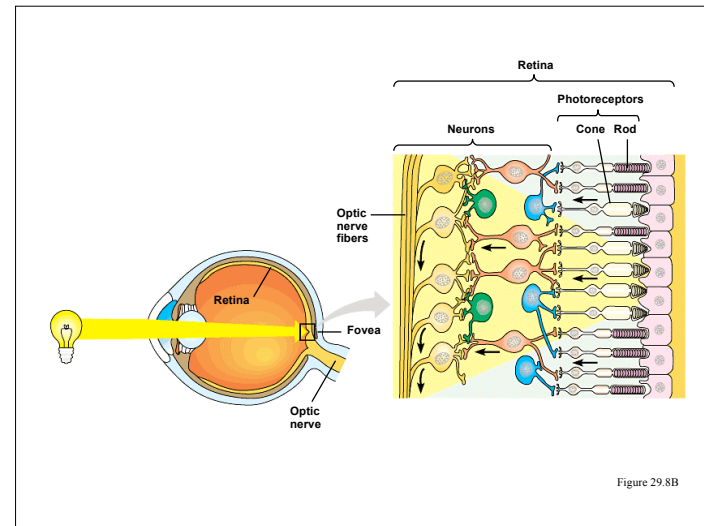
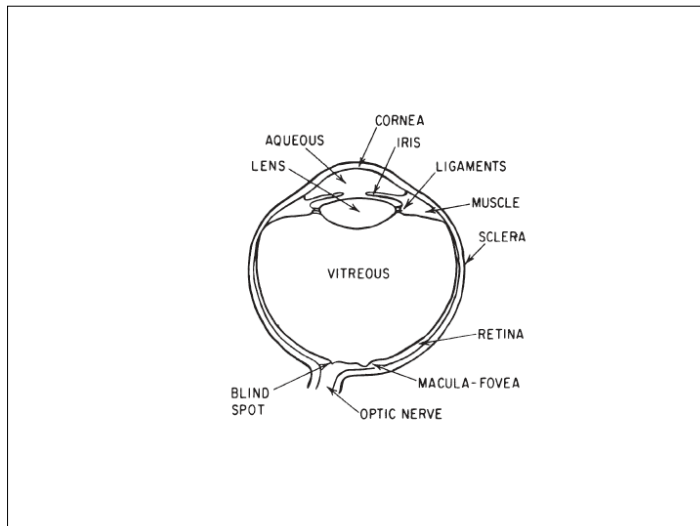
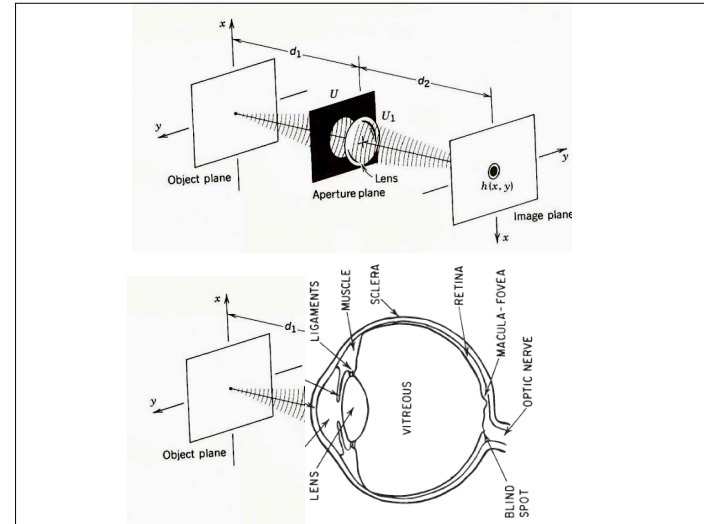
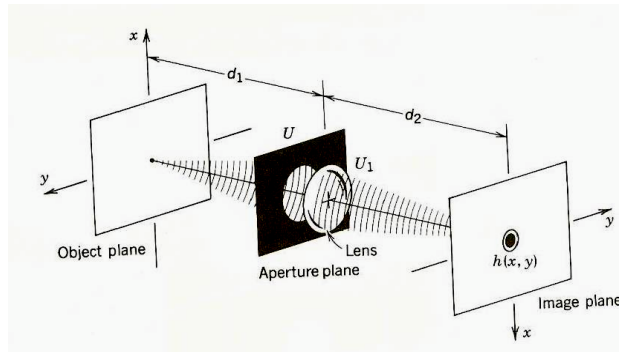
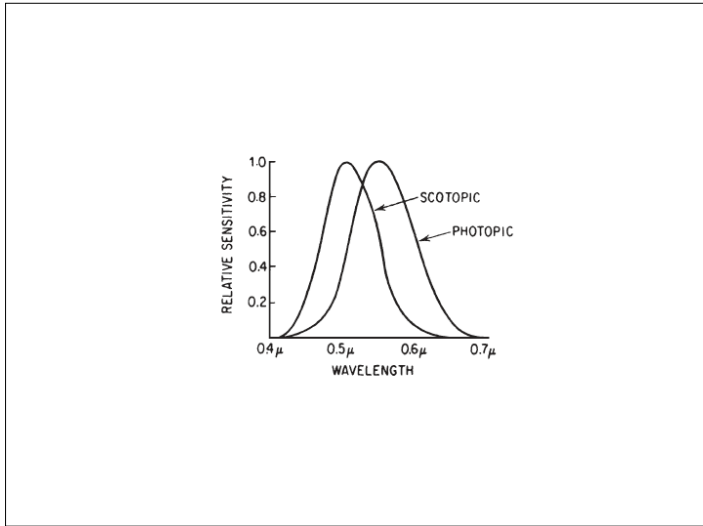


