Lab 20: Dissection: Nose, Nasal Cavities, Paranasal Sinuses, Pharynx, and Larynx

GOALS

1. Identify the bones and cartilages of the external nose
2. Bisect the head slightly off the midline to expose the nasal cavities and pharynx
3. Examine the nasal septum, identify its parts, and describe it neurovascular supply
4. Examine the lateral nasal wall and identify the nasal conchae (turbinates) and meatuses
5. Remove the middle nasal concha and identify the features of the middle meatus
6. Identify the paranasal sinuses and describe their drainage in the nasal cavity
7. Identify the three parts of the pharynx and study the features of the nasopharynx
8. Identify surface landmarks in the neck and the external anatomy of the larynx
9. Identify the laryngeal nerves in the neck and describe their functions
10. Remove the larynx and identify its cartilages and ligaments, anatomic features in the laryngeal airway, and intrinsic muscles

External Nose

Identify the parts of the **external nose** on your donor (and on yourself):

- **Root, apex (tip), dorsum (bridge), alae (left and right), nares (nostrils)**

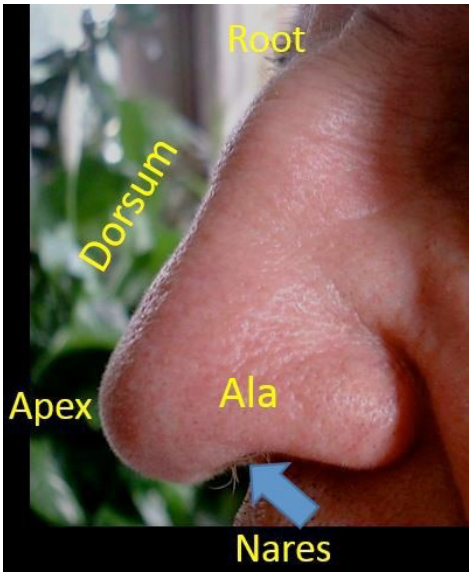

Figure 20.1. Parts of the external nose.

Remove the skin, fascia, and muscles from one side of the nose.

The "skeleton" of the nose is composed of bones and cartilage. After the skin is removed, identify the following parts of the skeleton of the nose (Figure 20.2):

- **Nasal bones (left and right)**
- **Major alar cartilage**
  - Each is U-shaped, with a **medial crus** and a **lateral crus**. The medial crura of the left and right cartilages line up, side-by-side in the midline to form the **mobile nasal septum** (aka = **Columella**). This is between the **nostrils**.
- **Lateral nasal cartilages**—connect above to the nasal bones

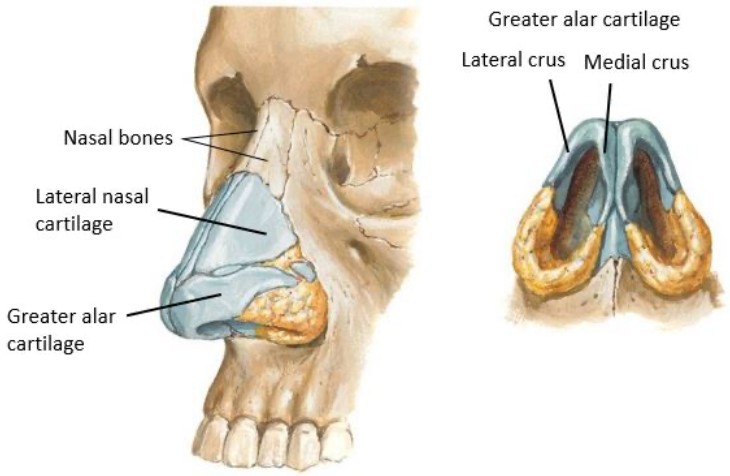

Figure 20.2. Skeleton of the nose.

WITH TWO FINGERS, DEMONSTRATE THE MOBILITY OF THE COLUMELLA ON THE DONOR (OR YOURSELF!).

Bisection of the head.

To study the nasal cavities, paranasal sinuses, and pharynx, it will be necessary to look inside the head —we will do this by dividing the head in the sagittal plane.

NOTE

This may be an uncomfortable procedure—but it will yield an excellent view of the anatomy that we need to learn today. Be brave! Take your time and learn as much as you can from this unique dissection.

1. Place blocks under the donor's back to elevate the head as high as possible.
2. It is best to bisect the head slightly lateral to the midline so that the nasal septum can be studied.
3. Looking upward through the nostrils, determine whether the nasal septum is deviated from the midline. If so, bisect the head slightly off the midline on the side away from the deviated septum, so that the septum will remain intact when the head is cut.
4. Start the bisection by using a scalpel to cut through the skin of the forehead, the lips, and the cartilages of the nose slightly to one side so that the entire septum will be on one side of the bisected head.
5. Standing at the head end of the donor, use a hacksaw to cut through the skull base slightly off the midline. Start your cut at the frontal bone and line up the saw blade with the incisions you made earlier through the nose and lips. Remember, you want one half of the head to contain the intact **nasal septum**.

6 Saw through the frontal, ethmoid, and sphenoid bones. **See Figure 20.3.** As one team member cuts, another should apply pressure to the two sides of the head to separate them and allow the saw blade to cut deeper.

7 As the saw moves toward the **foramen magnum**, it may become jammed. At this point, remove the saw and split the head with a hammer and chisel.

8 As the skull base is fractured, the head will separate. This takes some elbow grease. Continue to be brave!

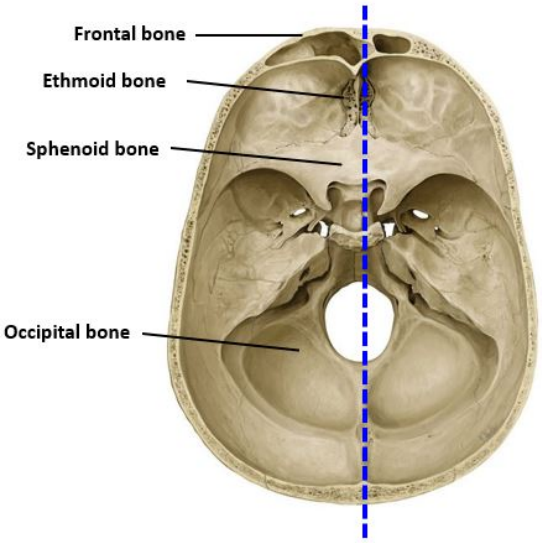

Figure 20.3. Skull base cut—saw slightly off the midline (to the left or right).

NOTE

With the head bisected, we can now examine the nasal cavity and pharynx.

Nasal Cavity

We will tackle the Nasal Cavity in two steps: Septum and Lateral Wall. The nasal septum should be on the larger of the two hemi–heads.

Nasal Septum

Dissect the intact nasal septum. Carefully peel away the mucosa and note that the septum has three parts.

1 Identify these three parts in the donor and in Figure 20.4.
   - **Bony septum**
   - **Septal cartilage**
   - **Mobile nasal septum (Columella)**

2 In Figure 20.4, identify the bones that contribute to the **bony septum**: the **perpendicular plate of the ethmoid bone** and the **vomer**. Find a dried skull in the lab. Look through the **piriform aperture** and identify the bony septum. Turn the skull upside down and identify the **vomer**.

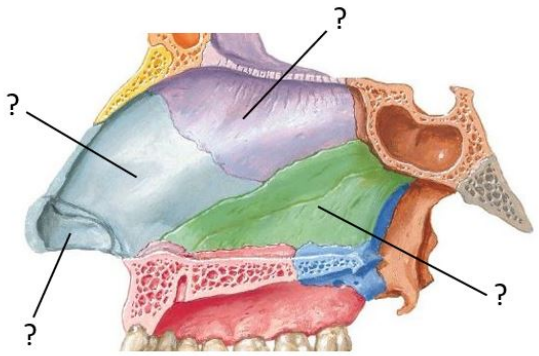

Figure 20.4. Nasal septum with mucosa removed.

QUESTION

Vomer is Latin for "plow." Is it plow-shaped?

3 *Sensory innervation of the septum and lateral nasal walls:* A similar pattern applies to both. See Figure 20.5.
   - The anterior/superior portion of the septum is supplied by branches of V1 (**ophthalmic division** of trigeminal nerve).
   - The posterior/inferior portion is supplied by branches of **V2** (**maxillary division** of trigeminal nerve).
   - Imagine an oblique line drawn from the nostrils to the sphenoid bone = above the line is V1 territory, below it is V2.
   - The large **nasopalatine nerve** (from V2) crosses the inferior part of the nasal septum obliquely. It supplies the postero-inferior septum and the anterior part of the hard palate. If you are skilled (and lucky?) this nerve may remain intact after you have carefully removed the mucosa from the septum.

