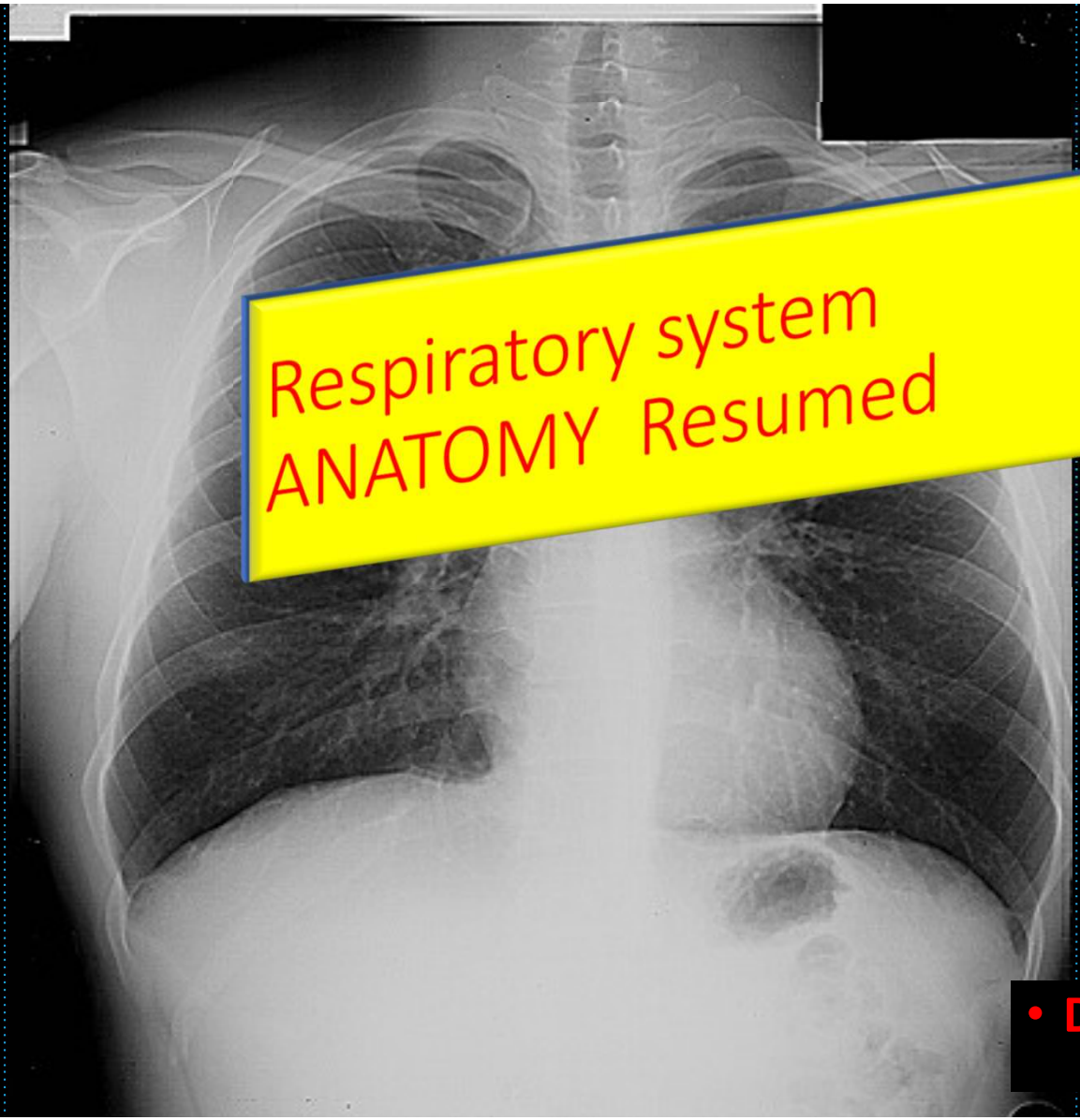

Respiratory system
ANATOMY Resumed

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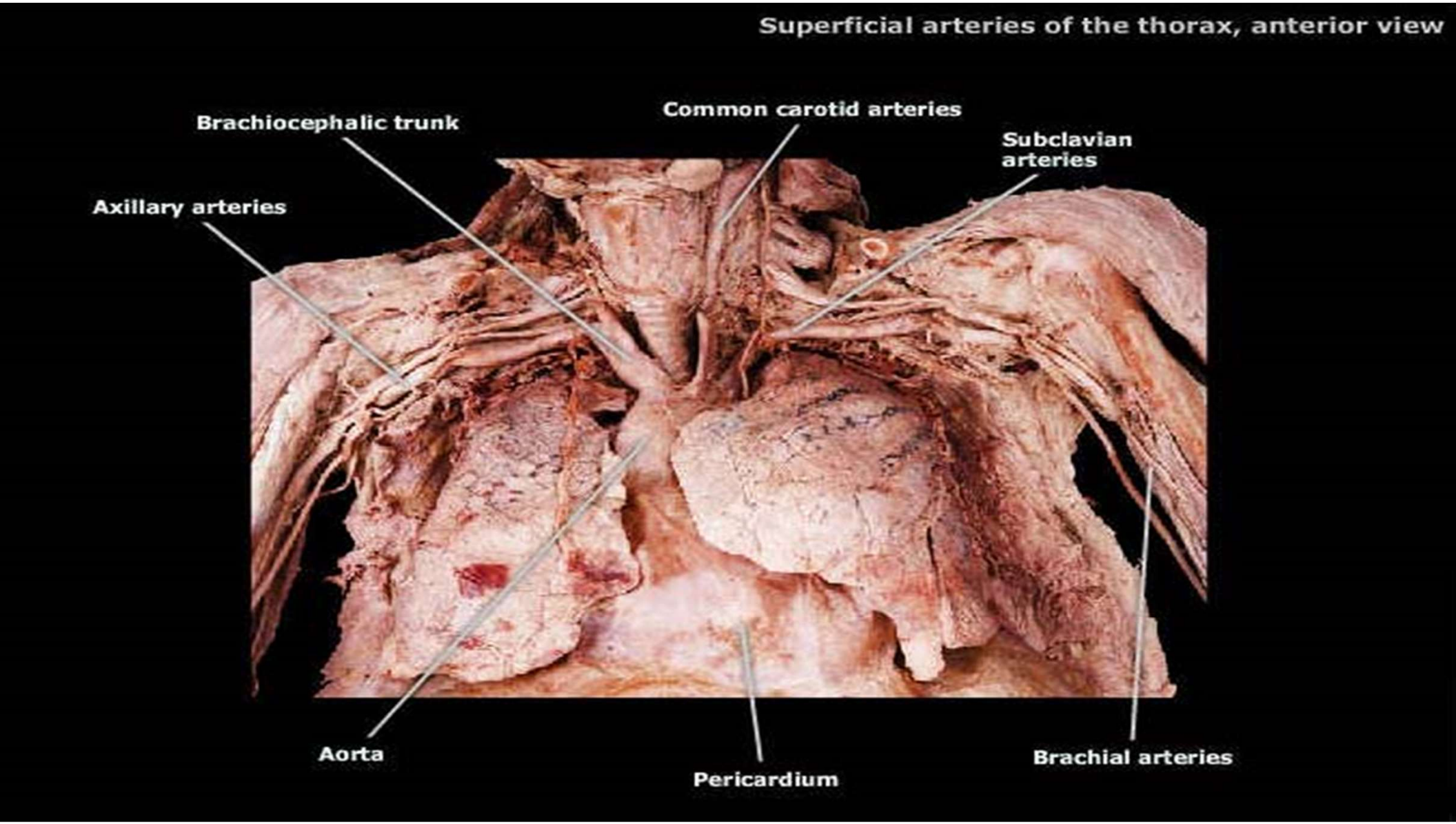
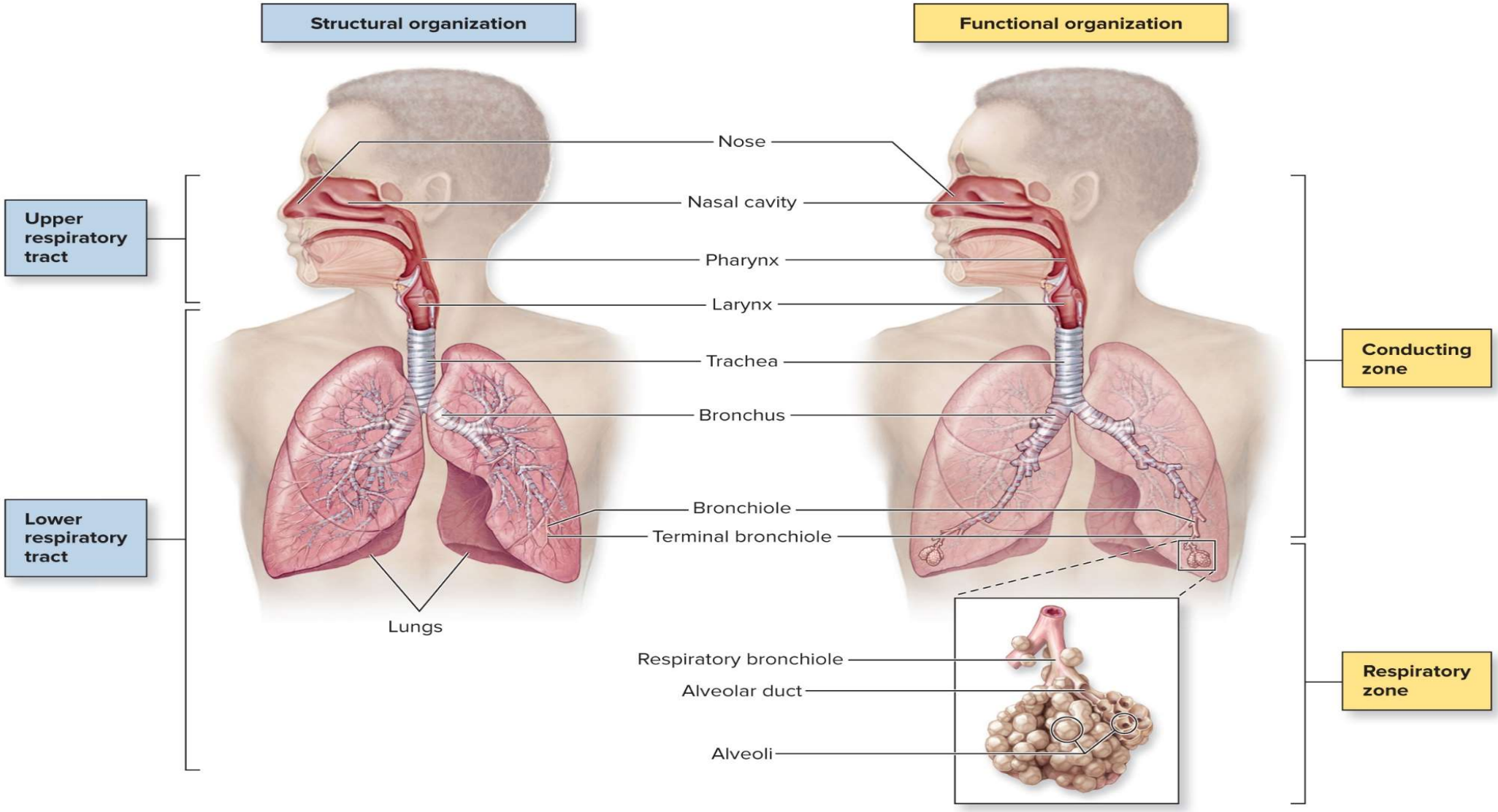
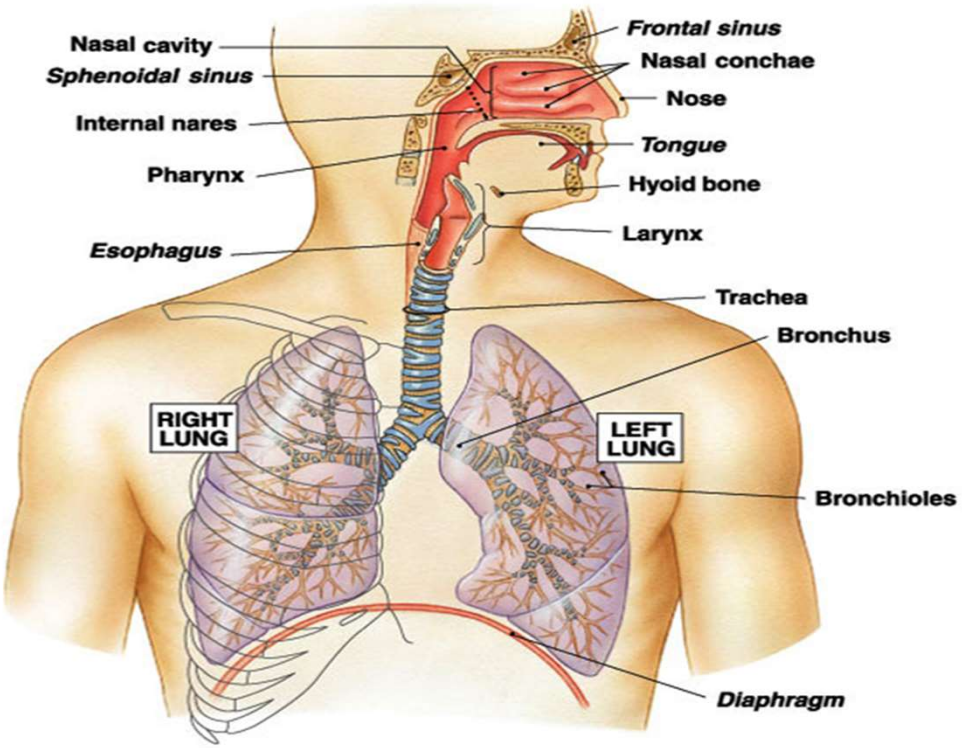
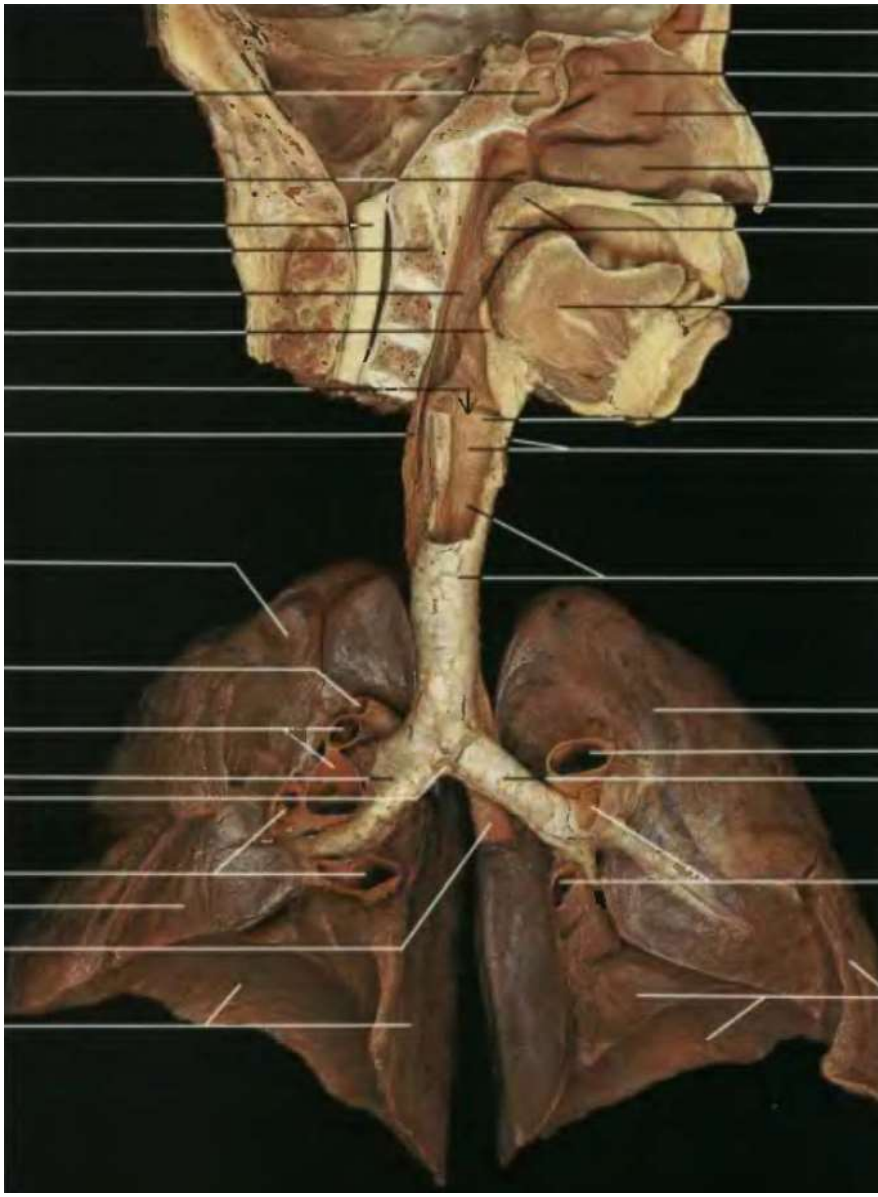
Superficial arteries of the thorax, anterior view

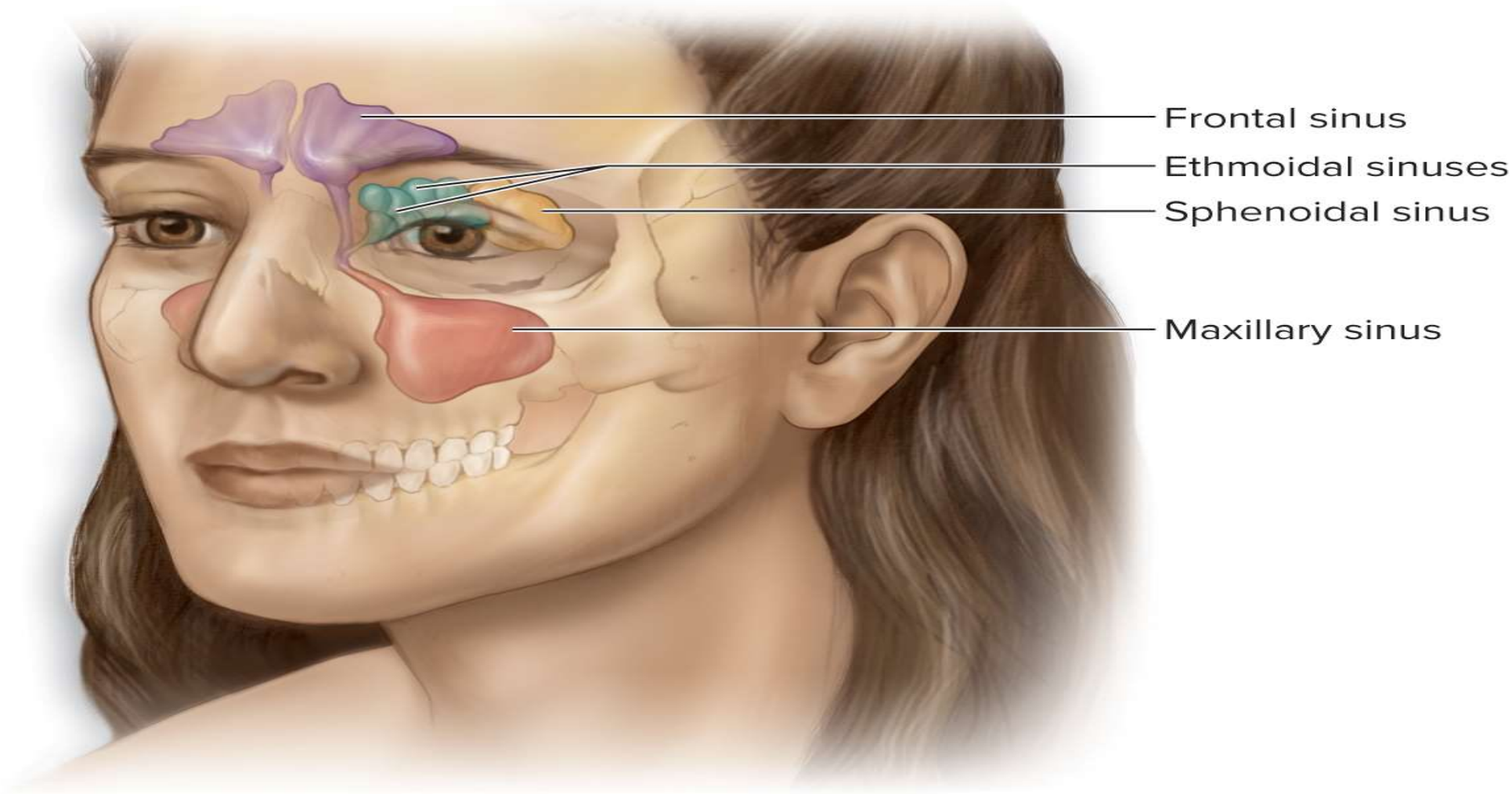




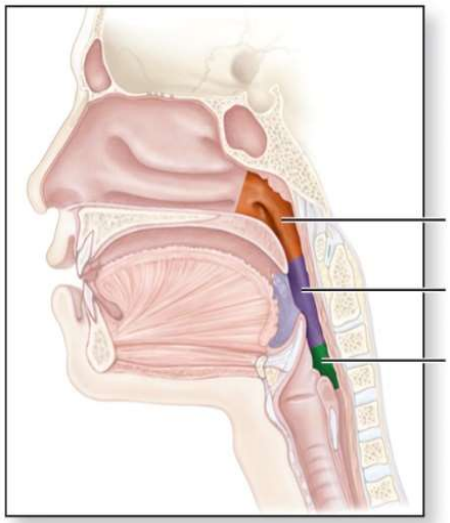
- Upper tract
  - Nose, pharynx and associated structures
- Lower tract
  - Larynx, trachea, bronchi, lungs



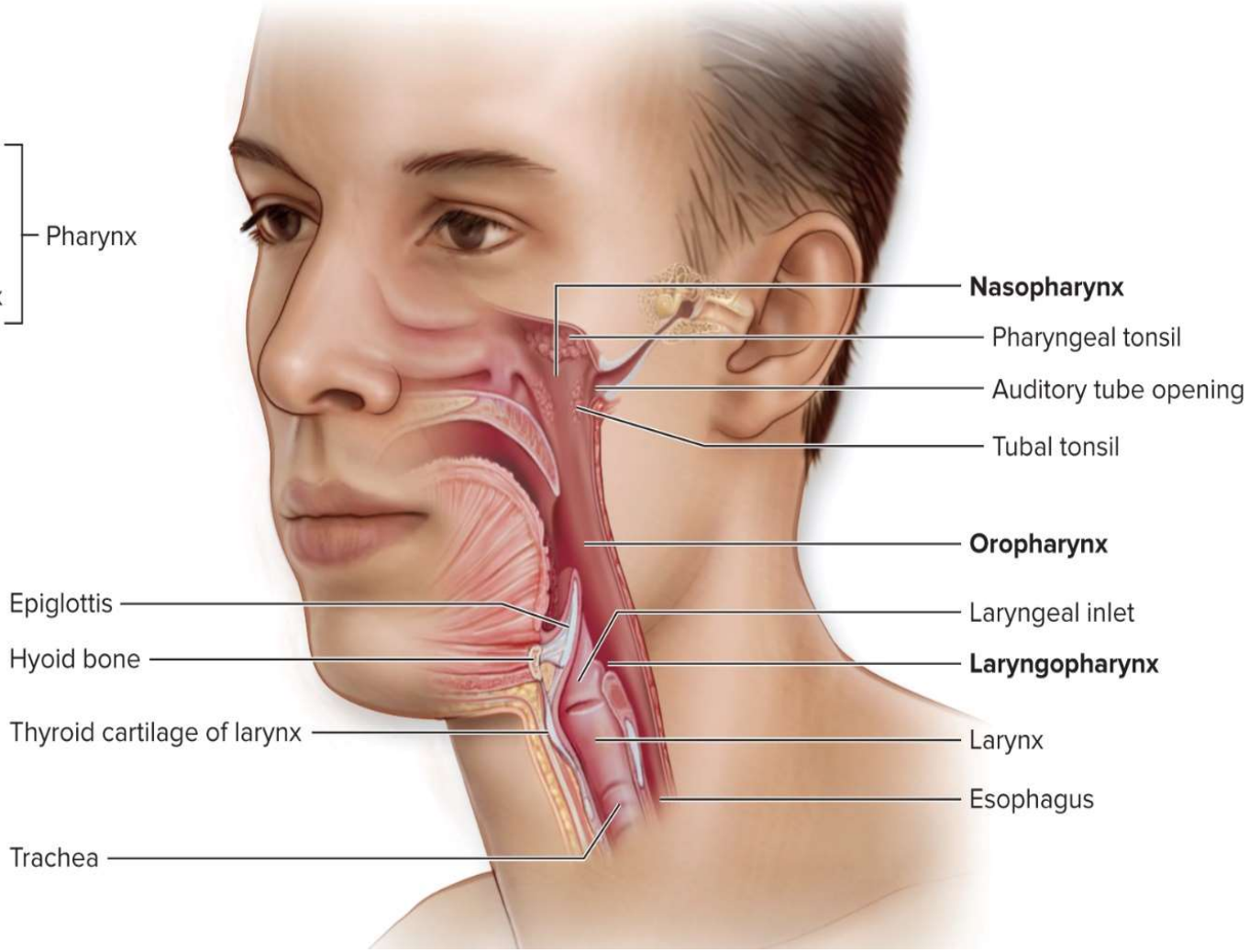




Anterolateral view



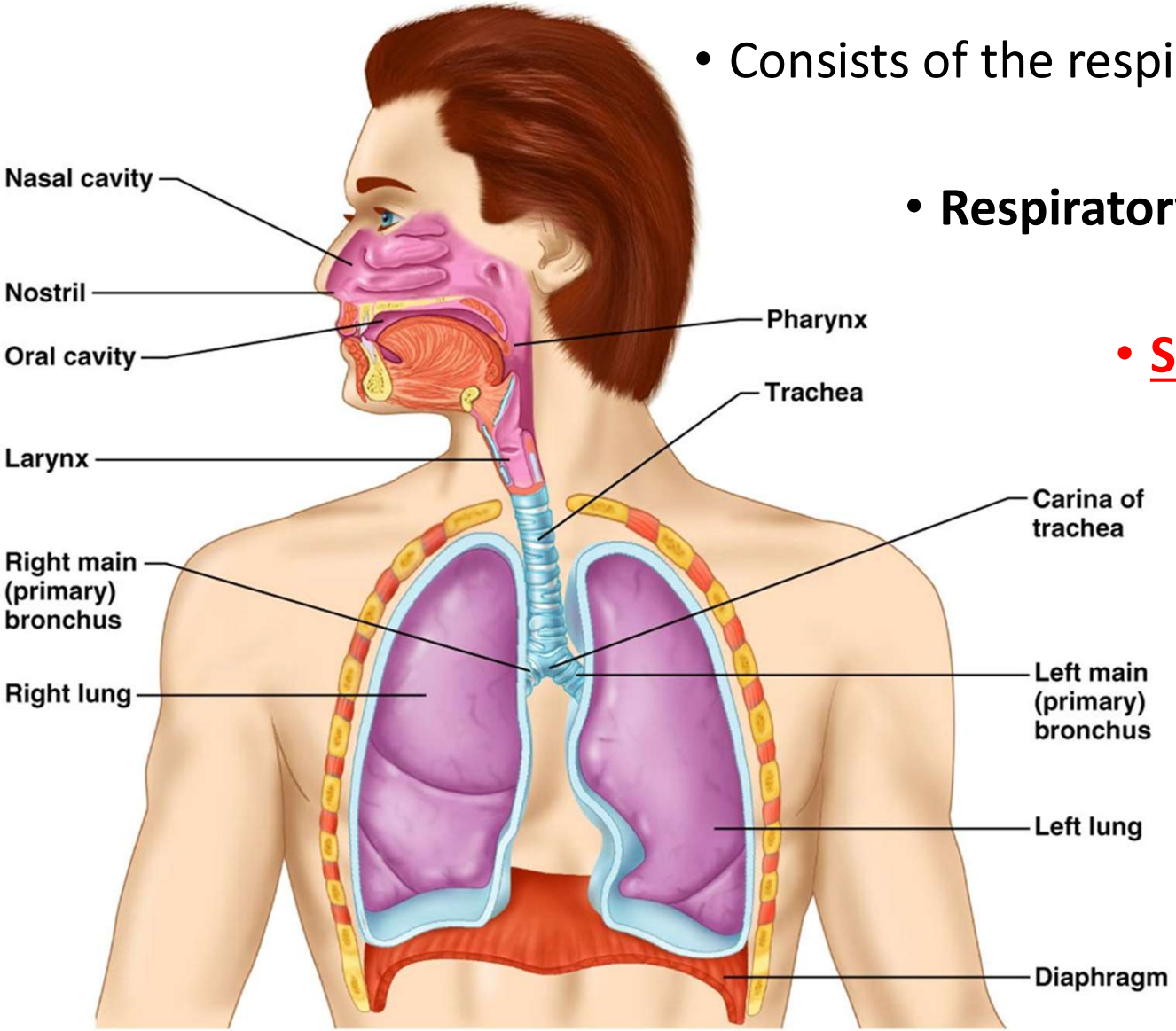
(a)



