Lecture Five

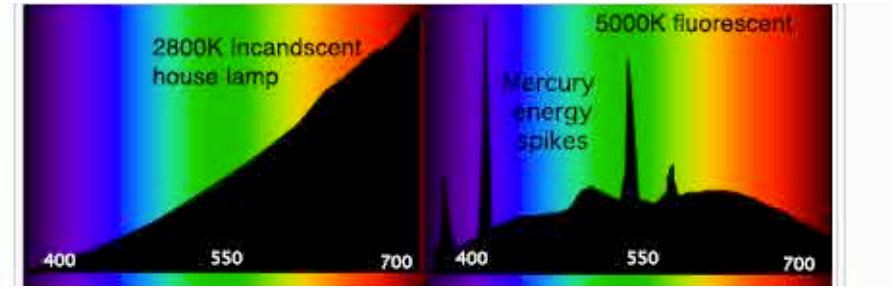
Questions?

Quiz three

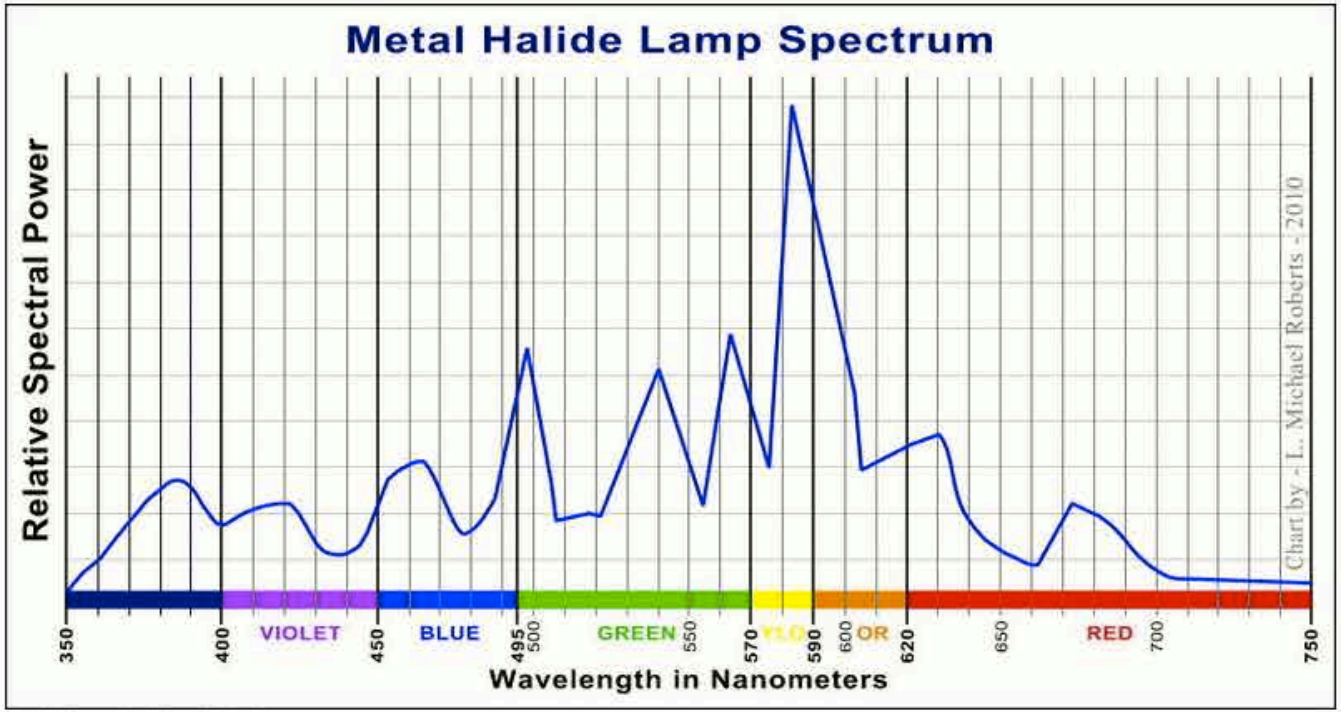
- State the relationship of NA to magnification
- What is spherical aberration?
- What is empty magnification
- List the advantages of an LED light source for microscopy

Illuminants & Color Temperature

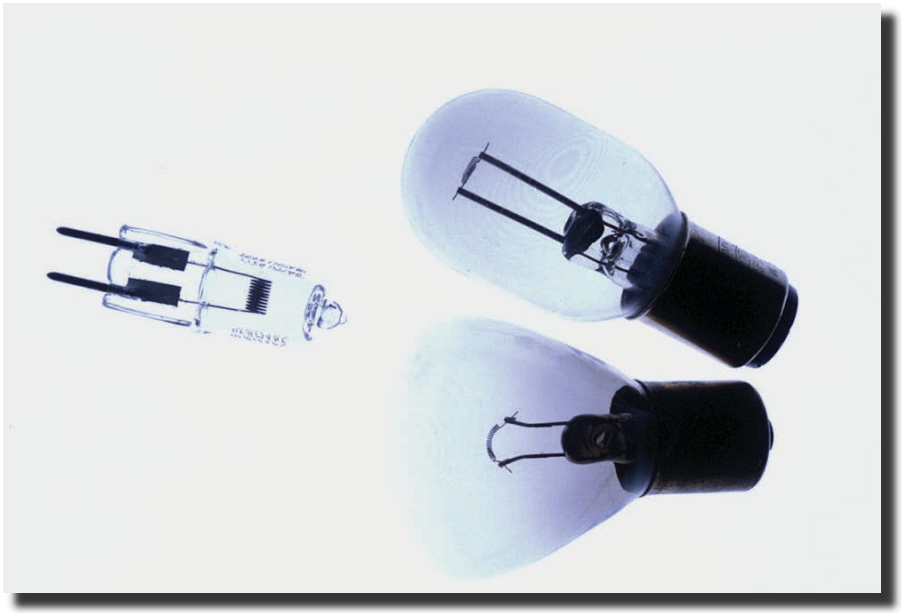
Described in degrees Kelvin, e.g. 3200K or 5500K



Continuous source and discontinuous source


Metal Halide Lamp Spectrum
Relative Spectral Power
Chart by - L. Michael Roberts - 2010
350
400
VIOLET
450
BLUE
495
500
GREEN
550
570
YLO
590
600
OR
620
650
RED
700
750
Wavelength in Nanometers