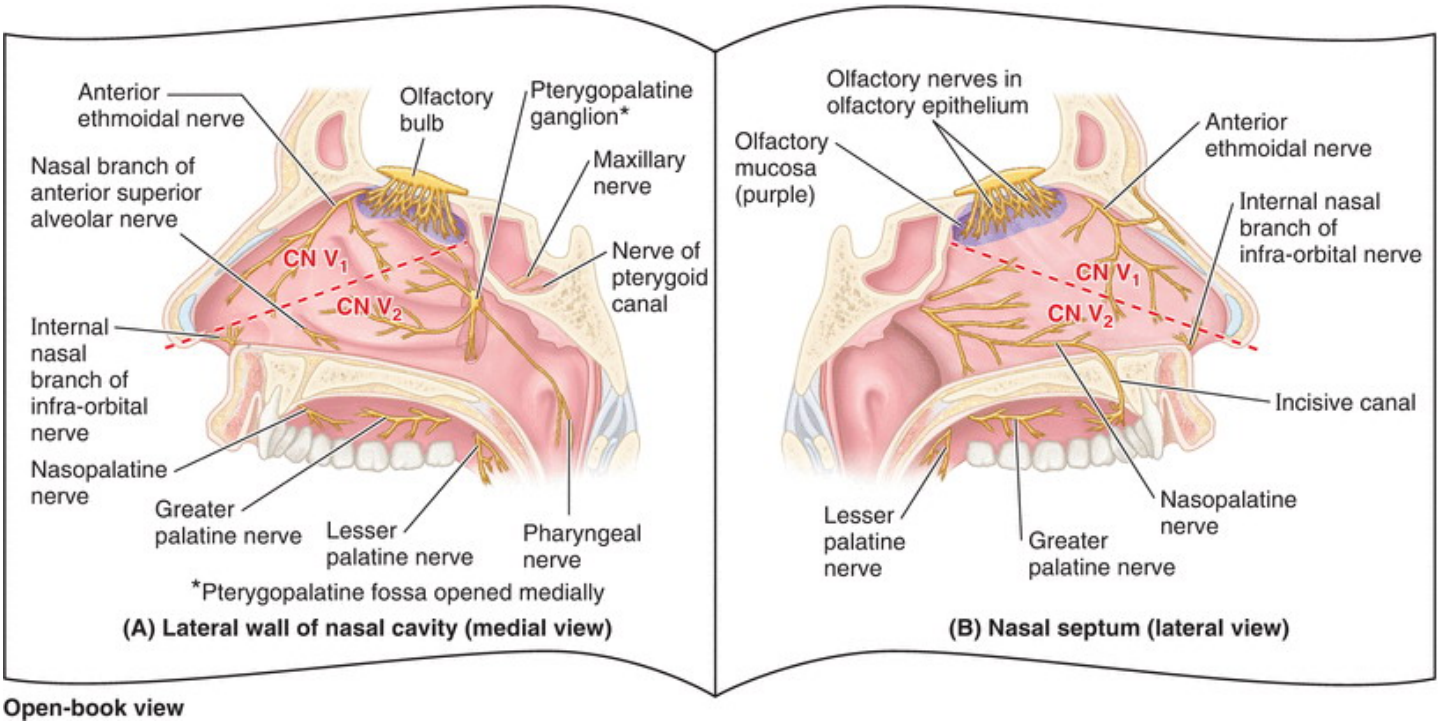

Figure 20.5. Innervation of the nasal cavity.

4 *Blood supply of septum and lateral nasal walls:*

- Five arteries supply blood to the nasal cavity (see Figure 20.6):
  - Two are derived from the **internal carotid artery** (via the **ophthalmic artery** in the orbit): **Anterior and posterior ethmoidal arteries**.
  - Three are derived from the **external carotid artery** (via the **maxillary artery**): **Sphenopalatine, facial, and greater palatine arteries**.

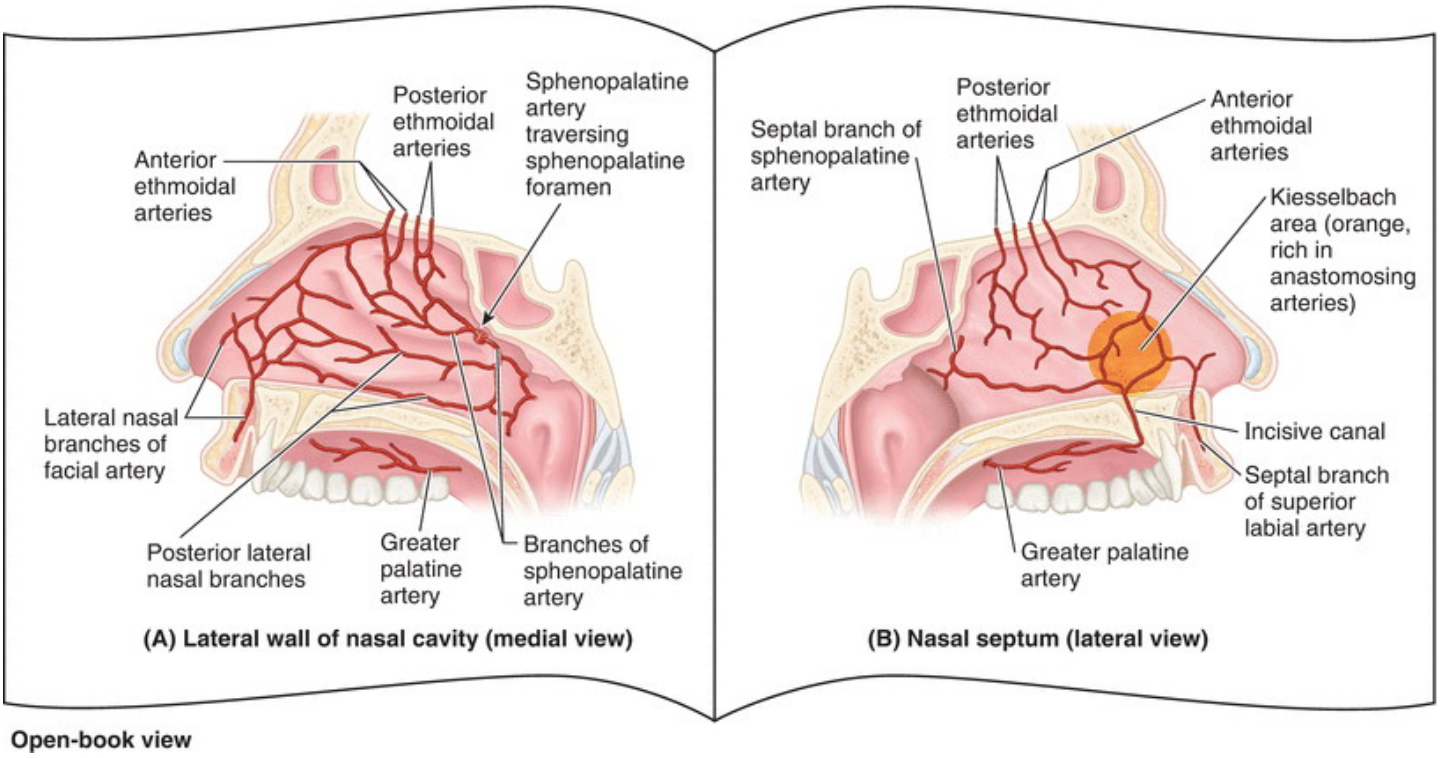

Figure 20.6. Blood supply of nasal cavity.

CLINICAL CORRELATIONS

Where is **Kiesselbach's area**, and why is it important?

Which artery is usually responsible for bleeding in the case of **posterior epistaxis**?

CHALK TALK

Draw the nasal septum twice. In one drawing sketch in the nerves; in the second, draw the arteries and locate Kiesselbach's Area.

Lateral Nasal Wall

On the other side of the head (without the nasal septum), inspect the lateral nasal wall.

1. Just inside the nostrils, locate the skin covered **vestibule**. Nose hairs (**vibrissae**) are found here.
2. Beyond the vestibule, the mucosa is thick and the epithelium changes to a **respiratory epithelium.**
3. A curved ridge, the **limen nasi**, separates the vestibule from the larger respiratory region of the lateral nasal wall. A color difference should be noted between the two areas.

QUESTION

Do you recall from Histology class how the respiratory epithelium is classified?

QUESTION

Where is the **olfactory region** of the nasal cavity located? What is significant about this region?

NOTE

When you quietly breathe, air entering the nasal cavity is swept posteriorly from the vestibule into the middle meatus = the direct route for most inspired air. When you sniff, air is accelerated upwards to higher reaches of the nasal cavity where the olfactory nerves are located.

4 Identify the three **nasal conchae (turbinates): Superior, middle, and inferior**. See Figure 20.7. Under them are the three **nasal meatuses**.

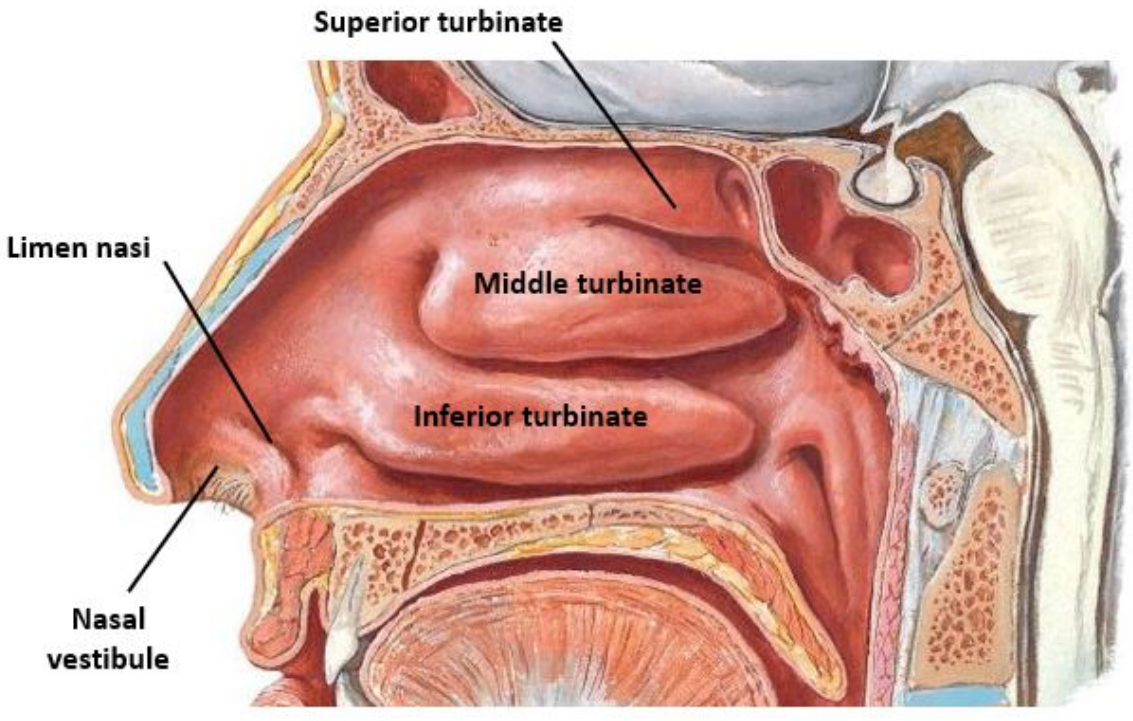

Figure 20.7. Features of the lateral nasal wall.