- **A) Upper Respiratory Tract (URT)**
  - **1) paranasal structures**
    - **a) external nares**
    - **b) nasal cavity and septum**
    - **c) nasal conchae**
    - **d) nasal meatuses**
    - **e) olfactory epithelium**
    - **f) paranasal sinuses**
    - **g) ciliated pseudostratified epithelium**
  - **2) pharynx**
    - **a) internal nares**
    - **b) auditory tubes**
    - **c) oropharynx**
    - **d) laryngopharynx**
- **B) Lower Respiratory Tract (LRT)**
  - **1) layrnx**
    - **a) thyroid & cricoid cartilage**
    - **b) vocal box**
    - **c) hyoid**
  - **2) trachea**
    - **a) "C" rings of cartilage**
    - **b) carina**
      - **i) receptors sensitive to irritants**
      - **ii) initiates cough reflex**
    - **c) bronchi**

3) lungs (right lung = three lobes; left lung = two lobes)

- **a) pleural membranes**
- **b) bronchi**
- **c) bronchioles**
- **d) terminal bronchioles**
- **e) smooth muscles within bronchiole walls**
  - i) parasympathetic NS activates (using histamine) bronchiole smooth muscle (constriction)
  - ii) sympathetic NS inhibits (using epinephrine) bronchiole smooth muscle (dilation)
- **f) alveolar ducts**
- **g) alveolar sacs**
- **h) alveoli**
  - i) simple squamous lining
  - ii) septal cells - produce surfactant
  - iii) macrophage (Kuppfer cells) - remove alveolar irritants, debris
  - iv) entire alveolar surface area = 750 sqft
  - v) alveolar surface area site of external respiration



- Consists of the respiratory and conducting zones

- **Respiratory zone:**

- **Site of gas exchange**
  - **Bronchioles,**
  - **Alveolar ducts,**
  - **Alveoli**

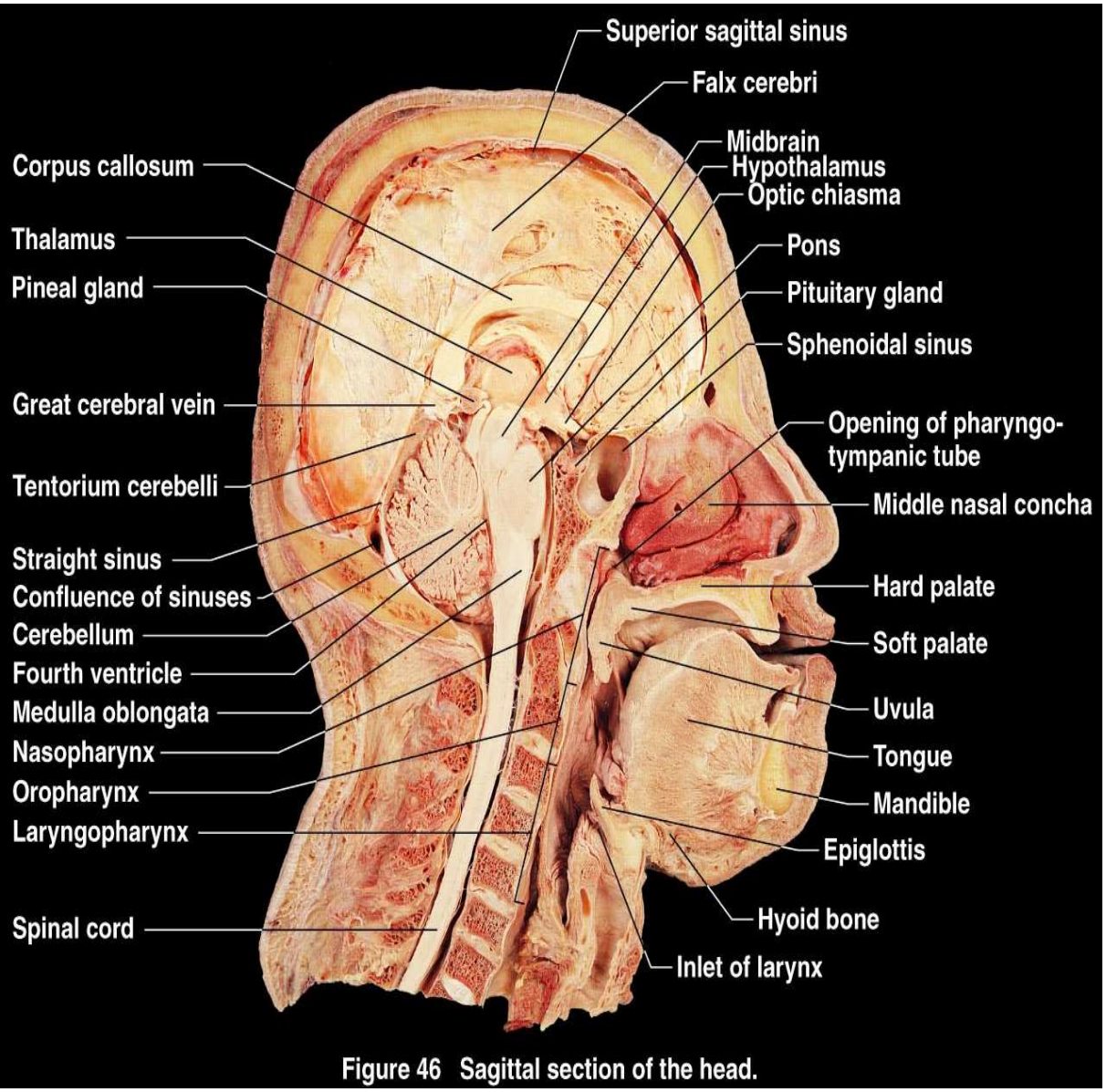
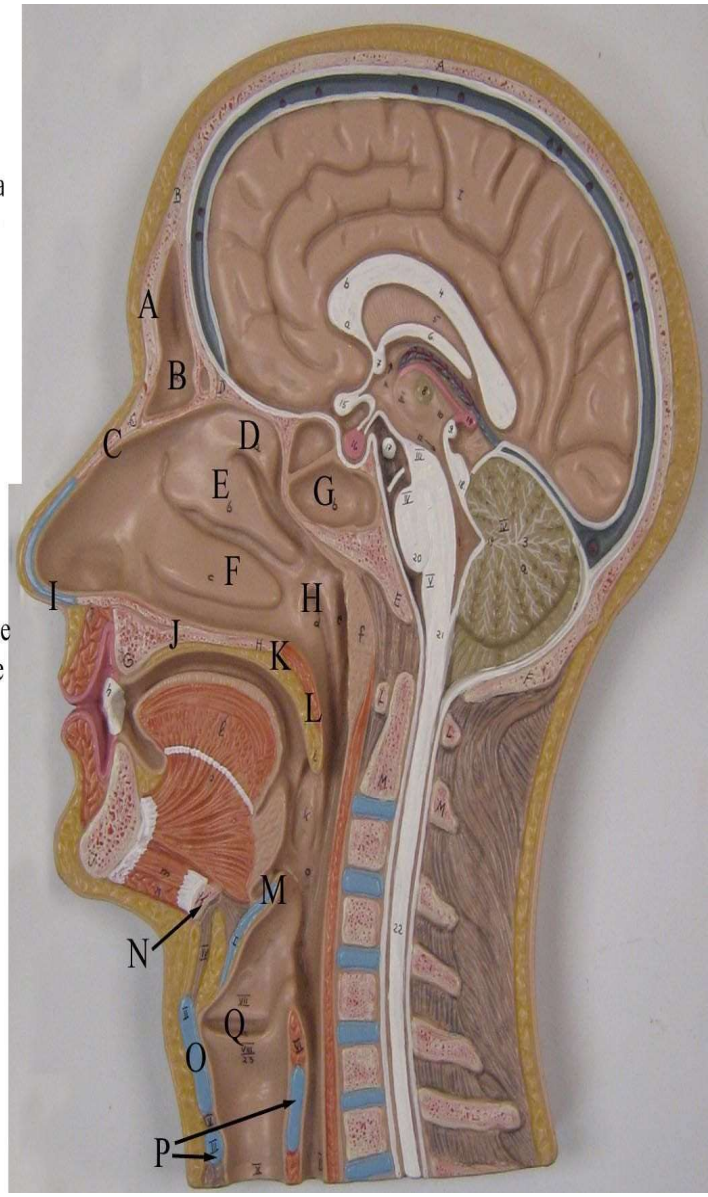
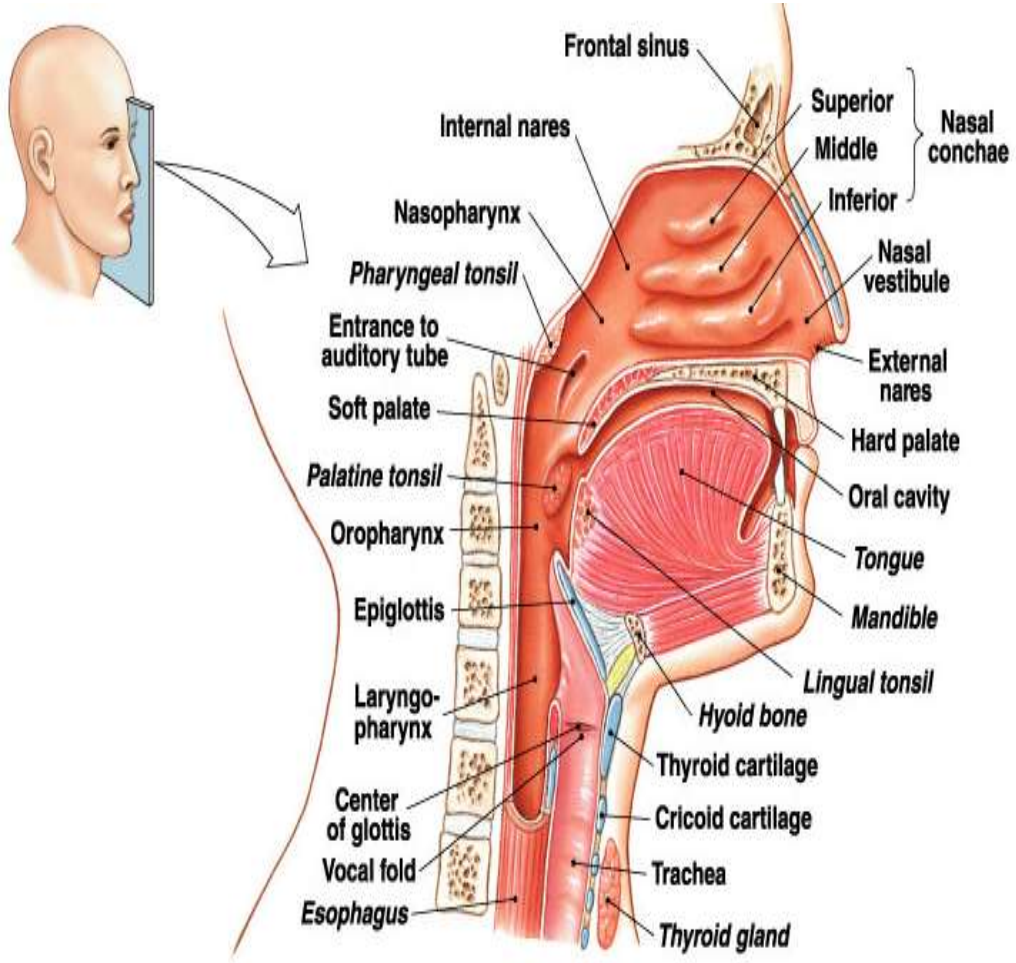


Figure 46 Sagittal section of the head.

A = frontal bone
B = frontal sinus
C = nasal bone
D = superior concha
E = middle concha
F = inferior concha
G = sphenoid sinus
H = internal nares
I = external nares
J = hard palate
K = soft palate
L = uvula
M = epiglottis
N = hyoid bone
O = thyroid cartilage
P = cricoid cartilage
Q = vocal cords



Nasal Cavity and Pharynx



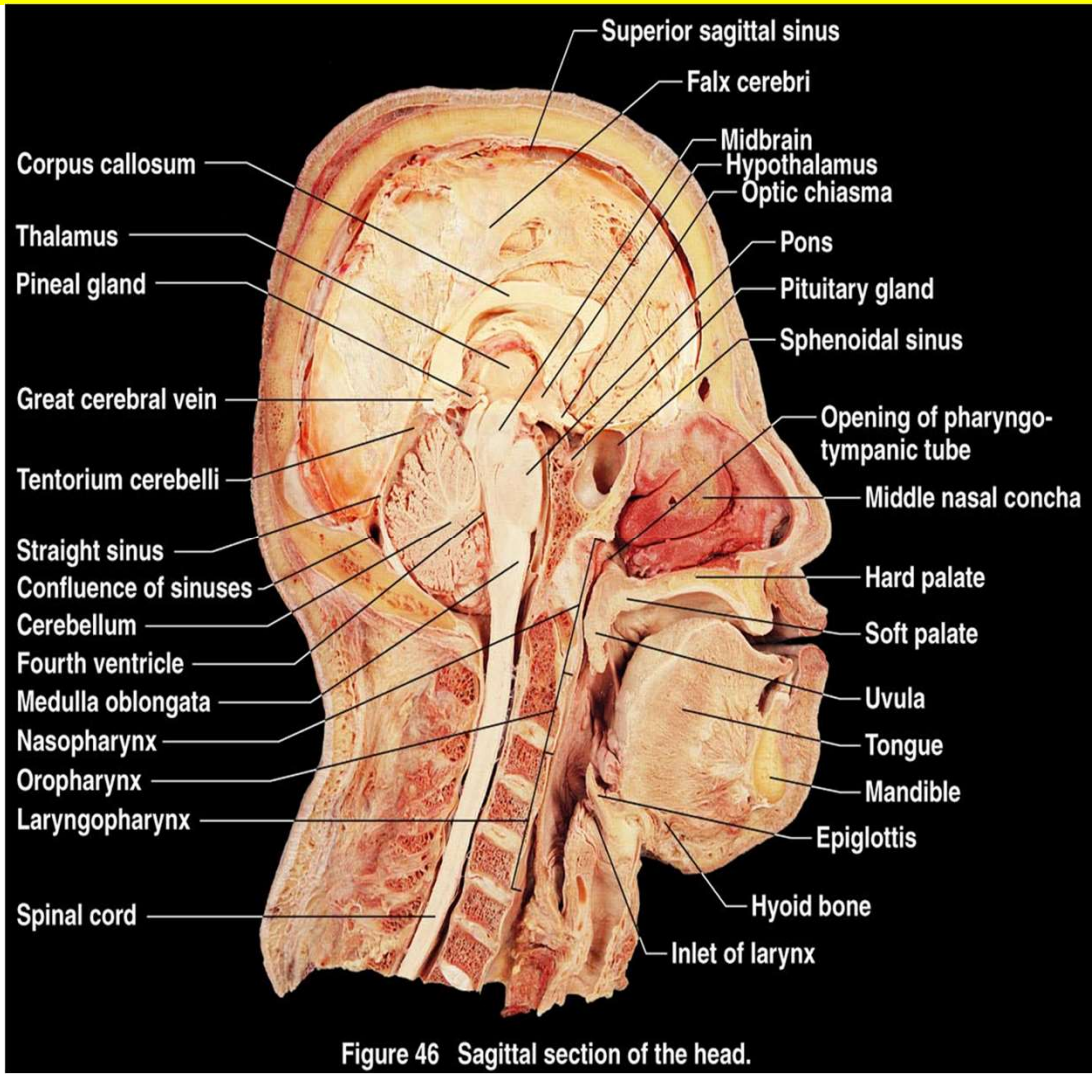


Figure 46 Sagittal section of the head.

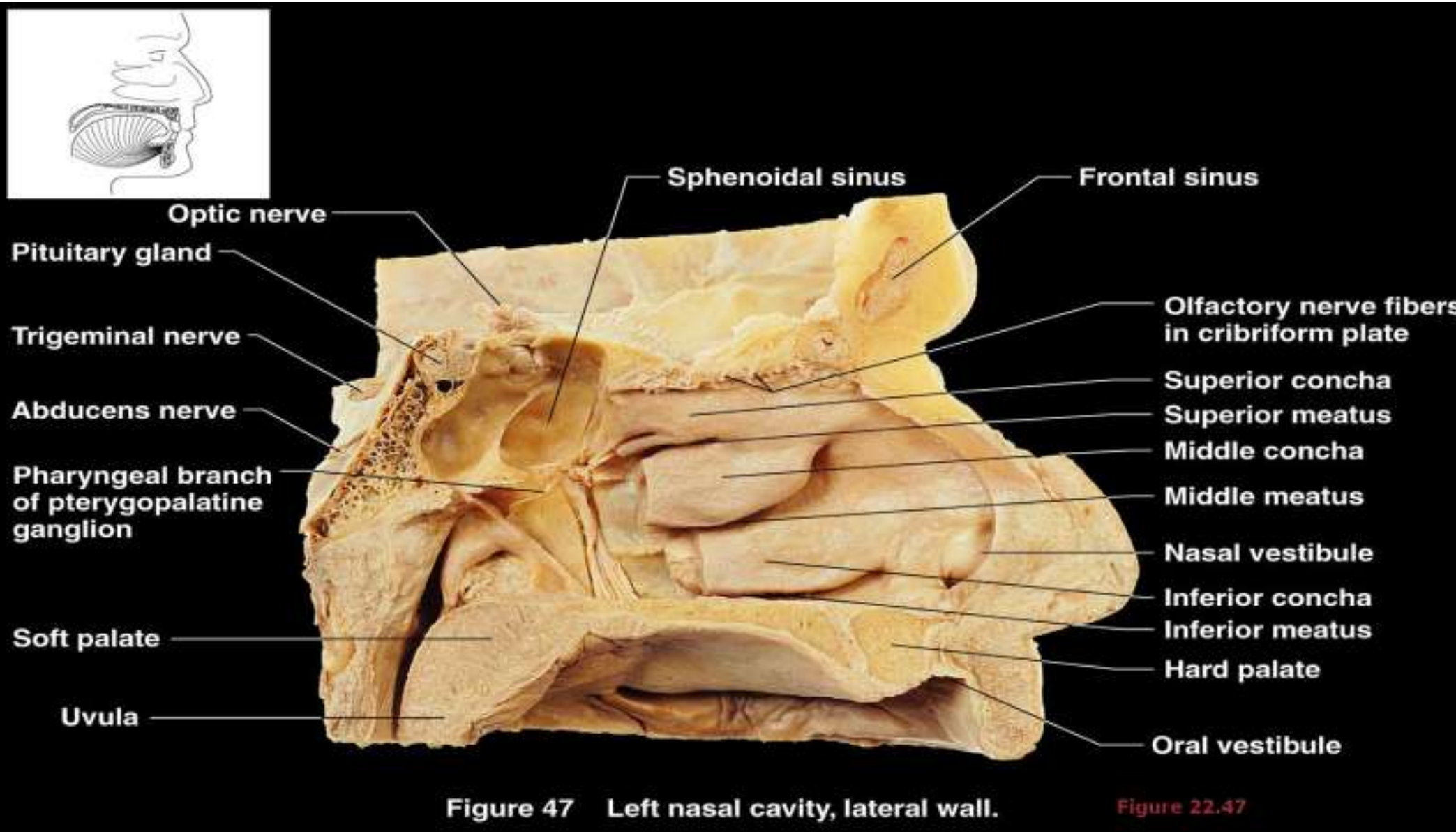
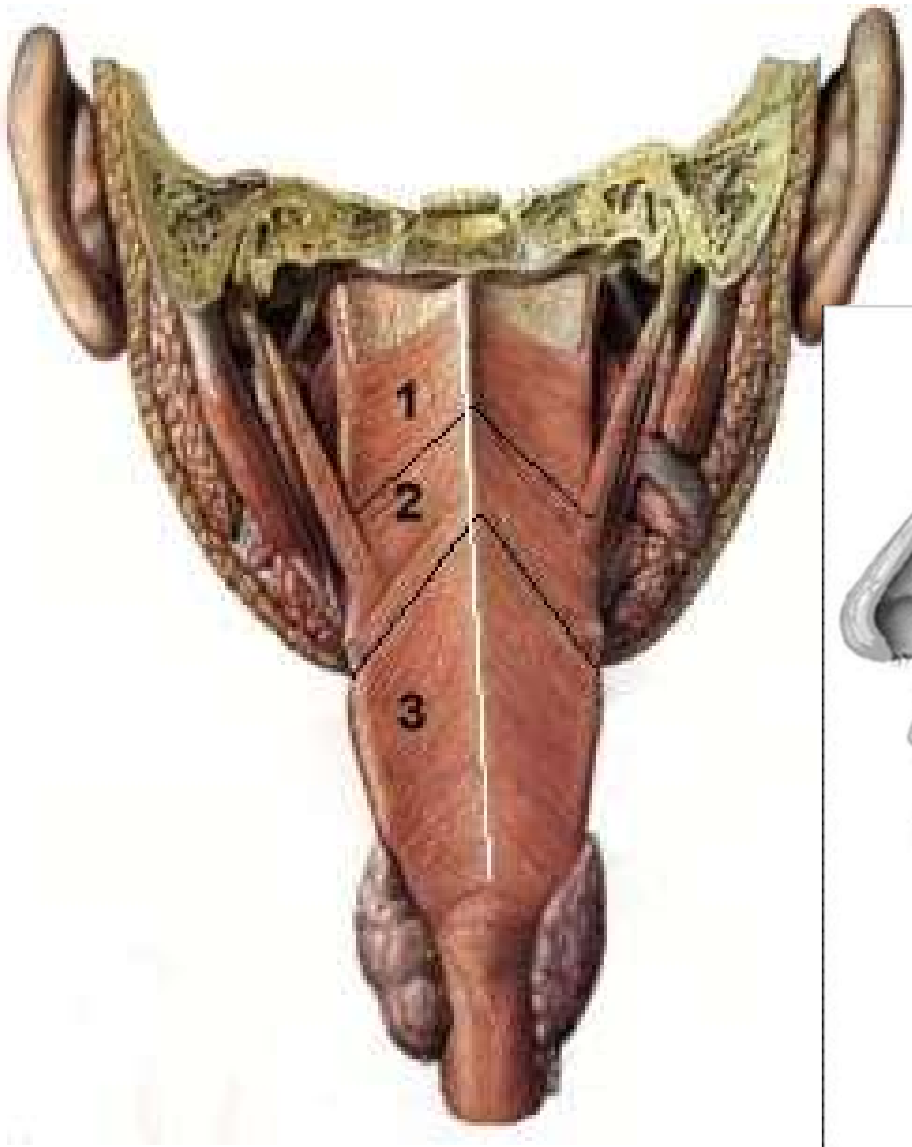


Figure 47 Left nasal cavity, lateral wall.

