OVERVIEW OF CRANIAL NERVES

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OVERVIEW OF CRANIAL NERVES

• Like spinal nerves, cranial nerves are bundles of sensory or motor fibers.
• That innervate *muscles* or *glands*, carry impulses from sensory receptors.
• They are called cranial nerves because they emerge through foramina or fissures in the cranium.
• They are covered by tubular sheaths derived from the cranial meninges.
OVERVIEW OF CRANIAL NERVES

• There are 12 pairs of cranial nerves, which are numbered 1st to 12th from rostral to caudal.

• Their names reflect the general distribution or function.
Cranial nerves carry following five main functional components.

Motor (efferent) fibers.
- Motor fibers to voluntary (striated) muscle.
- These include the somatic motor (general somatic efferent) axons.
- On the basis of the embryologic derivation of certain muscles of the head and neck, some motor fibers conveyed by cranial nerves to striated muscle.
CRANIAL NERVE COMPONENTS

They are classified as “special visceral.” These fibers are designated somatic (branchial) motor, referring to the muscle tissue derived from the pharyngeal arches in the embryo (e.g., muscles of Facial Expression).
CRANIAL NERVE COMPONENTS

• Motor fibers also involved in innervating involuntary (smooth) muscles or glands.
• These include **visceral motor (general visceral efferent)** axons that constitute the cranial outflow of the parasympathetic division of the autonomic nervous system (ANS).
The presynaptic fibers emerge from the brain and synapse outside the central nervous system (CNS) in parasympathetic ganglion.

The postsynaptic (postganglionic) fibers continue to innervate smooth muscles and glands. (sphincter pupillae and lacrimal gland).

**Sensory (afferent) fibers**
- Fibers transmitting general sensation (touch, pressure, heat, cold) from the skin and mucous membranes.
- These include somatic sensory (general somatic afferent) fibers, mainly carried by 5th but also by 7th, 9th and 10th CN.
Fibers conveying sensation from the viscera:
These include visceral sensory (general visceral afferent) fibers conveying information from the pharynx, larynx, trachea, bronchi, lungs, heart, and gastrointestinal tract.
CRANIAL NERVE COMPONENTS

Fibers transmitting unique sensations:

- These include **special sensory fibers** conveying taste and smell.
- Those serving the special senses of vision, hearing, and balance (special somatic afferent fibers).
CRANIAL NERVE COMPONENTS

- Some cranial nerves are **purely sensory**, others are considered **purely motor**, and several are mixed.
- CN 3rd, 4th, 6th, 11th, 12th and the motor root of 5th are considered to be pure motor nerves.
- However, a small number of sensory fibers for **proprioception**.
CRANIAL NERVE COMPONENTS

• The fibers of cranial nerves connect centrally to cranial nerve nuclei.
• Which are groups of neurons in which sensory or afferent fibers terminate, and from which motor or efferent fibers originate.
• Except for CN I and CN II, which involve extensions of the forebrain.
• The nuclei of the cranial nerves are located in the brainstem.
OLFACTORY NERVE

BY DR NIGHAT ARA
OLFACTORY NERVE

• **Function:** Special sensory (special visceral afferent)—that is, the special sense of smell. “Olfaction is the sensation of odors.

• The cell bodies of olfactory receptor neurons are located in the olfactory organ.

• which is located in the roof of the nasal cavity, and along the nasal septum and medial wall of the superior nasal concha.

• Olfactory receptor neurons are both receptors and conductor.
• The apical surfaces of the neurons possess fine olfactory cilia, bathed by a film of watery mucus secreted by the olfactory glands of the epithelium.

• The olfactory cilia are stimulated by molecules of an odiferous gas dissolved in the fluid.
OLFACTORY NERVE

- The basal surfaces of the bipolar olfactory neurons give rise to central processes that are collected into 20 olfactory nerves.

- They pass through tiny foramina in the cribriform plate of the ethmoid bone, surrounded by sleeves of meninges and enter the olfactory bulb in the anterior cranial fossa.
The olfactory bulb lies in contact with the inferior or orbital surface of the frontal lobe of the cerebral hemisphere.
• The olfactory nerve fibers synapse with mitral cells in the olfactory bulb.
• The axons of these secondary neurons form the olfactory tract.
• The olfactory bulbs and tracts are anterior extensions of the forebrain.
Each olfactory tract divides into lateral and medial olfactory striae (distinct fiber bands).
The lateral olfactory stria terminates in the *piriform cortex* of the anterior part of the temporal lobe, and the medial olfactory stria projects through the anterior *commissure* to *contralateral* olfactory structures.
The olfactory nerves are the only cranial nerves to enter the cerebrum directly.
CLINICAL CORRELATES

• **Bilateral anosmia:**
  can be caused by disease of the olfactory mucous membrane, such as the common cold or allergic rhinitis.

  **Unilateral anosmia:**
  can result from disease affecting the olfactory nerves, bulb, or tract. A lesion of the olfactory cortex on one side is unlikely to produce complete anosmia, because fibers from each olfactory tract travel to both cerebral hemispheres.

  **Fractures of the anterior cranial fossa:**
  Involving the cribriform plate of the ethmoid could tear the olfactory nerves.
Cerebral tumors of the frontal lobes or meningiomas of the anterior cranial fossa can produce anosmia by pressing on the olfactory bulb or tract.
Thank you