5 Reflect the middle turbinate upwards—or remove it completely. Study the **middle meatus** and see if you can identify these features (see Figure 20.8):

- **Ethmoidal bulla**: A mound ("bubble") in the lateral nasal wall produced by the underlying middle ethmoidal air cells.
- **Uncinate process**: A curved, bony ridge anterior and inferior to the bulla.
- **Semilunar hiatus**: The curved gap between the bulla and uncinate process.
- **Infundibulum**: A small chamber lateral to the uncinate process. Slip a probe through the semilunar hiatus to demonstrate the infundibulum.

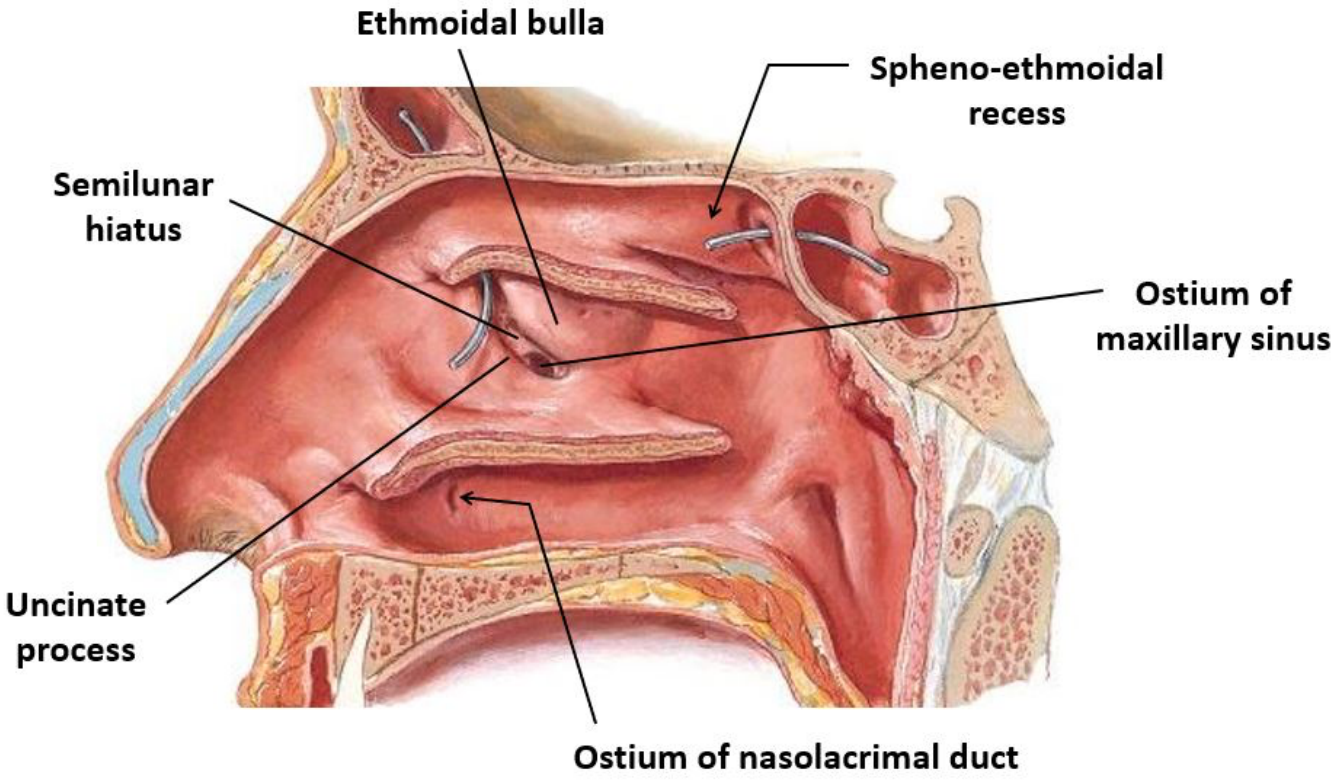

Figure 20.8. Anatomy of the nasal meatuses.

CLINICAL CORRELATION

Clinicians call the anatomic structures (list above) within the middle nasal meatus collectively the "**ostiomeatal unit**." It has clinical important because most of the paranasal sinuses drain into the nasal cavity via the parts of the ostiomeatal unit.

NOTE

See if you can find the ostium of the maxillary sinus through the semilunar hiatus.

QUESTION

Search the **inferior nasal meatus** for the **ostium of the nasolacrimal duct**. [This task may bring tears to your eyes!] What is the function of the nasolacrimal duct?

- Identify the **spheno-ethmoidal recess**. This is the area above the superior turbinate in the highest reaches of the nasal cavity. The sphenoidal air sinus opens here.

Paranasal Sinuses

There are four sets of paranasal sinuses. Their names reflect the bones they occupy.

- **Maxillary** (paired)
- **Frontal** (paired—rarely symmetrical)
- **Sphenoidal** (paired—rarely symmetrical)
- **Ethmoidal Air Cells** (paired and grouped into Anterior, Middle, and Posterior cells)
- You should be able to identify the **frontal** and **sphenoidal sinuses** in your sagittal head sections since they are usually asymmetric and cross the midline of the head.
- Observe an isolated dried **ethmoid bone** and note how it is like a honeycomb (or a piece of baklava!) = full of air cells.
- Probe the infundibulum in the middle meatus and locate the **ostium of the maxillary sinus**. Enlarge the ostium with scissors and demonstrate the maxillary sinus lateral to the infundibulum.

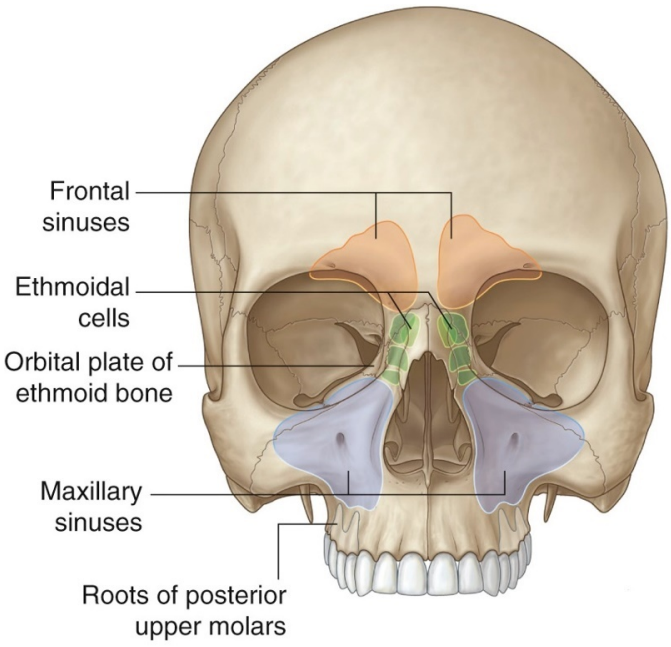

Figure 20.9. Paranasal sinuses.

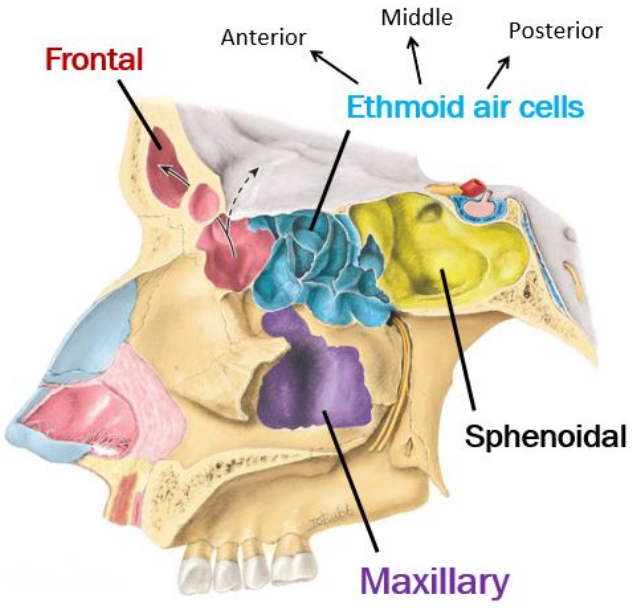

Figure 20.10. Paranasal sinuses.