Tungsten Lamps



Eye pieces

- Viewing
- Photo/video
- Indexed
- Magnification

Corrected or NOT

Setting and using

Prism head or beam splitter

- 100%
- 80%
- 50%

Filters

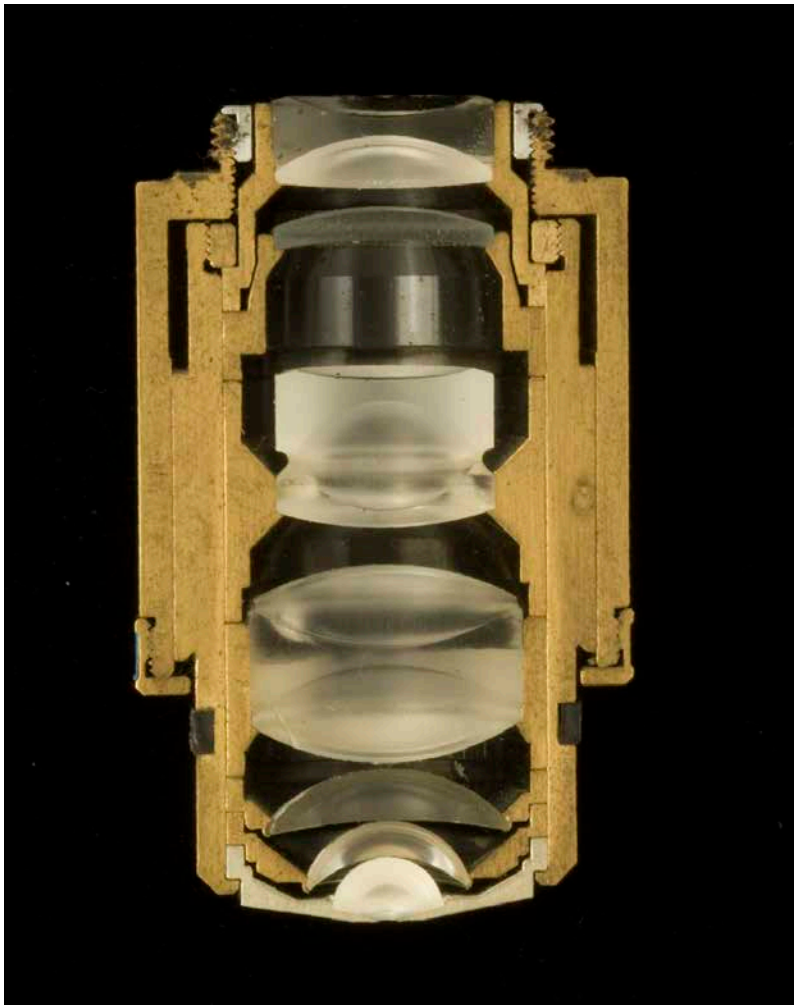
- ND
- Light Balancing
- Diffusion
- Fluorescence
- Heat absorbing

Substage Condensers

Substage condensers

- Abbe inexpensive NA 1.25
- Swing out NA .90
- Apo Aplanic NA 1.40
- Universal or Phase

OBJECTIVES



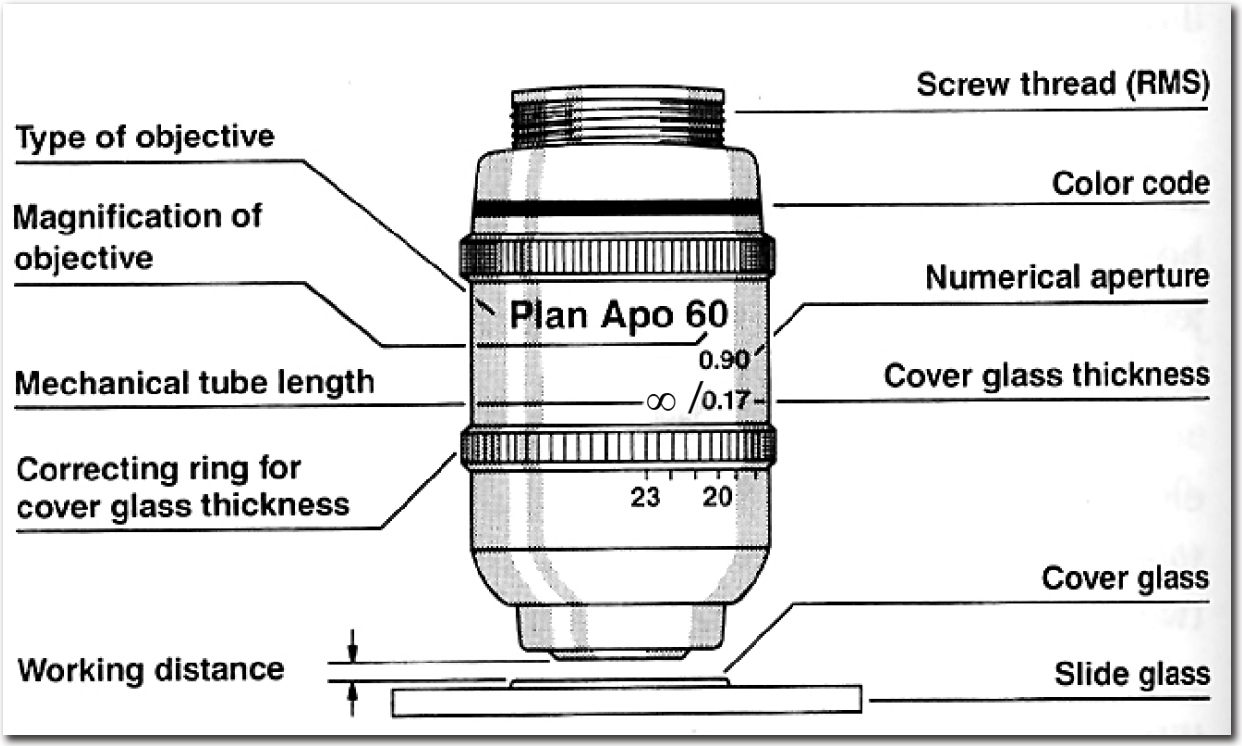
Classifications

Degree of Correction

Achro

Fl

APO


Screw thread (RMS)
Type of objective
Color code
Magnification of objective
Numerical aperture
Plan Apo 60
0.90
Mechanical tube length
∞ /0.17
Cover glass thickness
Correcting ring for cover glass thickness
23
20
Cover glass
Working distance
Slide glass

Objectives

- Numerical aperture
- PLAN
- Tube length
  - OLD Instruments - 160mm
  - NEW - infinity/∞
- Cover slip

