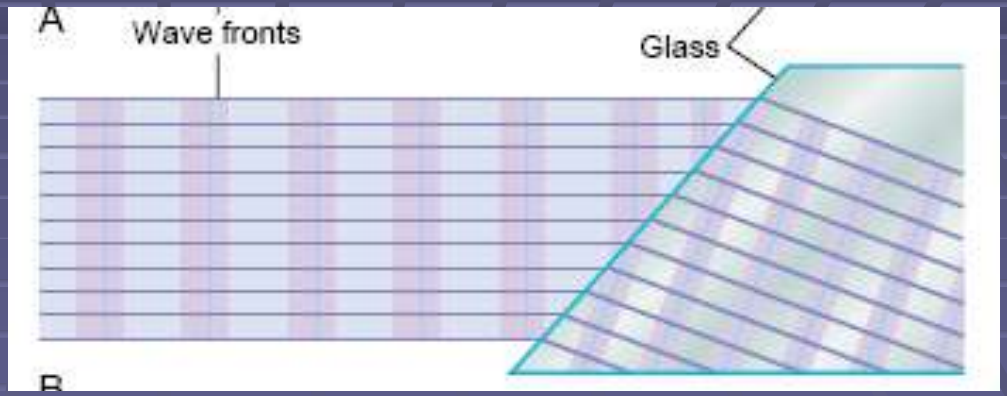
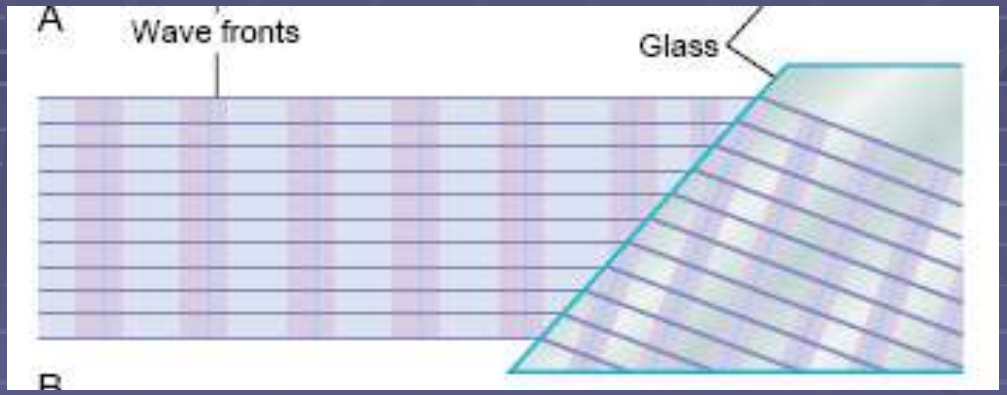
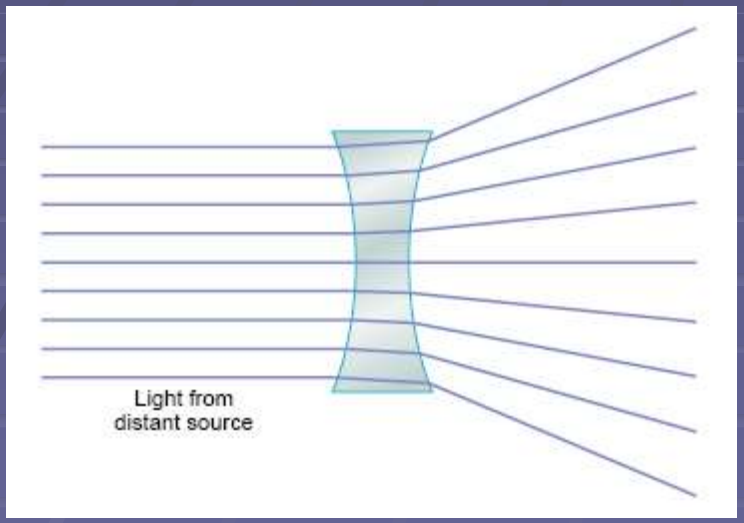
Optics of Vision