CLINICAL CORRELATIONS

- What are the functions of paranasal sinuses?
- Why are the sinuses susceptible to infection?
- Which areas of the head are adjacent to the sinuses? Chronic sinus infections could invade these areas.
- Note the relationship between the ethmoidal air cells and the orbits.
- Note the relationship between the maxillary sinuses and the upper teeth. Why is this important?

Drainage of Paranasal Sinuses

(See Figure 20.11.)

Most have their drainage into the **MIDDLE MEATUS**:

- **Frontal**, **anterior ethmoidal cells**, and **maxillary sinuses** drain to the infundibulum; **middle ethmoid cells** open on the ethmoidal bulla.
- **Posterior ethmoidal cells** open in the **SUPERIOR MEATUS**.
- The **sphenoidal sinuses** open into the area just above the superior concha = the **SPHENO-ETHMOIDAL RECESS.**

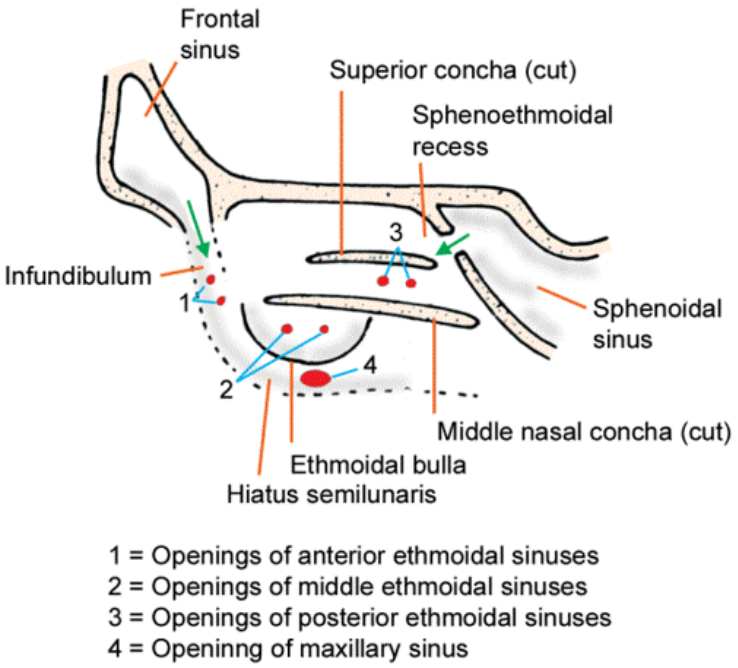

Figure 20.11. Openings of the paranasal sinuses in the nasal cavity.

The openings of the sinuses are diffcult to demonstrate in the donor. You may be able to slip a needle probe in the ostia of the maxillary and frontal sinuses.

CHALK TALK

A CHALK TALK on the whiteboard could summarize where the sinuses open in the nasal cavity.

Pharynx

The pharynx ("throat") is the upper end of the alimentary canal. It is shared by the digestive and respiratory systems. See Figures 20.12 and 20.13.

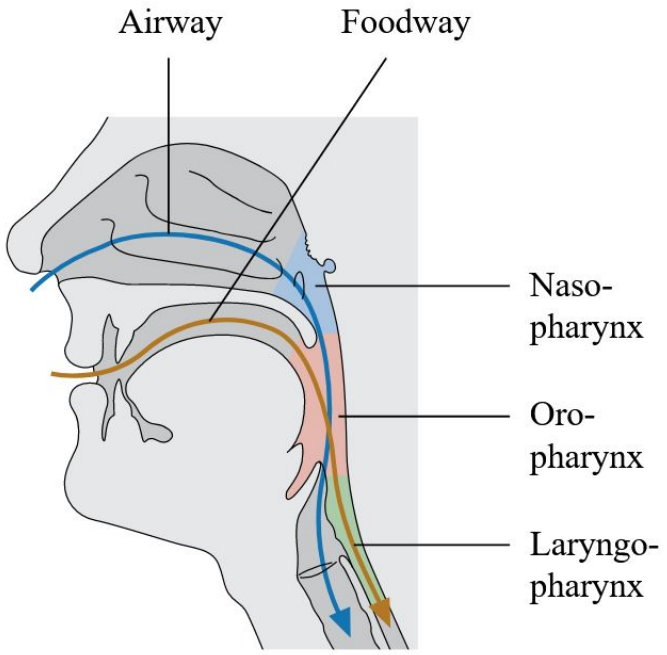

Figure 20.12. The pharynx.

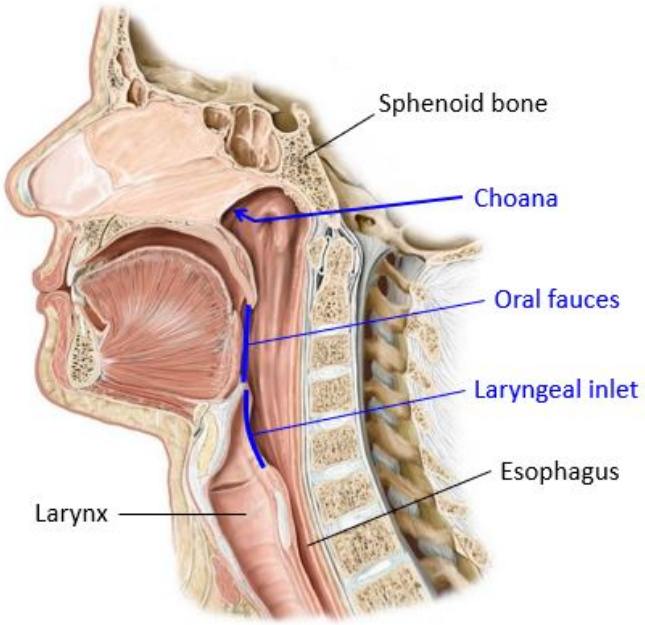

Figure 20.13. The pharynx.

1 Examine the pharynx in cross-section and answer these questions:

QUESTION

Where is the upper border of the pharynx?

Where does the pharynx end inferiorly?

Which bony structure is posterior to the pharynx?

2 Now define the boundaries of the three parts of the pharynx: **nasopharynx, oropharynx**, and **laryngopharynx**. You will need to identify the **uvula** and **epiglottis**.

The pharynx is open anteriorly, where it communicates with three cavities. The "thresholds" where the pharynx and these cavities connect have special names. See Figures 20.13 and 20.14.

- Nasopharynx communicates with the **nasal cavities** via the **choanae**
- Oropharynx communicates with the **oral cavity** via the **oral fauces**
- Laryngopharynx communicates with the **larynx** via the **laryngeal inlet**

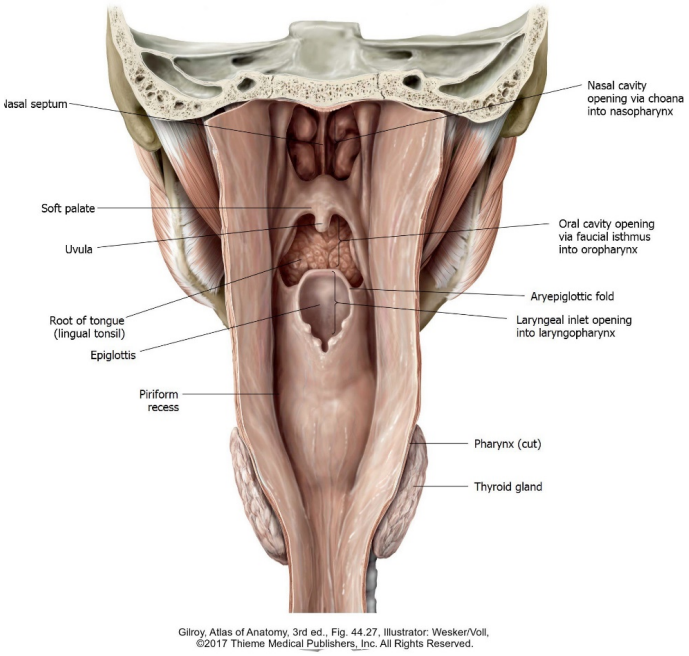

Figure 20.14. Posterior view of pharynx with pharyngeal wall opened.

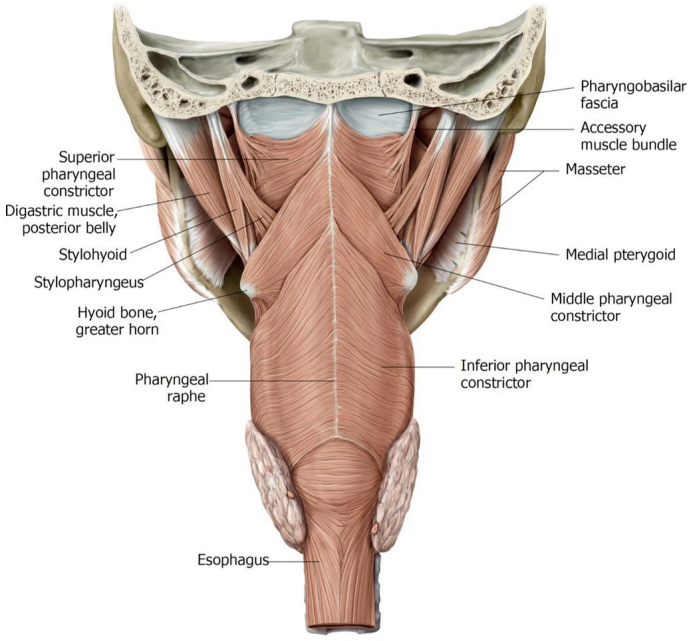

Figure 20.15. Posterior view of pharynx with pharyngeal wall intact. Note the pharyngeal constrictor muscles for swallowing. They meet in the midline posteriorly.

