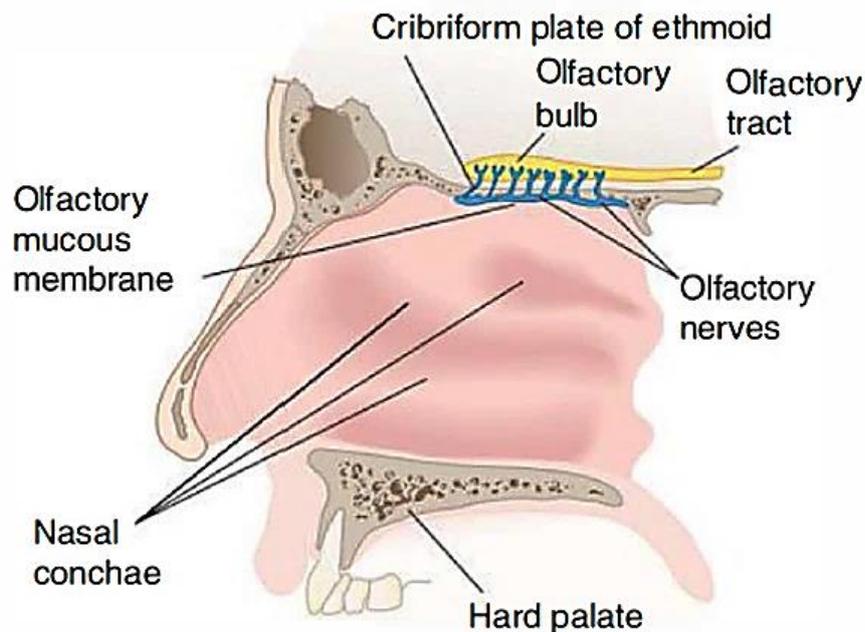


Cranial nerves and special senses

- ✚ The 12 pairs of cranial nerves are referred to by either name or Roman numeral named according to their order in exist from the brain and from the skull.
- ✚ The optic nerve are not true nerves but rather fiber tracts of the brain, whereas nerve XI (the spinal accessory nerve) is derived, in part, from the upper cervical segments of the spinal cord. The remaining nine pairs relate to the brain stem.
- ✚ Cranial nerve fibers with motor functions arise from the motor nuclei that lie deep within the brain stem; they are homologous to the anterior horn cells of the spinal cord.
- ✚ Cranial nerve fibers with sensory functions have their cells of origin (first-order nuclei) outside the brain stem, usually in ganglia that are homologous to the dorsal root ganglia of the spinal nerves.
- ✚ Nerves **I, II, and VIII** are the special sensory input.
- ✚ Nerves **III, IV, and VI** control eye movements and pupillary constriction.
- ✚ Nerves **XI and XII** are pure motor.
- ✚ Nerves **V, VII, IX, and X** are mixed.
- ✚ Nerves **III, VII, IX, and X** carry parasympathetic fibers.

I. Olfactory nerve

- ✚ There are 9 to 15 olfactory nerves that are short connections that project from the olfactory mucosa within the nose to the olfactory bulb within the cranial cavity on each side of the brain.
- ✚ They arise from the olfactory receptor cells in the nose.
- ✚ The olfactory bulb lies just above the cribriform plate and below the frontal lobe (nestled within the olfactory sulcus).
- ✚ Axons from the olfactory bulb run within the olfactory stalk, synapse in the anterior olfactory nucleus, and terminate in the:
 1. **Primary olfactory area:** located in the uncus.
 2. **Olfactory association area (area 28):** in the anterior part of the parahippocampal gyrus.
- ✚ **Effect of lesion:** partial or complete loss of smell.