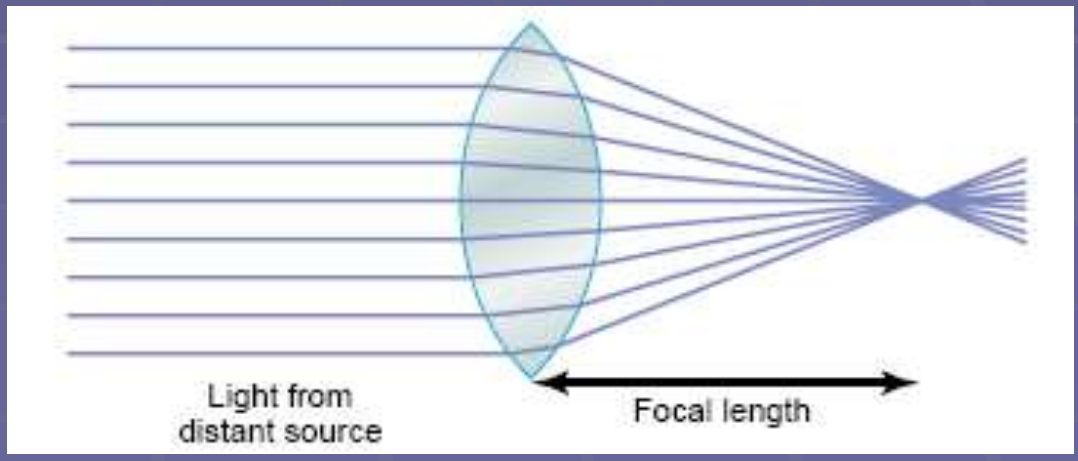
Light refraction



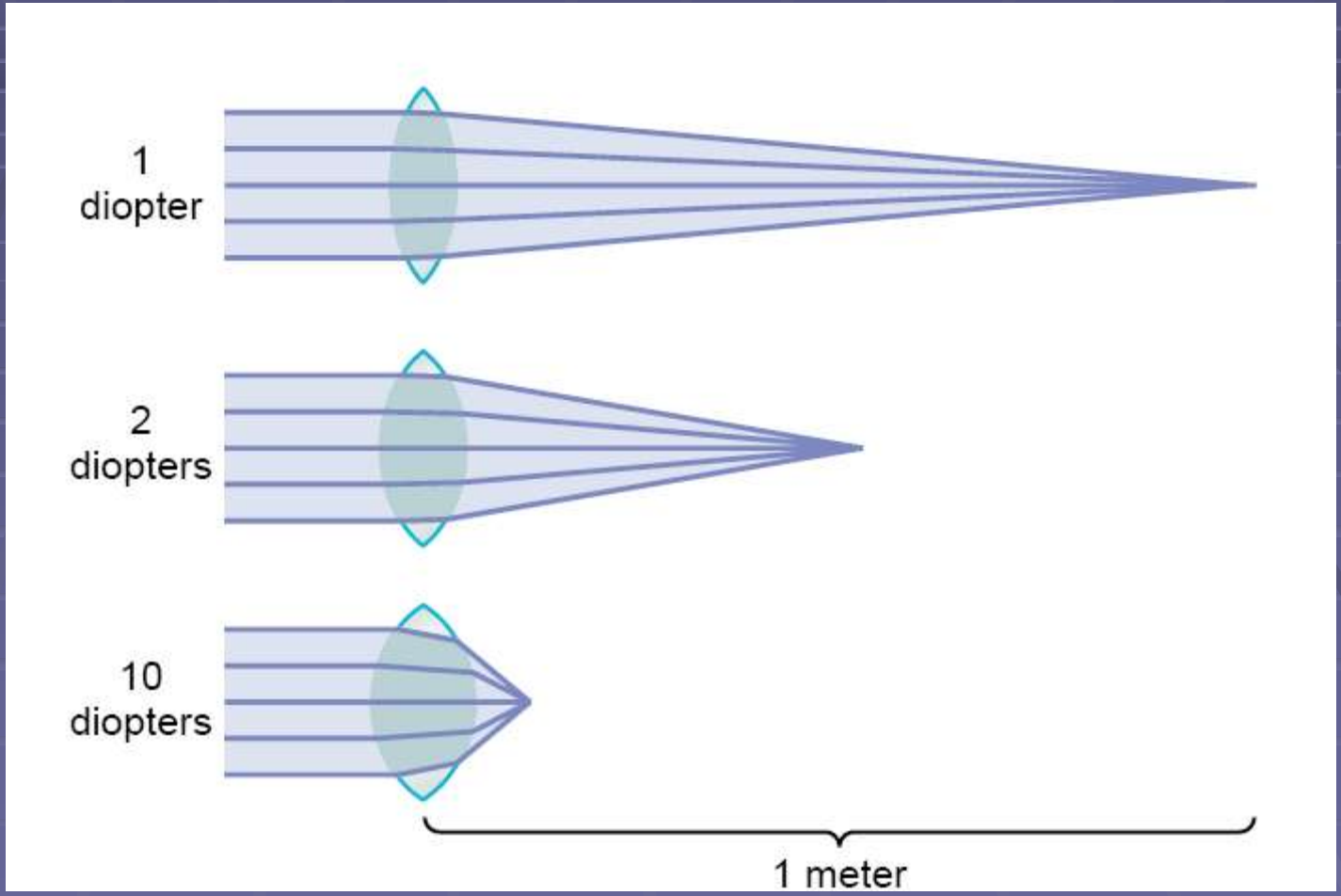
Optics of Vision





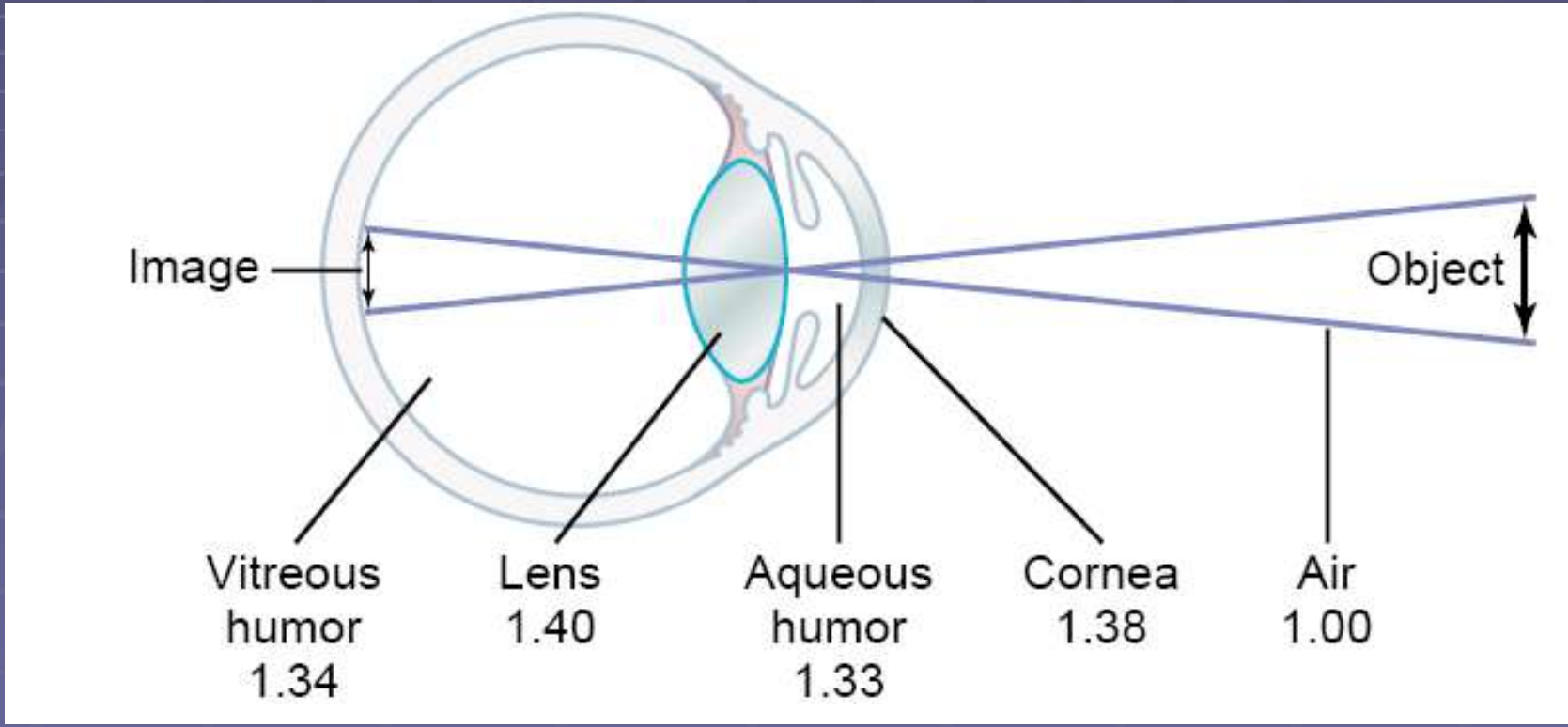


Optics of Vision

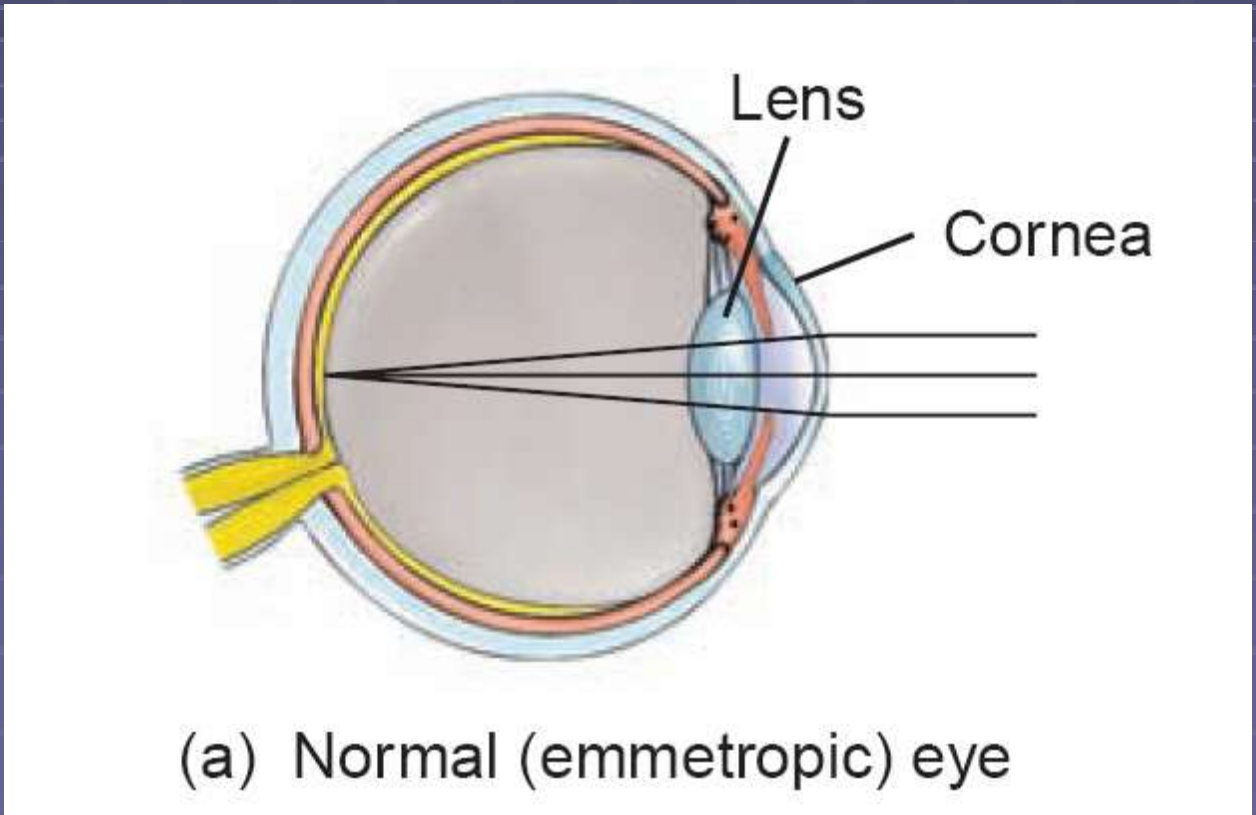


Refraction power a lens “Diopter” = 1 m / focal length

Optics of Vision

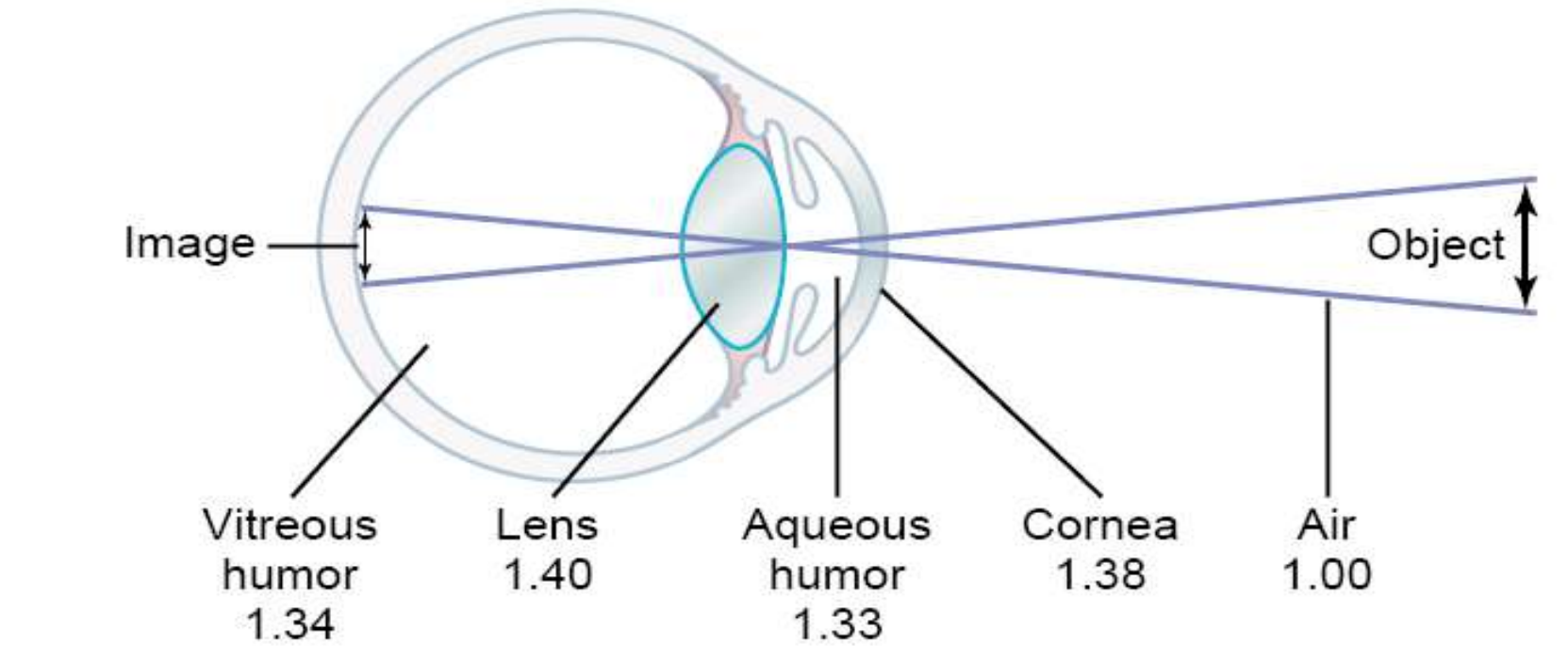


Optics of Vision



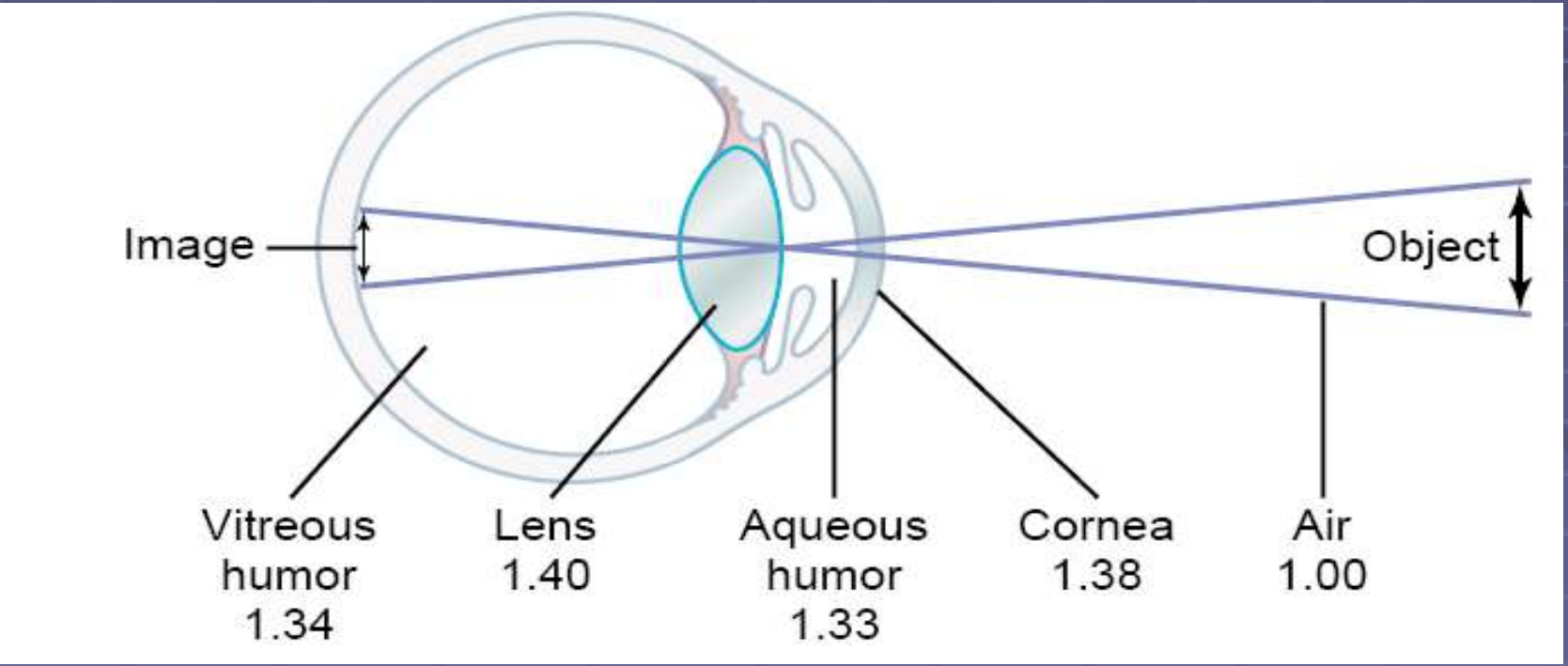
(a) Normal (emmetropic) eye

Picture Formation



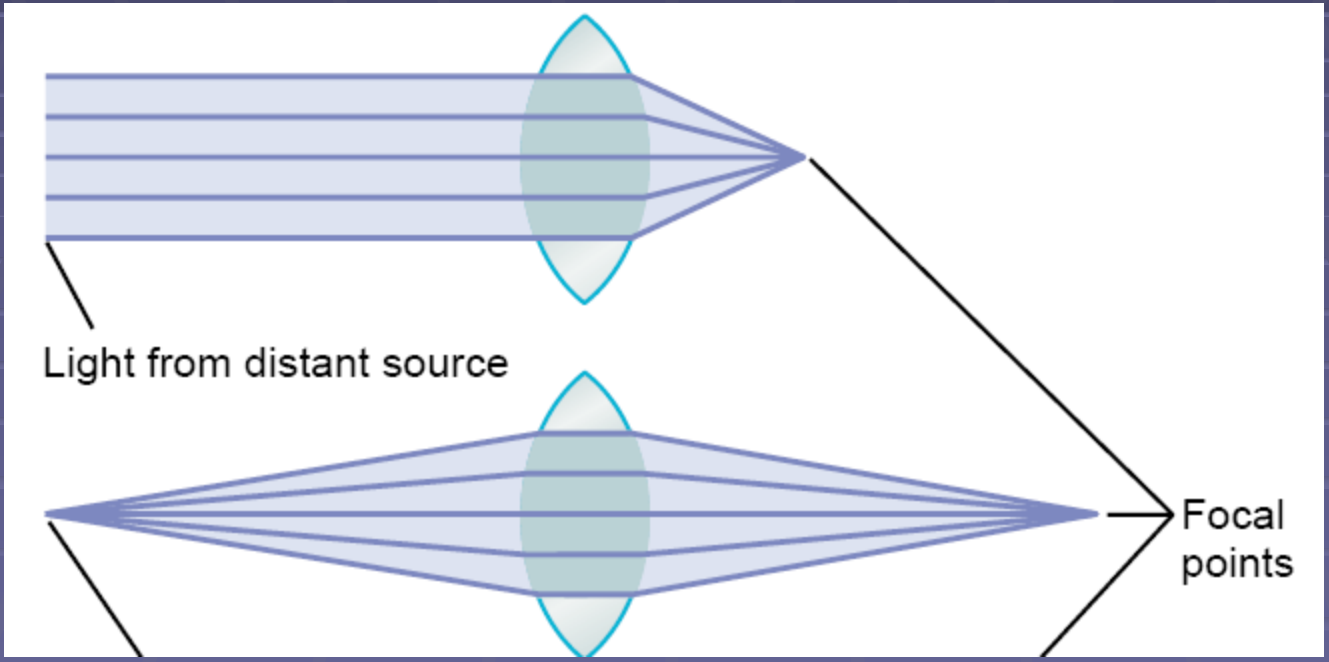
cataracts (opacities in the lens)