3 The pharynx is closed posteriorly where its two muscular sides meet in the midline (Figure 20.15).
   - Pull the posterior pharyngeal wall away from the cervical vertebrae. The muscles within the pharyngeal wall are the **pharyngeal constrictors**. These are used for swallowing.
   - Slide your fingers behind the pharynx, between pharynx and spine: your fingers are in the **retropharyngeal space**. **Why is the retropharyngeal space important clinically?**

Nasopharynx

- Locate the opening of the **pharyngotympanic (Eustachian) tube** in the nasopharynx. **Where does the other end of the tube open? What is the function of the Eustachian tube?**
- Above the opening of the Eustachian tube is a curved ridge called the **torus tubarius**.
- Posterior to the torus tubarius is the deep **pharyngeal recess (fossa of Rosenmüller)**.

CLINICAL CORRELATION

The pharyngeal recess is the most common site of origin for nasopharyngeal cancer.

- Note the locations of the **tubal tonsils** and **pharyngeal tonsils** (called **adenoids** when they are enlarged) in the pharyngeal mucosa.
  - The tubal tonsils are in the mucosa of the torus tubarius.
  - The pharyngeal tonsils are in the mucosa in the roof of the nasopharynx.

Oropharynx

- Identify the **epiglottis**. It is at the border between oropharynx and laryngopharynx. **What is the function of the epiglottis?**
- In the lateral wall of the oral fauces (the connection between oral cavity and oropharynx) identify the **palatine tonsils** (if present). They occupy a depression called the **tonsillar fossa**, between two mucosal folds called the **tonsillar arches** (tonsillar pillars).
- Between the epiglottis and tongue is a deep recess called the **epiglottic vallecula**. This is an important landmark for endotracheal intubation procedures (laryngoscope blade goes here). See Figure 20.16.

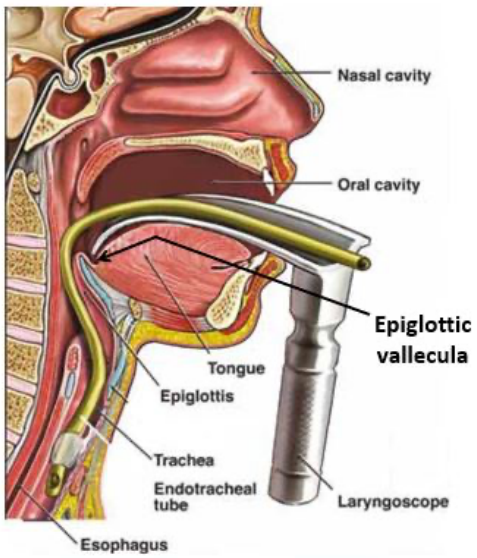

Figure 20.16. Endotracheal intubation—note the blade is in the epiglottic vallecula.

Laryngopharynx

The laryngopharynx connects below with the **esophagus** and anteriorly to the laryngeal airway via the **laryngeal inlet**. The inlet is below the epiglottis.

Neck Viscera

1 Let's take a quick tour of organs in the neck. Identify the **larynx, esophagus, trachea, and thyroid gland**.

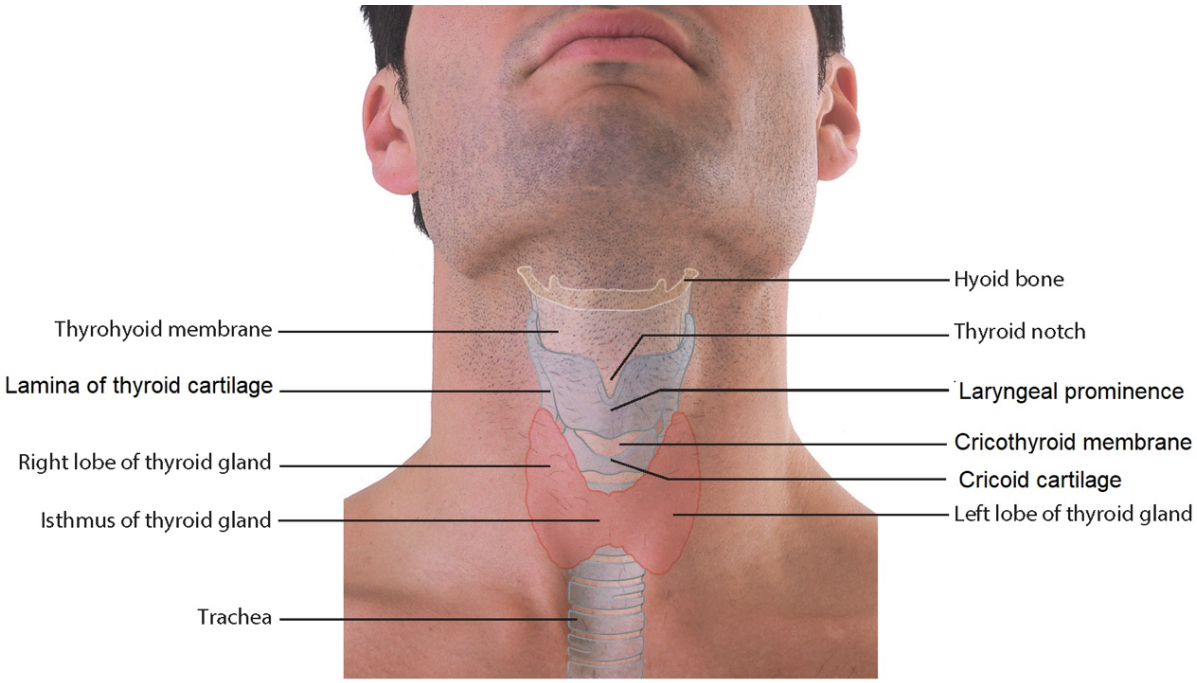

Figure 20.17. Surface landmarks of neck.

2 Palpate the neck in the midline from superior to inferior for these surface landmarks (see Figure 20.17):

- **Hyoid bone = U-shaped bone "floating" in the neck musculature.**
- **Thyroid cartilage** with **laryngeal prominence** ("Adam's apple")
- **Cricoid cartilage**
- **Cricothyroid membrane**
- **Trachea**. It is just above the suprasternal notch (remember this?). Palpate the **tracheal rings** of cartilage.

CLINICAL CORRELATION

Palpate the **cricothyroid membrane—the soft spot in the midline of the anterior neck between thyroid and cricoid cartilages.** Realize that this is the preferred site for an emergency airway (cricothyrotomy, "crike") because it is subcutaneous and has no vessels in the way. Puncture the cricothyroid membrane with your scalpel blade to demonstrate its location and thickness.

3 Palpate the hyoid bone in the neck. It has a **body** and **greater and lesser horns**. (Consult a skeleton.)

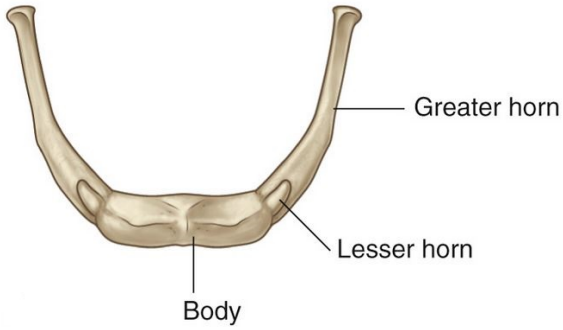

Figure 20.18. Hyoid bone.

Larynx

The larynx is the "voice box"—it is the organ of phonation (sound production). It also serves as a valve to regulate airflow to and from the lungs and as a sphincter to prevent foods and liquids from entering the airway.

Skeleton of the Larynx

The "skeleton" is formed from cartilages and ligaments. Identify its parts on your donor and on models in the lab (and see Figure 20.19):

- **Thyroid cartilage** (shield-shaped)
  - Has a midline **laryngeal prominence** (*Adam's apple*) and **left and right laminae**
- **Cricoid cartilage** (ring-shaped)
  - **Shorter in front; taller in back**
  - The only laryngeal cartilage that entirely surrounds the airway
- **Thyrohyoid membrane**
- **Cricothyroid membrane**
- **Epiglottis**: Made from a leaf-shaped epiglottic cartilage covered in mucous membrane

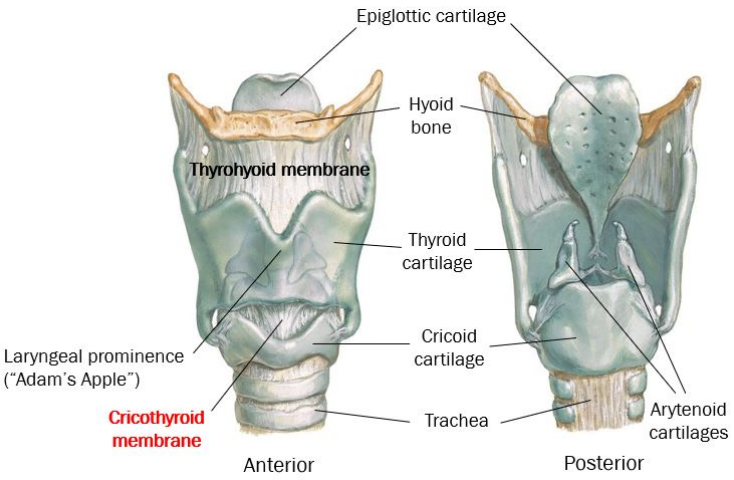

Figure 20.19. Skeleton of the larynx.