### Single Lens Imaging System

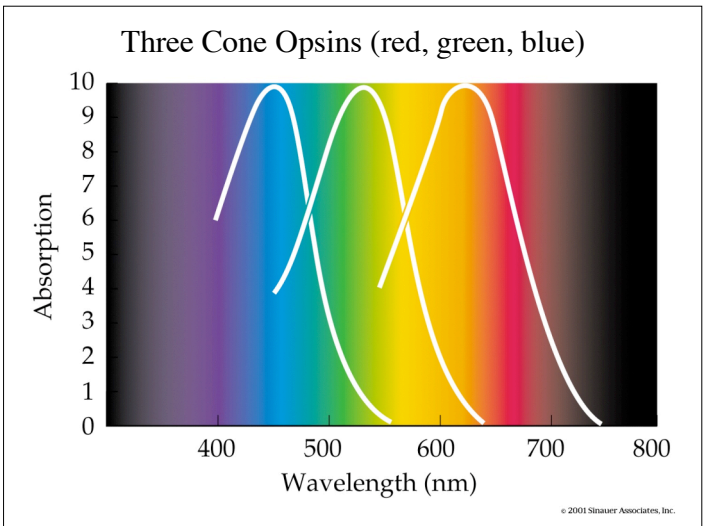
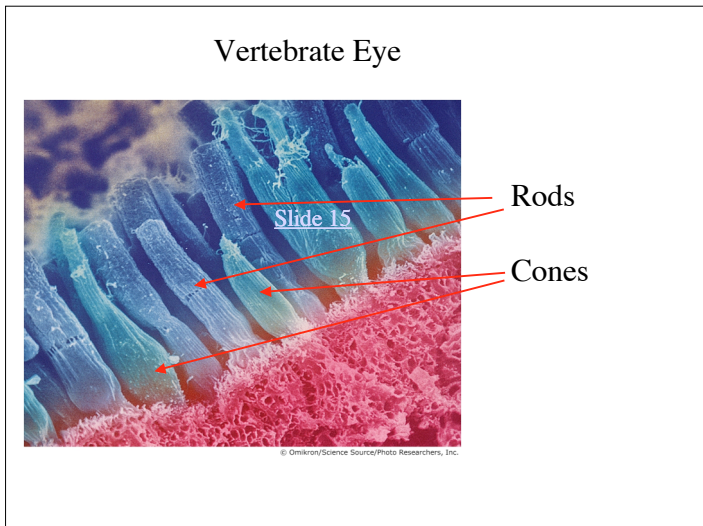




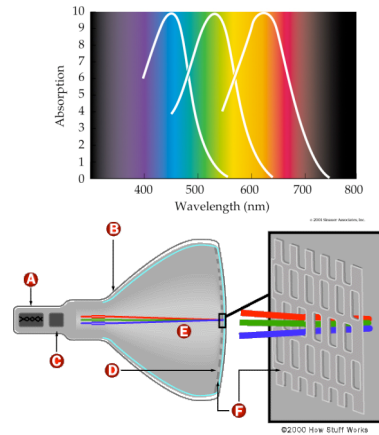
- Human photoreceptor cells are named for their shapes
  - Rods
  - Cones

The diagram shows two types of photoreceptor cells. The rod cell has a long, thin outer segment containing stacked membranous discs. The cone cell has a shorter, wider outer segment containing a single large disc. Both cells have a cell body with synaptic knobs and a base with synaptic knobs. Labels include 'Cell body', 'ROD', 'CONE', 'Synaptic knobs', and 'Membranous discs containing visual pigments'.

