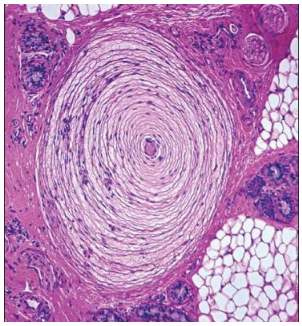
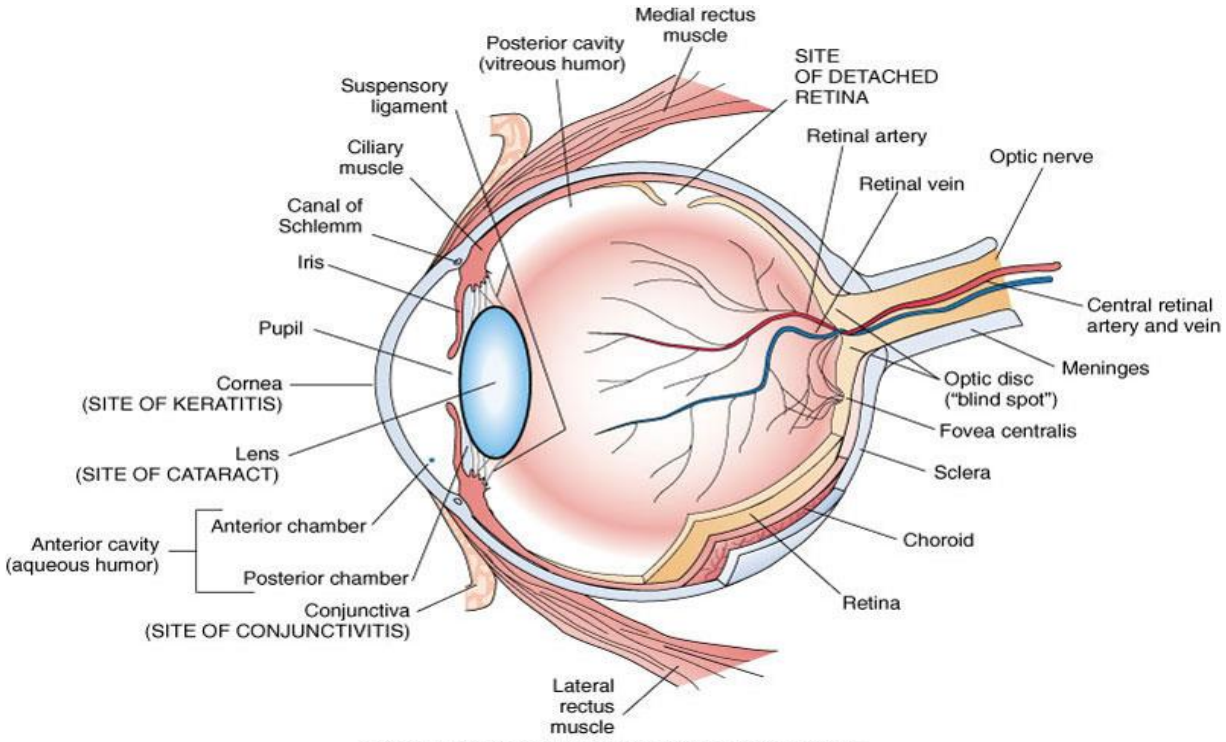
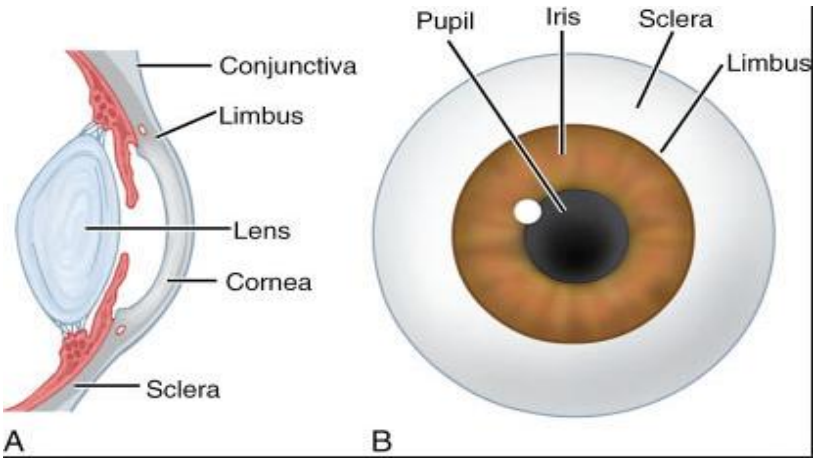
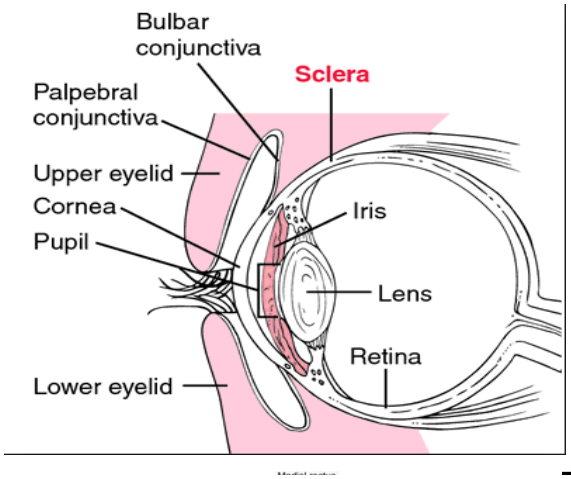
BIOS 2015 … CHAPTER 15- Eyes, Ears and Other Sensory Organs

