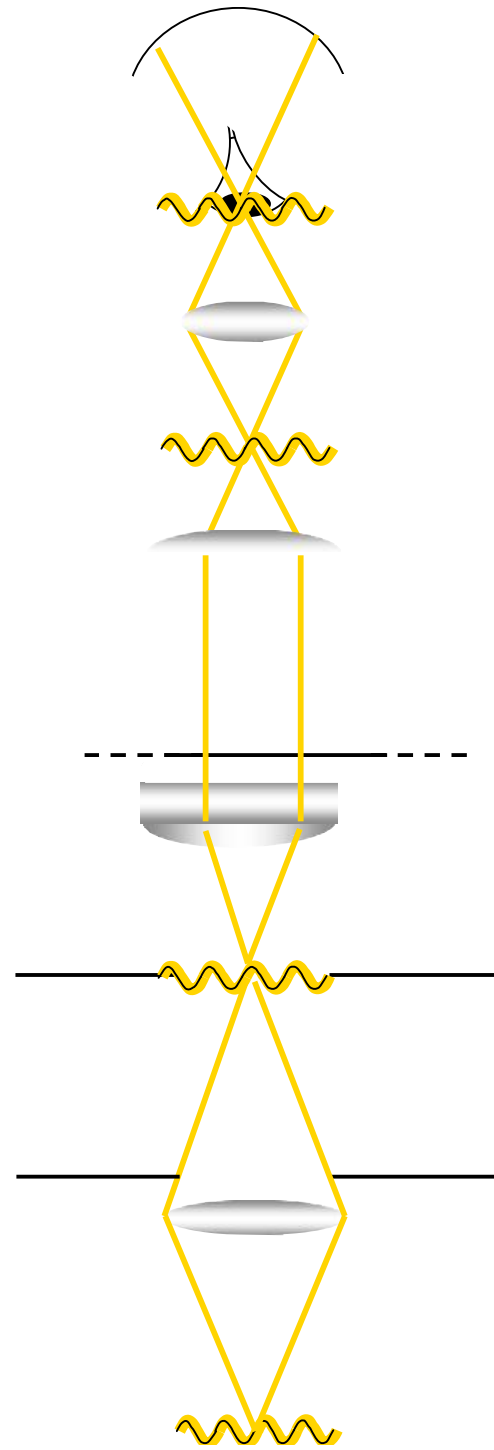


L i g h t
s o u r c e

E y e p i e
c e

O b j e c t i
v e

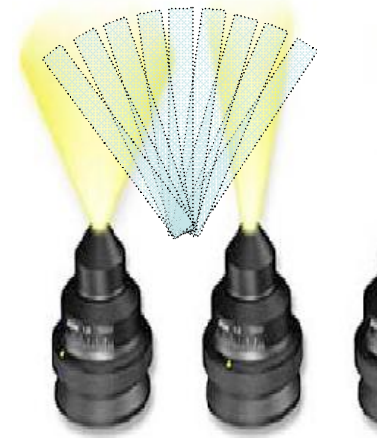
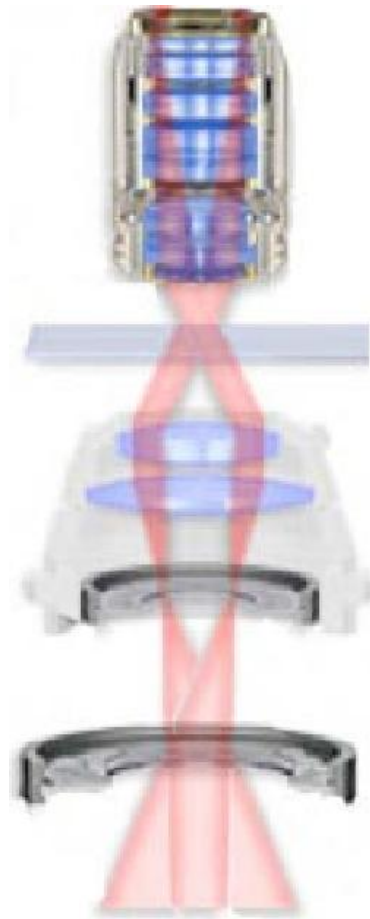
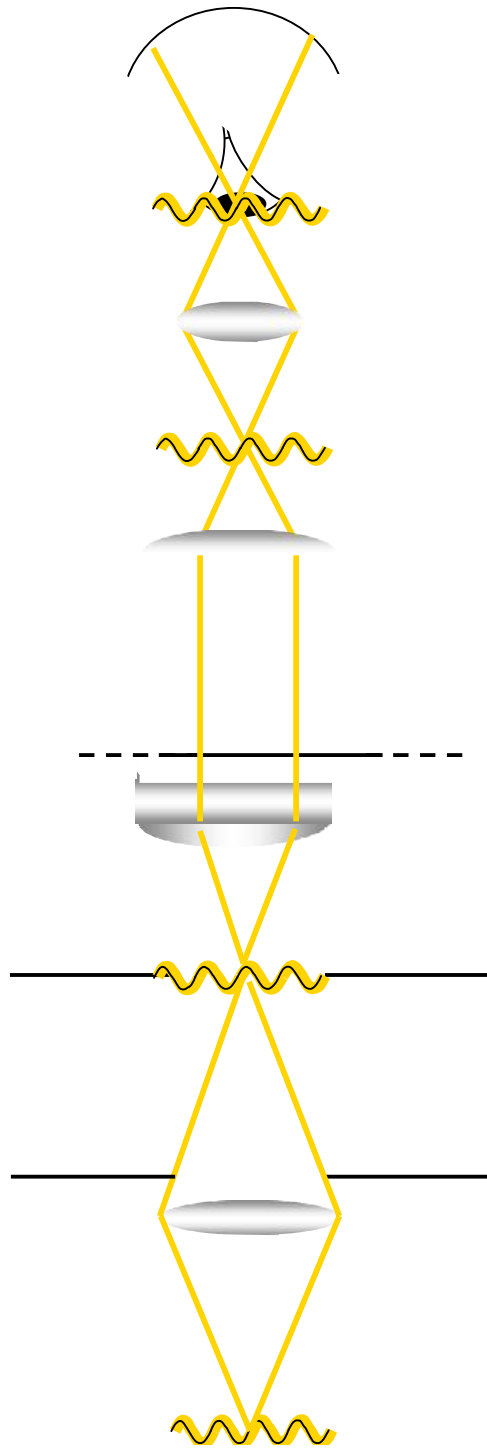
C o n d e n s
e r