Picture Formation

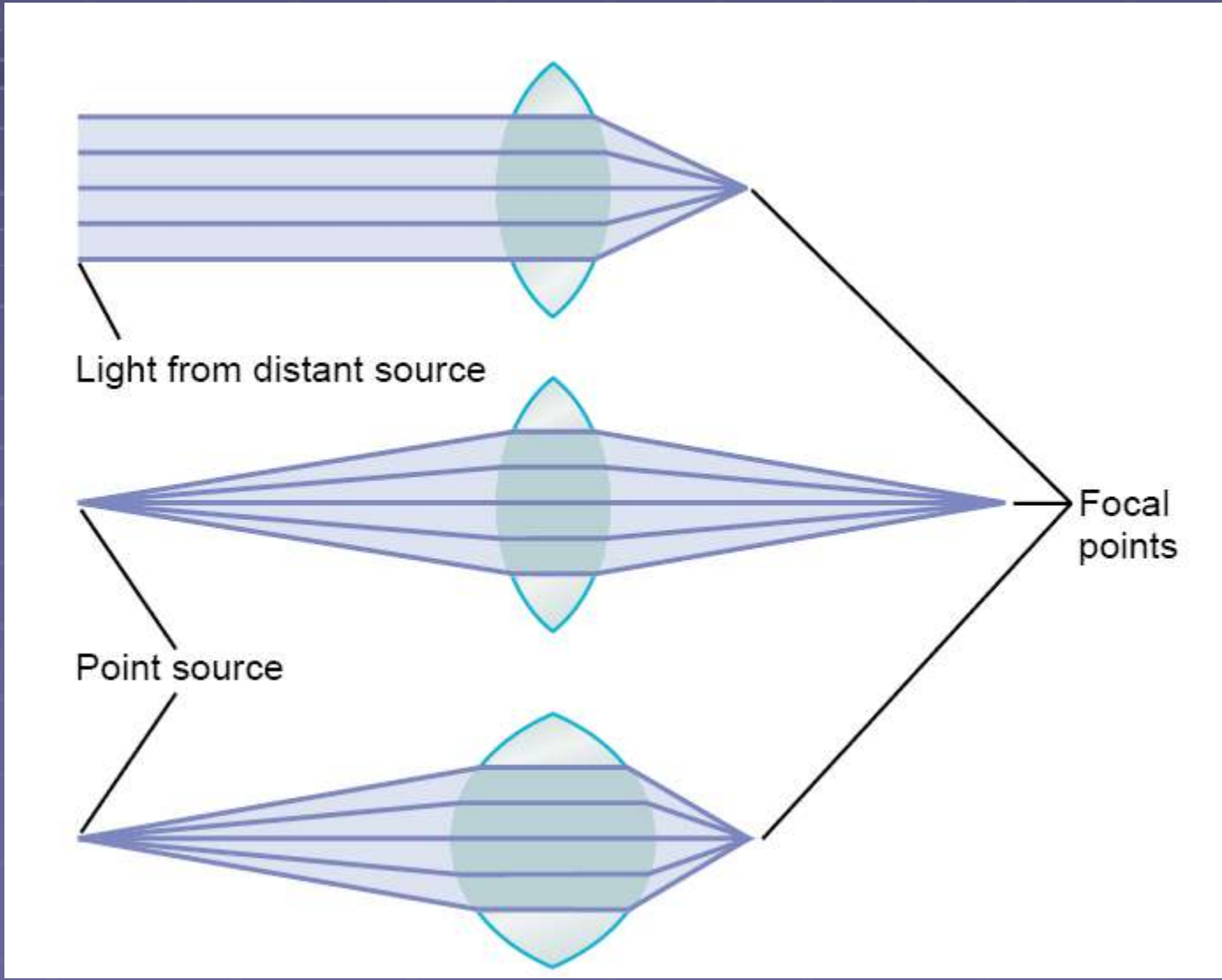


- Lens accommodation
- Pupil adjustment
- Fusion of the two eyes

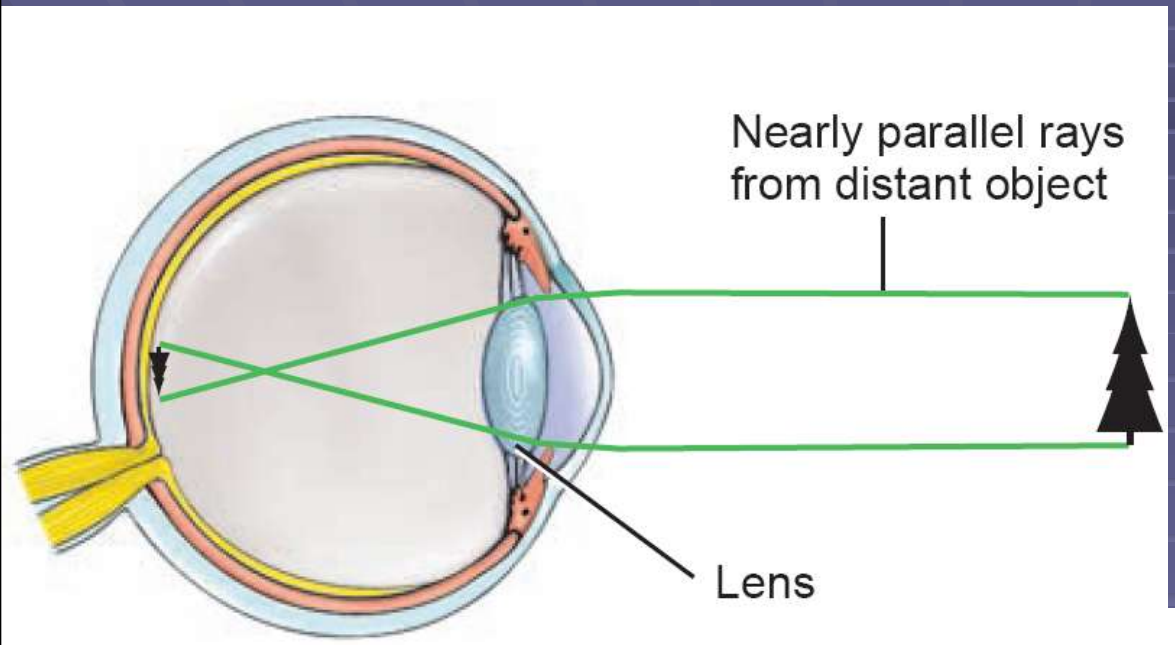
Optics of Vision

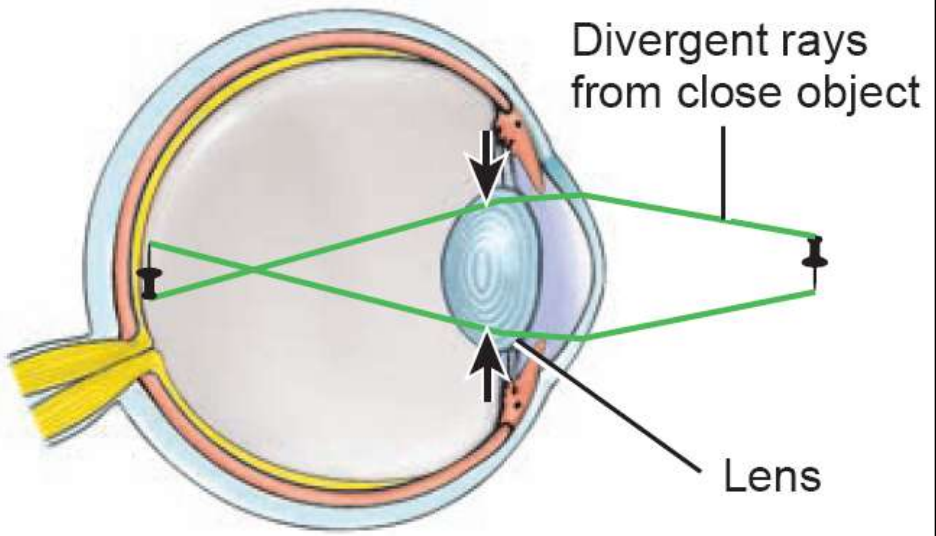


Optics of Vision

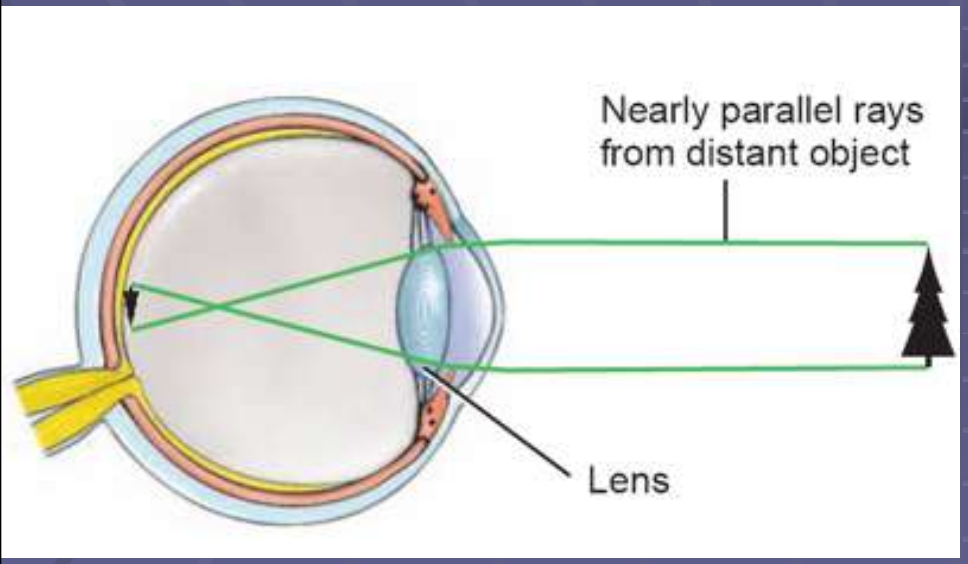


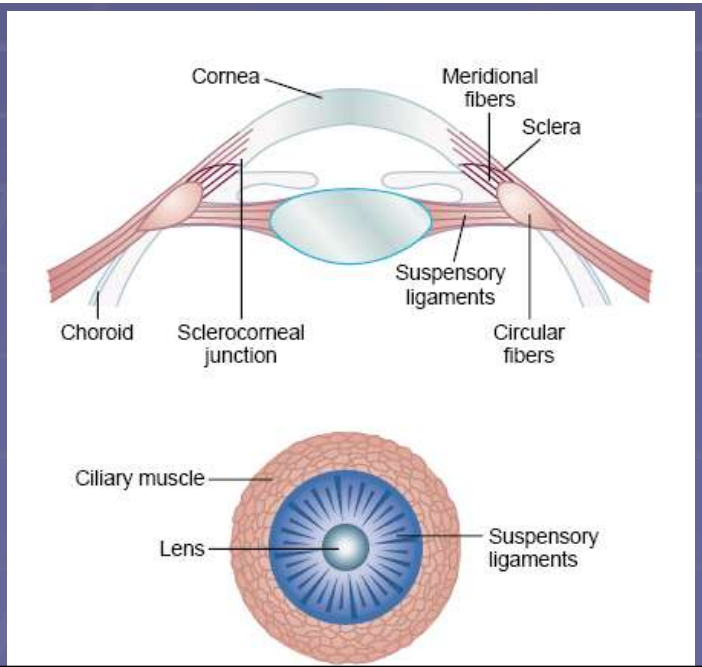
Accommodation

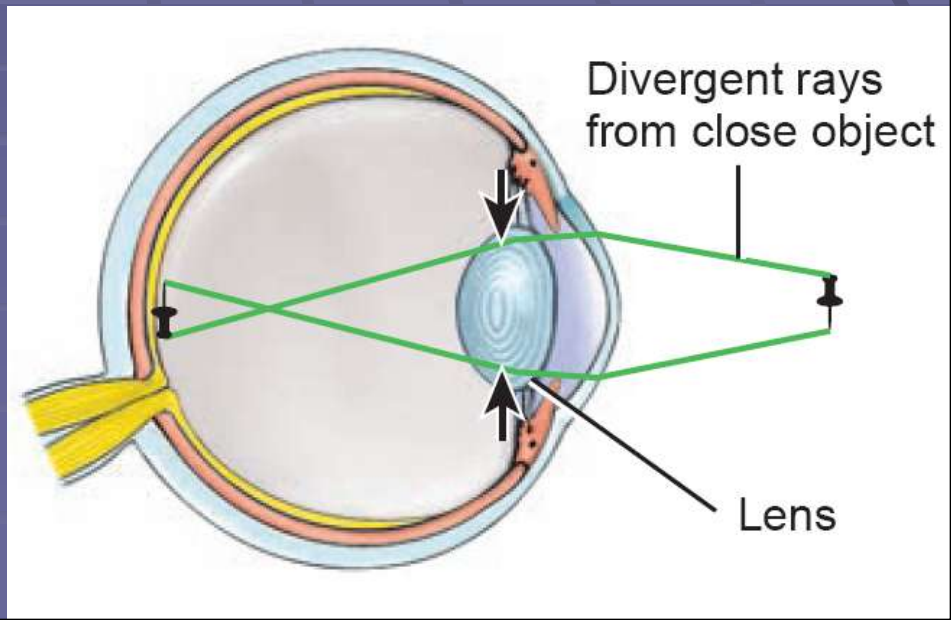




Accommodation

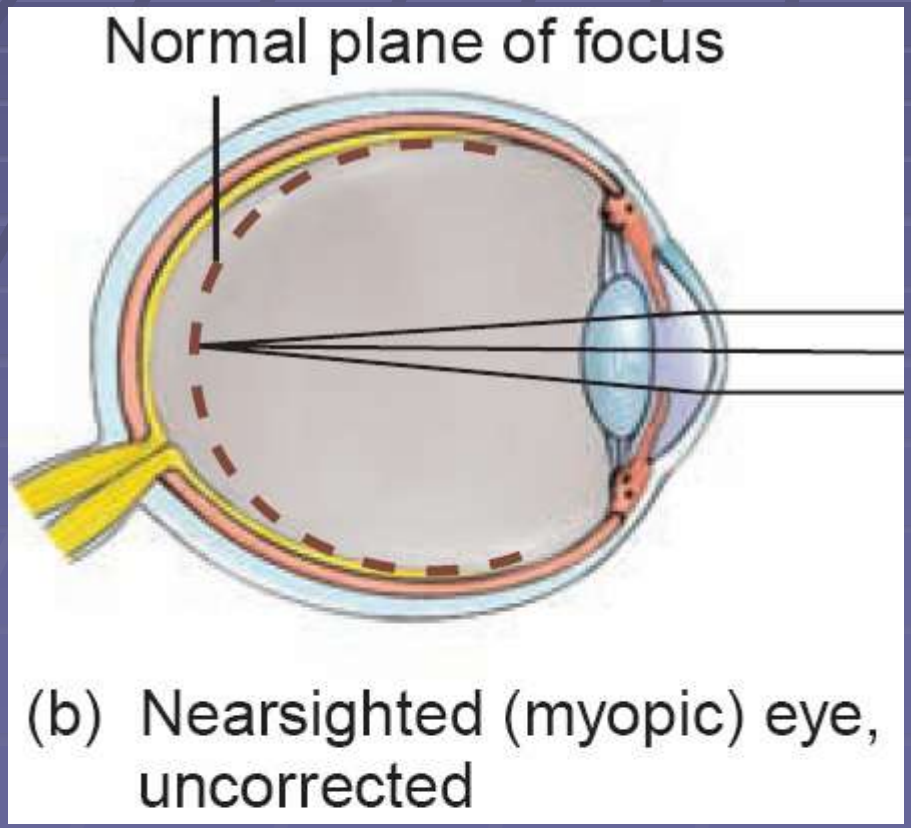


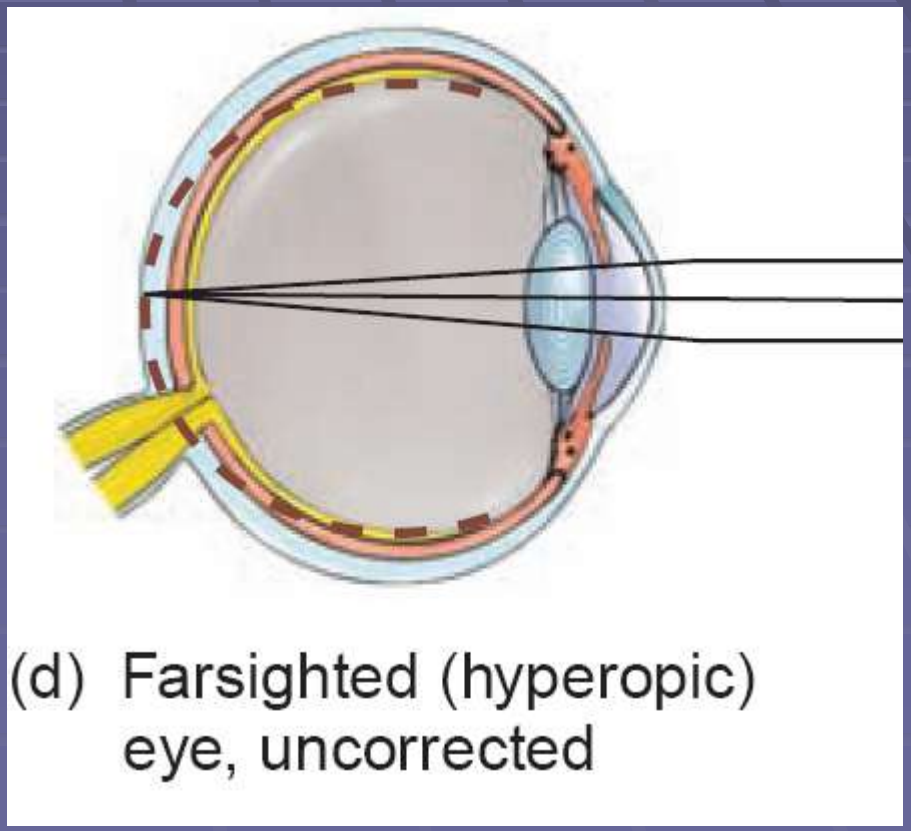




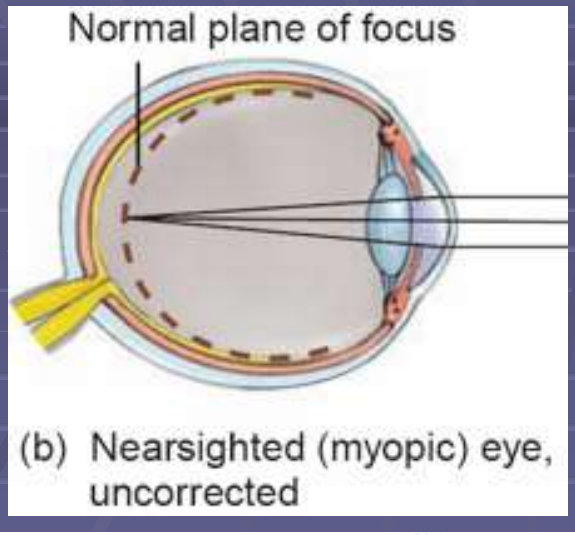
Vision problems

Ametropia : refraction error, inabiulity of properly focusing light on the retina, a frequent reason for reduced visual acuity

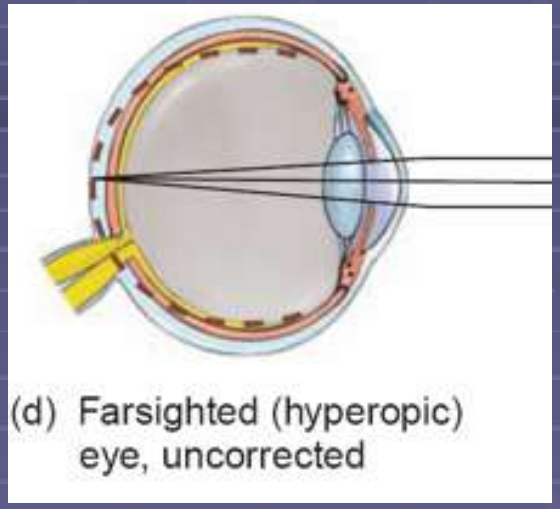




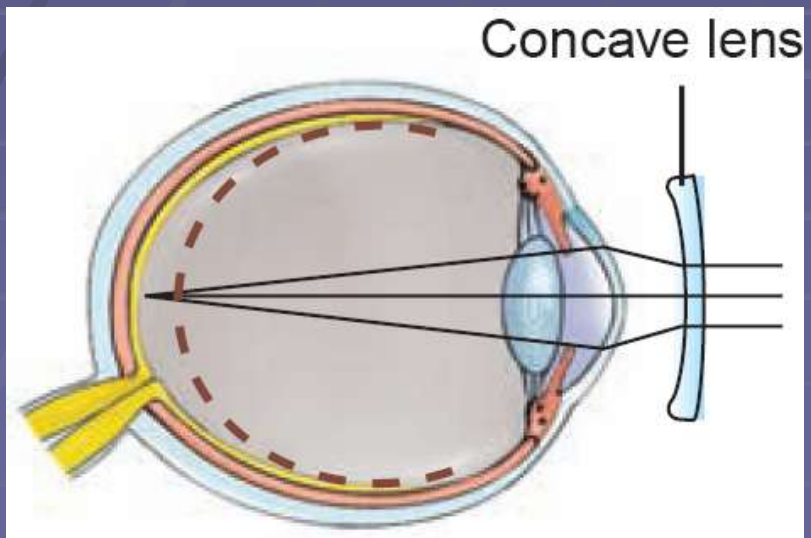
Vision problems



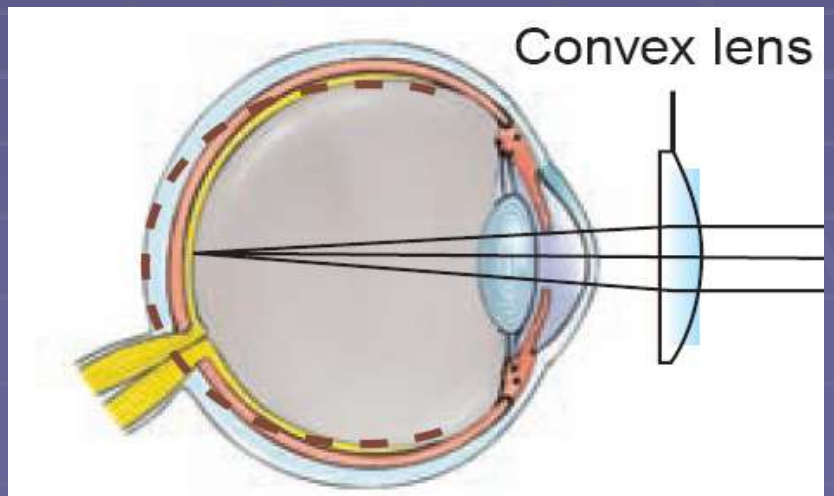
(b) Nearsighted (myopic) eye, uncorrected



(d) Farsighted (hyperopic) eye, uncorrected



(c) Nearsighted (myopic) eye, corrected



(e) Farsighted (hyperopic) eye, corrected

Visual acuity

- Ability to separate contours that are approximately 1.75 mm apart

Visual acuity

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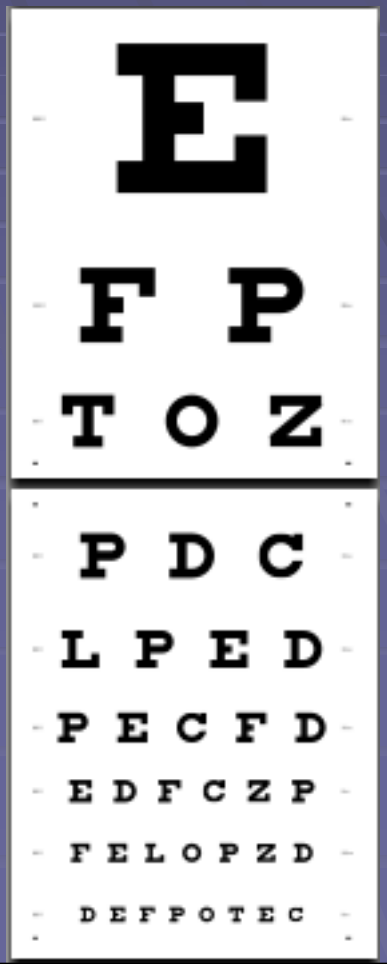
snellen eye chart