Figure 22.47

PHARYNX


1
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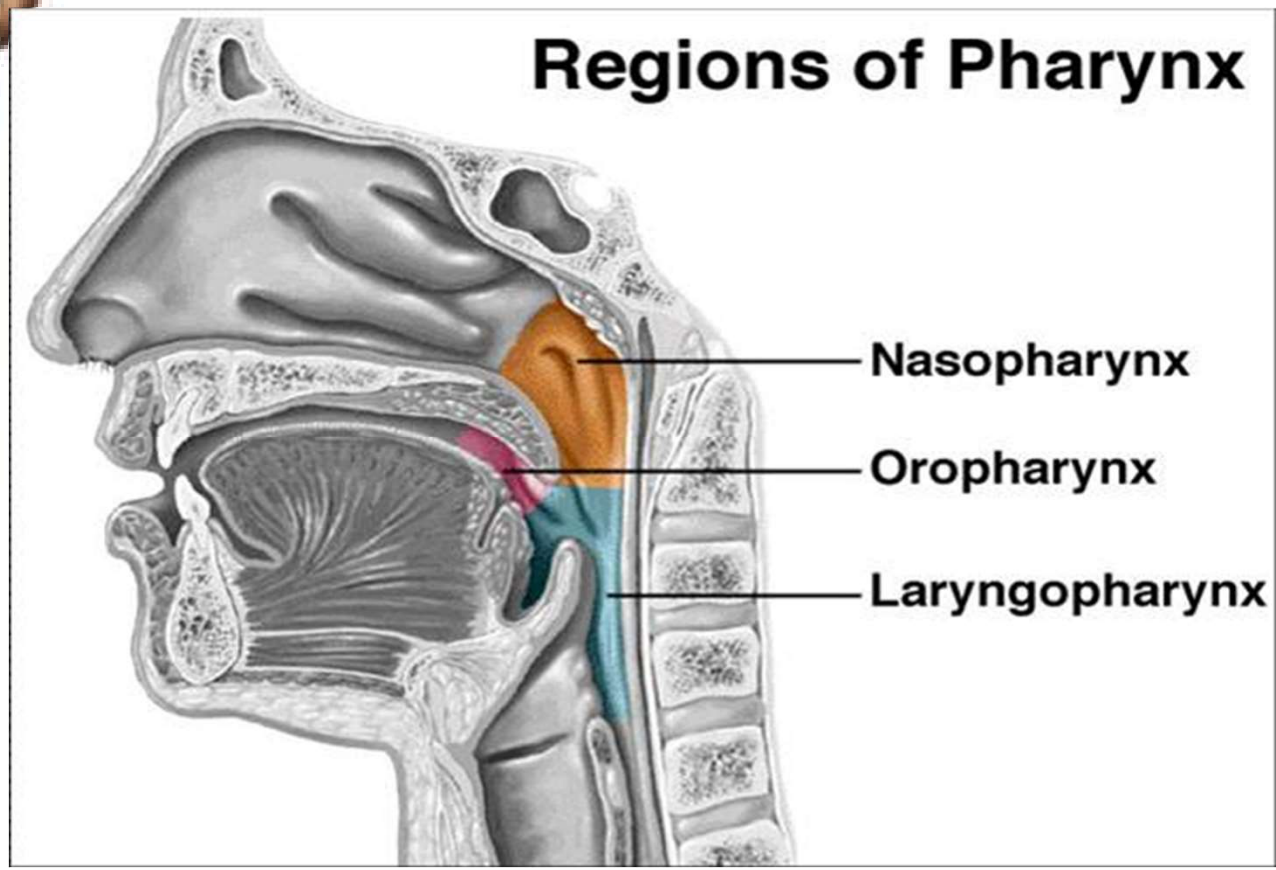
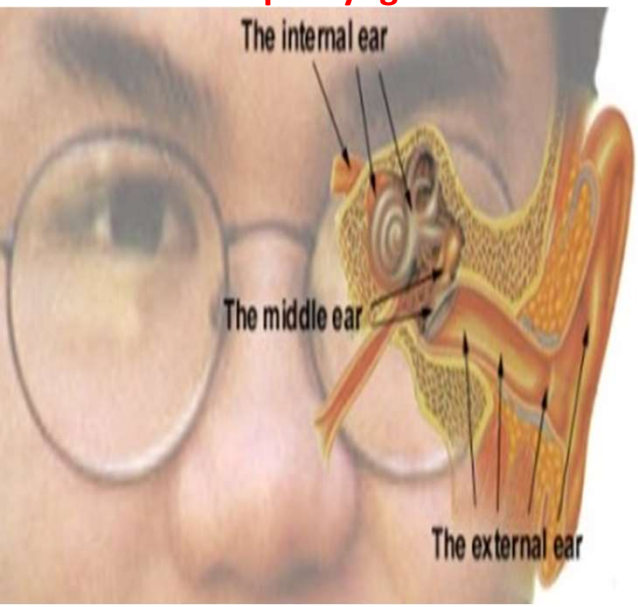

Regions of Pharynx
Nasopharynx
Oropharynx
Laryngopharynx

1/ Nasopharynx

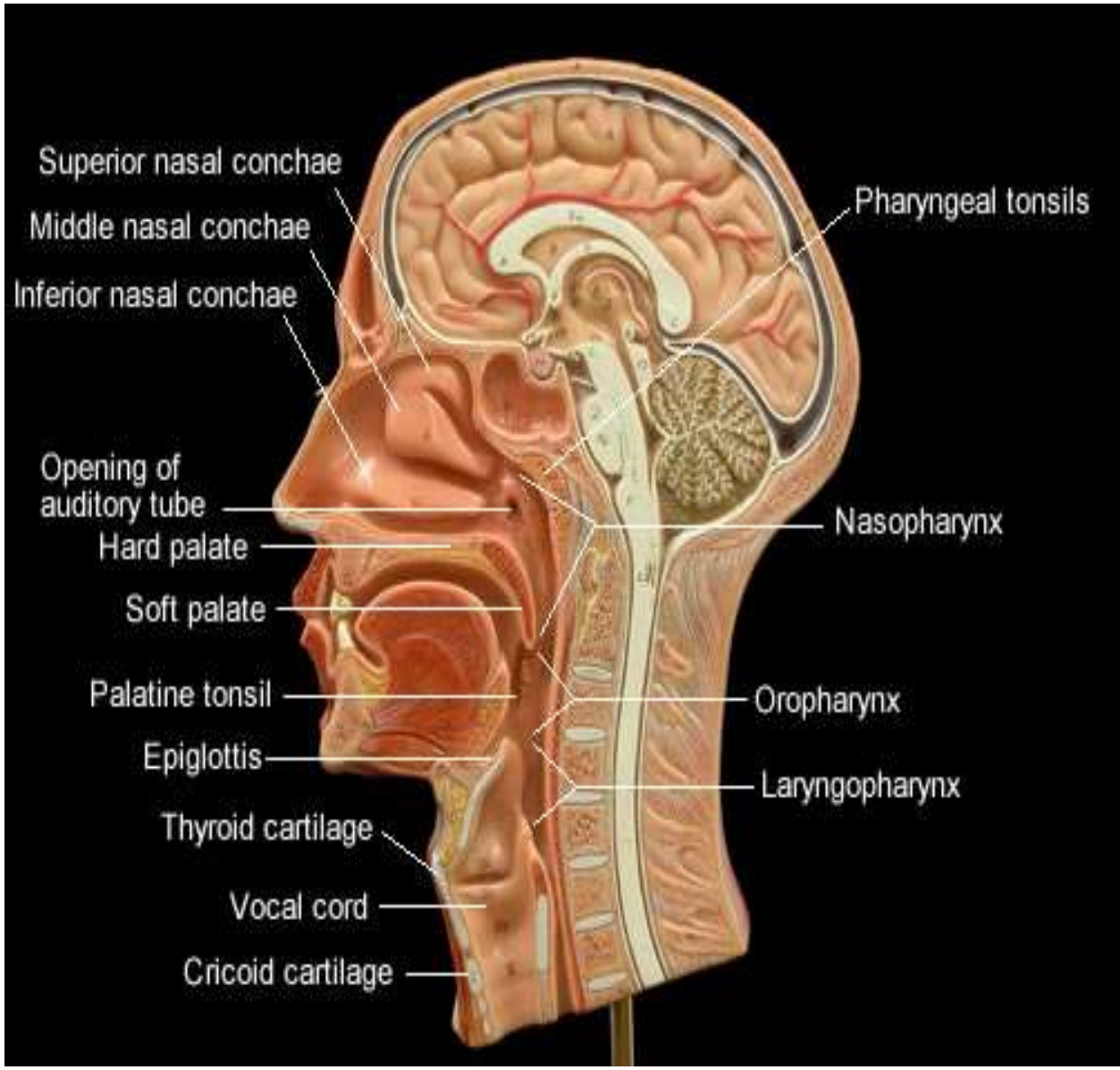
i. Continuous with the nasal cavity via the internal nares. Lined by respiratory epithelium.
Contains the opening to the **auditory tube** (a.k.a. the **Eustachian tube**).
The auditory tube connects the pharynx to the **middle ear cavity**.

2. It functions to ensure that the air pressure within the middle ear cavity is equal to atmospheric pressure.
Contains the **pharyngeal tonsil**.



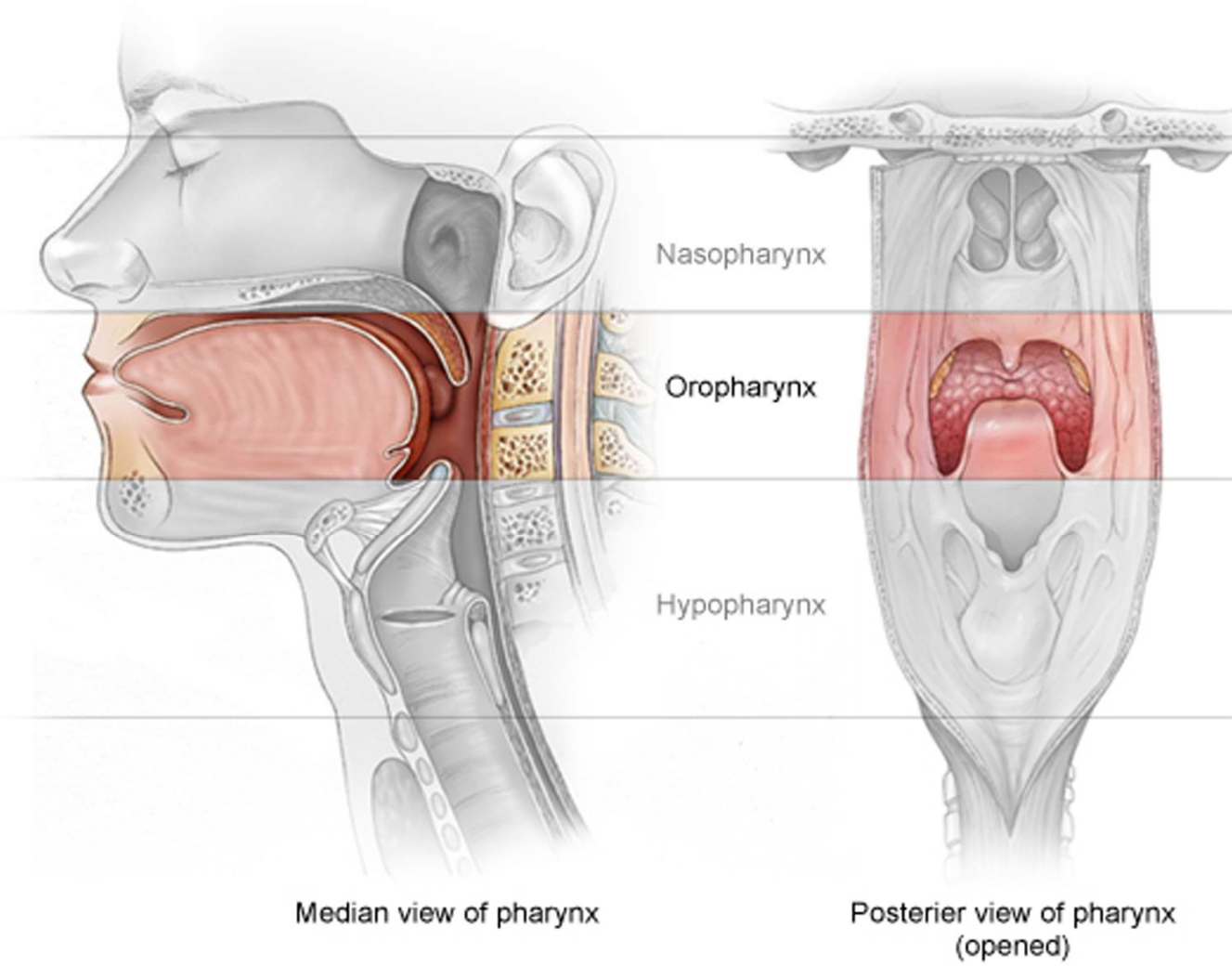
- **Lies posterior to the nasal cavity, inferior to the sphenoid, and superior to the level of the soft palate**
- **Strictly an air passageway**
- Lined with **pseudostratified columnar epithelium**
- **Closes during swallowing** to prevent food from entering the nasal cavity
- The pharyngeal tonsil lies high on the posterior wall
- Pharyngotympanic (auditory) tubes open into the lateral walls

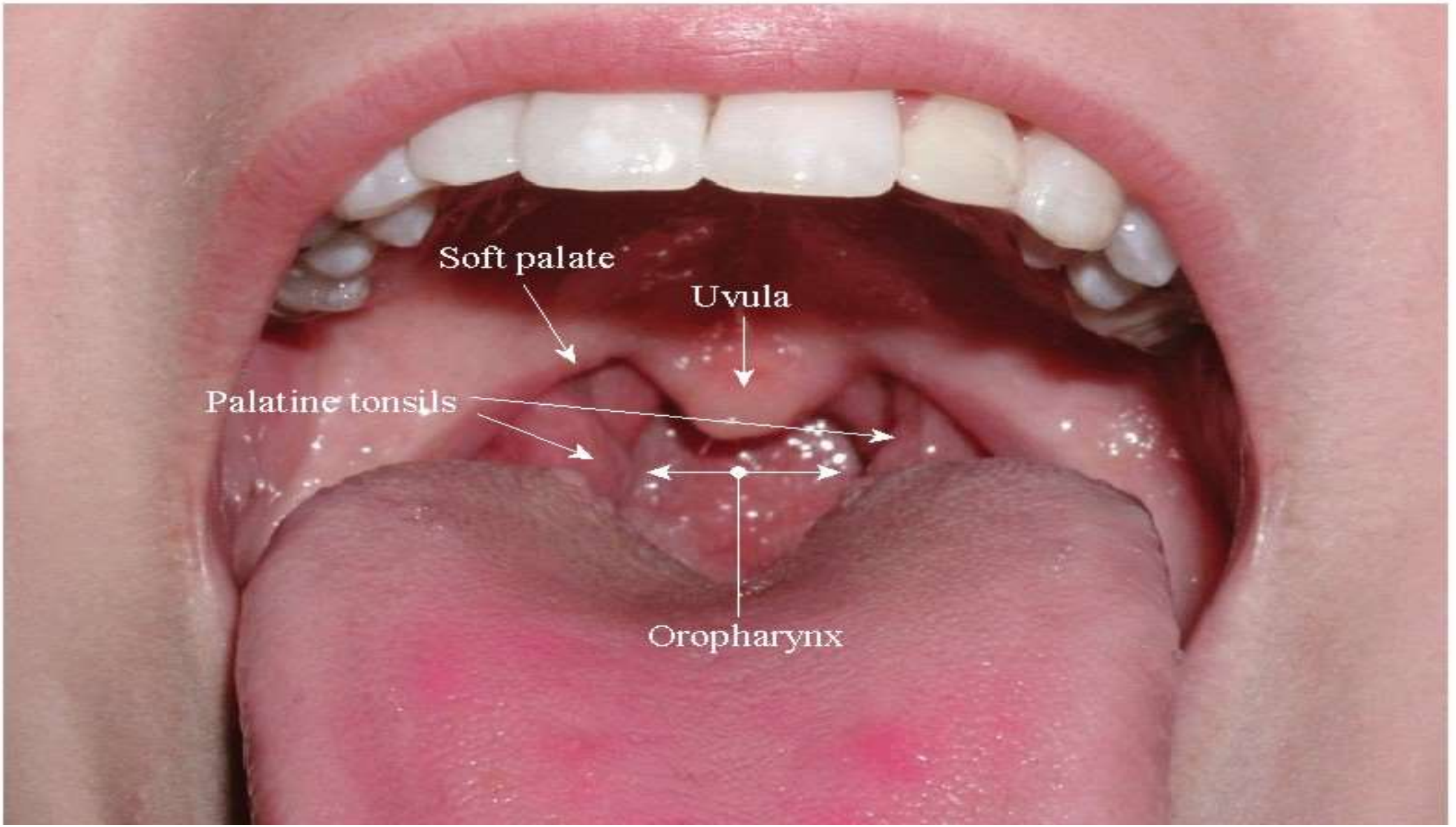
- **Lymphatic tissue is abundant all throughout the pharynx,**
- **Nasopharynx = Adenoids or pharyngeal tonsils**, true lymphatic follicles are located.
- **Palatine tonsils** = lymphoid tissue located laterally on each side at the junction of the oral cavity
- **Lingual tonsils** = lymphoid tissues located in the root of the tongue
- **Tubal tonsils** = collection of lyphoid tissues lateally in the nasopharynx around the opening of the pharyngotympanic (Eustachian) tube.



Oropharynx

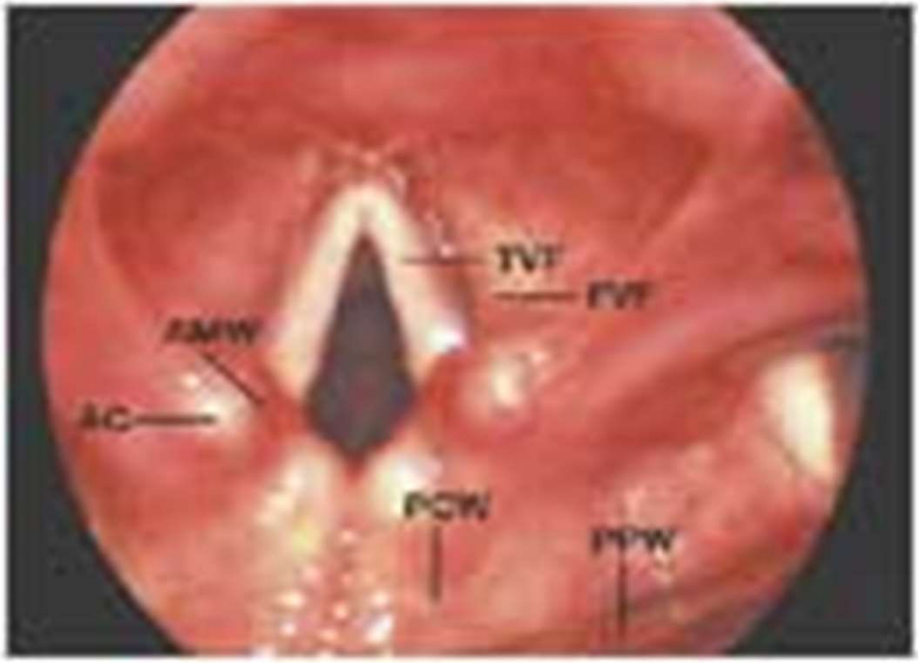
- Inferior to the uvula and superior to the epiglottis.
- Lined by **nonkeratinized stratified squamous epithelium** b/c it is a common pathway for food and air.
- The **palatine tonsils** are located near the opening of the oral cavity into the pharynx.

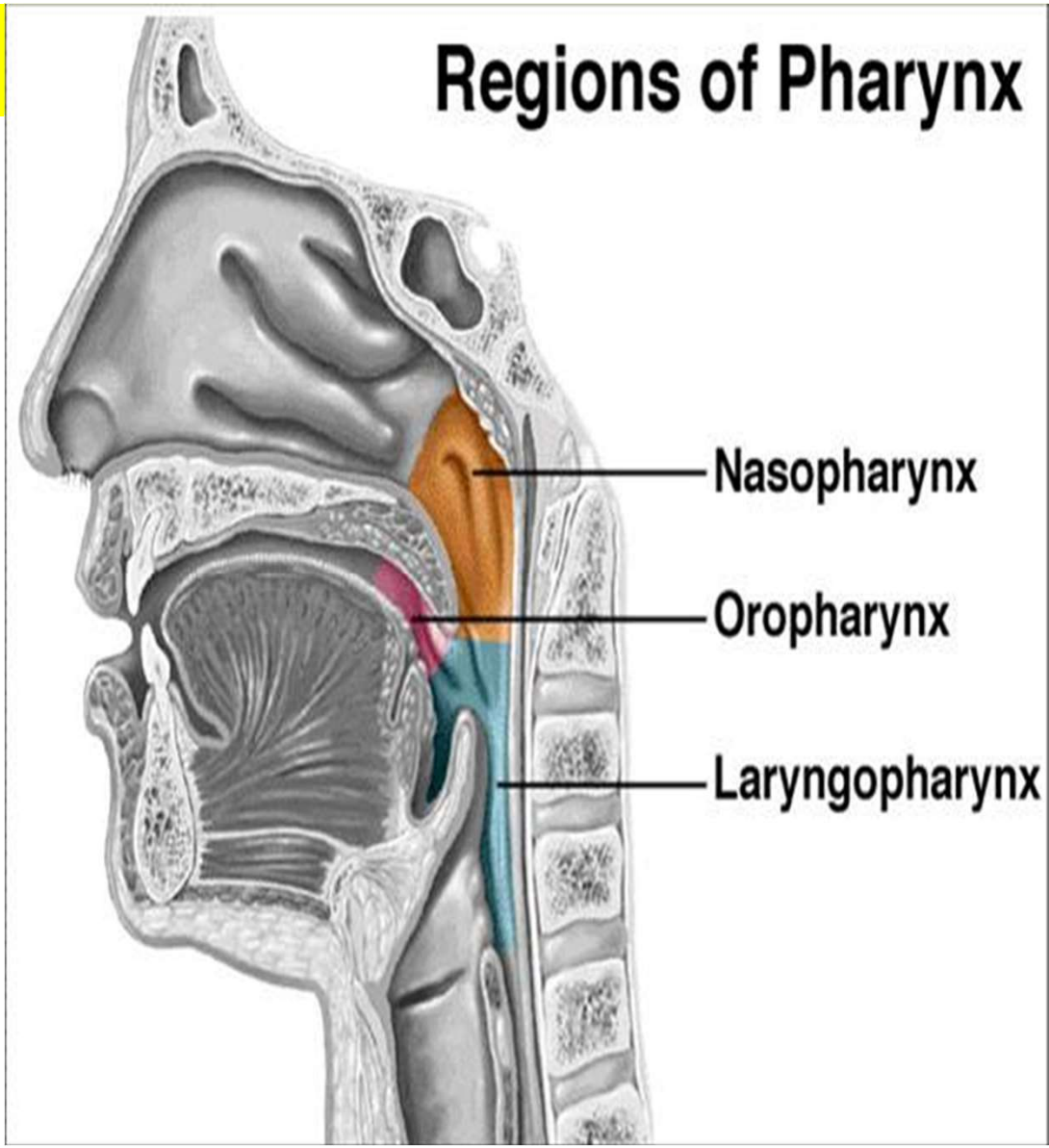



Soft palate
Uvula
Palatine tonsils
Oropharynx

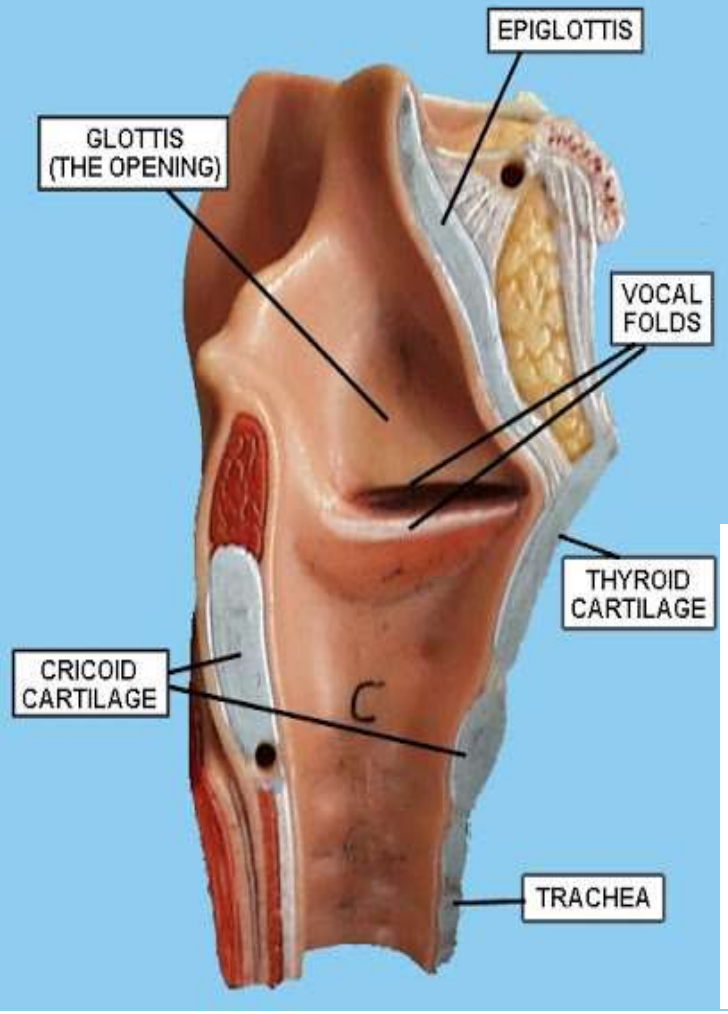
laryngopharynx

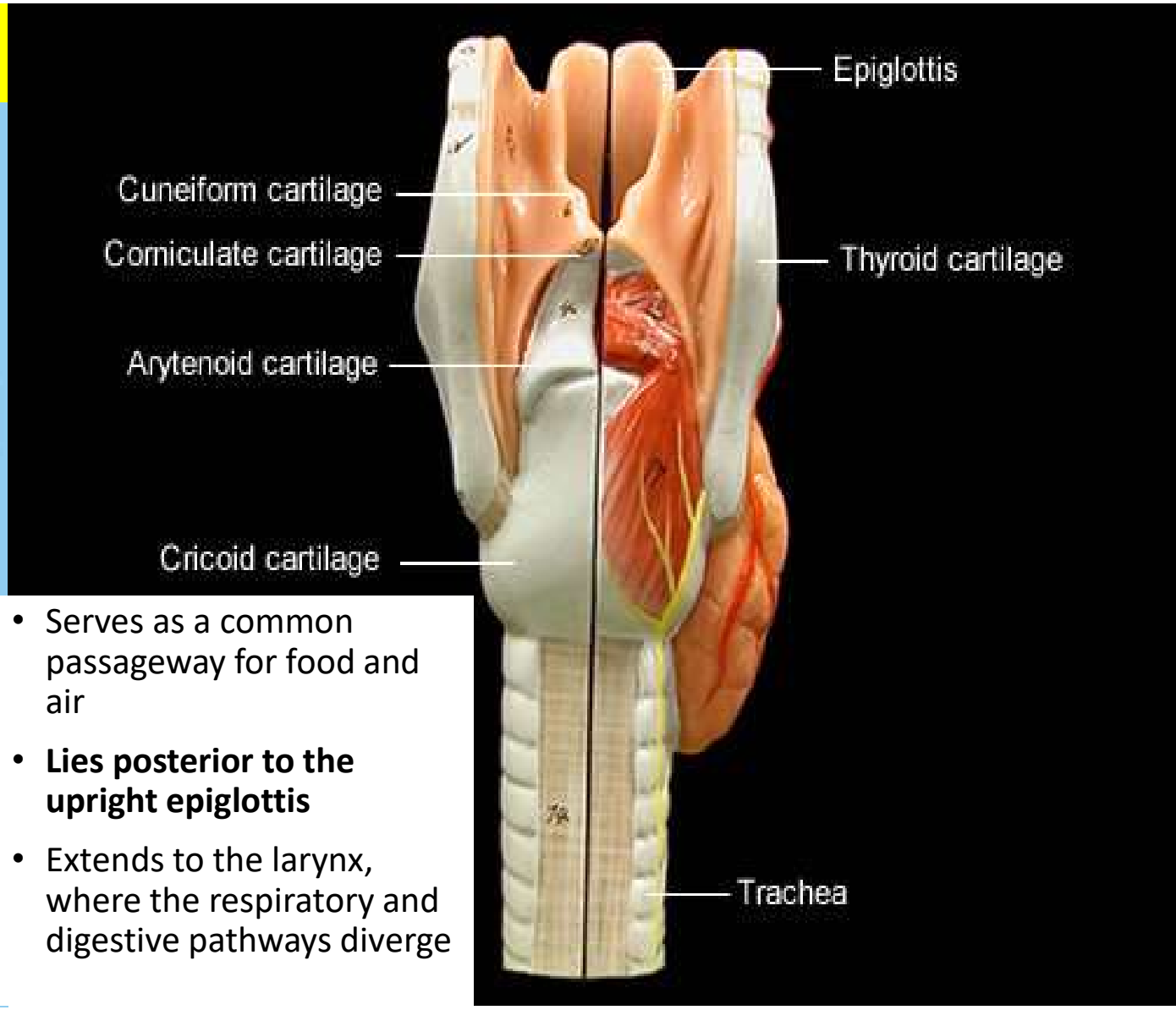
- Inferior to the epiglottis and superior to the split between the larynx and the esophagus.
- Lined by **nonkeratinized stratified squamous epithelium** b/c it is a common pathway for food and air.
- **Lingual tonsils** are located on the posterior surface of the tongue, which also places them near the opening of the oral cavity into the pharynx.