Numerical Aperture - NA

1000 x NA = empty mag

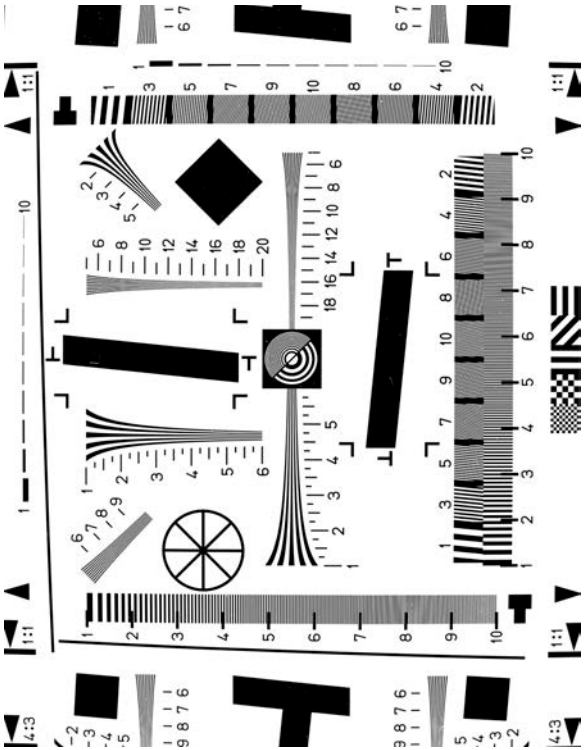
$$d\ (res) = \frac{\lambda}{NA_{objective} + NA_{condenser}}$$