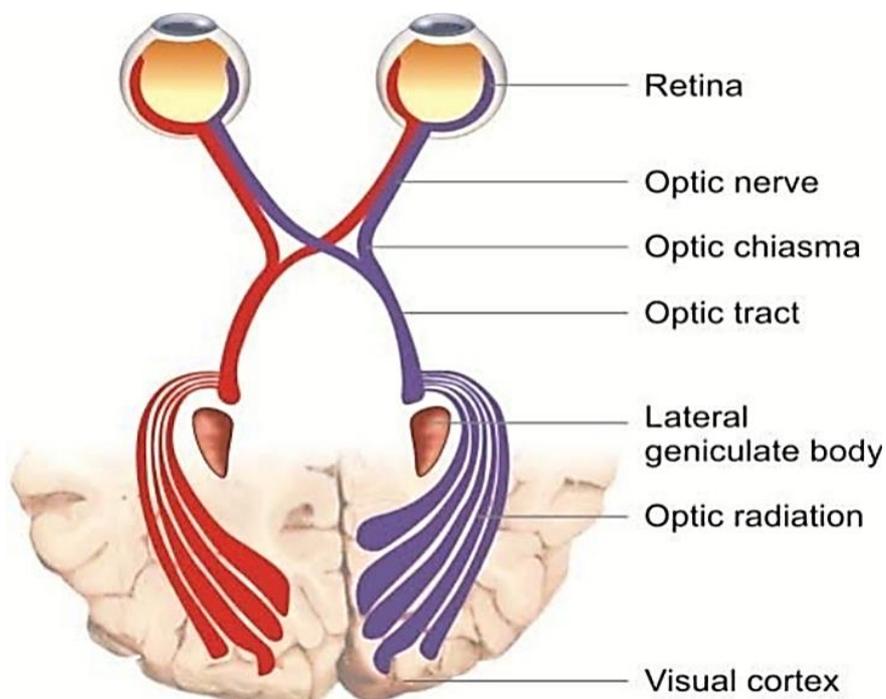


II. Optic nerve & Visual pathway

- ✦ The optic nerve contains myelinated axons that arise from the ganglion cells in the retina.
- ✦ The axons within the optic nerve are myelinated by oligodendrocytes.
- ✦ It contains a central retinal artery and vein.
- ✦ It is covered by the brain meninges and CSF.
- ✦ The optic nerve passes through the optic papilla to the orbit.

Visual pathway

- ✦ Retina to optic nerve → optic chiasma.
- ✦ In the optic chiasma, the temporal fibers enter the ipsilateral optic tract, while the nasal fibers cross the midline and enter the contralateral optic tract → lateral geniculate body.
- ✦ From the lateral geniculate body axons form the optic radiation → to the retrolenticular part of the internal capsule → the primary visual area (area 17) → the visual association areas (areas 18 & 19) for recognition of what we see.



MCQ :-

1. A lesion in the optic nerve leads to: Total blindness of the same eye
2. A central lesion at the optic chiasma causes: Bitemporal hemianopia
3. Which of the following is most commonly associated with a pituitary tumor? Bitemporal hemianopia
4. A lesion in the optic tract results in: Contralateral homonymous hemianopia
5. A lesion in the lateral geniculate body causes: Contralateral homonymous hemianopia
6. A total lesion in the visual cortex leads to: Contralateral homonymous hemianopia with macular sparing
7. A lesion in the cuneus (above calcarine sulcus) results in: Contralateral homonymous lower quadrant anopia
8. A lesion in the lingual gyrus (below calcarine sulcus) causes: Contralateral homonymous upper quadrant anopia

✚ Lesions of the Visual Pathway

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1. **Optic nerve:** total blindness of the same eye.

2. **Optic chiasma:**

☒ **Midline (central) lesion:** bitemporal hemianopia. It is usually due to a pituitary tumor.

☒ **Peripheral lesion on the two sides:** binasal hemianopia.

3. **Optic tract:** contralateral homonymous hemianopia.

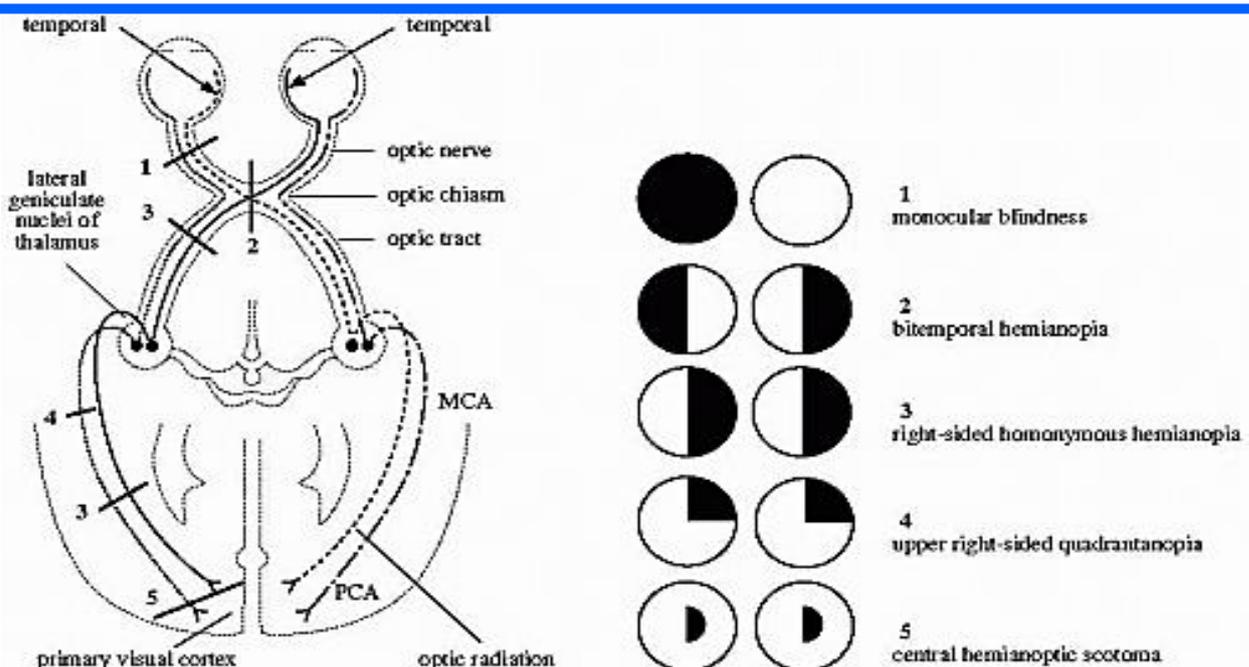
4. **Lateral geniculate body & optic radiation:** contralateral homonymous hemianopia.