- Paired **arytenoid cartilages** (pyramid-shaped), perched posteriorly on top of the cricoid cartilage.
  - Each arytenoid cartilage has a ***vocal process*** that projects anteriorly (vocal cords attach here) and a ***muscular process*** that projects laterally.

Laryngeal nerves.

The larynx is innervated by the **vagus nerve** (Cranial Nerve X). Two branches of the vagus supply the larynx: **Superior laryngeal nerve** and **Recurrent laryngeal nerve**.

Let's see if we can find these nerves in your donor. Your MS2 colleagues may have done you a favor by finding and cleaning them when they studied head and neck anatomy!

Superior Laryngeal Nerves: Internal and External Branches

1. Laterally, just below the greater horn of the hyoid bone, palpate the soft **thyrohyoid membrane**.
2. Carefully probe through the tissue lateral to the thyrohyoid membrane to find the **internal branch of the superior laryngeal nerve (internal laryngeal nerve)** entering the thyrohyoid membrane. (See Figure 20.20.) It is accompanied by the **superior laryngeal artery**, a branch of the **superior thyroid artery**.
    - The internal laryngeal nerve is a sensory nerve—it supplies the mucosa of the upper larynx (above the vocal cords) = the critical portion of the airway just inside the laryngeal inlet.

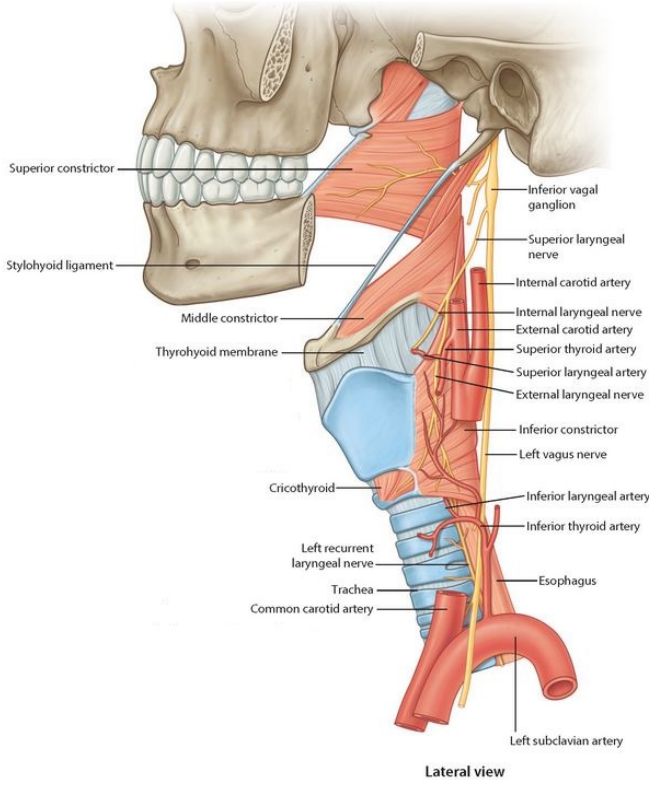

Figure 20.20. Nerves of the larynx.

CLINICAL CORRELATION

The internal laryngeal nerve is the "***Guardian of the Airway***," because its sensory fibers detect any foods or liquids that accidently enter the airway, eliciting a cough reflex to expel the aspirated substances.

IF YOU ARE SUPER SKILLED,

you may find the thin **external branch of the superior laryngeal nerve (external laryngeal nerve)** branching from the superior laryngeal nerve near the hyoid and descending to the **cricothyroid muscle**. (See Figure 20.20.)

- The external laryngeal nerve is a motor nerve—its only job is to innervate the cricothyroid muscle—which raises the vocal pitch.

SUMMARY

The superior laryngeal nerve has internal and external branches. Can you summarize the functions of each?

Recurrent Laryngeal Nerves

1 Clean the left and right **tracheo-esophageal grooves** inferior to the thyroid gland on both sides. Find the **recurrent laryngeal nerves** ascending in the grooves (left one loops under the **arch of the aorta**, and the right one recurs around the **right subclavian artery**).
   - The recurrent laryngeal nerves are **mixed nerves**.
     - They are sensory to the mucosa in the lower half of the laryngeal airway (inferior to the vocal cords).
     - They are motor to ALL the intrinsic muscles of the larynx, EXCEPT the **cricothyroid muscles**.

2 Reflect one of the lobes of the **thyroid gland** toward the midline and locate the recurrent laryngeal nerve deep to the lobe.

CLINICAL CORRELATION

The external laryngeal nerves and recurrent laryngeal nerves both relate to the thyroid gland (see Figure 20.21). When ligating the superior or inferior thyroid arteries, these nerves must be identified. IMPORTANT RELATIONSHIPS FOR THE SURGEON!

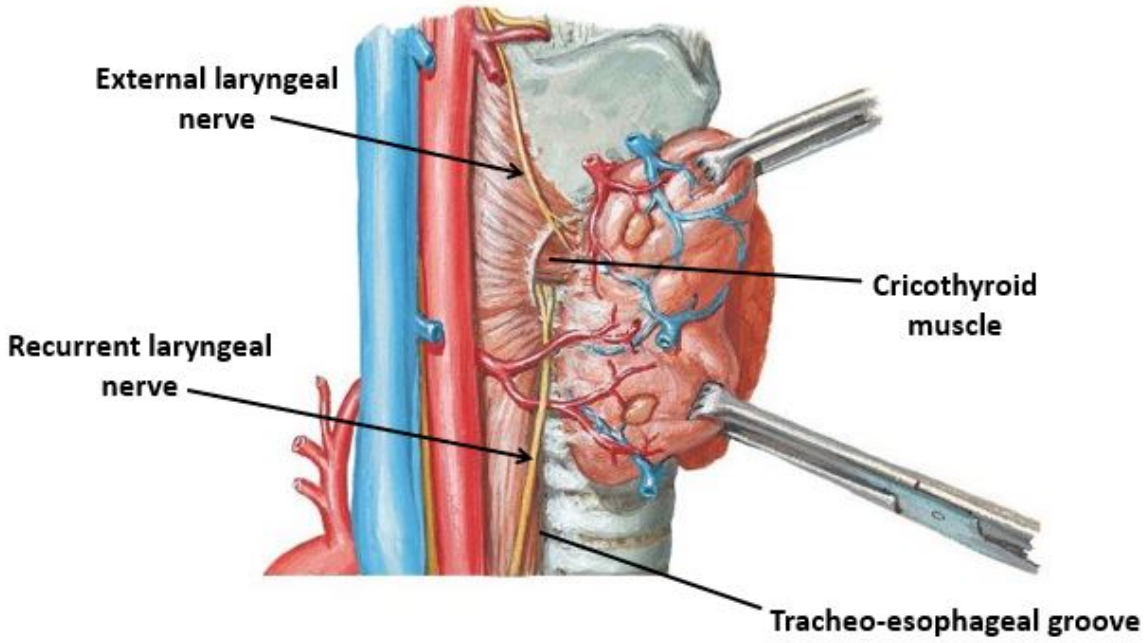

Figure 20.21. Relationship of laryngeal nerves and thyroid gland.

Remove the visceral unit of the neck.

This unit will contain the **larynx, laryngopharynx, esophagus, thyroid gland,** and a segment of the **trachea**.

NOTE

If you have nice laryngeal nerves supplying your larynx, check with your instructors before proceeding. We may wish to preserve one or two intact visceral units for later study!

Using a long knife, make two horizontal incisions:

1. **Incision #1: Make a transverse cut just above to the hyoid bone and carry the cut all the way to the vertebral column.**
2. **Incision #2: Make a transverse cut through the trachea** just above the suprasternal **notch of the sternum.**
3. Cut the blood vessels and nerves that supply the larynx and thyroid gland.
4. Cut the muscles that attach to the hyoid bone and thyroid cartilage (infrahyoid and suprahyoid muscles).
5. ***Put the neck visceral unit on a tray and dissect/study it.***

Laryngopharynx.

The lower part of the pharynx is the **laryngopharynx**. It is posterior to the larynx.

1. Turn over the visceral unit and open the **esophagus** and **laryngopharynx** posteriorly by making a vertical cut along the midline with scissors. You are cutting through the posterior wall of the pharynx, which contains fascia and skeletal muscles (**pharyngeal constrictors**).
2. The larynx is anterior to the pharynx. Locate the **laryngeal inlet, which leads to the laryngeal airway**. Note that the inlet is bordered and protected by the **epiglottis** and the **aryepiglottic folds** (Figure 20.22).
3. Within the laryngopharynx, locate the left and right **piriform recesses.** These are gutters on the sides of the laryngeal inlet (Figure 20.22).

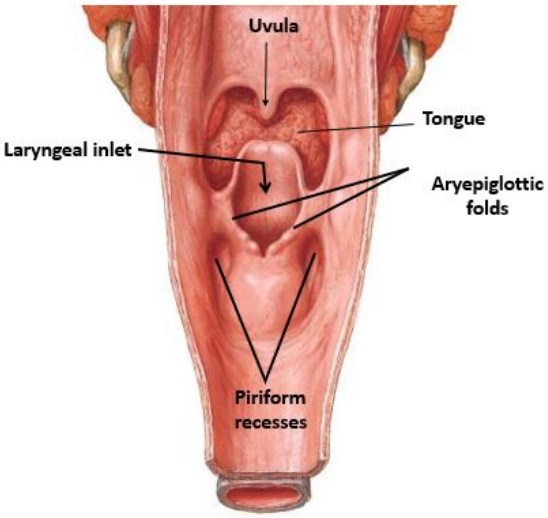

Figure 20.22. Laryngopharynx—posterior view.