Numerical Aperture

in Air - 1.00

in Oil - 1.53

Optical Resolution



Aperture diaphragm

Observed in the body tube

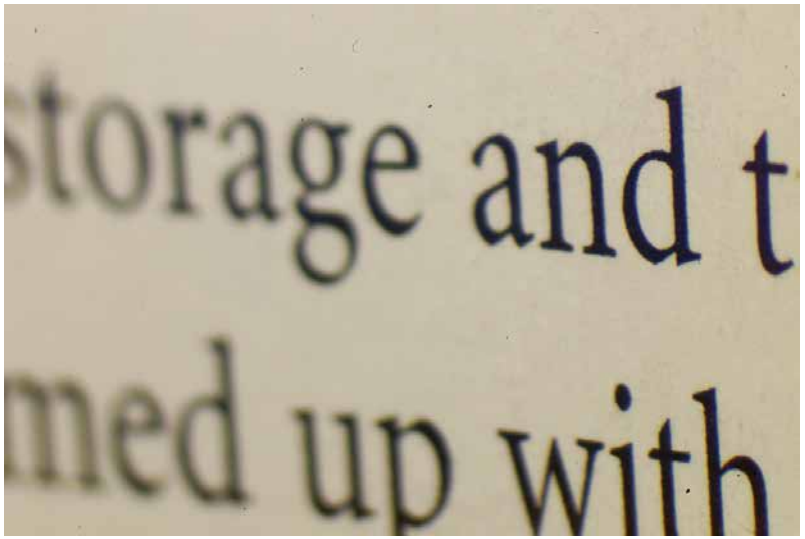
at the Exit Pupil of the Objective

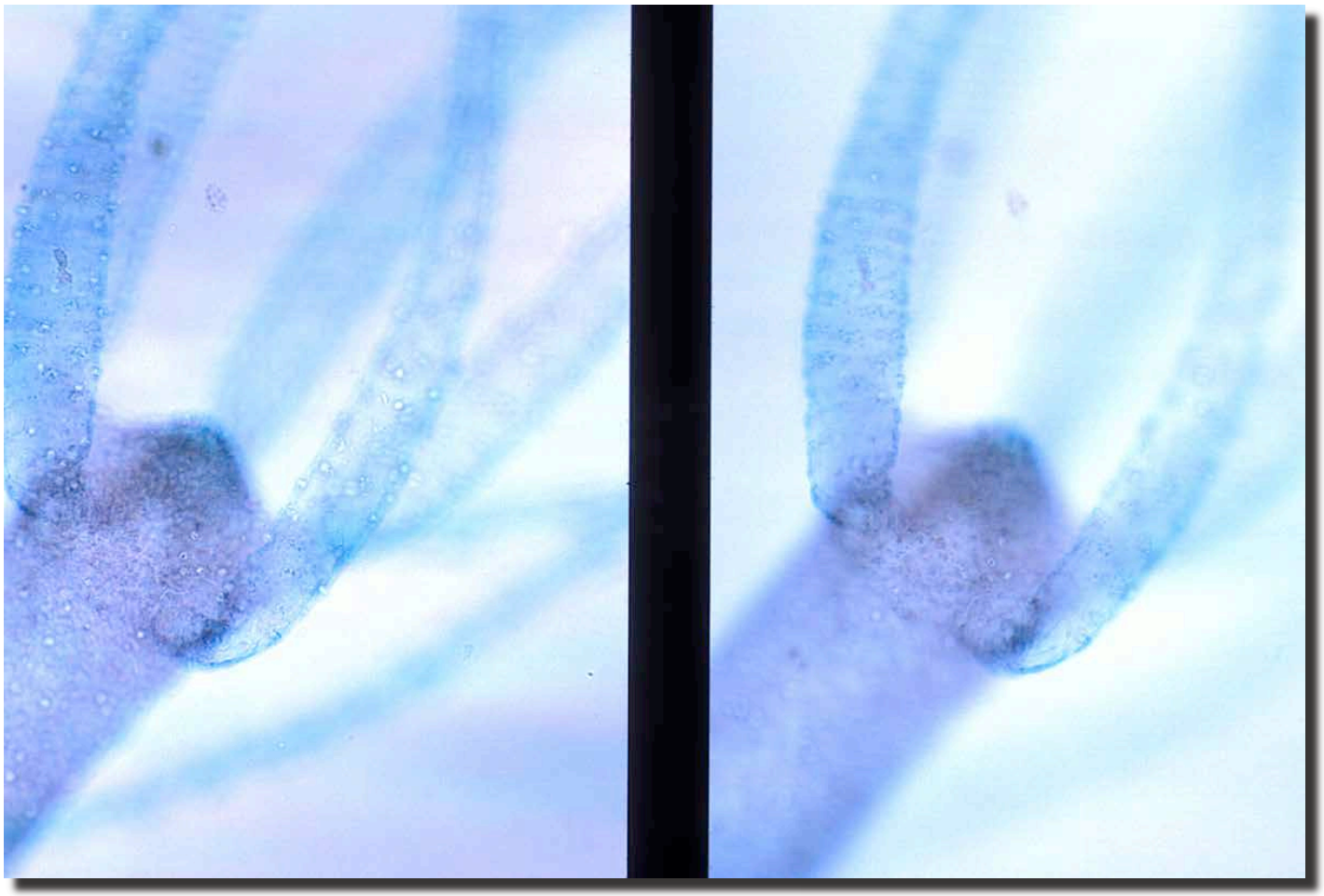
Aperture Diaphragm

- Intensity
- Depth of field
- Resolution
- Contrast

Depth of Field of your image

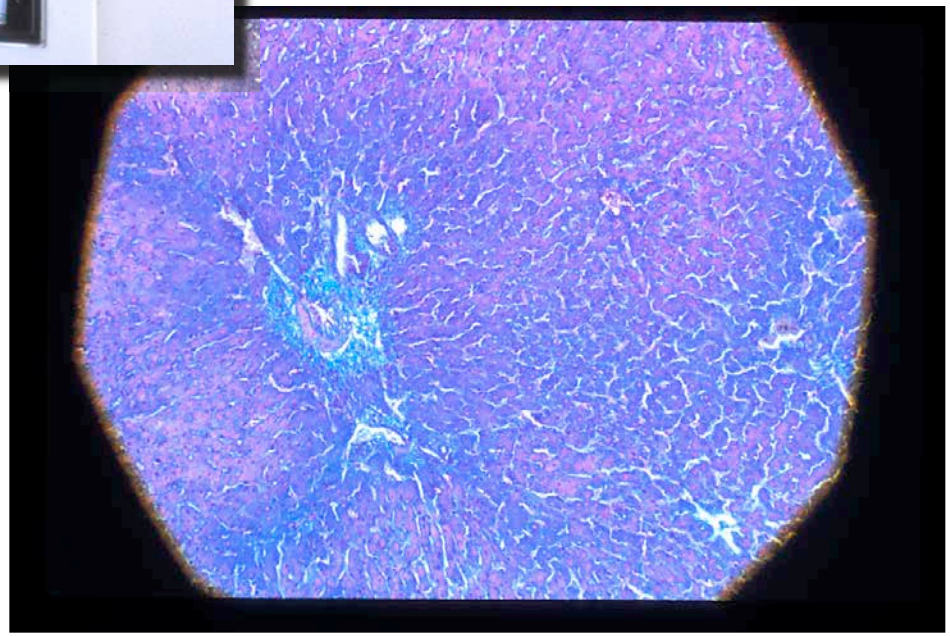
- Influenced by magnification
- Aperture choice



