- **Dorsal column-medial lemniscal system:**
- Contains large myelinated nerve fibers for fast transmission (30-110 m/sec), usually A beta fibers .
- Modalities: Fine touch, vibration, position, fine pressure and stereognosis.
- Dorsal column has better intensity gradation than AL-STP, which is less differences between stimuli because it transmits the signal faster.
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- The nerves of nervous system develop from **ectoderm**.
- **Anterolateral system (SPINOTHALAMIC PATHWAY SYSTEM):**
- Low degree of spatial and temporal orientation because of the slow conducting fibers and there is a lot of divergence.
- Modalities: Pain, thermal sensations, crude touch and pressure (poorly localized), tickle and itch, sexual sensations.
- for pain it goes to intralaminar nuclei
- Remember, the higher the speed of transmission the higher degree of spatial orientation.

- 3D position of the sensation related to **somatic association area .**

✓ Corticofugal fibers

- Descending fibers from the cortex back to the sensory relay areas of thalamus, medulla and spinal cord.
- These fibers are inhibitory, they can suppress the sensory input (negative feedback).
- Function to decrease the spread of a signal and sharpen the degree of contrast and adjust the sensitivity of the system.

- Bradykinin: Very important substance in exciting pain, It is produced by the activation of kallikrein system that acts on Kinins. Bradykinin sensitizes pain receptors.
- The local increase in potassium ion concentration and action of enzymes can contribute to pain as well.
- Some pain fibers go to the intralaminar nuclei VPL and VPM). The fibers that go there are important for the emotional aspect of pain.
- Remember that reaching the cerebral cortex is important for pain localization).
- most of the fast pain fibers terminate at the level of the cerebral cortex, while most of the slow pain fibers terminate at the level of the reticular formation, tectal area of the midbrain and periaqueductal grey matter
- slow pain is poorly localized, while fast better localized
- the difference between well and poorly localized is the reaching cerebral cortex or not.
- analgesic system of the brain descend ipsilateraly. the pain is suppressed before the signal crosses to the other side of the spinal cord.
- Enkephalin is believed to cause both pre- and post-synaptic inhibition of type C and type Ad pain fibers where they synapse in the dorsal horns.
- The enkephalins and dynorphin are found in the brain stem and spinal cord.
- The b endorphin is found in the hypothalamus and the pituitary.
- G cells (the tonically active inhibitory neurons).
- Viscera have very few pain receptors.
- Thermal receptors adapt to the stimulus but not completely.
- Cold or warm temperature is thought to change the metabolic rate of the receptor.
- Thermal adaptation starts as fast adaptation then slow adaptation, but there is no complete adaptation to temperature.

- vitreous humor derived from the embryonic mesenchyme.
- aqueous humor It's almost always in a constant dynamic amount, because it gets produced by the ciliary processes of the ciliary body at a rate of 2-3 microliters/min then it flows between the ligaments of the lens, through the pupil into the anterior chamber, goes between the cornea and the iris, through a meshwork of trabeculae to enter the **canal of schlemm** which empties into aqueous veins and then into extraocular veins.
- intraocular pressure Normally 15 mm Hg with a range of 12-20 mm Hg.
- An increase in intraocular pressure caused by an increase in resistance to outflow of aqueous humor through the canal of schlemm can subsequently cause a form of damage to the optic nerve resulting in a condition called Glaucoma.
- The refractive index is the ratio of the speed of light in air to the speed of light in the substance.
- The degree of refraction and the resulting degree of angulation of light increases as the difference in their R.I. increases.
- A shorter focal length indicates MORE power
- The unit used to express the power is called a Diopter NOT a Degree
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$$\underset{\text{(power)}}{Diopter} = \frac{1}{(focal\ length\ in\ meters)}$$