Figure 29.8A

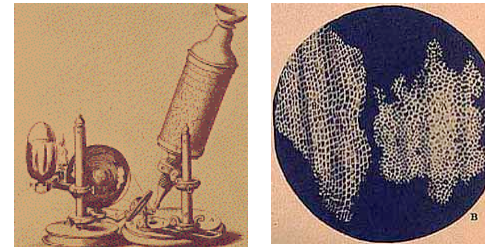


## R(ed), G(reen) B(lue) Monitors

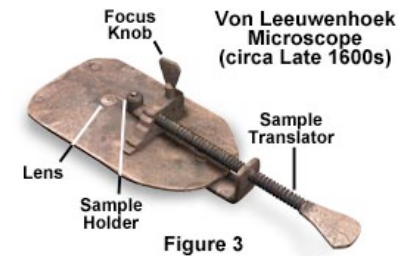


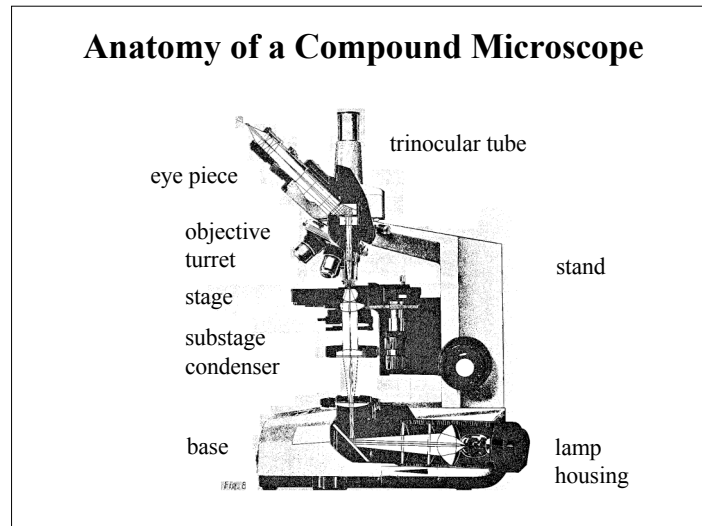
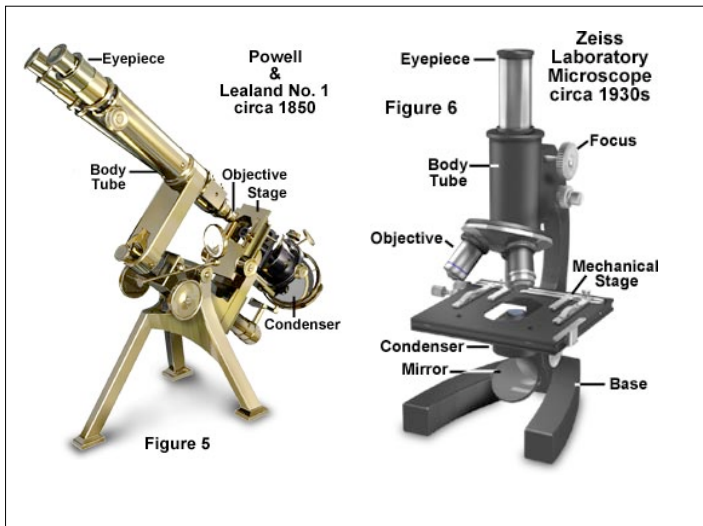
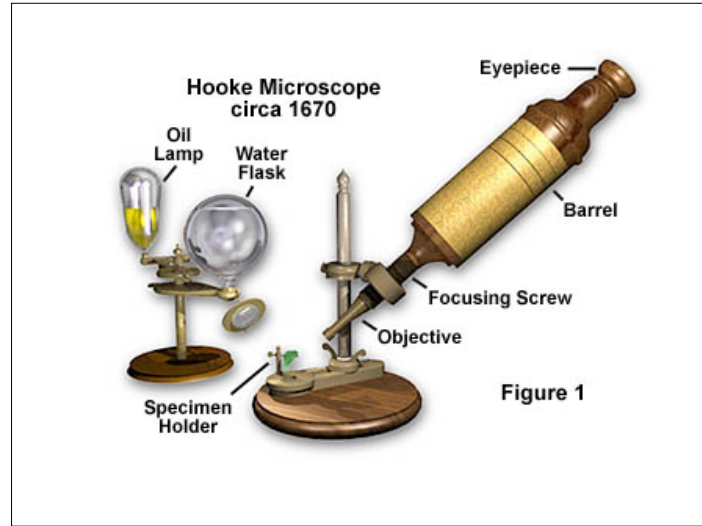
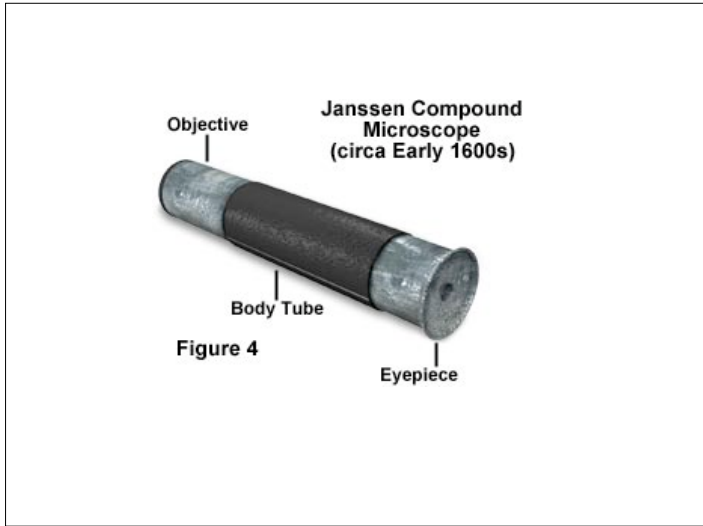
## Robert Hooke (1635 - 1703)