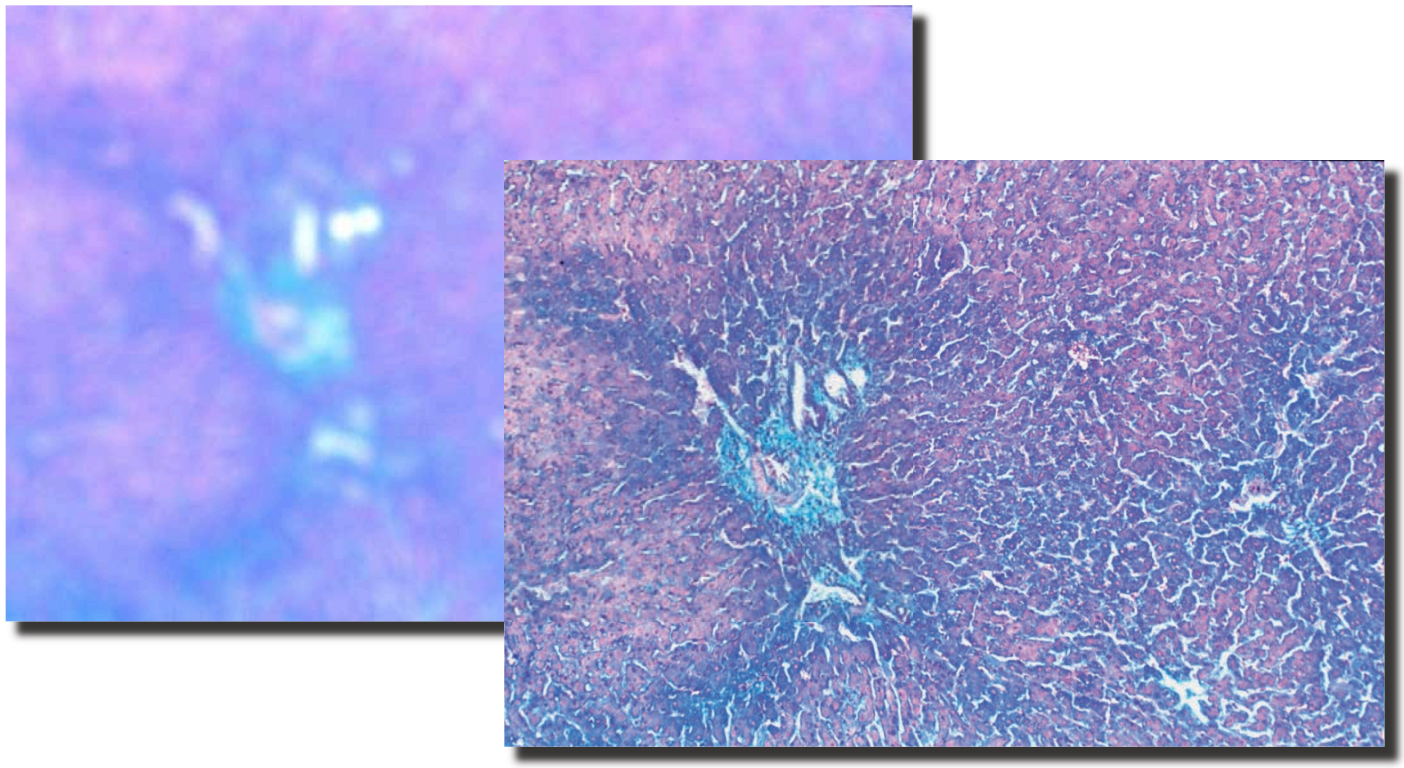


Field diaphragm

Diameter of the
illumination of the beam



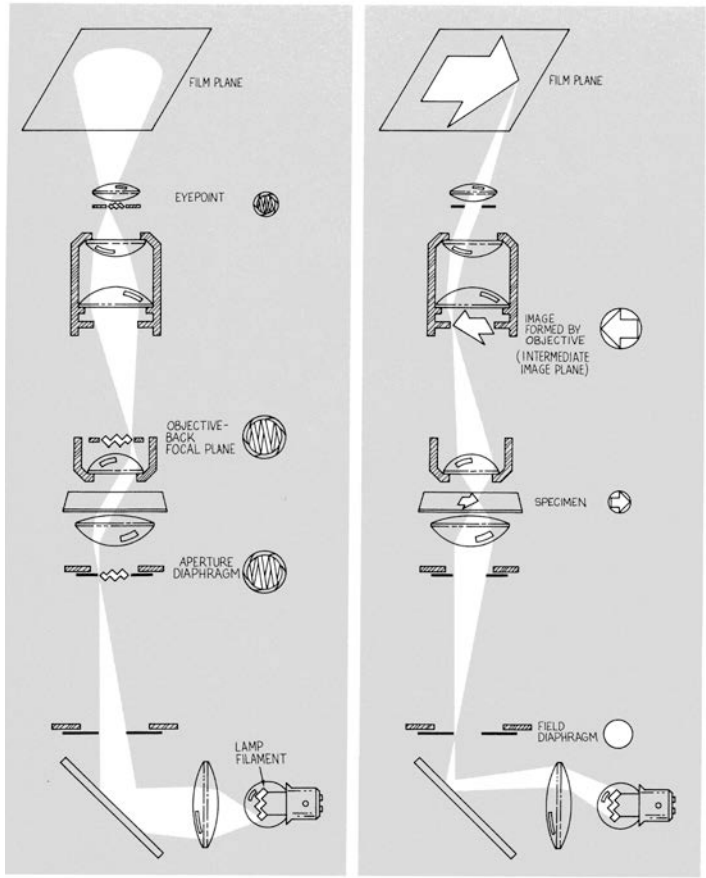
focusing



Kohler Illumination

August Kohler
“Kohlering”

- Imaging pathway
- Illumination pathway



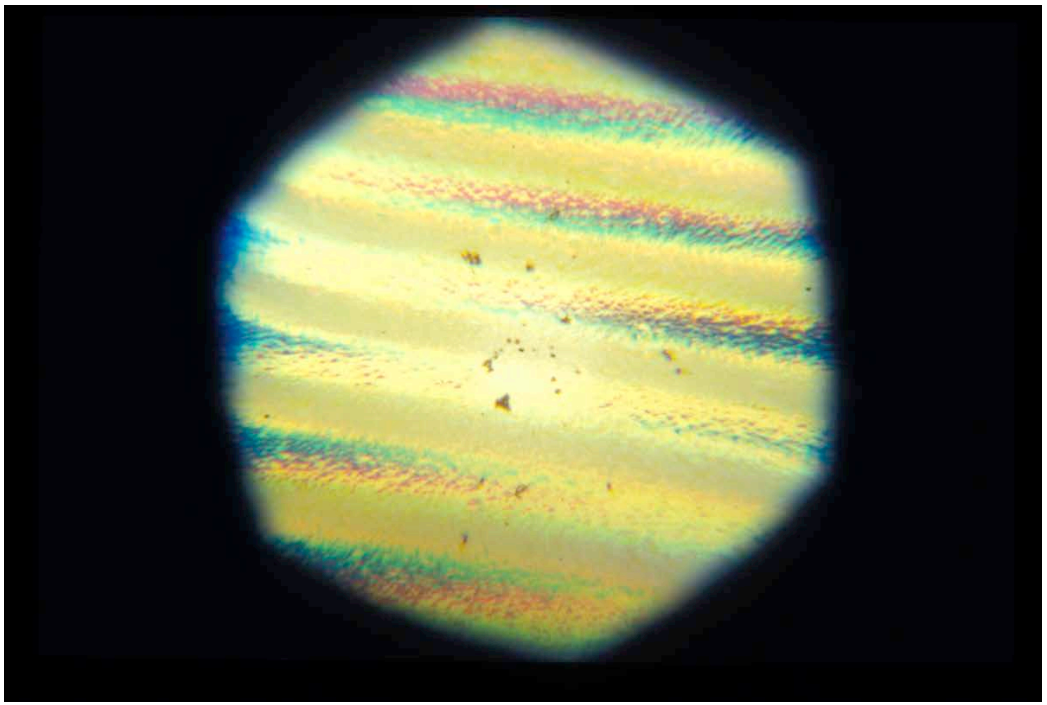
IMAGING pathway

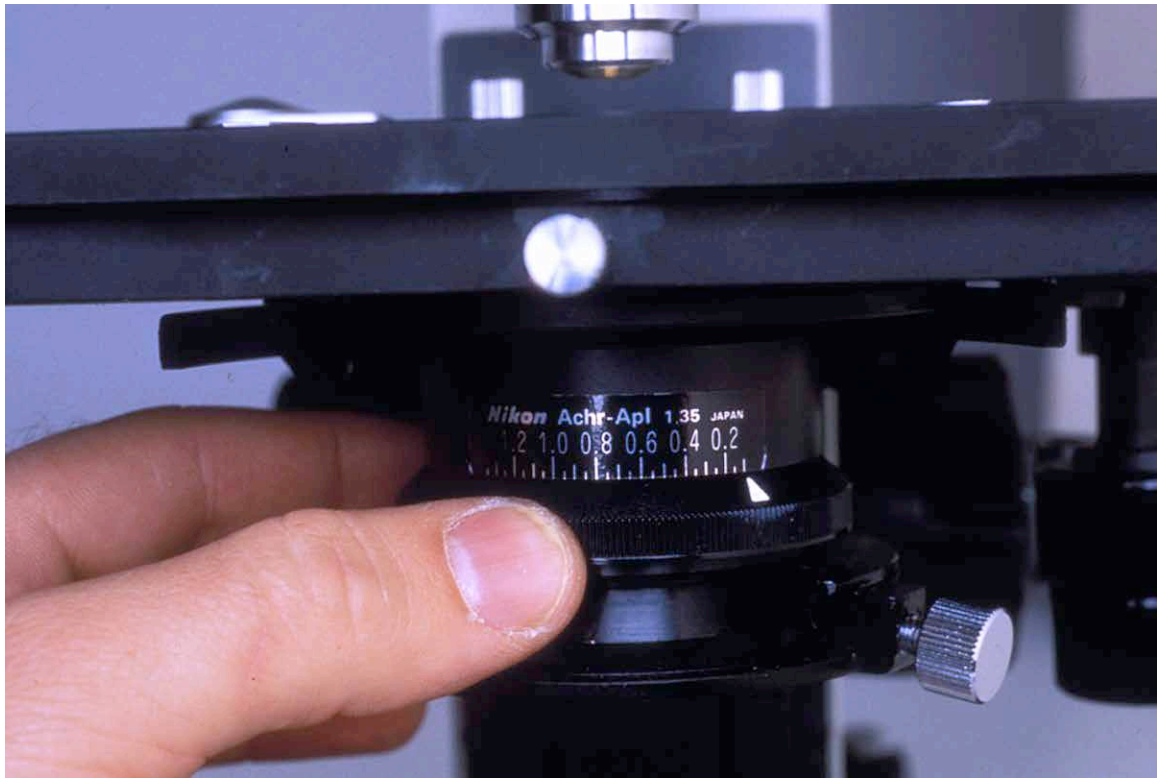
- Film plane
- Intermediate image plane
- Specimen
- Field diaphragm