- changing the convexity of the lens changes the power (positive relation), and the focal length (inverse relation).
- the eye has a total refractive power of 59 diopters
- Most of the refractive power of the eye results from the surface of the cornea
- Accommodation is necessary to focus the image on the retina.
- CONtraction – more CONvexity / Laxity – Less convexity
- the pupil constrict more when looking near and dilate more when looking at distant objects.
- Presbyopia is the Inability to Accommodate
- for normal people eyes the **near point** is about (25 cm)
- Astigmatism; another fovea within the same retina, We fix it by using cylindrical lenses that help focus the wrong plane correctly.
- Meaning that a person with normal visual acuity looking at two bright points of light 10
- meters away can barely distinguish the spots as separate entities when they are 1.5 to 2 millimeters apart.
- fovea centralis contains cones only.
- The only type of cells that respond by action potential in the eye is the ganglionic cells.
- Receptor potential is proportional to the logarithm of the light intensity.
- Corticofugal information increases sensitivity.
- The pigment portion of the photosensitive molecule (11-cis retinal) is the same in the cones as in the rods.
- **color blindness** is due to lack of a particular type of cone.
- lack of a red cone : Protanope.
- lack of a green cone : Deuteranope.
- The only cells which generate action potential are ganglion cells, and some amacrine cells.
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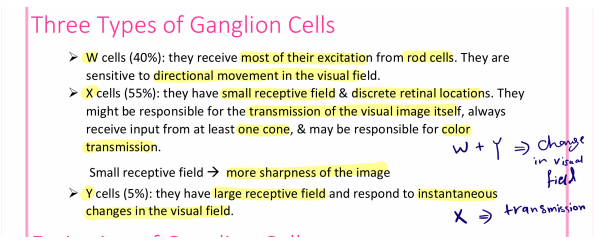
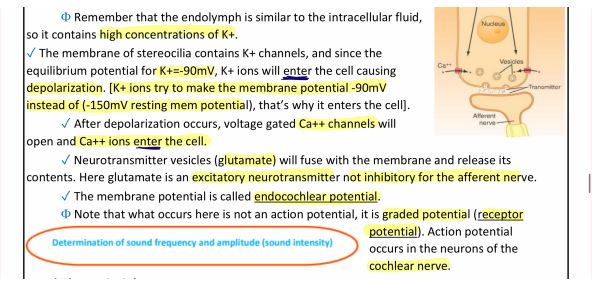


- fibers coming from nasal retina are affected if optic chiasm affected
- From the optic tracts to the suprachiasmatic nucleus of the hypothalamus. This pathway is important to control circadian rhythms (biological clock)
- Ventral lateral geniculate, to help control some of the body's behavioral functions.
- Damage to optic tract would lead to loss of vision from the opposite side of visual field
- Signals from one eye enter the columns, **alternating** with signals from the other eye (عشان هيك بنشوف صورة وحدة).
- the parasympathetic fibers excite the ciliary muscle and sphincter of the iris.
- accommodation results from contraction or relaxation of the ciliary muscle.
- Humans can hear sound intensities between (0-120 dB)
- Tensor tympani muscle (Trigeminal nerve/V mandibular): attached to the tympanic membrane, contracts and pulls the ossicular system & tympanic membrane inside.
- Stapedius muscle (facial/VII): attached to the stapes, contracts & pulls the stapes outward
- The outer cell layers of the hair cells of the ear are mainly supplied by efferent neurons from the cortex. while the inner cell layer is mainly supplied by afferent neurons; they transmit auditory signals.
- bony center of the cochlea (the modiolus)
- the basilar membrane is organized tonotopically, which **means** that it is organized according to the tone.
- 

- At the helicotrema site of the basilar membrane, there is discrimination of sound waves at very high range.
- medial geniculate nucleus for auditory
- lateral geniculate nucleus for vision
- superior colliculus for vision
- inferior colliculus for auditory
- If you have conductive hearing loss, the bone conduction is heard for longer than the air conduction sound.
- If you have sensorineural hearing loss, air conduction is heard for longer than bone conduction, but may not be twice as long.
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