laryngopharynx





- Serves as a common passageway for food and air
- **Lies posterior to the upright epiglottis**
- Extends to the larynx, where the respiratory and digestive pathways diverge

Larynx

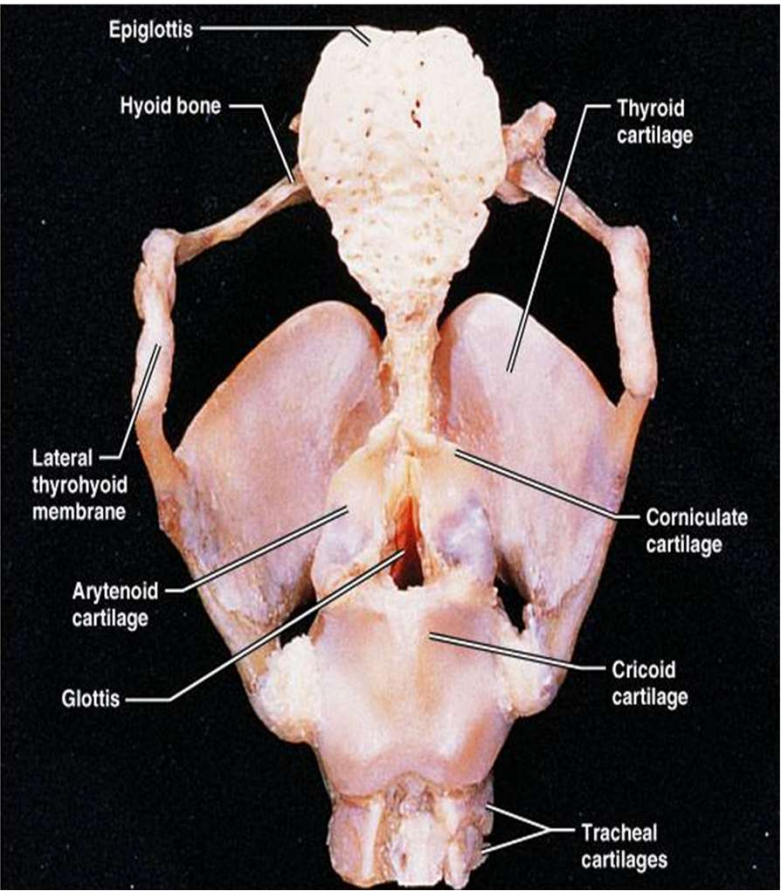
- Connects the pharynx and the trachea
- **Plays an important role in phonation**.
- The walls are of skeleton hyaline and elastic cartilage some with connective tissue , striated muscle and mucous glands.

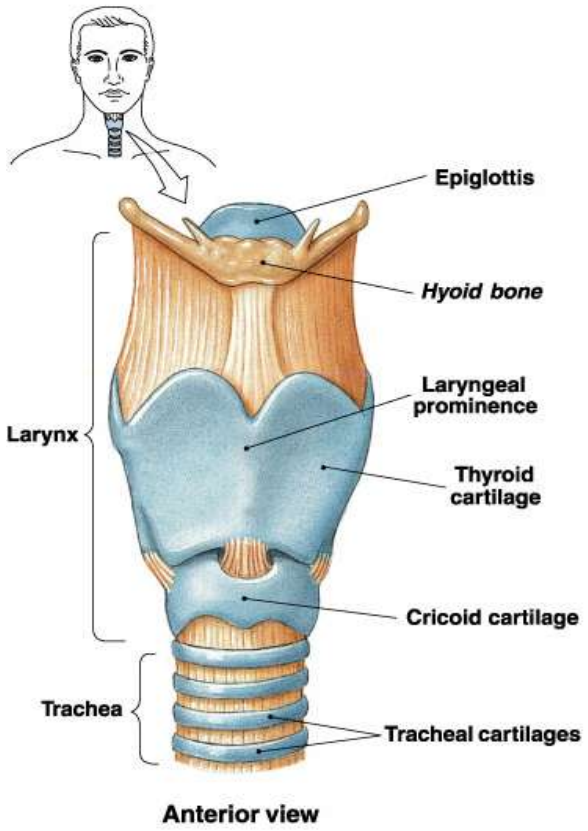
- Routes food and air down their correct passages.
- Contains the **vocal cords**, which function in voice production.
- Arrangement of **9 cartilages connected by membranes** and ligaments and lined by respiratory epithelium.
- **Cartilages include thyroid, cricoid, epiglottis and 3 small paired cartilages**.
- **All cartilages are hyaline with the exception of the epiglottis, which is elastic cartilage.**
- **Thyroid cartilage is the largest and its midline laryngeal prominence is the male "Adam's apple."**
- Inferior to the thyroid is the signet-ring shaped cricoid cartilage.
- The 3 pairs of small cartilages form much of the posterior and lateral larynx.

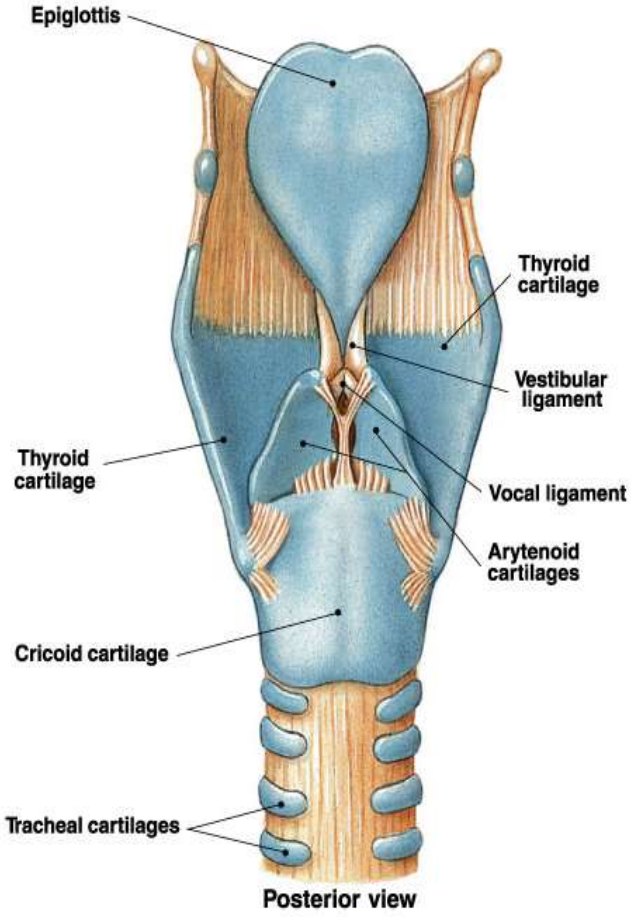
- The **epiglottis** extends from the base of the tongue to its hinge on the superior thyroid cartilage. During swallowing, the epiglottis tips and covers the entrance to the larynx and ensures that food enters the esophagus.

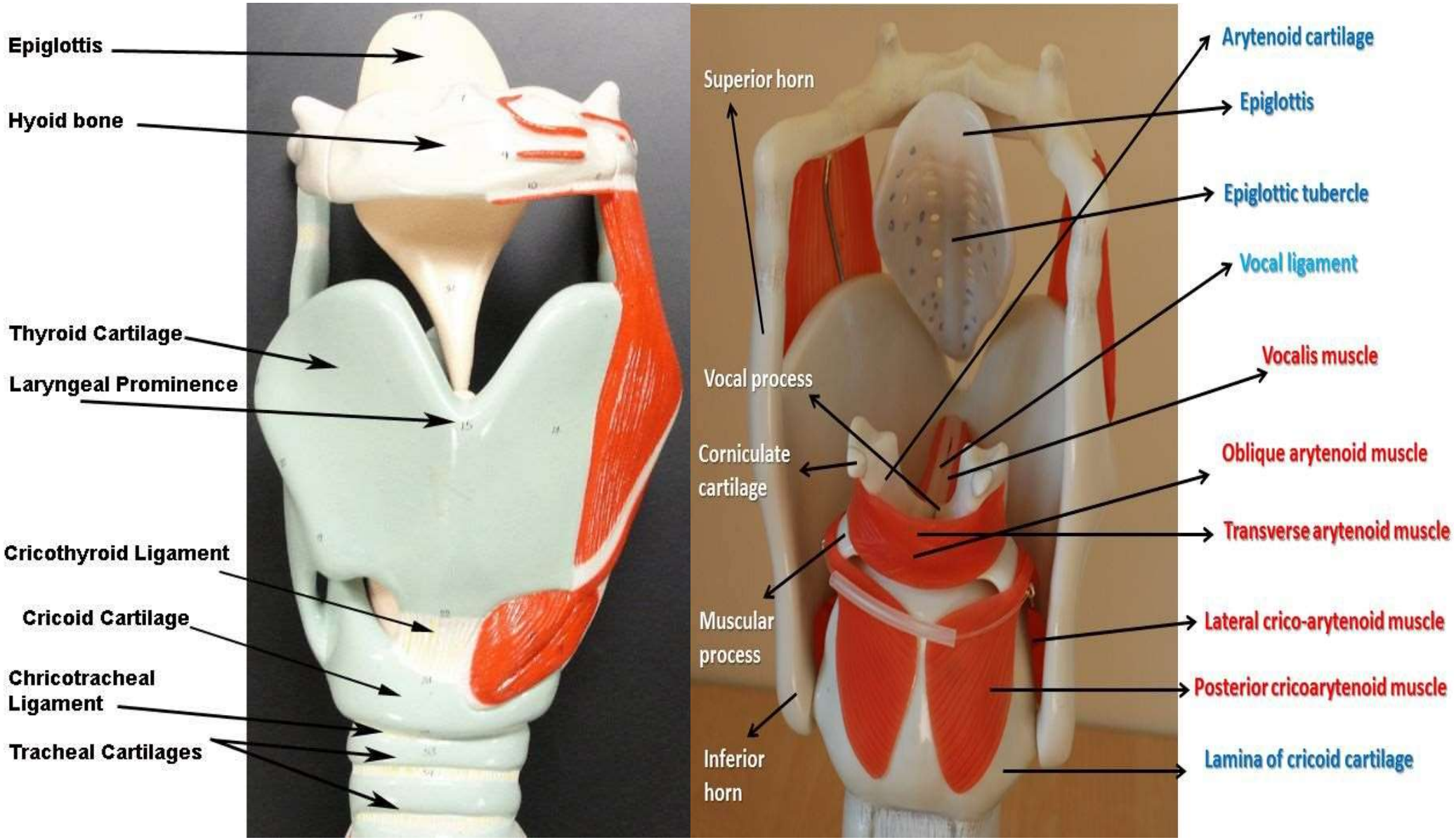
Larynx

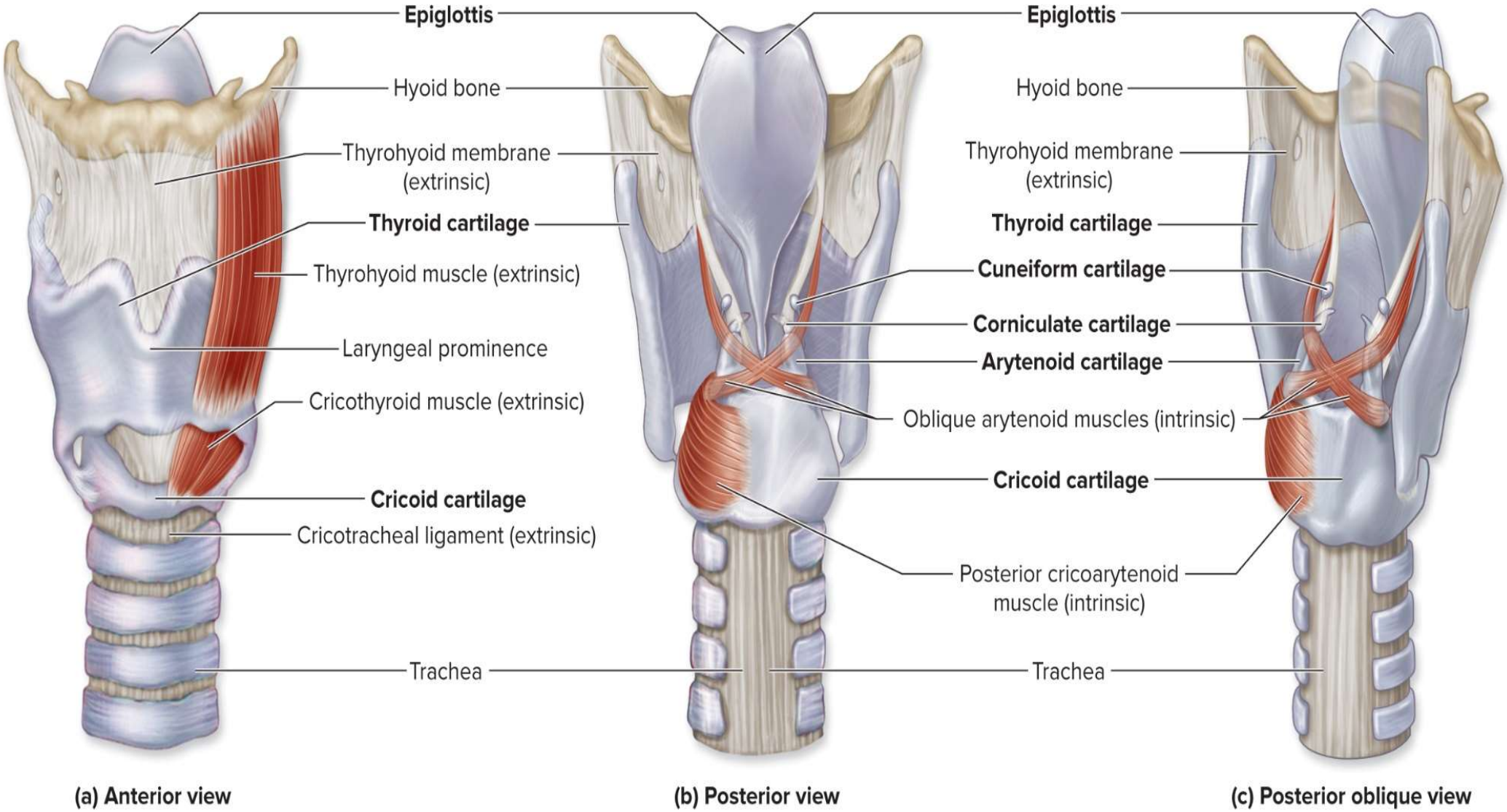
- Functions
  - Maintain an open passageway for air movement
  - Epiglottis and vestibular folds prevent swallowed material from moving into larynx
  - Vocal folds are primary source of sound production



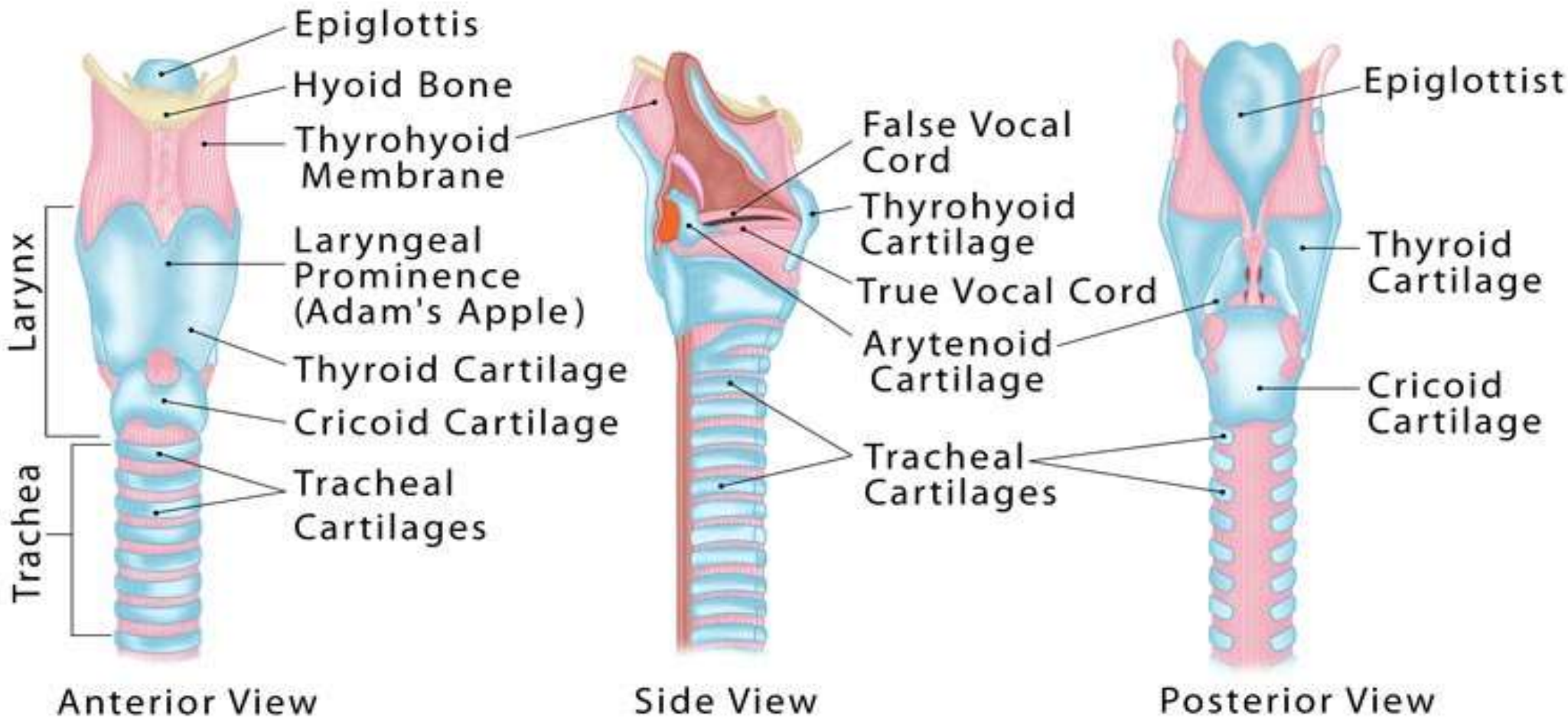


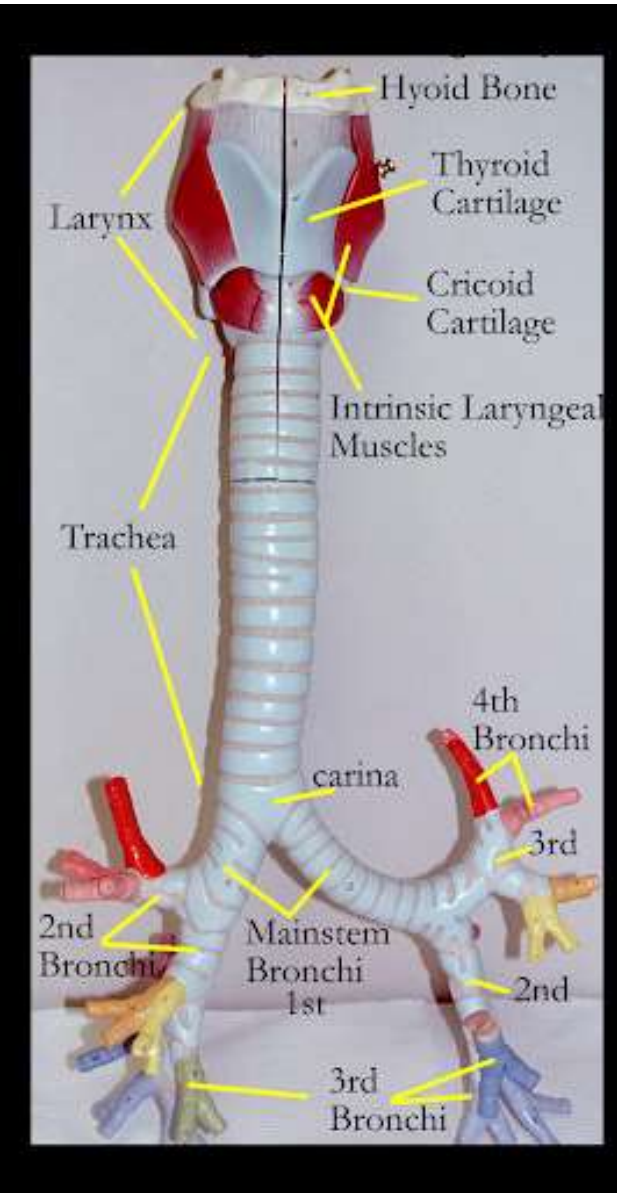



Epiglottis
Hyoid bone
Thyroid Cartilage
Laryngeal Prominence
Cricothyroid Ligament
Cricoid Cartilage
Chricotracheal Ligament
Tracheal Cartilages
Superior horn
Vocal process
Corniculate cartilage
Muscular process
Inferior horn
Arytenoid cartilage
Epiglottis
Epiglottic tubercle
Vocal ligament
Vocalis muscle
Oblique arytenoid muscle
Transverse arytenoid muscle
Lateral crico-arytenoid muscle
Posterior cricoarytenoid muscle
Lamina of cricoid cartilage