5. **Visual area:**

☒ **Total lesion:** contralateral homonymous hemianopia with macular sparing. The sparing is due the anastomoses between branches of the middle and posterior cerebral arteries.

☒ **Above calcarine sulcus (cuneus):** contralateral homonymous lower quadrant anopia.

☒ **Below calcarine sulcus (lingual gyrus):** contralateral homonymous upper quadrant anopia.



III. Oculomotor nerve

✚ **Type:** it is a motor nerve.

✚ **Deep origin:** it has a nuclear complex at the level of the superior colliculus.

1. Somatic motor nucleus:

- ☒ It supplies the levator palpebrae superioris and all the extraocular muscles except the lateral rectus and the superior oblique.

2. Parasympathetic nucleus (Edinger-Westphal nucleus): medial.

- ☒ The fibers synapse in the ciliary ganglion and supply the sphincter pupillae muscle and the ciliary muscle.

3. Accessory oculomotor nuclei:

- ☒ Interstitial nucleus of Cajal: for the vertical movements of the two eyes. It connects:
 - a. The oculomotor nuclei of the 2 sides for the upward eye movement.
 - b. Oculomotor and trochlear nuclei of the 2 sides for the downward eye movement.
- ☒ Pretectal nucleus: for the pupillary light reflex.

✚ **Lesions:**

1. Paralysis of levator palpebrae superioris: ptosis (drooping of the upper eyelid).
2. Paralysis of the medial rectus muscle: external strabismus (by the lateral rectus).
3. Paralysis of the sphincter pupillae muscle: mydriasis (dilatation of the pupil).
4. Loss of light and accommodation reflex of the same eye.

IV. Trochlear nerve

✚ **Type:** it is a motor nerve.

✚ **Deep origin:** The motor nucleus located at the level of the inferior colliculus.

- ☒ The axons cross to the opposite side to supply the opposite superior oblique muscle.
- ☒ It is the only cranial nerve which appears from the back of the brain stem.

✚ **Lesion:** paralysis of the superior oblique muscle. It causes inability to depress the adducted eye causing difficulty in walking downstairs.



V. Trigeminal nerve

✚ The trigeminal nerve is the largest cranial nerve.

✚ **Type:** mixed (sensory, motor & parasympathetic).

✚ **Deep origin:** It has 4 nuclei, one motor and 3 sensory:

A. Motor nucleus:

- ☒ Lies in the pons and forms the motor root of the trigeminal nerve.
- ☒ It supplies muscles of the 1st pharyngeal arch (4 muscles of mastication, anterior belly of the digastric and mylohyoid, tensor palate and tensor tympani).

B. 3 Sensory nuclei:

- ☒ **Main sensory nucleus:** lies in the pons. It mediates discriminative touch sensation from the same side of the face.
- ☒ **Spinal trigeminal nucleus:** lies in the medulla and upper 3 segments of the spinal cord. It mediates pain and temperature sensations from the same side of the face.
- ☒ **Mesencephalic nucleus:** lies in midbrain. It is the first-order neuron for proprioception from the muscles of the head and from the temporomandibular joint.

✚ Course:

- ☒ It leaves the pons as 2 roots (small motor and a large sensory). The large sensory root expands to form the trigeminal ganglion.
- ☒ The trigeminal ganglion lies within a pouch of dura mater called cavum trigeminal.
- ☒ The motor root of the trigeminal nerve is situated below the sensory ganglion and is separate from it.

✚ Branches:

- ☒ The ophthalmic (V1), maxillary (V2), and mandibular (V3) nerves arise from the anterior border of the ganglion.
- ☒ The motor root joins the mandibular nerve.

☒ Distribution:

1. **Ophthalmic (V1):** General sensory from bridge nose, upper eyelid, forehead and cornea.
2. **Maxillary (V2):** General sensory from lateral nose, lower eyelid, upper lip, cheek, upper teeth, and gingiva.
3. **Mandibular (V3):** Motor to muscles of mastication, tensor tympani, tensor palati. General sensory from lower lip, chin, lower teeth and gingiva, and anterior 2/3 of tongue (not taste).

✚ **Lesion:**

- ☒ Paralysis of muscles of mastication on the **same** side of the head.
- ☒ Loss of all sensations on the **same** side of the face.

VI. Abducent nerve

✚ **Deep origin:** it is a pure motor nerve.

✚ **The abducent nucleus is formed of 2 parts:**

- ☒ **Abducent motor nucleus:** forms with the encircling facial nerve fibers the facial colliculus of the 4th ventricle. It supplies the lateral rectus muscle.
- ☒ **Paraabducent nucleus (horizontal gaze center):** it connects the abducent nucleus of the same side with the oculomotor nucleus of the opposite side through the MLF for the ipsilateral lateral gaze (lateral rectus of the same side and medial rectus of the opposite side).

✚ **Lesion:**

- ☒ **Abducent nerve lesion** causes paralysis of the lateral rectus muscle producing **internal strabismus (squint)**.