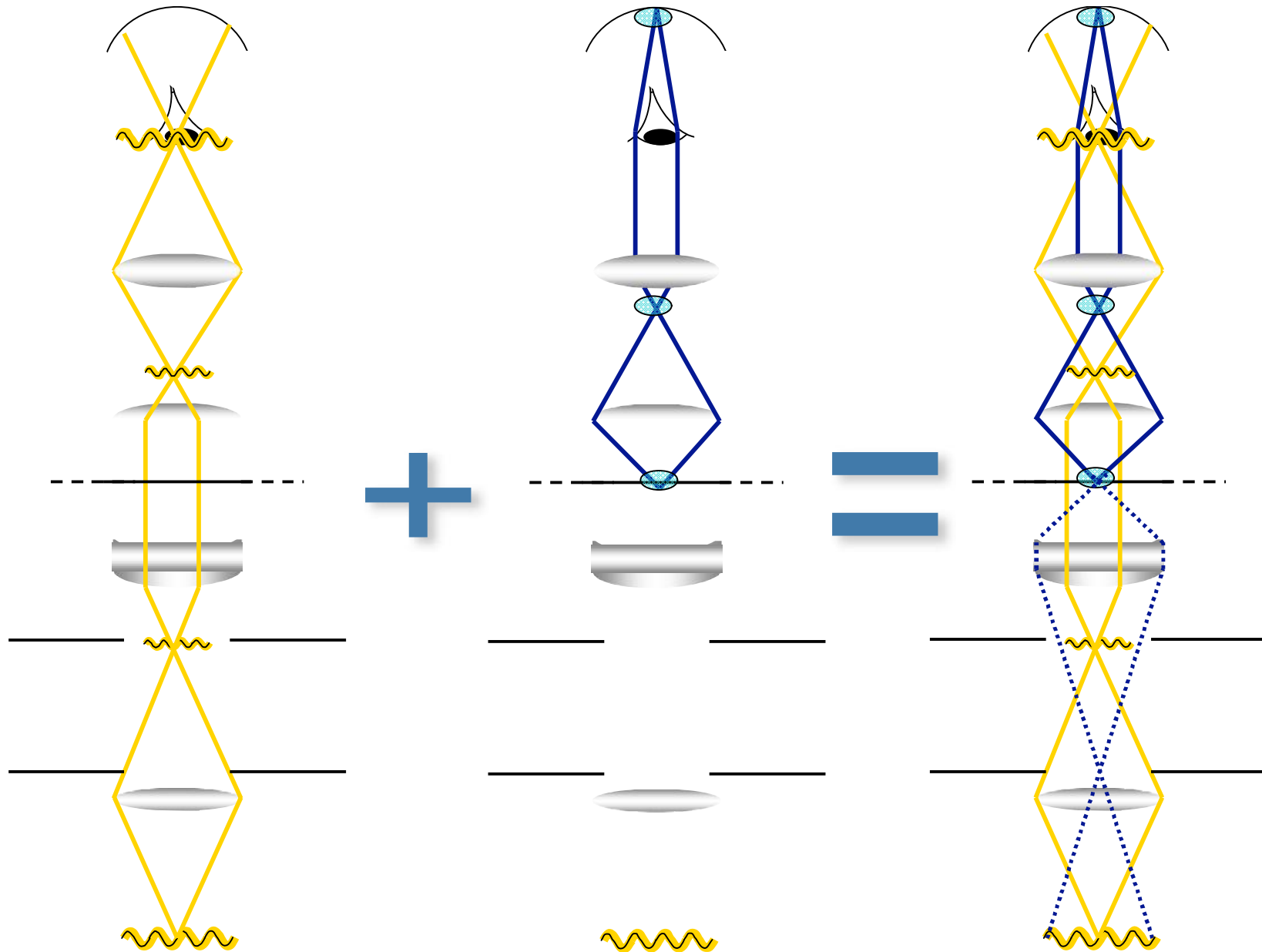


L i g h t
s o u r c e

OPTIONAL (JUST IN CASE)

