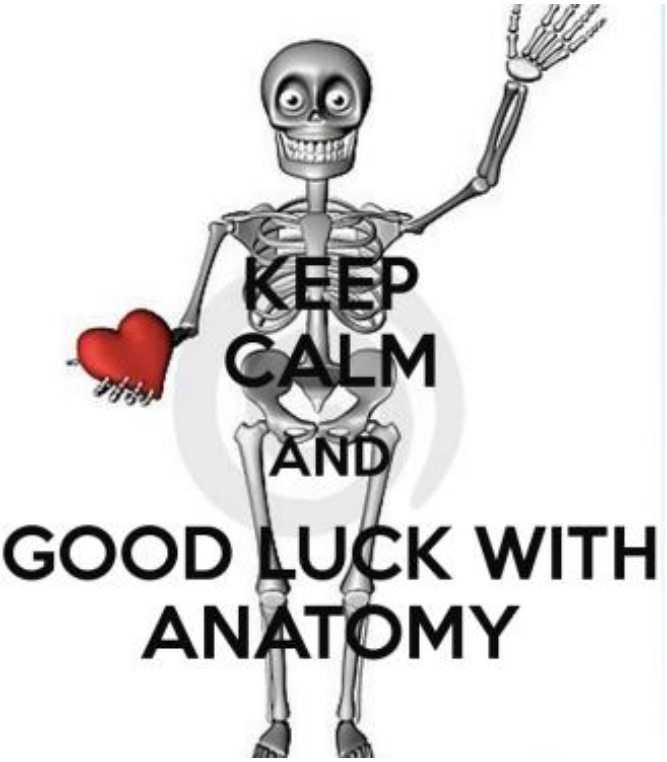
كلية المستقبل الجامعة قسم هندسة الطب الحياتي

المرحلة الثانية



HEAD & NECK

ANATOMY

(L9)

Pharynx, Larynx, Esophagus & Thyroid

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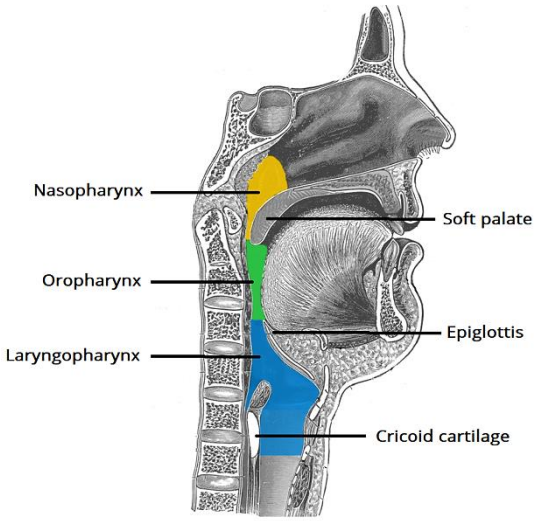
The pharynx

is a muscular tube that connects the oral and nasal cavity to the larynx and oesophagus. It begins at the base of the skull, and ends at the inferior border of the **cricoid cartilage** (C6). The pharynx is comprised of three parts (superior to inferior): Nasopharynx, Oropharynx and Laryngopharynx.



Nasopharynx

The **nasopharynx** is found between the base of the skull and the soft palate. It is continuous with the nasal cavity, and performs a respiratory function by conditioning inspired air and propagating it into the larynx.

This part of the pharynx is lined with **respiratory epithelium**; ciliated pseudostratified columnar epithelium with goblet cells.

The posterosuperior nasopharynx contains the **adenoid tonsils**, which enlarge between 3-8 years of age and then regress. **The oropharynx** is the middle part of the pharynx, located between the soft palate and the superior border of the epiglottis. It contains the following structures:

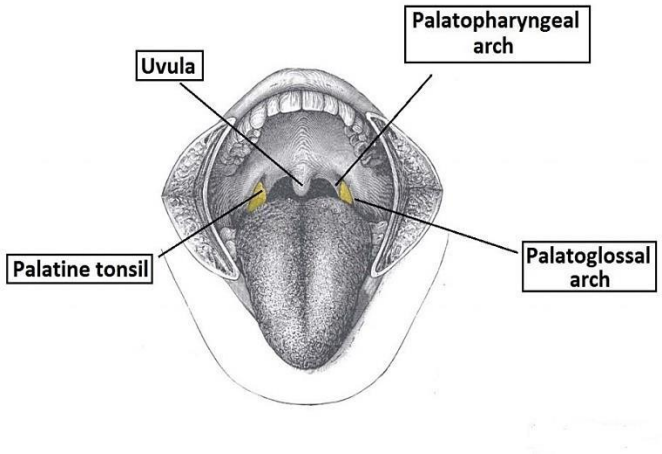
Posterior 1/3 of the tongue.

