The olfactory nerve (I)

The olfactory nerve has only a special sensory component.

It is an afferent functions in the special sense of smell or olfaction.

The olfactory system consists of the olfactory epithelium, bulbs and tracts along with olfactory areas of the brain collectively known as the rhinencephalon.
The optic nerve (II)

The optic nerve has only a special sensory component. Special sensory conveys visual information from the retina. It is thus a special afferent sensory nerve.

Visual information enters the eye in the form of photons of light which are converted to electrical signals in the retina. These signals are carried via the optic nerves, chiasm, and tract to the lateral geniculate nucleus of each thalamus and then to the visual centers of the brain for interpretation.

The occulomotor nerve (III)

Consists of two components with distinct functions:

- **Somatic motor**

  (somatic efferent)
  Supplies four of the six extraocular muscles of the eye and the levator palpebrae superioris muscle of the upper eyelid.

- **Visceral motor**

  (visceral efferent)
  Parasympathetic innervation of the constrictor pupillae and ciliary muscles.
There are 6 extra-ocular or extrinsic eye muscles

- Four muscles rectus muscles
  - Superior, Inferior, Medial and Lateral Rectus muscle

  - They are attached on the North, South, West and East poles of the eye
  - They run straight backwards and result in obvious motions

- Two oblique muscles (attach on an angle)
  - Superior oblique and Inferior oblique
The somatic motor component of CN III innervates the following four extraocular muscles of the eyes:

- superior rectus muscle
- medial rectus muscle
- inferior oblique muscle
- inferior rectus muscle

The visceral motor component of CN III (a parasympathetic action) is involved in the pupillary light and accommodation reflexes.

- constriction of the pupil (via circular smooth muscles in iris)
- adjustment of the lens via the ciliary muscles
The trochlear nerve (IV)

The trochlear nerve has only a somatic motor component:

**Somatic motor**

Somatic motor innervates the superior oblique muscle of the contralateral orbit.

The trigeminal nerve (V)

The trigeminal nerve has three branches that serve the head area.

It has the greatest sensory function of all cranial nerves and is the only nerve involved in sensory **cutaneous innervation**.

**Ophthalmic branch (V1)**

Sensory afferent nerves that provide sensory information from the scalp, forehead, nose, upper eyelid, cornea.

**Maxillary branch (V2)**

Sensory afferent nerves that provide sensory information from the palate, upper jaw, upper teeth and gums, skin of cheek, lower eyelid, upper lip.
The trigeminal nerve also has a motor function, in that it provides motor nerves to the muscles of mastication (chewing muscles).

**Mandibular branch (V3)**

Sensory afferent nerves that provides sensory information from the lower jaw, lower teeth and gums, tongue sensation, skin of cheek, lower lip

The trigeminal nerve also has a motor function, in that it provides motor nerves to the muscles of mastication (chewing muscles).

**Tic Douloureux**

Also called Trigeminal neuralgia

Inflammation and disorder in T.N.

Small touches to the face elicit enormous pain responses on other parts of the face
The abducens nerve (VI)

Has only a somatic motor component.

Somatic motor:

Innervates the **lateral rectus** muscle of the extrinsic eye muscles orbit

The lateral rectus muscle is one of the six extraocular muscles responsible for the precise movement of the eye for visual tracking or fixation on an object.
The facial nerve (VII)

The facial nerve has 3 major components with distinct functions:

**Somatic motor**

(efferent) Supplies the muscles of **facial expression**

**Visceral motor**

(visceral efferent) Parasympathetic innervation of the **lacrimal, submandibular, and sublingual glands**, as well as mucous membranes of nasopharynx, hard and soft palate.

**Special sensory**

(special afferent) **Taste sensation** from the anterior 2/3 of tongue; hard and soft palates.
The facial nerve (VII)

- Marked facial asymmetry
- Atrophy of facial muscles
- Eyebrow droop
- Drooping of the mouth corner
- Uncontrolled tearing
- Cannot close eye
- Lips cannot be held tightly together or pursed
- Difficulty keeping food in mouth while chewing on the affected side

Bell's Palsy

Lesion typically at or beyond trigeminal foramen

The vestibulo-cochlear nerve (VIII)

A purely sensory nerve that brings in sensory information from the cochlea (hearing) and vestibule (equilibrium)
The vestibulo-cochlear nerve (VIII)

The glosso-pharyngeal (IX)

The glosso-pharyngeal nerve consists of 3 main components with distinct functions:

**Somatic motor**

Supplies the stylopharyngeus muscle which elevates the pharynx during swallowing and speech. Controls action of swallowing.

**Visceral motor**

Parasympathetic innervation of the smooth muscle and glands of the pharynx, larynx (especially parotid gland)

**Sensory**

Provides taste sensation from the posterior one-third of the tongue. Also provides info from receptors that monitor blood pressure in major arteries.
The glosso-pharyngeal (IX)

“Vagus” is from the Latin meaning wandering.

This is a fitting name as the nerve wanders from the brainstem to the splenic flexure of the colon.

The vagus nerve consists of five components with distinct functions. We will only consider 2 of those.
### The Vagus nerve (X)

#### Somatic motor

Supplies the voluntary muscles of the pharynx and most of the larynx, as well as one extrinsic muscle of the tongue. Aids in swallowing actions.

#### Visceral motor

Parasympathetic innervation of the smooth muscle and glands of the pharynx, larynx, and viscera of the thorax and abdomen.

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### The Accessory nerve (XI)

The accessory nerve has a cranial root and a spinal root, both of which consist of branchial motor fibers.

- **cranial root**
  - Innervates muscles of larynx and pharynx (vocal cords)

- **spinal root**
  - Innervates the trapezius and sternocleidomastoid muscles.
The Hypoglossal (XII)

Has only a somatic motor (general somatic efferent) component.

Somatic motor Innervates all the intrinsic and most of the extrinsic muscles of the tongue.

CN XII supplies three of the four extrinsic muscles of the tongue including
  • genioglossus,
  • styloglossus,
  • hyoglossus.

The palatoglossus muscle is supplied by CN X (vagus nerve).
**Origin of cranial nerves**

<table>
<thead>
<tr>
<th>nerve</th>
<th>origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Olfactory bulb</td>
</tr>
<tr>
<td>II</td>
<td>Retina of eye</td>
</tr>
<tr>
<td>III, IV</td>
<td>Midbrain</td>
</tr>
<tr>
<td>V, VI, VII</td>
<td>Pons</td>
</tr>
<tr>
<td>IX, X, XI, XII</td>
<td>Medulla</td>
</tr>
</tbody>
</table>

**Action of cranial nerves**

- Pure Sensory : S
- Pure Motor : M
- Mixed S + M
- ParaSymp. Activity : PS