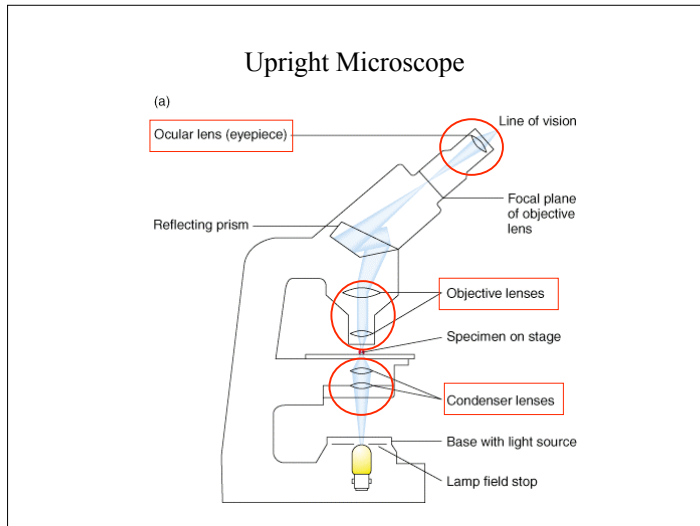
Built one of the first useful compound microscopes  
Observed structure of cork  
Coined the term "Cell".  
Published *Micrographia* (1665)



- 1665 Hooke publishes *Micrographia*
- 1678 van Leeuwenhoek observes protozoa ("little animals")
- 1838-9 Schleiden & Schwann proposed "Cell Theory"
- 1860 Pasteur confirms Cell Theory
- 1931 Ruska invents electron microscope
- 1932 Zerniki develops phase contrast microscopy
- 1955 Minsky invents the laser scanning microscope (LSM)
- 1989 Webb, Denk & Strickler invent multiphoton LSM







## Contrast Microscopy

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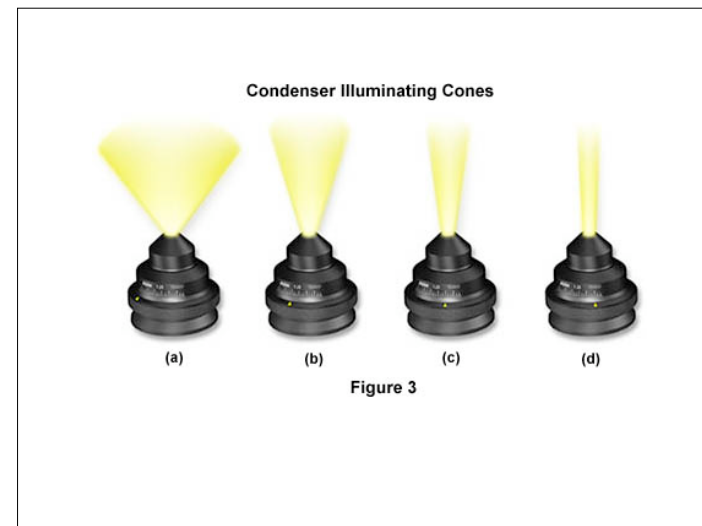
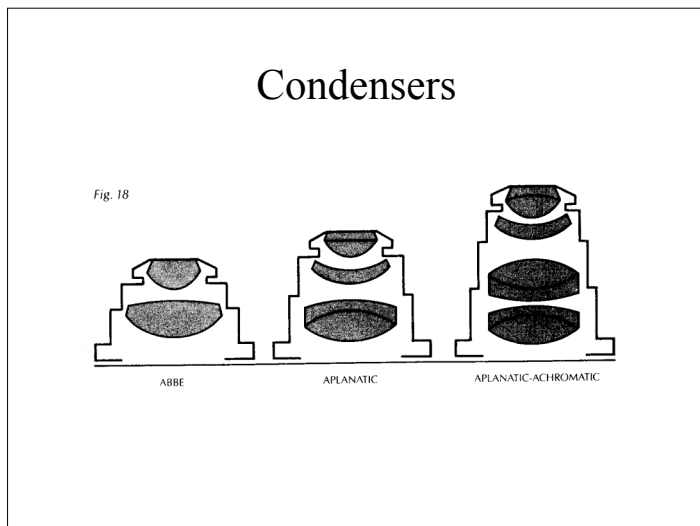
**Koehler Illumination**

