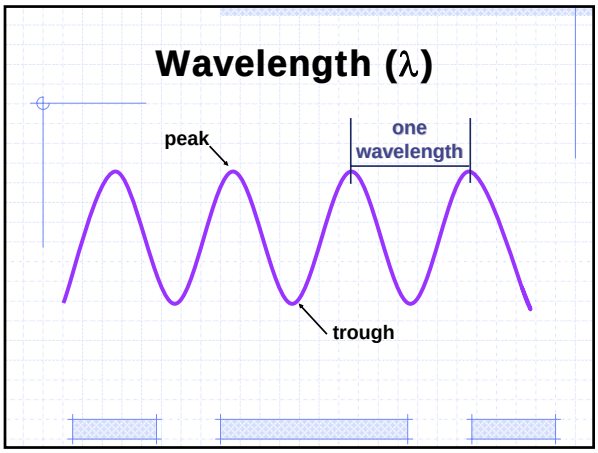
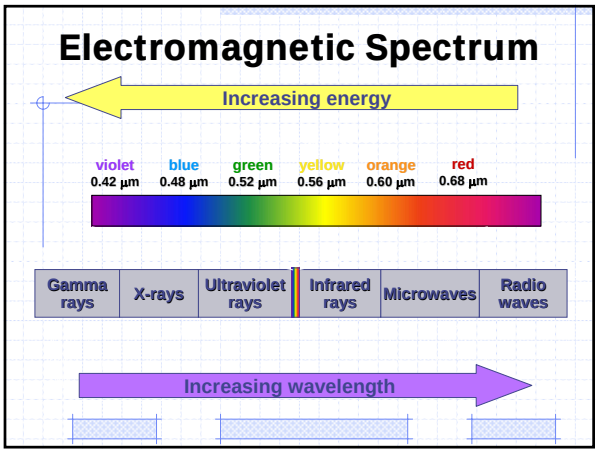
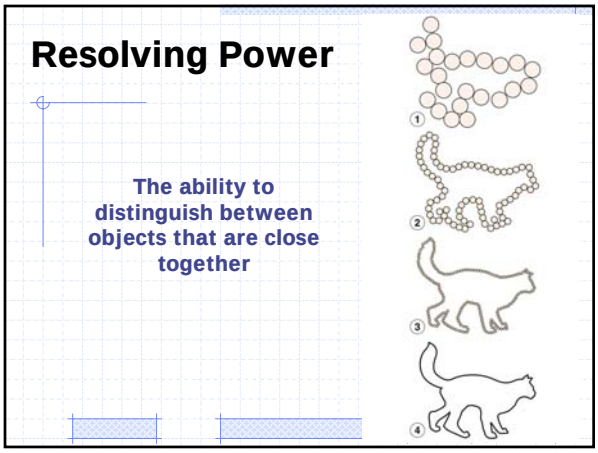
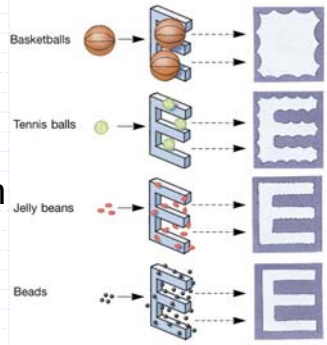

Wavelength (λ)
peak
one wavelength
trough


Electromagnetic Spectrum
Increasing energy
violet 0.42 µm
blue 0.48 µm
green 0.52 µm
yellow 0.56 µm
orange 0.60 µm
red 0.68 µm
Gamma rays
X-rays
Ultraviolet rays
Infrared rays
Microwaves
Radio waves
Increasing wavelength

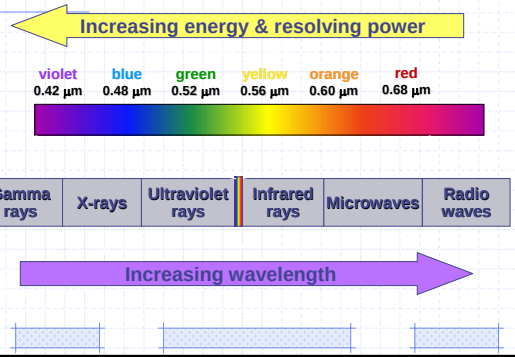

Resolving Power
The ability to distinguish between objects that are close together
1
2
3
4