Page	Note
	Sensory receptors are microscopic anatomic structures that allow a stimulus to be felt and perceived as a particular type of stimulus like pressure, temperature, etc…
	 To the left is a microscopic view of a Paccinian corpuscle that converts pressure into a nerve signal - it is a "pressure receptor". For example: It allows you to sense pressure in your finger tips so that you can tell how hard you are pressing your finger on a surface.
	Nomenclature:
	Exteroceptors: - Located close to body surface (cutaneous receptors) Examples—touch, pressure, temperature, pain **Visceroreceptors** - Located internally around the viscera **Proprioceptors** - Muscle sense
	Mechanoreceptors - Stimulated by mechanical force(s) - Touch, pressure, equilibrium, hearing **Chemoreceptors** - Change in chemical concentration - Taste, smell **Thermoreceptors** -Stimulated by change in the temperature - Warm and cold receptors
	Photoreceptors - Respond to light - Rods and cones in the retina (eye) **Nociceptors** - Respond to any tissue damage - Results in pain **Osmoreceptors** - Recognize changes in the osmolarity of body fluids - Concentrated in the hypothalamus

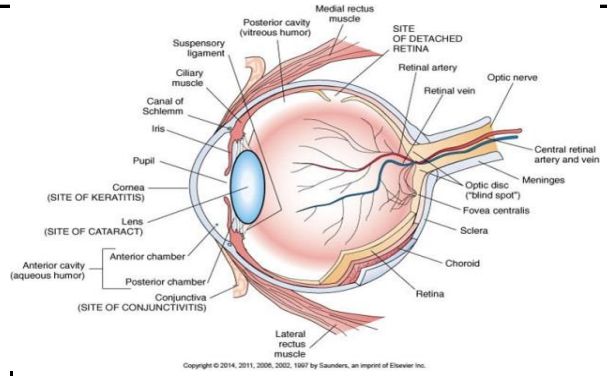
The EYE





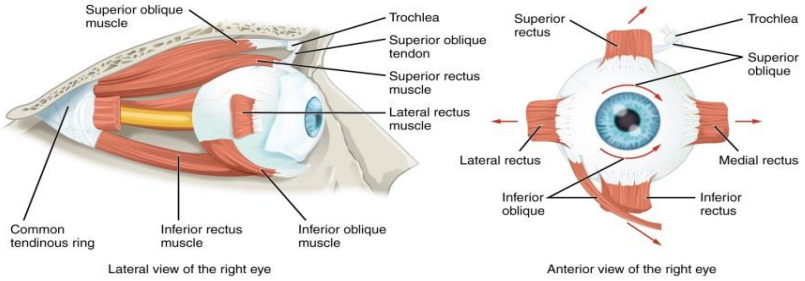


Find:
Pupil – hole in iris.
Iris – colored part behind cornea.
Sclera – white of eye continuous with the cornea that is clear.
Conjunctiva – lining of inner eyelid.



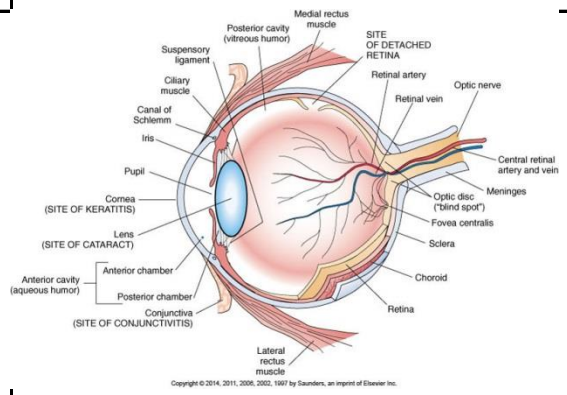
Anterior cavity
Between cornea and lens
Filled with aqueous humor
Amount formed should be equal to the amount reabsorbed—maintenance of normal intraocular pressure (IOP) below 24 mm Hg

Posterior cavity
Space between lens and retina



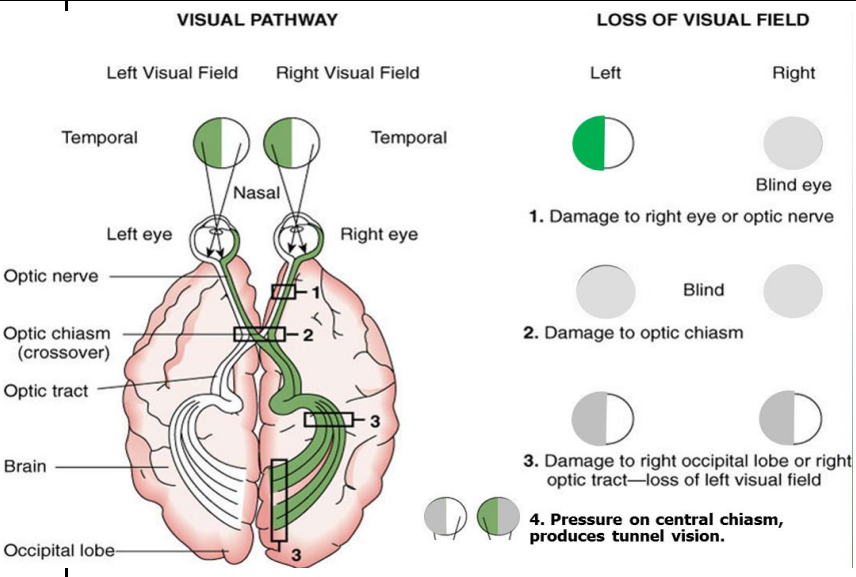
Extraocular Muscles:
- innevated by cranial nerves III, IV and VI.
- move eye up, down, right, left.

