

GO SEE THE OPTICAL ILLUSIONS PAGE

SPECIAL SENSES – EYE

Three tunics form the 'globe' of the eye:

Fibrous tunic (outer most layer)

1. Sclera - dense CT: 'white' of the eye
 - a. attachment site for extrinsic eye muscles
 - b. elastic/mechanical support for globe
2. Cornea
 - a. modified sclera (1/6th of globe)
 - b. nonvascular, several nerve endings
 - c. transparent bulge @ anterior surface
 - d. bulge refracts light before it hits lens

Vascular tunic (middle layer)

1. Choroid - inner-surface of globe (posterior)
 - a. vascular = helps nourish retina
 - b. black pigmentation absorbs "stray" light
2. Ciliary body - composed of muscle & ligaments
 - a. ciliary muscle - circular, sphincter-like muscle
 - b. suspensory ligaments - suspension of lens
3. Iris - "colored" pigmented portion of eye
 - a. muscular diaphragm made up of smooth muscle
 - b. iris controls diameter of pupil (hole)
 - c. separates ant./post. chambers of the anterior cavity

Neural tunic: Retina

1. Retina has two distinct layers:
 - a. posterior pigmented layer
 - dark pigmentation absorbs stray light
 - supports anterior neural layer....
 - b. anterior neural layer contains (9 layers)
 - ~130 million photoreceptors in a circular sheet
 - neurons = integration & preliminary processing
 - blood vessels, more nerves!

2. Light must pass thru 9 layers of neurons & vessels
 - eventually absorbed by posterior pigmented layer
 - 30% of entering light is actually '*perceived*'

3. Blind spot - point where optic nerve exits globe

4. Photoreceptor cells (rods and cones)
 - a. rods for dim light (125 million per eye)
 - b. cones for color vision (6 million per eye)
 - requires 'high-energy' = bright light
 - cone receptors tuned to specific wave-lengths
 - absence of any one type of cone = color blindness

5. Macula lutea & the fovea centralis
 - center of visual axis
 - contains high concentration of cones
 - spot of greatest resolution (sharpest focus)

Eye Cavities

1. Anterior cavity - anterior to the lens (two chambers)
 - a. anterior chamber - anterior to the iris
 - b. posterior chamber - posterior to the iris
 - c. **aqueous** humor (~ CSF) fills anterior cavity
 - produced by the ciliary process
 - returned to blood supply via canal of Schlemm
 - helps control intra-ocular pressure
2. Posterior cavity - posterior to the lens
 - a. **vitreous** humor (gel-like) fills posterior cavity
 - assists sclera in maintaining shape of eyeball

Accessory structures of the orbit:

1. Conjunctiva -
 - a. single cell layer (skin) covers anterior surface of eye
 - b. conjunctivitis = "pink-eye", conjunctival inflammation
2. Palpebrae - upper & lower eyelids
3. Canthi - medial (caruncle) & lateral canthus
4. Lacrimal gland - superolateral corner of orbit
 - a. secretes tears that bathe conjunctiva & cornea
 - b. wash, moisten, minimize friction
5. Lacrimal apparatus -
 - a. tears are squeezed into caruncle with each eye-blink
 - b. tears drain through (lacrimal puncta) into canaliculi
 - c. nasolacrimal sac > nasolacrimal duct > nasal cavity
6. Trochlea - sling of CT for superior oblique muscle

Extra-orbital musculature

1. *Levator palpebrae superioris* - lifts upper eyelid (CN III)
2. *Orbicularis oculi* - (sphincter) closes both eyelids (CN VII)

Extrinsic eye muscles:

<u>Muscle</u>	<u>CN</u>	<u>Movement</u>
<i>Lateral rectus</i>	Abducens*	Lateral
<i>Medial rectus</i>	Oculomotor	Medial
<i>Superior rectus</i>	Oculomotor	Superior
<i>Inferior rectus</i>	Oculomotor	Inferior
<i>Superior oblique</i>	Trochlear*	Inferior/ABDuction
<i>Inferior oblique</i>	Oculomotor	Superior/ABDuction

See the connections?

Trochlear (CN IV) ... *Trochlear ligament in orbit*
ABDucens (CN VI) ... *ABDuction*

Learning Device: SO₄LR₆

Obliques = ABDuction

Intrinsic muscles of the eye

Ciliary muscle (CN III) = internal ring of muscle (sphincter)

- contraction of ciliary muscle reduces diameter of sclera
- scleral diameter controls tension on suspensory lig.s
- suspensory ligaments affect stretch/shape of lens
- shape of lens affects the eye's ability to focus

** Note: ciliary muscles do NOT pull on suspensory ligs.!*

Iris (CN III) = circular & radial muscle groups (antagonists)

- sympathetic stimulation > dilation of pupil
- parasympathetic stimulation > contraction of pupil
- = regulates amount of light that passes to retina

Lens

1. thick biconvex disc of specialized fibers
2. orientation of fibers makes the lens transparent
3. no BV's present

Accommodation - ability to focus

a. requires change in lens shape

- little or no lens movement

b. close objects?

- ciliary muscles contract, ligaments sag & lens bulges

c. far objects?

- ciliary muscles relax, ligaments tighten & lens thins

Presbyopia - (*old + man + sight*)

- a. lens proteins become "stiffer" with old age
- b. ability of lens to change shape, slows considerably
- c. refractive properties of lens also change
- d. can't focus on near objects = far-sighted

Cataracts - (abnormal lens)

- a. combo of structural/bio-mechanical problems
- b. lens becomes cloudy
 - less light passes to retina
 - focusing becomes "patchy" across retina