An analogy for the effect of wavelength on resolution

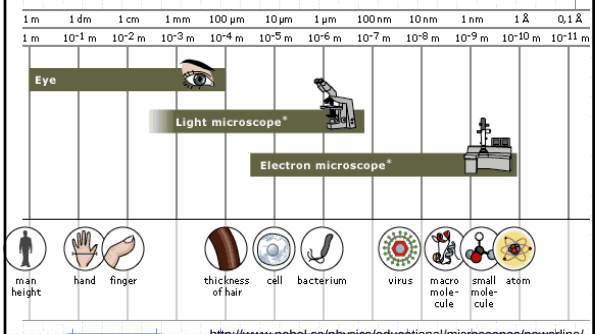


Black, J. (2002) *Microbiology: Principles & Explorations*, 5th Ed. Fig.3.6

Electromagnetic Spectrum

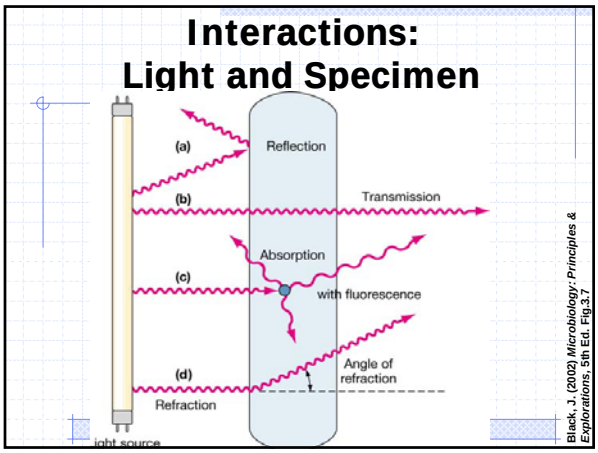


Relative Resolving Powers

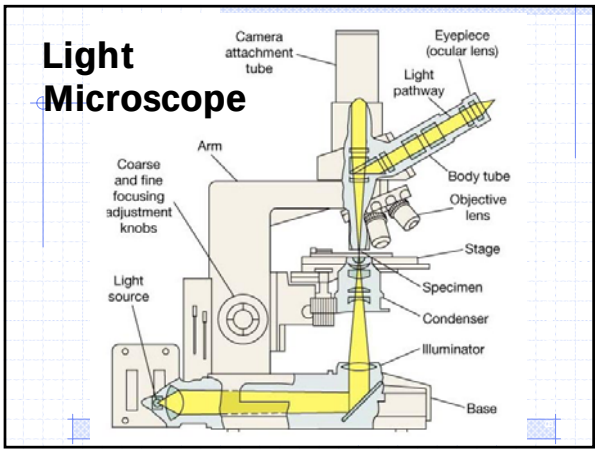


http://www.nobel.se/physics/educational/microscopes/powerline/

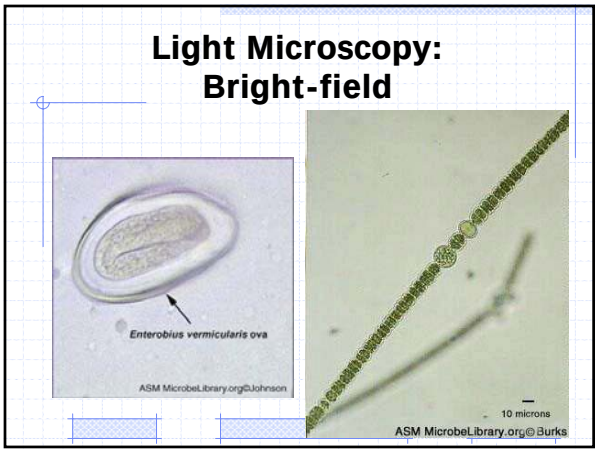
Interactions: Light and Specimen



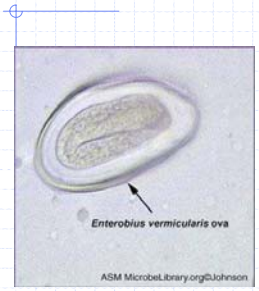
Light Microscope

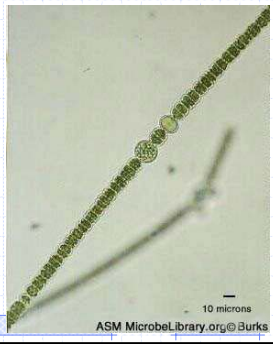


Light Microscopy: Bright-field

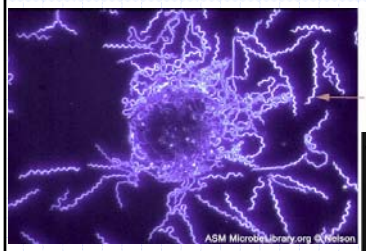


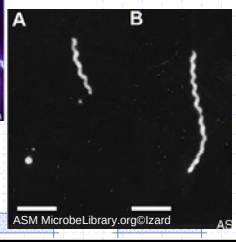
Light Microscopy: Bright-field



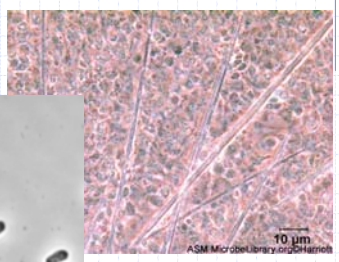


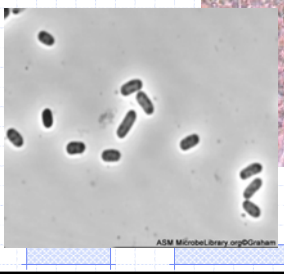
Light Microscopy: Dark-field





Light Microscopy: Phase-contrast



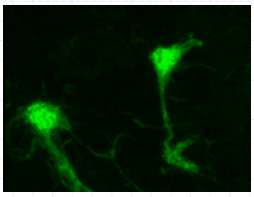