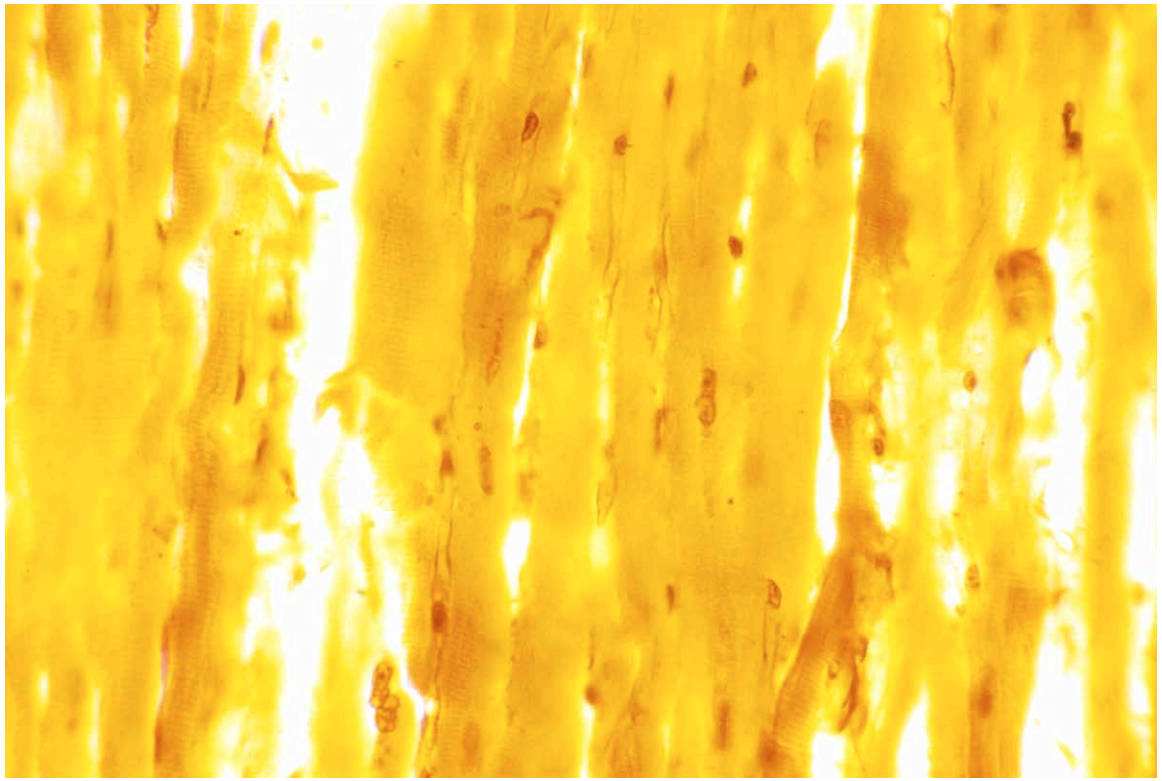
Illumination pathway

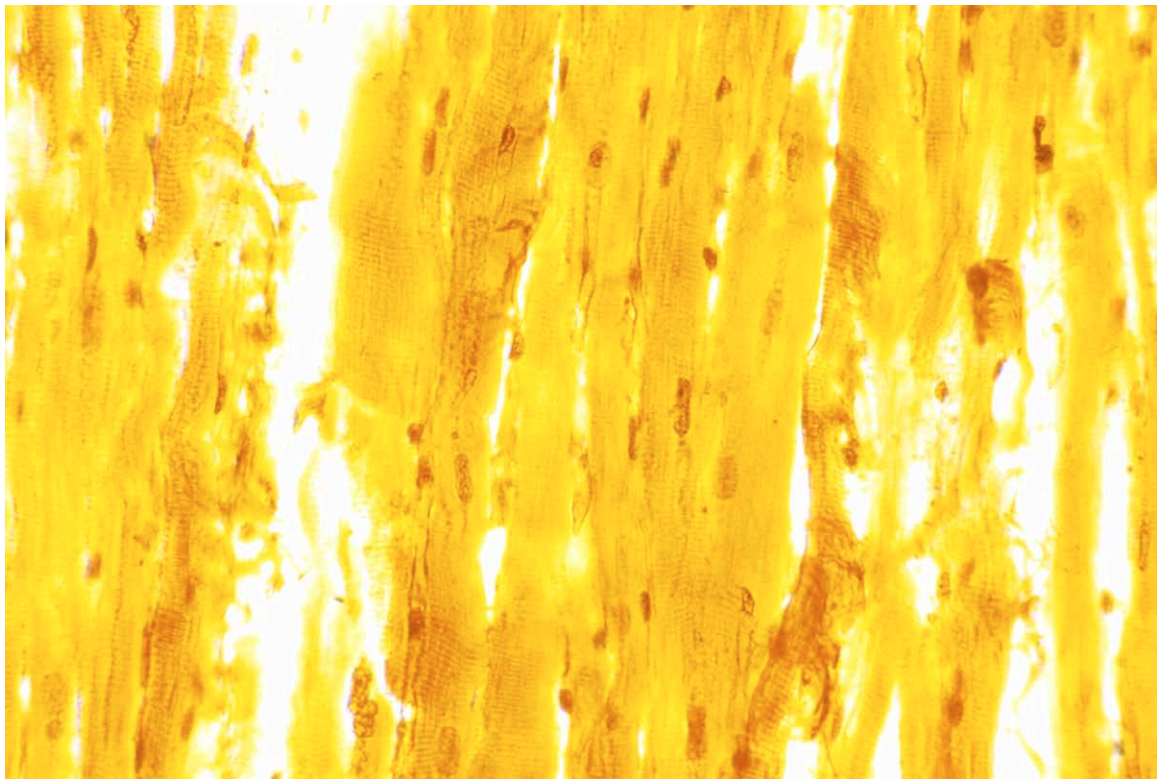
- Filament
- Aperture diaphragm
- Exit pupil of the objective
- Eye point