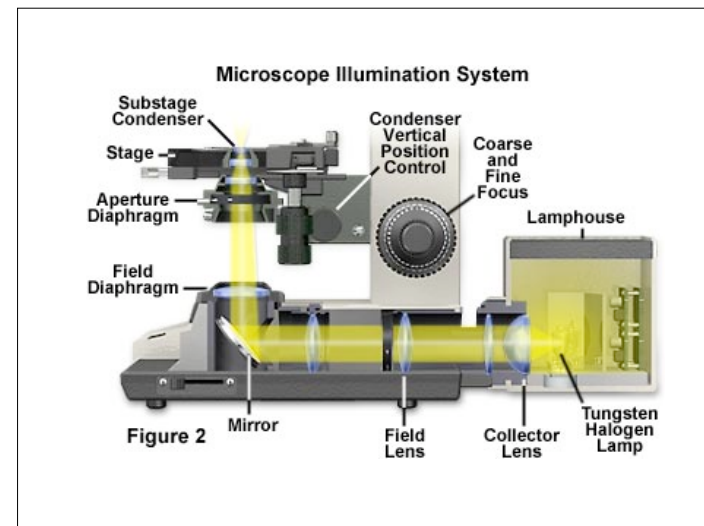
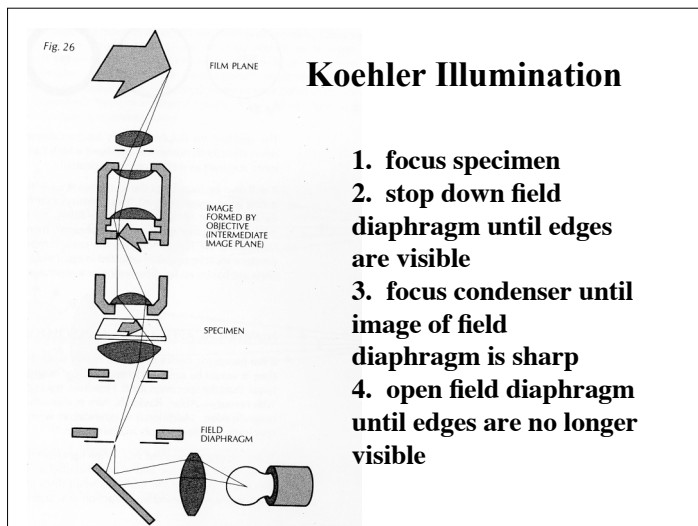
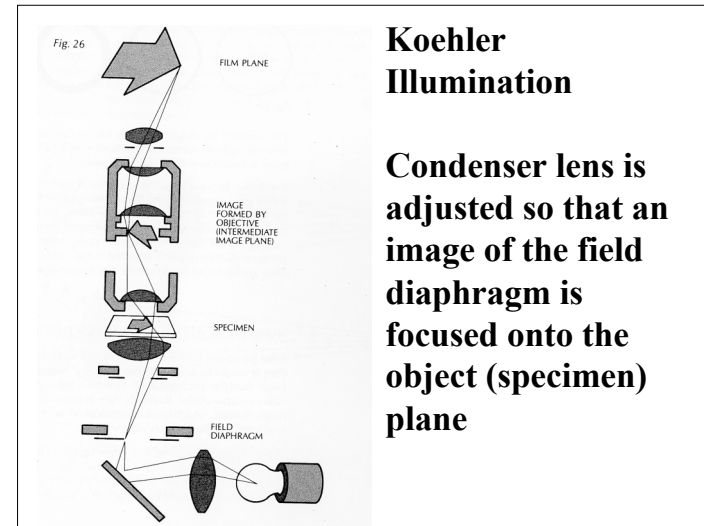
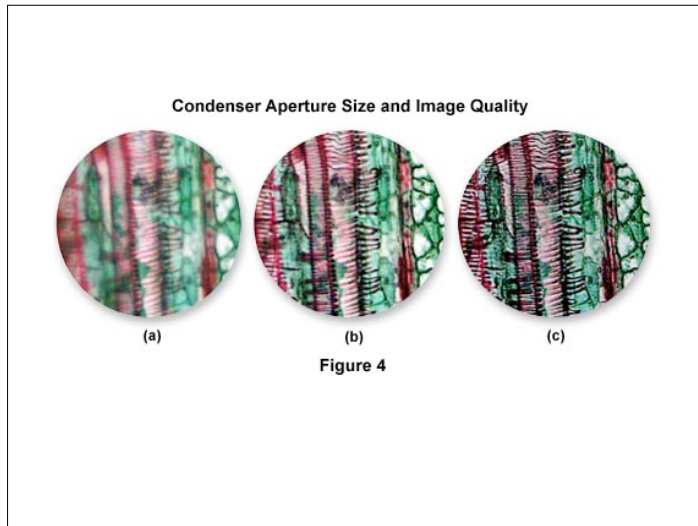
**Dark Field**