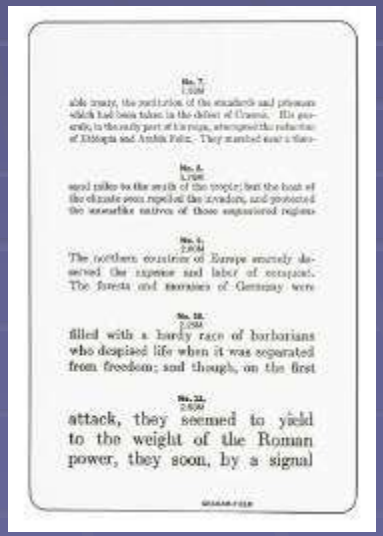
Jaeger eye chart



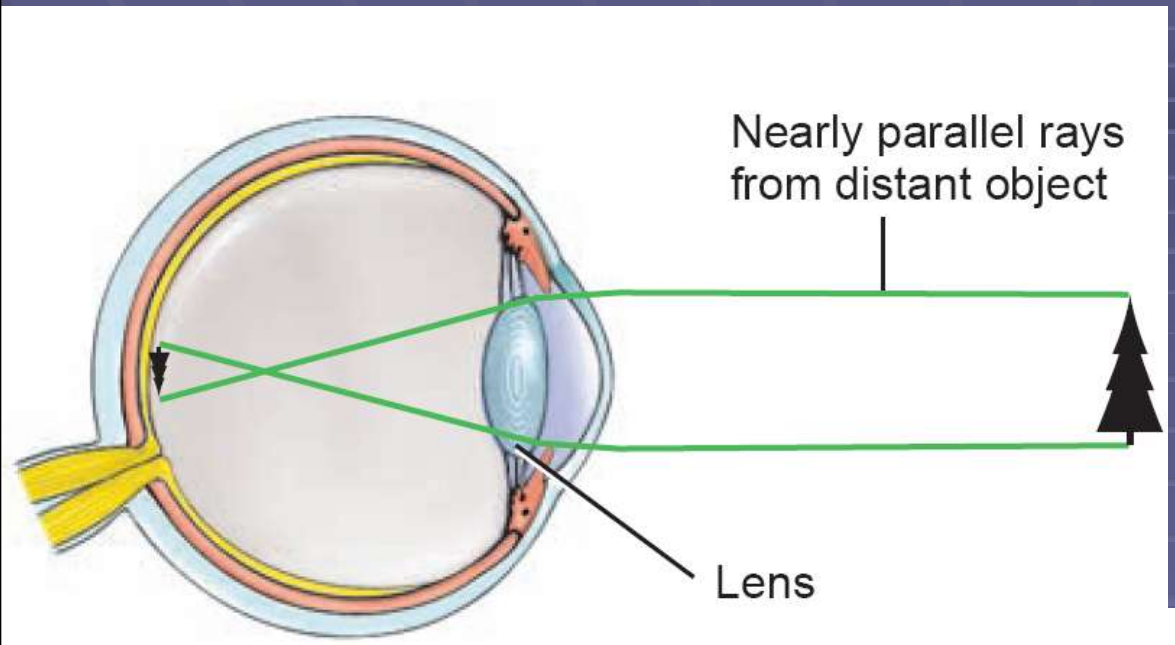
Visual acuity

- Ability to separate contours that are approximately 1.75 mm apart

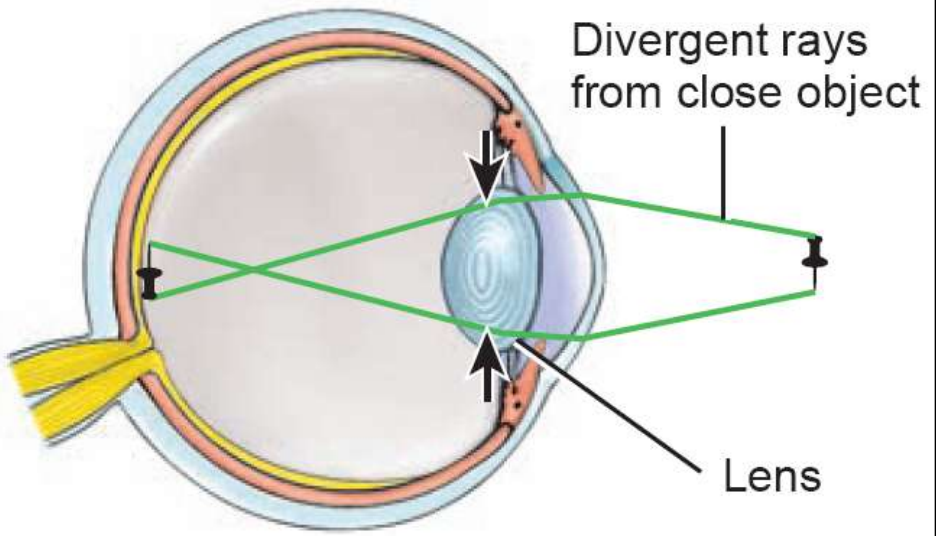
Jaeger eye chart



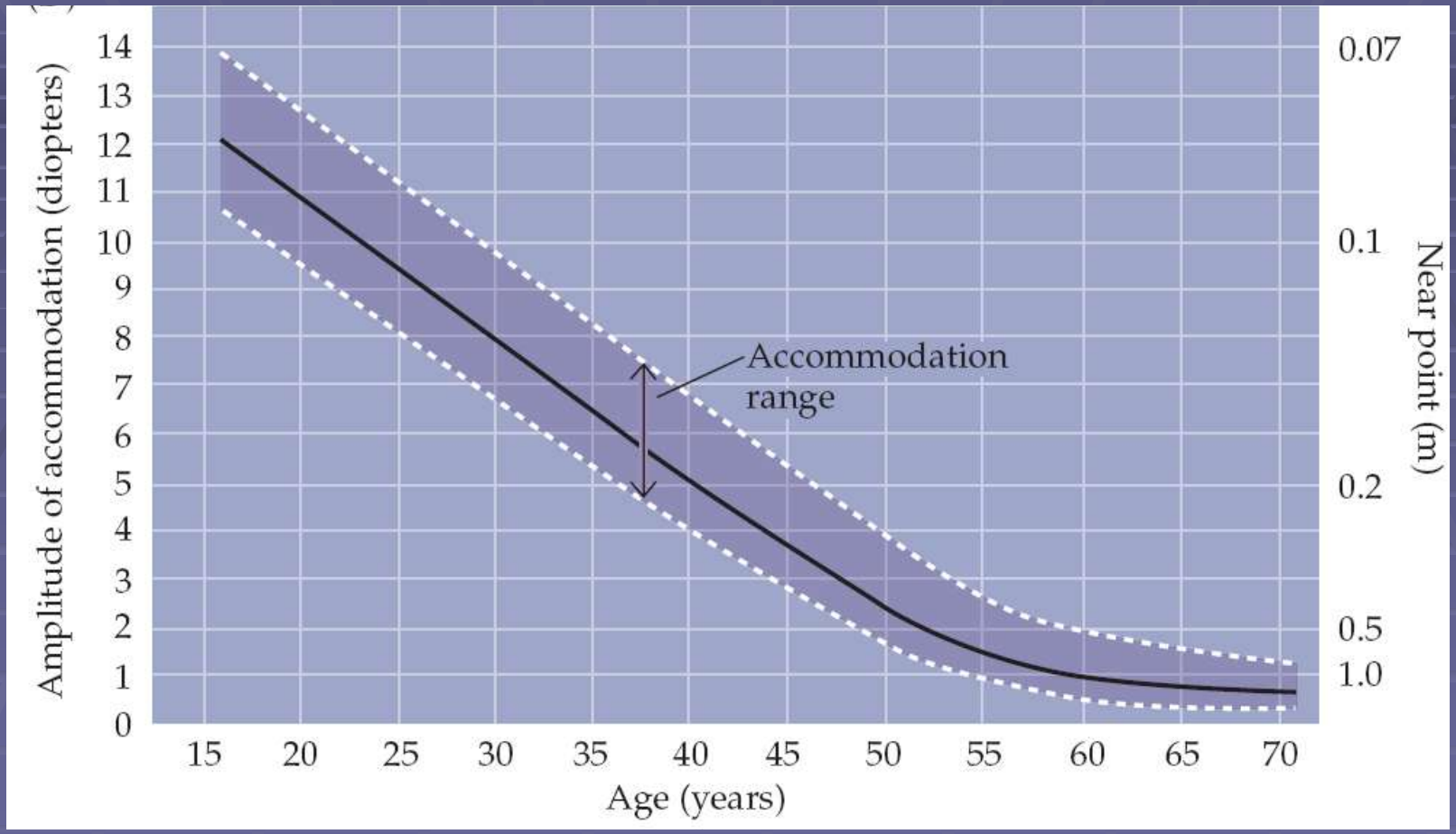
Accommodation



Presbyopia: Loss of accommodation by the lens



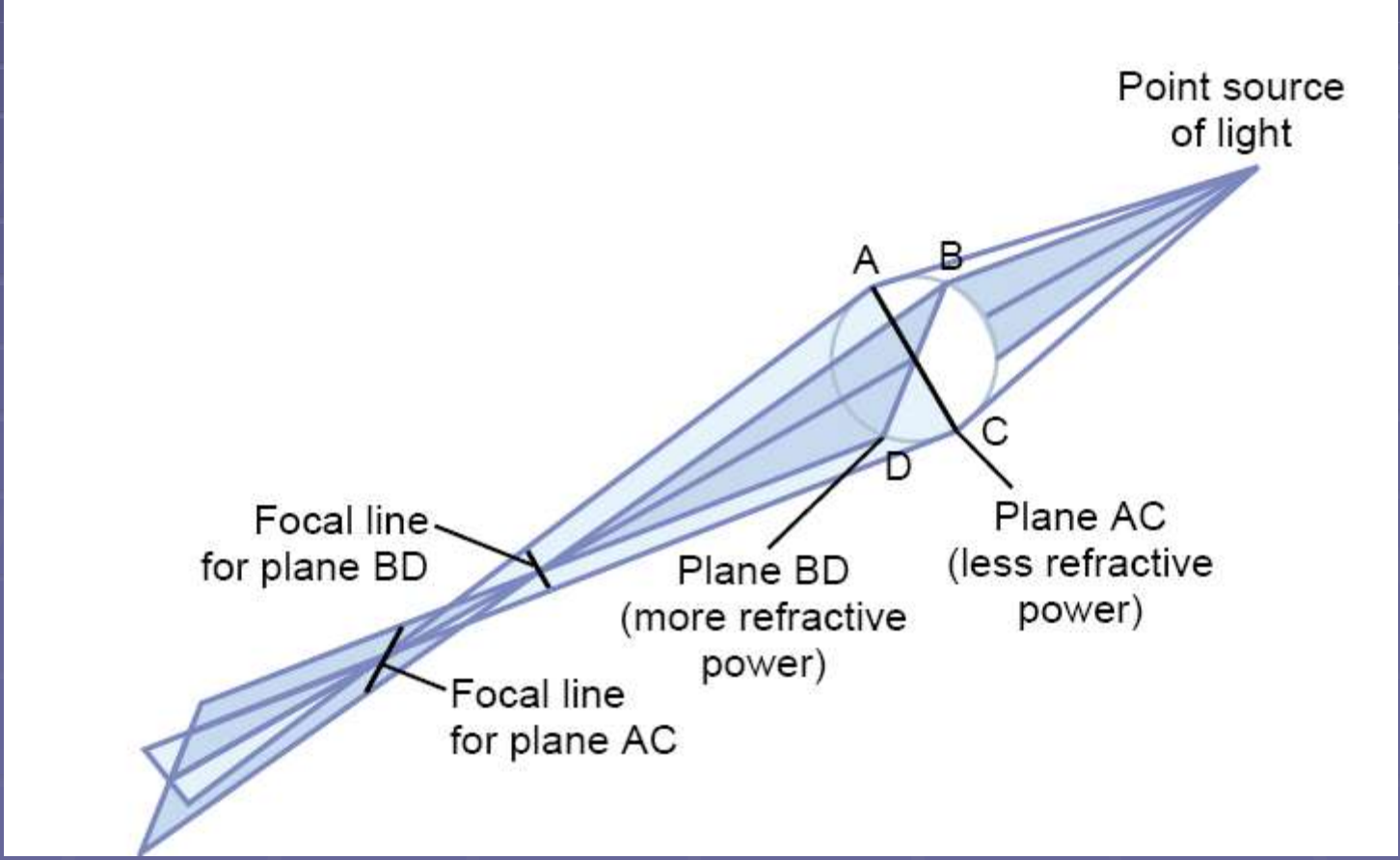
Accommodation



Presbyopia: Loss of accommodation by the lens

Vision problems

Astigmatism : irregular curvature of either the cornea or the lens, which lead to blurred or distorted vision due to parts of the image are out of focus.



Vision problems

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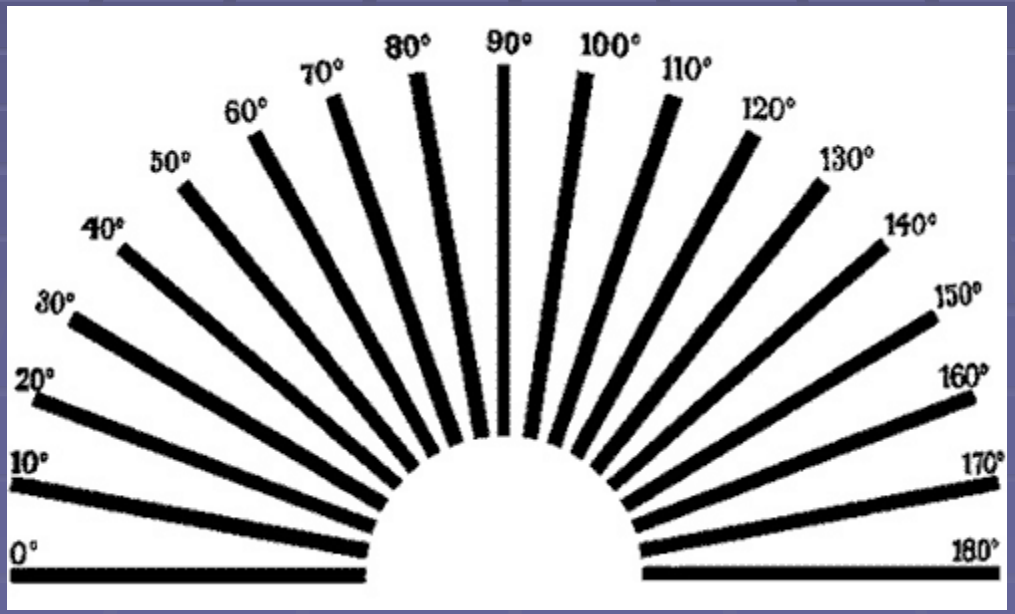
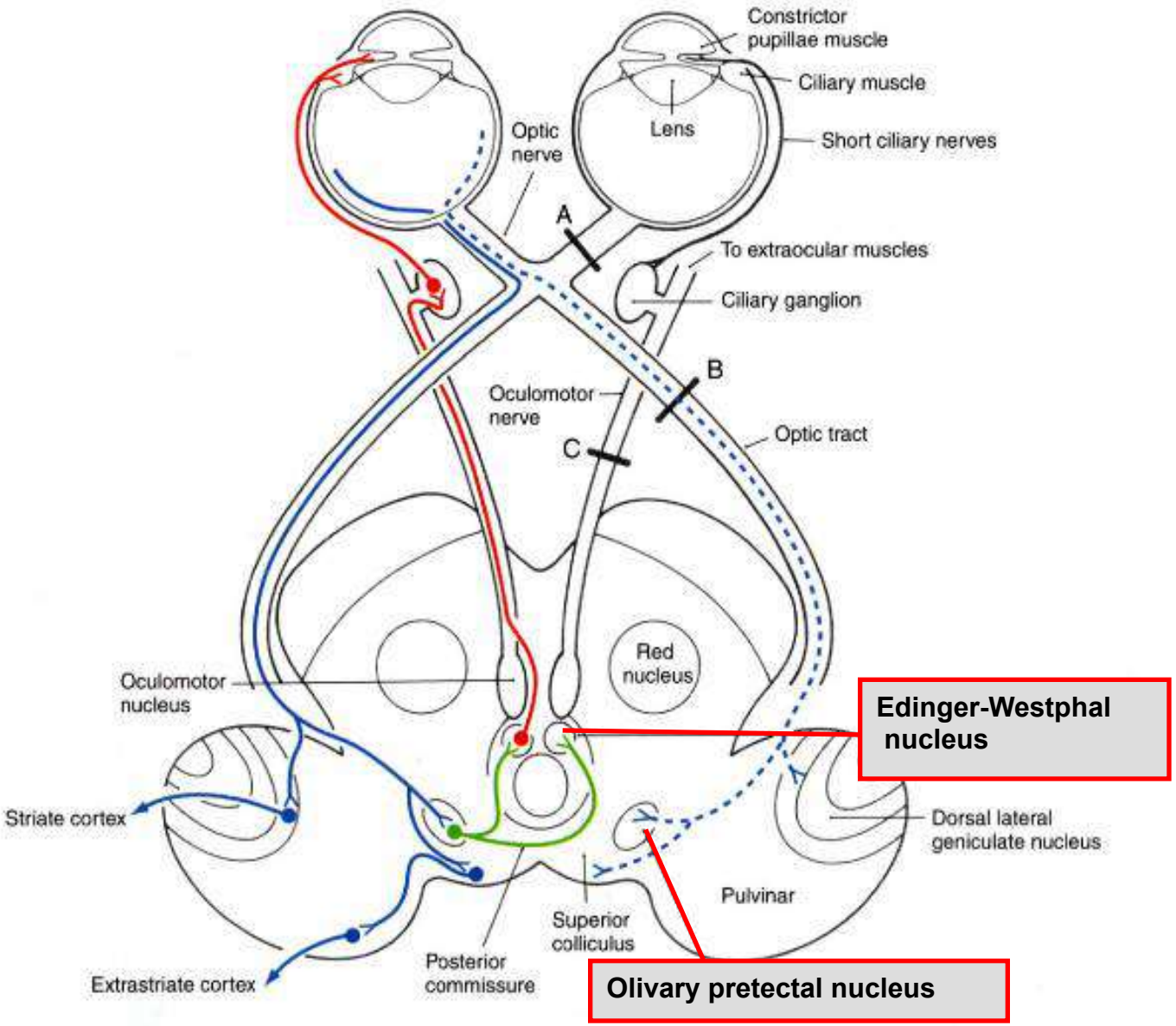
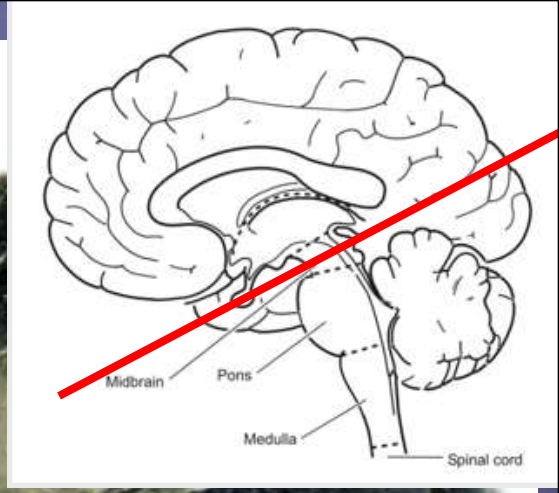
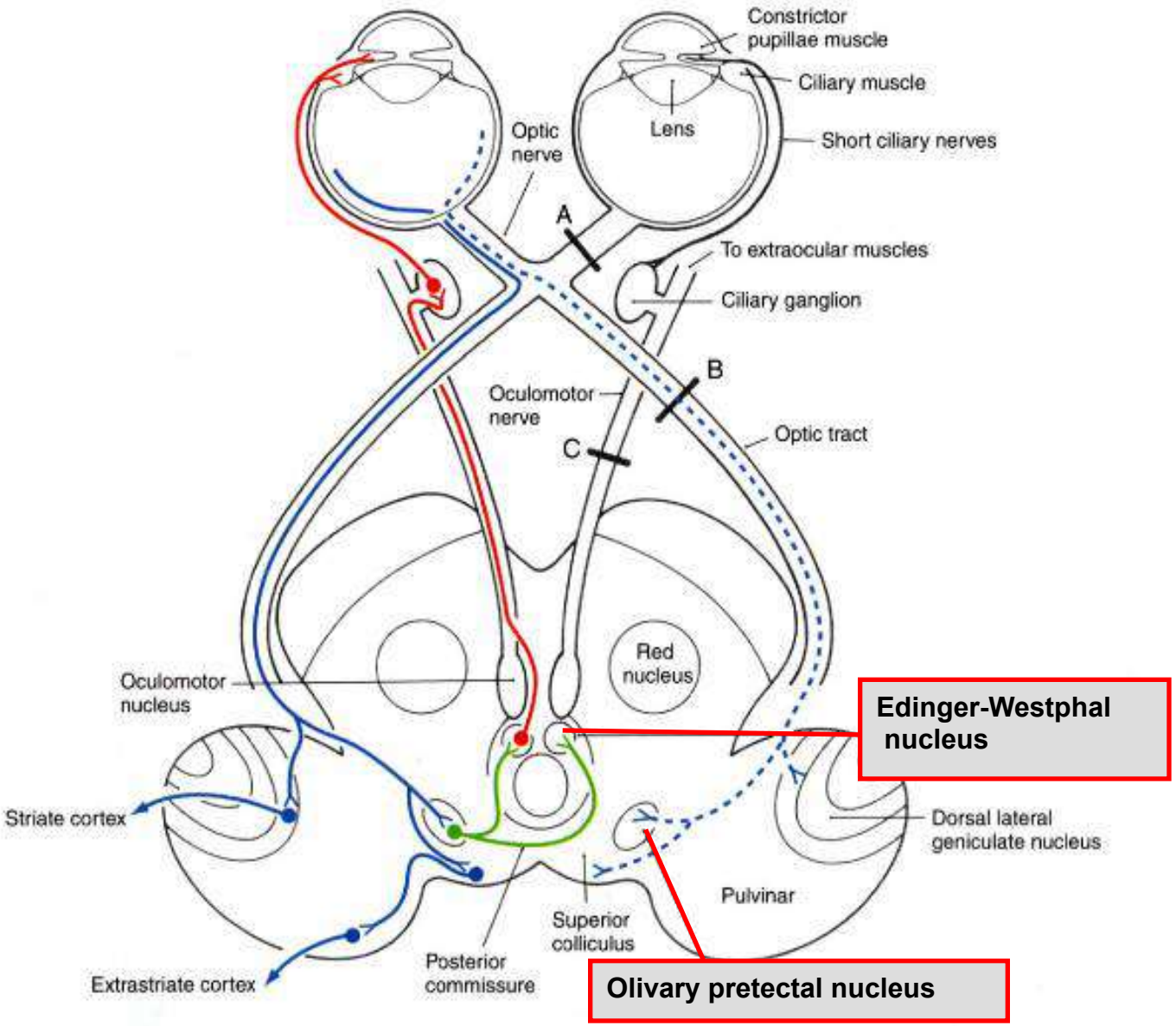


Pupillary Light Reflex


Constrictor pupillae muscle
Ciliary muscle
Lens
Short ciliary nerves
Optic nerve
A
To extraocular muscles
Ciliary ganglion
B
Oculomotor nerve
Optic tract
C
Red nucleus
Oculomotor nucleus
Edinger-Westphal nucleus
Striate cortex
Dorsal lateral geniculate nucleus
Pulvinar
Superior colliculus
Posterior commissure
Extrastriate cortex
Olivary pretectal nucleus