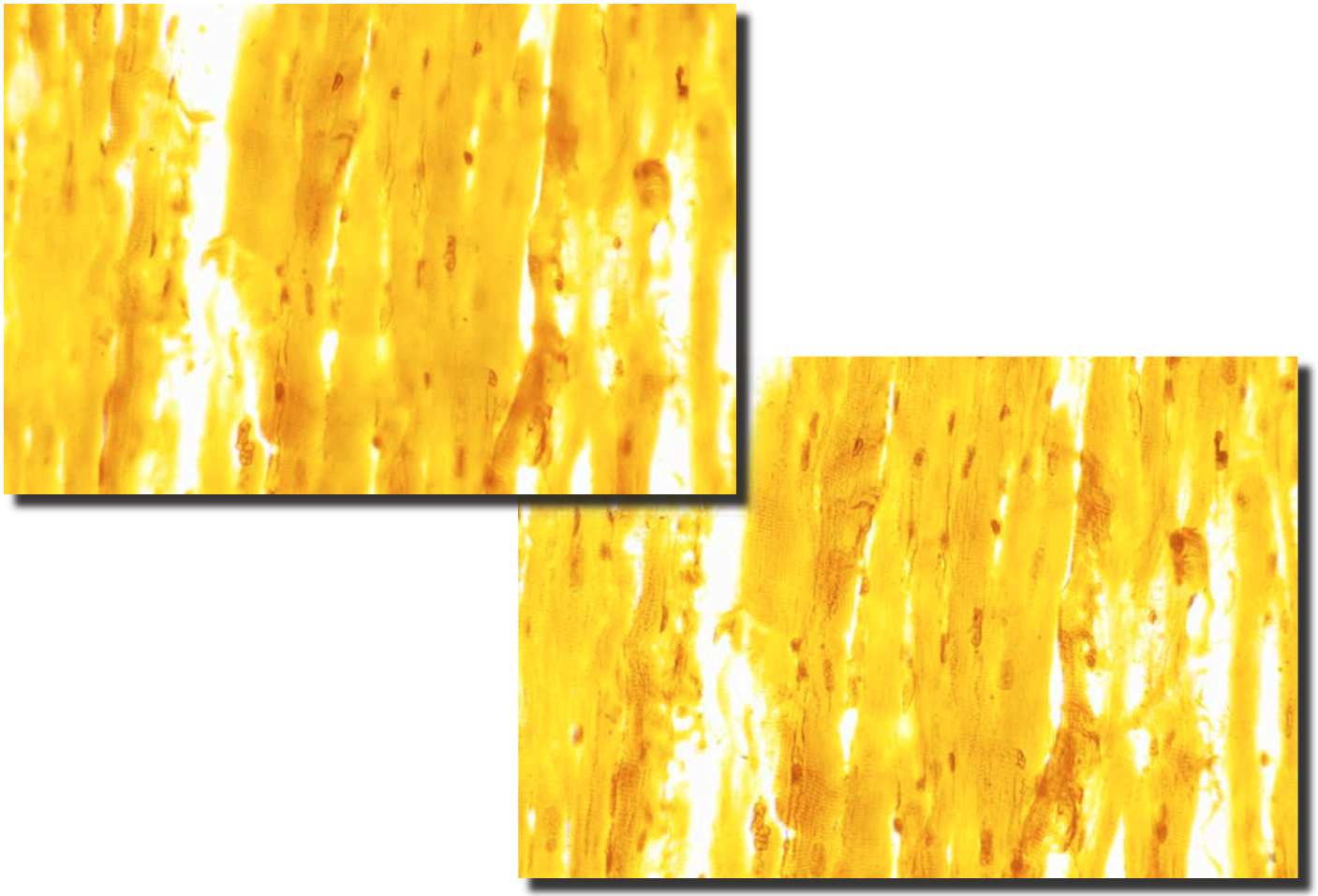
Aperture Diaphragm

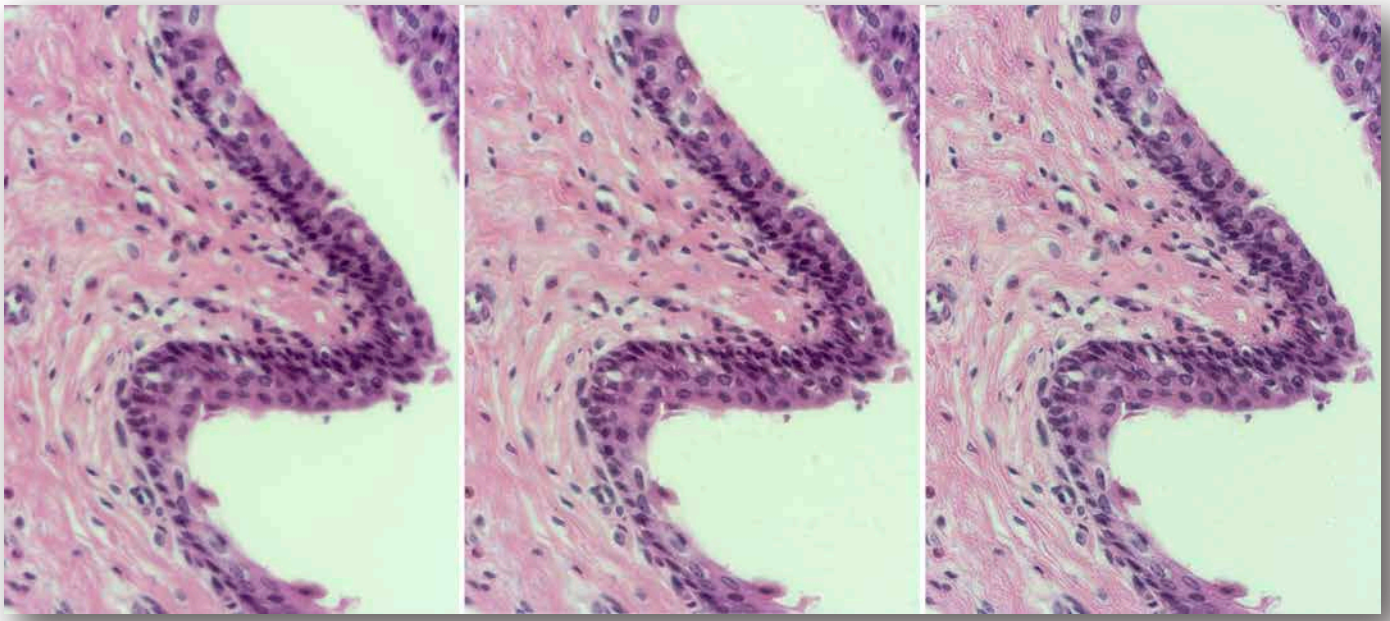



Nikon Achr-Apl 1.35 JAPAN
1.2 1.0 0.8 0.6 0.4 0.2

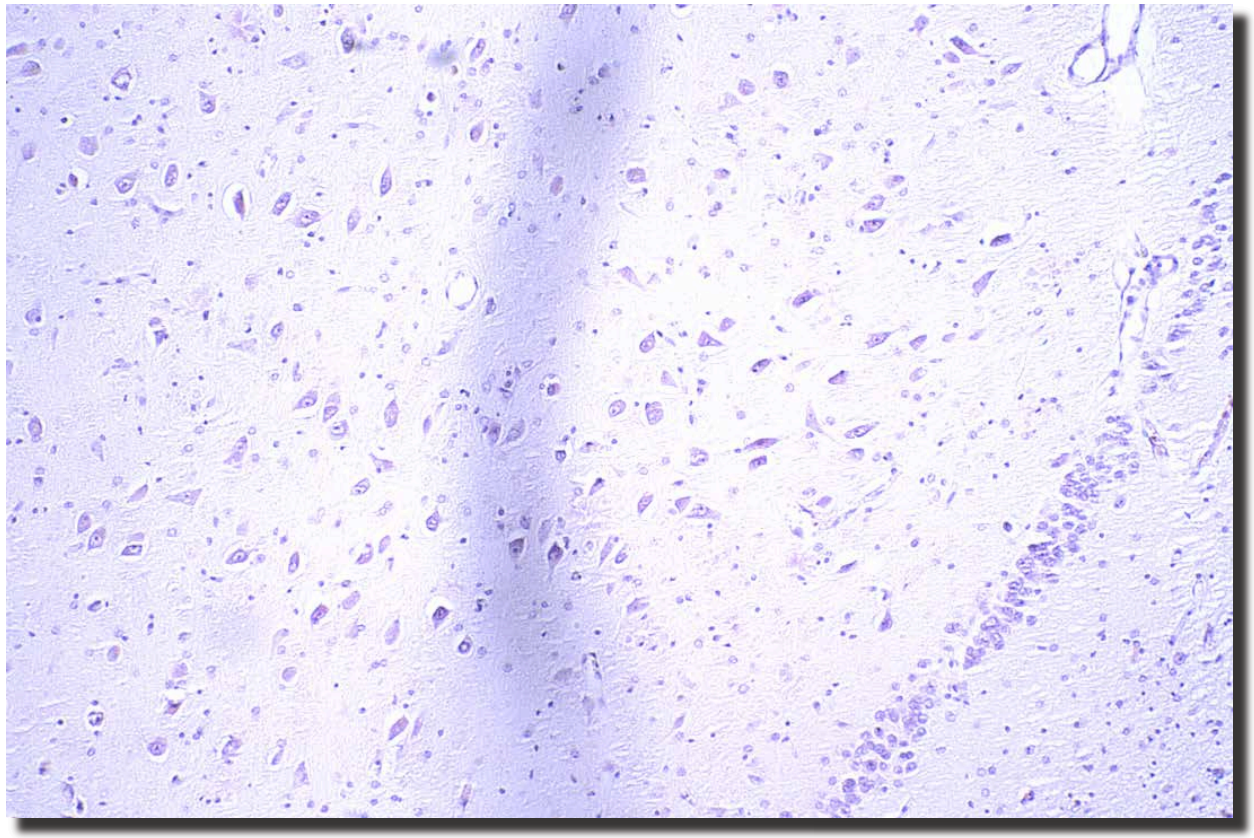