**Phase Contrast**

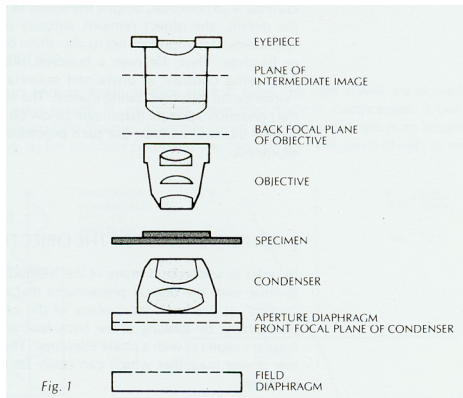
**Differential Interference Contrast**

**Hoffman Modulation**

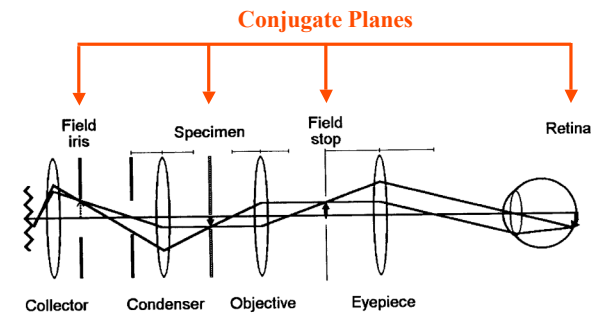




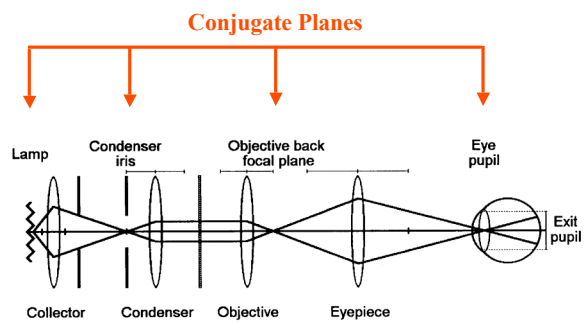
## Conjugate Planes of Focus



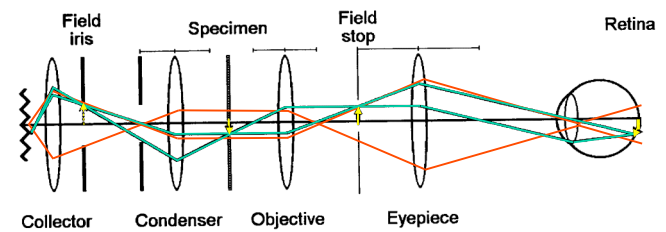
## Path of "Imaging Rays"



