MD Program
UNIVERSITY OF TORONTO

Anatomy

UNIT 2: Head and Neck

Lab 6

CLICK TO BEGIN

Lab 6 Exercise Selection

Pre-lab SLM

6A PRE-LAB SLM

Lab 6 Exercises

6.1 RADIOLOGY

6.2 THE LARYNX

6.3 THE PHARYNX

6.4 THE NECK II

If you finish any exercise early…

6.5 FIELD TRIP

Review Lab 6

QUIZLANDIA 6

6A Pre-lab SLM

Attention

This module is packing MASSIVE amounts of Meme HEAT

These memes are on FIRE

These memes are HOT

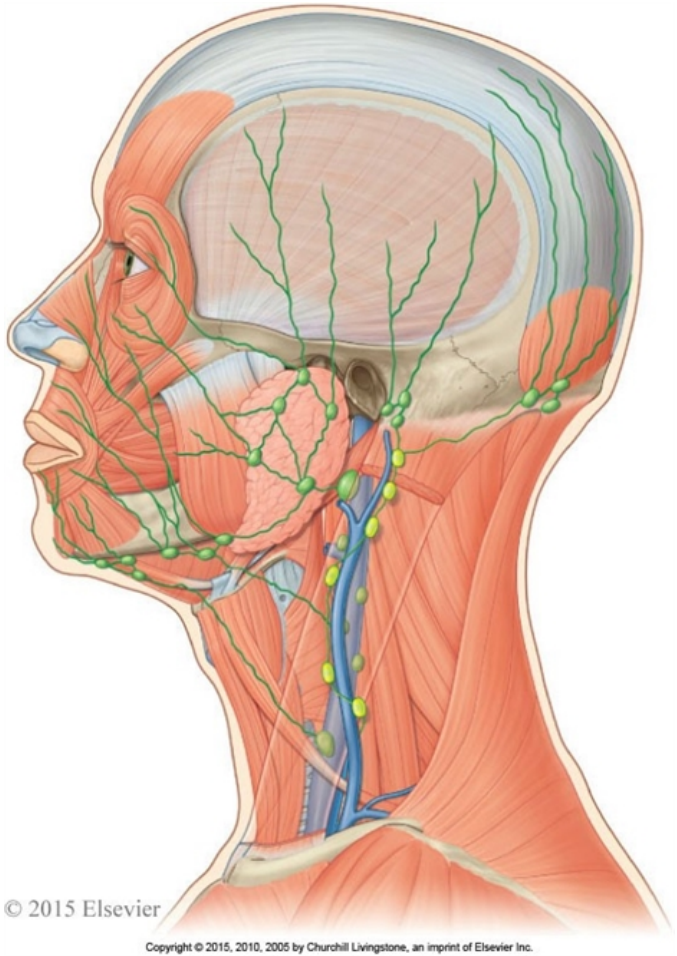
Are you feeling Hot?

#MedsNotHot

Objectives:

When you have completed this pre-lab exercise, you will be able to describe the:

- layers of the scalp and associated structures.
- lymphatic drainage of the superficial and deep structures of the face, including the major groups of lymph nodes.

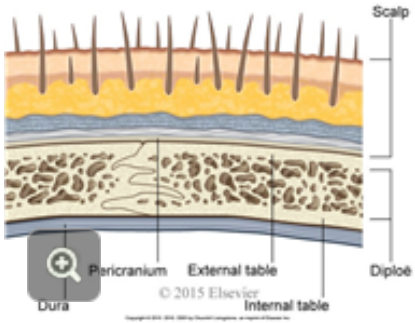


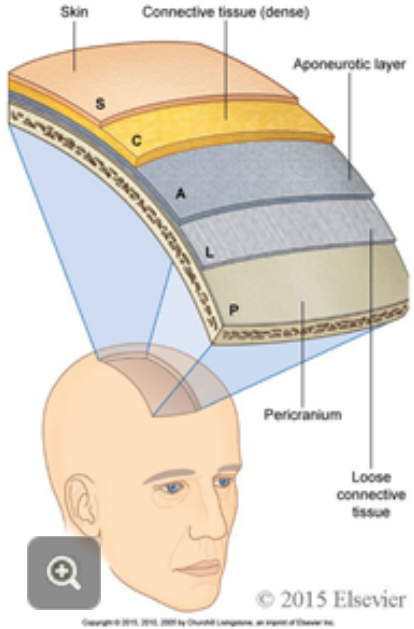
The **scalp** is a complex, multilayered structure covering the neurocranium. It extends from the superior border of the orbit, anteriorly, to the external occipital protuberance and adjacent part of the occipital bone, posteriorly. Laterally, it extends down to the level of the zygomatic arch.

It consists of 5 layers. The outermost 3 layers adhere tightly to each other, and, from superficial to deep, consist of the **skin**, a layer of **dense connective tissue** (CT) and an **aponeurotic layer**. The layer of dense CT is well vascularized and it adheres to the vessels. This prevents the vessels from constricting when cut, which is why **scalp lacerations typically bleed profusely**.

Deep to the aponeurosis is a layer of very **loose CT**. This is why it is so easy to slide the scalp back and forth on the skull. Unfortunately, this layer offers little resistance, and acts as a cleavage plane that makes it relatively easy to separate from the skull. It also **offers little resistance to the spread of infections** which gain entry to this layer.

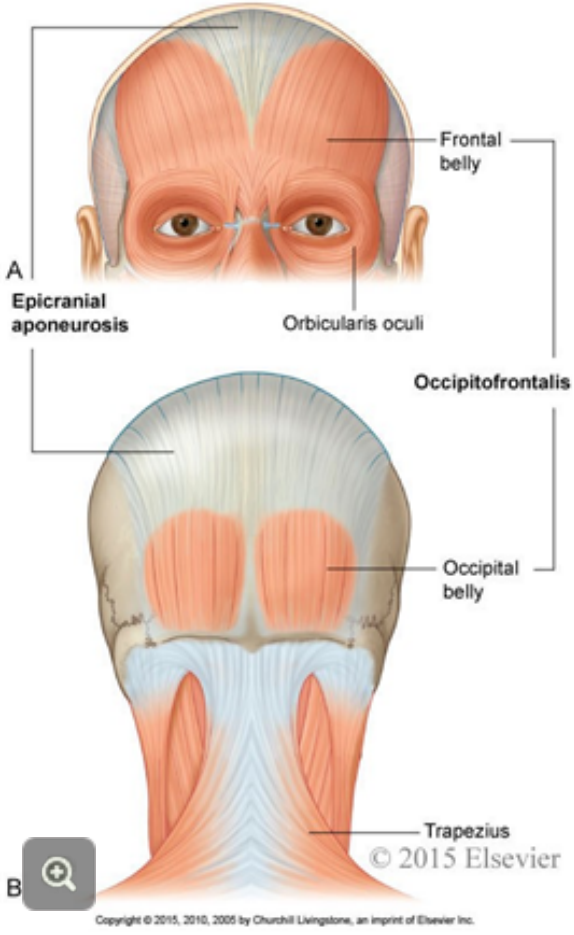
The deepest layer of the 5 layers in the scalp is the **periosteum of the skull**. You will recall from the histology eModule on bone, that the periosteum is the dense irregular CT layer that surrounds bone.

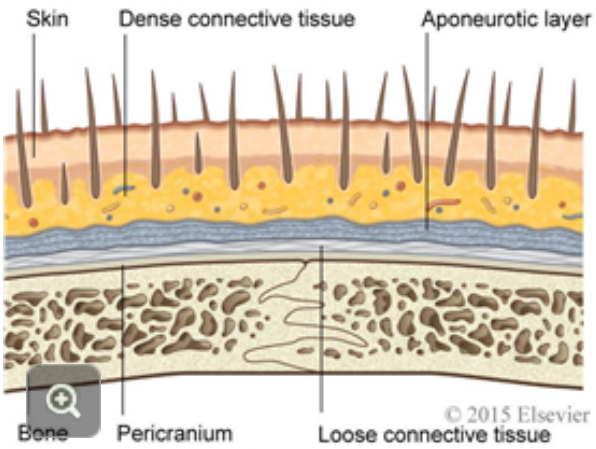




The middle, aponeurotic layer of the scalp connects the 2 bellies of the **occipitofrontalis** muscle. The **occipital belly** arises from the occipital bone to blend with the aponeurosis. The **frontalis belly**, which is responsible for wrinkling the skin of the forehead, arises from the skin of the eyebrows and extends into the aponeurosis.

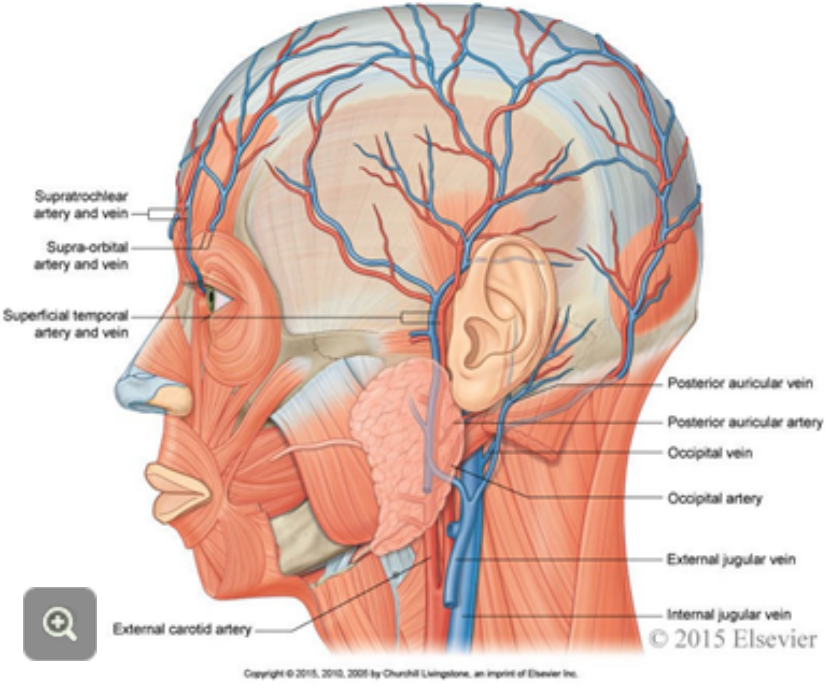
The occipitofrontalis is a **muscle of facial expression**, and is innervated by the facial nerve. **Asking a patient to raise their eyebrows is part of the neurological exam, and tests for the integrity of the facial nerve.**

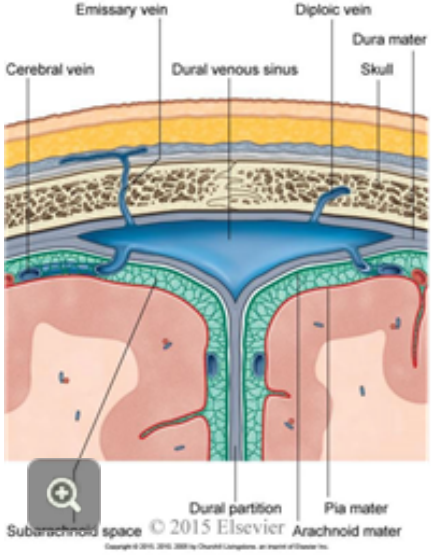




The scalp receives a rich blood supply from the:

- **supraorbital and supratrochlear branches of the ophthalmic arteries** anteriorly,
- the **superficial temporal branches of the external carotid arteries** laterally, and
- the **posterior auricular branches of the external carotid arteries** posteriorly.



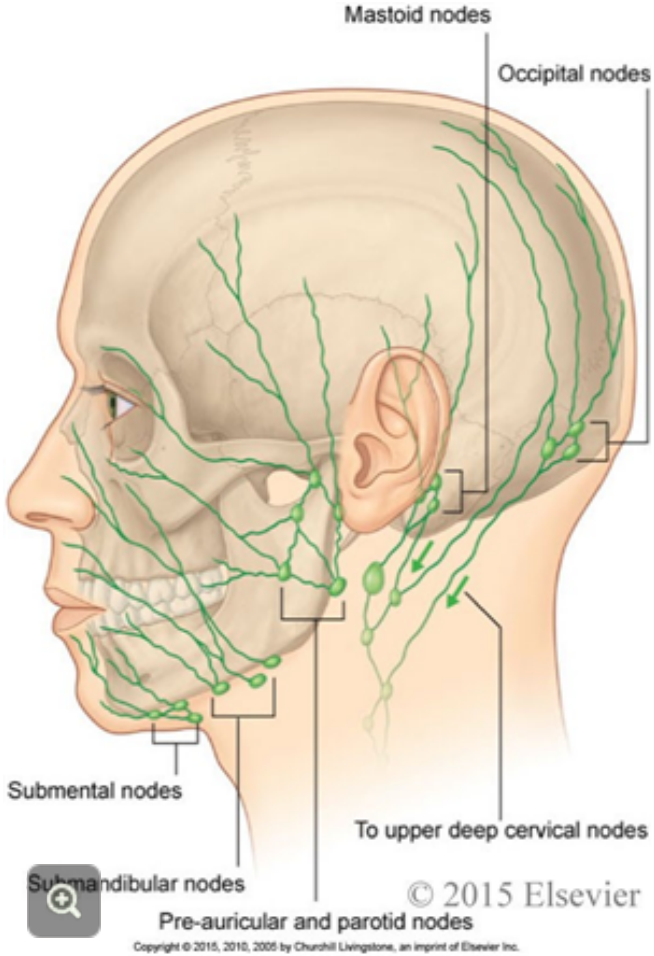


These vessels anastomose freely within the **dense connective tissue layer of the scalp**. Venous drainage is by veins of the same name that accompany the arteries. However, an additional route of venous drainage is available via the emissary veins which penetrate the skull bones to empty into intracranial vessels (left). **The emissary veins provide a potential route for scalp infections to spread intracranially**.

Lymphatic vessels from the scalp and face follow the arteries. They eventually reach a superficial group of nodes that form a ring around the base of the skull. These nodes cluster into several groups, **the names of which are regional** and therefore intuitive.

These are the:

- **occipital nodes**
- **retroauricular (mastoid) nodes**
- **preauricular (parotid) nodes**
- **submandibular nodes**
- **submental nodes**

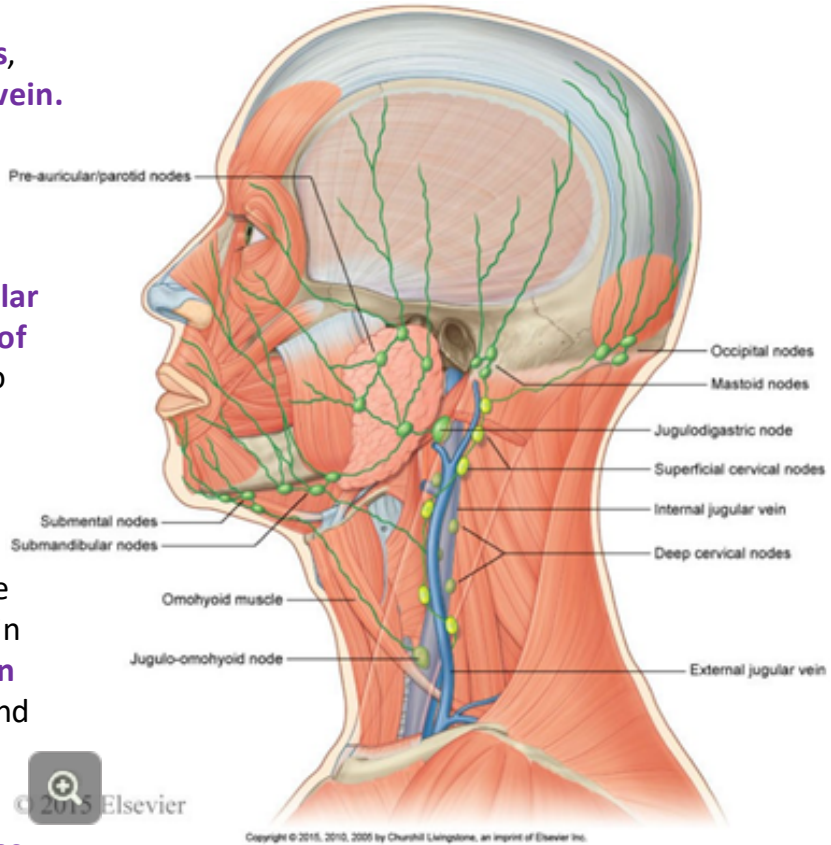


The **occipital, retroauricular, and preauricular nodes** drain directly into the **deep cervical nodes**, located along the course of the **internal jugular vein.**

The **submental nodes** receive lymph from the **lower lip, the anterior, inferior part of the gingiva and tip of the tongue**. The **submandibular nodes** receive lymph from the **tongue and floor of the mouth**. These two groups of nodes drain into the **superficial cervical nodes**, located along the course of the **external jugular vein**.

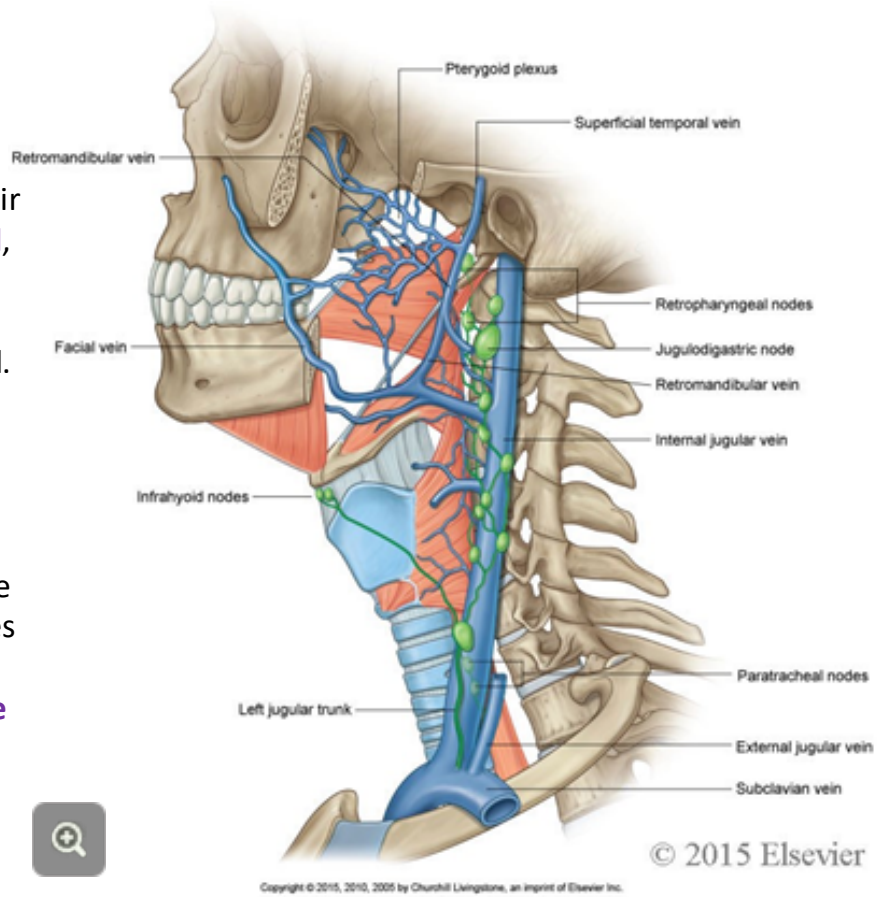
The **superficial cervical nodes** drain in turn to the **deep cervical nodes**, which makes the latter chain along the **internal jugular vein** the **final common pathway** for lymphatic drainage from the head and neck to the **jugular lymph trunks**.

You will recall that the jugular trunks ultimately empty lymph into the **right and left venous angles**.



Several groups of **deep cervical nodes** are described, and again, their names reflect their location. These include the **retropharyngeal**, **paratracheal**, and **infrahyoid**, draining the posterior part of the tongue, pharynx, esophagus, larynx, trachea and thyroid gland.

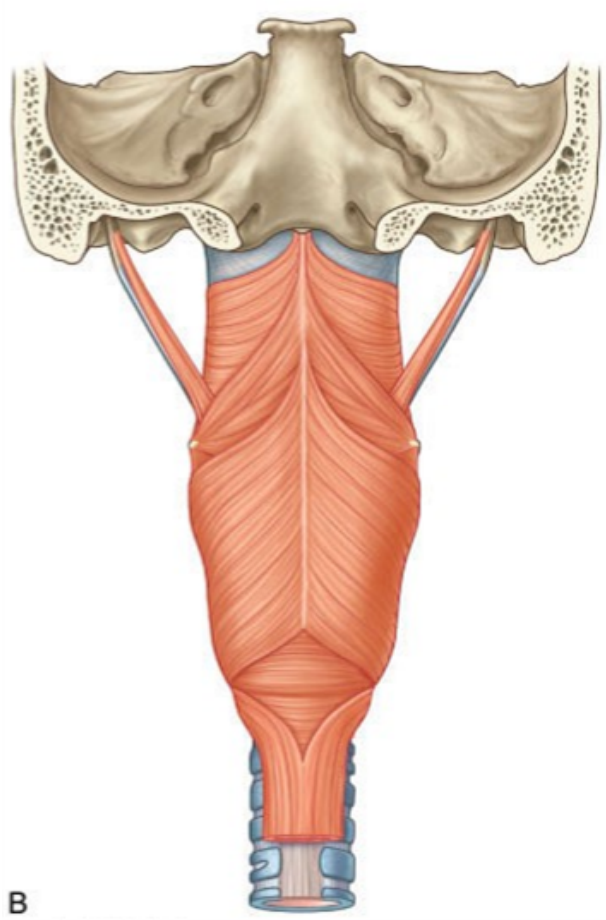
The **jugulodigastric node** is a node that is consistently located just inferior to where the posterior belly of the digastric muscle crosses the internal jugular vein. It is significant because it **receives lymph directly from the palatine tonsil and surrounding tissue**.



Objectives:

When you have completed this pre-lab exercise,you will be able to describe the:

- subdivisions of the pharynx, including their major features.
- retropharyngeal space.
- muscles of the pharynx, including their actions and nerve supply.
- internal features of the pharynx.
- nerves and vessels associated with the pharynx.

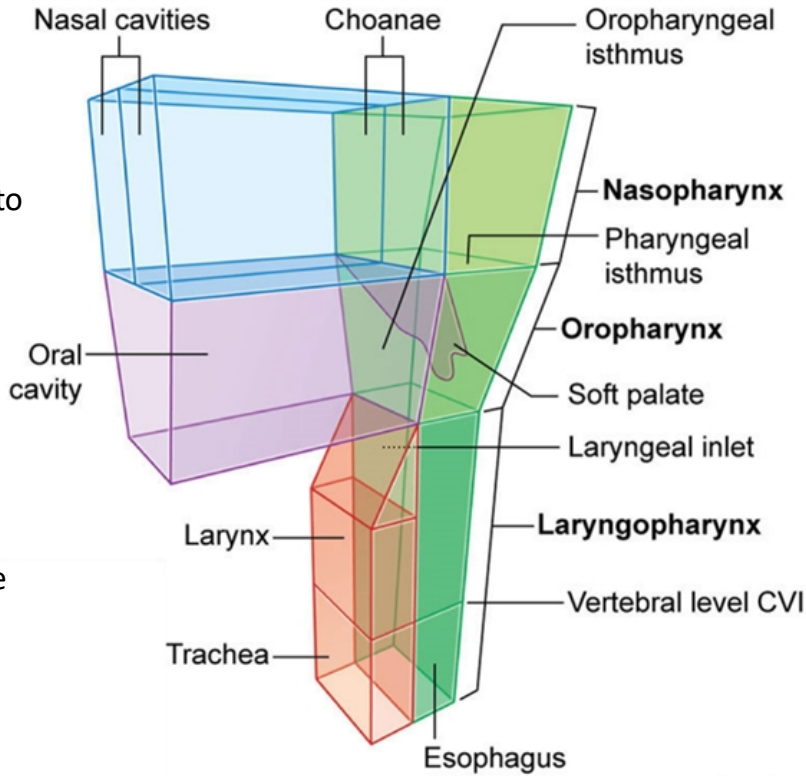


The pharynx is a passage common to both the respiratory and digestive systems. It extends from the **base of the skull** to the **inferior border of the cricoid** cartilage at the level of the **6th cervical vertebra**.