(you do not have to memorize the names of the muscles)



Light rays enter the eye through the cornea and pass through the lens to the receptor cells of the retina:
Rods—black and white vision
Cones—color vision

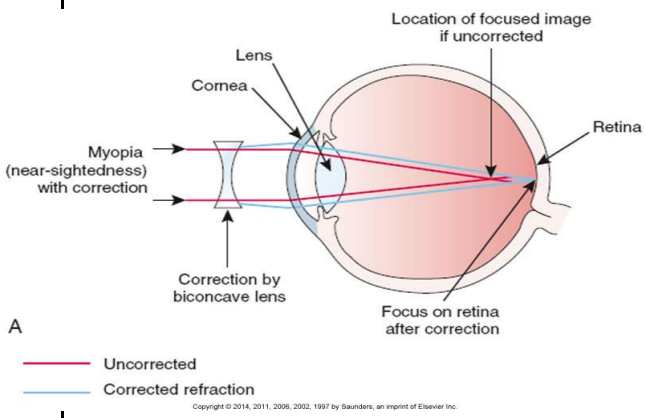
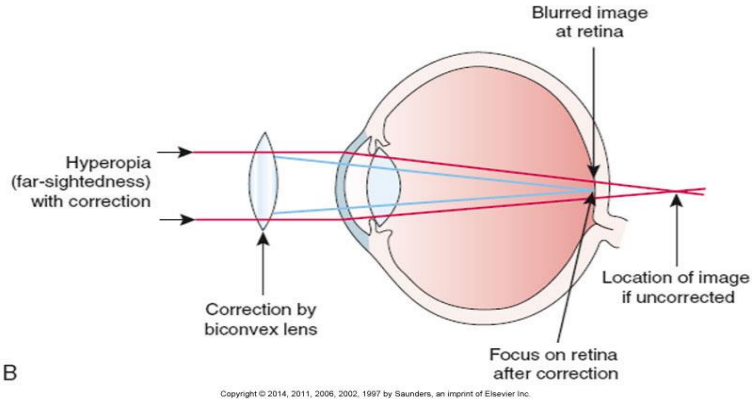
Visual stimuli are conducted by the optic nerve to the occipital lobe.



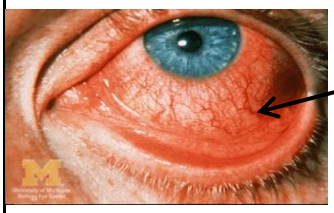
Light rays pass through cornea and are focused by the lens on the retina.

Retinal Nerve fibers form the optic nerve (CN II)

In the "Optic chiasm", fibers cross (see picture next slide), so that the left occipital lobes receive images from right visual fields, right occipital lobes from left visual fields.

	Diagnostic Tests
	Snellen chart (or similar test) - Measures visual acuity **Visual field test** - Checks for central and peripheral vision **Tonometry** - Assessment of Intraocular pressure. **Ophthalmoscope** - Visually examines internal structures, lets you look at the retina through the cornea.
	Structural Defects of the Eye
	Myopia - Nearsightedness - Image focused in front of the lens **Hyperopia** - Farsightedness - Eyeball is too short - Image focused behind the retina
	 
	Astigmatism - Irregular curvature in the cornea or lens **Strabismus (squint or cross-eyed)** - Results from deviation of one eye - Double vision (diplopia) - May be caused by weak or hypertonic muscle, short muscle, neurological defect

Infections and Trauma



Stye
- Infection involving a hair follicle on the eyelid
- Usually caused by staphylococci
- Swollen, red mass forms on eyelid
- Purulent exudate

Other infections
- Conjunctivitis, or "pink eye"

Conjunctivitis

Superficial inflammation or infection caused by:
- Allergens, irritating chemicals, bacteria, viruses

Etiologies:
- Virus is common in adults.
- Bacteria include: Staph., Strep. , H. Flu B

Spread by fingers or contaminated towels
- Occurs with contact lens use, contaminated makeup, contaminated medication

Antibiotic treatment to prevent damage to cornea

Other causes of conjunctivitis:

Chlamydia trachomatis and Neisseria gonorrhoeae
Both cause infections in the reproductive tract.
May infect eyes of newborns
May be transferred by self-inoculation