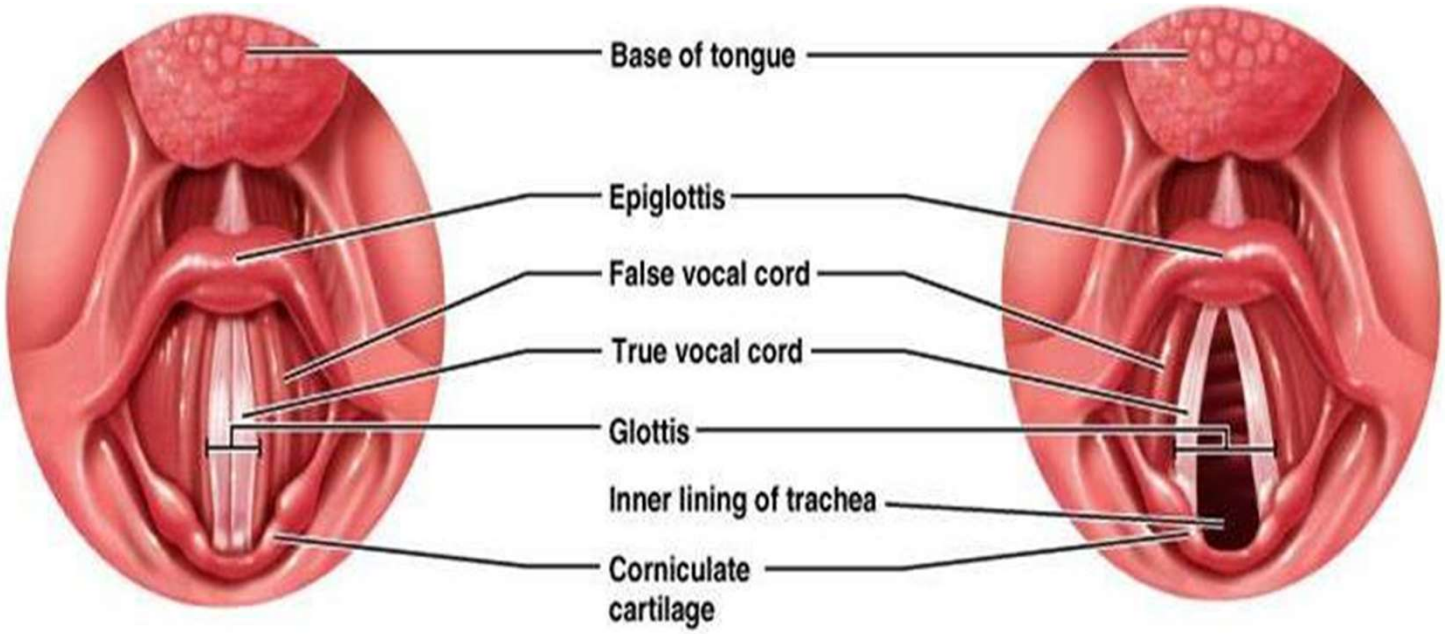
Anatomy of the Larynx

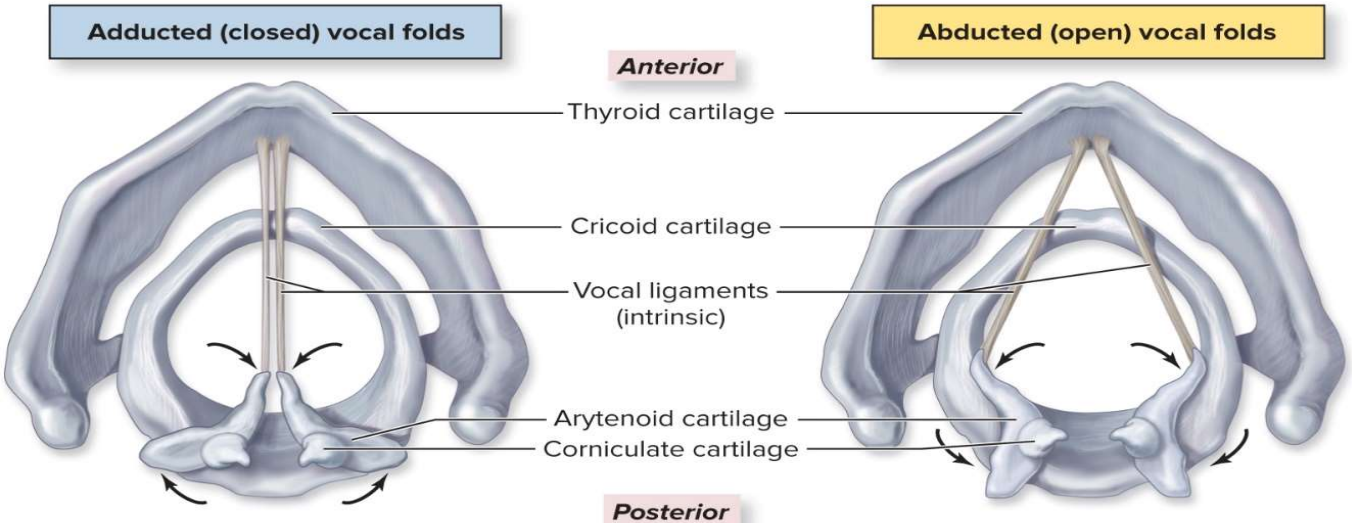




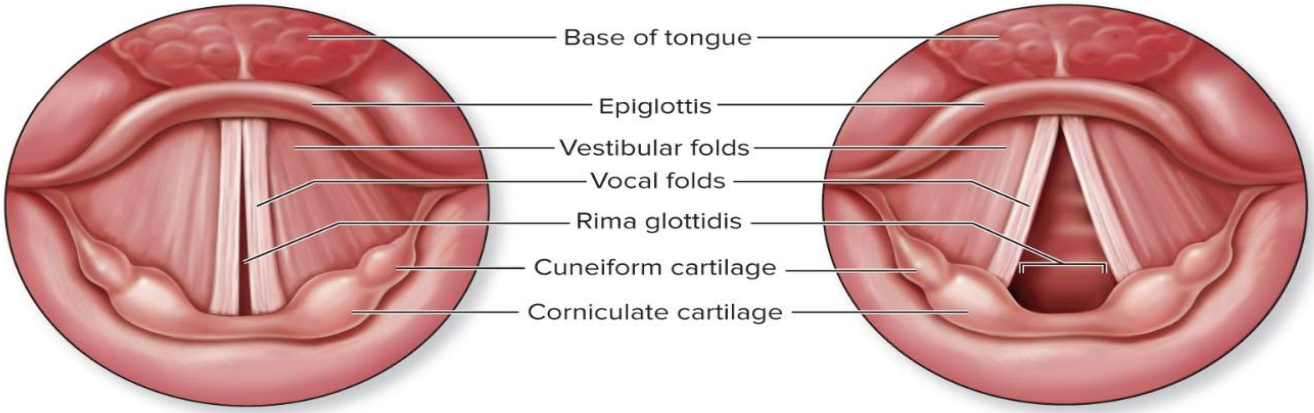
- **The true vocal cords consist of:**
- **stratified squamous epithelium**
- **vocal ligament** (connective tissue, which is mainly elastic bundles)
- **vocal muscle** (skeletal muscle, which regulates the tension of the folds).

- The false vocal cords consist of:
  - **respiratory epithelium**
  - ***lamina propria*** with many exocrine glands

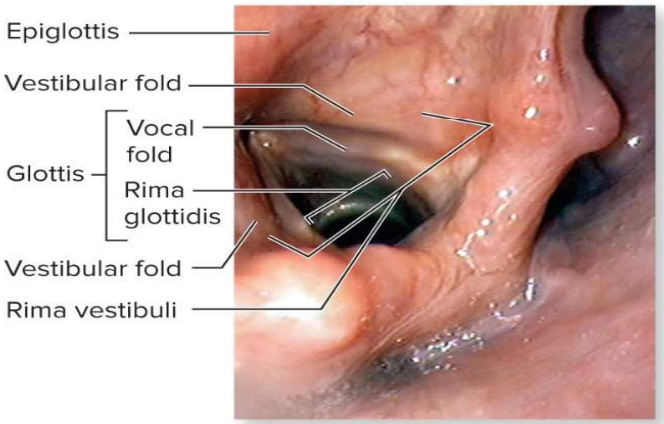




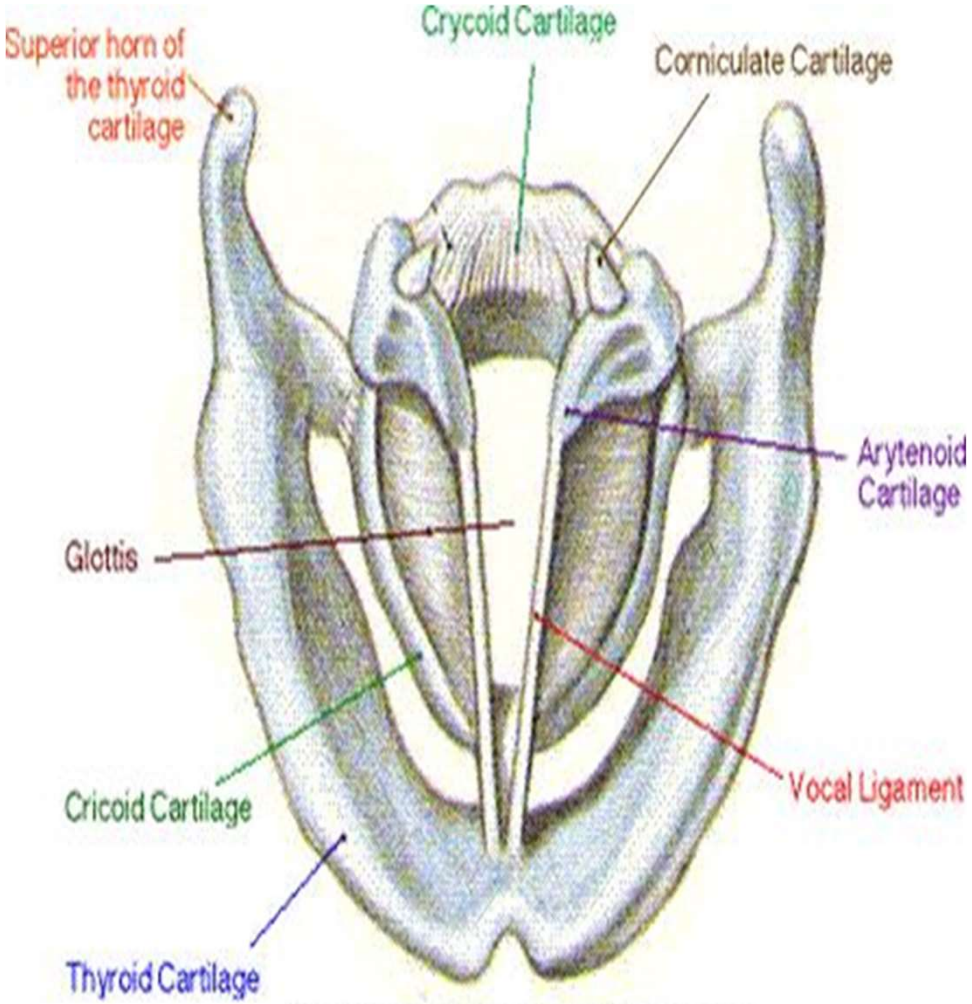
(a) Cartilages and ligaments



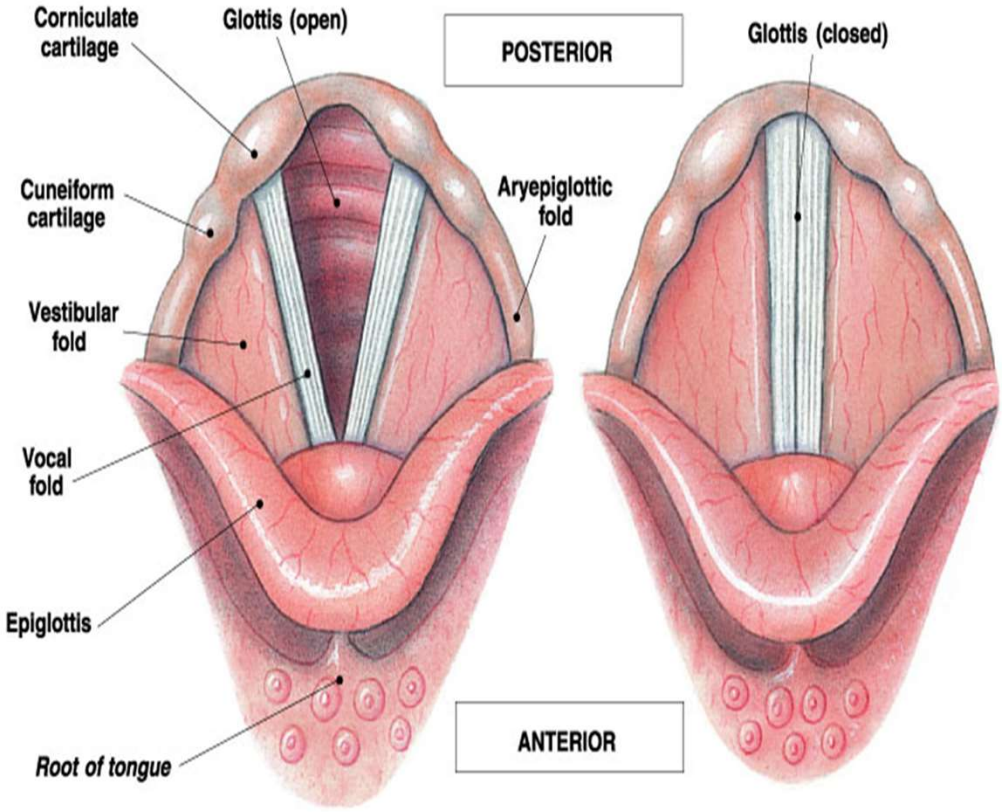
(b) Laryngoscopic view



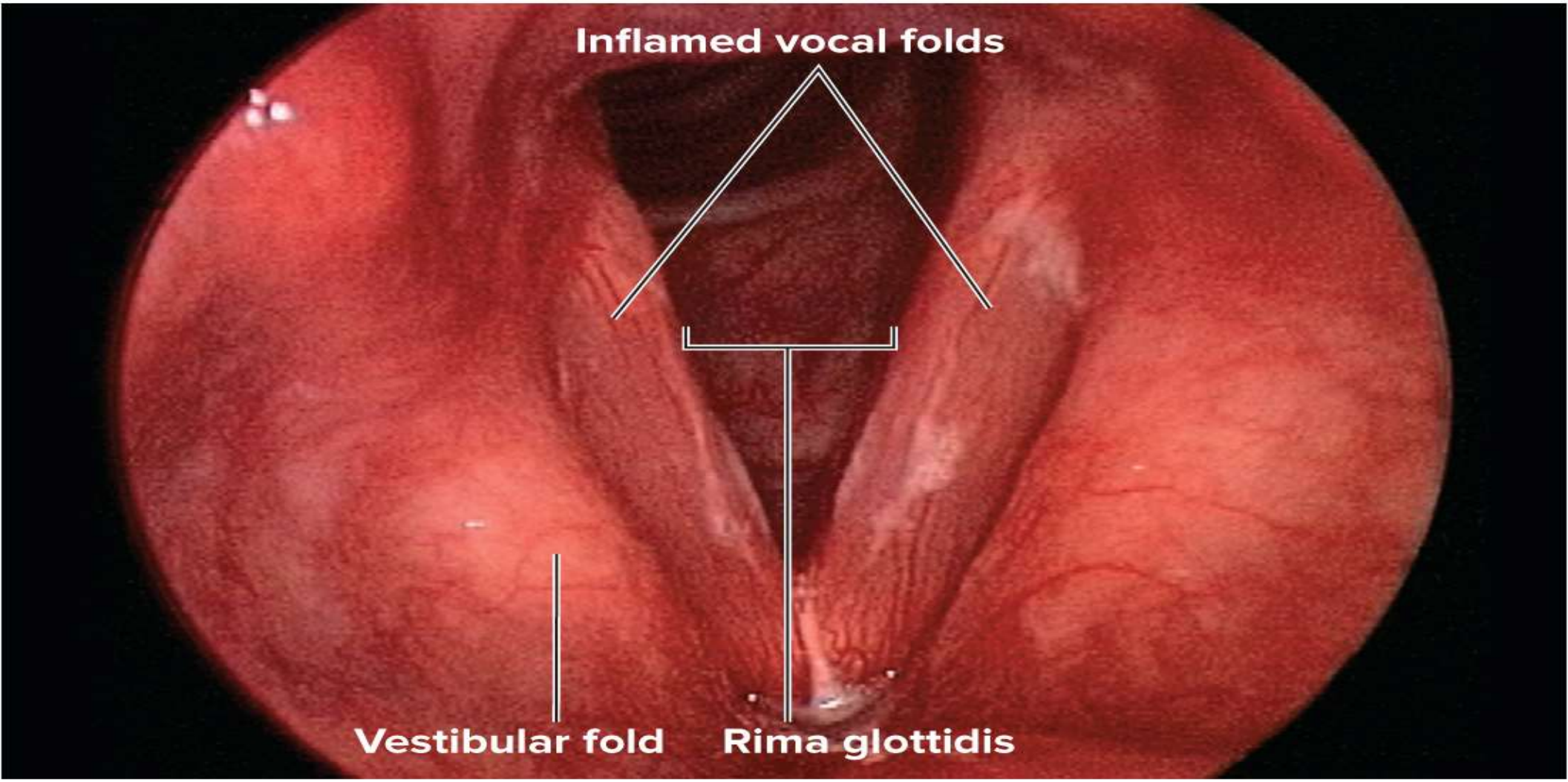
(c) Larynx, superolateral view



The Larynx: viewed from above



https://www.youtube.com/watch?v=BrnW9xSc1Hw



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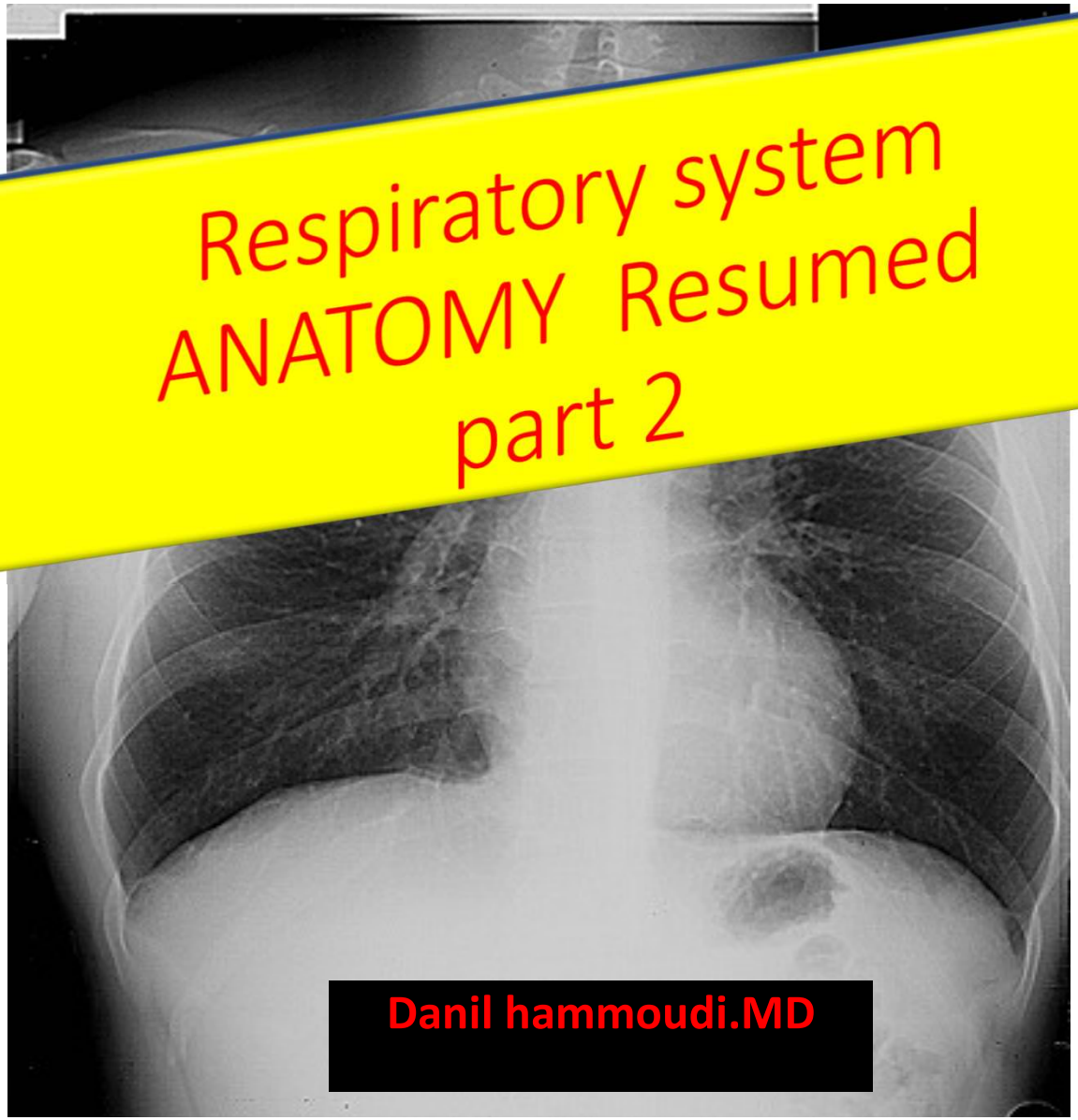
Sphincter Functions of the Larynx

- **The larynx is closed during coughing, sneezing, and Valsalva's maneuver**
- Valsalva's maneuver
  - Air is temporarily held in the lower respiratory tract by closing the glottis
  - Causes intra-abdominal pressure to rise when abdominal muscles contract
  - Helps to empty the rectum
  - Acts as a splint to stabilize the trunk when lifting heavy loads