There are **3 layers to its wall**; the inner **mucosa**, the middle **muscular layer**, and an outer layer of connective tissue called the **buccopharyngeal fascia.**

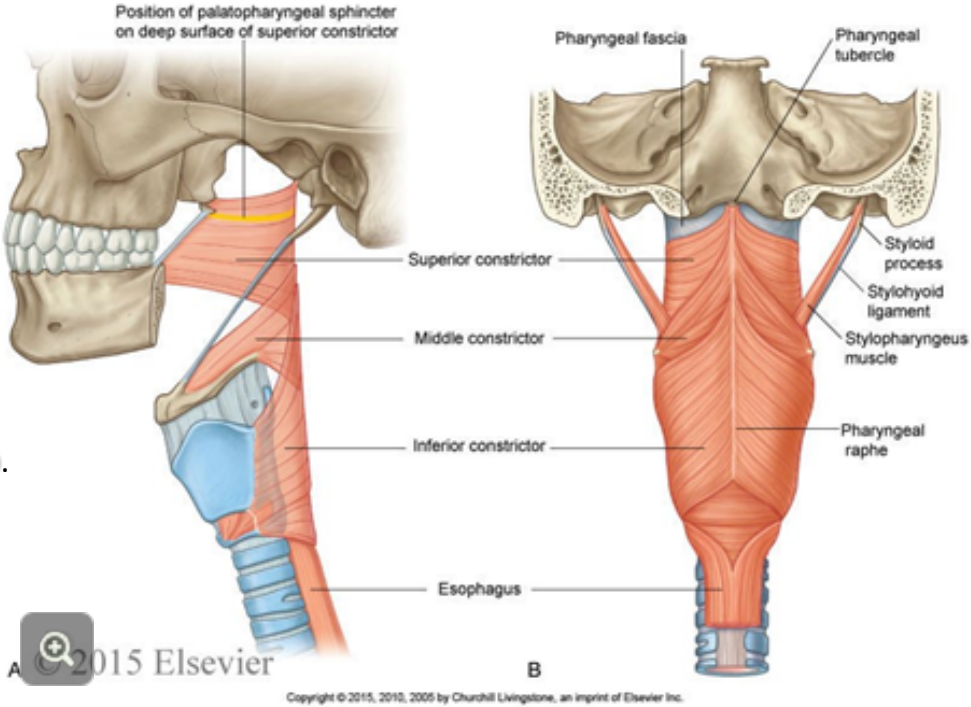
The pharynx opens anteriorly and is subdivided into 3 regions accordingly:

1. The **nasopharynx** opens into the nasal cavity. The nasopharynx extends from the base of the skull to the tip of the soft palate.
2. The **oropharynx** opens into the mouth. The oropharynx extends from the tip of the soft palate to the upper margin of the epiglottis.
3. The **laryngopharynx** opens into the larynx. The laryngopharynx extends from the upper margin of the epiglottis to the lower border of the cricoid cartilage.



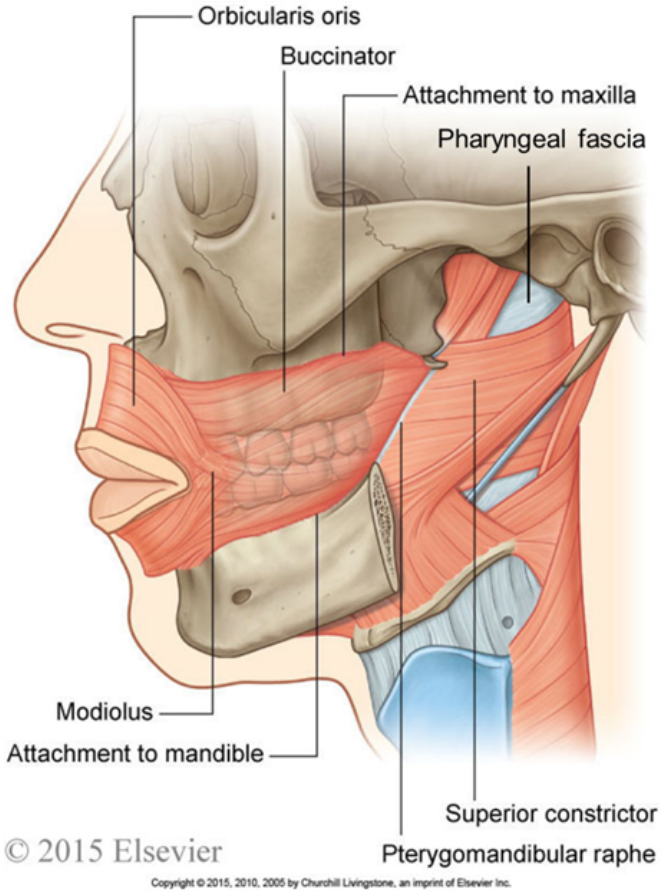
The muscular layer of the wall of the pharynx consists of an **outer layer of circularly arranged muscles** called the **pharyngeal constrictors** and an **incomplete inner longitudinal layer** formed by three paired muscles.

The superior, middle and inferior pharyngeal constrictors are paired muscles that attach anteriorly to the **skull**, **hyoid bone** and **thyroid and cricoid cartilages,** respectively. The fibres of each of the constrictor muscles pass posteriorly, and medially to meet the muscle from the opposite side in a midline **pharyngeal raphe**. The pharyngeal raphe is anchored superiorly to the **pharyngeal tubercle** on the occipital bone, just anterior to the foramen magnum.



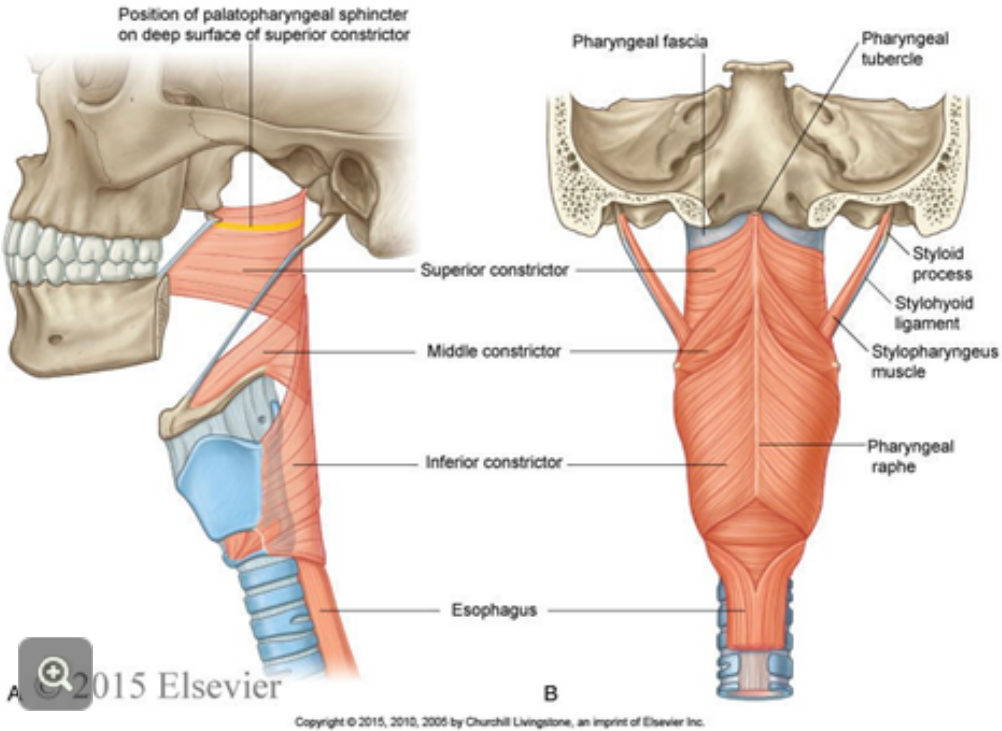
The **superior pharyngeal constrictor** attaches anteriorly to the **medial pterygoid plate** and to the **mandible** and to an intervening ligament called the **pterygomandibular raphe**. Attachment to the pterygomandibular raphe is shared by the superior constrictor posteriorly and the **buccinator muscle** anteriorly.

The gap in the musculature of the pharynx created between the uppermost fibres of the superior constrictor and the base of the skull is filled with a thick layer of connective tissue called the **pharyngobasilar or pharyngeal fascia**.



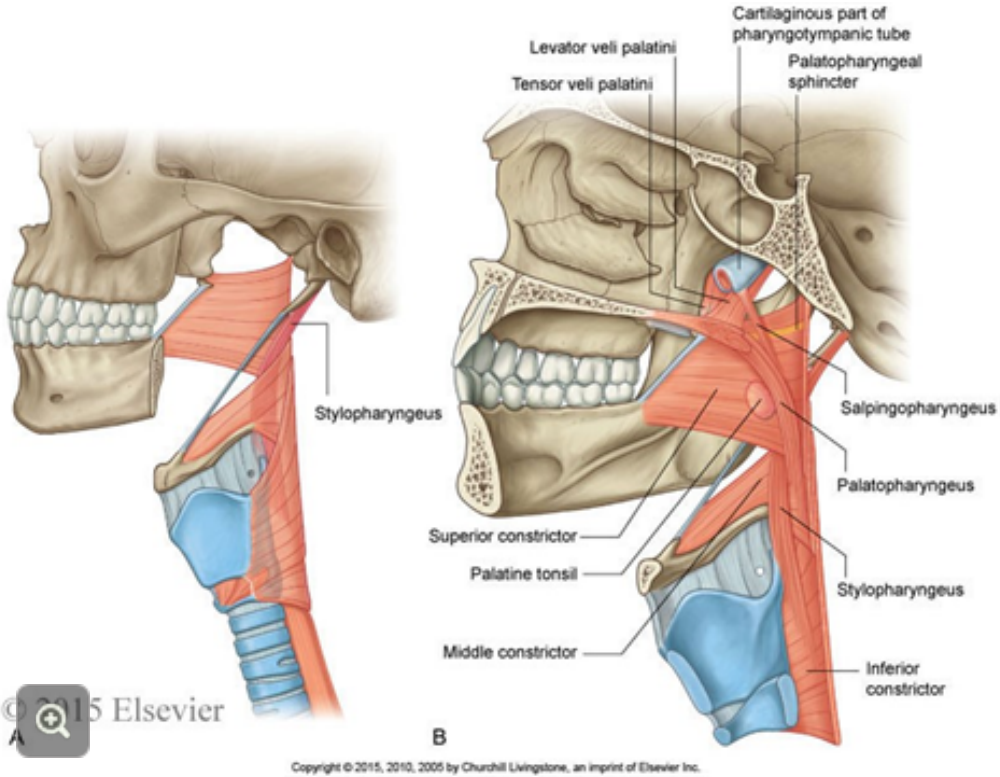
Anteriorly, the **middle constrictor** attaches to the **greater horn of the hyoid bone** and to the **stylohyoid ligament** that connects the styloid process to the lesser horn. The **upper fibres of the middle constrictor overlap and partially encircle the superior constrictor**.

The **inferior constrictor** attaches to the **cricoid and thyroid cartilages** anteriorly. The fibres of the inferior constrictor that are attached to the cricoid cartilage form the **cricopharyngeus muscle**. Cricopharyngeus is the **upper esophageal sphincter**. The sphincter is normally closed to prevent air form entering the digestive tract, but relaxes as part of the swallowing reflex to allow a bolus of food to pass. The **upper fibres of the inferior constrictor overlap and partially encircle the middle constrictor**.



The longitudinally-oriented muscles of the pharynx are the **stylopharyngeus**, **salpingopharyngeus** and the **palatopharyngeus**. The **stylopharyngeus** enters the pharynx by passing between the superior and middle constrictors.

The longitudinally-oriented muscles of the pharynx function to **raise the pharynx during swallowing**. This, coordinated with the narrowing of the pharynx behind a bolus of food through contraction of the constrictors, acts to propel food downward and into the esophagus.

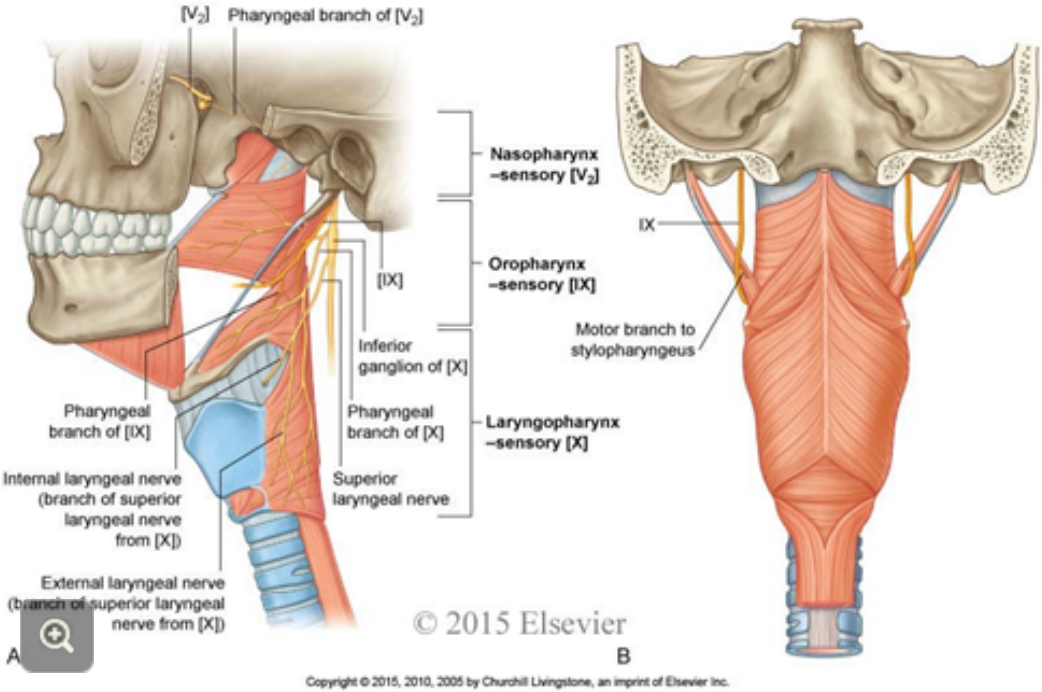


All **muscles** of the pharynx are innervated by **pharyngeal branches of the vagus nerve**, except for the **stylopharyngeus** which is innervated by the **glossopharyngeal nerve**.

Stylopharyngeus, in fact, is the only muscle innervated by the glossopharyngeal nerve.

Sensation from the pharyngeal mucosa is carried from the:

- **nasopharynx** by pharyngeal branches of the **maxillary nerve**,
- **oropharynx** by the **glossopharyngeal nerve**, and
- **laryngopharynx** by the **internal laryngeal branch of the superior laryngeal nerve, which arises from the vagus nerve**.



6.1 Radiology of the Head and Neck

What you'll need:

SPECIMENS

- Radiographs, skulls

Exercise 6.1 introduces you to identify structures in the head and neck region using medical images. Go through these slides prior to lab.

During the lab, go through them again with your group. Then, as a team, do the forty imaging questions in Quizlandia 6.1, using a skull as a reference, as needed, and **ensure that everyone can identify all structures**.

When you have completed this exercise, you will be able to describe the:

- major structures visible in medical imaging of the head and neck, including AP and lateral X-rays, coronal CT and sagittal and axial MRI.
- fascial layers and compartments of the neck including the major structures contained within these compartments and their identification in medical imaging

Use a skull, available to you in the lab, to assist you in identifying the following in the lateral radiograph provided:

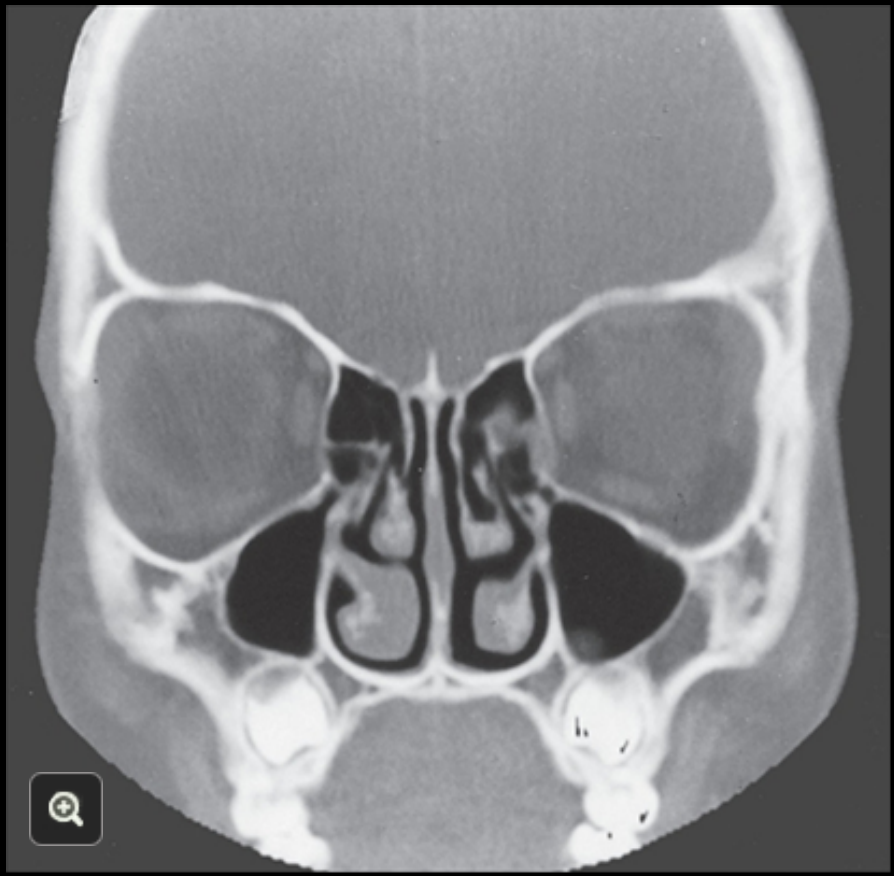
- the frontal (A), maxillary (B), ethmoid (C), sphenoid (D) , and mastoid (E) air sinuses.
- the pituitary fossa (F) in the sphenoid bone
- the petrous part of the temporal bone (G)
- the orbital plates of the frontal bone (H)
- the shadow of the middle meningeal artery (I)
- the hard palate (J)
- the nasopharynx (K), the oropharynx (L)

Use a skull, available to you in the lab, to assist you to identify the following in the posteroanterior (PA) radiograph provided:

- the frontal (A), maxillary (B), and ethmoid (C) air sinuses
- the perpendicular plate of the ethmoid (D), vomer (E), middle (F) and inferior (G) conchae
- the crista galli (H), lesser wing of sphenoid (I), and petrous ridge (J)
- the mandible (K) and the neck of the condyloid process (L)
- the spinous processes of cervical vertebrae (M)

In the coronal CT of the skull, identify:

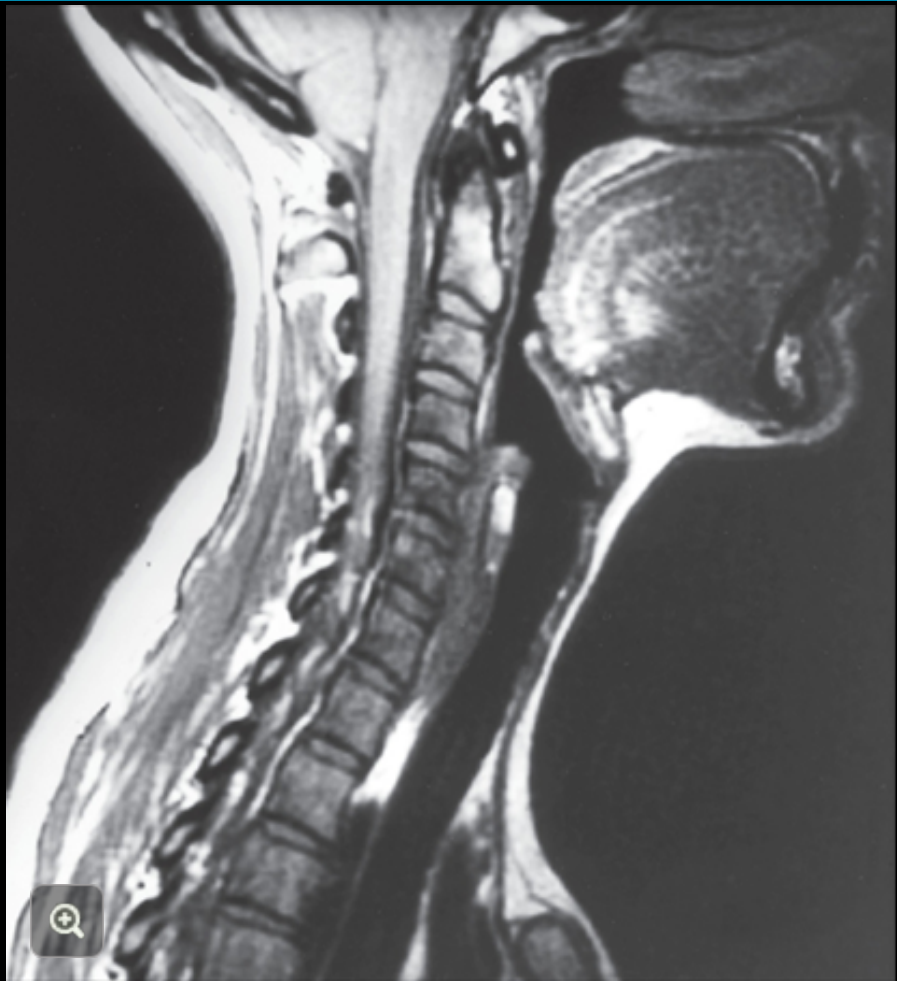
- the anterior cranial fossa (A) and crista galli (B)
- the ethmoid (C) and maxillary (D) air sinuses
- the nasal cavity (E), nasal septum (F), middle (G) and inferior (H) conchae
- the opening of the maxillary air sinus to the nasal cavity (I)
- erupted teeth (J), unerupted teeth (K), hard palate (L) and oral cavity (M)
- Note the relationships of the anterior cranial fossa, orbital cavities, ethmoid air cells, maxillary sinuses and oral cavity.



6.1 Radiology: A Sagittal MRI of the Neck

In the MRI, identify:

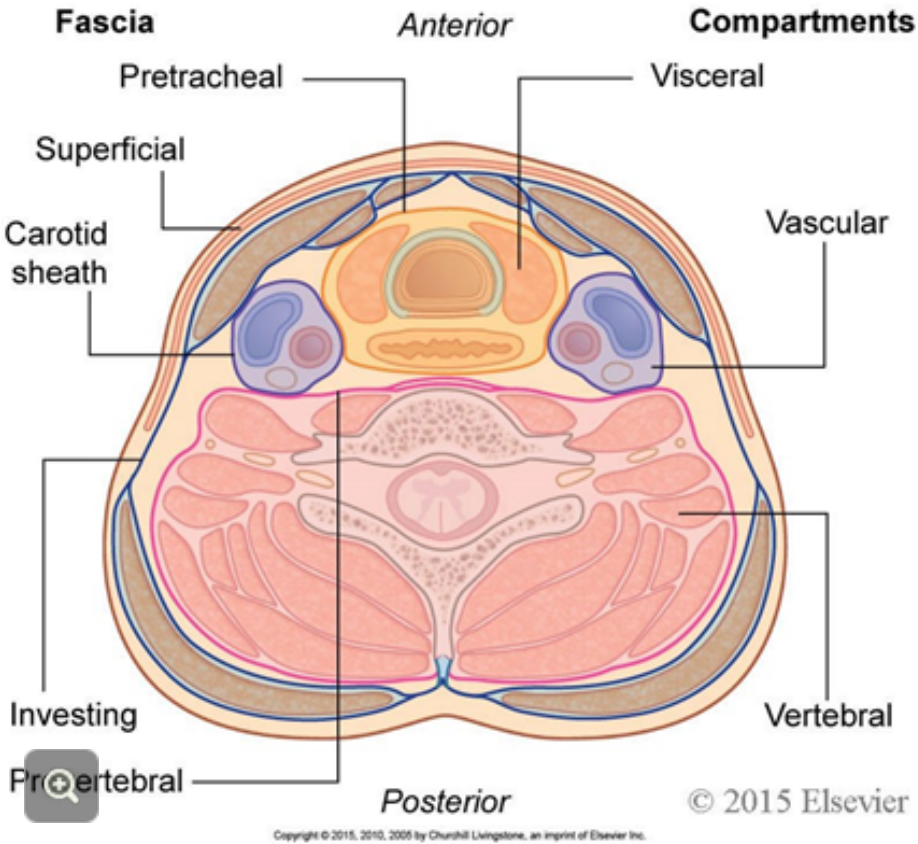
- the mandible (A), tongue (B), hard (C) and soft (D) palates
- the nasal cavity (E) and inferior concha (F)
- the larynx (G), hyoid bone (H), epiglottis (I) and cricoid (J) cartilage
- the trachea (K)
- the nasopharynx (L), oropharynx (M) and laryngopharynx (N)
- the anterior (O) and posterior (P) arches of the atlas
- the axis and odontoid (Q) process
- the cervical vertebrae (R) and intervertebral discs (S)
- the 1st thoracic vertebra (T)



The **deep fascia of the neck** is organized into several layers which create **compartments** that determine the **flow of free fluid** and the **spread of disease and infection**.