Light up the *specimen* uniformly





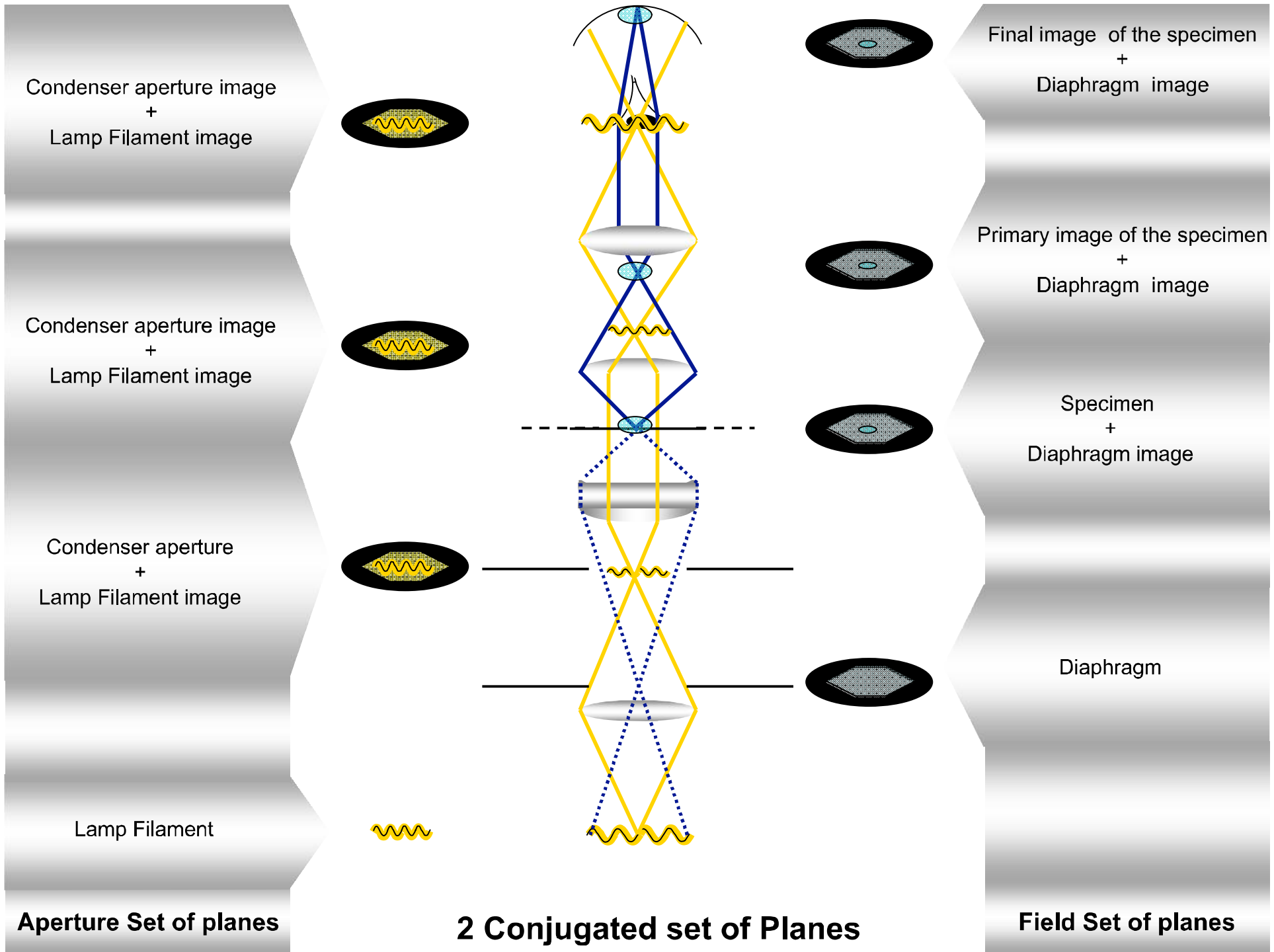
Set of "aperture"
Conjugated planes

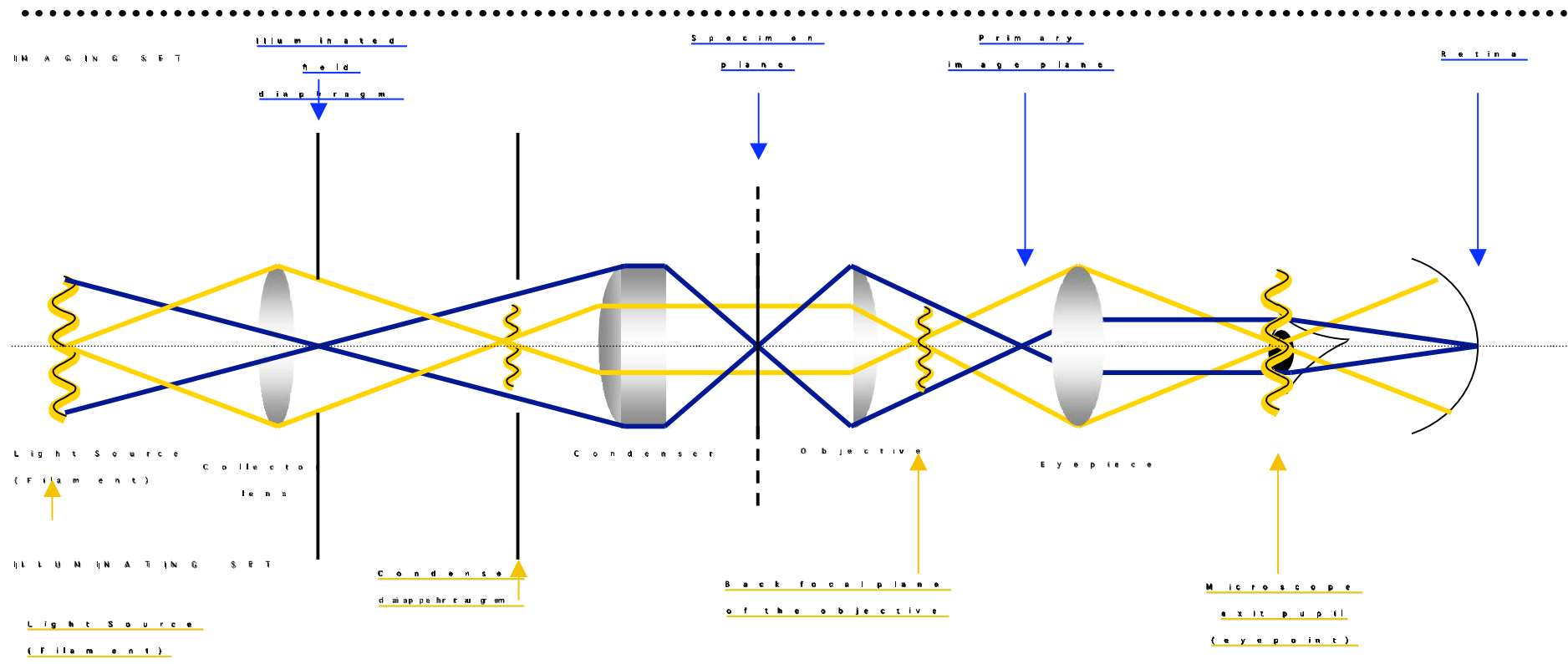
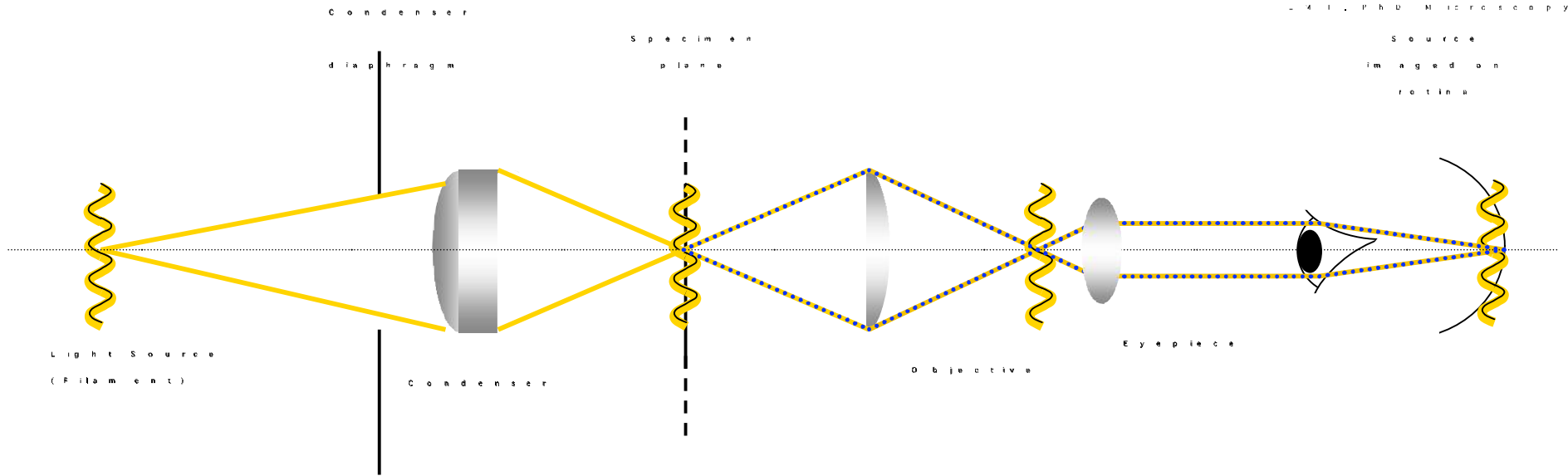
+