CLINICAL CORRELATION

When liquids or solids are swallowed, the epiglottis deflects them away from the inlet, so that they slide through the piriform recesses to the esophagus. The piriform recesses are spots where foodstuffs can become lodged (fishbones, for example).

4. With a scalpel or scissors, carefully remove the mucosa from the posterior surface of the larynx, below the inlet. This area corresponds to the posterior surfaces of the **arytenoid cartilages** and the **cricoid cartilage**.
    - Clean and identify the **posterior crico-arytenoid muscles** on the posterior side of the cricoid cartilage and the **transverse arytenoid muscle** that spans between the posterior surfaces of the arytenoid cartilages (Figure 20.23).

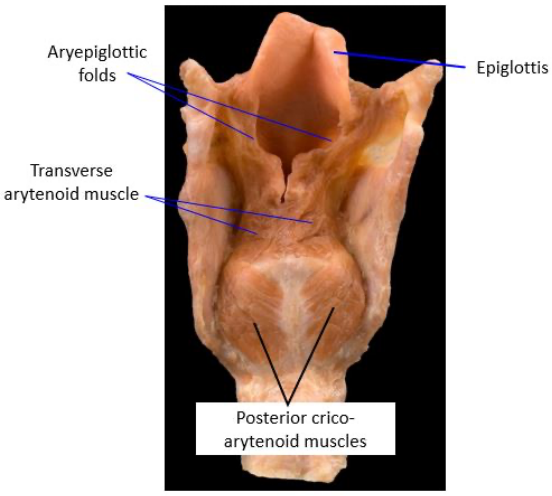

Figure 20.23. Muscles of larynx—posterior view from laryngopharynx.

Internal anatomy of larynx = Airway of the larynx.

Look into the interior of the larynx through the inlet. Identify the **vestibular folds above** and the **vocal folds** below the vestibular folds.

To study the internal anatomy of the larynx, use scissors or a scalpel to transect the posterior wall of the larynx in the midline.

1. Start at the inlet and proceed inferiorly. Cut through the posterior wall of the larynx and trachea in the midline. Don't cut through the anterior wall of the larynx—we don't want to cut the organ in half.
2. Reflect the two sides of the larynx as if opening a book, using the anterior wall of the larynx as a hinge. (See the upper right image in Figure 20.24.)
3. Identify the internal features of the larynx (Figure 20.24). Pretend you are a wee person and you are floating through the larynx on a cushion of inspired air. From superior to inferior, the named structures in the airway of the larynx are:
    - **Inlet**
    - **Vestibule** (between inlet and vestibular folds)
    - **Vestibular folds**
    - **Vocal folds (vocal cords)**
    - The space in the midline between the left and right vocal folds is the **rima glottidis**.
    - The **glottis** is the sound producing part of the larynx. It consists of the two vocal folds and the rima glottidis between them.
    - The **laryngeal ventricles** are lateral diverticula on each side of the airway between the vestibular and vocal folds. Slip the tip of a probe into the ventricle.
    - **Infraglottic cavity** (below the vocal folds; between them and the first tracheal ring).

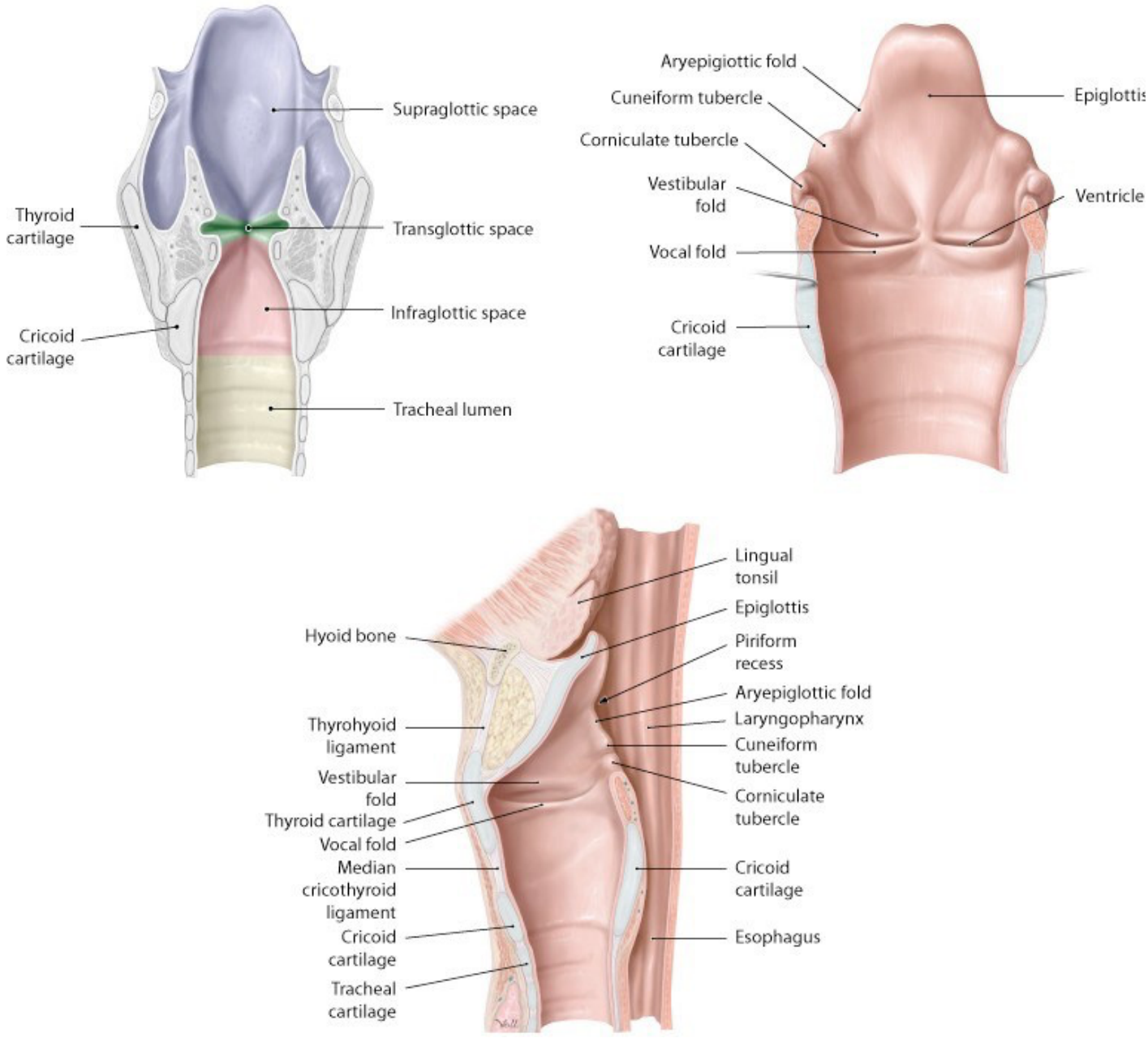

Figure 20.24. The airway of the larynx.

CLINICAL CORRELATION

Clinicians use the glottis as a landmark when describing regions of the larynx = supraglottic and infraglottic regions, for example.

Intrinsic Muscles of the Larynx

Use a model to identify these first, then see if you can identify some of them on your larynx specimen. Grouping these muscles by function helps when learning.

— Abductors/adductors of the vocal folds

- **Posterior crico-arytenoid muscles**: Attach to the posterior surface of the cricoid cartilage below and to the muscular processes of the arytenoid cartilages above. Their contraction swivels the vocal processes laterally, thus **abducting the vocal folds** and **widening the rima glottidis**.

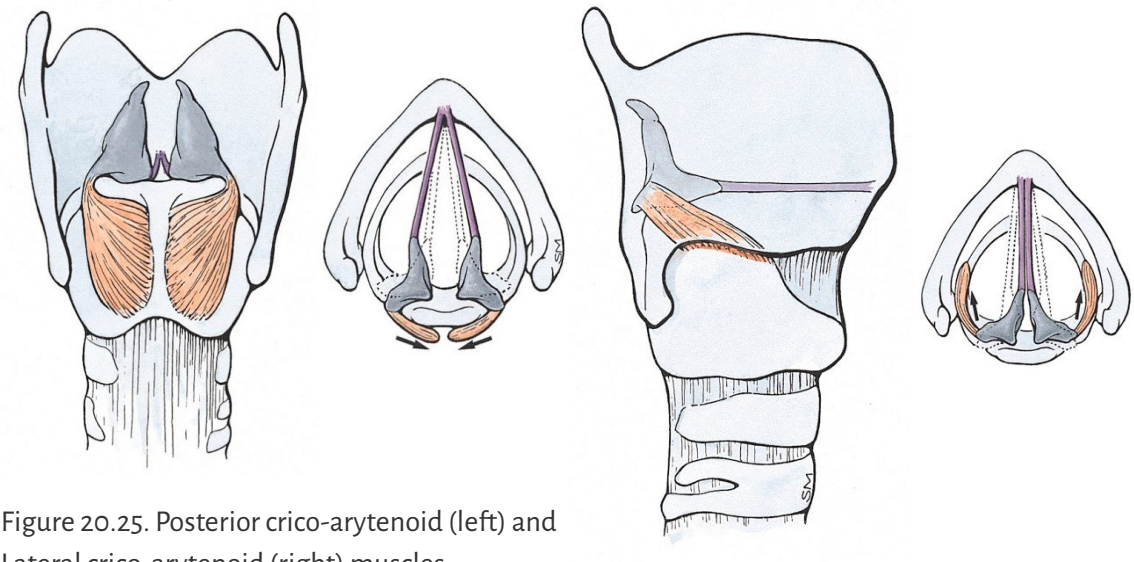

Figure 20.25. Posterior crico-arytenoid (left) and Lateral crico-arytenoid (right) muscles.