Edinger-Westphal nucleus




Constrictor pupillae muscle
Ciliary muscle
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Short ciliary nerves
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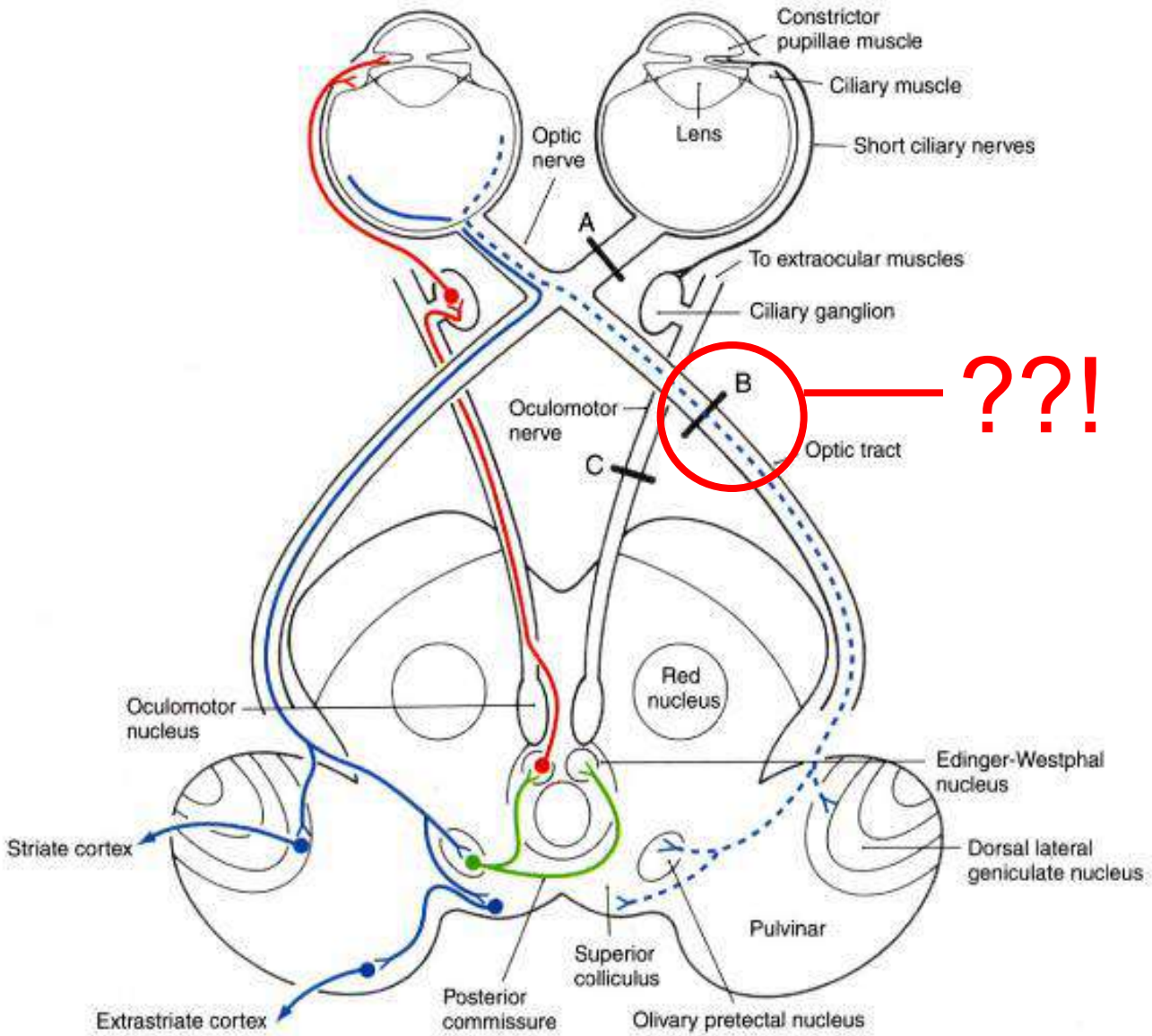
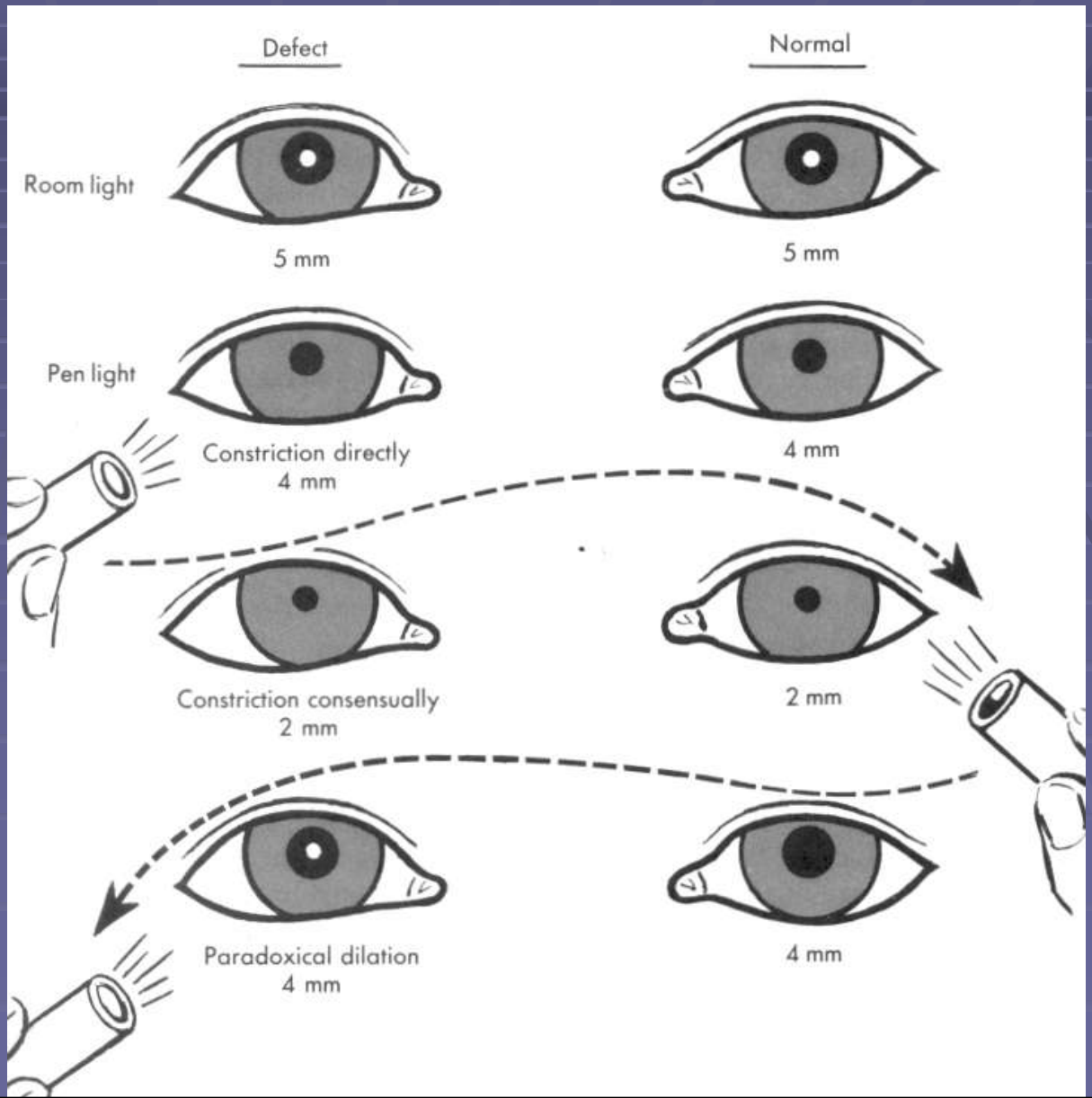
Striate cortex
Dorsal lateral geniculate nucleus
Pulvinar
Superior colliculus
Posterior commissure
Extrastriate cortex
Olivary pretectal nucleus


Constrictor pupillae muscle
Ciliary muscle
Lens
Short ciliary nerves
Optic nerve
A
To extraocular muscles
Ciliary ganglion
B
??!
Oculomotor nerve
C
Optic tract
Red nucleus
Oculomotor nucleus
Edinger-Westphal nucleus
Striate cortex
Dorsal lateral geniculate nucleus
Pulvinar
Superior colliculus
Posterior commissure
Olivary pretectal nucleus
Extrastriate cortex

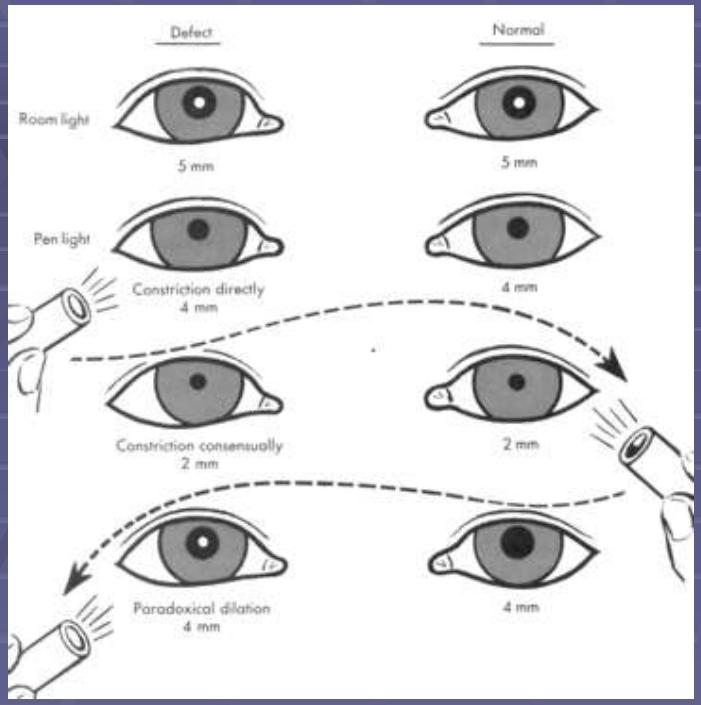
relative afferent pupillary defect (RAPD)

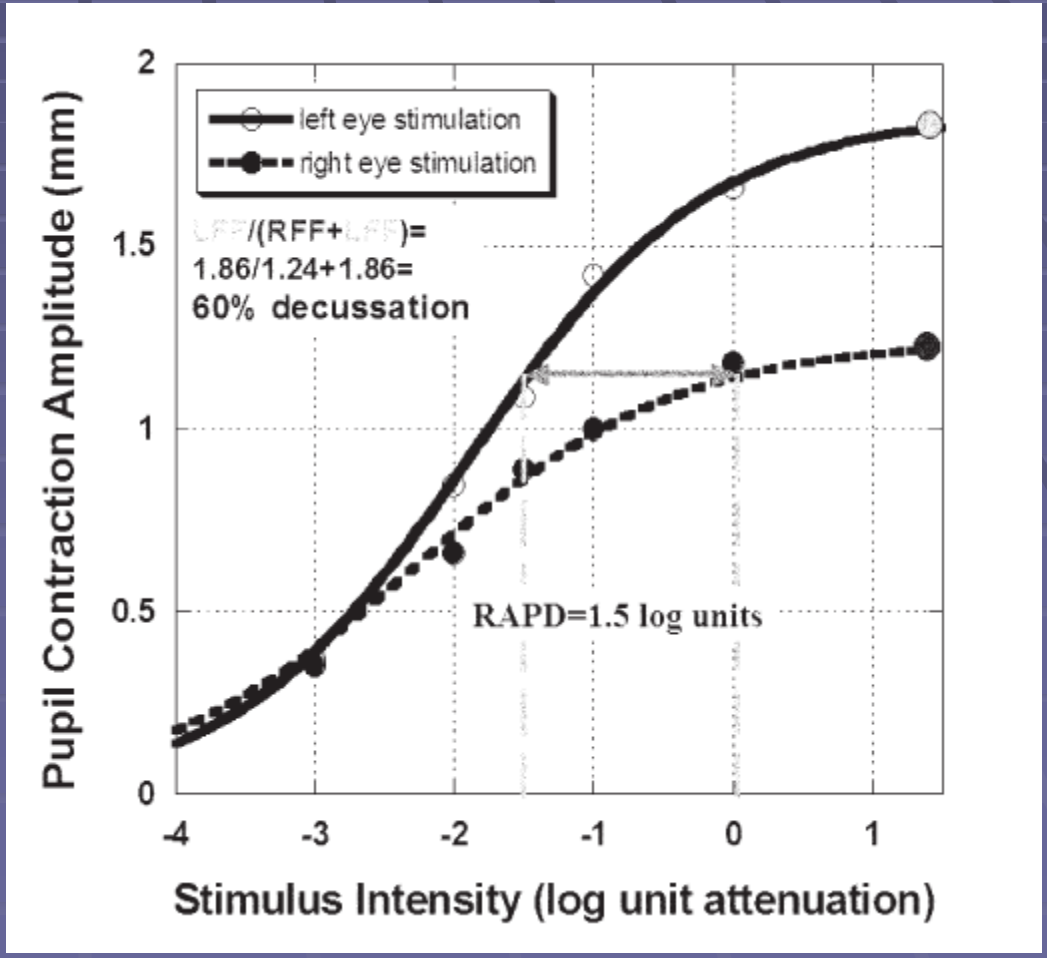
relative afferent pupillary defect (RAPD)

swinging-flashlight test



relative afferent pupillary defect (RAPD)

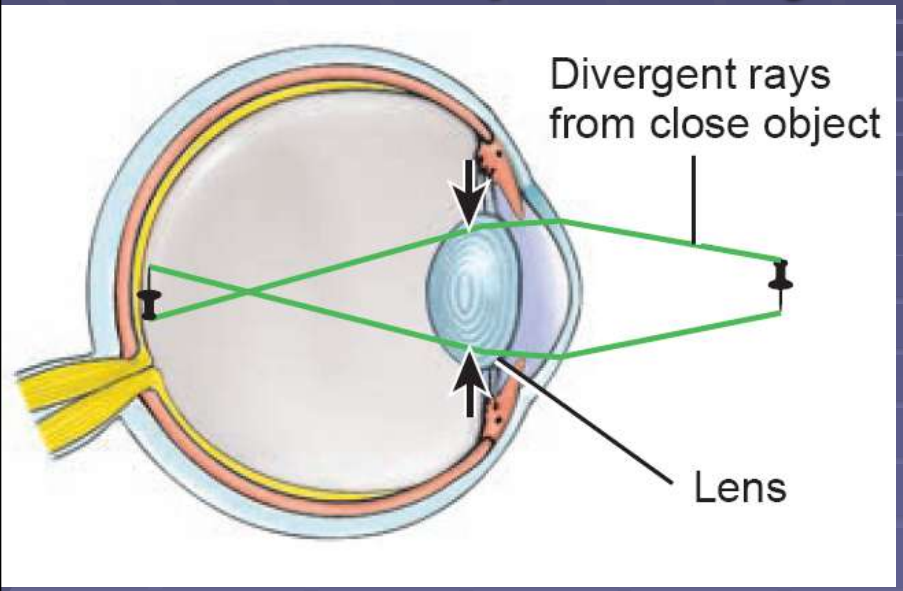




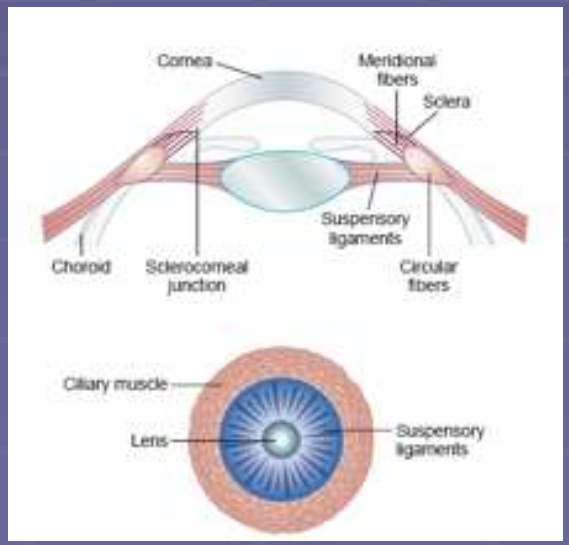
relative afferent pupillary defect (RAPD)

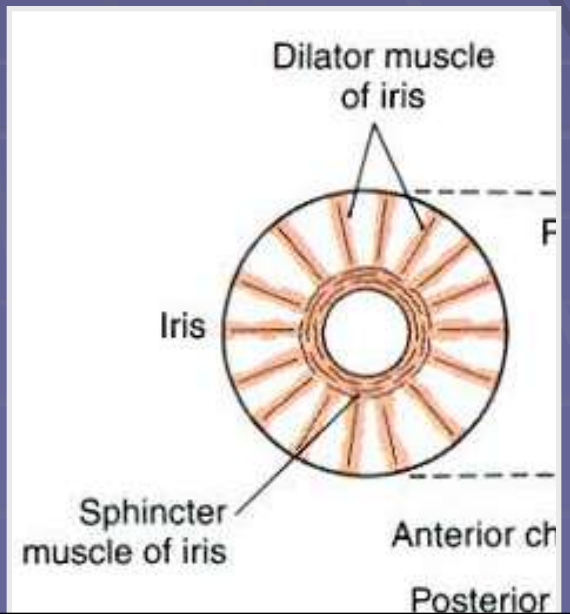
- Usually before the chiasm problem
  - Retinal detachment
  - Ischemic retina
  - Optic nerve : ischemia ,compression neuritis , recovered neuritis … etc
  - diabetic retinopathy
  - Demyelination (MS)
- Unilateral Optic track lesion
- Unilateral mid brain lesion