https://www.youtube.com/watch?v=k5o26XwpCt4

https://www.youtube.com/watch?v=mViHwWXNyj0



Respiratory system ANATOMY Resumed part 2

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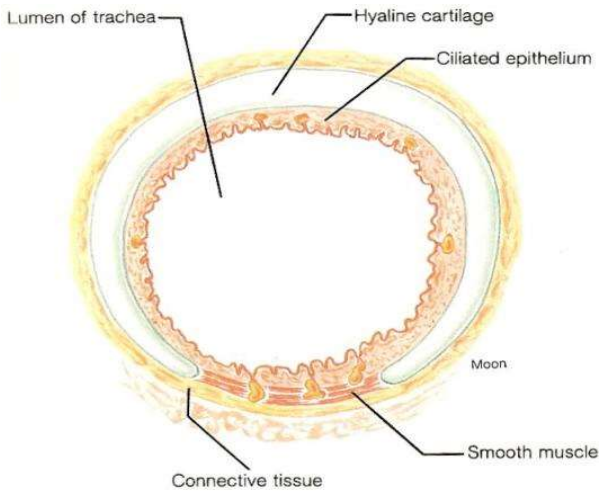
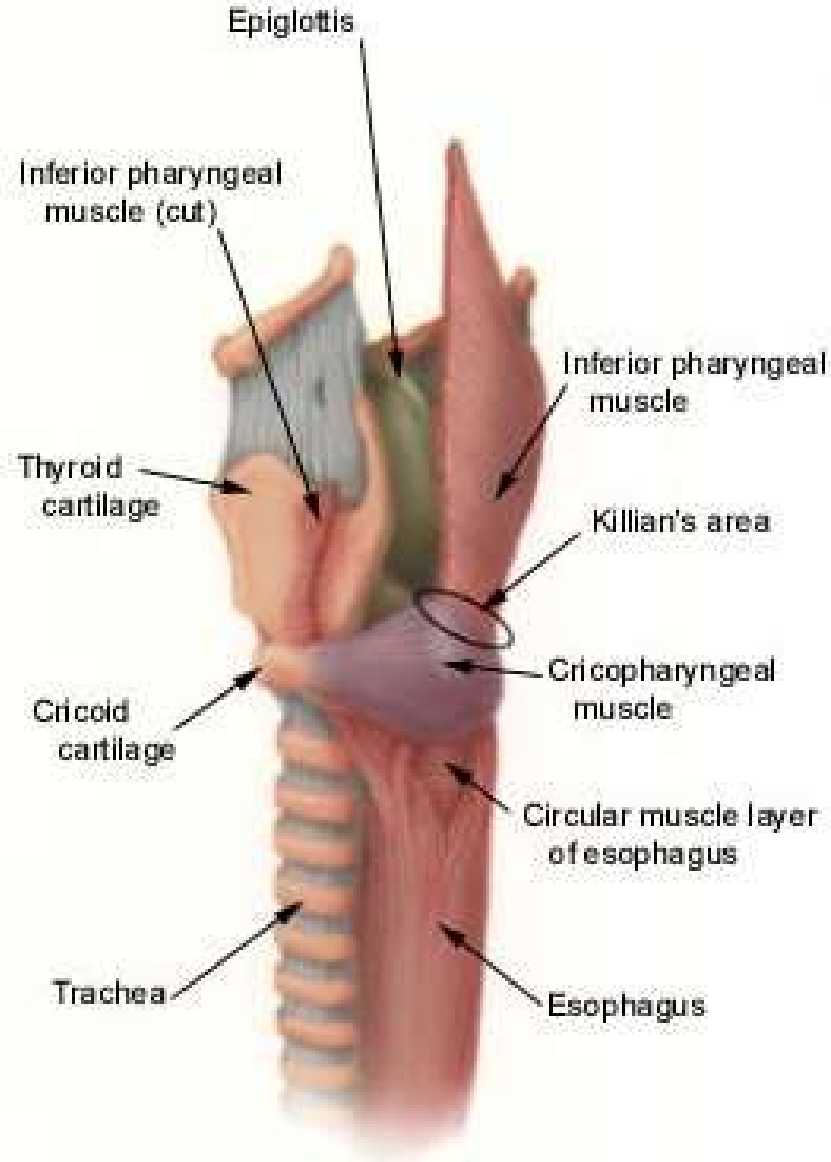
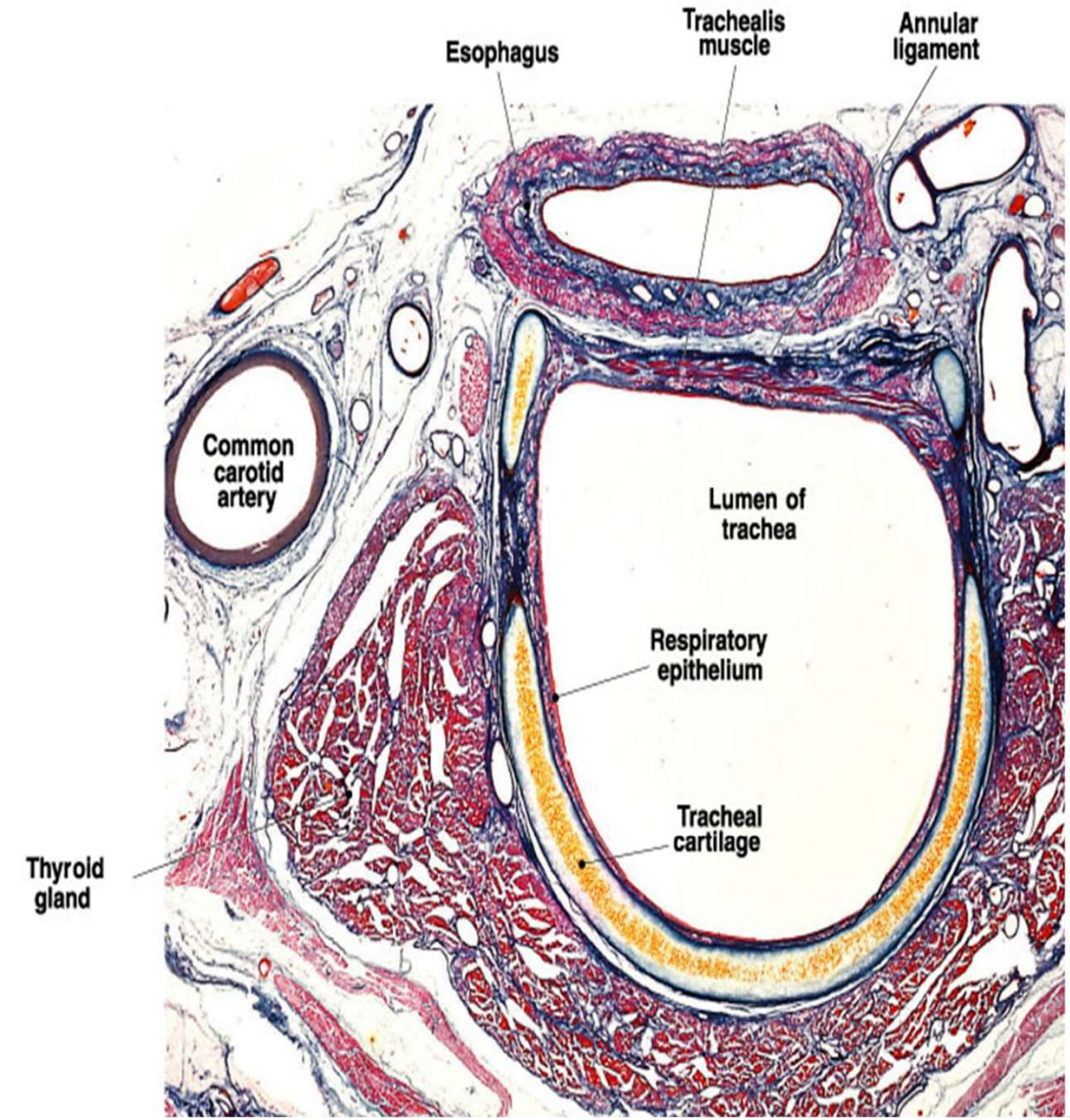
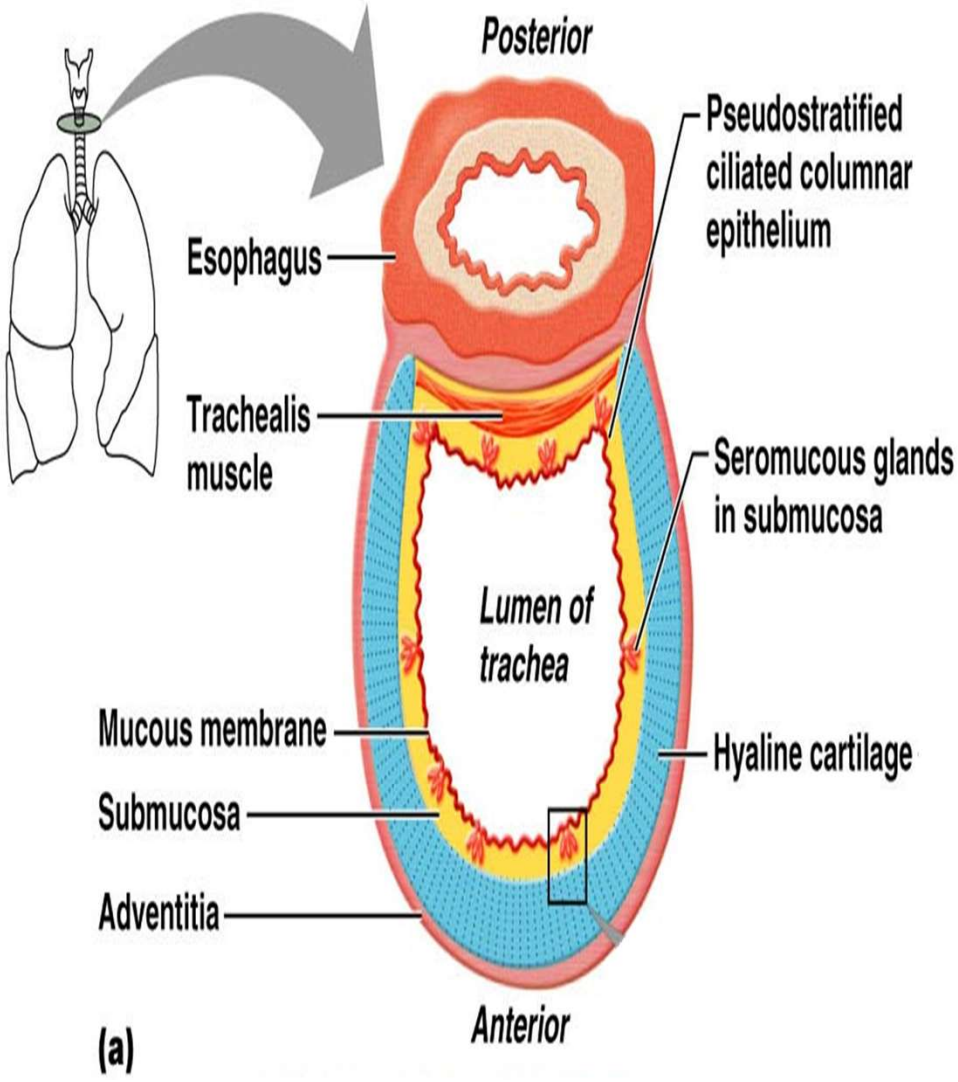
Trachea

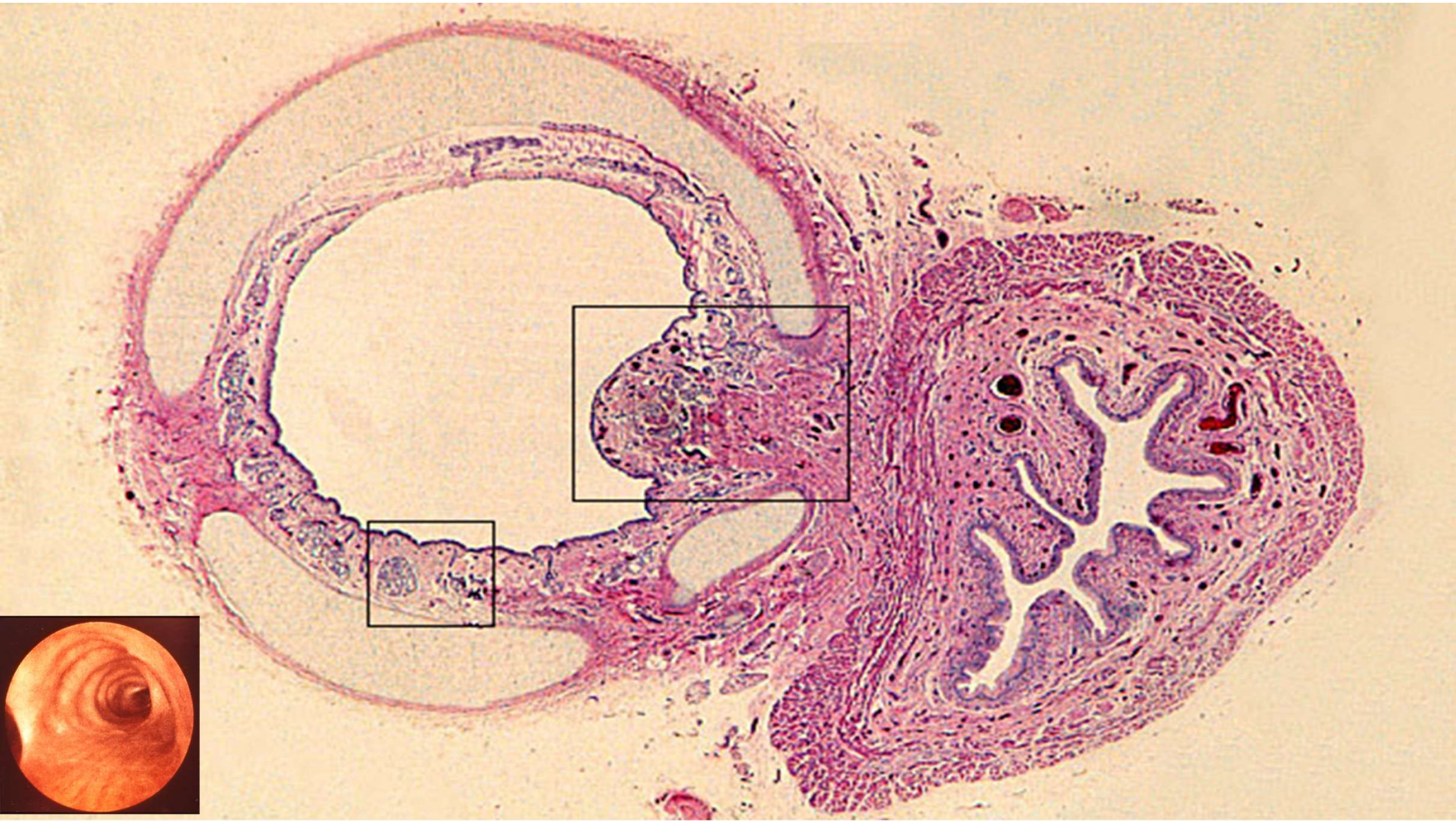
- The open portion of the cartilage rings is posterior and there you find the **trachealis muscle**.
- The lack of posterior cartilage is important b/c it provides the esophagus with room to expand when a large bolus of food is swallowed.
- **Carina** - the point where the trachea divides into the left and right primary bronchus.

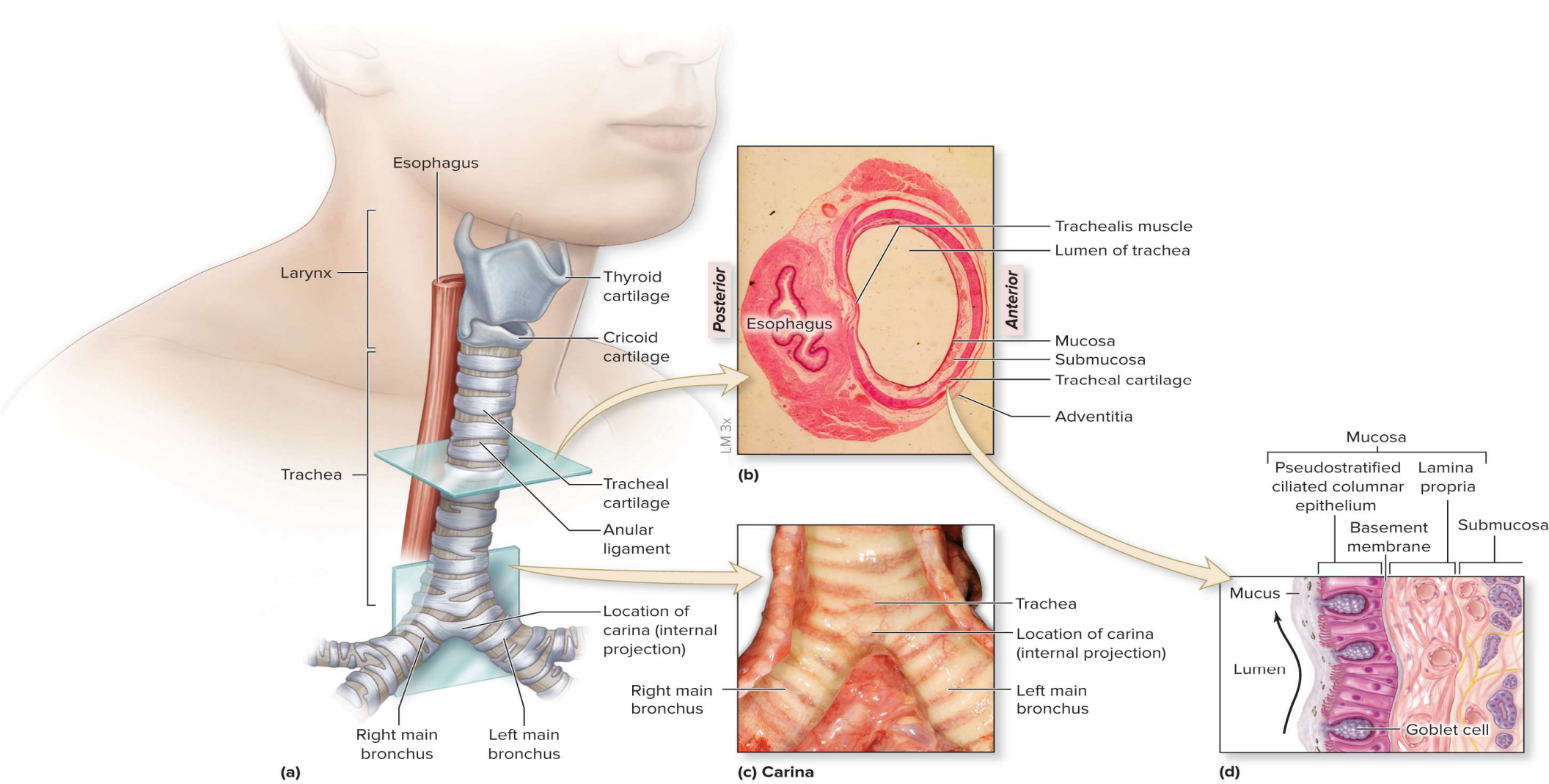




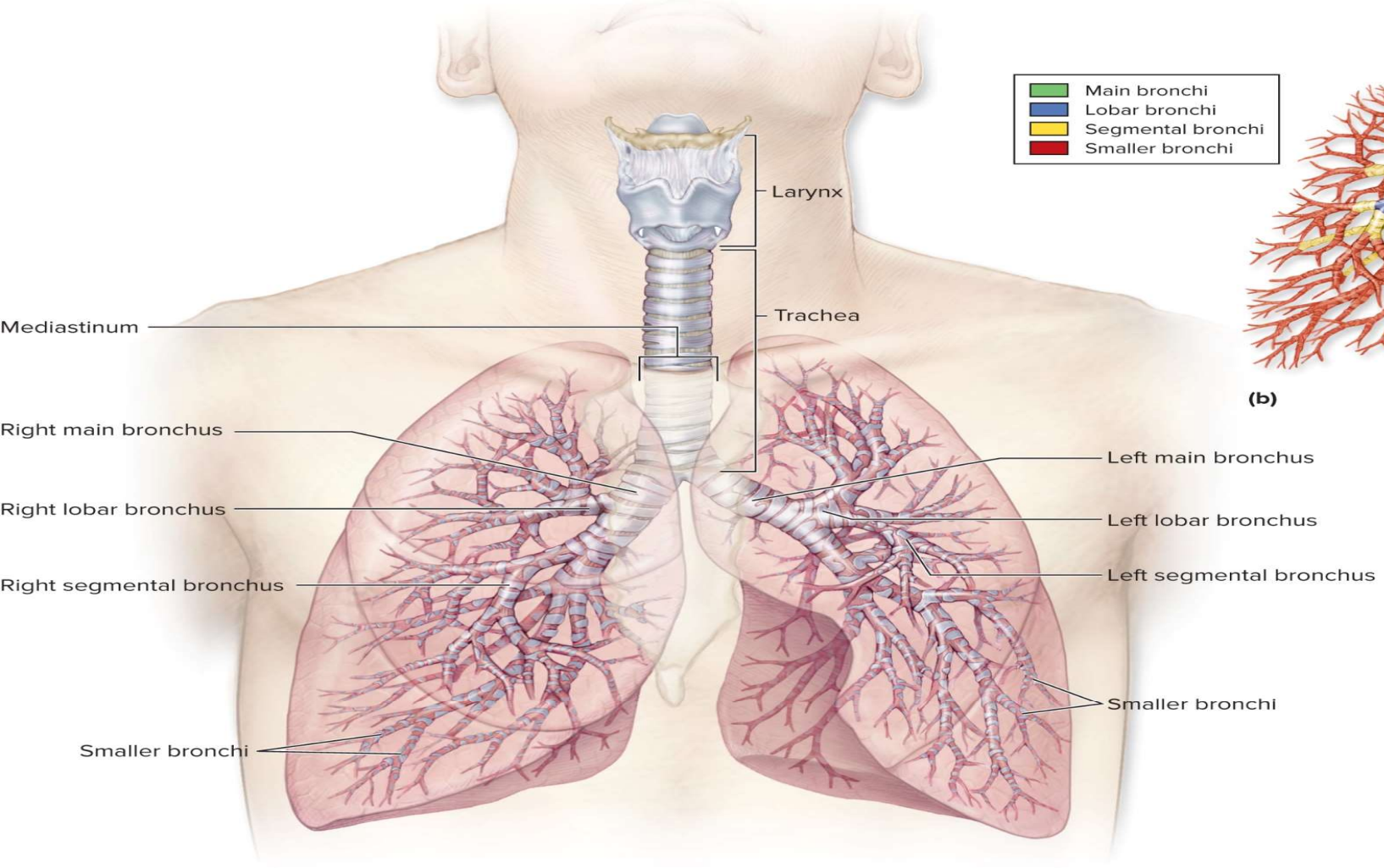

Esophagus
Trachealis muscle
Annular ligament
Common carotid artery
Lumen of trachea
Respiratory epithelium
Tracheal cartilage
Thyroid gland


Posterior
Pseudostratified ciliated columnar epithelium
Esophagus
Trachealis muscle
Seromucous glands in submucosa
Lumen of trachea
Mucous membrane
Hyaline cartilage
Submucosa
Adventitia
Anterior
(a)

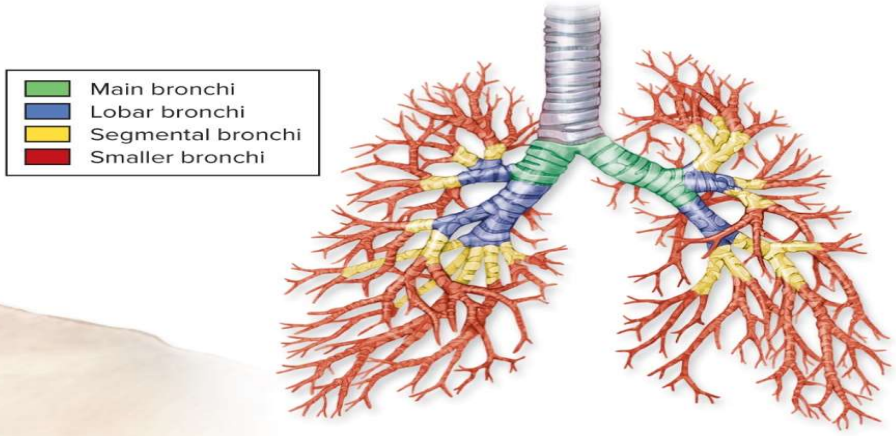




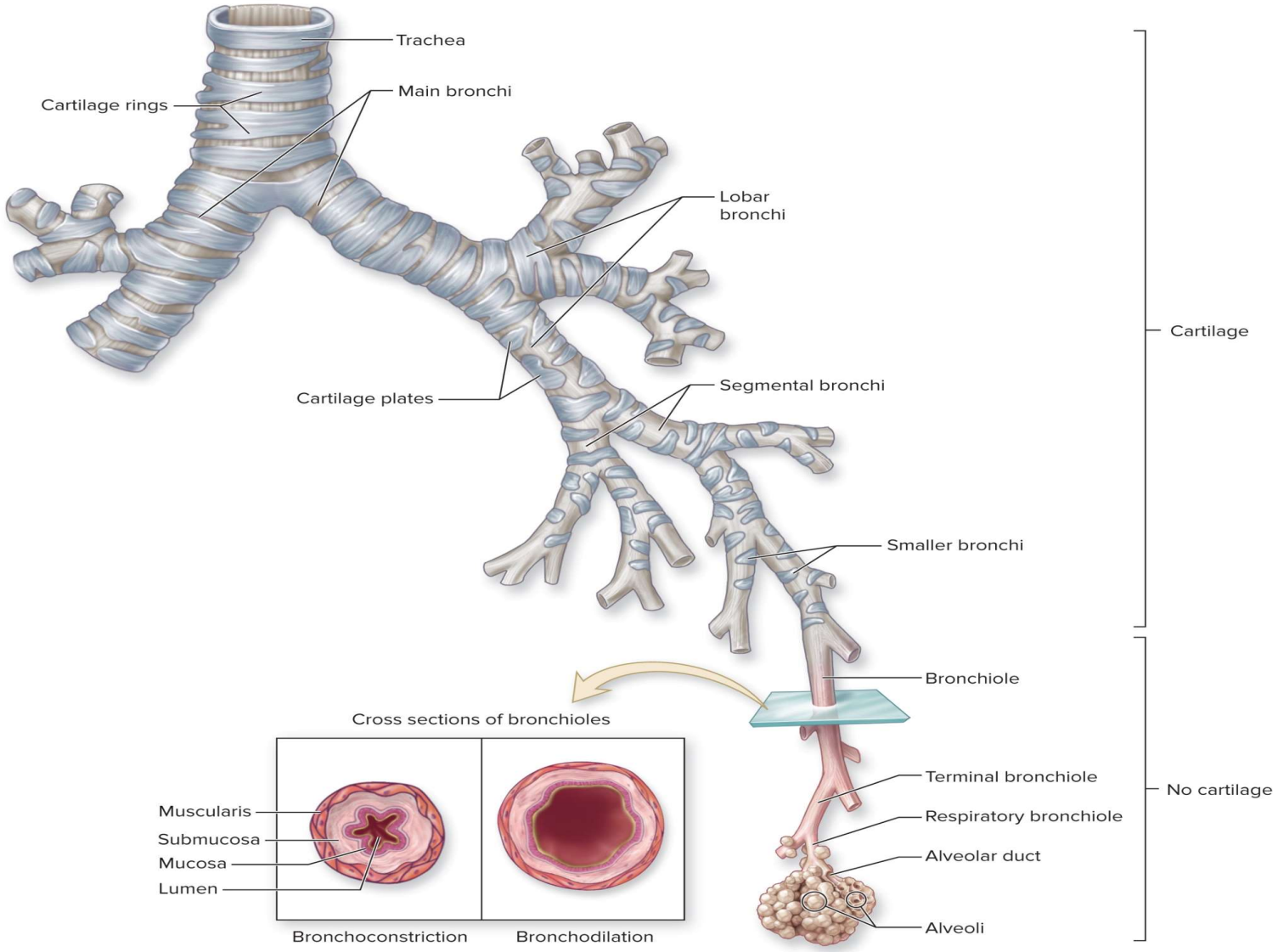
(b) ©Lester V. Bergman/Corbis; (c) ©SPL/Science Source