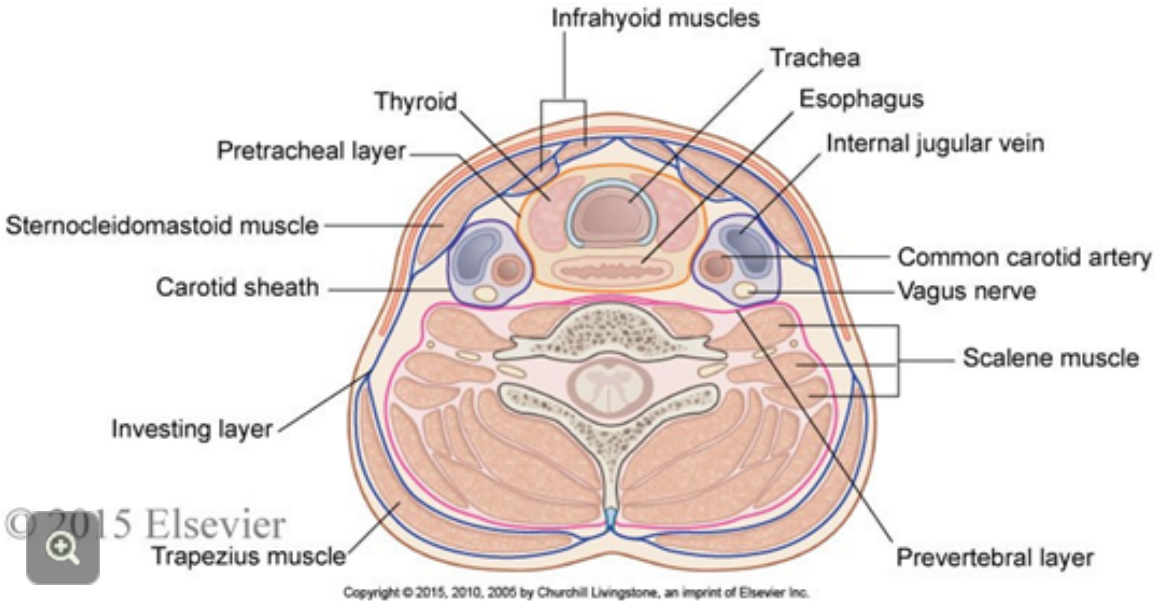
In the diagram, identify the:

- **investing fascia** surrounding all structures in the neck
- **prevertebral fascia** surrounding the **vertebral compartment**
- **pretracheal fascia** surrounding the **visceral compartment**
- **carotid sheath** surrounding the **vascular compartment**



The **investing fascia** surrounds all of the structures in the neck. It is attached posteriorly to the superior nuchal line. Note in the diagram that it **splits to enclose** the **trapezius**, the **SCM** and the **infrahyoid muscles**.

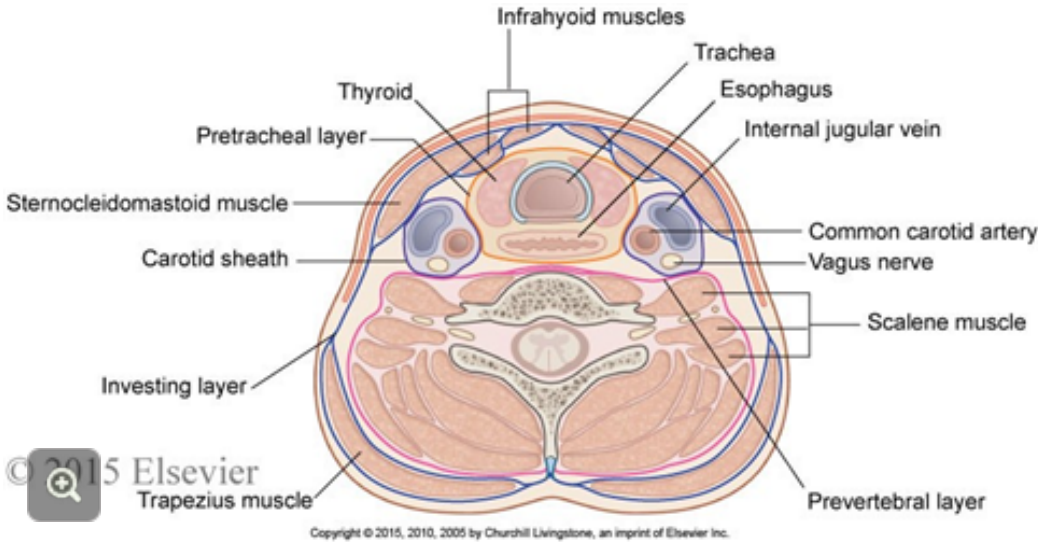
The **prevertebral fascia** surrounds the **vertebral compartment**. Note in the diagram that it contains the cervical part of the **vertebral column**, the **prevertebral muscles,** the **deep muscles of the back** and the **anterior, middle and posterior scalene** muscles. As the roots of the brachial plexus and the subclavian artery emerge from in between the anterior and middle scalene to enter the upper limb, they carry out an extension of this fascial layer which forms the **axillary sheath**.



The **pretracheal fascia** surrounds the **visceral compartment.** Note in the diagram that contained within this compartment, are the **esophagus, larynx, trachea,** and **thyroid gland**. More superiorly, it surrounds the **pharynx** as the **buccopharyngeal fascia**.

The **carotid sheath** is the layer of fascia surrounding the **vascular compartment.** Note in the diagram that it contains the **common carotid artery** (and, more superiorly, its **internal carotid branch**), the **internal jugular vein**, and the **vagus nerve**.

In the axial MRI that follows, outline the vertebral, and visceral compartments and the carotid sheath. Identify the positions in which the vagus nerves, recurrent laryngeal nerves, sympathetic chains, and phrenic nerves are located.



In the MRI of the neck identify the:

- cervical vertebral body (A) and neural arch (B)
- esophagus (C)
- cricoid cartilage (D)
- thyroid gland (E)
- internal jugular vein (F) and common carotid artery (G)
- SCM (H), infrahyoid (I) and trapezius muscles (J).

Since embarking on this exercise, you have learned to identify many anatomical structures of the head and neck region in medical images.

If you are satisfied with your ability to identify these structures, call your TA over for confirmation.

Your TA will assess you by having each of you identify structures in the images provided.

Once your TA is satisfied with your progress, you will be given permission to move on to the next stage of the lab.

6.2 The Larynx

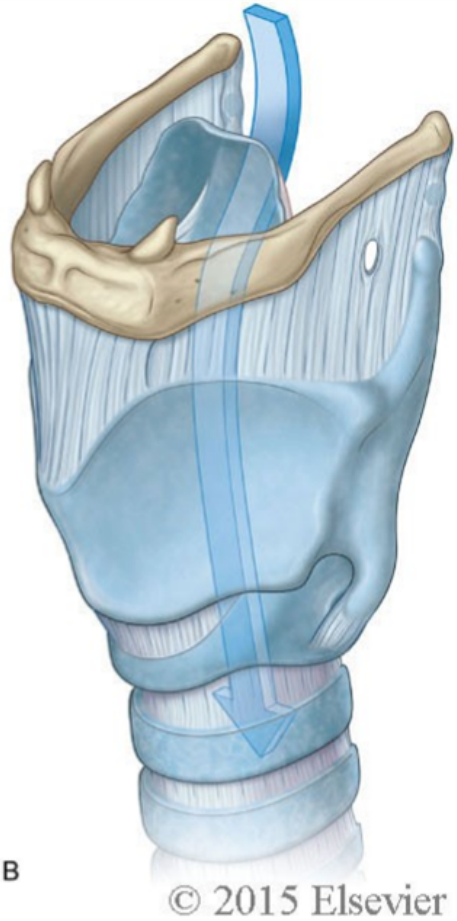
What you'll need:

SPECIMENS

- Larynx models and prosections
- 4 bisected cadaver heads, those used for the dissection of the oral cavity in Lab 5
- cadaver 1, as needed

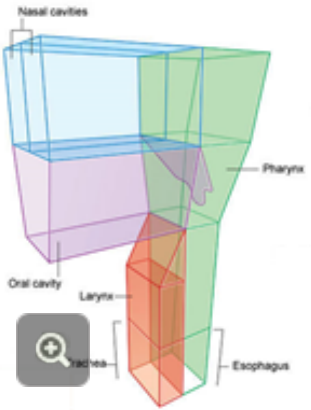
When you have completed this exercise, you will be able to identify and describe the:

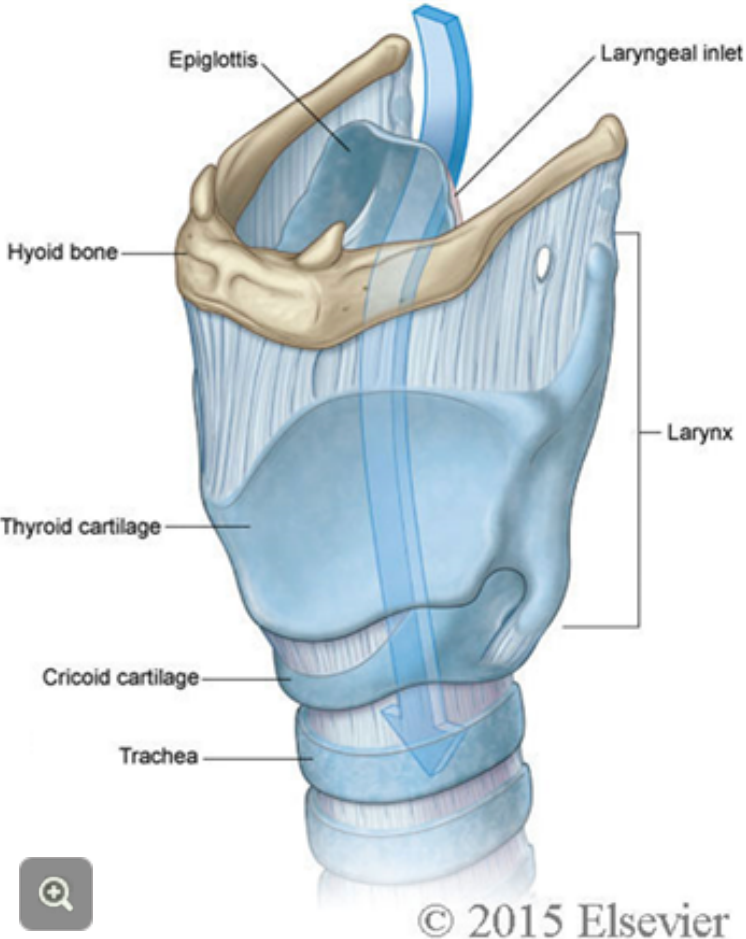
- skeleton of the larynx.
- membranes associated with the larynx
- vocal and vestibular ligaments, and their relationships to the membranes of the larynx
- spaces within the larynx
- intrinsic muscles of the larynx, including their actions and nerve supply
- blood supply of the larynx



The larynx is a structure that serves the dual functions of **supporting the airway** and **producing sound**.

The **skeleton** of the larynx consists of a series of **articulated cartilages** that maintain the **patency** of the airway at this level and which give **attachment** to **membranes, ligaments, and muscles** necessary for the production of sound.

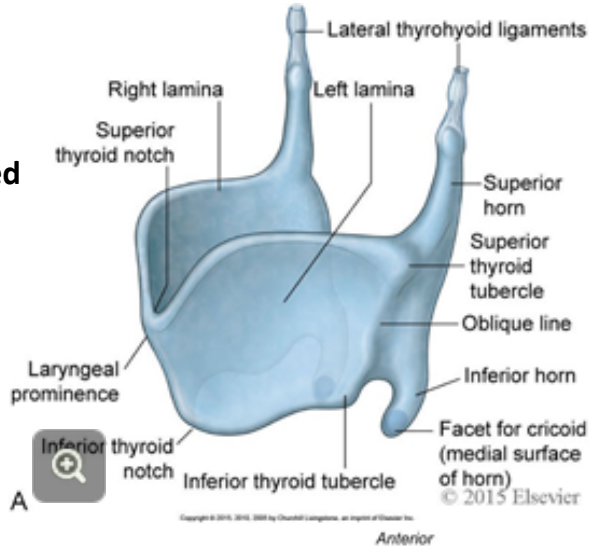




TASK

On the model of the larynx, IDENTIFY

the laminae of the thyroid cartilage and the laryngeal prominence (Adam's apple) created by the angle formed between the two laminae. Locate the superior thyroid notch. Palpate the laryngeal prominence and superior thyroid notch on yourself.



INFO

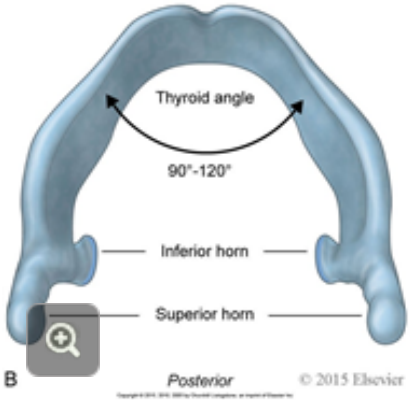
Adam's Apple

The laminae meet at a more acute angle in males than in females, accounting for the more prominent Adam's apple in males.

TASK

IDENTIFY the superior and inferior horns of the thyroid

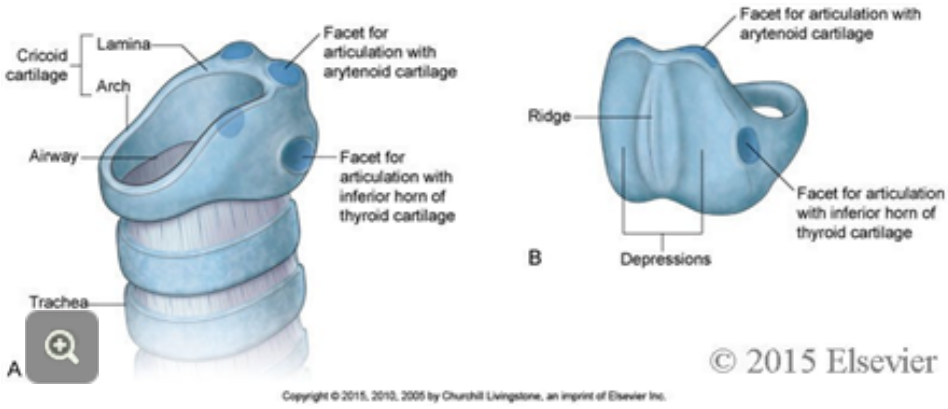
cartilage on the posterior margins of the laminae. Note that the inferior horns of the thyroid form synovial joints with the cricoid cartilage that allow the thyroid cartilage to tilt anteriorly and posteriorly on the cricoid. As you will learn, this changes the length and thickness of the vocal folds, and thus the pitch of the voice.



TASK

IDENTIFY the ring-shaped

cricoid cartilage, its narrow **arch**, anteriorly, and its wider **lamina**, posteriorly.



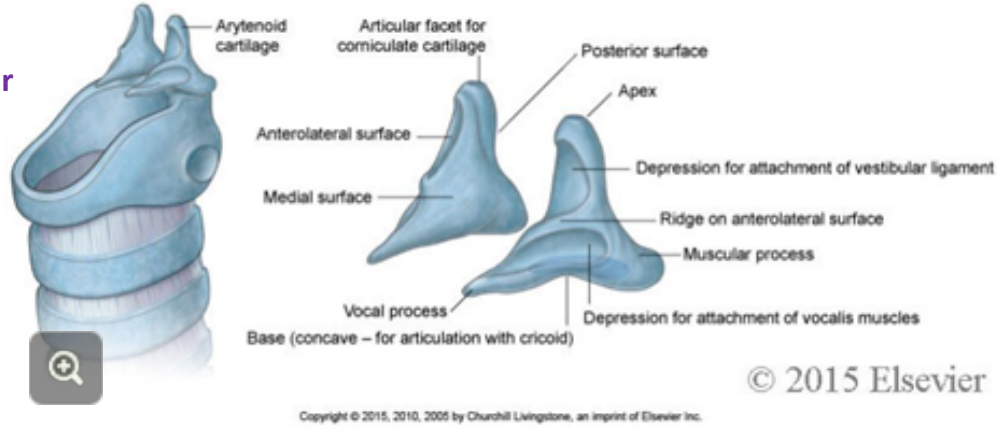
TASK

IDENTIFY the two

pyramidal-shaped arytenoid cartilages, which articulate via synovial joints with the superior surface of the cricoid lamina.

Locate the apex, vocal, and muscular processes of one of the arytenoids.

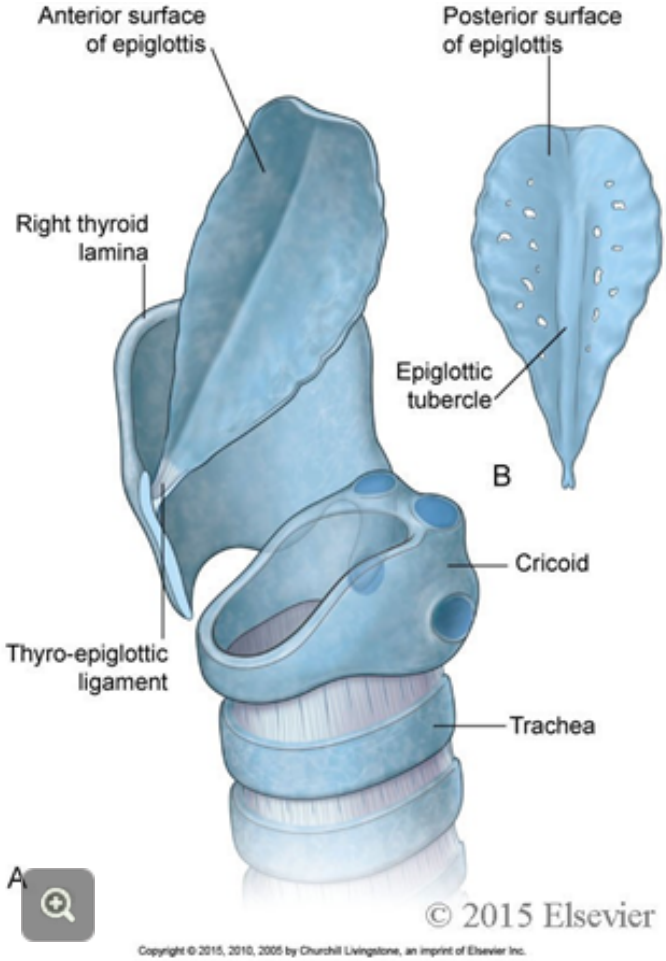
The arytenoid cartilages are able to rotate, to tilt anteriorly and posteriorly and to slide away from each other (abduct) and toward each other (adduct) at the joints they form with the cricoid.



TASK

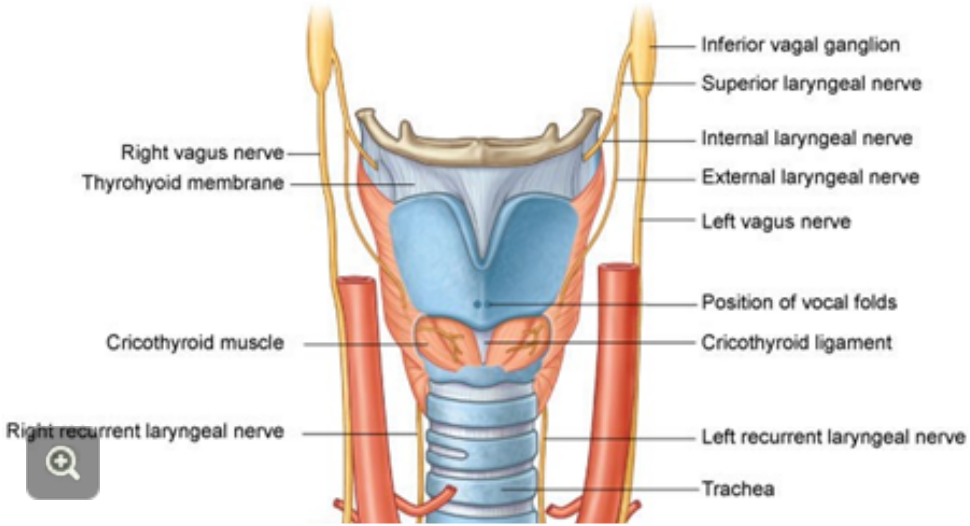
IDENTIFY the epiglottis,

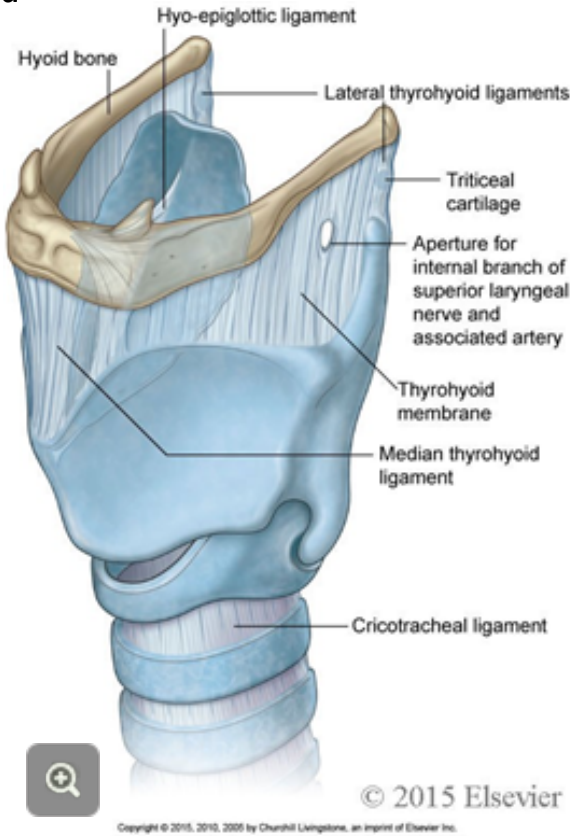
a leaf-shaped cartilage with its stem attached by a ligament to the posterior (internal) aspect of the laryngeal prominence, just inferior to the superior thyroid notch.



TASK

On the prosected specimen, LOCATE the thyrohyoid membrane between the hyoid bone and superior border of the thyroid cartilage. The superior laryngeal nerve penetrates the lateral part of the thyrohyoid membrane to deliver sensory nerve fibres to the laryngeal lining above the level of the vocal folds. Identify the paired cricothyroid muscles, and between them identify the median cricothyroid ligament. It may have been pierced with a needle by paramedics training on cadavers to perform cricothyrotomy.



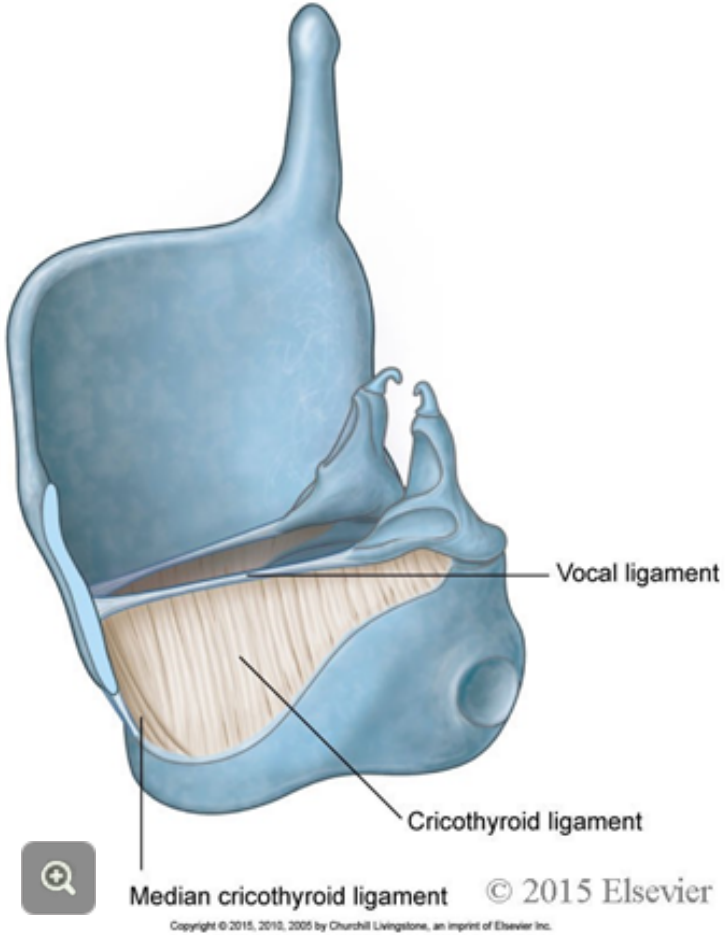


The **median cricothyroid ligament** spreads out laterally on each side as the **cricothyroid ligaments**, sheet-like membranes that arise from the lateral margins of the cricoid and extend superiorly to meet the **vocal ligaments**. The vocal ligaments stretch from the **vocal process of each arytenoid cartilage** to attach to the **thyroid cartilage** just below the attachment of the epiglottis. The cricothyroid ligament is sometimes referred to as the cricovocal membrane, or, **conus elasticus**.

TASK

On the model of the larynx, LOCATE

the cricothyroid membranes and the vocal ligaments. The vocal ligaments are essentially, the free margins of the cricothyroid membranes on each side of the larynx.