Lingual tonsils – lymphoid tissue at the base of the tongue.

Palatine tonsils – lymphoid tissue located in the tonsillar fossa (between the palatoglossal and palatopharyngeal arches of the oral cavity).

Superior constrictor muscle.

Waldeyer's ring is the ring of lymphoid tissue in the naso- and oropharynx formed by the paired palatine tonsils, the adenoid tonsils and lingual tonsil.



Laryngopharynx: The most distal part of the pharynx, the **laryngopharynx** is located between the superior border of the epiglottis and inferior border of the cricoid cartilage (C6). It is continuous inferiorly with the oesophagus. It is found posterior to the larynx and communicates with it via the laryngeal inlet, lateral to which one can find the **piriform fossae**. The laryngopharynx contains the middle and inferior **pharyngeal constrictors**.

Muscles: There are two main groups of **pharyngeal muscles**; longitudinal and circular.The muscles of the pharynx are mostly innervated by

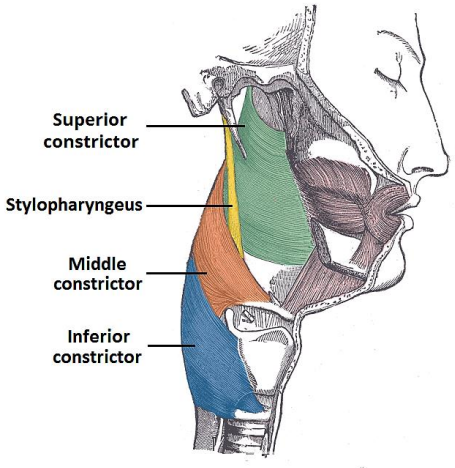
the **vagus nerve** – the only exception being the stylopharyngeus (glossopharyngeal nerve).

Circular : There are three circular pharyngeal constrictor muscles; the superior, middle and inferior **pharyngeal constrictors**. They are stacked like glasses, which form an incomplete muscular circle as they attach anteriorly to structures in the neck. The circular muscles contract **sequentially** from superior to inferior to constrict the lumen and propel the bolus of food inferiorly into the oesophagus.

Superior pharyngeal constrictor – the uppermost pharyngeal constrictor. It is located in the oropharynx.

Middle pharyngeal constrictor and **Inferior pharyngeal constrictor** – located in the laryngopharynx.

All pharyngeal constrictors are innervated by the **vagus nerve** (CN X)



The longitudinal muscles are the stylopharyngeus, palatopharyngeus and salpingopharyngeus. They act to shorten and widen the pharynx, and elevate the larynx during swallowing.

Innervation Motor and sensory innervation of the majority of the pharynx (except nasopharynx) is achieved by the **pharyngeal plexus.**

The pharyngeal plexus, which mainly overlies the middle pharyngeal constrictor, is formed by:

Pharyngeal branches from the **glossopharyngeal** nerve (CN IX).

Pharyngeal branch of the **vagus** nerve (CN X).

Branches from the external laryngeal nerve.

Sympathetic fibres from the superior cervical ganglion.

Sensor The pharynx recieves sensory innervation from the **glossopharyngeal nerve**.

Motor All the muscles of the pharynx are innervated by the **vagus nerve** (CN X), except for the stylopharyngeus, which is innervated by the glossopharyngeal nerve (CN IX).

Vasculature

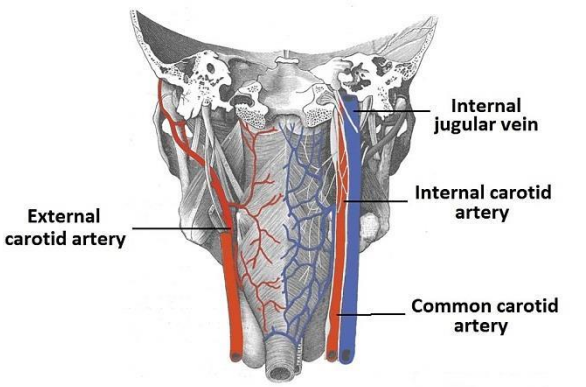
Arterial supply to the pharynx is via branches of the **external carotid** artery:

Ascending pharyngeal artery

Branches of the facial artery

Branches of the lingual and maxillary arteries.

Venous drainage is achieved by the **pharyngeal venous plexus**, which drains into the internal jugular vein.