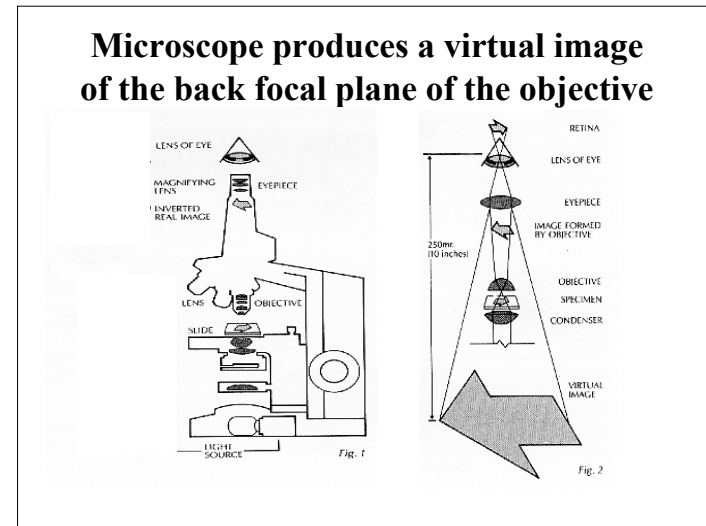
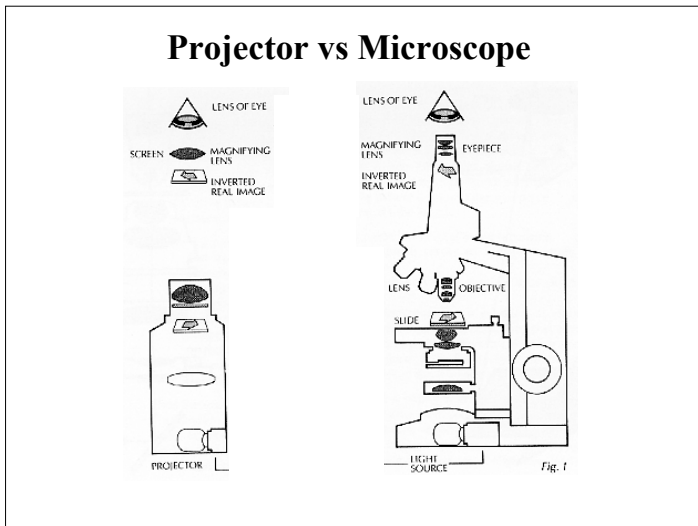
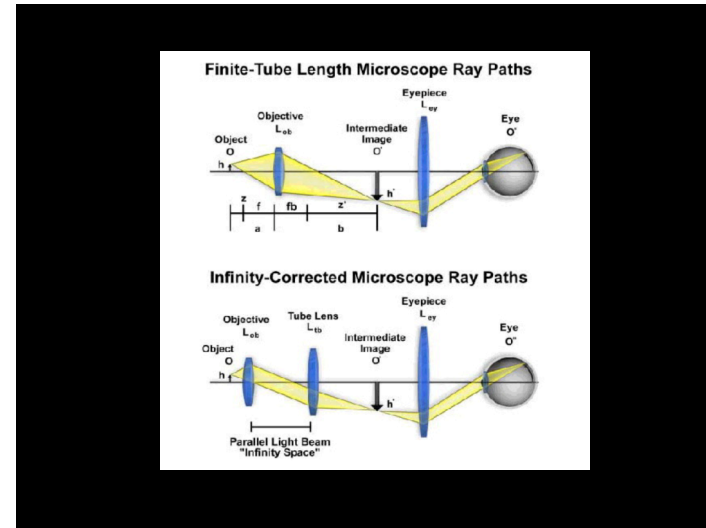
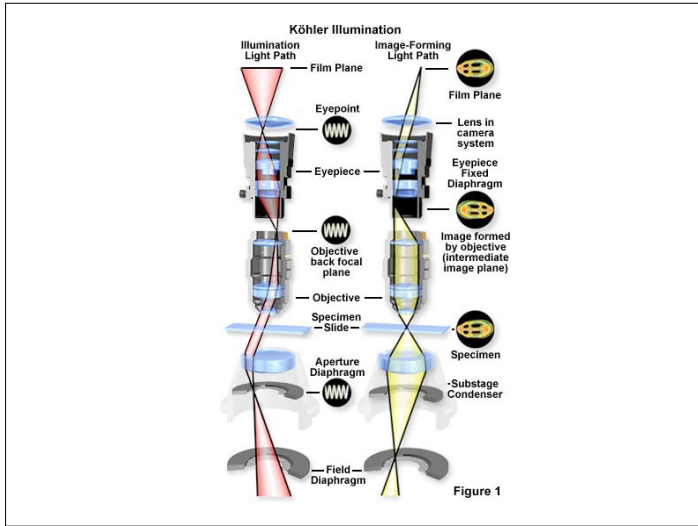
## Path of "Illuminating Rays"



## Light Paths

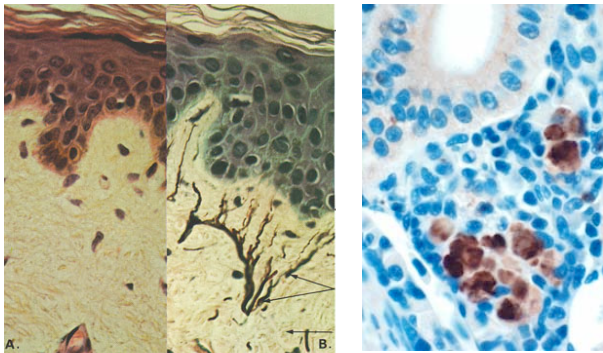


**Illuminating** and **imaging** rays do not share conjugate planes





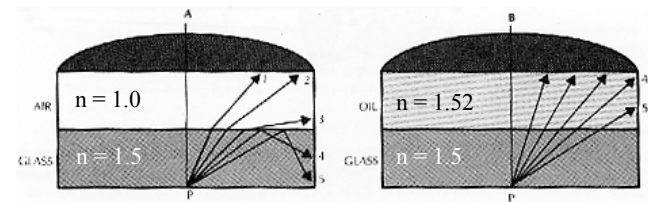
## Histochemistry



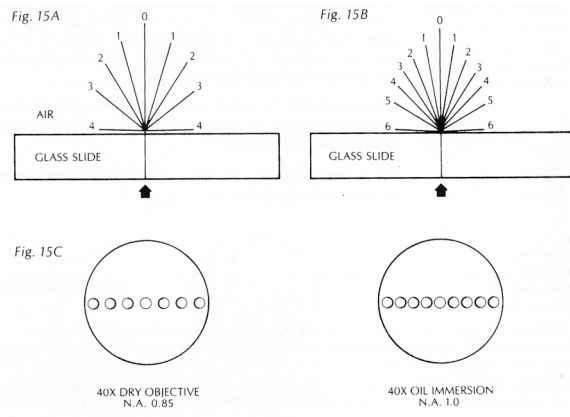
Hematoxylin & Eosin  
(H & E stain)