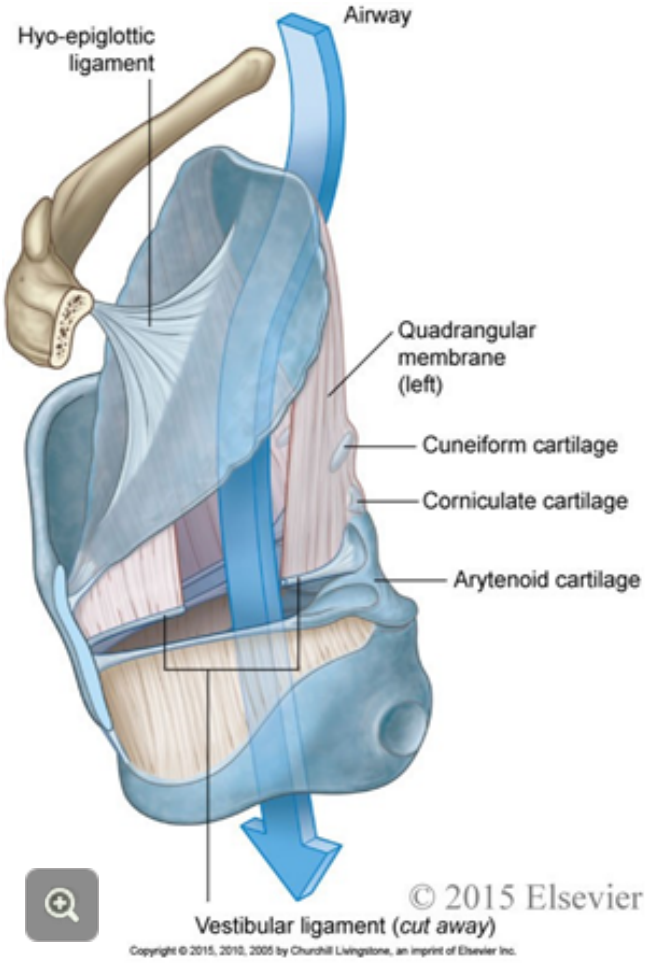
The **quadrilateral membrane** is an elastic membrane, which connects the **lateral edge of the epiglottis** to the **arytenoid cartilage** on each side. The **inferior free edge of the quadrilateral membrane** is called the **vestibular ligament**.

TASK

On the model of the larynx,

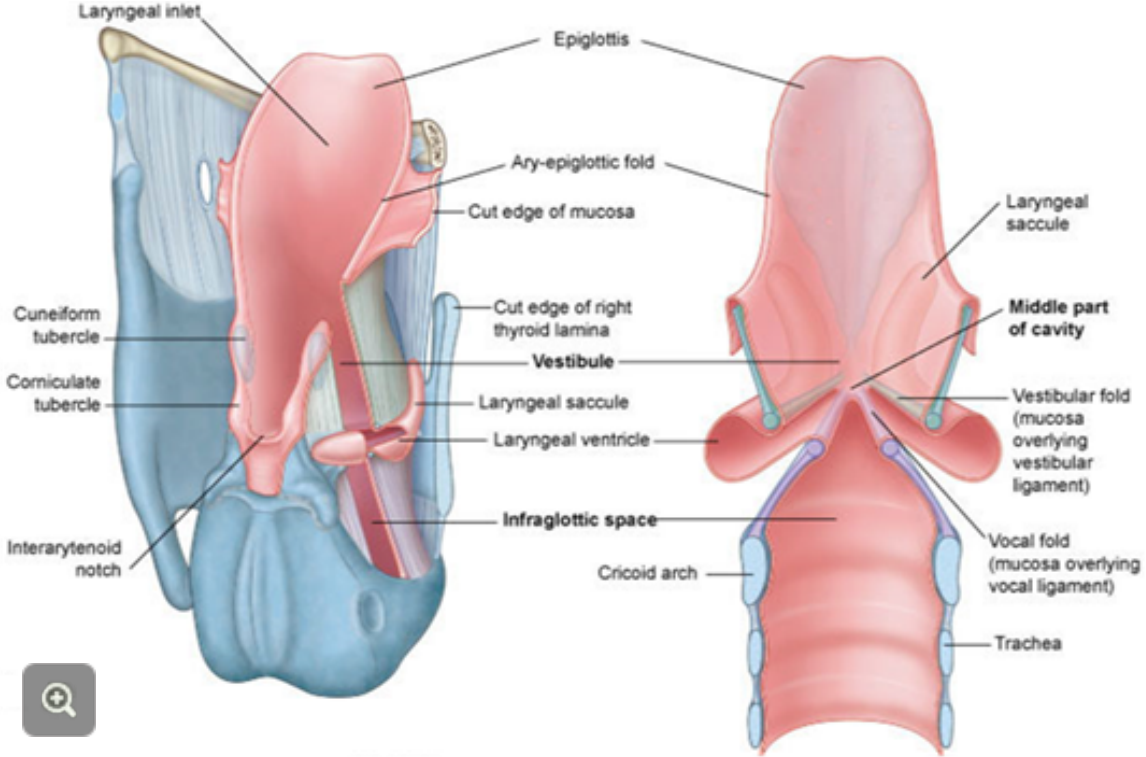
identify the attachments of the quadrilateral membrane and the location of the vestibular ligament.

On the prosection of the larynx, identify the quadrilateral membranes and vestibular ligaments.



The internal lining of the larynx is covered with **mucous membrane**. The mucous membrane drapes over the superior border of the quadrilateral membrane, creating the **aryepiglottic fold**. It then tucks under the vestibular ligament, forming the **vestibular fold**, or, **false vocal cord**. The mucosa then comes back medially to cover the vocal ligament, forming the **vocal fold**, or, **true vocal cord**, before passing inferiorly onto the internal surface of the cricothyroid ligament.

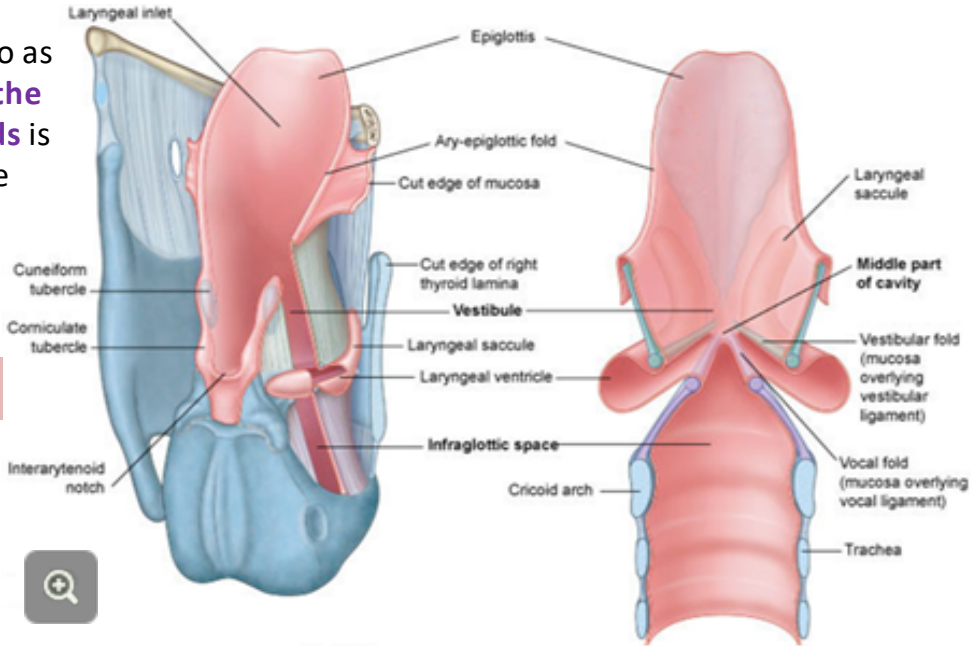
The slit-like space created between the vestibular and vocal folds is called the **ventricle**. The ventricle has an anterosuperior extension called the **saccule** and the mucosa of both the ventricle and saccule are rich in mucous glands producing secretions that keep the vocal folds supple.



TASK

On the prosection of the larynx with vessels, LOCATE the epiglottis and aryepiglottic folds. Identify the laryngeal inlet, bordered by the epiglottis and the superior margin of the aryepiglottic fold on each side. The laryngeal inlet is the border between the laryngopharynx and the larynx.

Locate the false vocal cords (vestibular folds) and the true vocal cords (vocal folds) and the ventricles. The space between the 2 vocal folds is referred to as the rima glottidis. The space from the laryngeal inlet to the true vocal cords is called the vestibule and it includes the vestibular folds and the ventricles. Inferior to the true vocal cords lies the infraglottic space.



TASK

Using the bisected cadaver head, IDENTIFY the aryepiglottic fold, the piriform fossa lateral to it, the true and false vocal folds and the ventricle.

Since embarking on this exercise, you have **identified** the following structures and learned the **answers to the following questions**:

On the larynx model:

- the thyroid cartilage (laminae, laryngeal prominence, superior thyroid notch, superior and inferior horns), cricoid cartilage (arch, lamina); With what do the inferior horns of the thyroid cartilage articulate and how does the thyroid cartilage move at these articulations?
- the arytenoid cartilages (apex, vocal and muscular processes); With what do the arytenoid cartilages articulate? What three movement pairs are possible at this articulation?
- the epiglottis; Describe the location of its articulation with the thyroid cartilage.
- the cricothyroid membranes and the vocal ligaments; What is their relationship to each other? What are the attachments of the vocal ligaments? What is the conus elasticus?
- the lines of attachment of the quadrilateral membranes and vestibular ligaments; What is their relationship to each other?

On the prosected specimen:

- the thyrohyoid membrane, superior laryngeal nerve (if present), cricothyroid muscles, median cricothyroid ligament, the quadrilateral membranes and vestibular ligaments
- the epiglottis, aryepiglottic folds, laryngeal inlet, false vocal cords (vestibular folds), true vocal cords (vocal folds), ventricles; What is the rima glottides? the vestibule? the infraglottic space?

On the bisected cadaver head:

- aryepiglottic fold, piriform fossa, true and false vocal folds (proper names?) and ventricle

Pause here to assess your learning. Quiz each other thoroughly. If you are satisfied with your **ability to identify these structures** and **answer these questions, move on** to the next stage of the exercise.

Sound is produced in the larynx by the vibration of the true vocal focal folds. Vibration occurs when the rima glottidis is closed, forcing air to flow rapidly past the true vocal folds. Sound is modulated by the **tension** and **position** of the vocal cords and the **position of the larynx**.

The **position of the larynx** is under the control of the **extrinsic muscles of the larynx**, which were identified during the dissection of the anterior triangle of the neck**.**

TASK

REVIEW these muscles on the cadaver:

the sternohyoid, omohyoid, sternothyroid and thyrohyoid.

The **position and tension of the vocal cords** is under the control of the **intrinsic muscles of the larynx**. These are muscles that have attachments confined to the laryngeal cartilages.

On the cadaver, review the **cricothyroid**, which functions to raise the pitch of the voice by increasing the tension on the vocal folds when it contracts to tilt the thyroid cartilage anteriorly.

TASK

On the model of the larynx and on the prosected larynx specimen, IDENTIFY

the posterior cricoarytenoid muscle passing from the posterior surface of the cricoid lamina to the muscular process of the arytenoid cartilage.

Posterior cricoarytenoid **abducts the vocal cords**, by causing the vocal process to rotate outwards when the muscle contracts. It is the only muscle that will do so and **open the rima glottidis**. The rima glottidis opens when we breathe.

TASK

IDENTIFY the lateral cricoarytenoid muscle

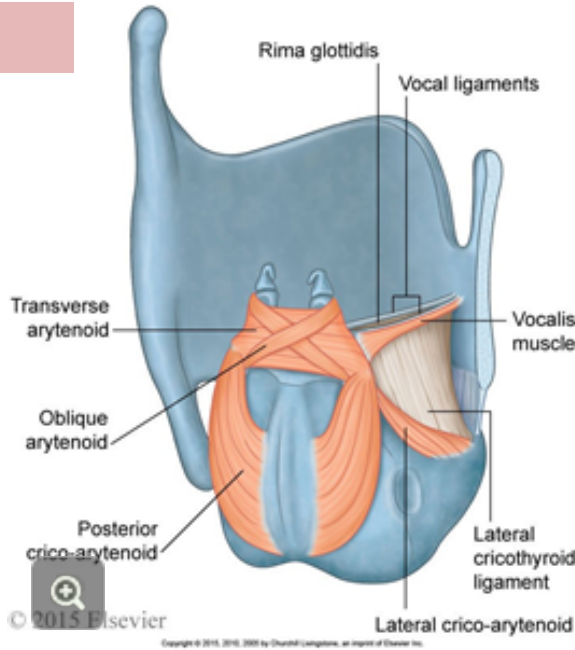
attaching the cricoid ring to the muscular process of the arytenoid.

The lateral cricoarytenoid rotates the vocal process inwards when it contracts, thereby **adducting the vocal cord**. This occurs when we swallow and is necessary for the larynx to produce sound.

TASK

On the model of the larynx only, IDENTIFY

the arytenoid muscle connecting the two arytenoid cartilages to each other. The arytenoid muscle has both oblique and transverse parts and acts to draw the arytenoid cartilages closer together, helping to **close the rima glottidis**. This occurs when we swallow and is necessary for the larynx to produce sound.

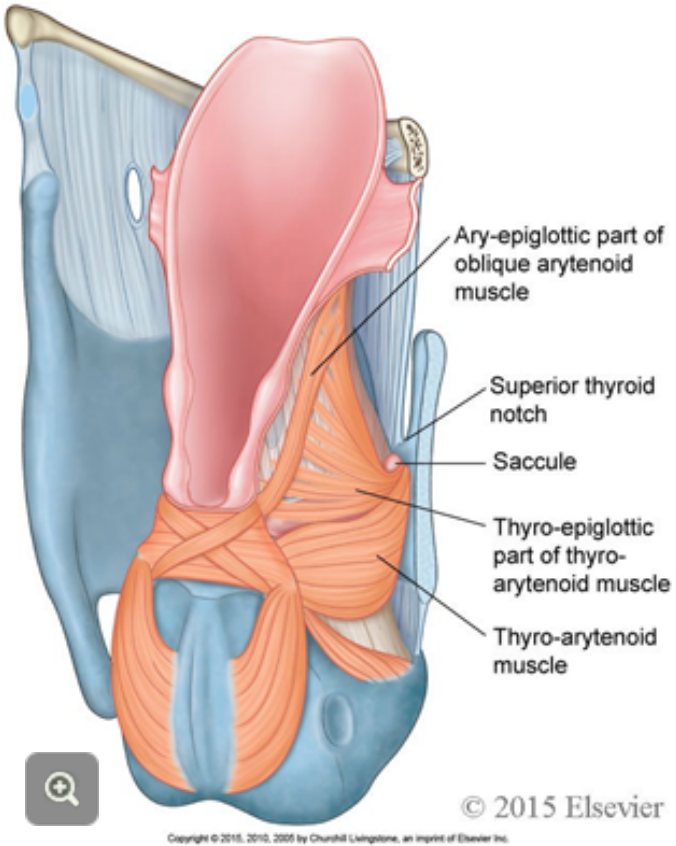


TASK

On the model of the larynx and on the prosected larynx specimen, IDENTIFY

the thyroarytenoid muscle, passing between the thyroid and arytenoid cartilages, lateral to the vocal ligament.

It draws the thyroid and arytenoid cartilages **closer, reducing the tension on the vocal cords and thereby lowering the pitch of the voice**.



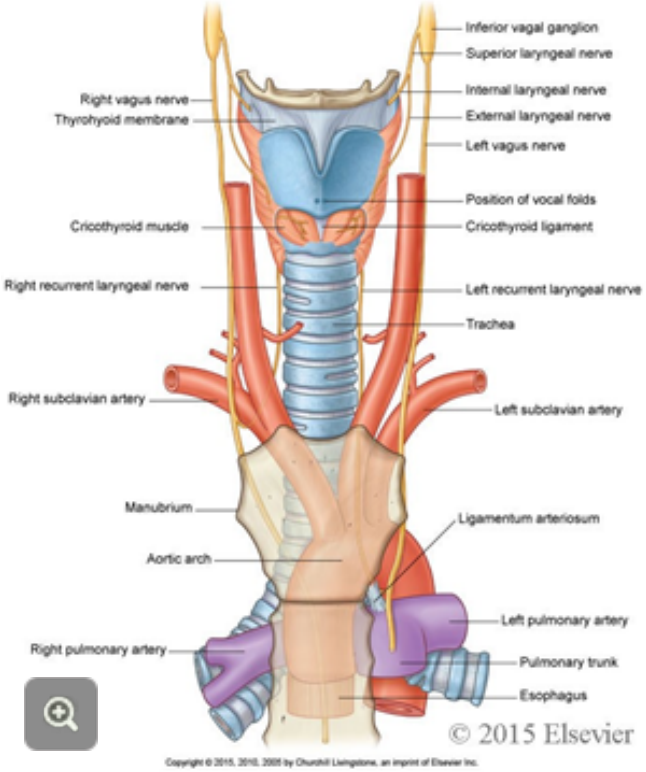
The **intrinsic muscles of the larynx** are all innervated by somatic motor fibres carried in branches of the **vagus nerve**.

The **superior laryngeal nerve** is a branch of the vagus nerve. Its **external laryngeal branch** innervates the **cricothyroid muscle**. Its **internal laryngeal branch** is sensory to the laryngeal mucosa **above the vocal folds**.

The **recurrent laryngeal nerve** innervates **all other intrinsic muscles** of the larynx and supplies **sensory fibres** to the laryngeal mucosa of the **infraglottic space**.

The **right** recurrent laryngeal nerve arises from the vagus as it crosses the right subclavian artery to enter into the thorax, and recurs under the **right subclavian artery**.

The **left** recurrent laryngeal nerve arises from the left vagus as it crosses the arch of the aorta in the thorax and recurs under the **aortic arch**.



TASK

On the prosection of the larynx with vessels,

LOCATE the recurrent laryngeal nerves. They lie along the groove where the esophagus meets the trachea. Trace them superiorly to where they pass deep to the inferior constrictor muscle. At this point they enter into the larynx and may be referred to as the inferior laryngeal nerves.

The blood supply to the larynx is derived from superior and inferior laryngeal arteries, branches of the superior and inferior thyroid arteries respectively.

TASK

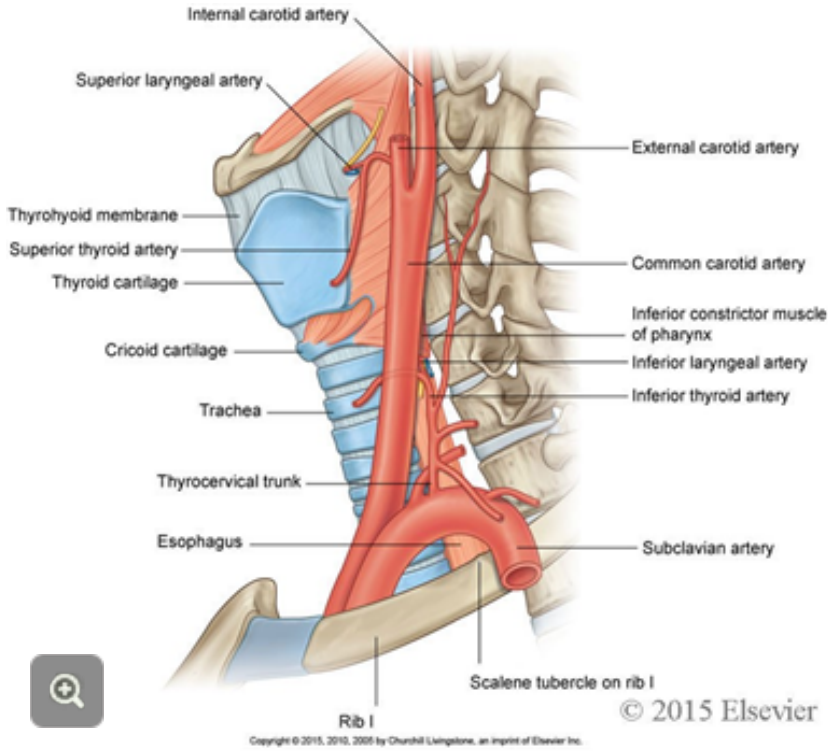
On the prosection of the larynx with vessels,

IDENTIFY the external carotid artery, superior thyroid artery and finally the superior laryngeal artery.

The superior laryngeal artery accompanies the internal laryngeal nerve as it penetrates the thyrohyoid membrane.

Once the deep neck dissection is complete, identify the following in cadaver 1:

- superior laryngeal nerve, internal and external branches
- external carotid artery, superior thyroid artery and its branch, the superior laryngeal artery
- recurrent laryngeal nerve (a.k.a. inferior laryngeal nerve)
- inferior thyroid artery and its branch, the inferior laryngeal artery



Since the last progress check, you have **identified** the following structures and learned the **answers to the following questions**:

On cadaver 1:
- the extrinsic muscles of the larynx: the sternohyoid, omohyoid, sternothyroid and thyrohyoid; What is their action as a group? What is the action of the intrinsic muscles of the larynx as a group?
- the intrinsic muscles of the larynx: the cricothyroid (action on the thyroid cartilage and vocal folds?)
- once the deep neck dissection is completed, identify the superior laryngeal nerve and its internal and external branches (distribution?), the superior thyroid and superior laryngeal arteries, the recurrent laryngeal nerves, bilaterally (distribution?), the inferior thyroid and inferior laryngeal arteries

On the larynx model:
- the posterior cricoarytenoid muscle (action? when is it used?), lateral cricoarytenoid muscle (action? when is it used?), arytenoid muscle (action? when is it used?), thyroarytenoid muscle (action? when is it used?)

On the prosected specimen:
- the posterior cricoarytenoid muscle (action? when is it used?), lateral cricoarytenoid muscle (action? when is it used?), , thyroarytenoid muscle (action? when is it used?)

On the prosected specimen with vessels:
- the recurrent laryngeal nerves, bilaterally
- the external carotid, superior thyroid and superior laryngeal arteries
- the inferior thyroid and inferior laryngeal arteries

If you are satisfied with your **ability to identify these structures** and **answer these questions**, call your TA over for confirmation and for **permission to move on**.

6.3 The Pharynx

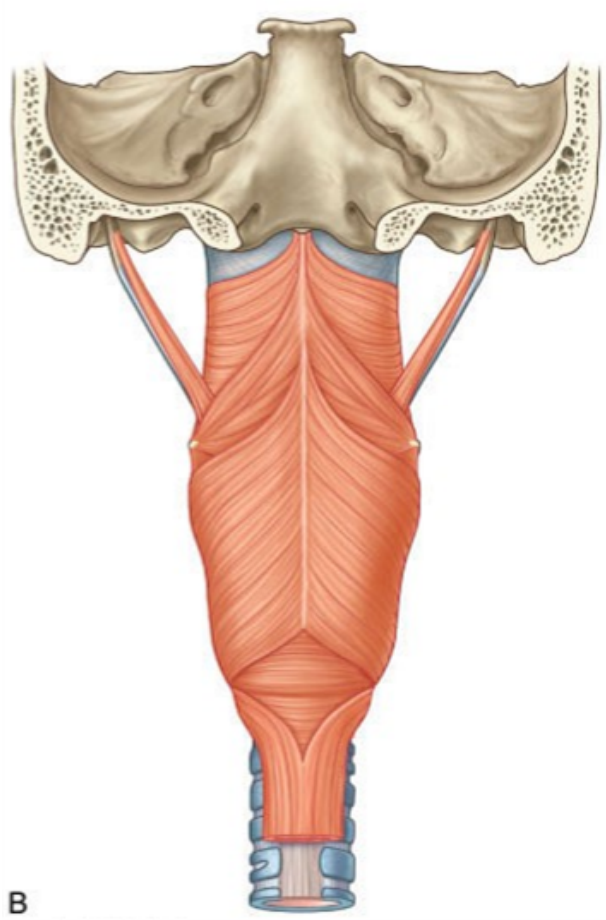
What you'll need:

SPECIMENS

- 4 bisected cadaver heads (those used for the nasal cavity dissection in Lab 5)
- 1 open pharynx prosection

When you have completed this exercise, you will be able to identify and describe the:

- subdivisions of the pharynx, including their major features.
- retropharyngeal space.
- muscles of the pharynx, including their actions and nerve supply.
- internal features of the pharynx
- nerves and vessels associated with the pharynx

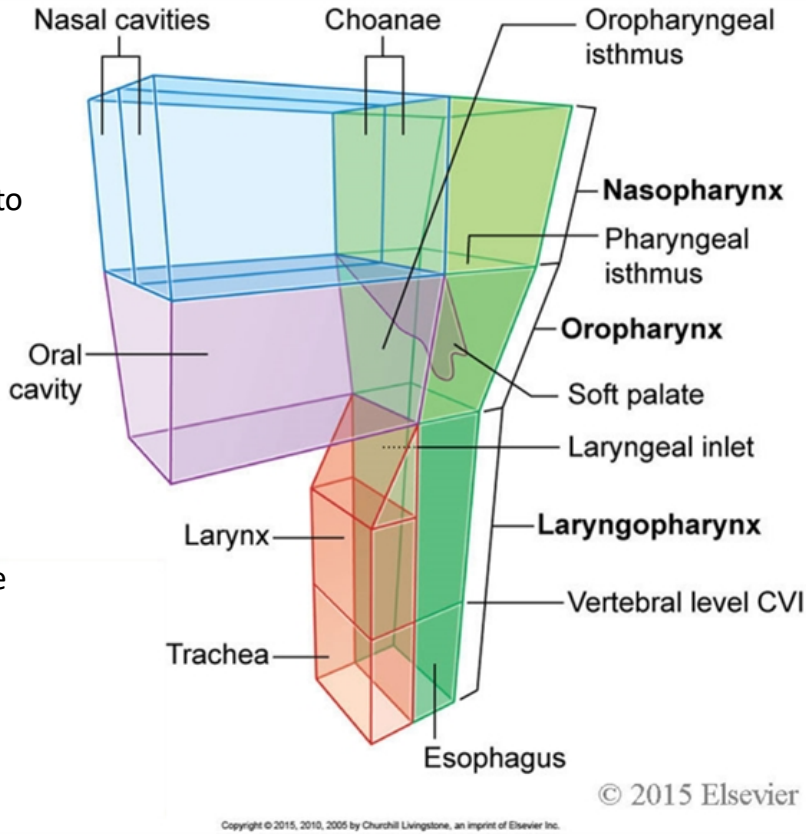


The pharynx is a passage common to both the respiratory and digestive systems. It extends from the **base of the skull** to the **inferior border of the cricoid cartilage** at the level of the **6th cervical vertebra**.