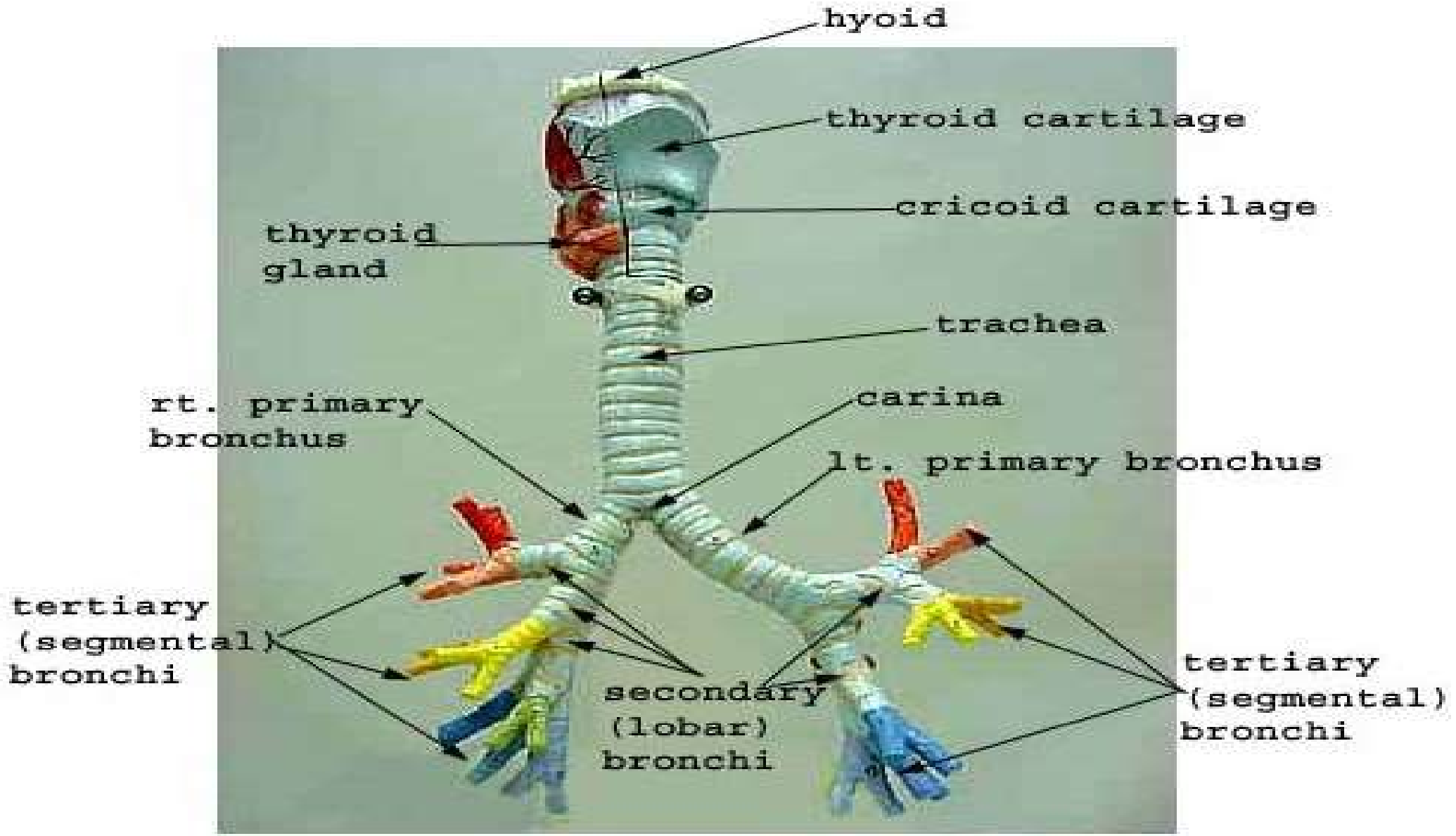


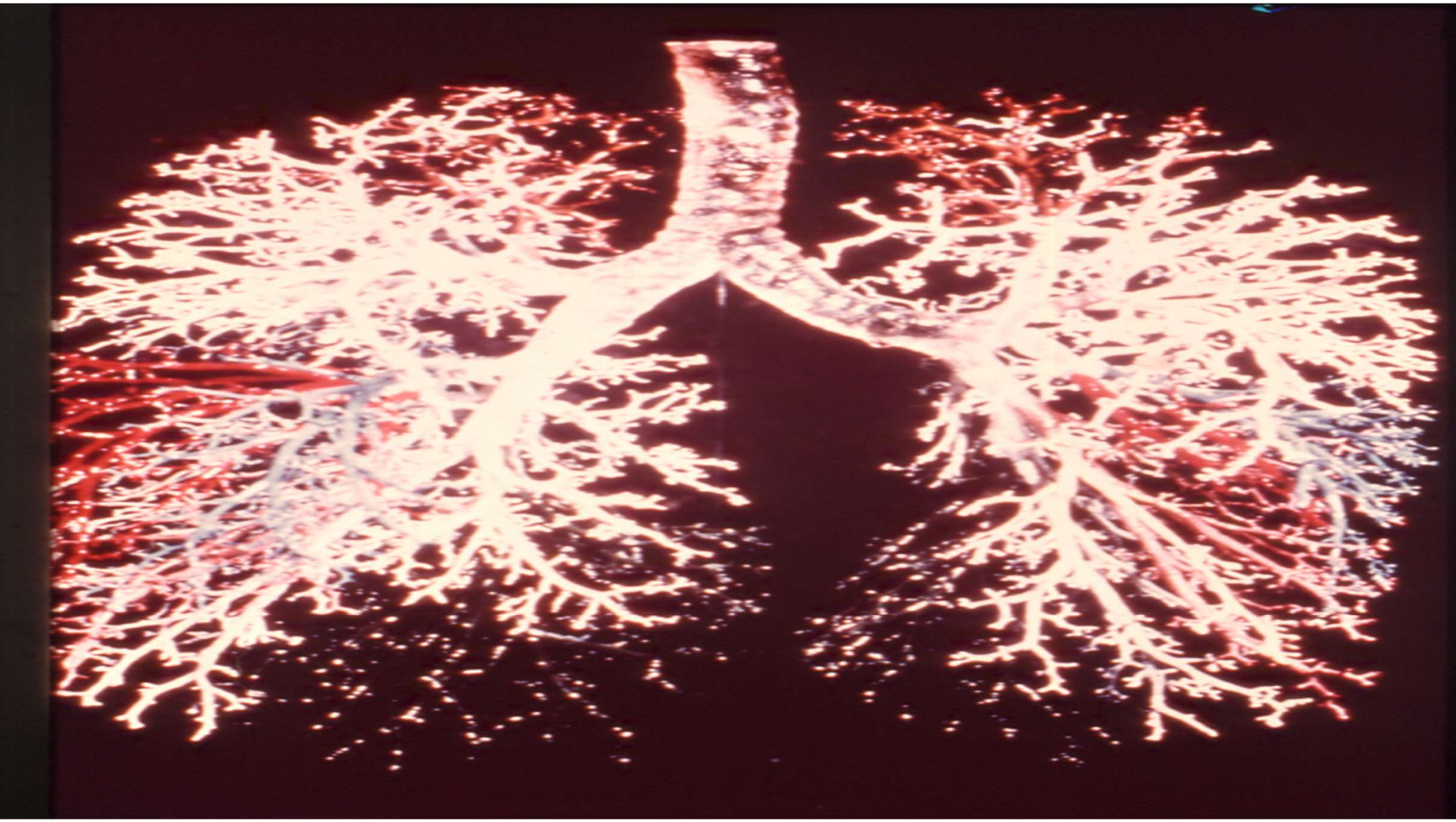
(a) Anterior view



(b)



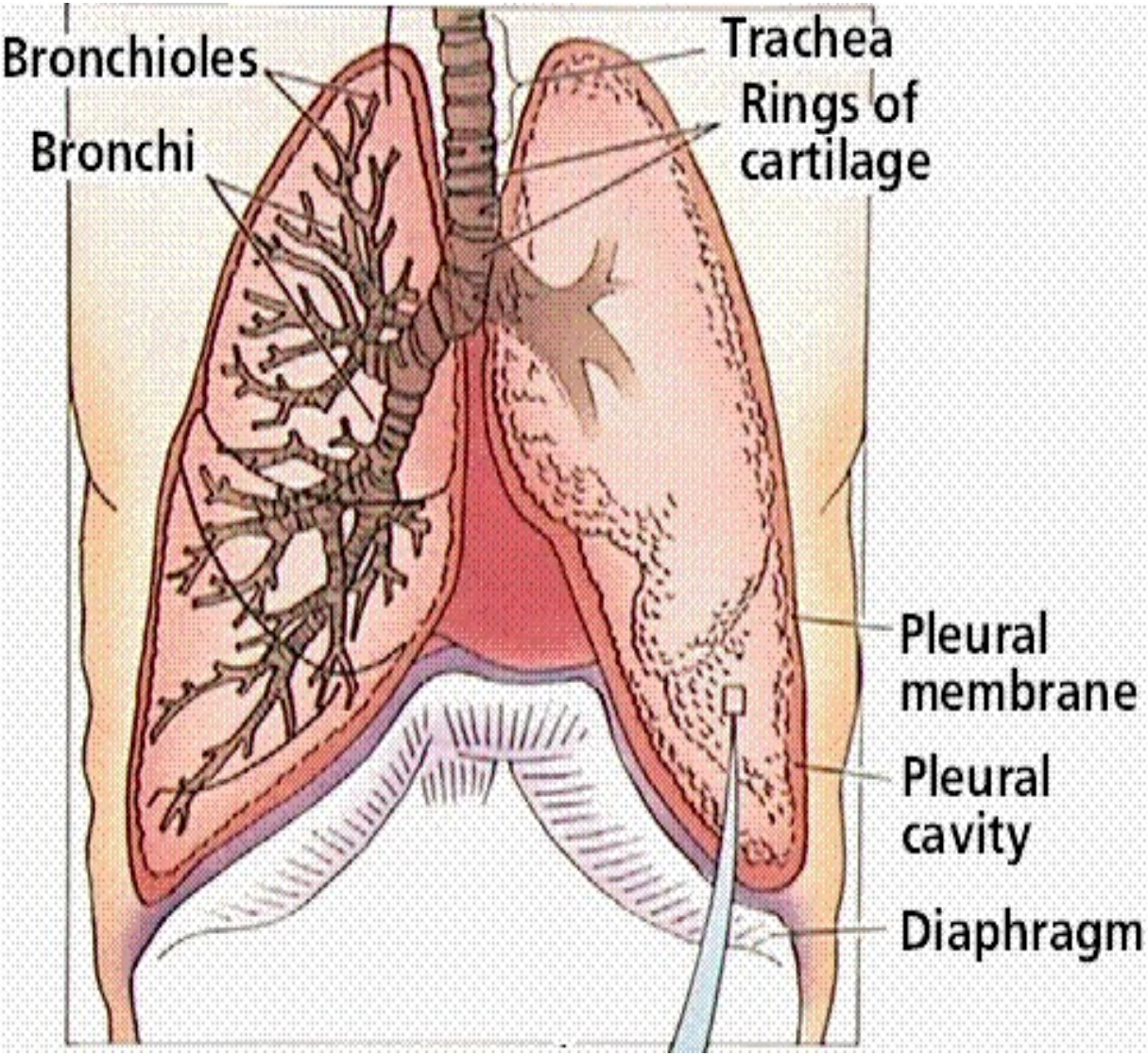

hyoid
thyroid cartilage
cricoid cartilage
thyroid gland
trachea
rt. primary bronchus
carina
lt. primary bronchus
tertiary (segmental) bronchi
secondary (lobar) bronchi
tertiary (segmental) bronchi



The Respiratory part

Composed of the :

- Lower trachea
- Bronchus
- Bronchioles
- Alveoli



- Right lung has 3 lobes:
  - **Left has Less Lobes (2) and Lingula (homolog of right middle lobe).**
- **Instead** of a middle lobe, left lung has a space occupied by the heart **.**

- Relation of the pulmonary artery to the bronchus at each lung hilum is described by **RALS—Right**
- **Anterior; Left Superior.**
- **Carina is posterior to ascending aorta and anteromedial to descending** aorta **.**

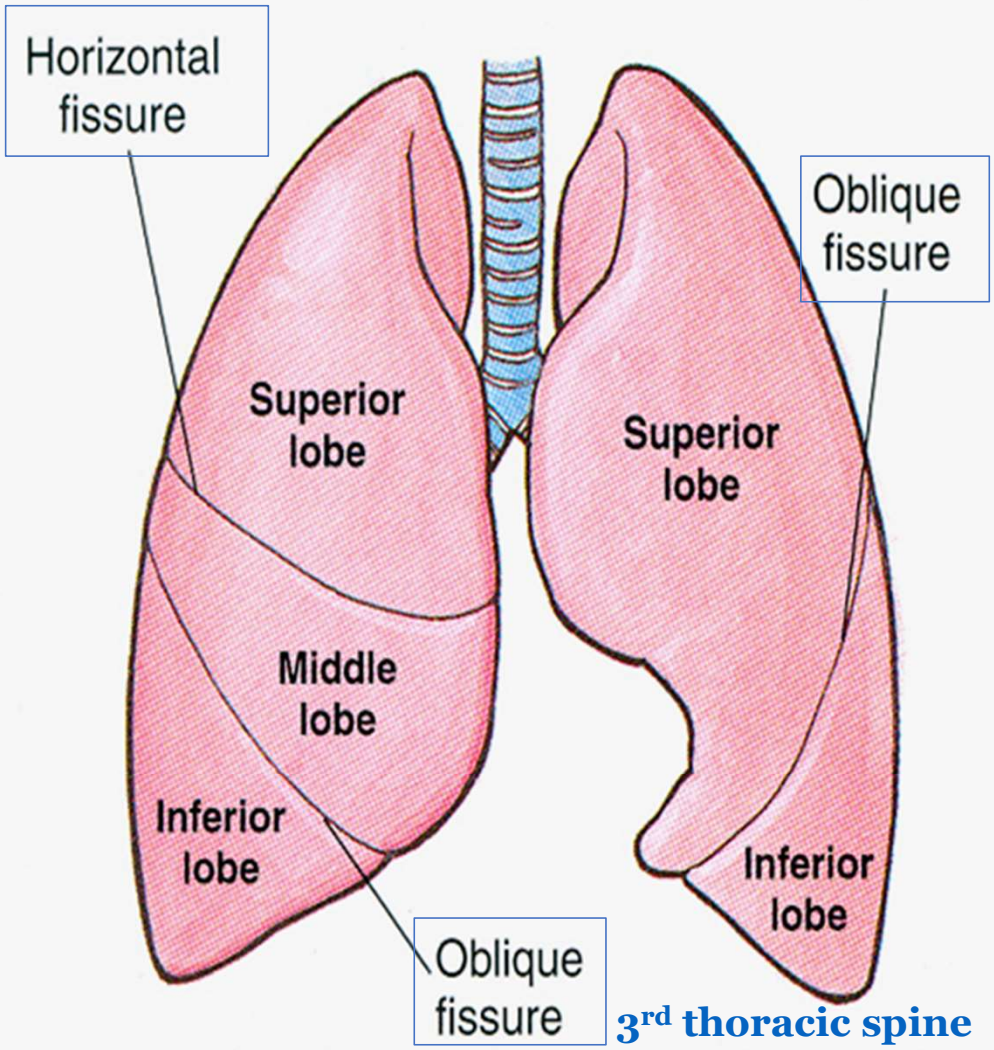
- Right lung is a more common site for inhaled foreign bodies because right main stem bronchus is **wider, more vertical, and shorter than the left.**

If you aspirate a peanut:

ƒ **While supine**—usually enters right lower lobe.
ƒ **While lying on right side**—usually enters right upper lobe.
ƒ **While upright**—usually enters right lower lobe.

Right lung (three lobes)

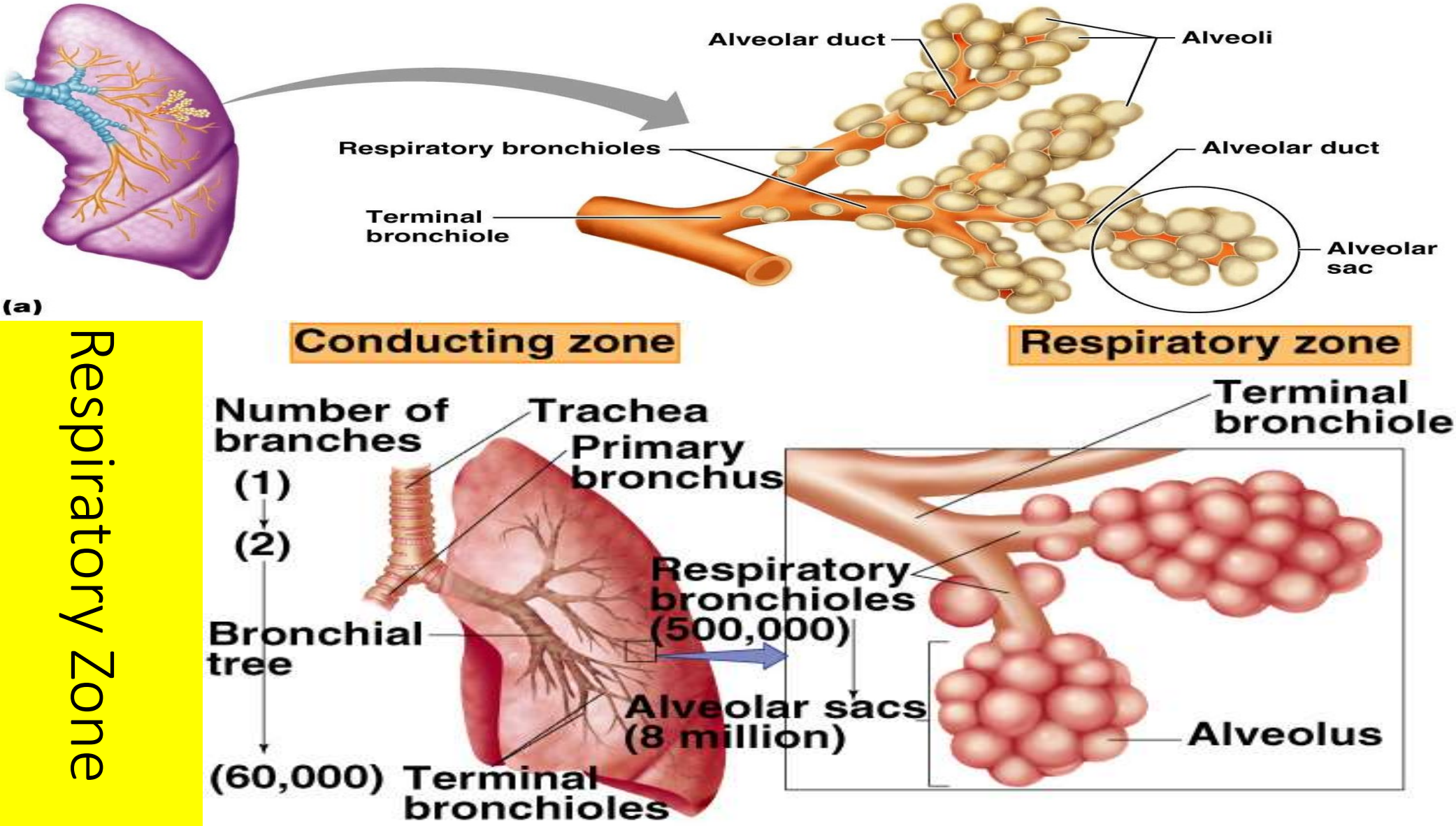
Superior (upper) lobe separated by horizontal fissure from the middle lobe separated by oblique fissure from the inferior (lower) lobe

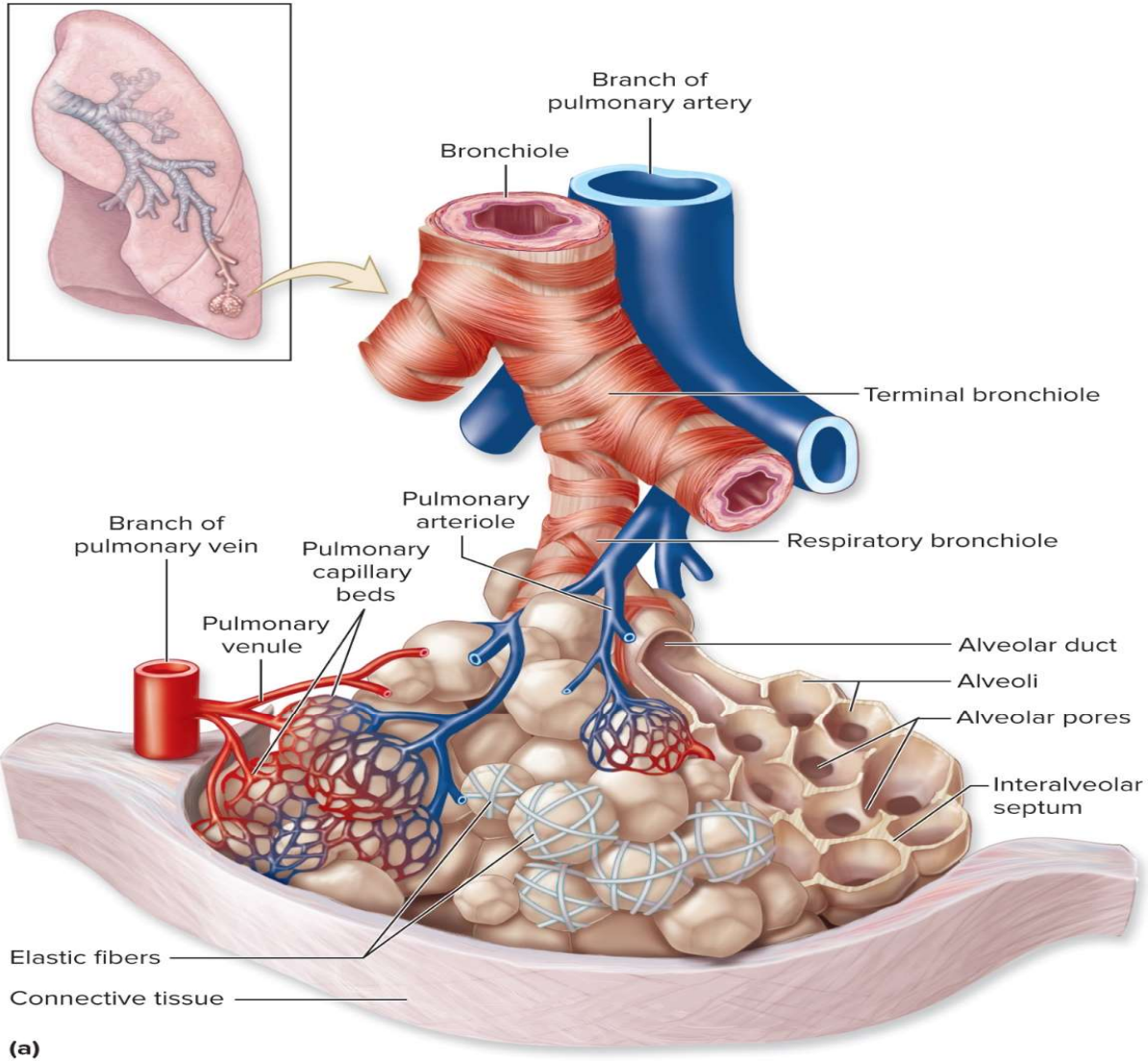


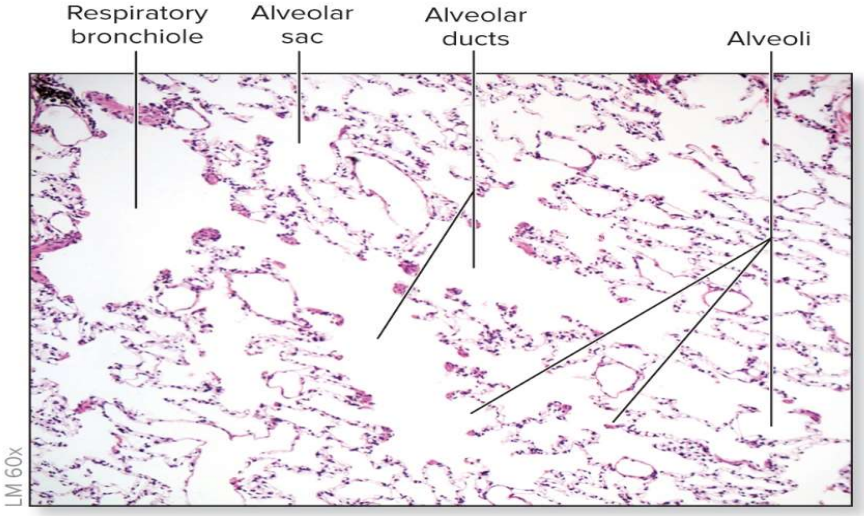
Left lung (two lobes)

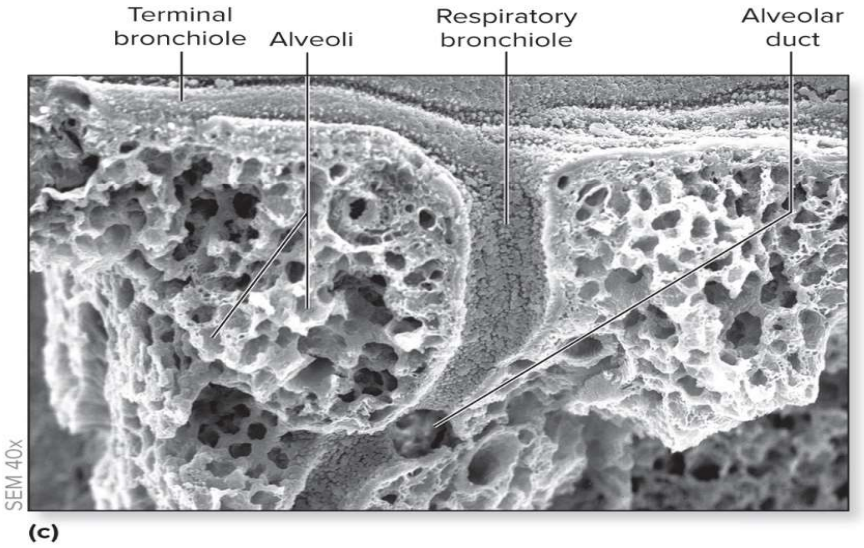
Superior (upper) lobe separated by oblique fissure from the inferior (lower) lobe