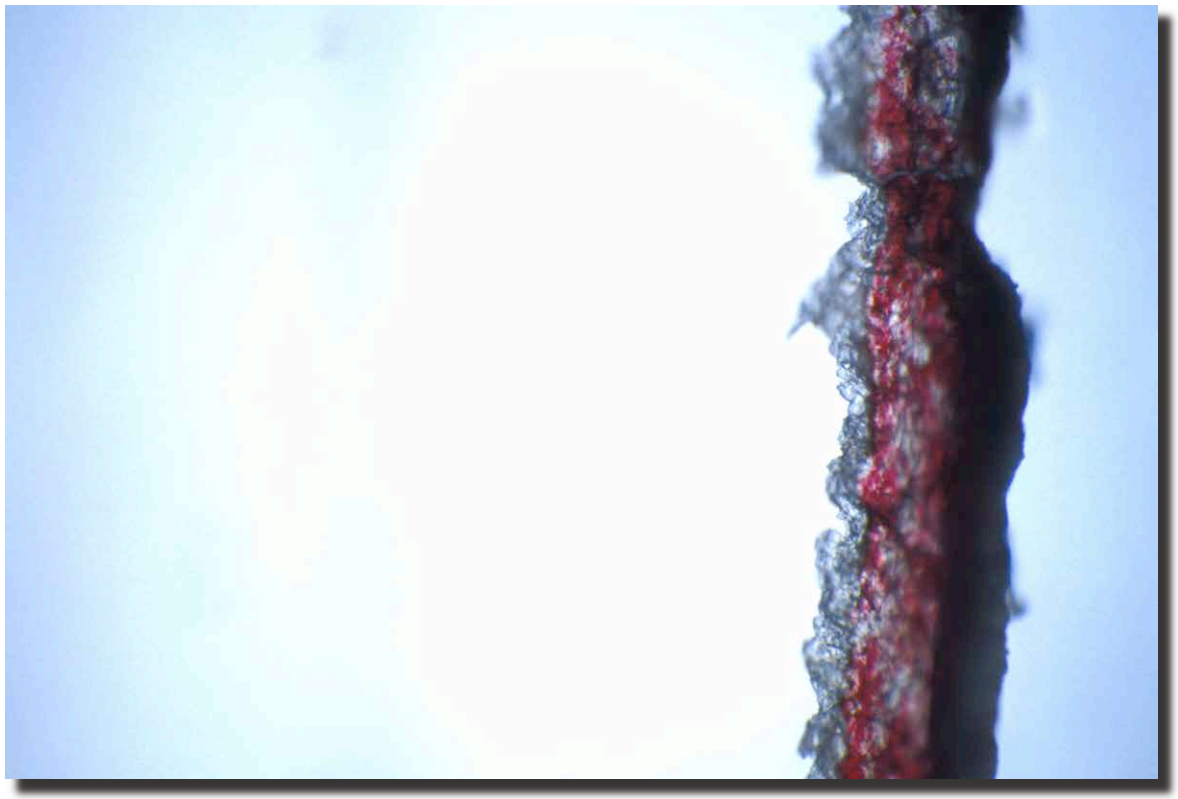







Nikon
WARD'S






WARD'S
Iso-Propyl Alcohol
Nikon
HM-S
Nikon
LENS
CLEANING
TISSUE
Kodak
Ektachrome
64T
GLASS SLIDES
HM-S