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ANATOMY OF THE TONGUE

The tongue is a muscular organ in the mouth. The tongue is covered with moist, pink tissue called mucosa. Tiny bumps called papillae give the tongue its rough texture. Thousands of taste buds cover the surfaces of the papillae. Taste buds are collections of nerve-like cells that connect to nerves running into the brain.

The tongue is anchored to the mouth by webs of tough tissue and mucosa. The tether holding down the front of the tongue is called the frenum. In the back of the mouth, the tongue is anchored into the hyoid bone. The tongue is vital for chewing and swallowing food, as well as for speech.

The four common tastes are sweet, sour, bitter, and salty. A fifth taste, called umami, results from tasting glutamate (present in MSG). The tongue has many nerves that help detect and transmit taste signals to the brain. Because of this, all parts of the tongue can detect these four common tastes;

One of the most important landmarks of the tongue is the central or terminal sulcus, lying about two-thirds from the tongue’s tip. The tongue may be further divided into right and left halves by the midline groove and just beneath the groove’s surface lies the fibrous lingual septum. The underside of the tongue is covered with a thin, transparent mucous membrane through which one can see the underlying veins.

The lingual frenulum is a large midline fold of mucosa that passes from the tongue side of the gums (or gingiva) to the lower surface of the tongue. The frenulum connects the tongue to the floor of the mouth while allowing the tip to move freely. It is notable that the submandibular salivary gland has a duct that opens beneath the tongue, passing saliva into the mouth here.

Consider these general descriptions of the gross parts of the tongue:

**• Root:** This is most often defined as the back third of the tongue. It sits low in the mouth and near the throat, and it is relatively fixed in place. It is attached to the hyoid bone and mandible (lower jaw). It is close in proximity to two muscles: the geniohyoid and mylohyoid muscles.

**• Body:** The rest of the tongue, notably the forward two-thirds that lie in front of the sulcus. It is extremely mobile and serves multiple functions.

**• Apex:** This is the tip of the tongue, a pointed portion most forward in the mouth. It is also extremely mobile.

**• Dorsum:** This is the curved upper surface towards the back. It has a V-shaped groove on it called the terminal sulcus.

**• Inferior Surface:** Underneath the tongue lies this last feature, important for the ability to visualize veins that allow the rapid absorption of specific medications

Papillae Types

The more forward surface of the tongue is covered in numerous small bumps called papillae. These may have different shapes, sizes, and functions. Many are associated with taste buds, but some may have other purposes. The back of the tongue has no papillae, but underlying lymphatic tissue may give it an irregular, cobblestone appearance.

**• Vallate papillae:** These large, flat-topped bumps lie just in front of the terminal sulcus, located about two-thirds back on the surface of the tongue. They are surrounded by deep trenches—into which ducts open from fluid-producing glands—and their walls are covered in taste buds.

**• Folate papillae:** Though poorly developed in humans, these small folds of the mucosa surface of the tongue are found to the sides. They also have taste receptors located in taste buds.

**• Filiform papillae:** Lying in V-shape rows parallel to the terminal sulcus, these bumps are elongated and numerous. They contain nerve endings that are sensitive to touch. Appearing scaly, threadlike, and pinkish-grey in color, they can make the tongues of some animals (such as cats) especially rough. At the tongue’s tip, these papillae sit more cross-wise (arranged transversely).

**• Fungiform papillae:** Scattered among the filiform papillae are these oddly mushroom-shaped spots that may be pink or red in coloration. They are most commonly found along the tip or sides of the tongue. Many contain receptors for taste within taste buds.

Muscles

The tongue may seem like one big muscular mass. It is actually composed of many interlaced muscles, some within what would be recognized as the tongue itself and others that are nearby and control its complex movements. These various muscles are grouped as intrinsic muscles (those entirely within the tongue that affect shape) and extrinsic muscles (those that originate outside the tongue, attach to it and surrounding bones, and affect its position).

The muscles of the tongue, with main actions as noted, include intrinsic muscles and extrinsic muscles.

Intrinsic muscles:

**• Superior longitudinal:** Curls the tip and sides of the tongue upward and shortens the tongue.

**• Inferior longitudinal:** Curls the tip of the tongue downward and shortens the tongue.

**• Transverse:** Narrows and elongates the tongue, increasing its height and causing it to stick out (protrude).

**• Vertical:** Flattens and broadens the tongue within the mouth, causing it to protrude or push against the front teeth.

Extrinsic muscles:

**• Genioglossus:** A large fan-shaped muscle, it contributes most of the bulk to the tongue. It lowers the tongue and may pull it forward to stick out or even to wag it back and forth.

**• Hyoglossus:** A thin, four-sided muscle that lowers the tongue and pulls it back into the mouth.

**• Styloglossus:** Another small, short muscle with fibers that interdigitate with the hyoglossus muscle. It can retract the tongue and draw it up to create a trough for swallowing a bolus of food.

**• Palatoglossus:** In fact, more part of the soft palate than the tongue proper, it works to elevate the back portion of the tongue.

Nerves

All the muscles of the tongue are innervated by the hypoglossal nerve (also known as cranial nerve XII) with the exception of the palatoglossus muscle that is innervated by a branch of the pharyngeal plexus. Sensation, including touch and temperature, of the anterior two-thirds of the tongue’s surface, is supplied by the lingual nerve (a branch from the trigeminal nerve). Taste is a special sensation and it comes from the chorda tympani nerve, branching from the facial nerve. The back third of the tongue receives its general and special sensation innervation from a branch of the glossopharyngeal nerve. Just forward of the epiglottis is a small patch of the tongue that receives its special sensation from the internal laryngeal nerve, a branch of the vagus nerve.