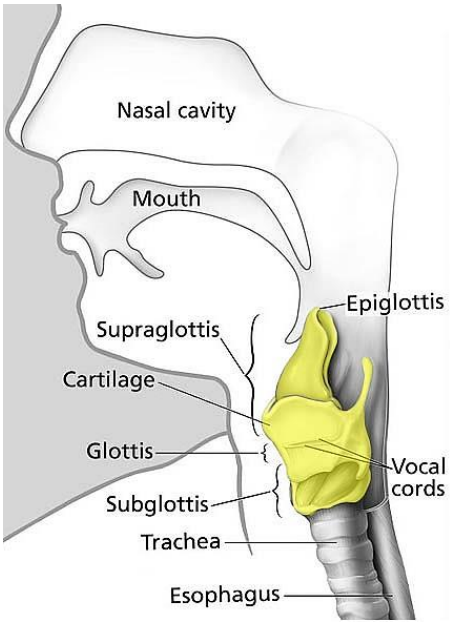


The larynx

(voice box) is an organ located in the anterior neck. It is a component of the respiratory tract, and has several important functions, including phonation, the cough reflex, and protection of the lower respiratory tract. The structure of the larynx is primarily cartilaginous, and is held together by a series of ligaments and membranes. Internally, the laryngeal muscles move components of the larynx for **phonation** and breathing.

Anatomical Position and Relations

The larynx is located in the **anterior compartment** of the neck, suspended from the hyoid bone, and spanning between C3 and C6. It is continuous inferiorly with the **trachea**, and opens superiorly into the laryngeal part of the pharynx. It is covered anteriorly by the infrahyoid muscles, and laterally by the lobes of the **thyroid gland**. The larynx is also closely related to the major blood vessels of neck, which ascend laterally to it. Posterior to the larynx is the **oesophagus**.



Anatomical Structure

The larynx is formed by a cartilaginous skeleton, which is held together by ligaments and membranes. The laryngeal muscles act to move the components of the larynx for phonation and breathing. *More information about each of these structures can be found in their respective sections.*

Anatomically, the internal cavity of the larynx can be divided into :

Supraglottis – From the inferior surface of the epiglottis to the vestibular folds (false vocal cords).

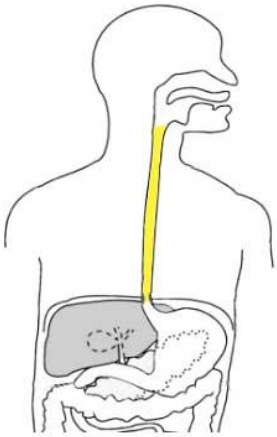
Glottis – Contains vocal cords and 1cm below them. The opening between the vocal cords is known as rima glottidis, the size of which is altered by the muscles of phonation.

Subglottis – From inferior border of the glottis to the inferior border of the cricoid cartilage. The interior surface of the larynx is lined by **pseudostratified ciliated columnar epithelium**. An important

exception to this is the true vocal cords, which are lined by a stratified squamous epithelium.

The oesophagus

is a fibromuscular tube, approximately 25cm in length, that transports food from the pharynx to the stomach.It originates at the inferior border of the cricoid cartilage (C6) and extends to the cardiac orifice of the stomach (T11).



Anatomical Course

The **oesophagus** begins in the neck, at the level of C6. Here, it is continuous superiorly with the laryngeal part of the pharynx (the laryngopharynx). It descends downward into the superior mediastinum of the thorax, positioned between the trachea and the vertebral bodies of T1 to T4. It then enters the abdomen via the **oesophageal hiatus** (an opening in the right crus of the diaphragm) at T10.

The abdominal portion of the oesophagus is approximately 1.25cm long it terminates by joining the cardiac orifice of the **stomach** at level of T11.

Anatomical Structure

The oesophagus shares a similar structure with many of the organs in the alimentary tract: **Adventitia –** outer layer of connective tissue.

Note: The very distal and intraperitoneal portion of the oesophagus has an outer covering of serosa, instead of adventitia.

Muscle layer – external layer of longitudinal muscle and inner layer of circular muscle. The external layer is composed of different muscle types in each third:

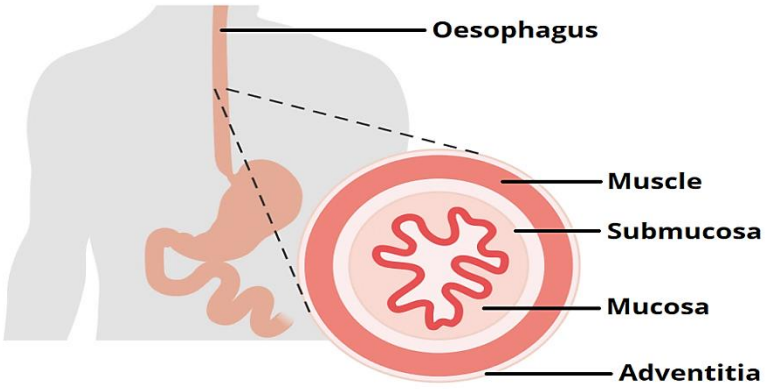
Superior third – voluntary striated muscle