Set of "field"
Conjugated planes

=

2 Sets of conjugated Planes

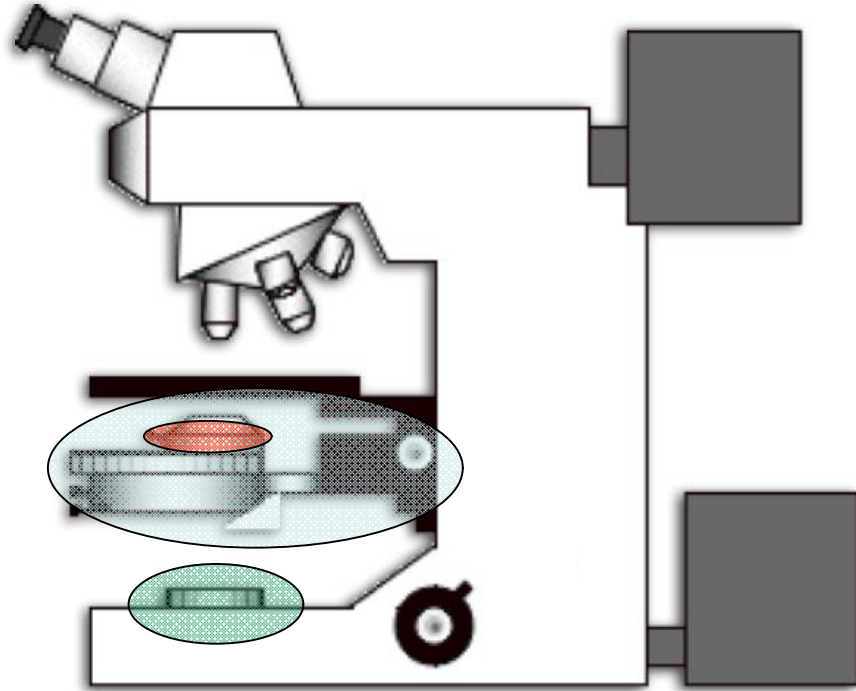




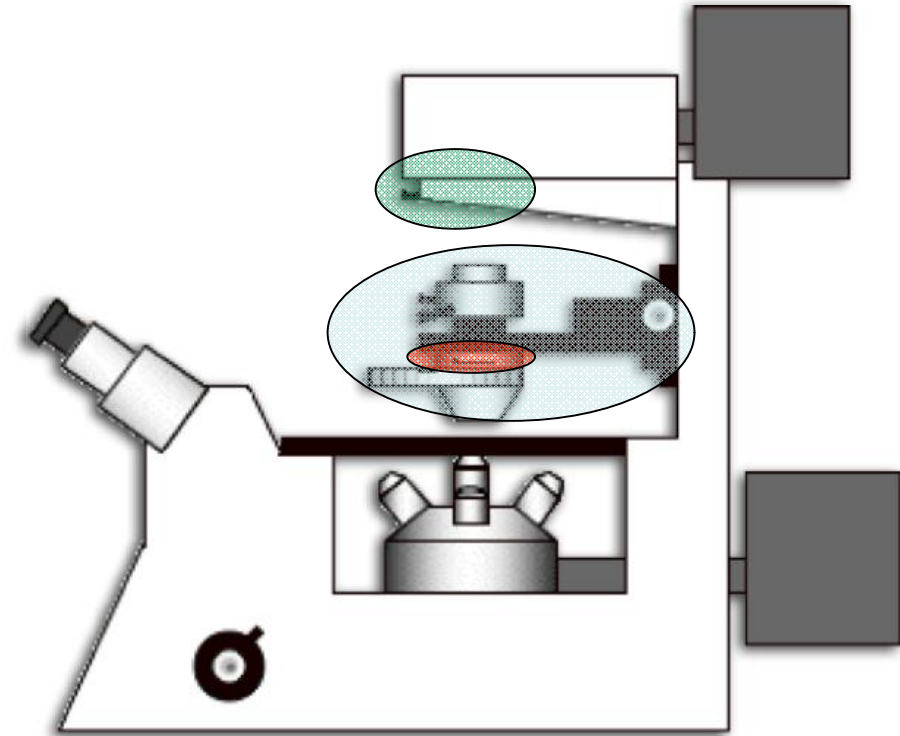
What are we trying to do when illuminating a microscopical specimen??

- Light up the *specimen* **uniformly**
 - over a **controllable** *area*
- Illuminate the *objective aperture* **uniformly**
 - over a **controllable** *angle*

U P R I G H T M I C R O S C O P E



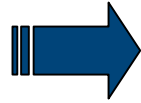
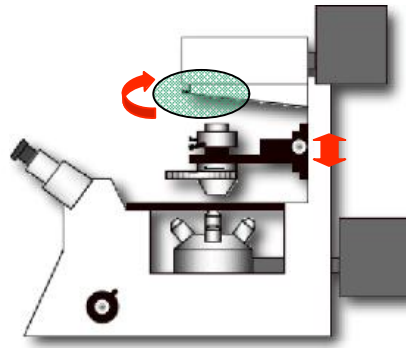
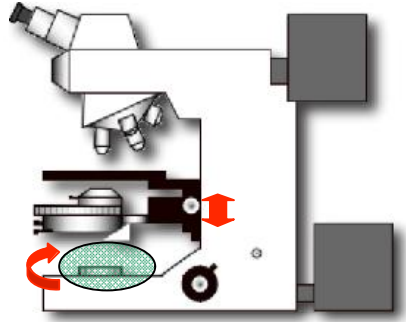
I N V E R T E D M I C R O S C O P E



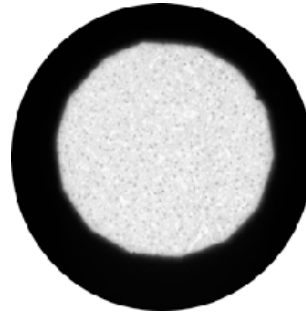
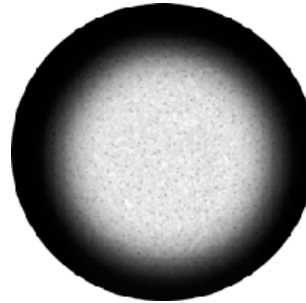
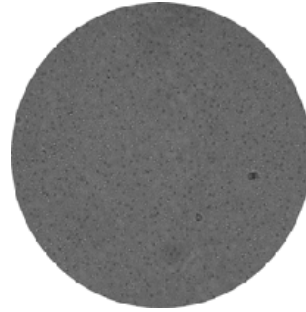
○ Condenser

○ Field Diaphragm. (FD)

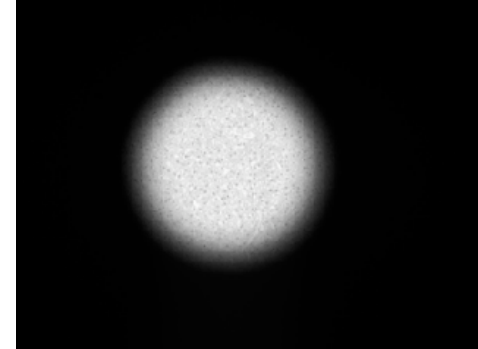
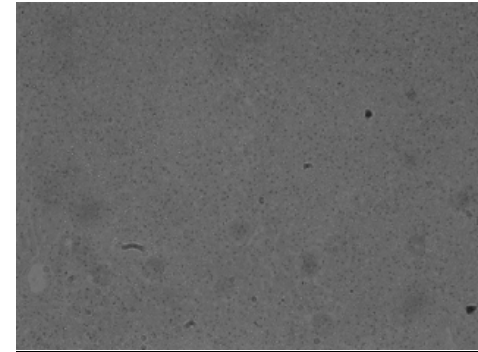
○ Condenser Aperture. (CD)

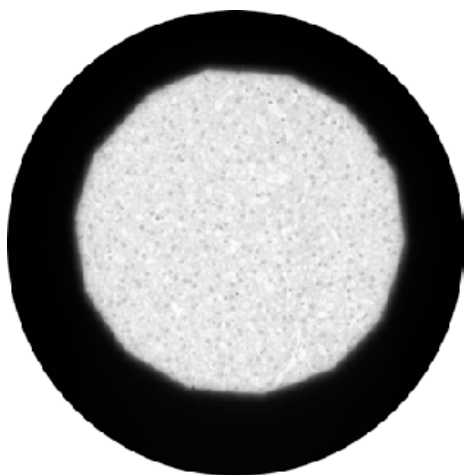
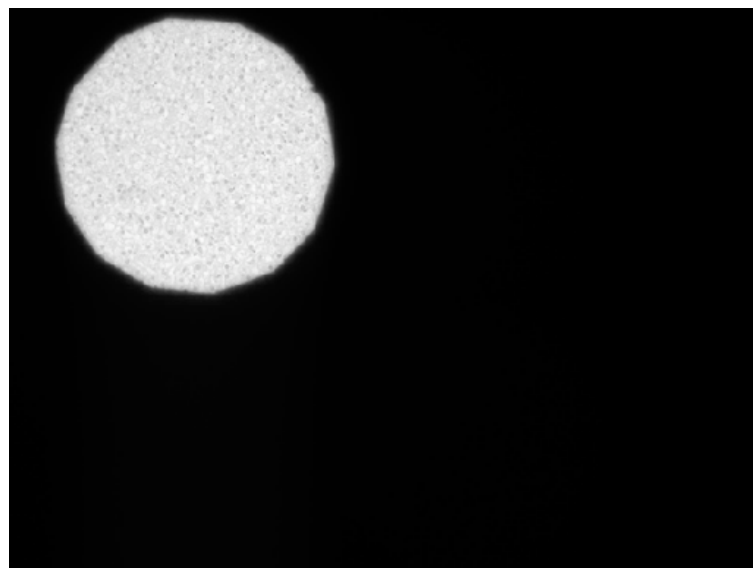