Accommodation and parasympathetic

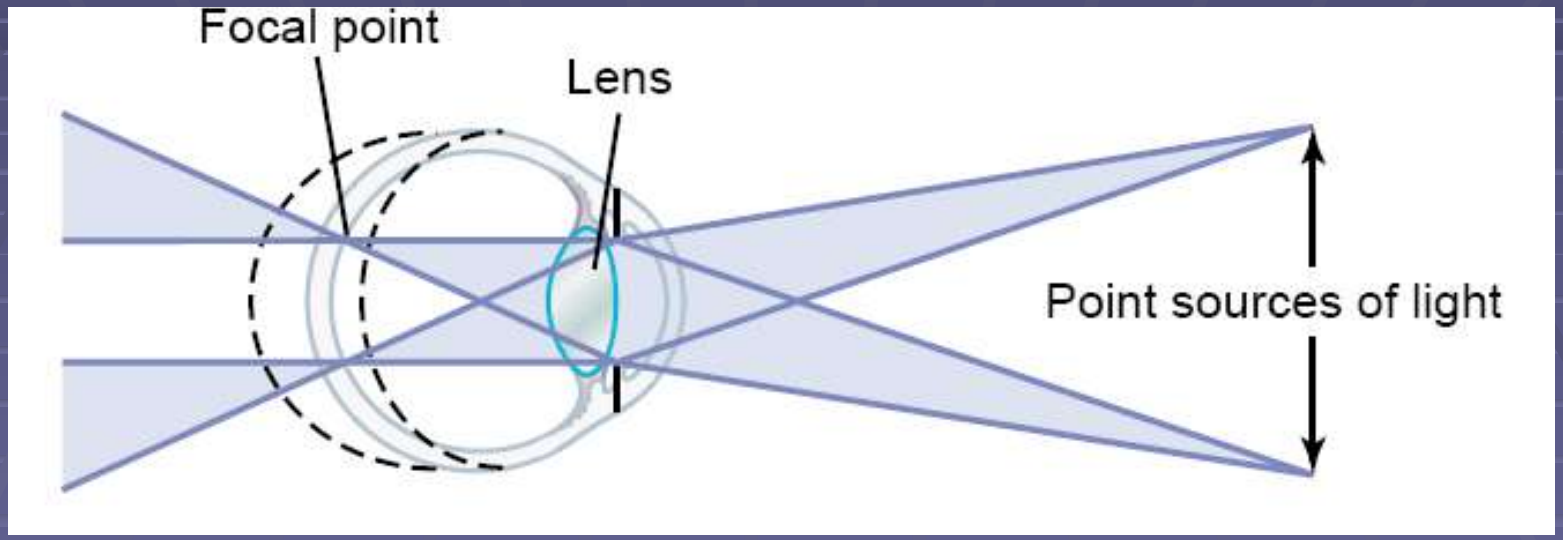


The pupil near reflex

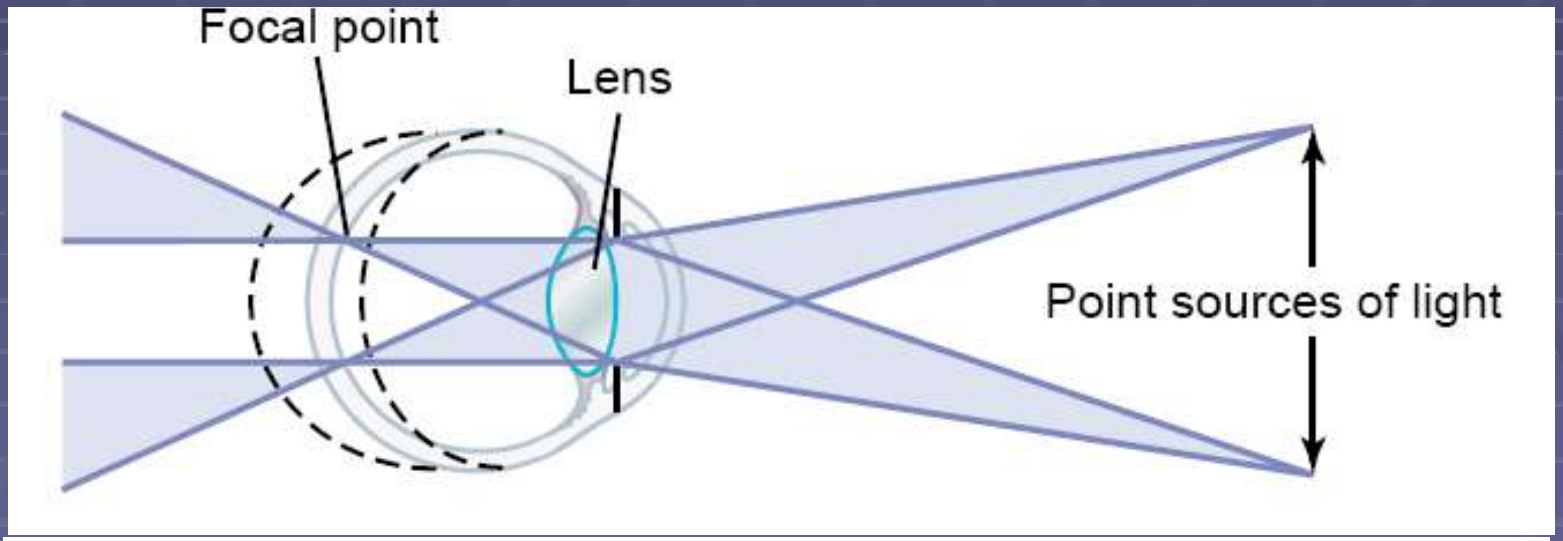


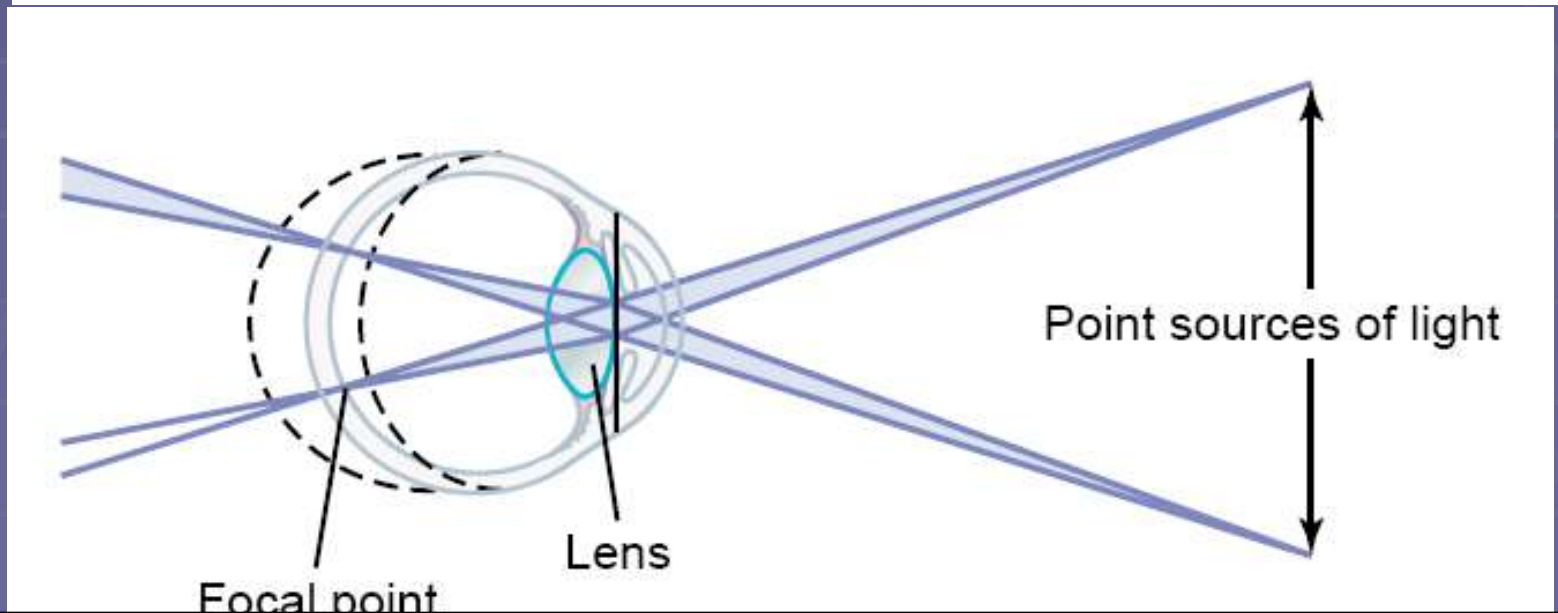


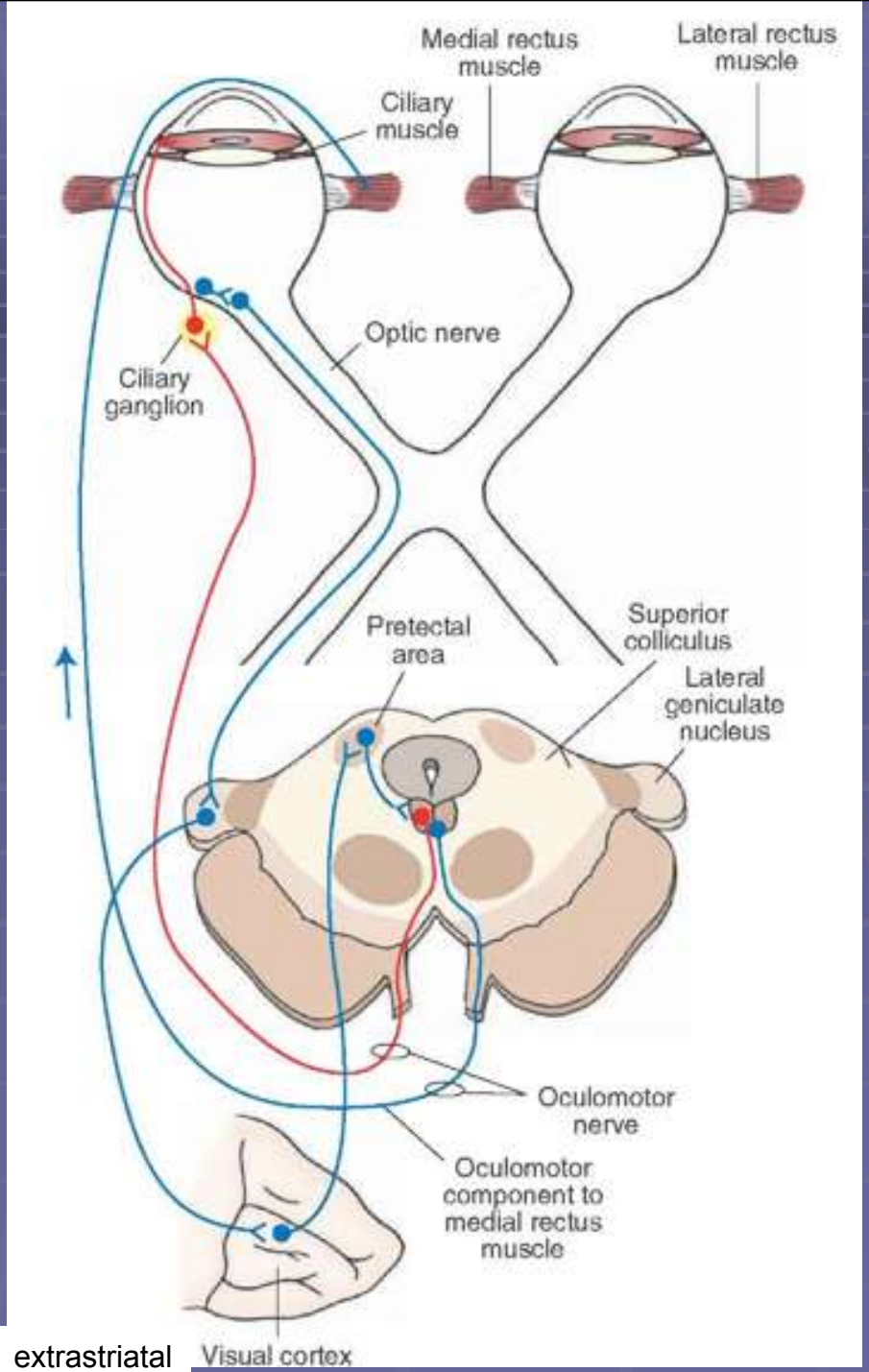
Pupillary Adjustment



Pupillary Adjustment






Medial rectus muscle
Lateral rectus muscle
Ciliary muscle
Optic nerve
Ciliary ganglion
Pretectal area
Superior colliculus
Lateral geniculate nucleus
Oculomotor nerve
Oculomotor component to medial rectus muscle
extrastriatal
Visual cortex

light-near dissociation

light-near dissociation

- Adie's tonic pupil
- Damage to the dorsal mid-brain (tectal area) around the cerebral aqueduct "but not the E W nucleus"
  - Stroke
  - Meningitis
  - Tumor
  - Neurosyphilis
  - Diabetic neuropathy
  - Demyelination (MS)
- Dorsal midbrain syndrome (**Parinaud's Syndrome**)

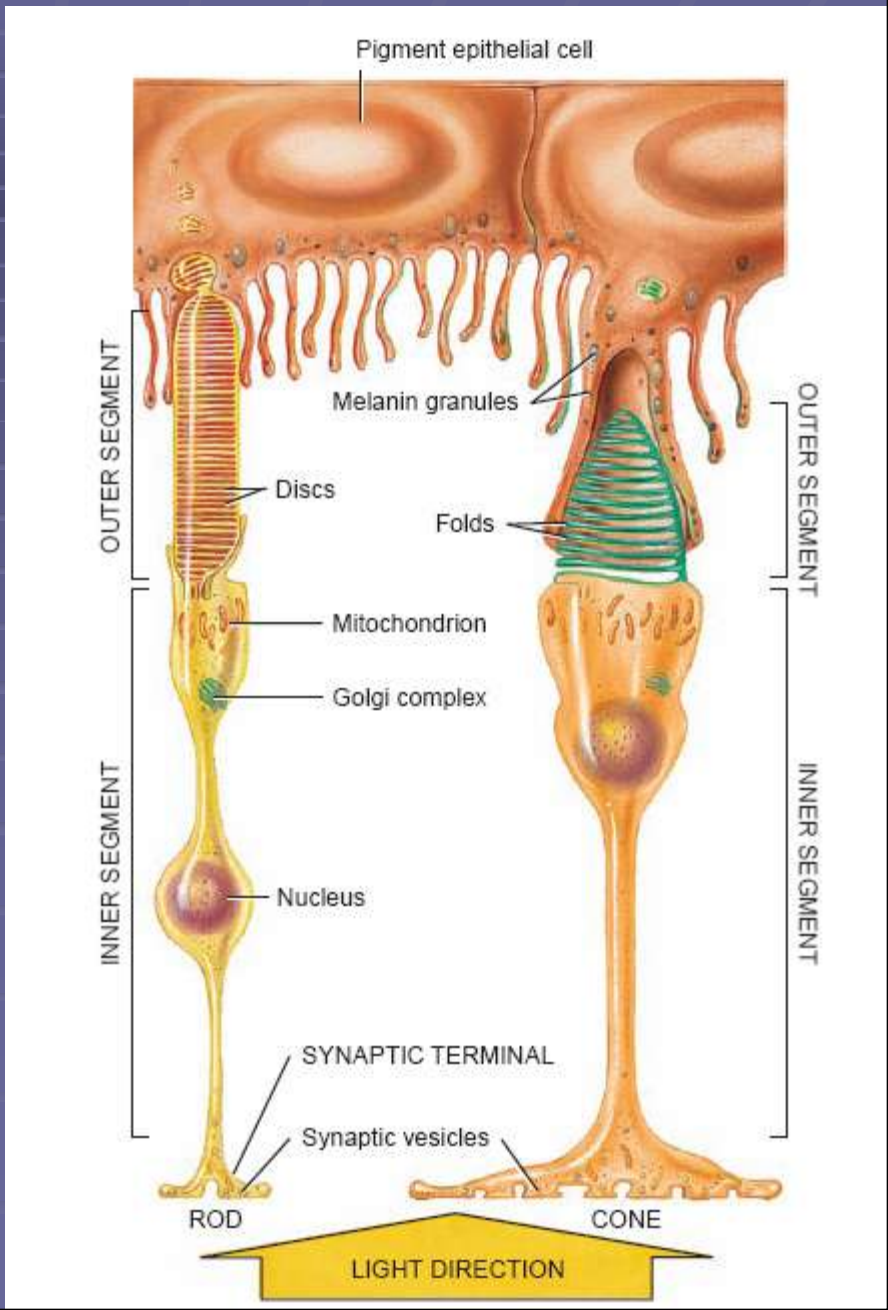
Anisocoria

Anisocoria

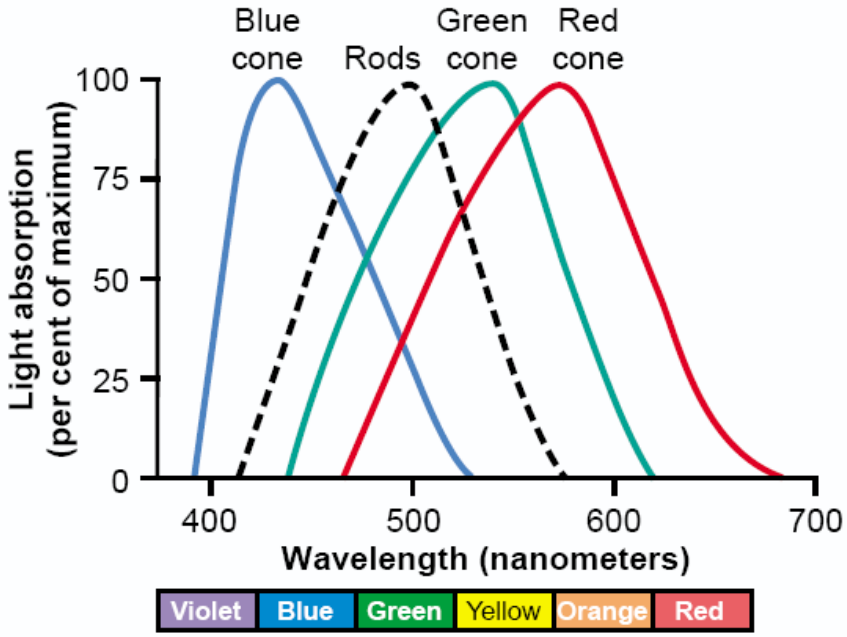
- Efferent pathway or the eye it self
- Adie’s tonic pupil
- One side Dorsal midbrain syndrome
- Horner syndrome

