Anatomy and Physiology

Nervous System – Part 2
External View of the Eye

- Eyebrow
- Eyelashes
- Pupil
- Iris
- Lateral angle (canthus)
- Sclera
- Epicantal fold
- Palpebral fissure

A. Medial angle (canthus)  Lacrimal caruncle  Lower (inferior) eyelid
B. Semilunar fold  Upper (superior) eyelid

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Eyeball Anatomy

3 layers:
- Supporting or fibrous layer
- Vascular layer
- Retinal or neural layer
Eyeball Anatomy

Supporting or fibrous layer
Outermost or superficial coating of the eyeball
Light enters through the cornea
Sclera is a dense tissue that provides shape to the eyeball
Eyeball Anatomy

**Vascular layer**

**Choroid** contains abundant blood vessels

**Ciliary body** = ciliary process (aqueous humor) + ciliary muscle (alters shape of lens)

**Iris** = colored portion of eyeball

**Pupil** = hole in center of iris
Eyeball Anatomy

Retinal layer

Innermost layer of eyeball

Retina & optic disc

Fovea centralis is the area with the greatest visual acuity
Eyeball Anatomy

Retinal Cells

Photoreceptors (rods & cones), Bipolar cells & Ganglion cells
Chambers of the Eye

Anterior Chamber
B/w cornea & iris
Filled with aqueous humor which nourishes the lens and the cornea
Intraocular pressure and glaucoma
Open-Angle Glaucoma

Open-angle glaucoma is the more common type of glaucoma and usually affects both eyes. In open-angle glaucoma, the pressure increases slowly, even though the drainage channel for the fluid is open and the size (angle) of the chamber is normal. Without treatment, the high pressure can damage the optic nerve and cause blindness. Open-angle glaucoma occurs most often in people over age 35, but it sometimes occurs in children. It tends to run in families and is more common among African Americans.
Open-Angle Glaucoma

Open-angle glaucoma will gradually worsen if not treated. Blind spots occur first in side vision and later, central vision may become affected. Any resulting vision loss is permanent because nerve cells that have been damaged cannot be restored, but the proper treatment can prevent additional damage. Open-angle glaucoma often has no symptoms in the early stages and is usually diagnosed during an eye exam. A glaucoma screening will detect pressure inside the eye but a comprehensive eye exam is typically performed for a complete diagnosis.
Closed-Angle Glaucoma

Closed-angle glaucoma is a blockage caused by a change in the position of the iris (the colored part of the eye). The change in position causes the iris to block the drainage channels. This type of glaucoma usually happens in one eye at a time. When this type of glaucoma happens suddenly, it is called acute closed-angle glaucoma and is a medical emergency. Symptoms may include:

- severe pain in and above your eye
- hazy or foggy vision
- halos around lights
- headache
- redness and watering of the eye
- a dilated pupil that doesn't close normally in response to light
- nausea and vomiting
Chambers of the Eye

**Posterior Chamber**

Between the lens and the retina

Filled with vitreous humor
View from the Ophthalmoscope

Extrinsic Eye Muscles

Superior rectus, inferior rectus, lateral rectus, medial rectus, superior oblique, and inferior oblique.
The formation of images on the retina consists of 3 events:

- Light refraction
- Accommodation
- Changes in pupil diameter
Light Refraction

Bending of light as it passes through mediums of different density

Refraction occurs at both the cornea & lens

Images focused on retina are inverted
Accommodation

Process by which the curvature of the lens is changed when focusing on near objects.

Curvature is affected by contraction of ciliary muscle and the elastic nature of the lens.

Over time the lens loses elasticity and its ability to accommodate (presbyopia).
Abnormalities of Refraction

Myopia = near-sightedness

Hyperopia = far-sightedness
The circular muscle of the iris contract to produce constriction of the pupil. This prevents too much light from entering the eye through the periphery of the lens.
ANY QUESTIONS ?
Olfactory receptors (neurons) are located in the nasal mucosa; their axons pass through the ethmoid bone and synapse with other neurons in the olfactory bulbs.
The perception of odors occurs in the temporal lobes, but other areas of the brain are involved as well.
Anatomy of the Ear

External ear
Auricle
External auditory canal
Tympanic membrane divides external ear from middle ear
Anatomy of the Ear

Middle ear
Eustachian (auditory) tube
Ossicles
Oval window
Round window
Anatomy of the Ear

**Inner ear**
- Cochlea
- Spiral organ of Corti
- Semicircular canals
- CN VIII

**External ear**
- Auricle (pinna)

**Middle ear**
- Temporal bone
- External auditory meatus
- Tympanic membrane

**Inner ear**
- Semicircular canals
- Oval window
- Facial nerve
- Vestibular nerve
- Cochlear nerve
- Cochlea
- Vestibule
- Auditory tube
- Auditory ossicles
- Malleus
- Incus
- Stapes

Acoustic nerve (VIII)
Anatomy of the Cochlea

3 spiral ducts
Scala vestibuli
Scala tympani
Scala media or cochlear duct
Anatomy of the Cochlea

The cochlear duct is separated from the scala vestibuli by the vestibular membrane and from the scala tympani by the basilar membrane.

The cochlea is filled with 2 types of fluid: perilymph and endolymph.
Resting on the basilar membrane is the spiral organ of Corti which consists of many supporting cells and hair cells.
When sound waves strike the eardrum, it vibrates back & forth – this rocking motion is transferred to the ossicles, which in turn vibrate. As the stapes rocks back & forth against the oval window ……..
its sets the perilymph in the scala vestibuli into a similar back & forth motion.

Pressure waves descend through the flexible vestibular membrane, then through the endolymph of the cochlear duct, and finally through the basilar membrane.
Physiology of Hearing

Diagram showing the anatomy of the ear, including the Malleus, Incus, Stapes, Cochlear duct, Cochlear nerve, Tympanic membrane, External auditory canal, Oval window, Auditory tube, Hair cells on organ of Corti.
Physiology of Hearing

Anatomy of the Cochlea

- Spiral ganglion
- Vestibular membrane
- Oval window
- Vestibular membrane
- Cochlear duct (scala media)
- Scala vestibuli
- Scala tympani
- Cochlear duct
- Tectorial membrane
- Organ of Corti
- Basilar membrane
- Outer hair cells
- Supporting cells
- Basilar membrane
- Inner hair cell
- Fibers of cochlear nerve
- Hairs (stereocilia)

Back to spiral organ.... the tips of the hairs are embedded within and firmly bound to the tectorial membrane above the spiral organ of Corti.
Physiology of Hearing

As the basilar membrane vibrates, the bending of the hair cells is transduced into electrical signals that travel via CN VIII to the temporal lobes.
Gustation

The taste buds are the sense organs of taste. They contain both supporting cells and the gustatory cells, which generate the electrical impulses ultimately interpreted by the brain as taste.
Gustation

Chemicals dissolved in the saliva help stimulate the gustatory cells. The electrical impulses that are generated travel to the brain via CN VII and CN IX.
ANY QUESTIONS ?