Immunohistochemistry

## Oil immersion



## Effect of Oil



## Contrast Microscopy

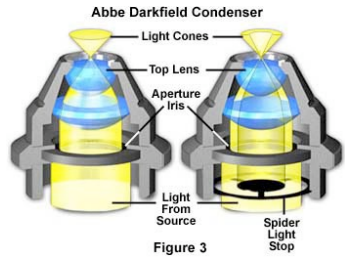
Koehler Illumination

Dark Field

Phase Contrast

Differential Interference Contrast

Hoffman Modulation

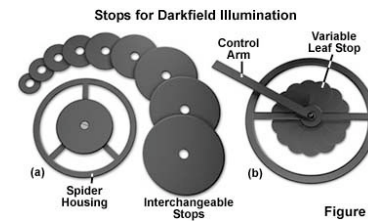
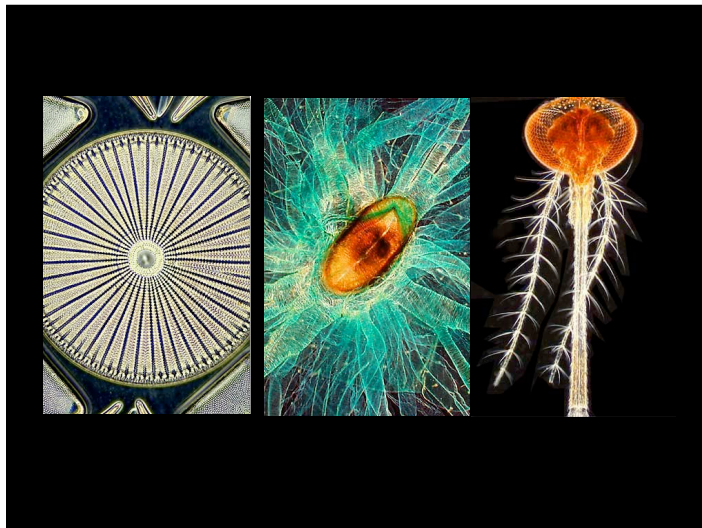


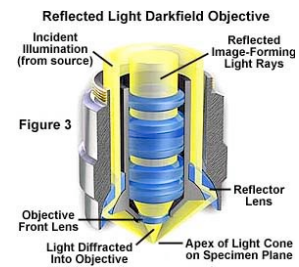
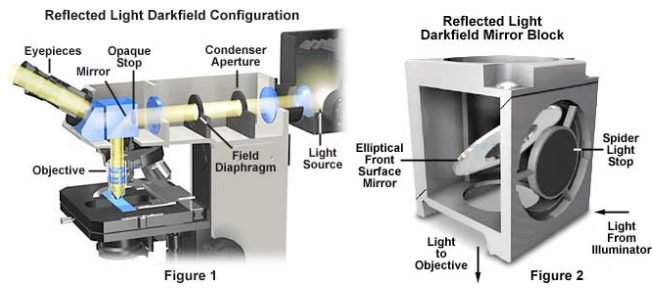
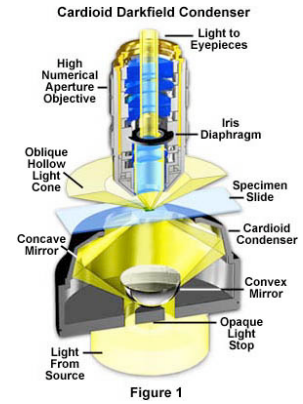
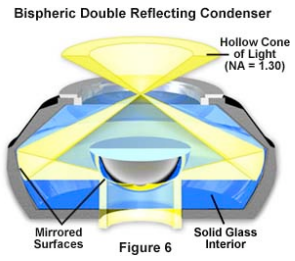
## Darkfield Images

Brightfield



Darkfield





Brightfield and Darkfield Reflected Light Microscopy

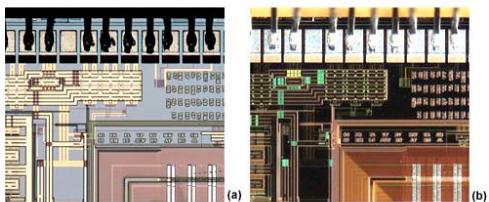


Figure 4