Human Anatomy

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Cranial nerves

Cranial nerves are bundles of sensory or motor fibers that innervate muscles or glands, carry impulses from **sensory receptors**, or have a combination of **motor and sensory fibers**. They are called cranial nerves because they emerge through foramina or fissures in the cranium and are covered by tubular sheaths derived from the cranial meninges. Twelve pairs of cranial nerves arise from the brain, and they are identified both by their names and by Roman numerals I to XII **(Figs. 1 & 2)**. Their names reflect their general distribution or function. Some cranial nerves are purely sensory, others are considered purely motor, and several are mixed **(Table 1).** The cranial nerves are somewhat unique and can contain multiple functional components:

- **General**: same general functions as spinal nerves.
- **Special:** functions found only in cranial nerves.
- **Afferent and efferent:** sensory and motor functions, respectively.
- **Somatic and visceral:** related to skin and skeletal muscle **(somatic)** or to smooth muscle, cardiac muscle, and glands **(visceral)**. Therefore, each cranial nerve (CN) may possess one or more of the following five main functional components: **(Tables 1&2).**

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1. Motor efferent fibers to voluntary (striated) muscle (e.g., muscles of mastication).

2. Motor efferent fibers to involuntary (smooth) muscles or glands. (e.g., the sphincter pupillae and lacrimal gland).

3. Sensory afferent fibers transmitting general sensation. (e.g., touch, pressure, heat, cold.

4. Sensory afferent fibers conveying sensation from the viscera (e.g., pharynx, larynx, trachea, bronchi, lungs, heart, and gastrointestinal tract).

5. Sensory afferent fibers transmitting unique sensations: Special visceral (e.g., taste and smell). Special somatic (e.g., vision, hearing, and balance).

Table (1): Summery of Cranial Nerves

The Cranial Nerves			
Nerve Number and Name		Composition	Some Functions
I	Olfactory	Sensory only	Olfaction (smell)
II	Optic	Sensory only	Vision
III	Oculomotor	Motor and sensory	Serves muscles of the eye
IV	Trochlear	Motor and sensory	Serves the superior oblique eye muscle
V	Trigeminal	Motor and sensory	Sensory from face and mouth; motor to muscles of mastication (chewing)
VI	Abducens	Motor and sensory	Serves the lateral rectus eye muscle
VII	Facial	Motor and sensory	Serves the muscles of facial expression, lacrimal glands, and salivary glands
VIII	Vestibulocochlear	Sensory only	Equilibrium and hearing
IX	Glossopharyngeal	Motor and sensory	Serves the pharynx (throat) for swallowing, posterior third of tongue, parotid salivary gland
X	Vagus	Motor and sensory	Sensations from visceral (internal) organs, and parasympathetic motor regulation of visceral organs
XI	Accessory	Motor and sensory	Serves muscles that move head, neck, and shoulders
XII	Hypoglossal	Motor and sensory	Serves muscles of the tongue

The origins of the cranial nerves are summarised in **(Fig.1).**

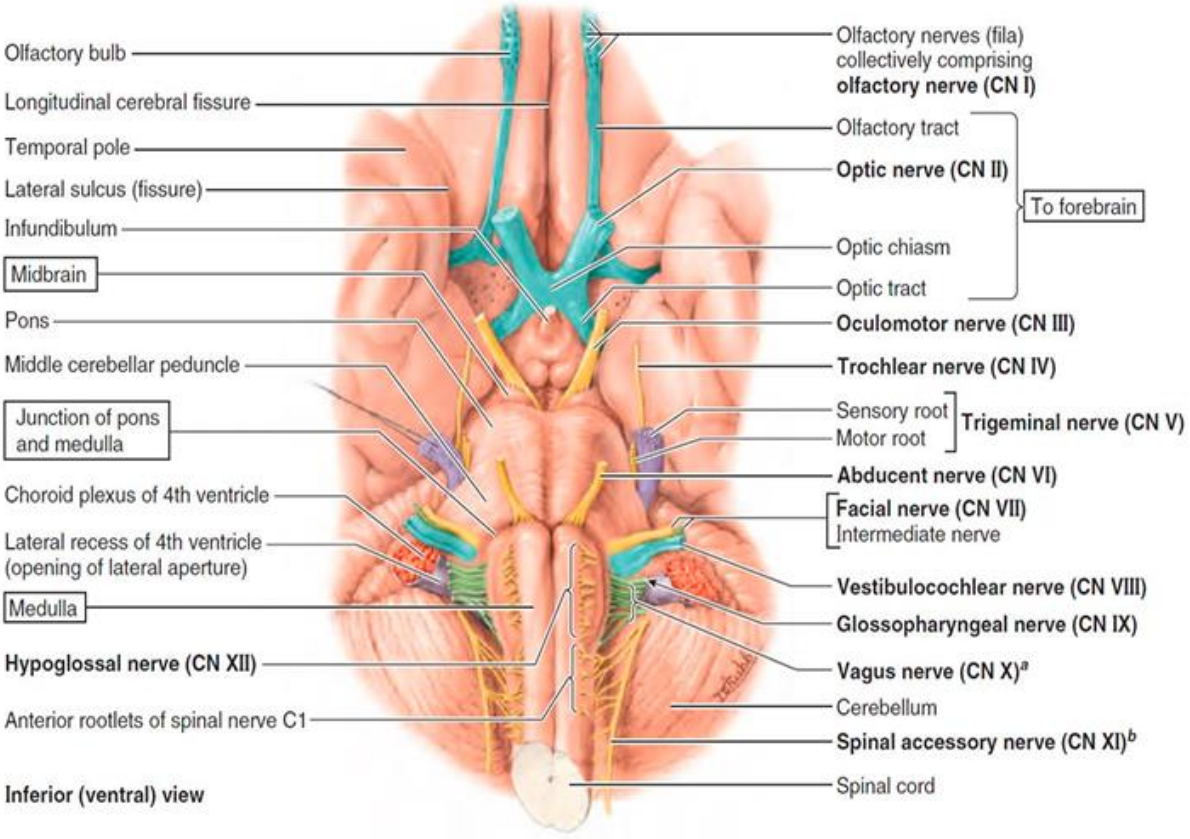

Figure 1: Superficial origins of cranial nerves from brain and spinal cord (except for CN IV, which arises from the posterior aspect of the midbrain)

Table (2): Major Foramina and Fissures.

Foramen caecum	Emissary veins
Olfactory foramina	Olfactory nerve
Optic canal	Optic nerve (CNII), ophthalmic artery, dural sheath of optic nerve
Superior orbital fissure	Oculomotor nerve (CNIII), trochlear nerve (CN IV), ophthalmic division of the trigeminal nerve (CNV1), abducent nerve (CNVI), ophthalmic veins
Foramen rotundum	Maxillary division of the trigeminal nerve (CN V2)
Foramen ovale	Mandibular division of the trigeminal nerve (CN V3), accessory meningeal branch of maxillary artery, emissary vein (, lesser petrosal nerve)
Foramen spinosum	Middle meningeal artery
Foramen lacerum	Greater petrosal nerve
Carotid canal	Internal carotid artery
Internal acoustic foramen	Facial nerve (CNVII), Vestibulocochlear nerve (CNVIII)
Jugular foramen	Glossopharyngeal nerve (CNIX), vagus nerve (CNX), descending portion of the spinal accessory nerve (CNXI), internal jugular vein
Hypoglossal canal	Hypoglossal nerve (CNXII)
Foramen magnum	Brainstem/spinal cord, vertebral arteries, ascending portion of the spinal accessory nerve (CNXI)