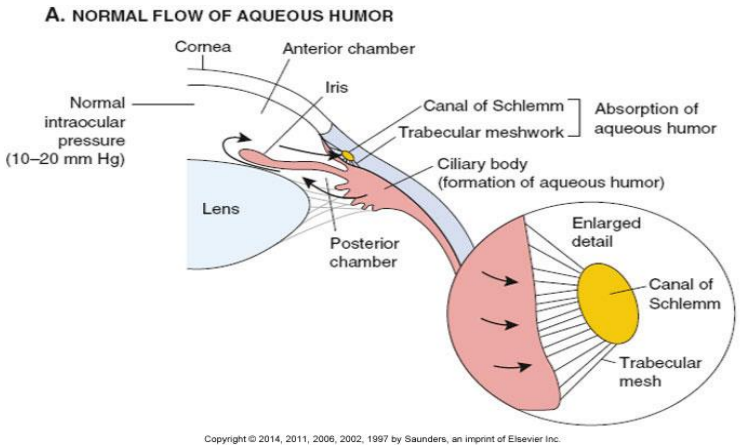
Keratitis

Develops when cornea is infected or irritated
- Herpes simplex can be cause
  Transfer from herpes lesion around mouth
  Transfer by fingers, dental office, spray of contaminated saliva
- Severe pain and photophobia
- Increased risk of ulceration eroding the cornea
- Scar tissue formation interferes with vision.

Trauma is another etiology:
Damage from chemicals, splashes, fumes.

Glaucoma

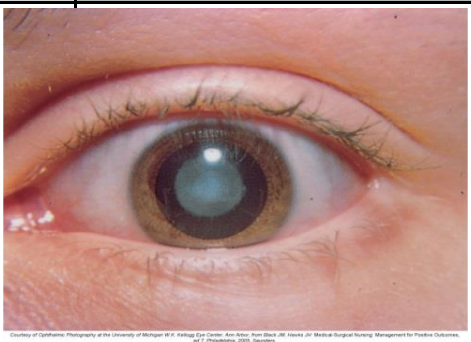
Result of increased IOP caused by excessive accumulation of aqueous humor
Most common and preventable loss of vision in developed countries
May be acute or chronic
Signs and symptoms
Halos around lights at night
Loss of peripheral vision
Pain may occur if IOP is greatly increased, as in acute form



Aqueous humor is produced in the ciliary body and absorbed in the Canal of Schlemm.

If production is greater than absorption (example: from block of canals of Schlemm) then pressure increases in the anterior chamber causing glaucoma.

Cataracts



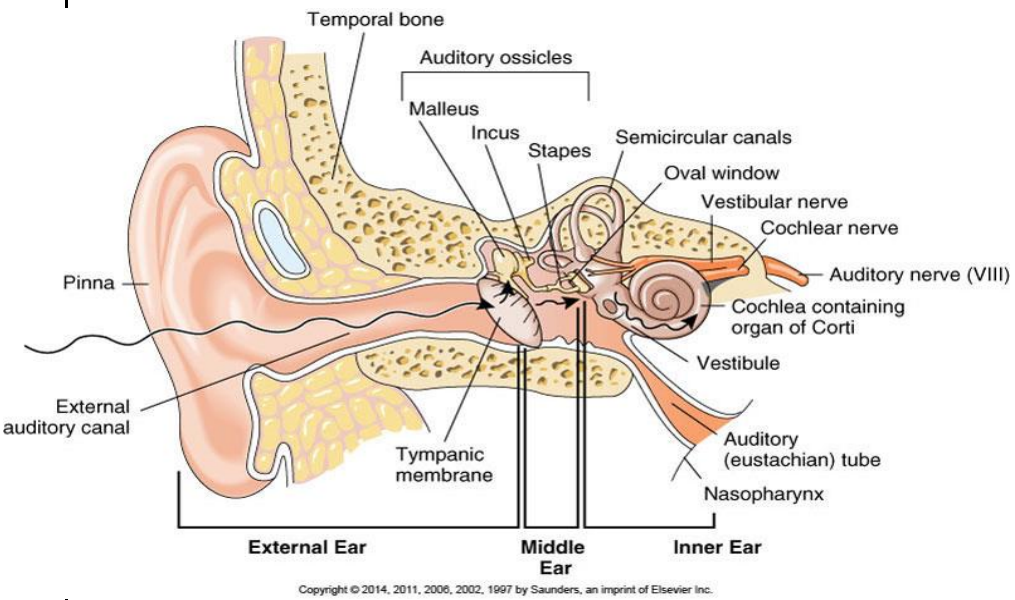
Progressive opacity or clouding of the lens
- Interferes with light transmission
- Size, site, and density of clouding vary among individuals.
- May be different in individual's two eyes