There are **3 layers to its wall**; the inner **mucosa**, the middle **muscular layer**, and an outer layer of connective tissue called the **buccopharyngeal fascia.**

The pharynx opens anteriorly and is subdivided into 3 regions accordingly:

1. The **nasopharynx** opens into the nasal cavity. The nasopharynx extends from the base of the skull to the tip of the soft palate.
2. The **oropharynx** opens into the mouth. The oropharynx extends from the tip of the soft palate to the upper margin of the epiglottis.
3. The **laryngopharynx** opens into the larynx. The laryngopharynx extends from the margin of the epiglottis to the lower border of the cricoid cartilage.



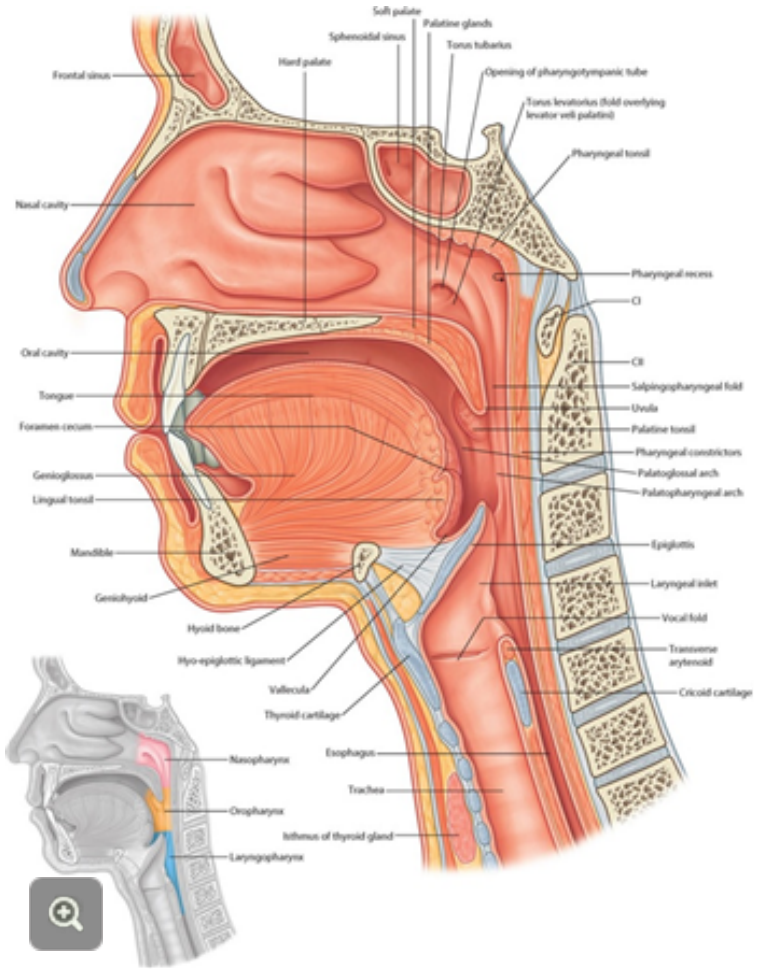
TASK

On the bisected cadaver head,

IDENTIFY the following landmarks: the cut edge of the body of the sphenoid on the base of the skull, the soft palate, the epiglottis, the cut posterior edge of the cricoid cartilage. Using these landmarks, identify the 3 subdivisions of the pharynx.

In the nasopharynx, identify the opening of the pharyngotympanic tube (auditory tube, or, Eustacian tube).

The pharyngotympanic tube is a passage that connects the nasopharynx with the middle ear, an air filled space in the temporal bone.



INFO

Otitis Media

The wall of the pharyngotympanic tube where it opens into the nasopharynx is supported by **elastic cartilage**, which confers the ability of the tube to open and close. **The tube is usually closed** except when pressure increases in the nasopharynx, or, during swallowing and yawning, when the action of several muscles attaching around the tube create traction on the opening. The middle ear is lined with a **mucous membrane**, and the pharyngotympanic tube provides a **route for drainage** of the fluid produced by the membrane. **Inflammation of the mucosa** in the tube can interfere with normal drainage leading to **fluid build-up in the middle ear**. This can provide **a medium for bacterial growth**, leading to ear infection (**otitis media**). The pharyngotympanic tube **is shorter, more horizontal, and narrower in children**, making them **prone to recurring middle ear infections**. The fluid build-up in the middle ear with recurring middle ear infections in children may impair conductive hearing. To prevent this, sometimes it becomes necessary to insert **tympanostomy tubes** through the tympanic membrane in order to provide an alternate route for drainage.

INFO

Equilibration of Pressure Across the Tympanic Membrane

The pharyngotympanic tube also allows a route through which **air pressure in the middle ear can equilibrate with atmospheric pressure**. Most have experienced the action of the pharyngotympanic tube when taking off in an airplane. As ambient pressure begins to drop, the air trapped in the middle ear will expand, distorting the tympanic membrane, creating a sensation of pressure. When the pharyngotympanic tube opens, for instance during swallowing, the pressure of air in the middle ear equilibrates with atmospheric pressure and the sensation is relieved.

TASK

IDENTIFY the raised margin called the

torus tubarius around the opening to the pharyngotympanic tube.

This is created by mucosa covering the elastic cartilage at the opening of the tube.

TASK

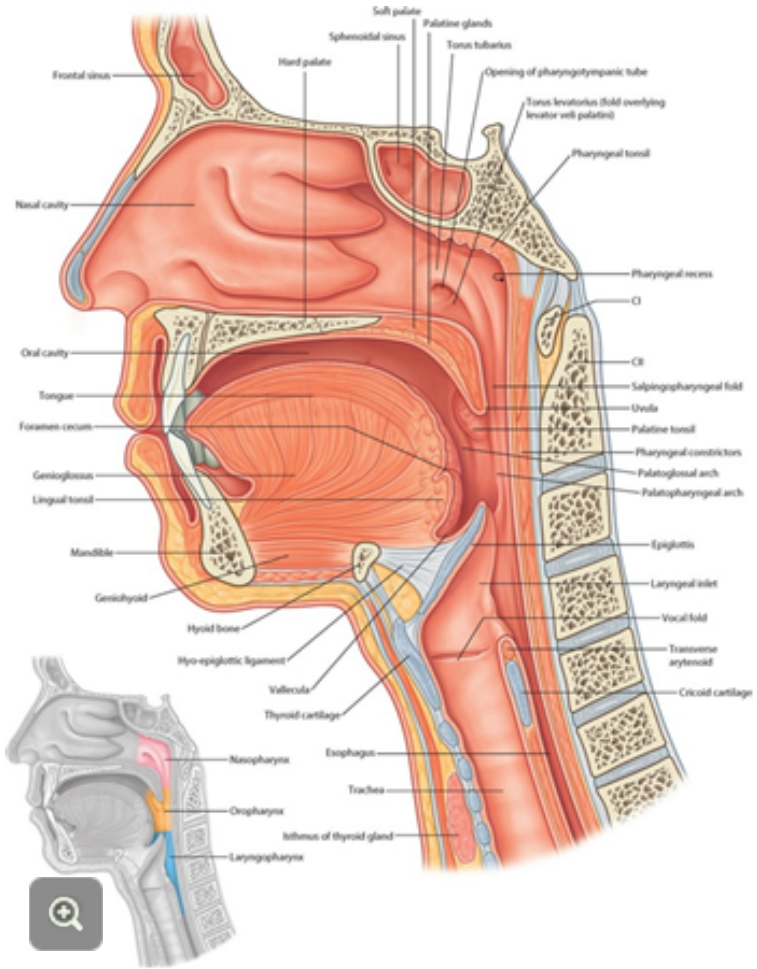
OBSERVE the pharyngeal recess

superior and posterior to the torus tubarius. The **pharyngeal tonsils** lie in the pharyngeal recess.

INFO

Adenoids

Enlarged pharyngeal tonsils are called **adenoids**. Adenoids can obstruct the flow of air through the choanae, making it necessary to breathe through the mouth.

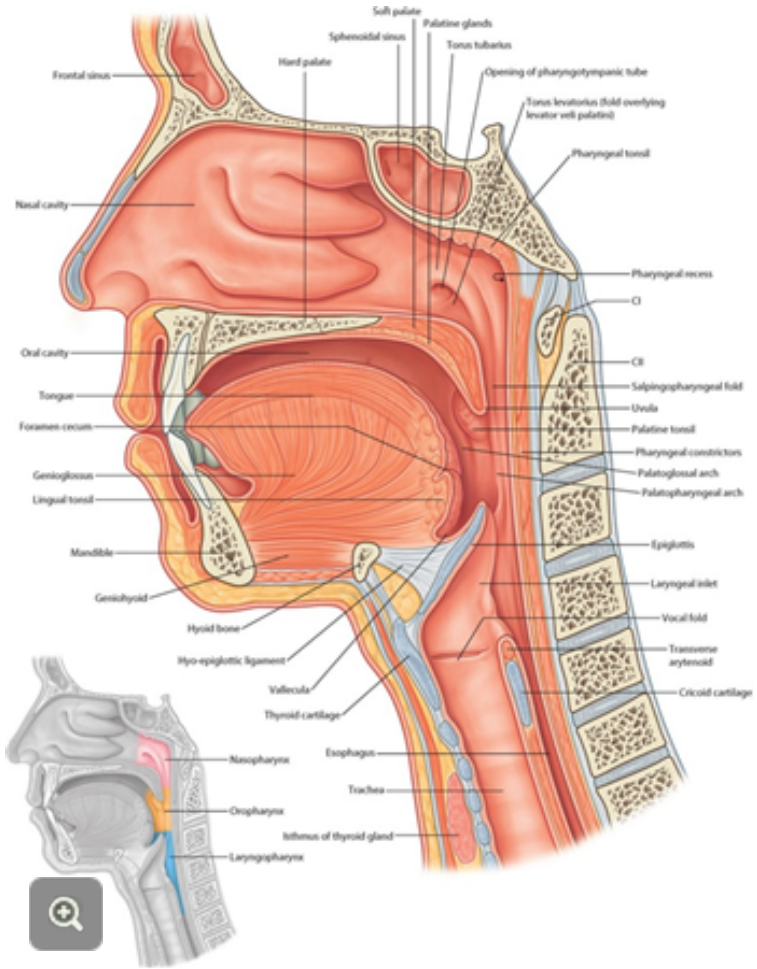


TASK

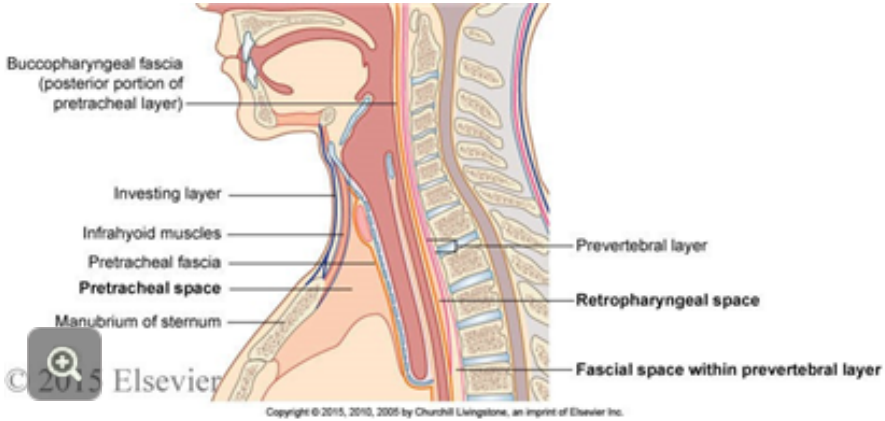
In the oropharynx, IDENTIFY the palatopharyngeal fold and palatine tonsil at the junction of the oral cavity with the oropharynx. Note that the posterior one third of the tongue (approximately) faces into the oropharynx.

Identify the right and left valleculae, spaces located between the tongue and the epiglottis. Identify the median glossoepiglottic fold, which separates the right and left valleculae. Depending on how the head was bisected, the median glossoepiglottic fold might be located on the other half.

Next, confirm that the laryngopharynx opens into the larynx anteriorly and the esophagus inferiorly. Identify the aryepiglottic fold forming the margin of the laryngeal inlet and the piriform recess, the space that lies lateral to it.



Posteriorly, the **retropharyngeal space** lies between the **buccopharyngeal fascia** on the outer pharyngeal wall and the **prevertebral fascia** covering the muscles attached to the anterior surface of the vertebral column (prevertebral muscles). **The 'space' contains connective tissue and the retropharyngeal lymph nodes** and it extends from the base of the skull inferiorly into the thorax.



INFO

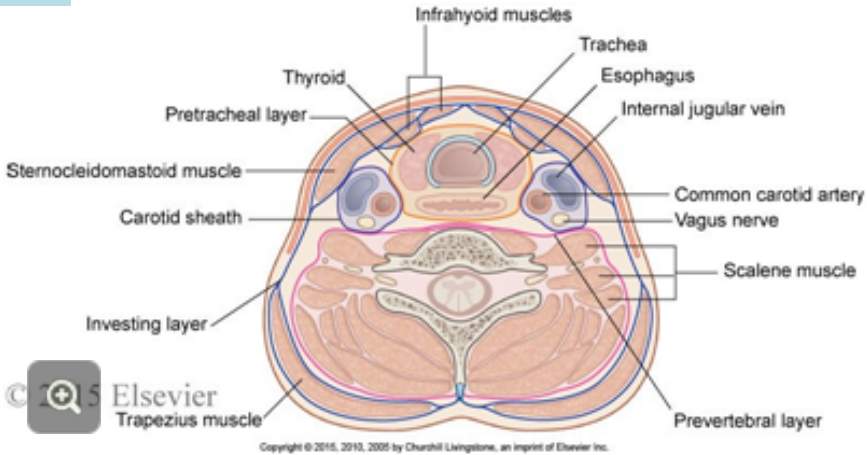
Spread of Infection through the neck

Infections in the neck that gain access to the retropharyngeal space can readily spread to the thorax.

TASK

Using a dissecting probe,

IDENTIFY the retropharyngeal space in the bisected head.



Since embarking on this exercise, you have **identified** the following structures and learned the **answers to the following questions**:

- Name the three layers of the pharyngeal wall.

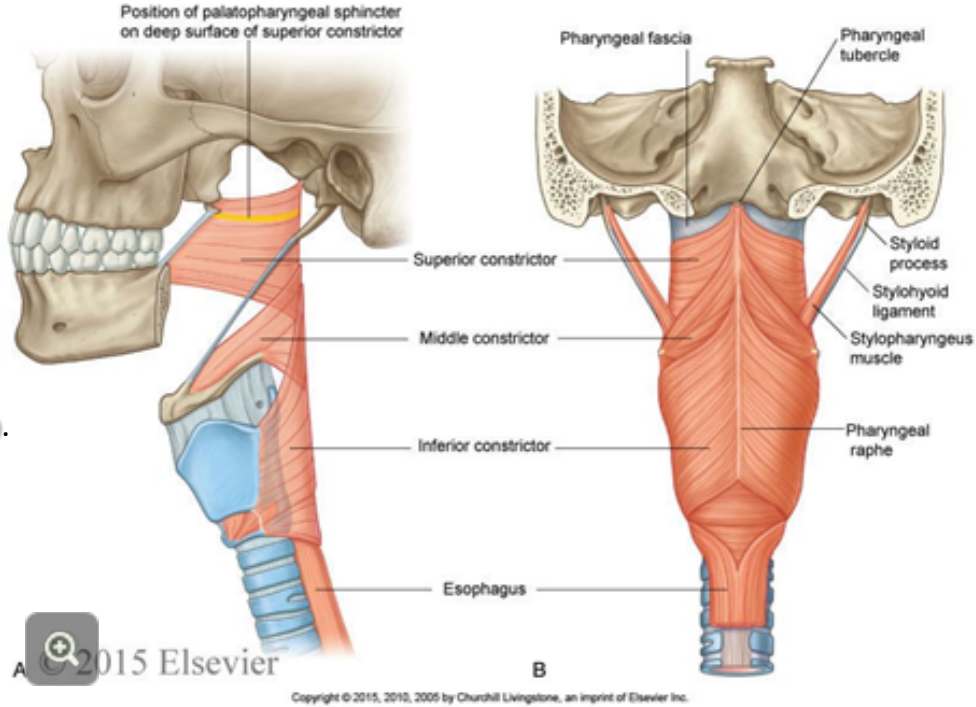
On the bisected cadaver head:

- the body of the sphenoid, soft palate, epiglottis, cricoid cartilage; identify the three subdivisions of the pharynx and identify the superior and inferior limits of each
- features of the nasopharynx: the opening of the pharyngotympanic tube (With what cavity is this opening continuous? What is its relationship to otitis media? How does it differ, anatomically, in children that makes them more susceptible to otitis media?) the torus tubarius and pharyngeal recess (What lies in the wall of the pharyngeal recess?)
- features of the oropharynx: palatopharyngeal fold, palatine tonsil, base (post. 1/3 of) the tongue, the vallecula, median glossoepiglottic fold
- features of the laryngopharynx: opening into the larynx and the aryepiglottic fold, piriform recess, opening into the esophagus,
- the retropharyngeal space (What borders it anteriorly and posteriorly? What does it contain? What is its relationship to the spread of infection?)

If you are satisfied with your **ability to identify these structures** and **answer these questions**, call your TA over for confirmation and for **permission to move on** to the next stage of the exercise.

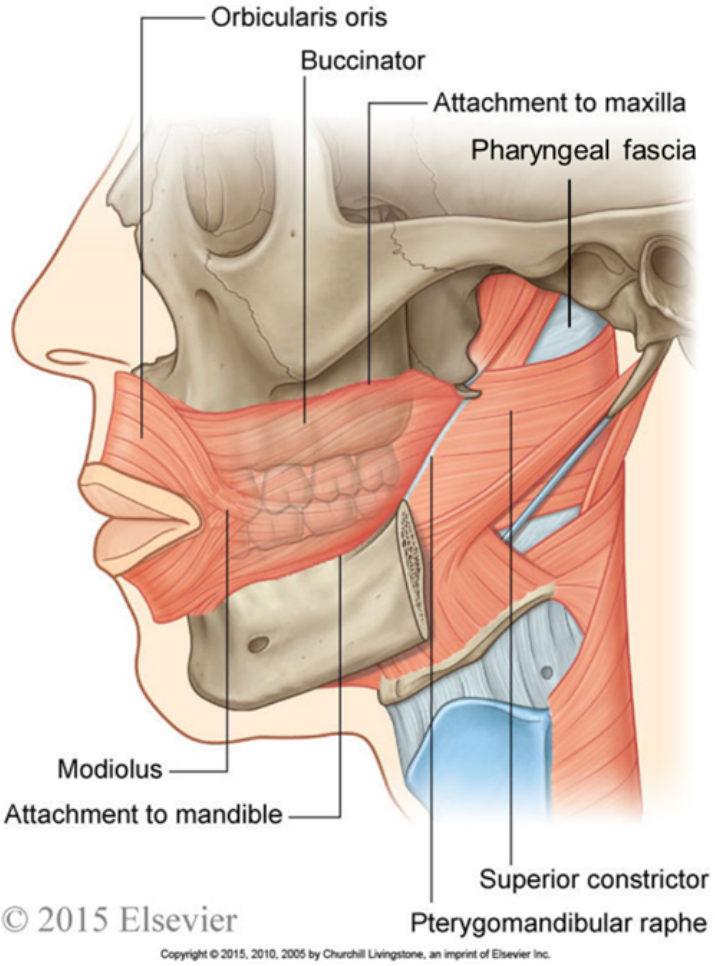
The muscular layer of the wall of the pharynx consists of an **outer layer of circularly arranged muscles** called the **pharyngeal constrictors** and an **incomplete inner longitudinal layer** formed by three paired muscles.

The superior, middle and inferior pharyngeal constrictors are paired muscles that attach anteriorly to the **skull**, **hyoid bone** and **thyroid and cricoid cartilages,** respectively. The fibres of each of the constrictor muscles pass posteriorly, and medially to meet the muscle from the opposite side in a midline **pharyngeal raphe**. The pharyngeal raphe is anchored superiorly to the **pharyngeal tubercle** on the occipital bone, just anterior to the foramen magnum.



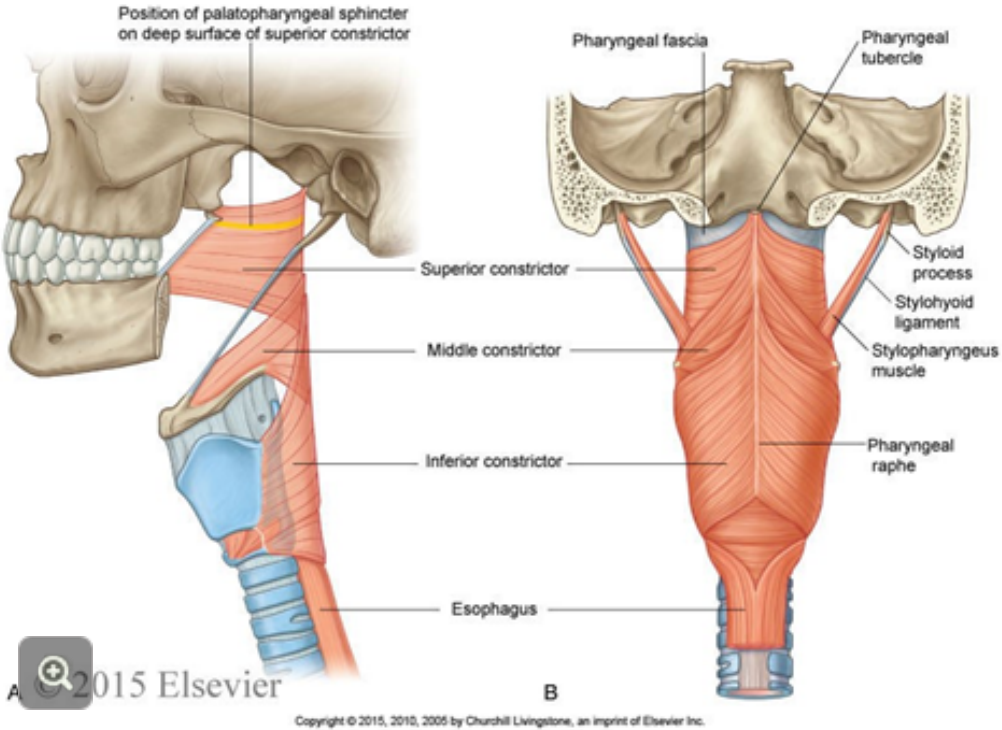
The **superior pharyngeal constrictor** attaches anteriorly to the **medial pterygoid plate,** the **mandible** and to an intervening ligament called the **pterygomandibular raphe**. Attachment to the pterygomandibular raphe is shared by the superior constrictor posteriorly and the **buccinator muscle** anteriorly.

The gap in the musculature of the pharynx created between the uppermost fibres of the superior constrictor and the base of the skull is filled with a thick layer of connective tissue called the **pharyngobasilar or pharyngeal fascia**.