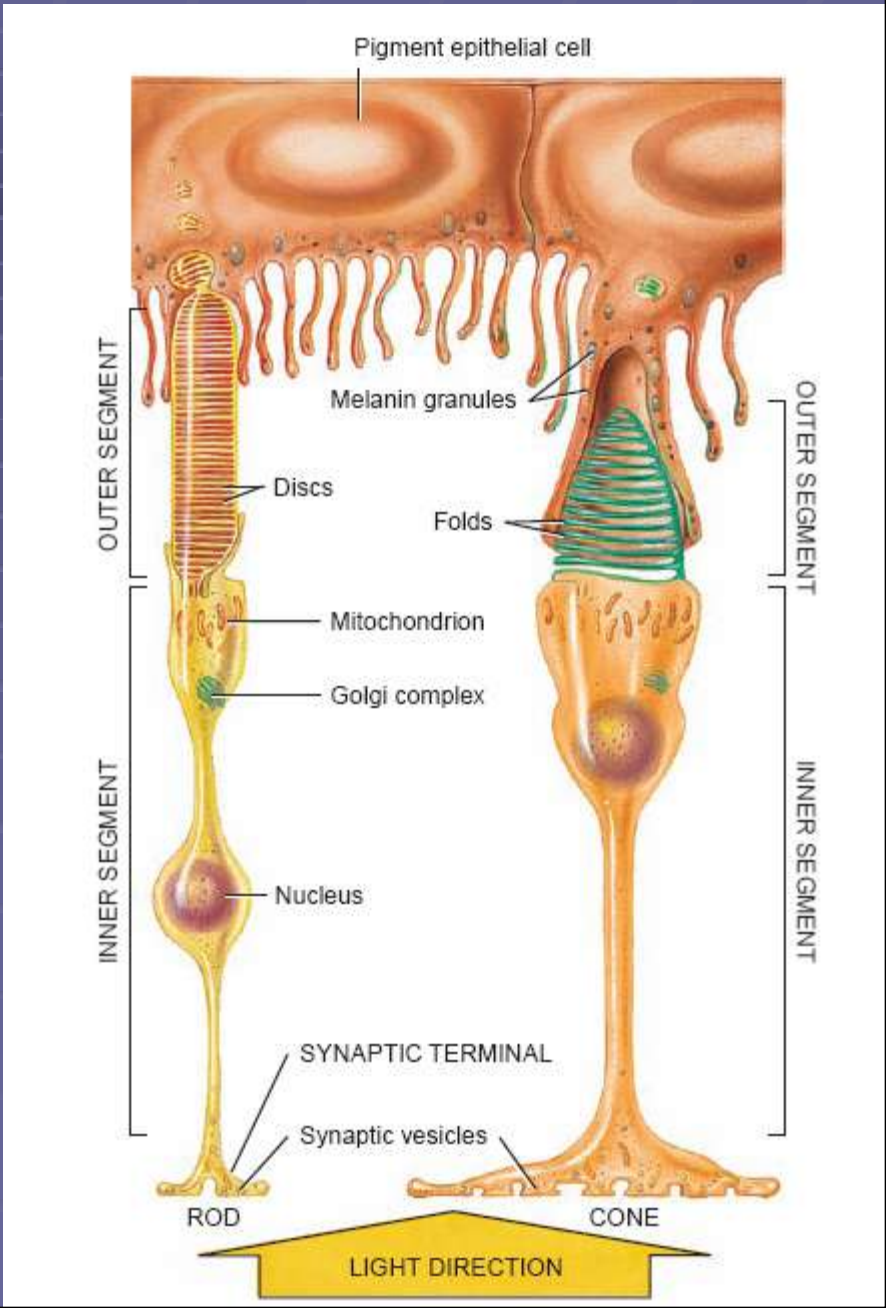
Photoreceptors

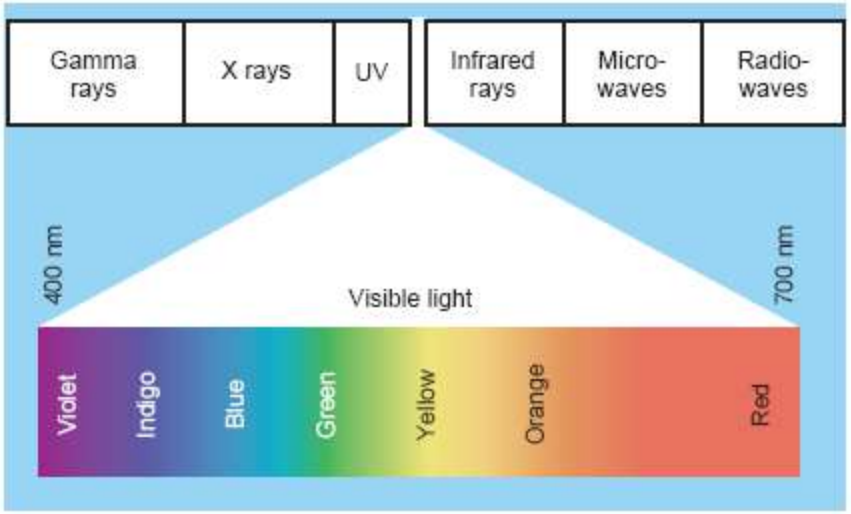
- Cones
- Rods



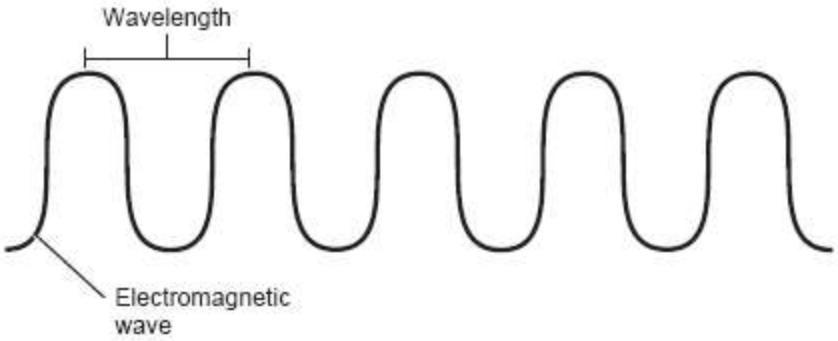
Photoreceptors

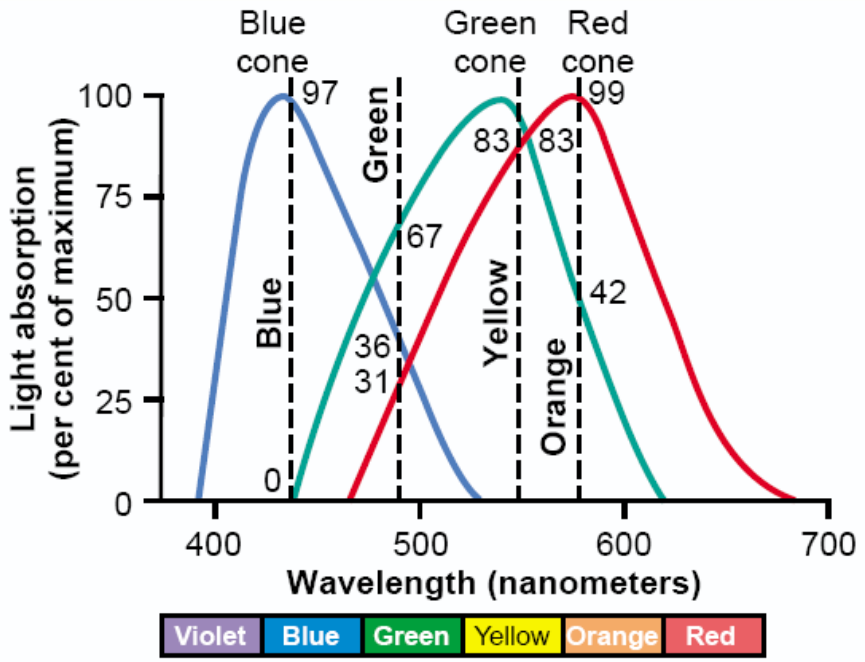






(a) Electromagnetic spectrum





Color names if you're a girl...

Color names if you're a guy...

Color Blindness

Color Blindness

- Red-green color blindness

Color Blindness

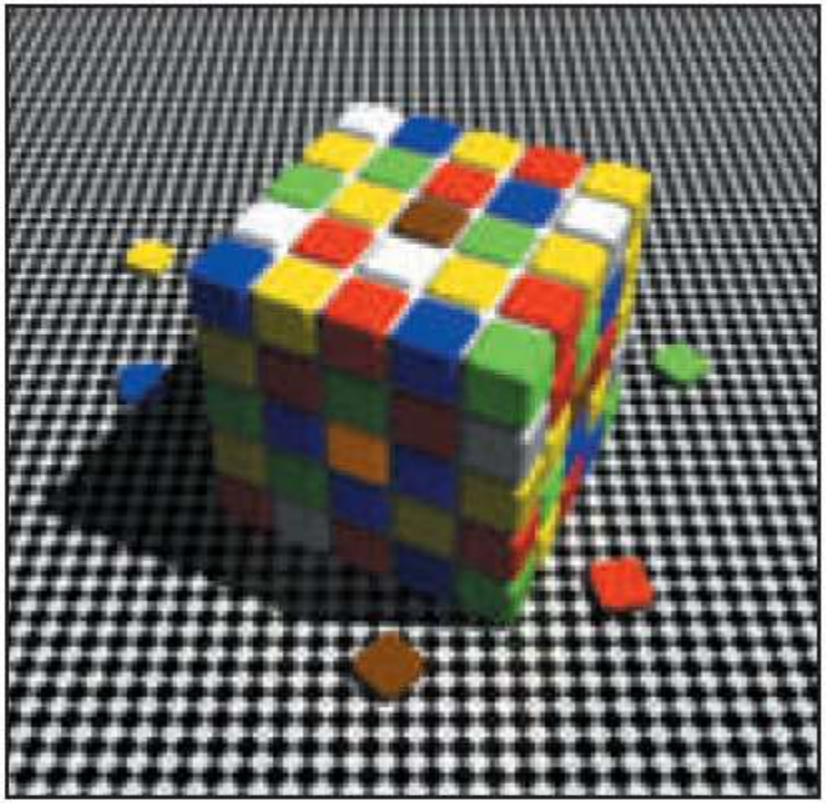
- Red-green color blindness
  - X linked

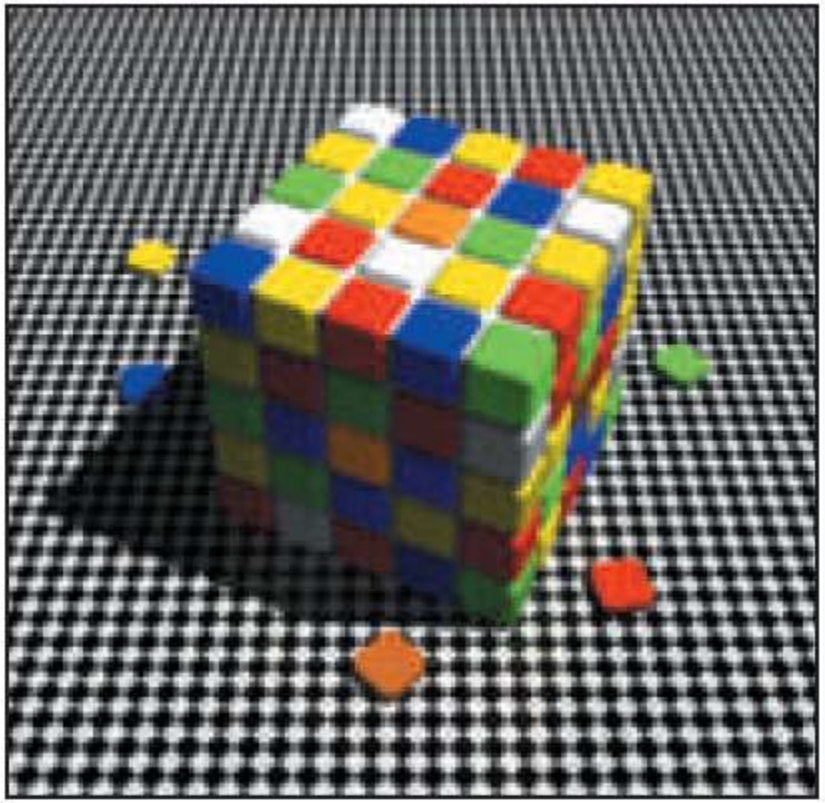
Color Blindness

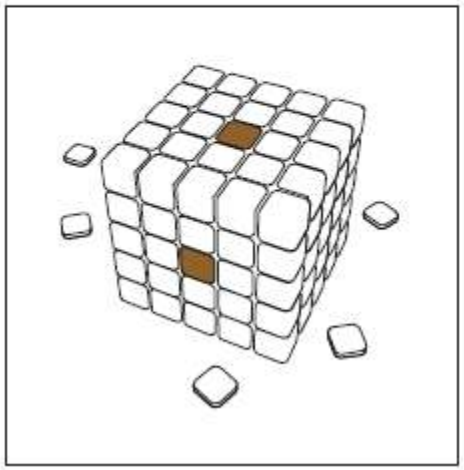
- Red-green color blindness
  - X linked
  - Deuteranope >>> green
  - Protanope >>> red

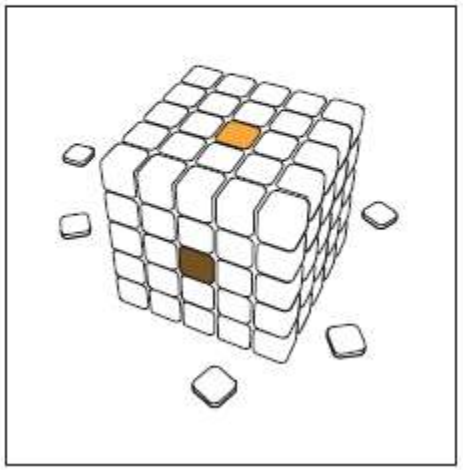
Color Blindness

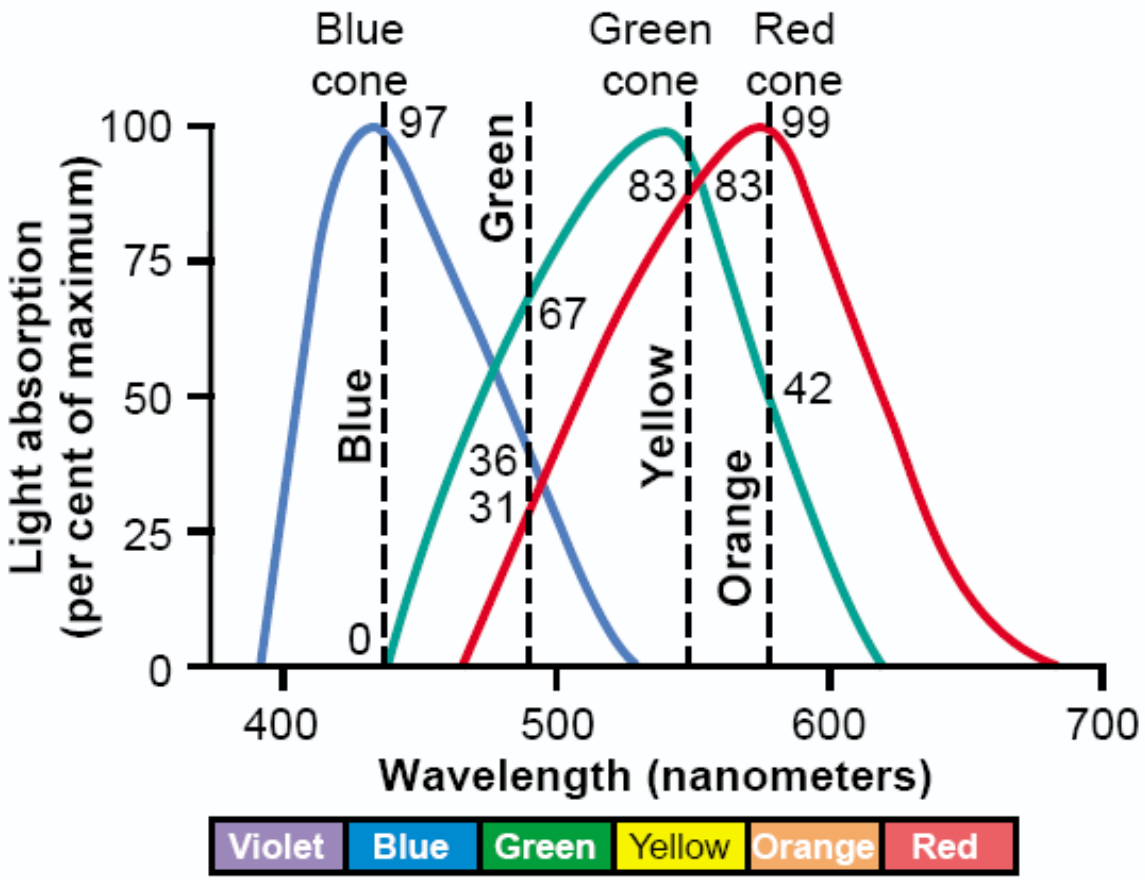
- Red-green color blindness
  - X linked
  - Deuteranope >>> green
  - Protanope >>> red
- Tritanopia >>> Blue Chromosome 7
- ***anomaly : shift in the spectrum of one of the proteins i.e. Deuteranomaly, Protanomaly, Tritanopia

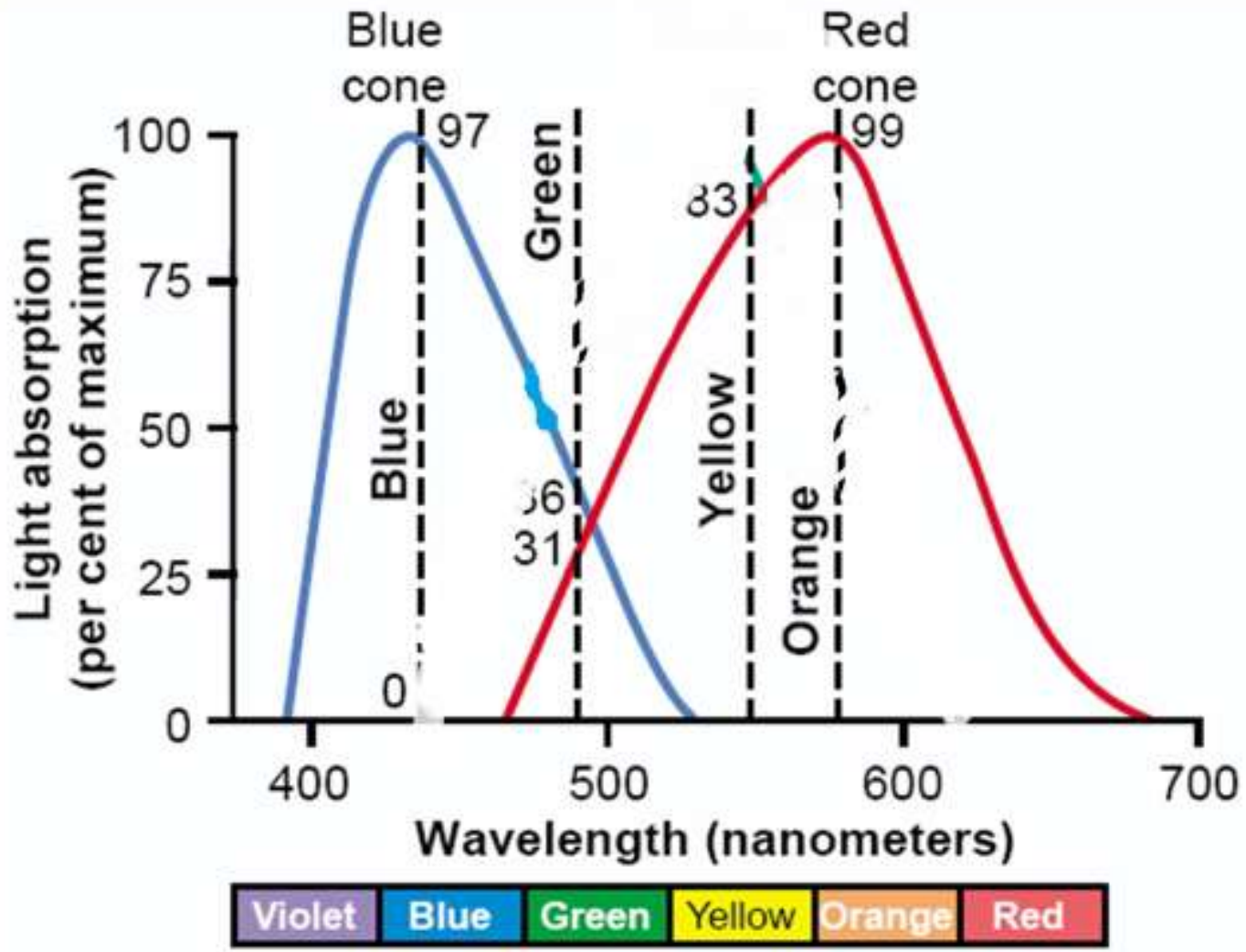









Blue cone
Green cone
Red cone
97
99
83
83
67
42
36
31
0
Blue
Green
Yellow
Orange
100
75
50
25
0
Light absorption (per cent of maximum)
400
500
600
700
Wavelength (nanometers)
Violet
Blue
Green
Yellow
Orange
Red