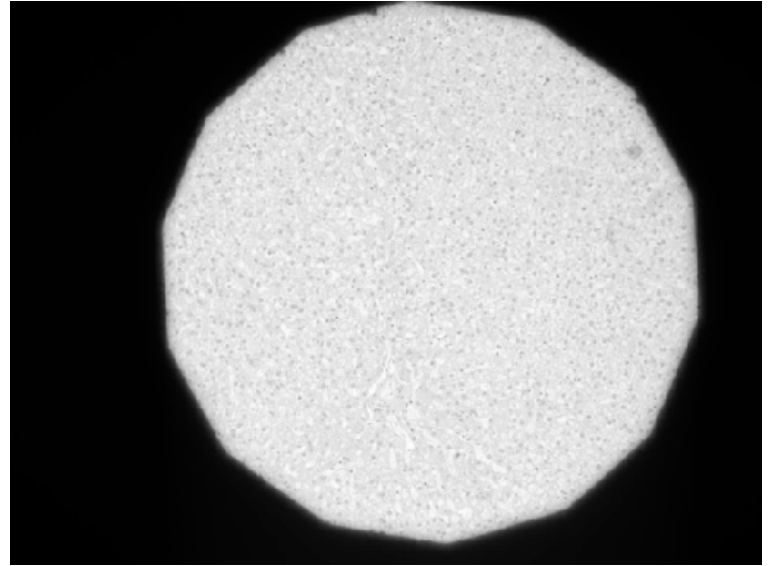
E y e

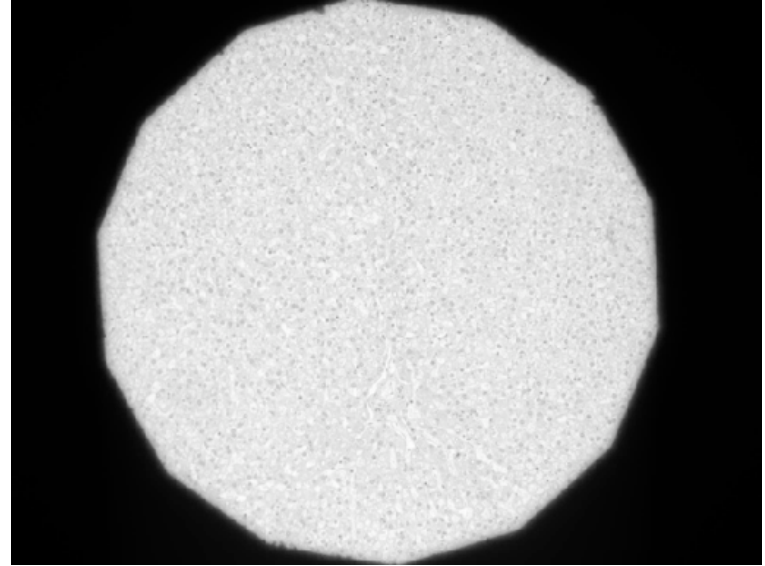


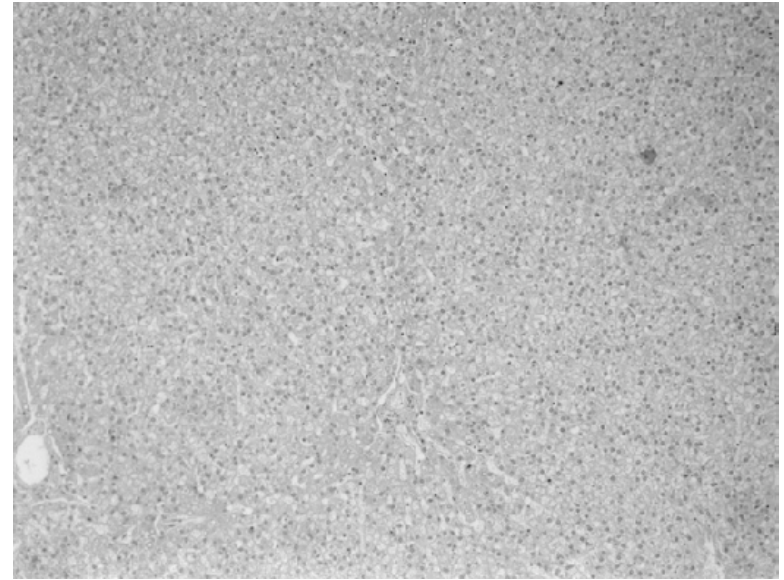
C C D





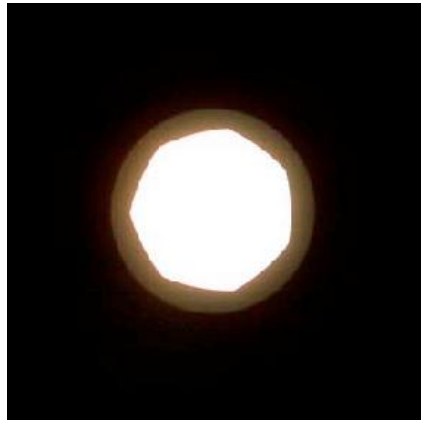








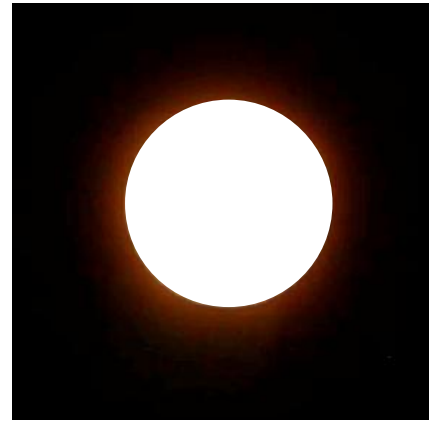
60%



80%



95%



100%

Condenser Aperture too large

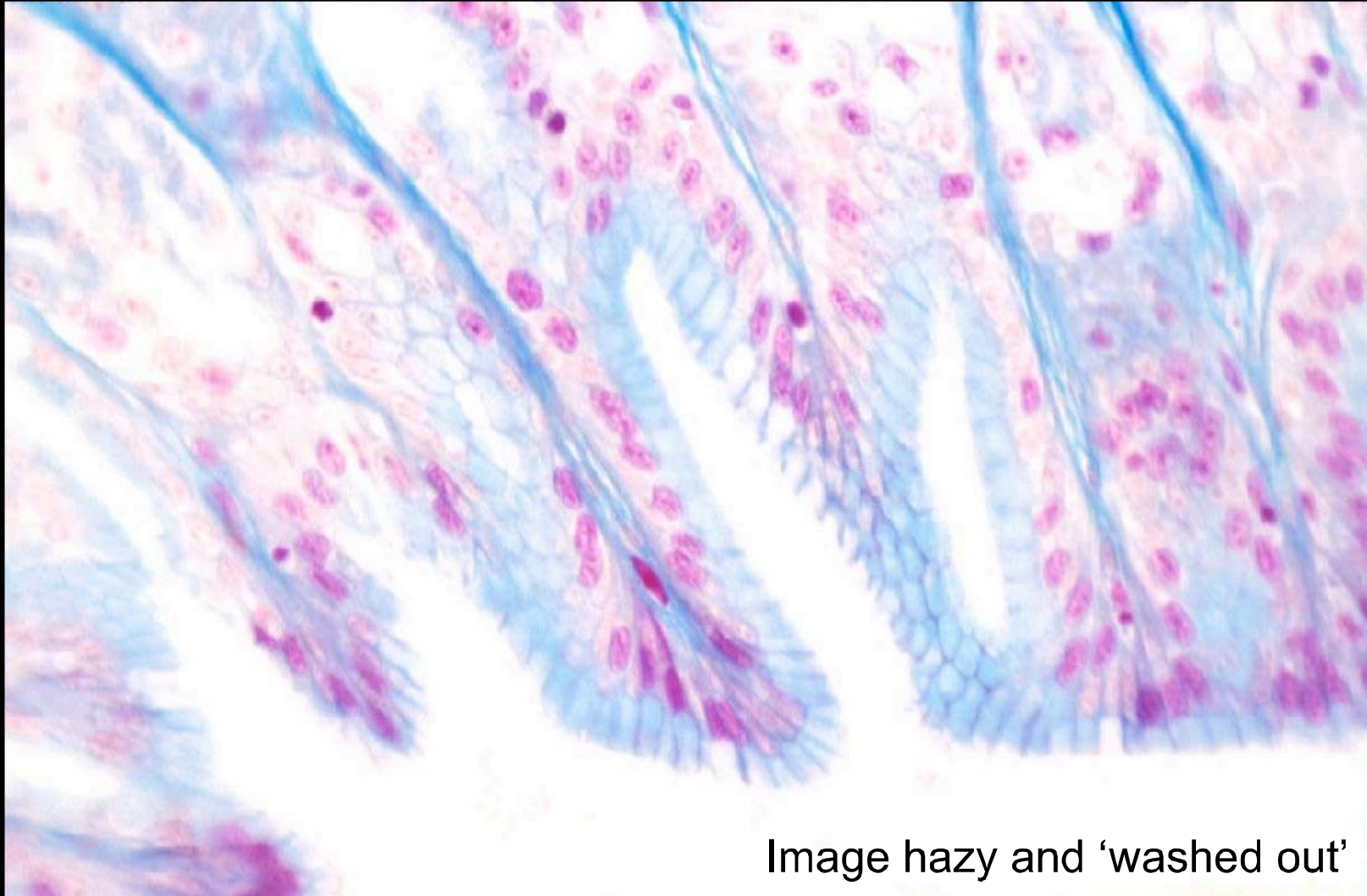


Image hazy and 'washed out'