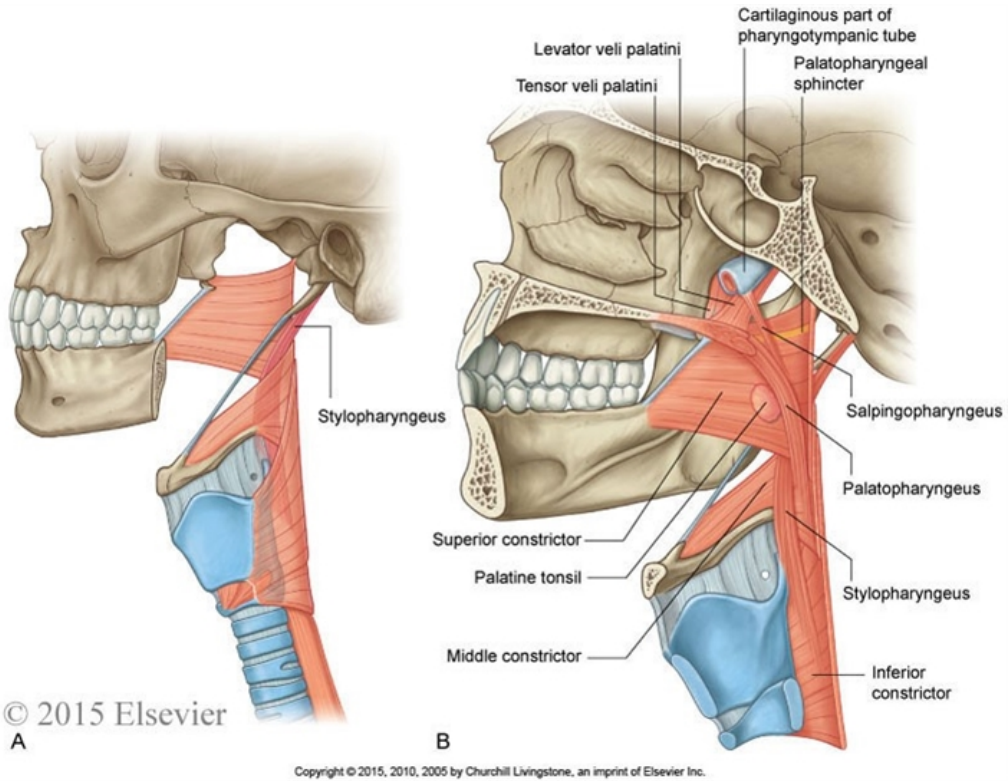
Anteriorly, the **middle constrictor** attaches to the **greater horn of the hyoid bone** and to the **stylohyoid ligament** that connects the styloid process to the lesser horn. The **upper fibres of the middle constrictor overlap and partially encircle the superior constrictor**.

The **inferior constrictor** attaches to the **cricoid and thyroid cartilages** anteriorly. The fibres of the inferior constrictor that are attached to the cricoid cartilage form the **cricopharyngeus muscle**. Cricopharyngeus is the **upper esophageal sphincter**. The sphincter is normally closed to prevent air form entering the digestive tract, but relaxes as part of the swallowing reflex to allow a bolus of food to pass. The **upper fibres of the inferior constrictor overlap and partially encircle the middle constrictor**.



The longitudinally-oriented muscles of the pharynx are the **stylopharyngeus**, **salpingopharyngeus** and the **palatopharyngeus**. The **stylopharyngeus** enters the pharynx by passing between the superior and middle constrictors.

The longitudinally-oriented muscles of the pharynx function to **raise the pharynx during swallowing**. This, coordinated with the narrowing of the pharynx behind a bolus of food through contraction of the constrictors, acts to propel food downward and into the esophagus.

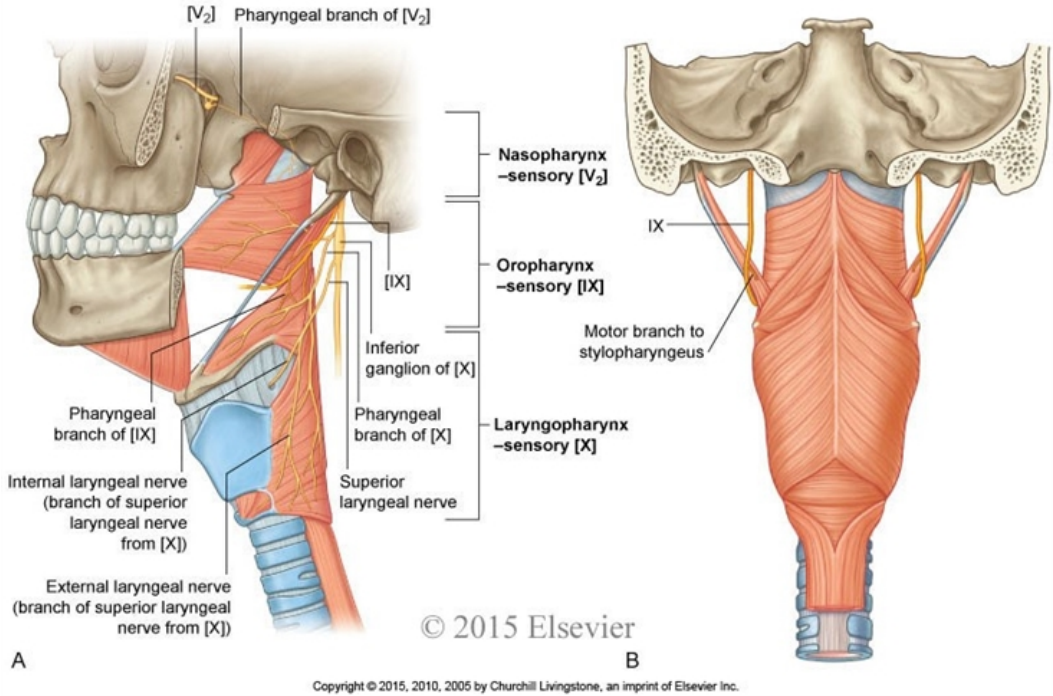


All **muscles** of the pharynx are innervated by **pharyngeal branches of the vagus nerve**, except for the **stylopharyngeus** which is innervated by the **glossopharyngeal nerve**.

Stylopharyngeus, in fact, is the only muscle innervated by the glossopharyngeal nerve.

Sensation from the pharyngeal mucosa is carried from the:

- **nasopharynx** by pharyngeal branches of the **maxillary nerve**,
- **oropharynx** by the **glossopharyngeal nerve**, and
- **laryngopharynx** by the **internal laryngeal branch of the superior laryngeal nerve, which arises from the vagus nerve**.



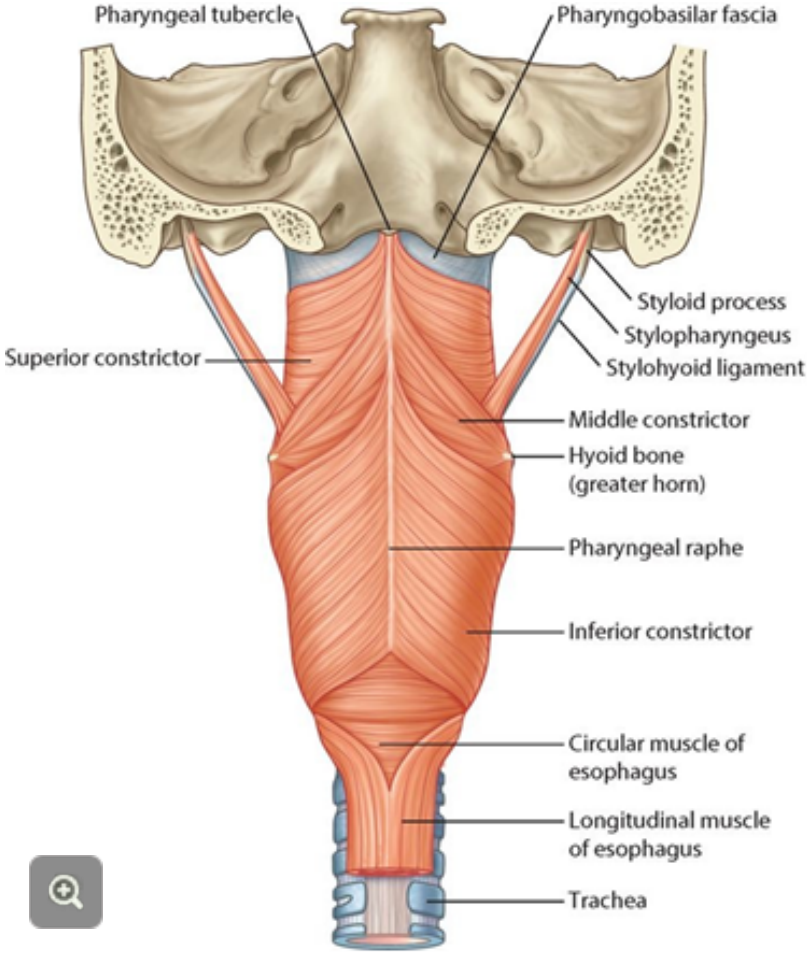
TASK

On the prosected specimen of the posterior pharynx, identify the greater horn of the hyoid. Using this as a landmark, locate the inferior, middle and superior constrictor muscles.

Identify the stylopharyngeus muscle passing between the superior and middle constrictor muscles on each side. Identify the glossopharyngeal nerve following the stylopharyngeus muscle into the gap between the superior and middle constrictor muscles.

Other than the stylopharyngeus, ALL muscles of the pharynx (the three constrictors, the palatopharyngeus and the salpingopharyngeus) are innervated by the vagus nerve.

In addition, the vagus nerve innervates the levator veli palatini and the palatoglossus.



TASK

By way of review,

Identify the SCM muscle, then locate and trace the accessory nerve.

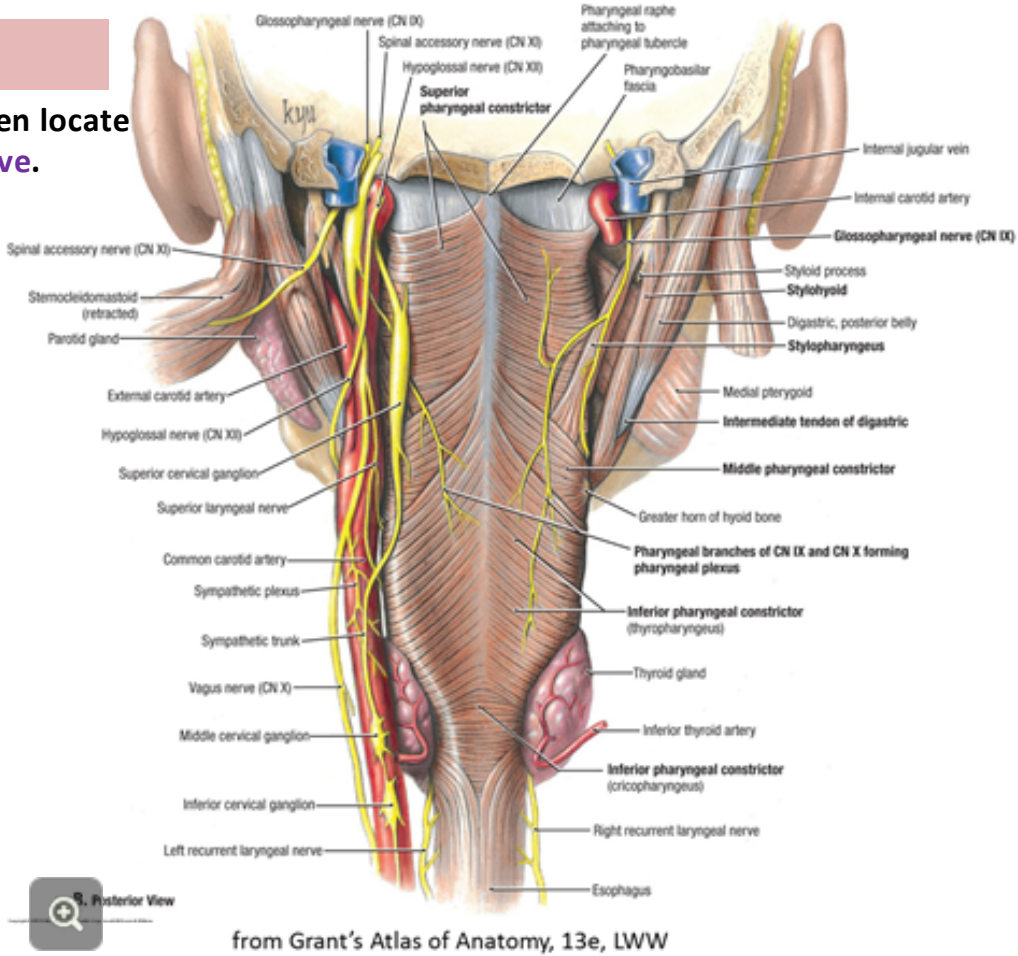
Identify the stylohyoid muscle and the posterior belly of the digastric and locate and trace the hypoglossal nerve.

Identify the vagus nerve, the sympathetic trunk, and the superior cervical ganglion.

Identify the internal jugular vein and common carotid artery.

Trace the common carotid artery and identify the internal and external carotid arteries, and the carotid sinus.

Identify the superior thyroid, lingual and facial branches of the external carotid artery.



from Grant's Atlas of Anatomy, 13e, LWW

The posterior pharyngeal wall in this specimen has been divided along the midline raphe connecting the constrictors of each side.

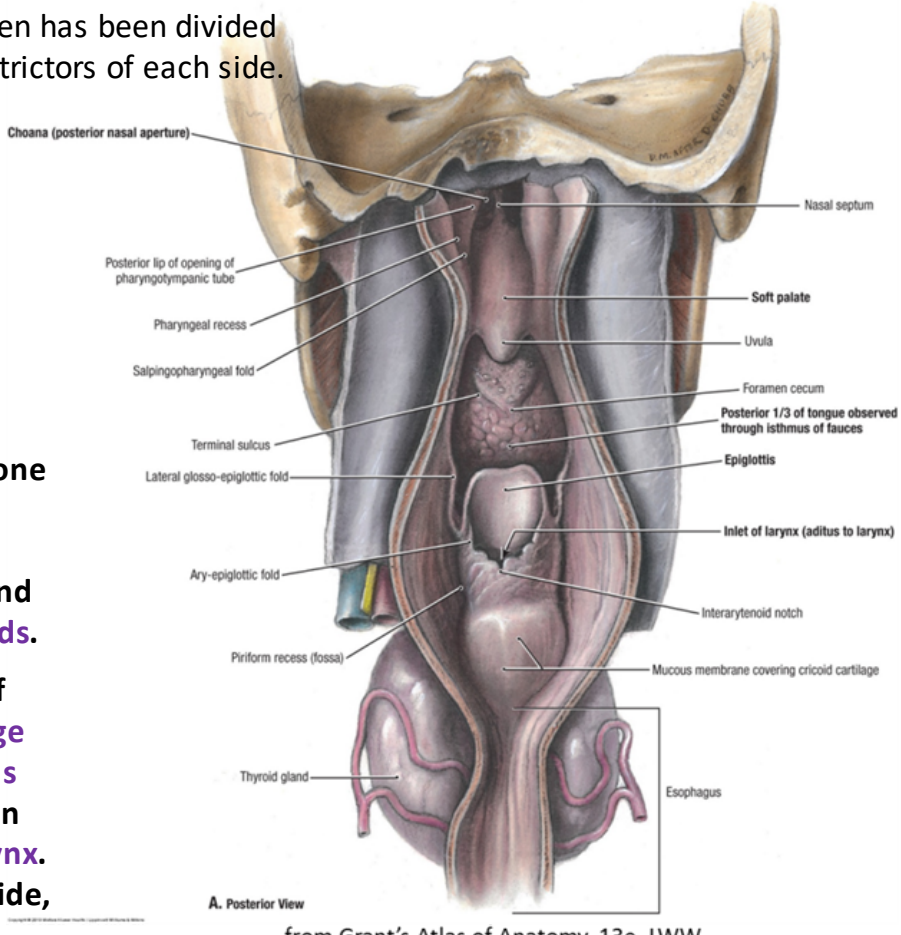
TASK

Open the pharynx and LOCATE the nasopharynx, oropharynx, laryngopharynx, and esophagus.

Identify the nasal septum, choanae, torus tubarius, the position of the pharyngeal tonsil, the soft palate, and the uvula.

Identify the palatoglossal folds, posterior one third of the tongue, lingual tonsil, and the epiglottis. Between the root of the tongue and the epiglottis identify the valleculae and the median and lateral glossoepiglottic folds.

In the laryngopharynx, find the location of the posterior surface of the cricoid cartilage (the lamina). Identify the aryepiglottic folds passing from the cricoid to the epiglottis on each side and flanking the inlet to the larynx. Lateral to the aryepiglottic folds on each side, identify the piriform fossae.



from Grant's Atlas of Anatomy, 13e, LWW

Since the last progress check, you have **identified** the following structures and learned the **answers to the following questions**:

On the prosected specimen, from the posterior aspect:

- the greater horn of the hyoid bone, inferior, middle and superior pharyngeal constrictor muscles, the stylopharyngeus muscle (between which two constrictors does it pass to enter the pharynx? Name the two other longitudinal muscles of the pharynx. What is the action of the longitudinal muscles? How does this contribute to swallowing?), glossopharyngeal nerve, vagus nerve; Describe the motor innervation of the pharyngeal muscles. What nerve innervates the palatoglossus and the levator veli palatini?
- the sternocleidomastoid muscle and accessory nerve
- stylohyoid muscle and posterior belly of the digastric, hypoglossal nerve
- the sympathetic trunk and superior cervical ganglion, internal jugular vein and common carotid artery, internal and external carotid arteries, carotid sinus, superior thyroid, lingual and facial branches of the external carotid artery

On the prosected specimen, inside the pharynx:

- nasopharynx, oropharynx, laryngopharynx, esophagus; What three nerves supply sensory fibres to each of the three subdivision of the larynx?
- in the nasopharynx, identify the nasal septum, choanae, the soft palate and uvula, torus tubarius, the pharyngeal recess (what is located in the wall of the nasopharynx here?),
- in the oropharynx, identify the palatoglossal folds, root of the tongue, lingual tonsil, epiglottis, valleculae, median and lateral glossoepiglottic folds
- in the laryngopharynx, identify the lamina of the cricoid cartilage, aryepiglottic folds, piriform fossae

If you are satisfied with your **ability to identify these structures** and **answer these questions**, call your TA over for confirmation and for **permission to move on**.

6.4 The Neck II

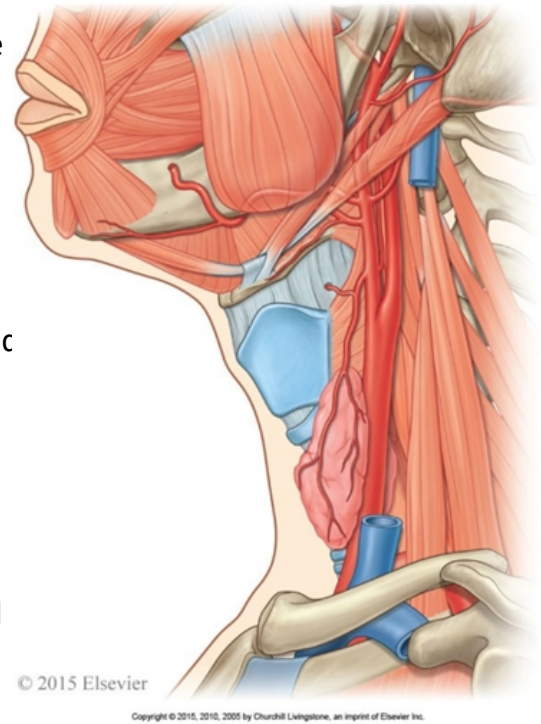
What you'll need:

SPECIMENS

- Cadaver 1

When you have completed this exercise, you will be able to identify and describe the:

- hypoglossal nerve, including its relationship in the neck to the external carotid artery and the stylohyoid, posterior belly of the digastric, and mylohyoid muscles
- distribution of the hypoglossal nerve
- common carotid artery, internal carotid artery, carotid sinus, external carotid artery, and its superior thyroid, lingual and facial branches in the neck
- gross structure, blood supply and venous drainage of the thyroid and parathyroid glands
- sensory and motor nerve supply to the larynx
- vagus nerve, recurrent laryngeal nerve and phrenic nerve
- vertebral artery, thyrocervical trunk and inferior thyroid artery
- sympathetic chain including the superior cervical ganglion, and the distribution of sympathetic fibres in the neck



TASK

ENLIST the help of your colleagues and block up the shoulders of the cadaver.

This will extend the neck and also give you better access to its lateral aspect as you work.

Remember to remove this block when you're done dissecting. If the block is left under the cadaver between labs, the cadaver will dry out.

You have, by now, completed a **superficial dissection of the neck**, bilaterally. Decide which side has the better dissection; you will **leave it dissected at this level**.

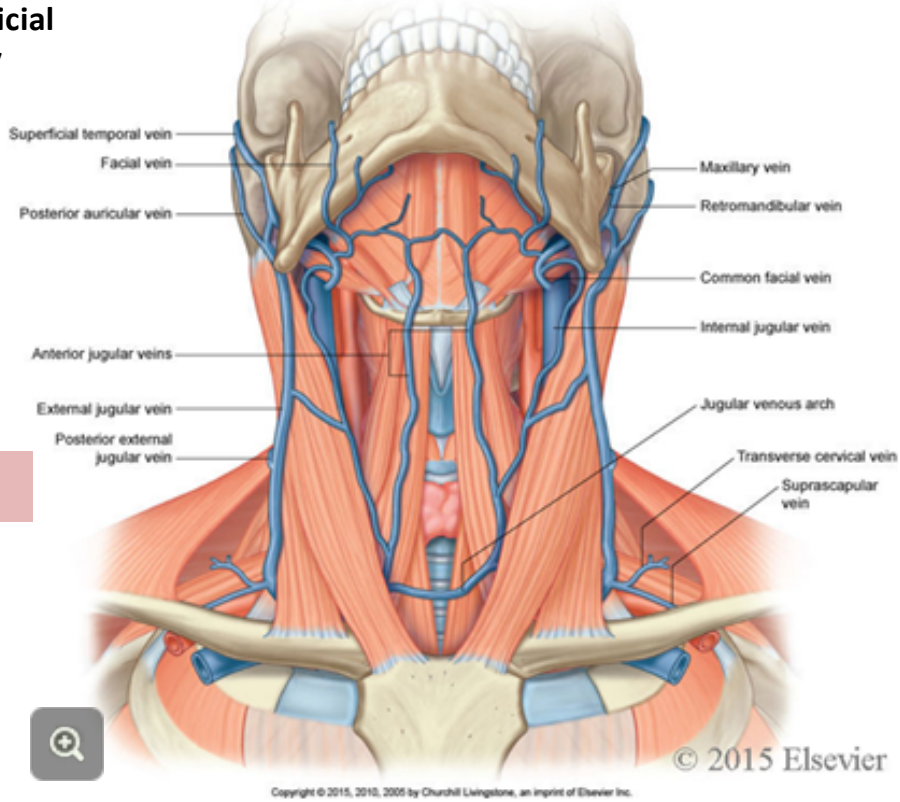
On the other side, the side with the less successful superficial dissection, you will perform a **deep dissection of the neck**.

In this way, by the end of lab 6, you will have the face dissected bilaterally and both superficial and deep dissections of the neck completed and available for study and review.

TASK

REMOVE the superficial portion of the submandibular gland unilaterally.

The submandibular gland wraps around the posterior border of the mylohyoid muscle, and is thus divided into a superficial portion (currently visible) and a deep portion, the latter located in the floor of the mouth. **Isolate the superficial portion of the gland from the facial artery and vein and all surrounding connective tissue. Remove the superficial portion of the submandibular gland and leave the facial artery and vein intact.**



TASK

IDENTIFY the external jugular vein and review its course. Note that it receives blood from the **retromandibular vein** and empties into the **subclavian vein** just lateral to the internal jugular vein.

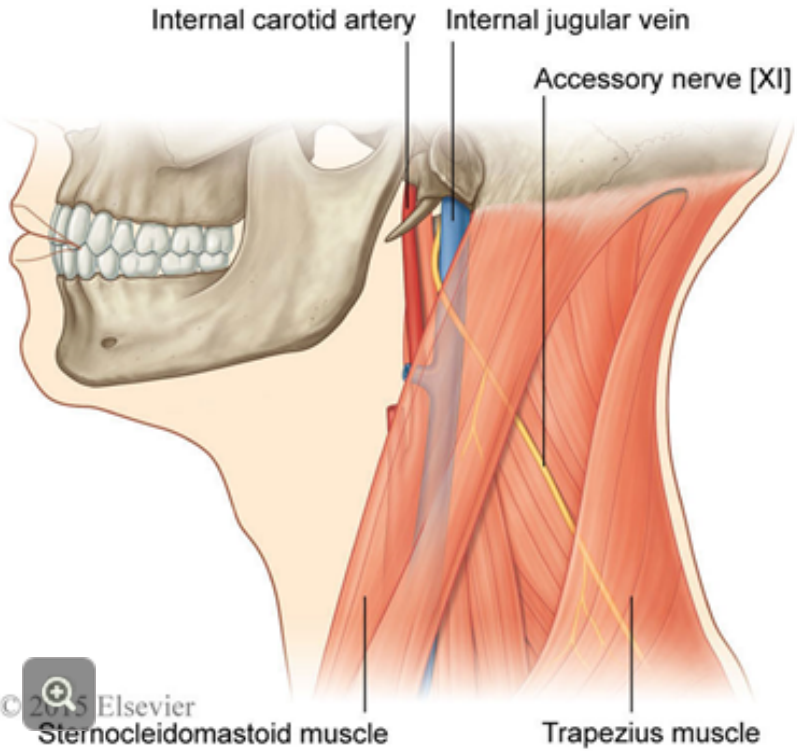
TASK

CUT the external jugular vein.