Blood Supply

The arteries of the tongue derive from the lingual artery, which arises from the external carotid artery. The venous drainage includes the dorsal lingual vein and deep lingual veins, emptying to the internal jugular vein. The veins under the tongue may be enlarged and tortuous (varicose) in older people, but they do not bleed and this change has no clinical significance.

**Applied Anatomy**

**Ankyloglossia**

As noted above, the lingual frenulum (from the Latin word meaning “bridle”) is a small fold of mucous membrane that connects the middle of the lower surface of the tongue to the floor of the mouth. If it is too short, often from birth, the tongue may be abnormally retracted into the lower jaw. This lower position leads to a condition that is colloquially known as being “tongue tied.” This may be rarely checked (or simply ignored), especially if it is at the back of the tongue, and often goes untreated. It may be recognized with early infancy swallowing problems and speech impairment at school age as the short frenulum may interfere with tongue movements and function. Clipping the frenulum is a simple surgery and this frenulectomy may be necessary for infants to free the tongue for normal speech development.

**Genioglossus muscle paralysis**

When this muscle becomes paralyzed, the tongue falls backward, potentially obstructing the airway and increasing the risk of suffocation. Total relaxation of the tongue occurs during general anesthesia. As such, this shift of the tongue must be prevented to avoid blocking the airway. This is usually accomplished by inserting a temporary breathing tube during surgery.

**Hypoglossal nerve injury**

Trauma to the lower jaw (mandible) may cause a fracture that injures the hypoglossal nerve, resulting in paralysis and eventual shrinking of one side of the tongue. After the injury, the tongue deviates to the paralyzed side when protruded.

**Lingual carcinoma**

Cancer, or carcinoma, may affect the tongue. This is more likely due to infections from human papillomavirus (HPV) or from the use of tobacco, including chewing or smoking.3 The back of the tongue has lymphatic drainage that may cause aggressive cancers to metastasize to the superior deep cervical lymph nodes on both sides of the neck. Cancers of the tongue may require surgical treatment, radiation therapy, and even chemotherapy if metastatic.

**Thyroglossal duct cyst**

Rarely, there can be a cystic remnant of the thyroglossal duct found within the root of the tongue. Most of these cysts lie close to the body of the hyoid bone, producing a painless swelling of the neck at the midline. It may connect with a fistula to the skin’s surface, leading to a non-healing sore (called a thyroglossal fistula) at the neck. Surgery may be required for the resolution of the problem.

**Aberrant thyroid gland**

The thyroid gland typically descends within the embryo along the thyroglossal duct. In some cases, remnants of the thyroid gland may remain behind. These may be found in the root of the tongue or even in the neck. In some cases, it may be treated with radioactive iodine and long-term thyroid replacement for post-surgical hypothyroidism is necessary.

AIR SINUSES

The paranasal sinuses (the hollow spaces in the skull and facial bones around the nose) are air-filled cavities within the frontal, ethmoidal, sphenoidal and maxillary bones.They are outgrowths from the nasal cavity. All of them drain into the superior or lateral aspect of the nose. The lining mucosa of the sinuses is continuous with the nasal cavity; therefore, any infections from the nasal mucosa can spread to the sinuses, easily.

Structure and Function

There are 4 pairs of the paranasal sinuses:

• Maxillary sinuses (the biggest)

• Frontal sinuses

• Ethmoidal air cells

• Sphenoid sinus

The pyramid-shaped maxillary sinuses are located within the body of the maxilla. The apex of the sinus extends into the zygomatic process of the maxilla and the lateral wall of the nose forms the base.  The roof is formed by the floor of the orbit, while the alveolar process forms the floor. These sinuses are located at just above the level of the first and second premolars and of the third molar, and sometimes the root of the canine, bilaterally. It drains into the middle meatus of the nose via the hiatus semilunaris. The sinus readily accumulates fluid because of the ostium for drainage point is located high on the medial wall of the sinus.

The frontal sinuses which are separated from each other by a thin bony lamella lie within the frontal bone. They are triangular in shape and extend upward above the medial end of the supraorbital crest and backward into the medial part of the orbit. Each frontal sinus drains into the middle meatus of the nose via infundibulum.

The ethmoidal sinuses are variable in both size and the number of small cavities within the ethmoid labyrinth of the ethmoid bone. A collection of air cells (3 to 18) are located between the nose and the orbit. The lamina papyracea which is a thin, orbital plate of the ethmoid bone separates the sinuses from the orbit. The ethmoid sinuses are divided into 3 groups of cells by bony basal lamellae. The most important of these lamellae is the basal lamellae of the middle turbinate which separates the ethmoid from the anterior and posterior groups with different drainage pathways.

The sphenoidal sinuses lie within the body of the sphenoid bone. They are located at the most posterior (farthest toward the back of the head) of the paranasal sinuses. Each sinus opens into the sphenoethmoidal recess which is above the superior concha.[

The paranasal sinuses have a wide variety of functions including lightening the weight of the head, humidifying and heating inhaled air, increasing the resonance of speech, and serving as a crumple zone to protect vital structures in the case of the facial trauma. The most sinuses are absent or rudiments in newborn; extend into the regarding bones during childhood and reach their mature size in the early 20s, and their shape and development vary greatly, and they enlarge slowly until death.