Light Microscopy: Fluorescence

E. Coli MM294 cells (1000x) transformed with plasmid containing jellyfish gene for GFP. Viewed under UV light.

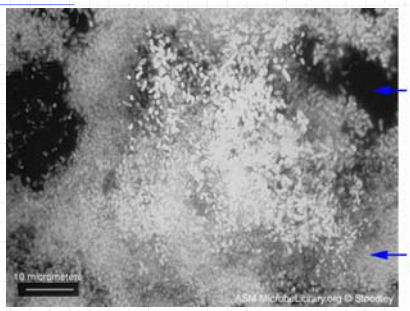
Photo by Catherine Pongratz

Confocal Microscopy



MEF cells with *Borrelia burgdorferi* spirochetes attached

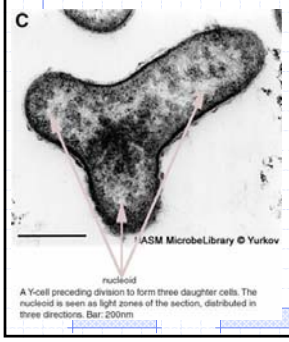
Confocal Microscopy

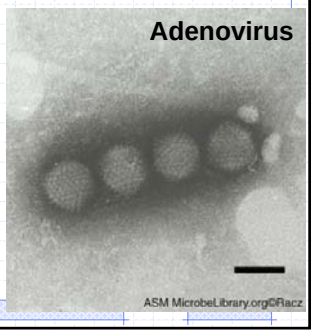


Electron Microscopy

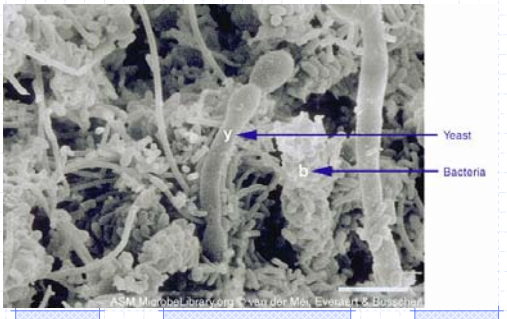
- electrons travel in waves!
- must add heavy atoms
- must use vacuum

Electron Microscopy: Transmission (TEM)





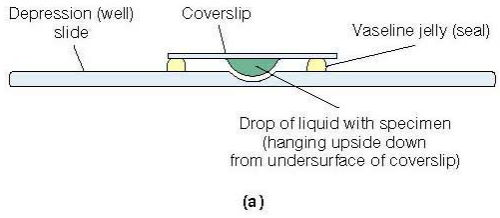
Electron Microscopy: Scanning (SEM)



Guesstimating Sizes

TOTAL Magnification	Field of View (Diameter)
40x	4500 μm
100x	1800 μm
400x	450 μm
450x	400 μm
1000x	180 μm

Specimen Preparation: Hanging Drop



Black, J. (2002) *Microbiology: Principles & Explorations*, 5th Ed. Fig.3.27