Changes may be:
- Age-related or caused by metabolic abnormalities
- Excessive exposure to sunlight
- Congenital
- Traumatic

Detached Retina

Acute emergency
Retina tears away from underlying choroid
Retinal ischemia can lead to irreversible loss of receptors.
No pain or discomfort
Visual field contains areas of blackness (scotomas), as if a curtain has fallen over the eye.

Ear



External ear
- Pinna and external auditory meatus (canal)

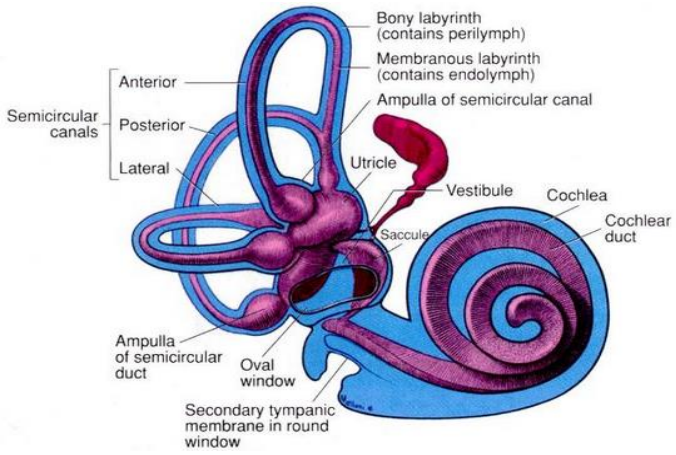
Middle ear
- Tympanic membrane
- Bony ossicles
- Auditory tube connects to upper respiratory tract

Inner ear
- Cochlea
- Organ of Corti—hearing
- Semicircular canals

Balance and equilibrium

Pathway of Sound

1. Sound waves enter the external ear canals.
2. Vibration of the tympanic membrane causes the ossicles to vibrate.
3. Motion of stapes against oval window initiates movement of the fluid in the cochlea.
   - Stimulates the hair cells in the organ of Corti
   - Initiates nerve impulses
4. Impulses are conducted to the auditory area in the temporal lobe for interpretation of sound



Three semicircular canals at right angles to each other measure equilibrium and balance in 3 dimensions.

At one end of each canal is a swelling, the ampulla, that has sensors that are stimulated by movement of fluid (called endolymph) in the canal.

Nausea from motion sickness is caused due to chaotic signals from the semicircular canals.

Meniere's syndrome - excessive production of endolymph causes episodes of vertigo (dizziness with visual disturbance - room appears to be

Hearing Loss

Two types

1. Conduction deafness

- Sound is blocked in the external ear or middle ear.
- **Accumulation of wax, foreign object, scar tissue**
- Otosclerosis of the ossicles

2. **Sensorineural impairment**

- **Damage to the organ of Corti or auditory nerve**
- **Infection**
- Head trauma
- Neurological disorders
- **Ototoxic drugs**
- Sudden very loud sounds or prolonged exposure to loud noise
- **Congenital defects**

Infections

Otitis Externa: Infection of external ear canal, Known as "swimmer's ear".

Otitis Media: Infection of middle ear.

- May require drainage by a small incision (myringotomy) in the ear drum. Sometimes a tube is inserted.
- **Pathogenesis:**

  Eustachian tube blocked (swelling from allergy or virus).

  Fluid collects in middle ear.

  Fluid gets infected (from nasopharyngeal bacteria).