Blue cone
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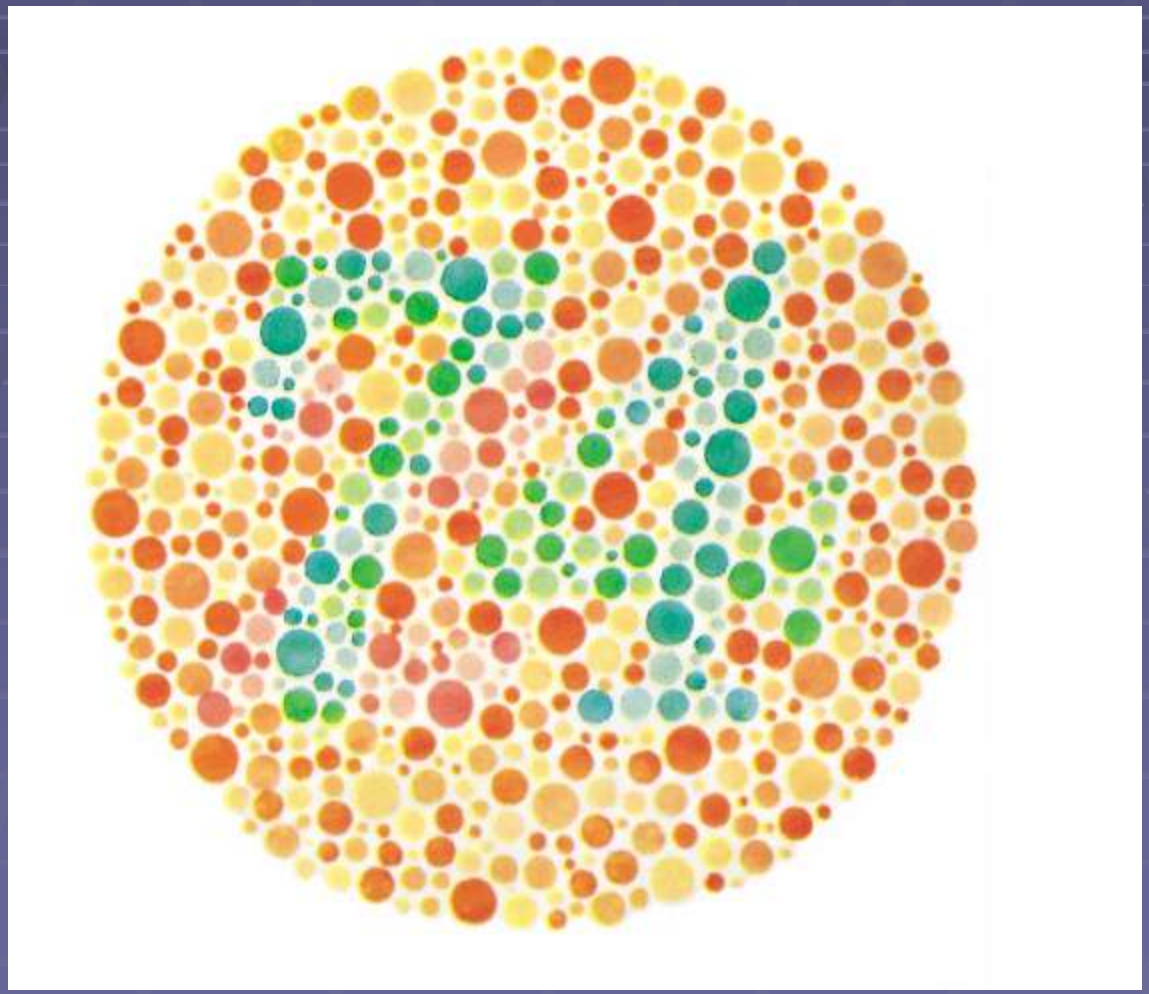
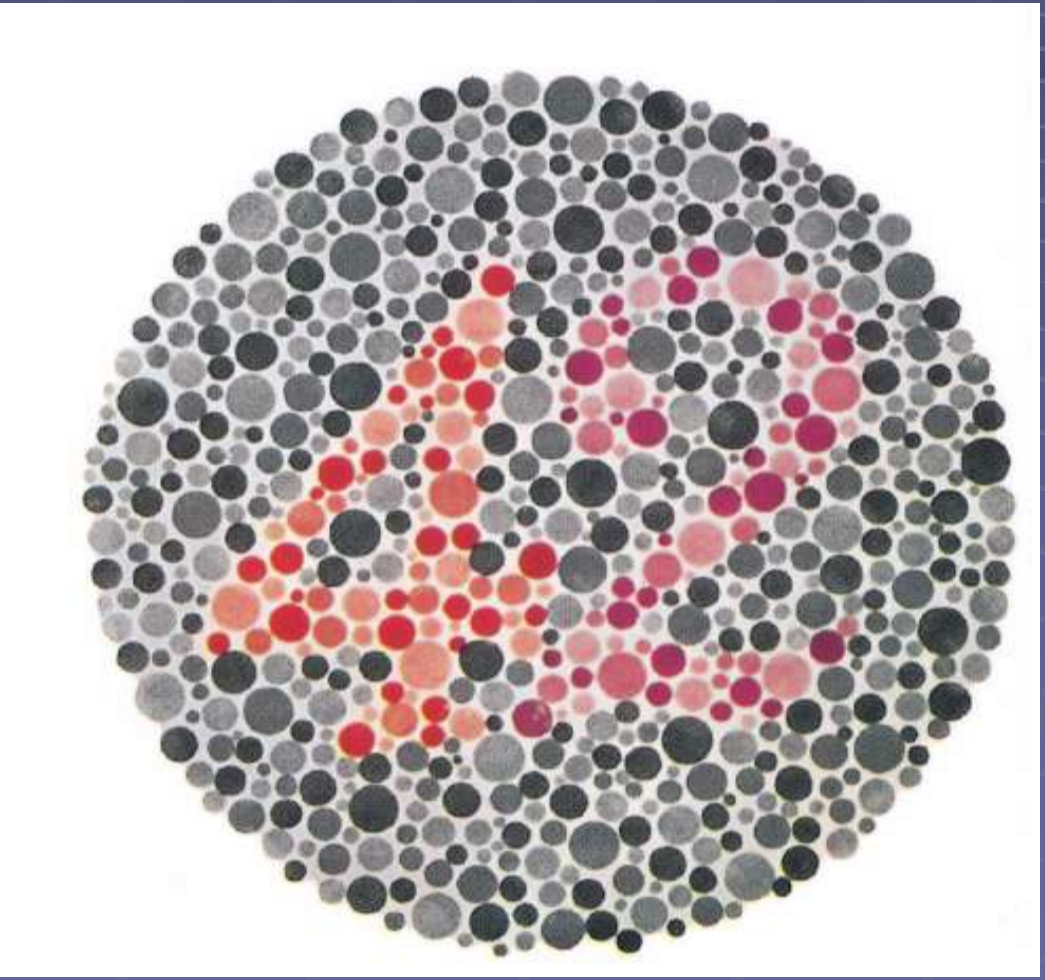
Green
Blue
Yellow
Orange
31
0
400
500
600
700
Wavelength (nanometers)
Violet
Blue
Green
Yellow
Orange
Red

Color Test Chart



74 VS 21

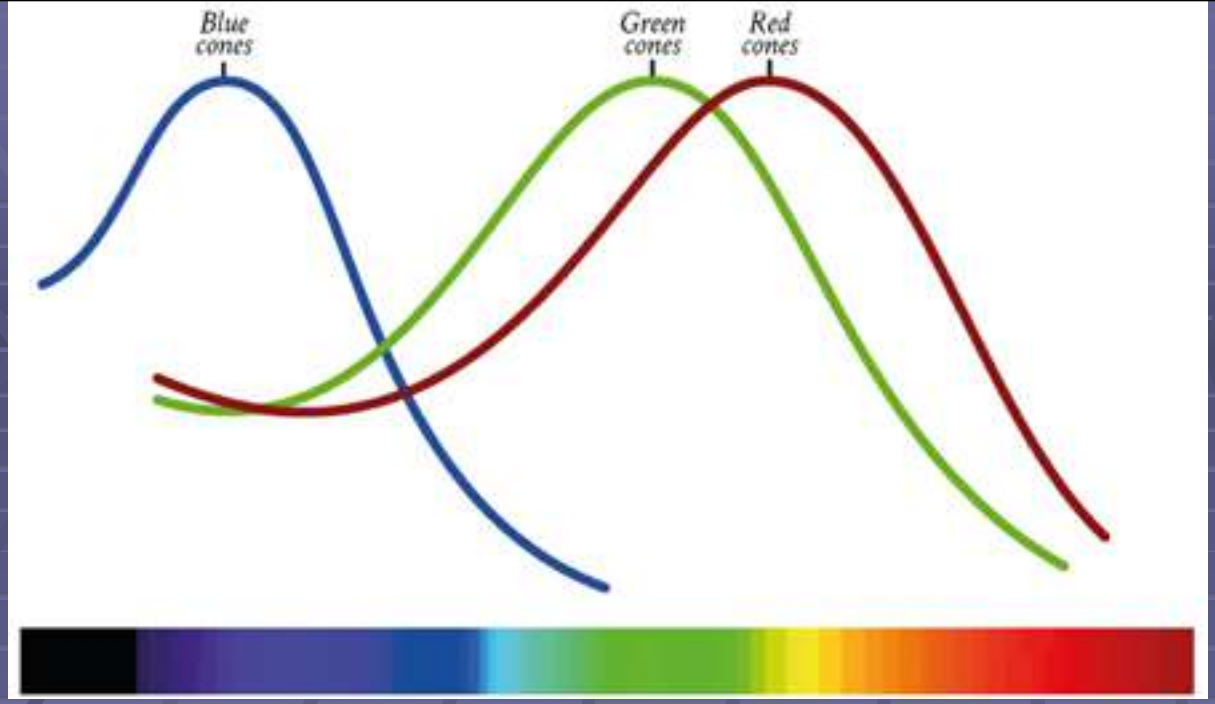
Color Test Chart

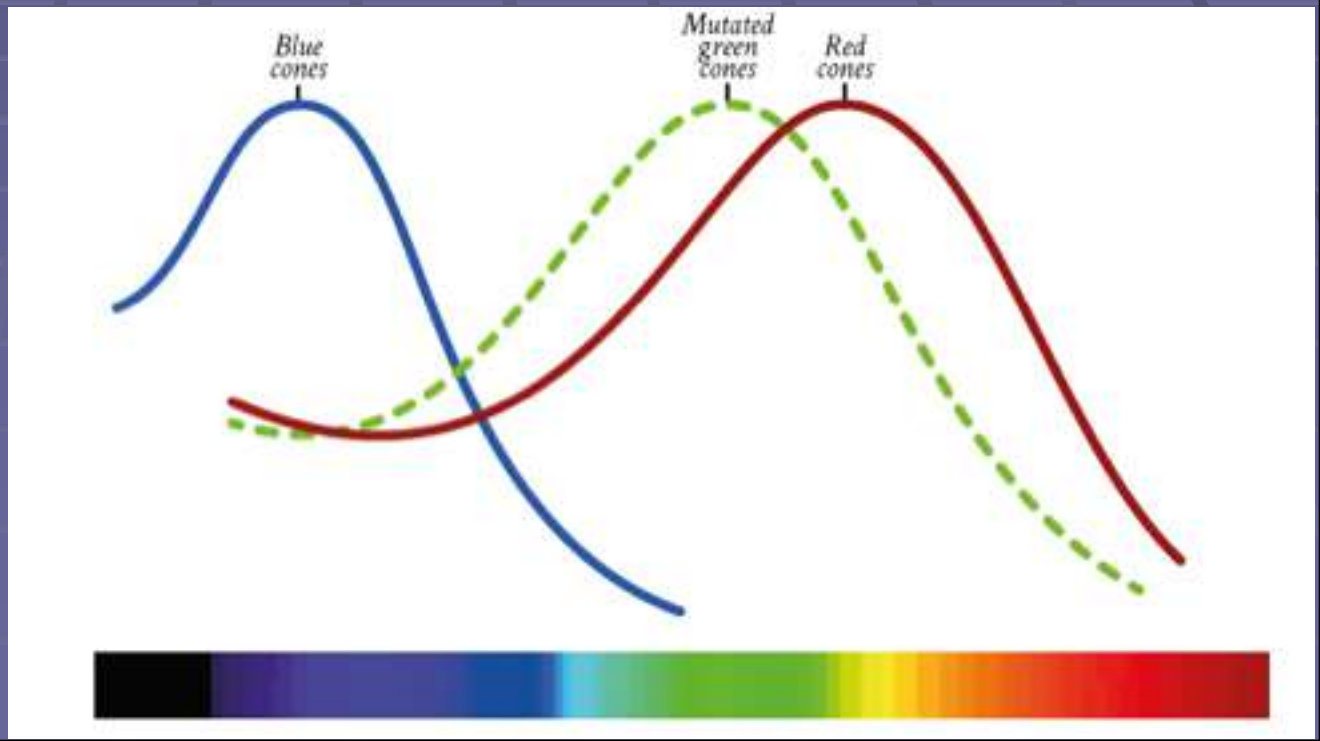


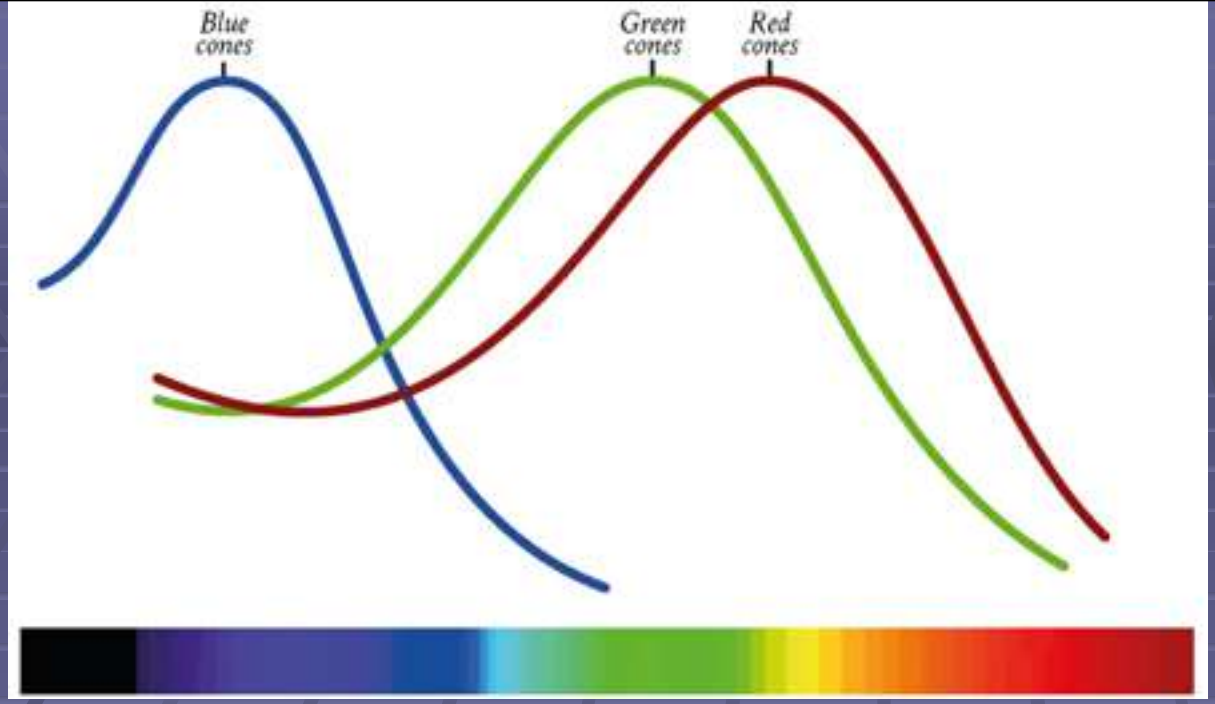
42 VS 4 “green” / 2 “red”

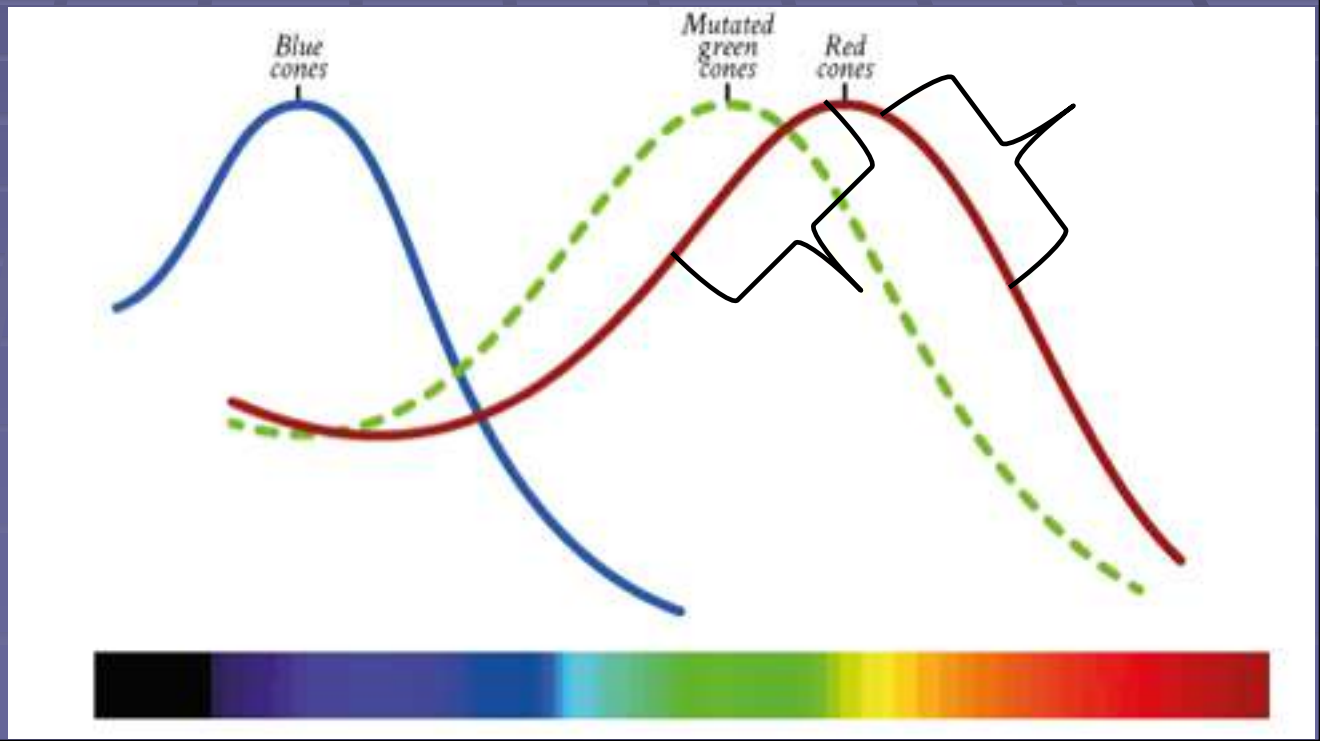
Color Blindness

Type	Prevalence
Deuteranomaly (green)	%4.63
Deuteranopia (green)	%1.27
Protanomaly (red)	%1.08
Protanopia (red)	%1.01
Tritanomaly (blue)	%0.02
Tritanopia (blue)	%0.03


Blue cones
Green cones
Red cones


Blue cones
Mutated green cones
Red cones


Blue cones
Green cones
Red cones


Blue cones
Mutated green cones
Red cones

Type	Problematic colors
Deuteran (green)	Green/red, green/blue, green/gray, green/brown, blue/purple, orange/red, yellow/orange.
Protan (red)	purple/dark blue, orange/green, brown/dark green, red/brown, green/yellow, gray/purple
Tritan (blue)	blue/yellow, violet/yellow-green, red/red-purple, dark blue/black, yellow/white