Condenser Aperture correct

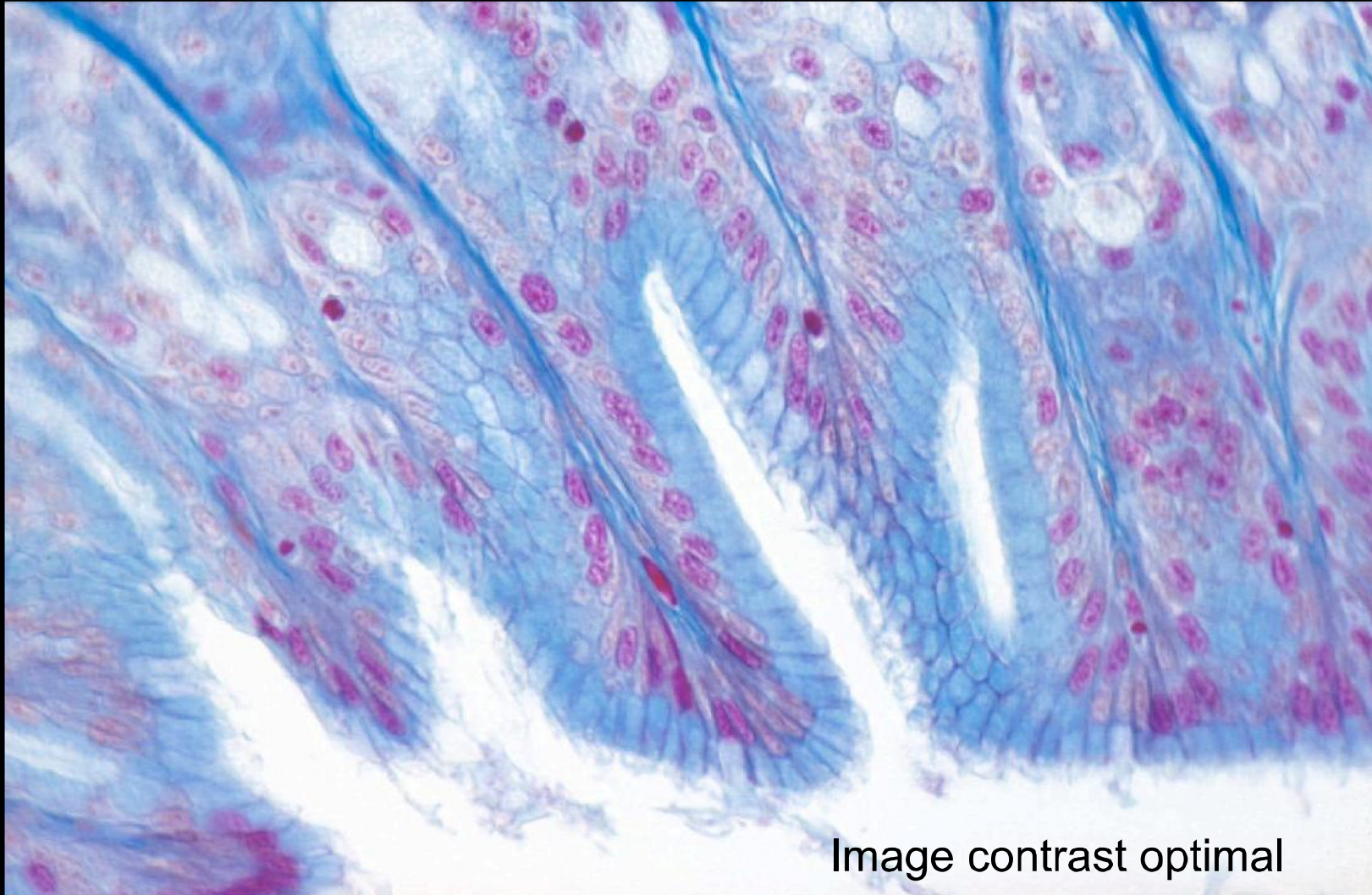


Image contrast optimal