- **Lateral crico-arytenoid muscles**: Attach to the lateral surfaces of the cricoid cartilage below and to the muscular processes of the arytenoid cartilages above. Their contraction swivels the vocal processes medially, thus **adducting the vocal folds** and **narrowing the rima glottidis**.
- **Transverse arytenoid muscle**: Extends horizontally, stretching from the posterior surface of one arytenoid cartilage to the other. (See Figure 20.23.) When contracted, this muscle moves the arytenoid cartilages closer together, thus **adducting the vocal folds** and **closing the rima glottidis**, especially its posterior part.

— Tensors/relaxors of the vocal folds

- **Cricothyroid muscles**: These are on the anterior/external surface of the laryngeal skeleton. They attach above to the thyroid cartilage and below to the antero-lateral surfaces of the cricoid cartilages. These muscles tilt the thyroid cartilage forward. Since the vocal cords attach to the internal aspect of the thyroid cartilage, when the cartilage is tilted forward the vocal cord is stretched, thus **tensing the vocal folds and raising the pitch of the voice**.
- **Thyro-arytenoid muscles**: Run parallel and lateral to the vocal cords. They extend from the arytenoid cartilages posteriorly to the internal surface of the thyroid cartilage anteriorly. Their contraction draws the arytenoid cartilages toward the thyroid cartilage, thus releasing tension and **relaxing the vocal folds**. Relaxed vocal folds **lower the pitch of the voice**.

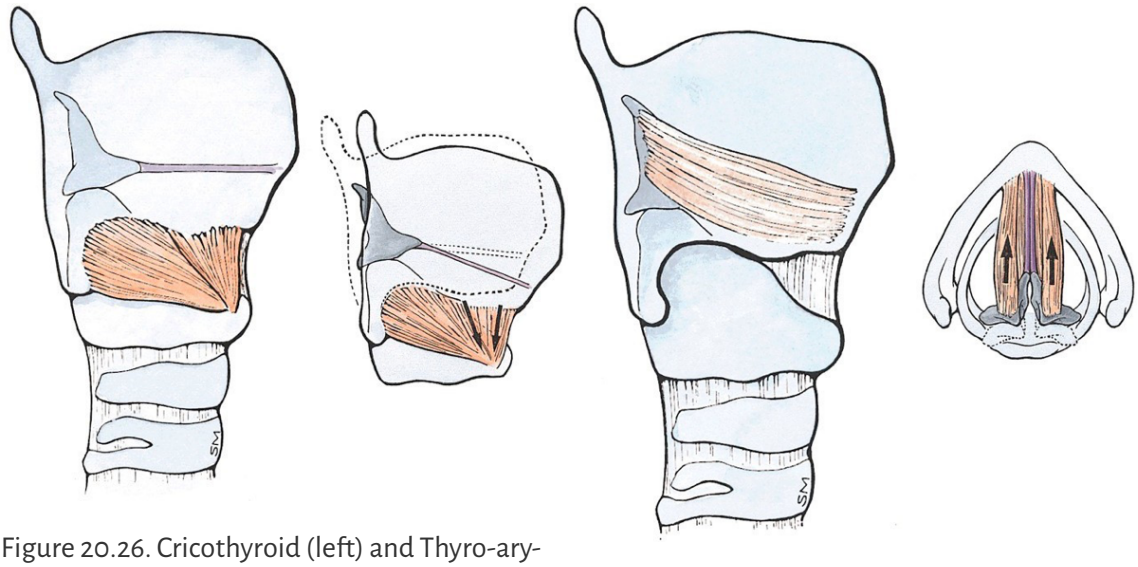

Figure 20.26. Cricothyroid (left) and Thyro-arytenoid (right) muscles.

QUESTION

Realize that the recurrent laryngeal nerve innervates all the intrinsic muscles of the larynx EXCEPT one. Which muscle is the exception? What is its innervation?

Advanced dissection of laryngeal muscles (time permitting).

1 On *one side* of the larynx, detach the lateral part of the thyrohyoid membrane from the hyoid bone with scissors.

2 On the same side, cut away the **lamina of the thyroid cartilage**.

3 Disarticulate the **inferior horn of the thyroid cartilage** from the cricoid cartilage (cricothyroid joint).

4 Remove half of the thyroid cartilage on one side. (See Figure 20.27.)

5 Clean the lateral surface of the **cricoid cartilage**. Identify the **lateral crico-arytenoid muscle** passing obliquely from the cricoid cartilage to the **muscular process of the arytenoid cartilage**.

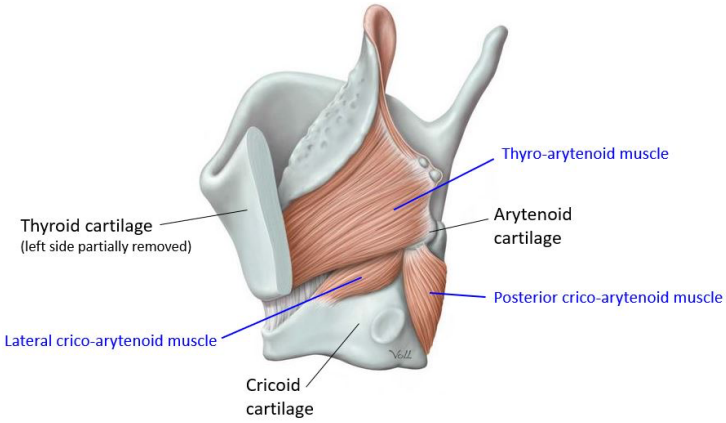

Figure 20.27. Advanced deep dissection of laryngeal muscles.

6 See if you can define the **thyro-arytenoid muscle** stretching from the internal surface of the thyroid lamina to the arytenoid cartilage.

CHECKLIST, LAB #20

REVIEW AND MAKE SURE YOU HAVE IDENTIFIED EACH OF THE STRUCTURES BELOW.

EXTERNAL NOSE

- ☐ Root, apex, dorsum (bridge), alae
- ☐ Nasal bones
- ☐ Major alar cartilages
- ☐ Mobile nasal septum (Columella)

NASAL CAVITY

- [ ] Nasal septum (septal cartilage and bony nasal septum)
- [ ] Bony septum = Perpendicular plate of ethmoid bone and vomer (identify on skull)
- [ ] Vestibule of nasal cavity (lined by skin)
- [ ] Superior, middle, and inferior nasal conchae (turbinates)
- [ ] Superior, middle, and inferior meatuses
- [ ] Spheno-ethmoidal recess (above superior concha)
- [ ] Choanae (connect nasal cavities to nasopharynx)

Within the middle meatus:

- [ ] Ethmoidal bulla
- [ ] Uncinate process
- [ ] Semilunar hiatus
- [ ] Infundibulum

Know where these sinuses/ducts drain within the nasal cavity:

- [ ] Nasolacrimal duct
- [ ] Frontal sinus
- [ ] Anterior, middle, and posterior ethmoidal air cells
- [ ] Sphenoidal sinus
- [ ] Maxillary sinus

PHARYNX

- [ ] Nasopharynx
- [ ] Opening of pharyngotympanic (Eustachian) tube
- [ ] Torus tubarius
- [ ] Tubal tonsils (in mucosa of torus tubarius)
- [ ] Pharyngeal tonsils (in mucosa of roof of nasopharynx)
- [ ] Pharyngeal recess (fossa of Rosenmüller)
- [ ] Oropharynx
- [ ] Uvula
- [ ] Epiglottic vallecula
- [ ] Tonsillar arches
- [ ] Tonsillar fossa
- [ ] Palatine tonsil (if present)
- [ ] Laryngopharynx
- [ ] Laryngeal inlet
- [ ] Epiglottis
- [ ] Aryepiglottic folds
- [ ] Piriform recesses
- [ ] Retropharyngeal space—behind pharynx, anterior to spine

LARYNX = DONOR SPECIMENS AND MODELS

- [ ] Thyroid cartilage with laminae and laryngeal prominence
- [ ] Cricoid cartilage
- [ ] Thyrohyoid and cricothryoid membranes
- [ ] Arytenoid cartilages with vocal and muscular processes
- [ ] Laryngeal inlet
- [ ] Vestibule of larynx
- [ ] Vestibular folds
- [ ] Ventricles of larynx
- [ ] Vocal folds and rima glottidis
- [ ] Infraglottic cavity
- [ ] Cricothyroid muscles
- [ ] Transverse arytenoid muscle
- [ ] Posterior crico-arytenoid muscles
- [ ] Lateral crico-arytenoid muscles
- [ ] Thyro-arytenoid muscles

NERVES

- [ ] Left and right recurrent laryngeal nerves
- [ ] Internal branch of superior laryngeal nerve (internal laryngeal nerve)
- [ ] External branch of superior laryngeal nerve (external laryngeal nerve) = WISH LIST—you are a ⭐ if you can identify it!

ARTERIES

- [ ] Superior thyroid artery (from external carotid—accompanies external laryngeal nerve)
- [ ] Inferior thyroid artery (from subclavian artery—relates to recurrent laryngeal nerve)