Middle third – voluntary striated and smooth muscle

Inferior third – smooth muscle

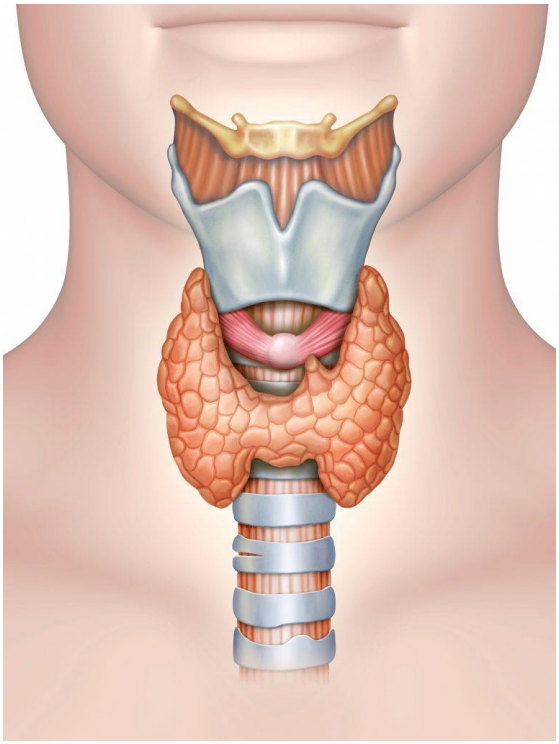
Submucosa **Mucosa** – non-keratinised stratified squamous epithelium (contiguous with columnar epithelium of the stomach).

Food is transported through the oesophagus by **peristalsis** – rhythmic contractions of the muscles which propagate down the oesophagus.



The thyroid gland is an endocrine structure located in the neck. It plays a key role in regulating the metabolic rate of the body. The **thyroid gland** is an endocrine structure located in the neck. It plays a key role in regulating the metabolic rate of the body.

Anatomical Location The **thyroid gland** is located in the anterior neck and spans the C5-T1 vertebrae. It consists of two lobes (left and right), which are connected by a central isthmus anteriorly – this produces a butterfly-shape appearance. The lobes of the thyroid gland are wrapped around the cricoid cartilage and superior rings of the **trachea**. The gland is located within the **visceral** compartment of the neck (along with the trachea, oesophagus and pharynx). This compartment is bound by the pretracheal fascia.



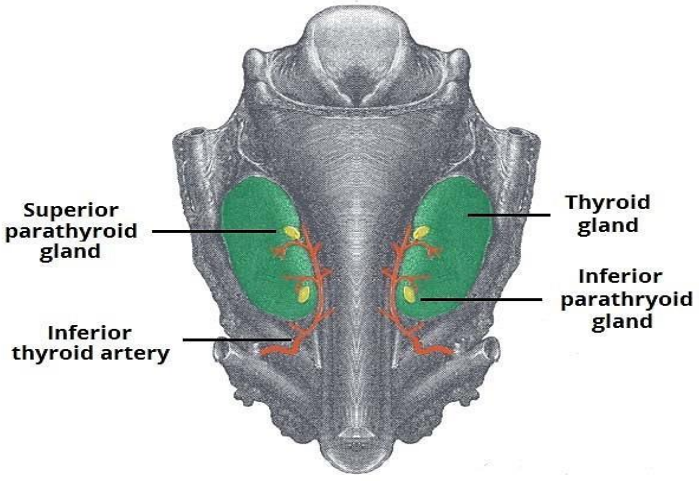
The parathyroid glands are endocrine glands located in the anterior neck.They are responsible for the production of **parathyroid hormone** (PTH), which acts to increase the level of serum calcium.

Anatomical Location

The **parathyroid glands** are usually located on the posterior aspect of the thyroid gland. They are flattened and oval in shape – situated external to the thyroid gland itself but within the pretracheal fascia.

Most individuals have **four** parathyroid glands, although variation in number (from two to six) is common: **Superior parathyroid glands (x2)** located at the middle of the posterior border of each thyroid lobe.

Inferior parathyroid glands (x2) Although inconsistent in location between individuals, the inferior parathyroid glands are usually found near the inferior poles of the thyroid gland.In a small number of people, the inferior parathyroid glands can be found as far inferiorly as the **superior mediastinum**.



Posterior aspect of the thyroid gland, demonstrating the most common location of the parathyroid glands