Condenser Aperture too small

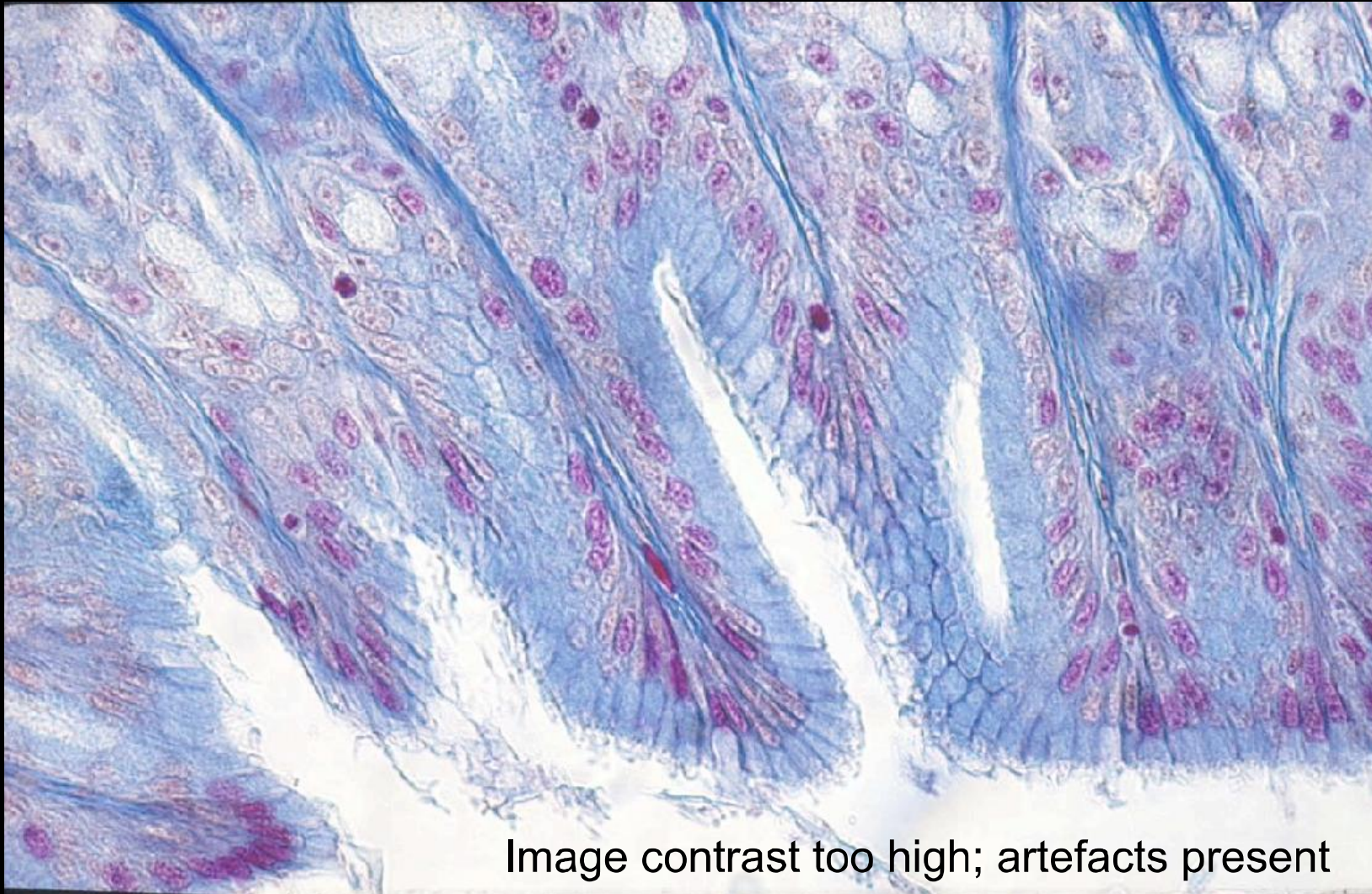
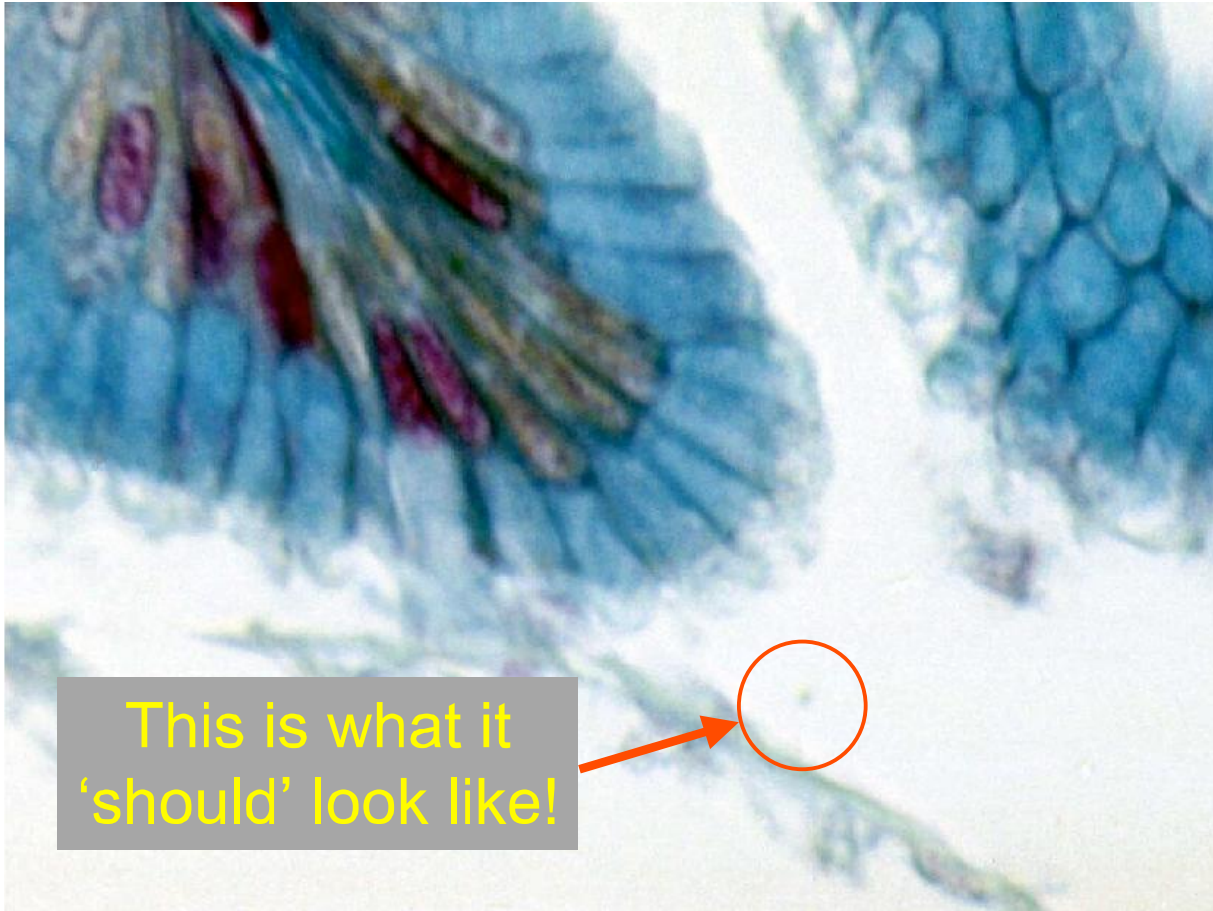