About 5 cm superior to the SCM's attachment to the clavicle, and using blunt dissection (open scissors technique) and fingers, free up the SCM from all surrounding CT.

Transect the SCM here using large scissors, and then continuing with blunt dissection and fingers, reflect the SCM superiorly as far as the mastoid process. Identify the accessory nerve where it enters the deep surface of the SCM, and trace it superiorly as far as possible.

The accessory nerve innervates the SCM and trapezius muscles.

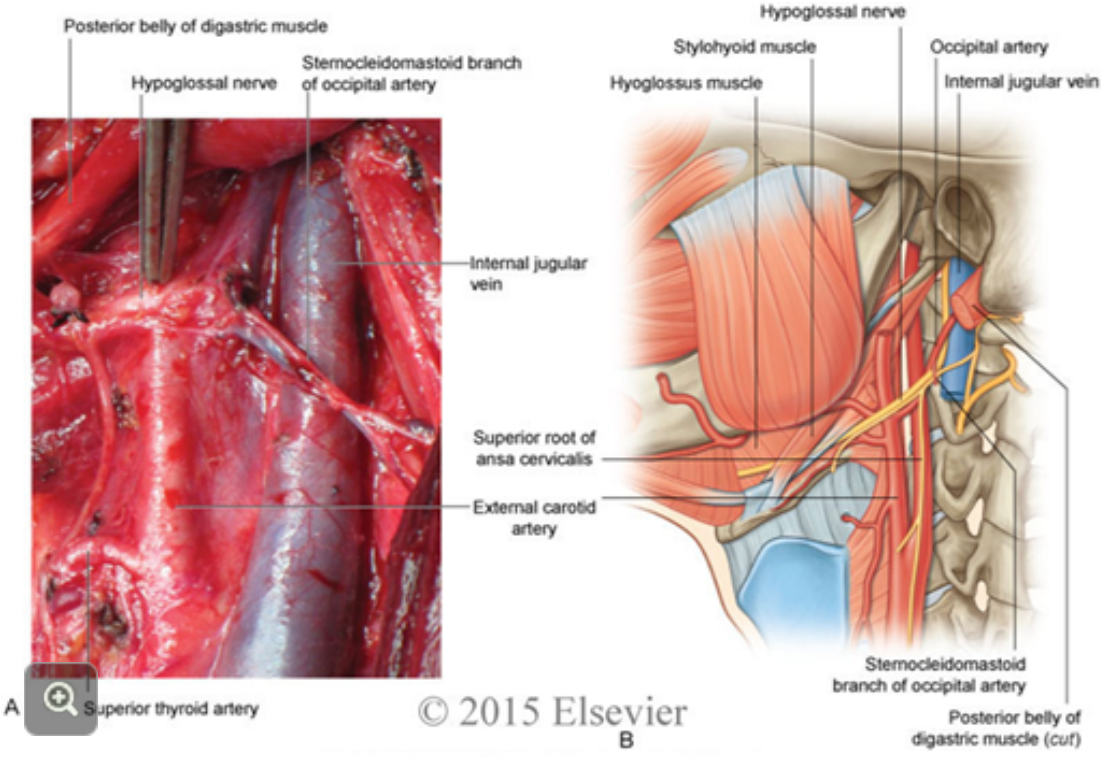


TASK

IDENTIFY the posterior belly of the digastric and stylohyoid muscle.

By palpation, identify the tip of the greater horn of the hyoid bone. Between the tip of the hyoid and the posterior belly of the digastric, identify and outline the hypoglossal nerve.

Clean it carefully and observe that the nerve sweeps inferior to the posterior belly of the digastric, crossing the external carotid artery before it passes medial to the digastric and enters the mouth deep to the mylohyoid muscle.



TASK

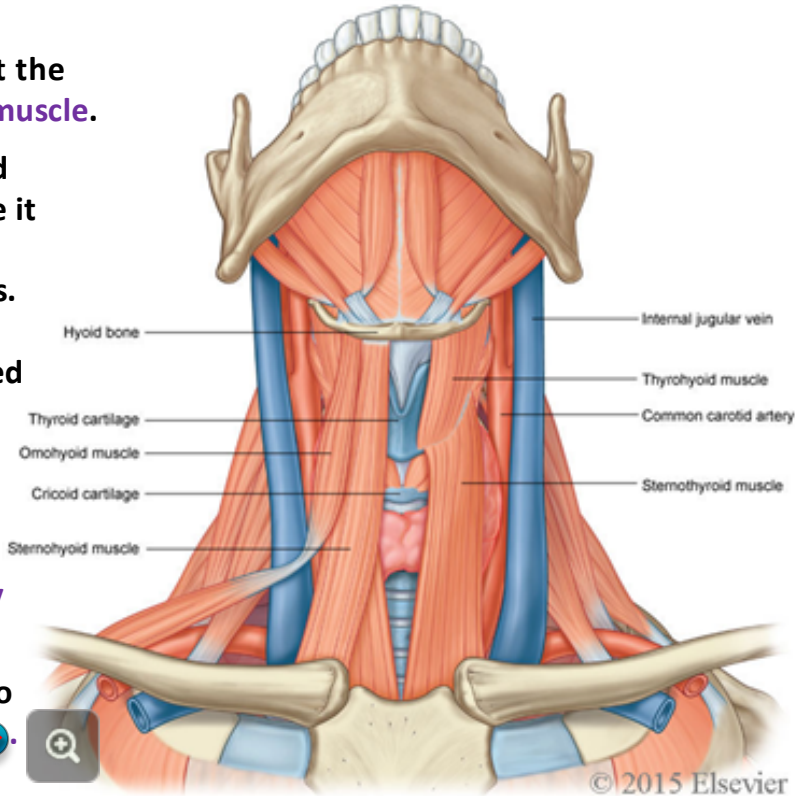
Continuing to work on the same side of the cadaver on which the SCM muscle has been transected, review the attachments of the sternohyoid and omohyoid muscles.

Cut the attachments of the sternohyoid muscle at the hyoid bone and at the sternum and remove the muscle.

Cut the attachment of the omohyoid to the hyoid bone, and transect the muscle at the point where it passes under the anterior edge of the trapezius. Remove the omohyoid between the two cut ends. Note that the tendon between the two bellies of omohyoid passes through a loop of fascia attached to the internal jugular vein.

Next, cut the sternothyroid muscle from its attachments to the sternum and the thyroid cartilage, and remove the muscle. Lift the muscle carefully watching for the superior thyroid artery and external laryngeal nerve that pass deep to it.

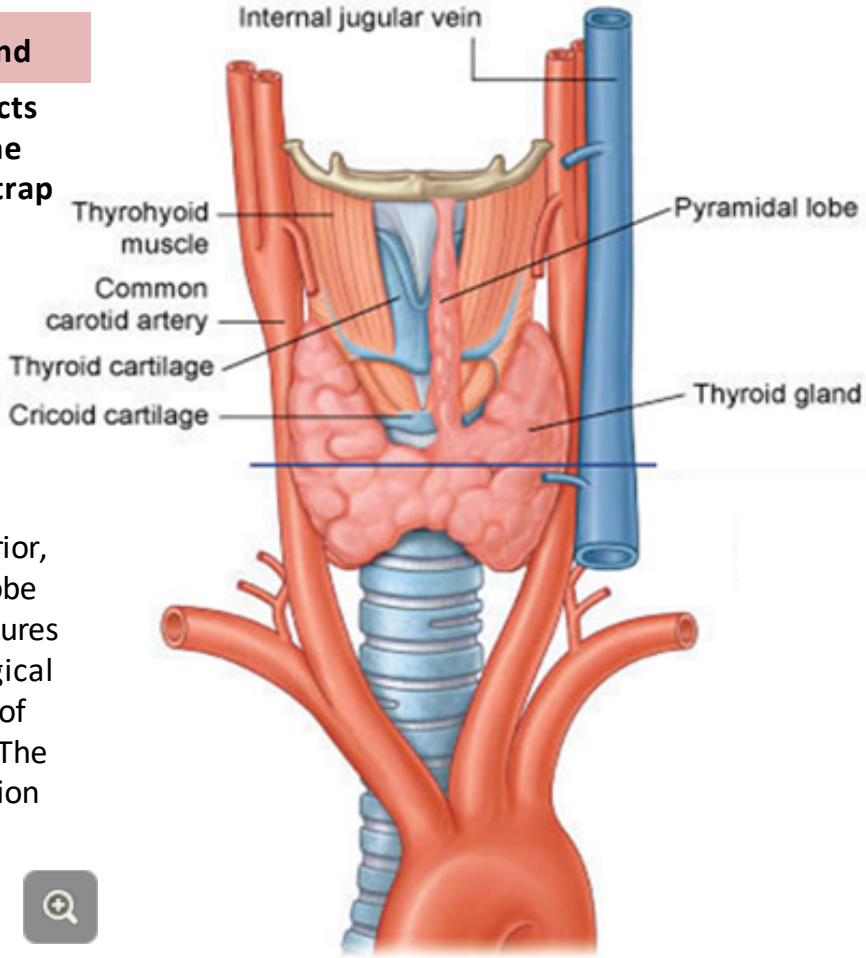
Identify the superior thyroid artery and trace it to where is arises from the external carotid artery.



TASK

IDENTIFY the lobe of the thyroid gland and outline the isthmus, which connects the lobe to its opposite member on the other side of the cadaver where the strap muscles should remain intact.

Frequently, the thyroid gland has a pyramidal lobe that extends superiorly in a variable distance from the isthmus.



Two parathyroid glands, superior and inferior, normally lie on the posterior surface of each lobe of the thyroid gland. However, these are structures that migrate to their position during embryological development and so occasionally one or more of these glands may be found in other locations. The parathyroid glands are essential in the regulation of calcium levels in the body and each has a diameter of about 5 mm. It is not necessary to identify the glands.

TASK

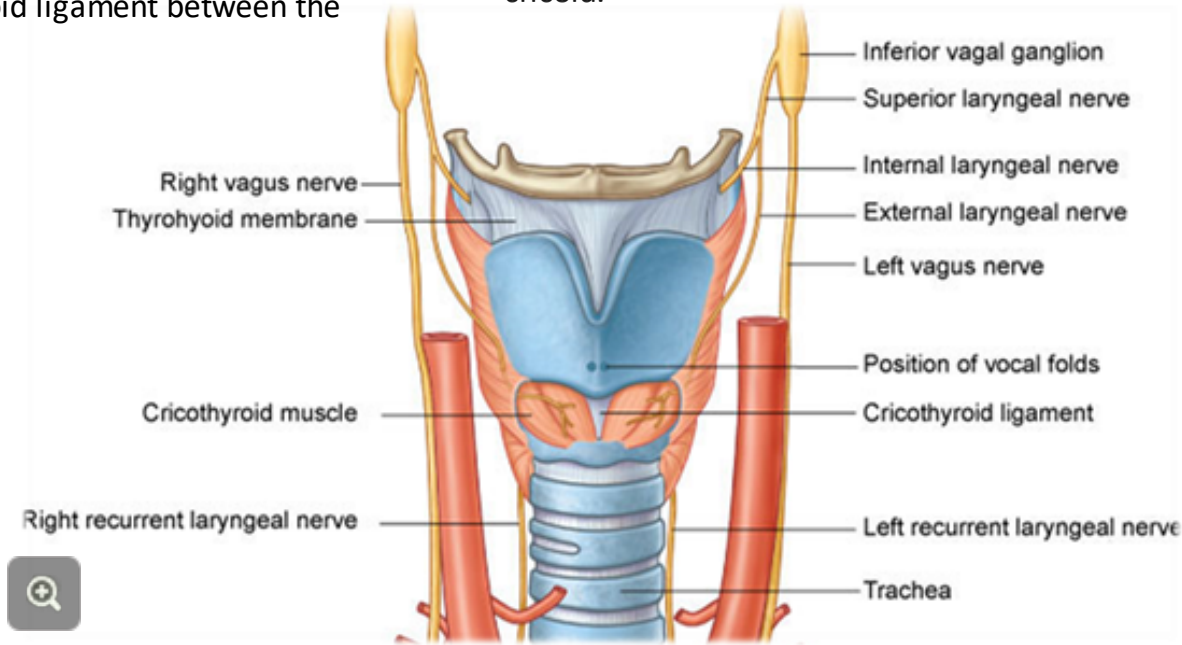
IDENTIFY the cricothyroid muscle, passing between the thyroid and cricoid cartilages. This muscle serves to tilt the thyroid cartilage anteriorly, which has the effect of tightening the vocal cords, thus **raising the pitch of the voice**.

Identify the cricothyroid ligament between the cricothyroid muscles.

INFO

Cricothyrotomy

Medial to the cricothyroid muscle lies the **cricothyroid ligament**, which is pierced during **cricothyrotomy**, an emergency procedure for opening an obstructed airway above the level of the cricoid.



TASK

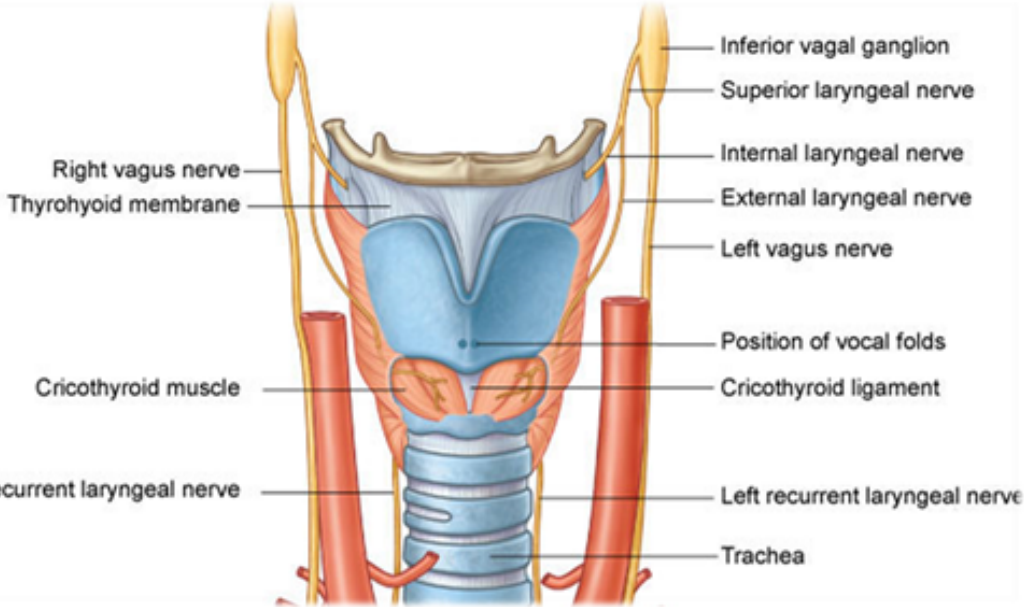
IDENTIFY the thyrohyoid membrane connecting the superior border of the thyroid cartilage and hyoid bone. Locate the internal branch of the superior laryngeal nerve piercing the thyrohyoid membrane adjacent to the posterior margin of the thyrohyoid muscle.

Trace the internal laryngeal nerve superiorly to the point at which it passes deep to the external carotid artery and try to identify the external branch of the superior laryngeal nerve, which arises near this point. The external laryngeal nerve passes inferiorly in the company of the superior thyroid artery to end by innervating the cricothyroid muscle.

The **superior laryngeal nerve is a branch of the vagus nerve**.

Its **internal laryngeal branch** pieces the thyrohyoid membrane to supply sensory fibres to the mucosa of the larynx above the level of the vocal cords.

The **external laryngeal branch** is a motor branch to the cricothyroid muscle and to the inferior constrictor muscle of the pharynx.

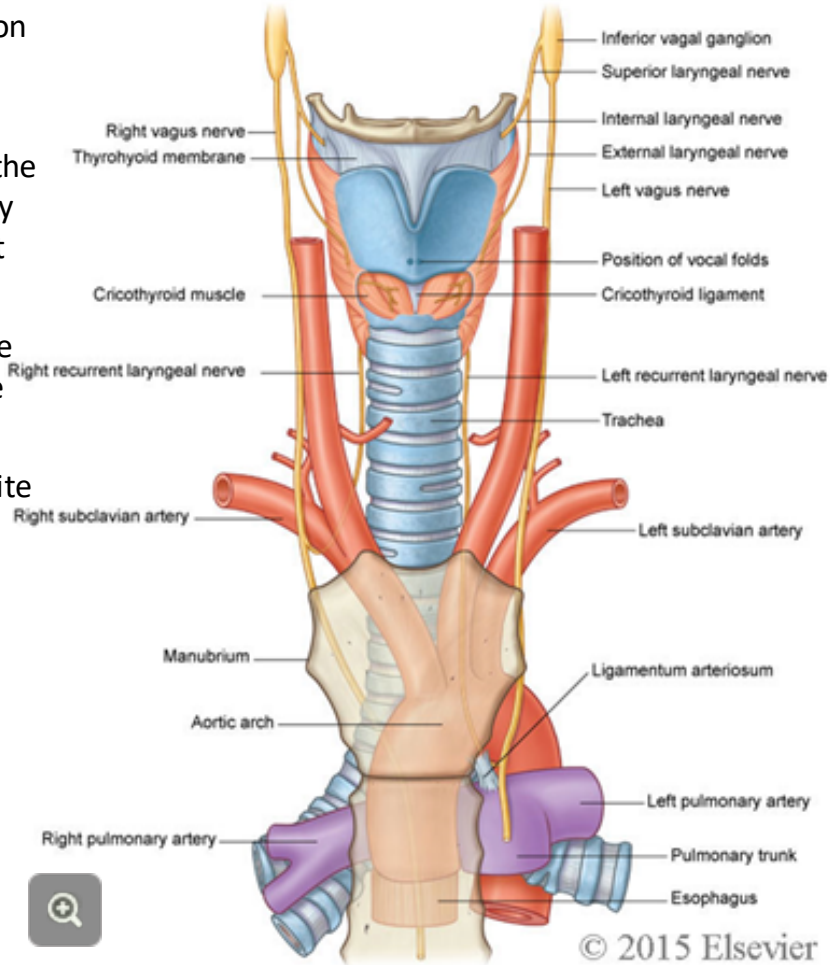


The remainder of the sensory and motor innervation to the larynx is provided by another branch of the **vagus**, the **recurrent laryngeal nerve**.

The **right recurrent laryngeal nerve** arises from the right vagus as it crosses the right subclavian artery to enter into the thorax. It recurs under the right subclavian artery.

The **left recurrent laryngeal nerve** arises from the left vagus as it crosses the arch of the aorta in the thorax. It recurs under the aortic arch.

Both nerves ascend to the larynx lying along the site where the trachea and esophagus are in contact with each other.

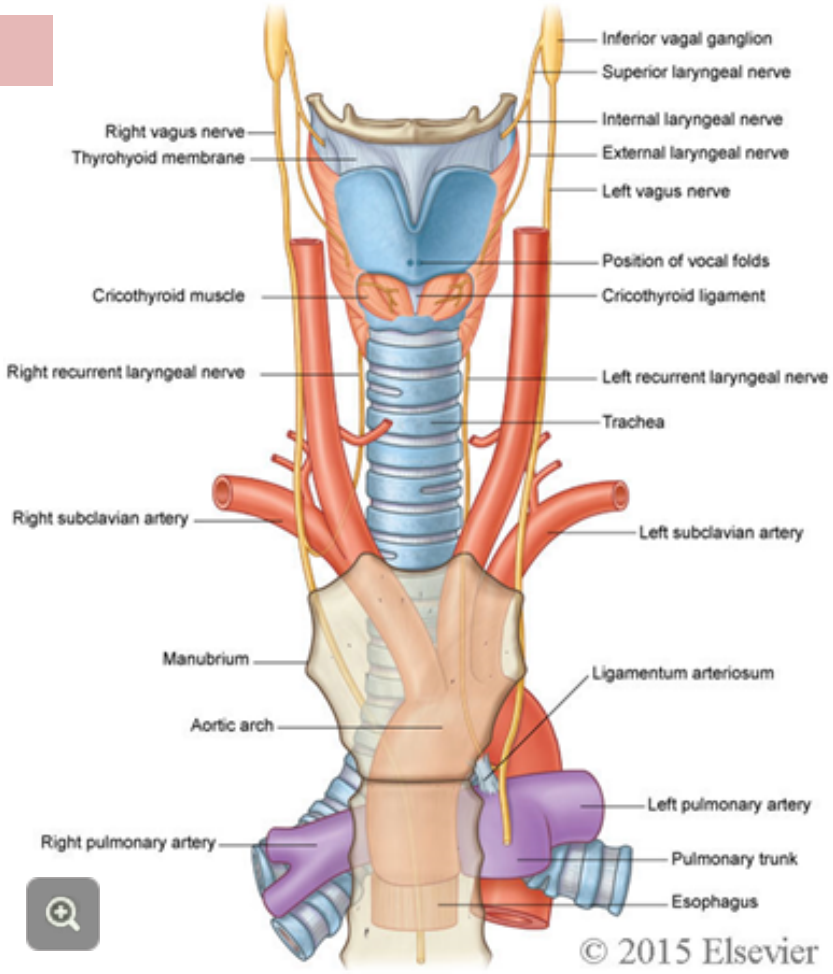


TASK

Carefully LIFT the exposed lobe of the thyroid gland by blunt dissection to expose the edge of the trachea.

Locate the recurrent laryngeal nerve at the posterior edge of the trachea, where it meets the esophagus.

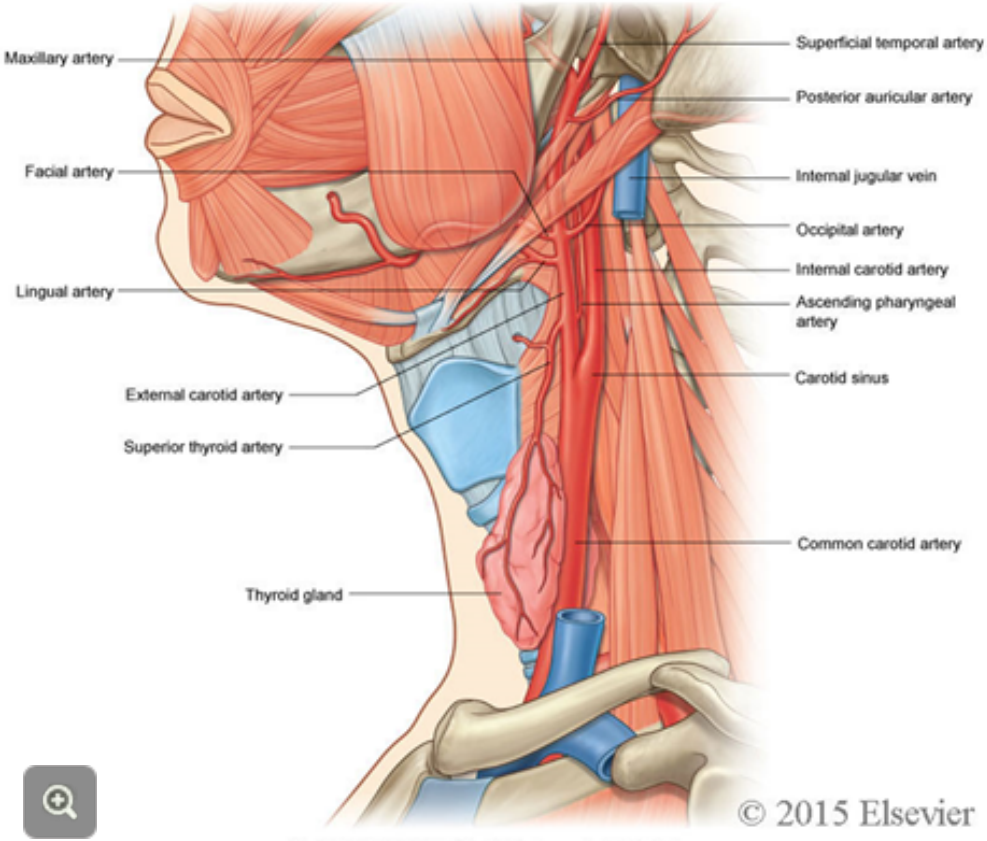
Each recurrent laryngeal nerve innervates **all of the intrinsic muscles of the larynx except the cricothyroid** and is **sensory to the mucosa of the larynx below the vocal cords** on its half of the larynx.



The **internal jugular vein, common carotid artery, and the vagus nerve** all lie within a sleeve of fascia called the **carotid sheath**.