Image contrast too high; artefacts present

Condenser Aperture too small





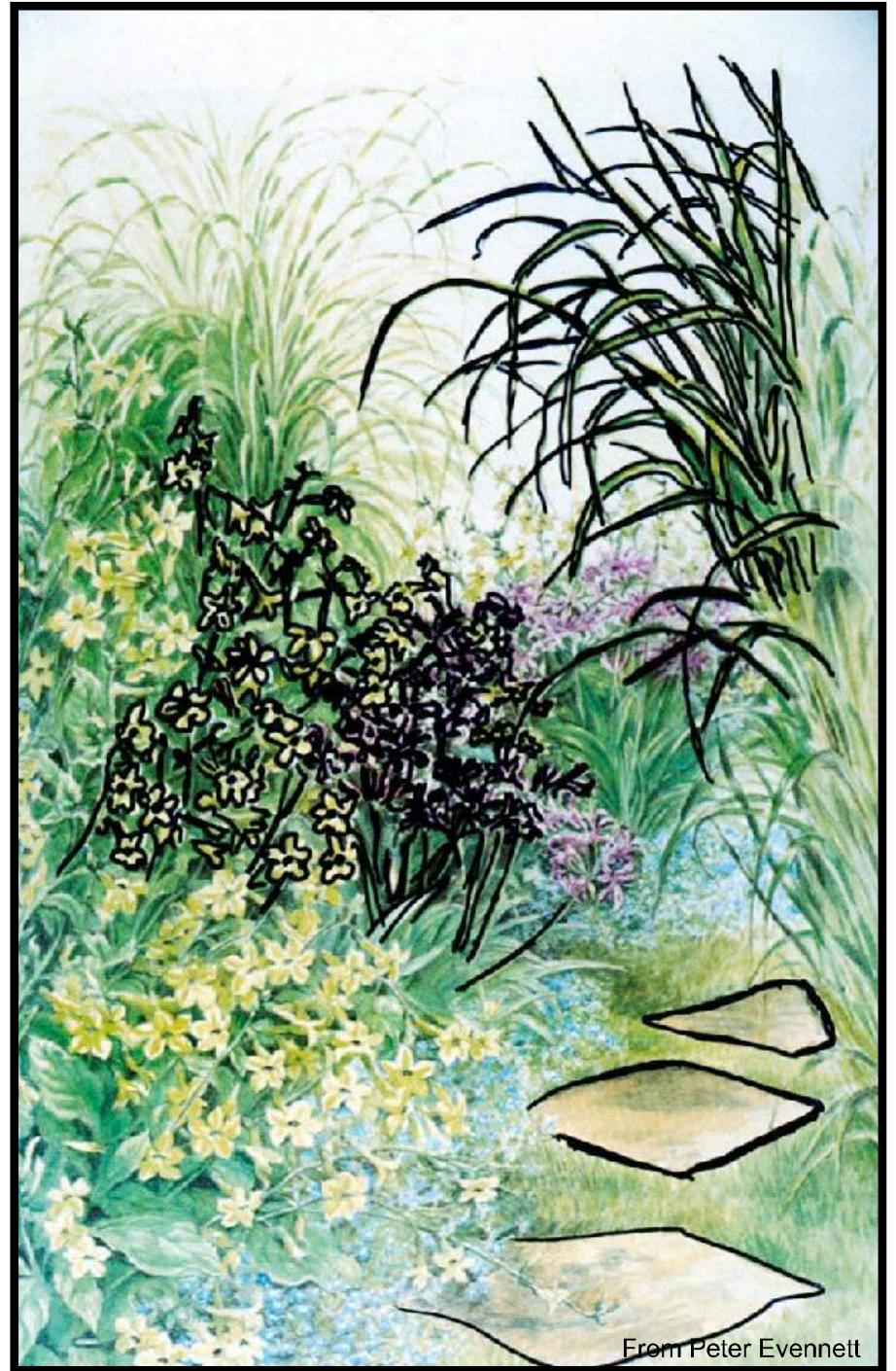
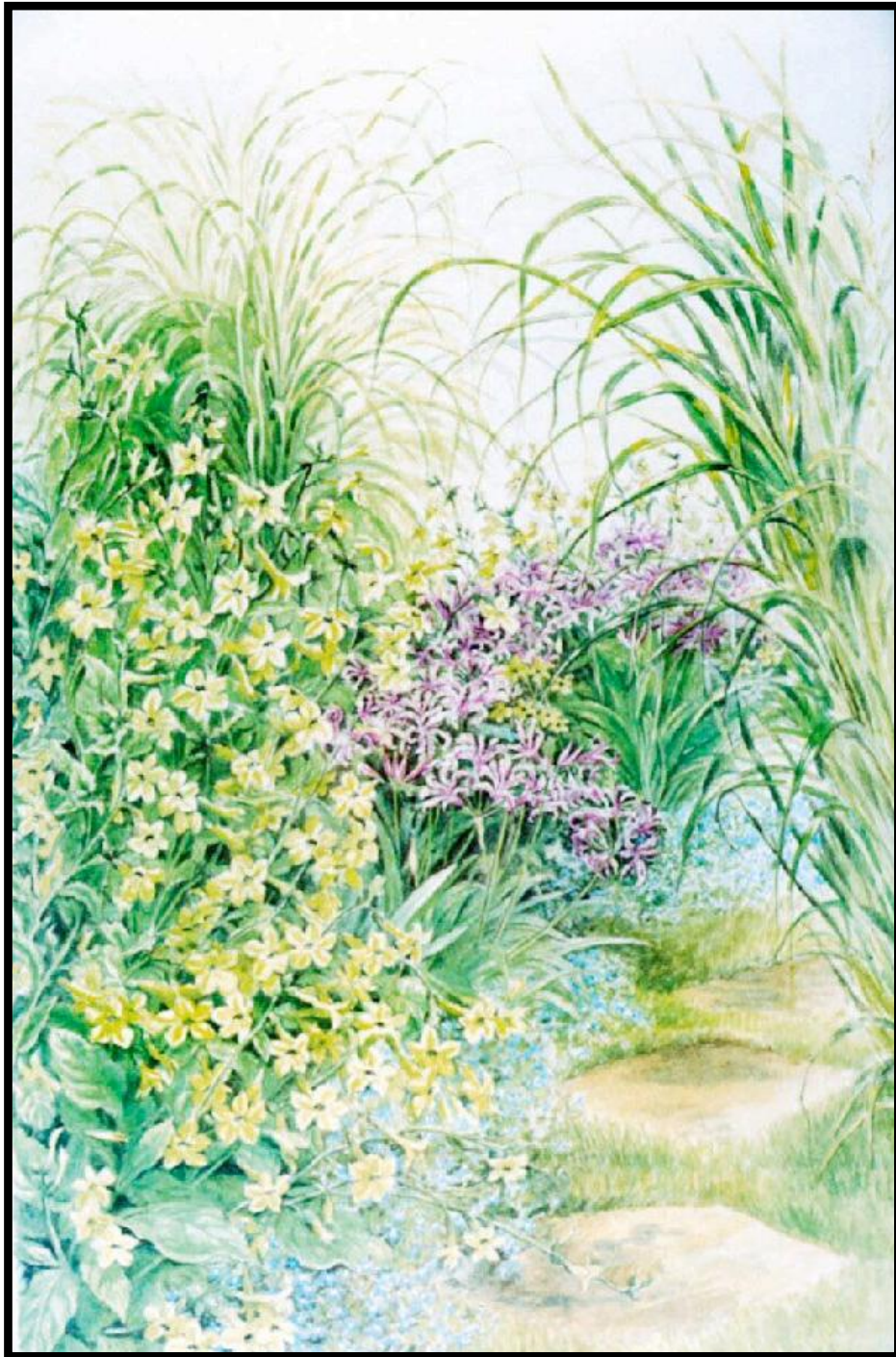
This is what it 'should' look like!

Condenser aperture correct



Condenser aperture too small

Note this object



From Peter Evennett

Köhler Illumination provides

Control of **Area illuminated** by the
Illuminated Field Diaphragm,
which is adjusted according to **magnification**.

Control of **Angle of illumination** by the
Illuminating Aperture Diaphragm
(the condenser aperture),
which is adjusted according to objective **aperture**.