TASK

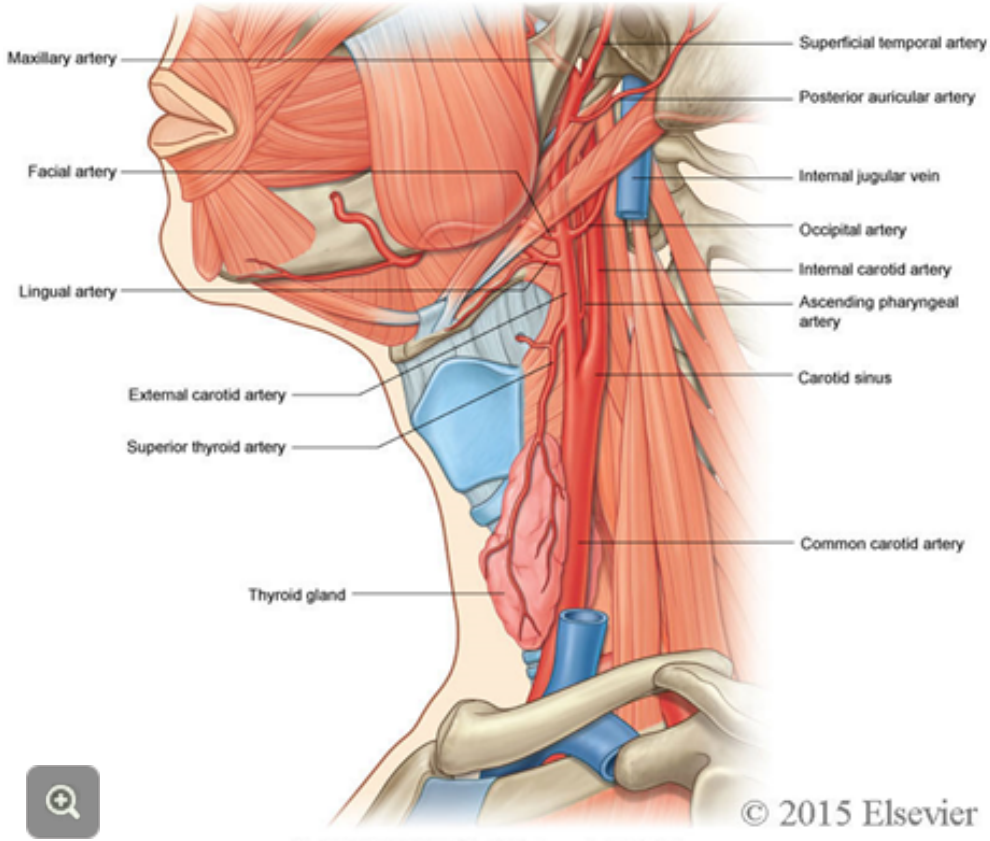
IDENTIFY and clean the internal jugular vein, from the clavicle to where it passes deep to the posterior belly of the digastric muscle. Medial to the internal jugular vein, identify and clean the common carotid artery from the clavicle to where it bifurcates into the external and internal carotid arteries at the level of the superior border of the thyroid cartilage. At the point of bifurcation, identify the carotid sinus a dilatation in the vessel extending into the internal carotid artery.



TASK

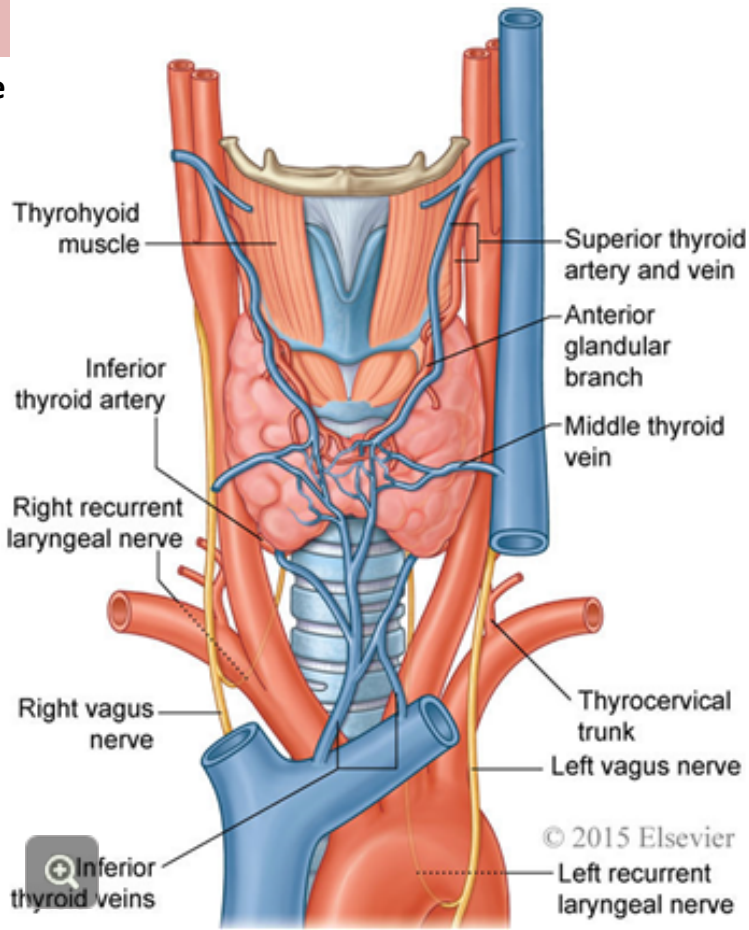
TRACE the external carotid artery superiorly to where it passes deep to the posterior belly of the digastric muscle.

Next, trace the following of its branches: the superior thyroid to the thyroid gland; the lingual artery to where it passes deep to the posterior belly of the digastric to enter the mouth; the facial artery to where it passes deep to the posterior belly of the digastric. Confirm that the facial artery passes deep to the mandible before emerging to enter the face over the body of the mandible just anterior to the masseter.



TASK

Between the internal jugular vein and common carotid artery locate and outline the vagus nerve. As you outline the course of the nerve into the root of the neck, approaching the subclavian artery, try not to damage the thyrocervical trunk arising from the subclavian artery near where it is crossed by the vagus.

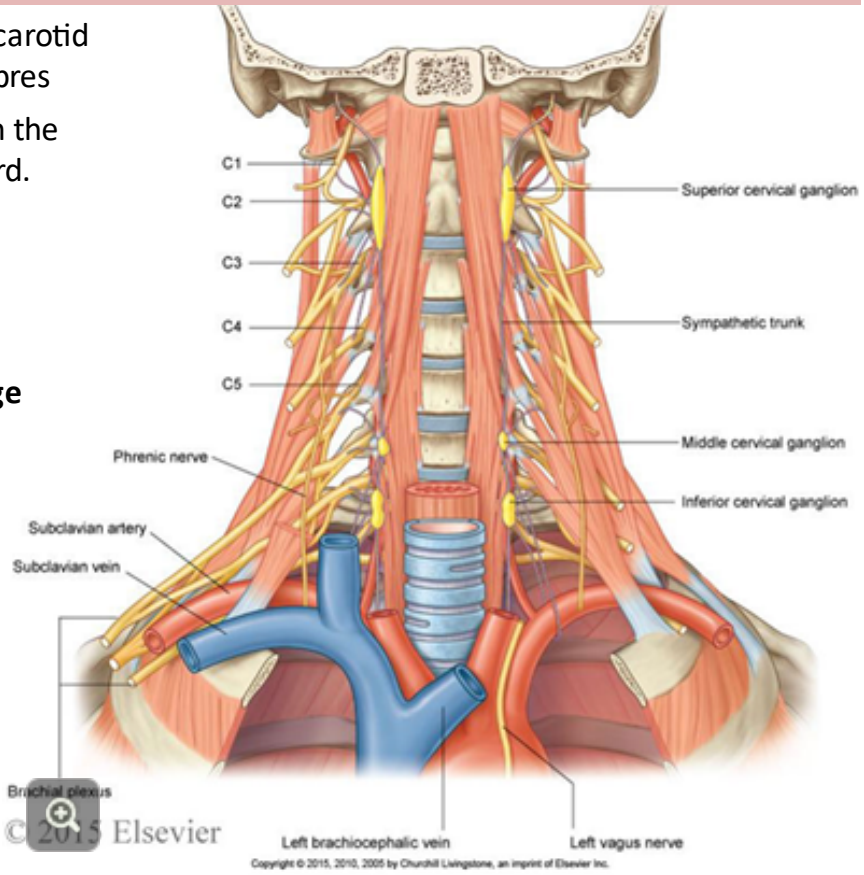


TASK

Posterior and medial to the common carotid artery, IDENTIFY the sympathetic chain.

The sympathetic chain is **not** within the carotid sheath. It contains mainly sympathetic fibres from neurons whose cell bodies can be found in the upper 4 or 5 thoracic segments of the spinal cord. There are three cervical sympathetic ganglia: superior, middle and posterior. The middle and inferior ganglia are small and often difficult to locate.

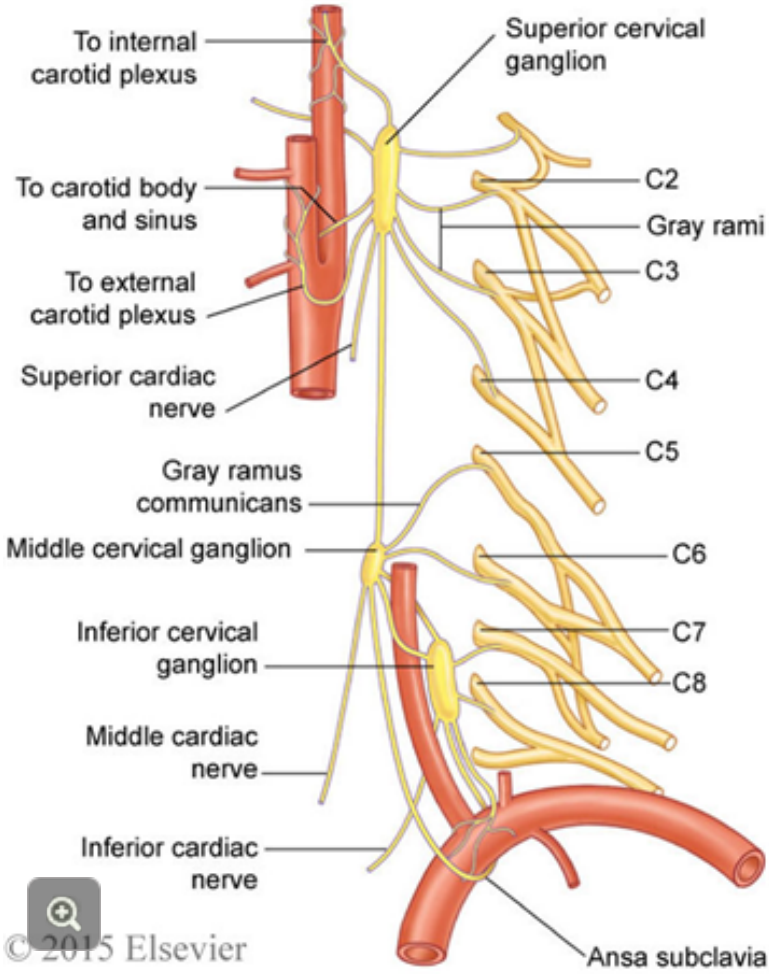
Trace the chain superiorly and locate the large superior cervical ganglion.



Some of the fibres in the chain have already synapsed in ganglia of the thoracic part of the chain before ascending to cervical levels, and will leave the sympathetic chain in the neck as **sympathetic cardiac branches** to descend into the thorax and innervate the heart.

Other fibres of the chain are preganglionic and will synapse in one of the three ganglia located on the chain in the neck. The postganglionic fibres will enter into the cervical spinal nerves via **grey rami communicantes** to innervate cutaneous targets in cervical dermatomes.

In addition to the rami communicantes, other postganglionic fibres leave this ganglion and form **plexuses on the internal and external carotid arteries** and in this way, sympathetic innervation is carried to **targets in the head**.

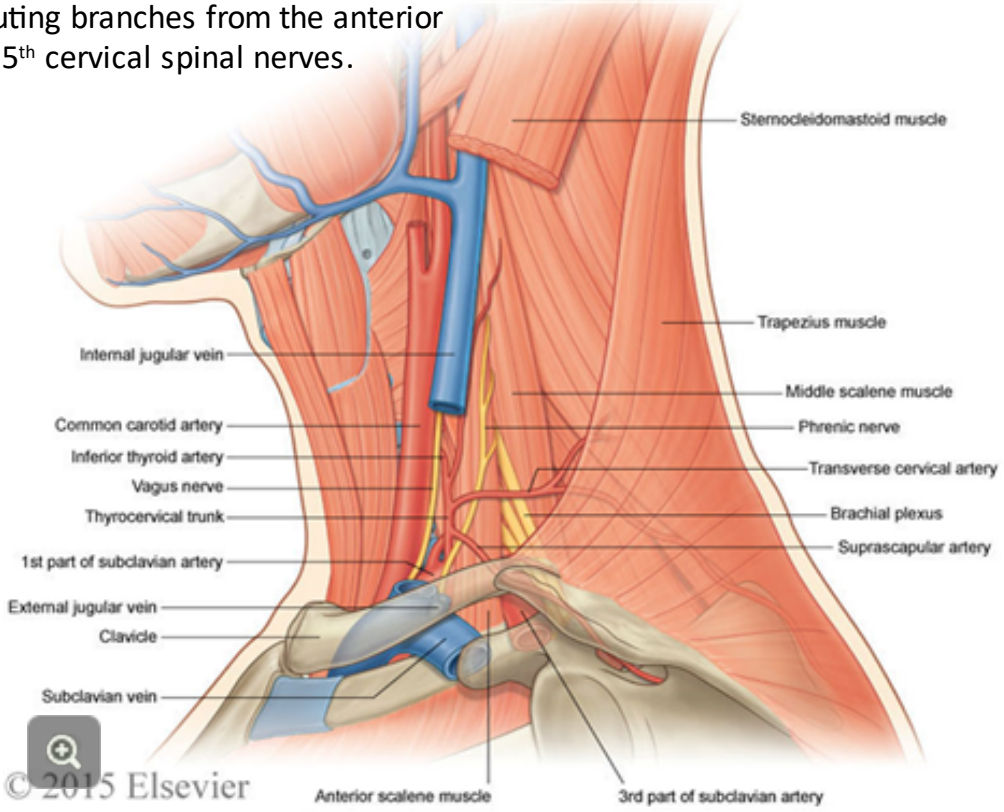


TASK

Lateral to the internal jugular vein, IDENTIFY and outline the phrenic nerve on the anterior surface of the anterior scalene muscle. The phrenic nerve receives contributing branches from the anterior primary rami of the 3rd, 4th and 5th cervical spinal nerves.

At the inferior attachment of the anterior scalene muscle, identify the subclavian vein crossing the muscle anteriorly as it leaves the thorax to become the axillary vein.

Posterior to anterior scalene muscle, between it and the middle scalene muscle, identify the subclavian artery leaving the thorax to become the axillary artery. Posterior to the artery lie components of the brachial plexus that innervate the upper limb.



TASK

LOCATE the thyrocervical trunk arising from the subclavian artery.

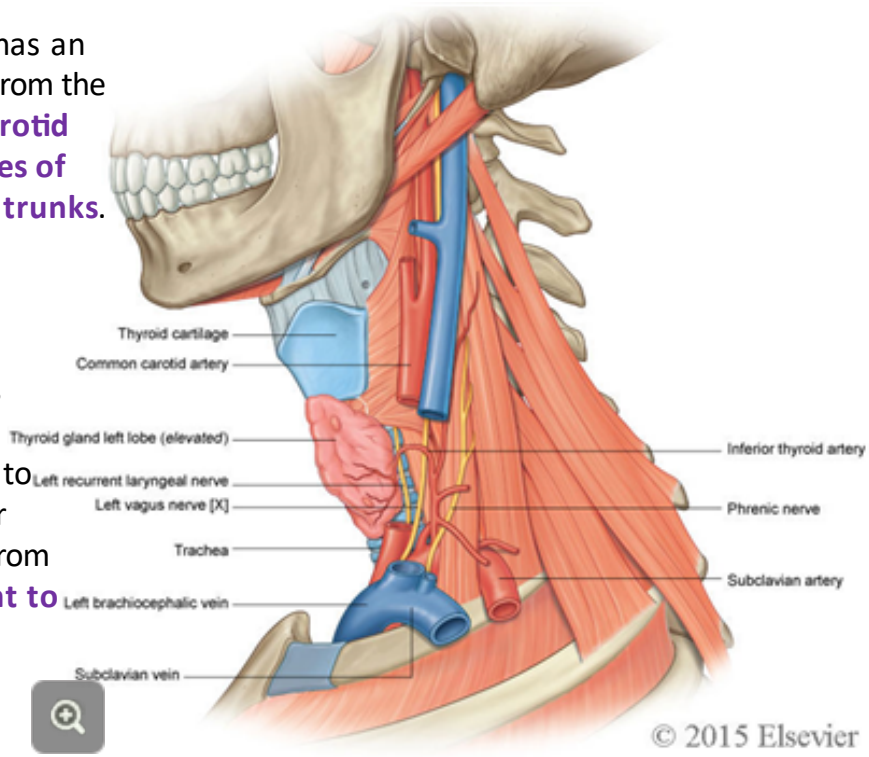
Trace it superiorly and identify the inferior thyroid artery branching from it. Trace the inferior thyroid artery to the thyroid gland.

Like most endocrine organs, the thyroid gland has an abundant blood supply and rich anastomoses from the **superior thyroid branches of the external carotid arteries** and from the **inferior thyroid branches of the subclavian arteries via the thyrocervical trunks**.

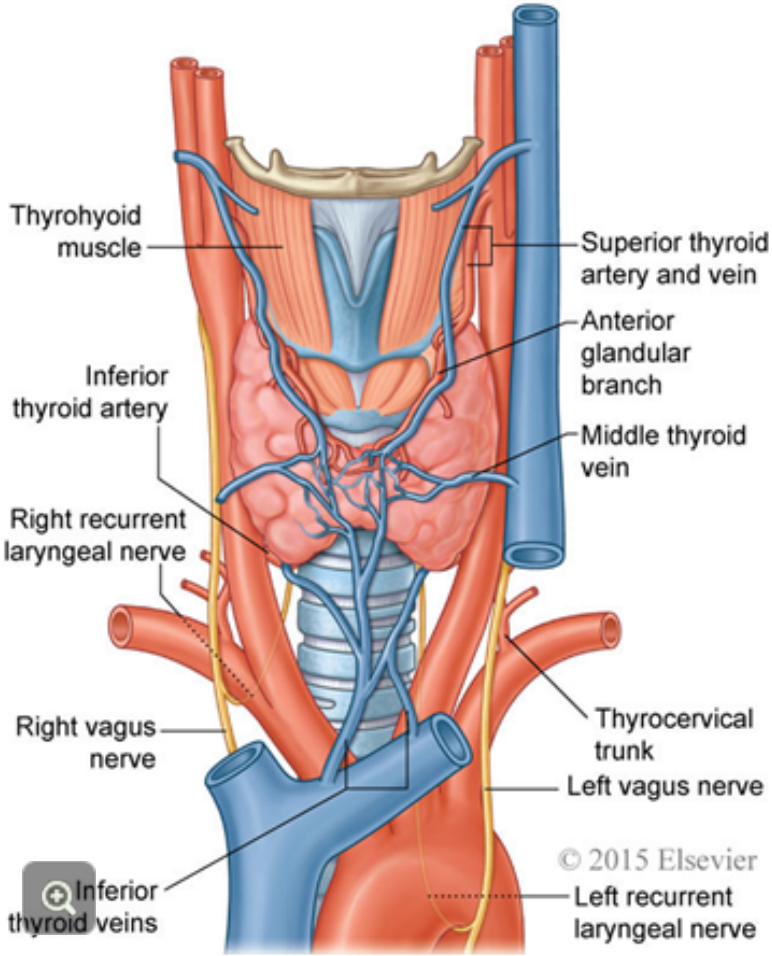
INFO

The Thyroid Ima Artery

In addition, in a small but significant proportion of people, the thyroid receives a branch called the **thyroid ima artery**. This is a **midline vessel** which ascends to the thyroid isthmus from the brachiocephalic or common carotid arteries, or, sometimes even from the arch of the aorta. **It is an important variant to remember in surgeries involving the thyroid gland or trachea**.



Venous drainage from the thyroid gland is via the **superior**, and **middle thyroid veins** that enter the **internal jugular veins** and the **inferior thyroid veins** that enter the **brachiocephalic veins**.



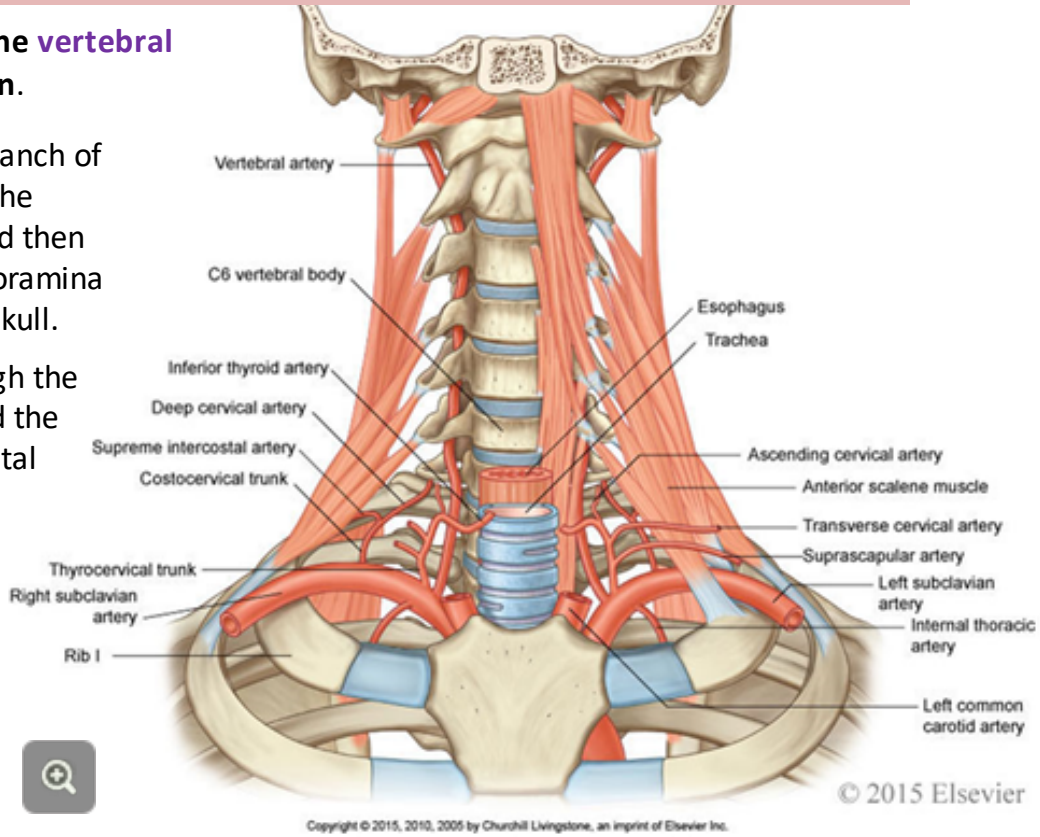
TASK

Medial to the origin of the thyrocervical trunk from the subclavian artery,

IDENTIFY the origin of the vertebral artery from the subclavian.

The vertebral artery is the first branch of the subclavian. It quickly enters the foramen transversarium of C6 and then ascends through the remaining foramina transversaria to the base of the skull.

It enters the neurocranium through the foramen magnum to supply blood the brainstem, cerebellum and occipital lobes.



Since embarking on this exercise, you have **identified** the following structures and learned the **answers to the following questions**:

- sternocleidomastoid muscle and accessory nerve; what other muscle does the accessory nerve innervate?
- posterior belly of the digastric and stylohyoid muscle, tip of the greater horn of the hyoid bone, hypoglossal nerve
- external laryngeal nerve and superior thyroid artery arising from the external carotid artery
- lobe and isthmus of the thyroid gland; does the thyroid gland in your cadaver have a pyramidal lobe?
- cricothyroid muscle (action? effect on voice? innervation?), cricothyroid ligament (what is cricothyrotomy?)
- the thyrohyoid membrane, thyrohyoid muscle, internal branch of the superior laryngeal nerve (origin? function? distribution?), external branch of superior laryngeal nerve (function? distribution?)
- both right and left recurrent laryngeal nerves (origin? function? distribution?),
- What are the contents of the carotid sheath?
- the internal jugular vein, common carotid artery, external and internal carotid arteries, carotid sinus (what is the carotid sinus?), the superior thyroid, lingual, and facial arteries
- vagus nerve, sympathetic chain, superior cervical ganglion; What are the internal and external carotid plexuses?
- the anterior scalene muscle, the phrenic nerve (what are its spinal roots? what functional fibre types does it contain?), the subclavian vein, subclavian artery, roots of the brachial plexus, middle scalene muscle
- the thyrocervical trunk, inferior thyroid artery, the thyroid ima artery (if present) the vertebral artery; describe the venous drainage of the thyroid gland

If you are satisfied with your **ability to identify these structures** and **answer these questions**, call your TA over for confirmation and for **permission to move on**.