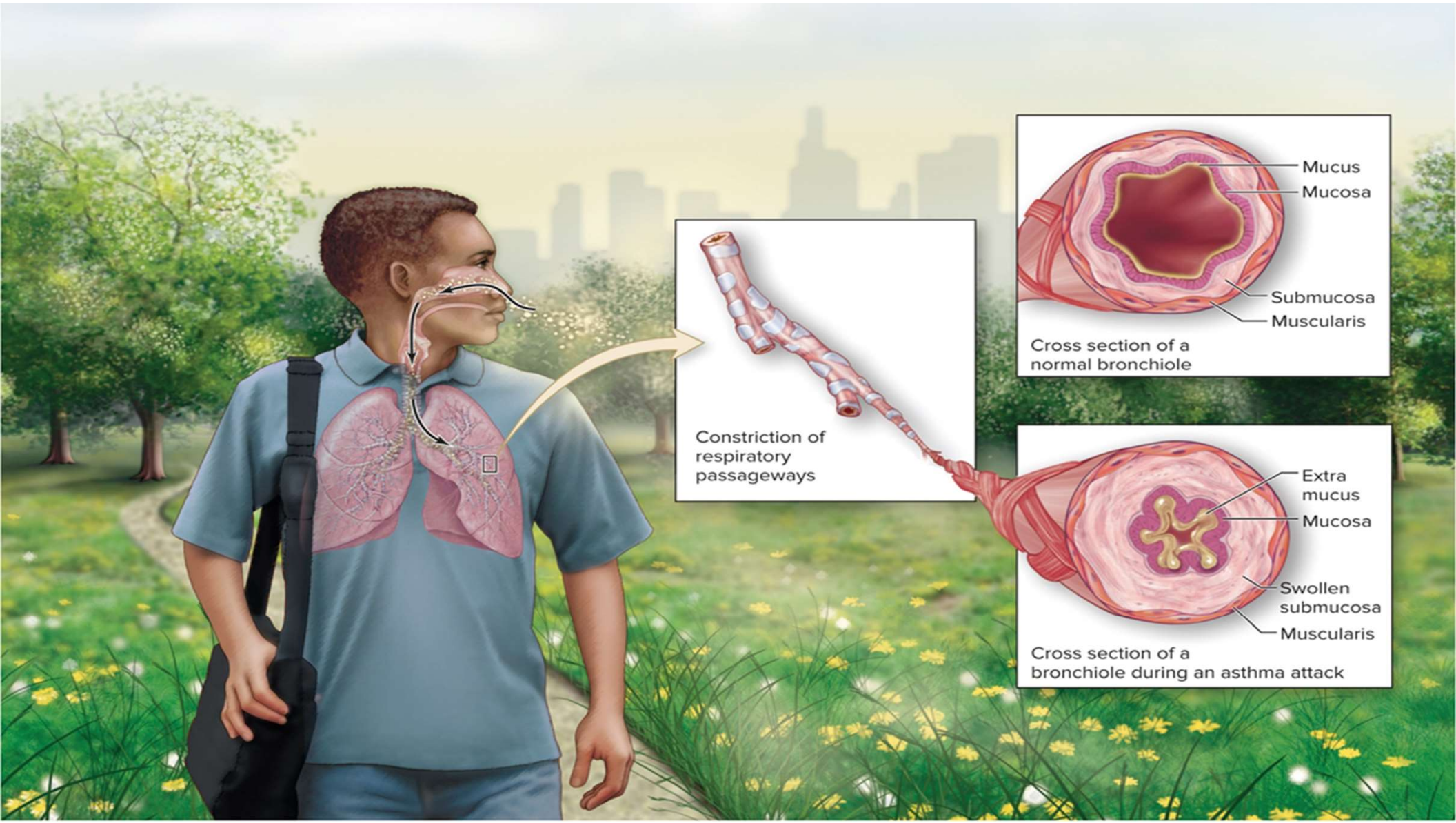
Respiratory Zone







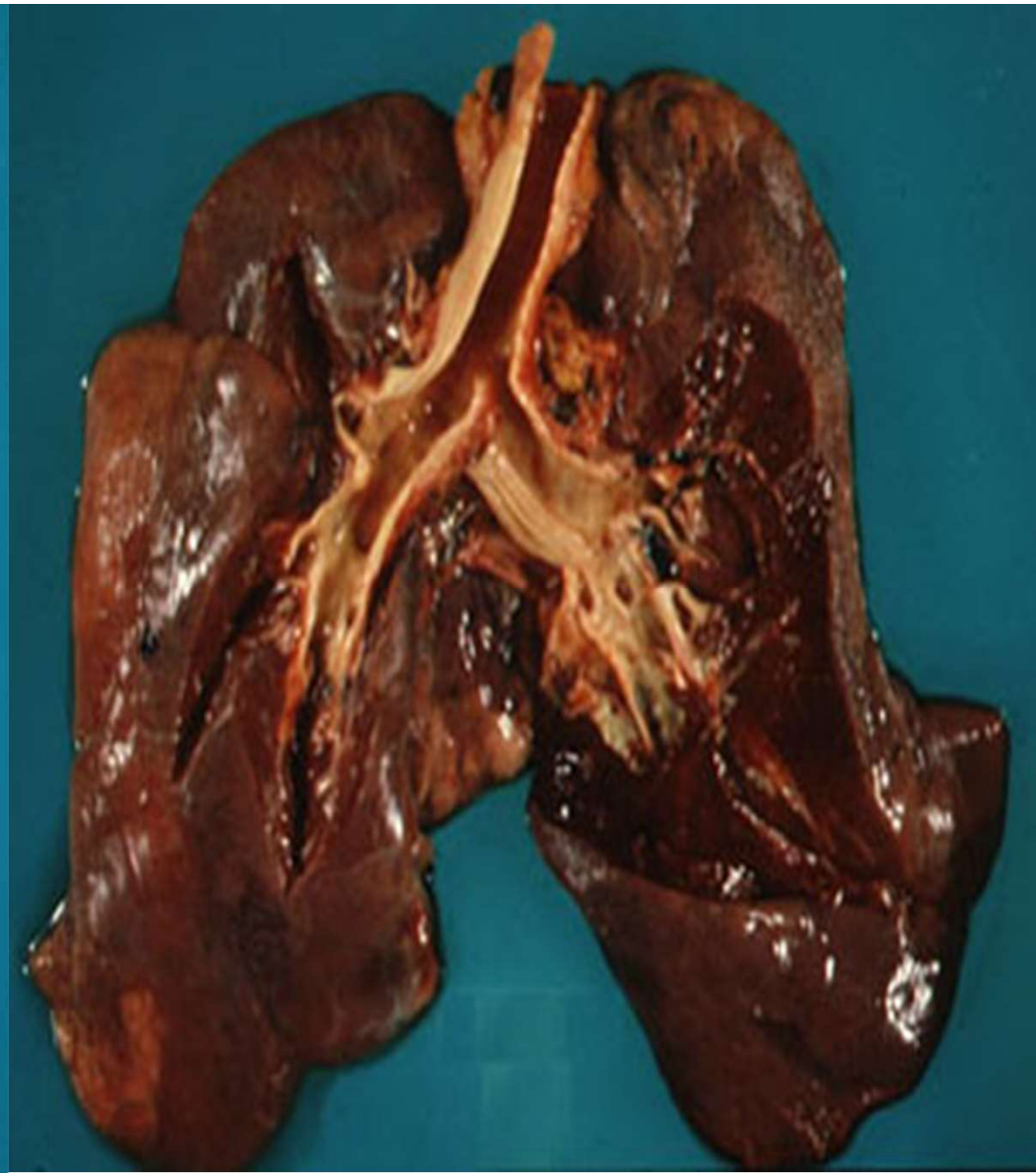



Constriction of respiratory passageways
Mucus
Mucosa
Submucosa
Muscularis
Cross section of a normal bronchiole
Extra mucus
Mucosa
Swollen submucosa
Muscularis
Cross section of a bronchiole during an asthma attack

Lungs

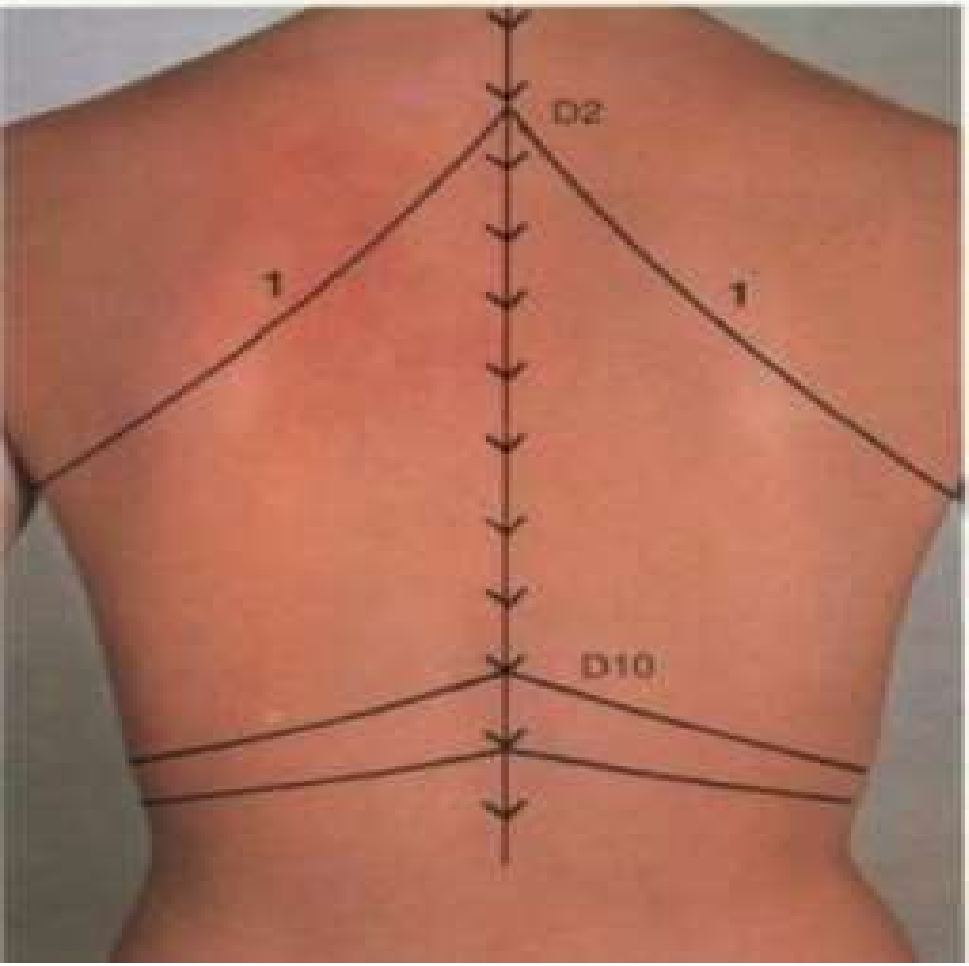
Anatomy.app

Anterior view

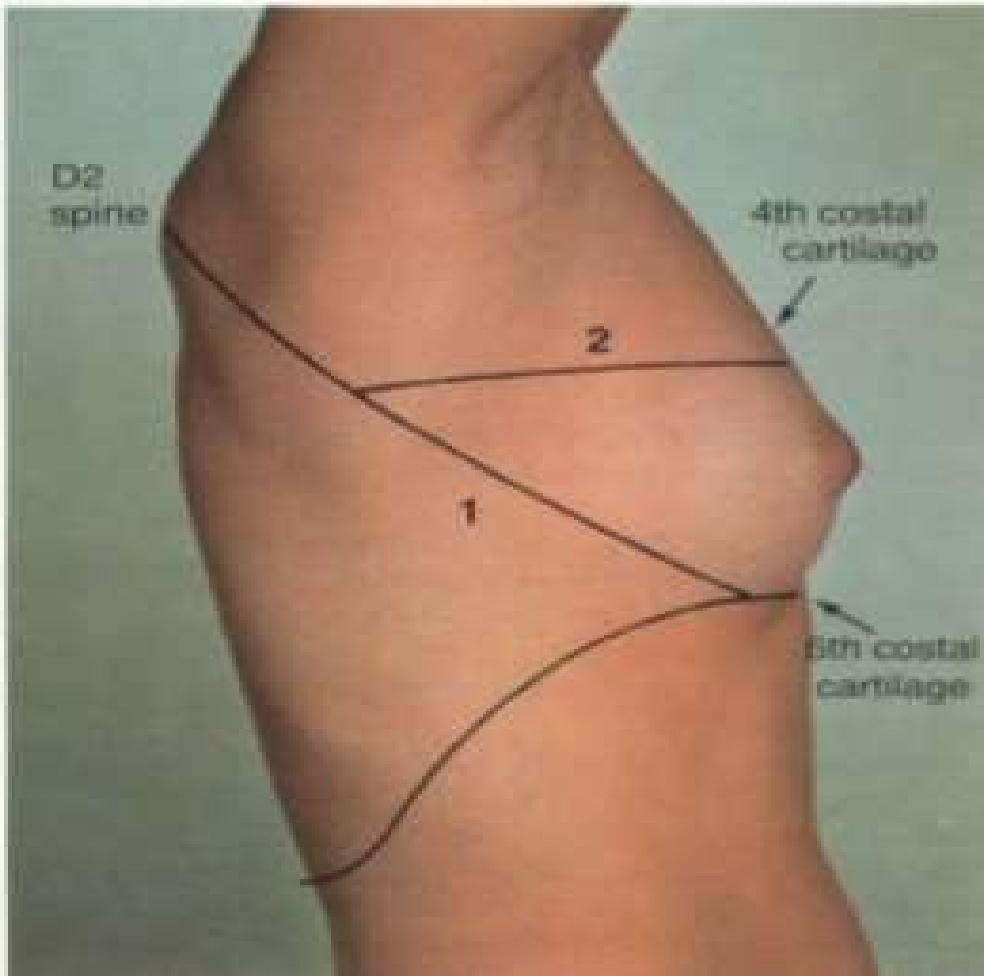


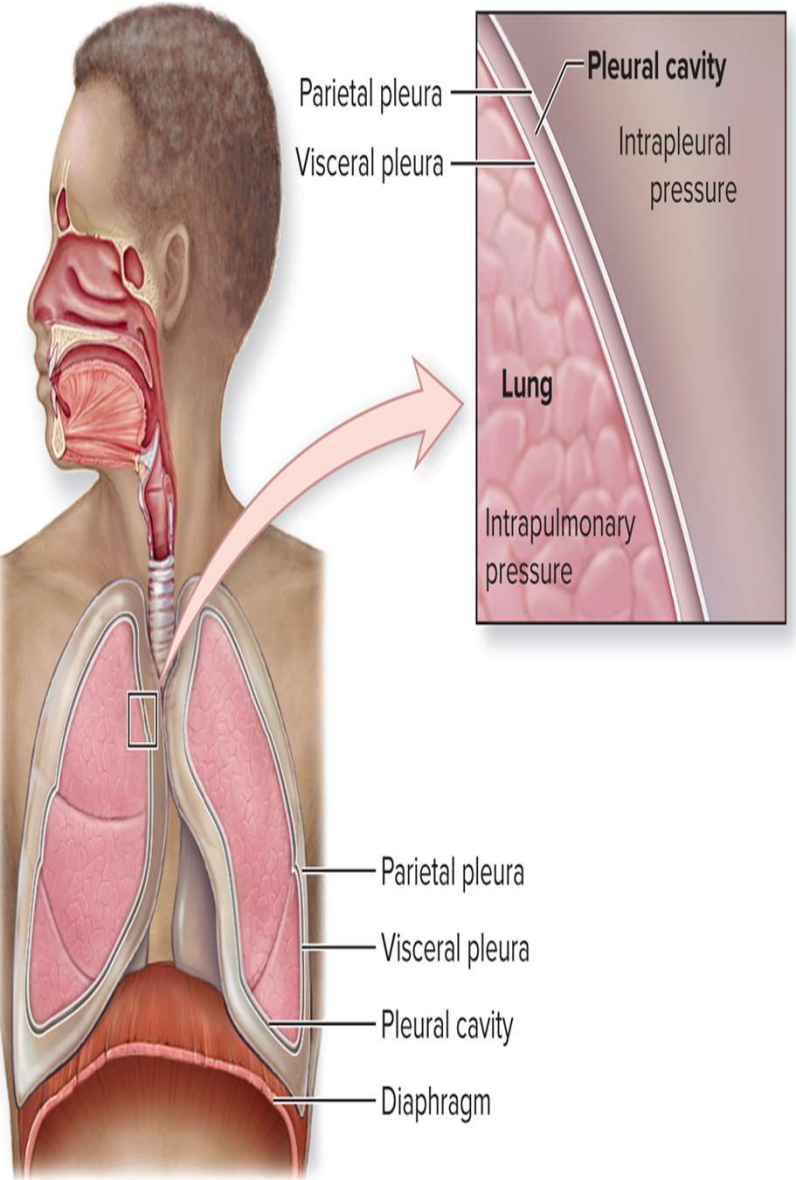
Fissures & Lobes of the Lungs

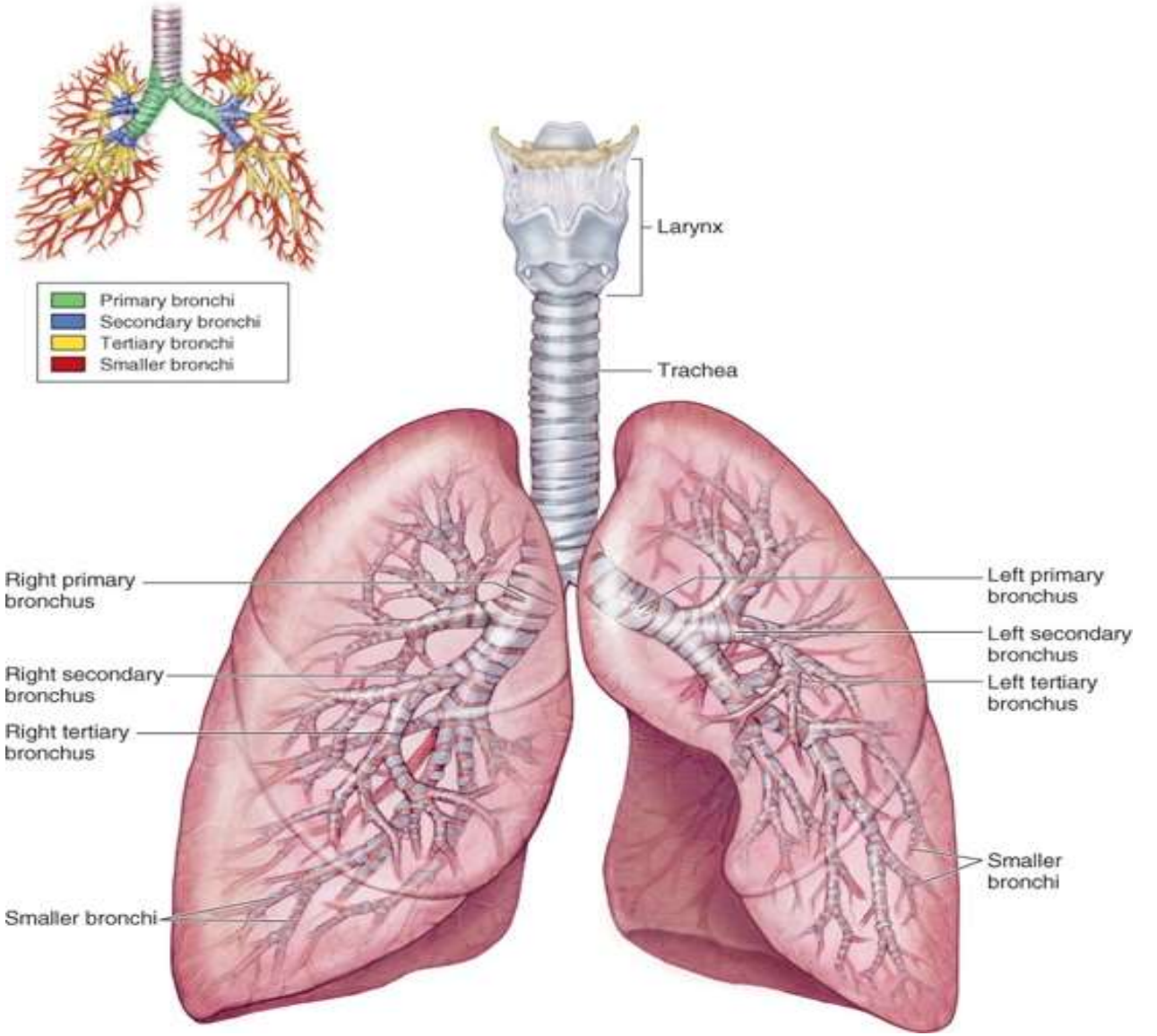
4

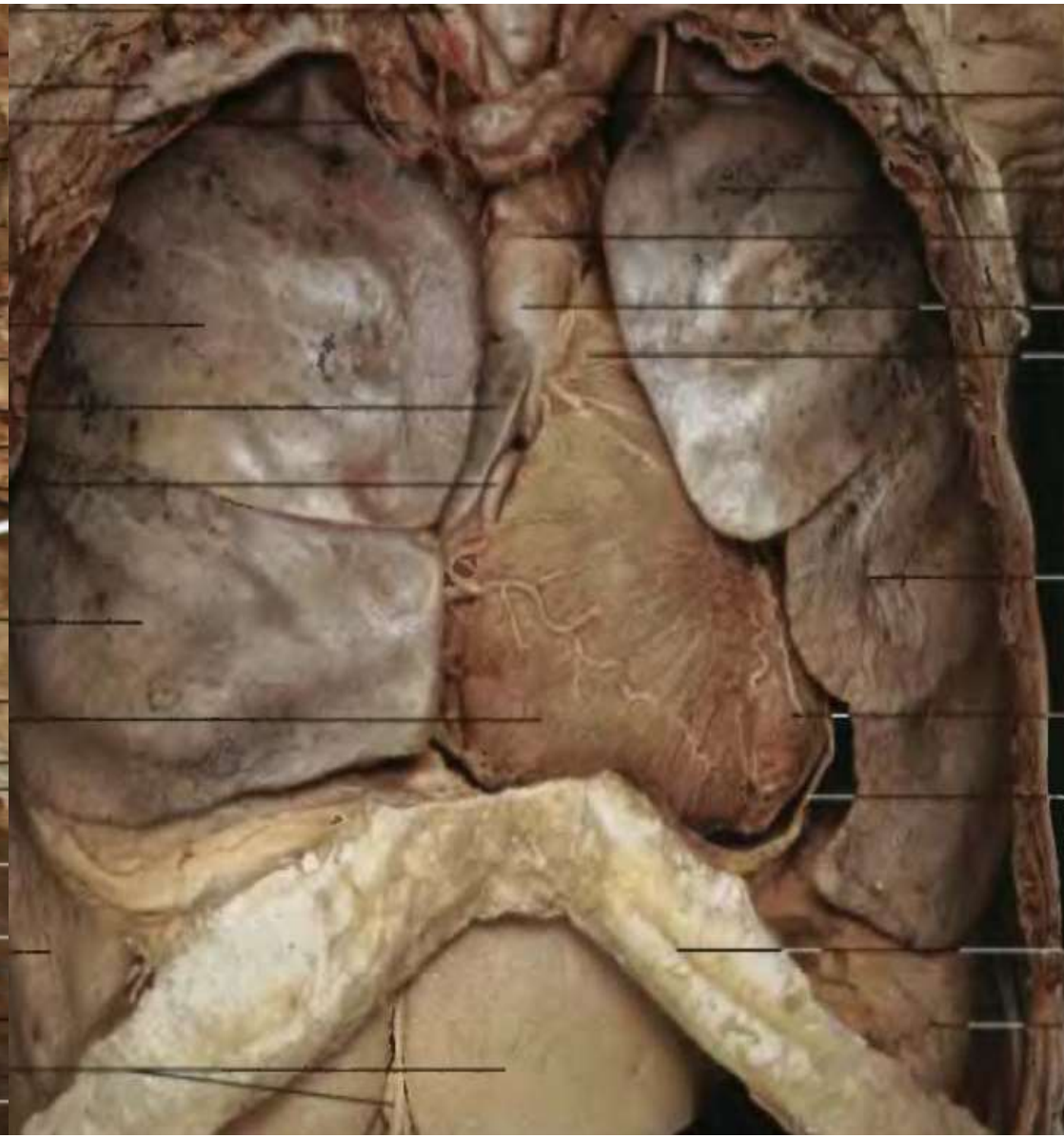


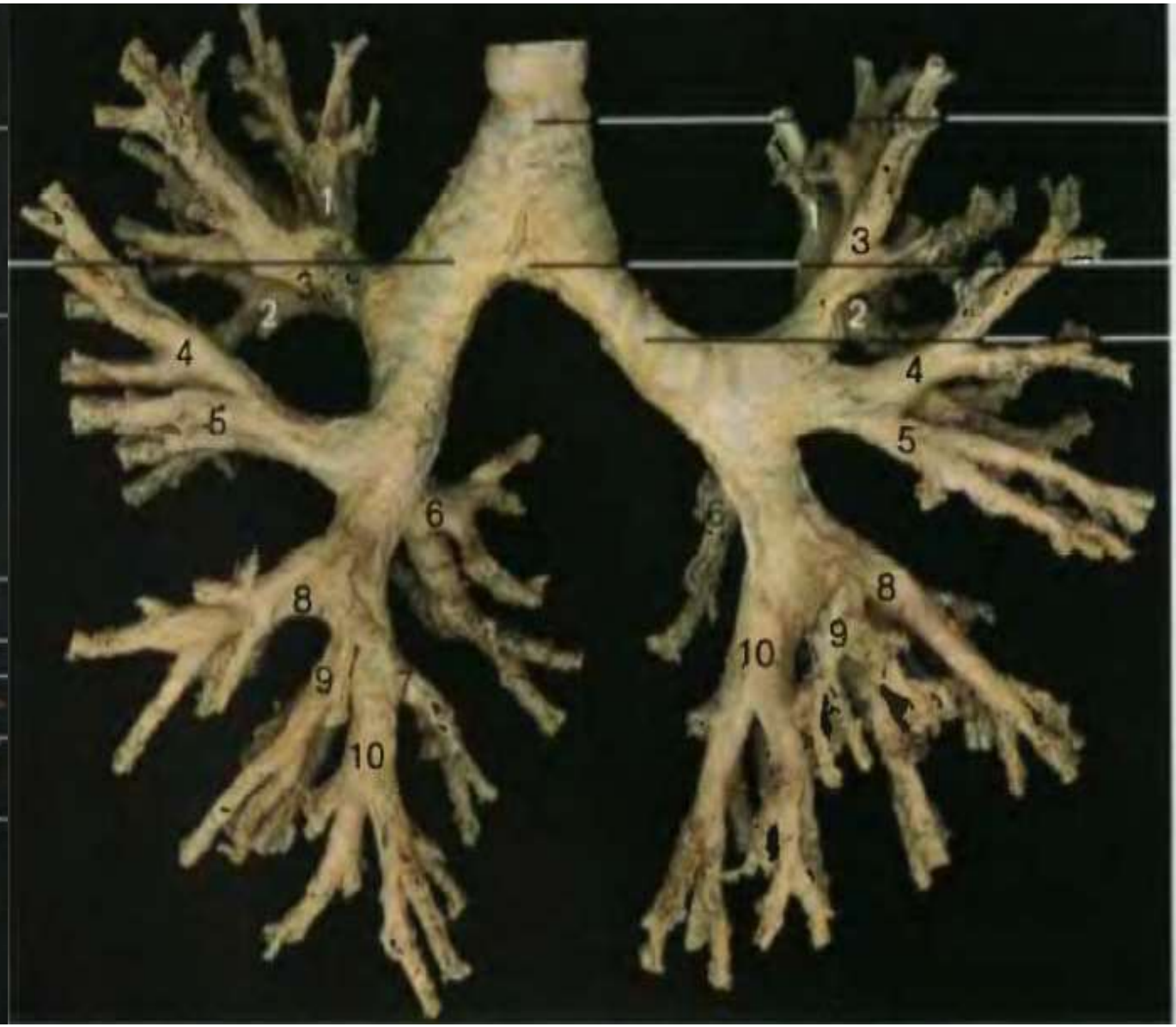
5




Parietal pleura
Visceral pleura
Pleural cavity
Intrapleural pressure
Lung
Intrapulmonary pressure
Parietal pleura
Visceral pleura
Pleural cavity
Diaphragm


Primary bronchi
Secondary bronchi
Tertiary bronchi
Smaller bronchi
Larynx
Trachea
Right primary bronchus
Right secondary bronchus
Right tertiary bronchus
Smaller bronchi
Left primary bronchus
Left secondary bronchus
Left tertiary bronchus
Smaller bronchi

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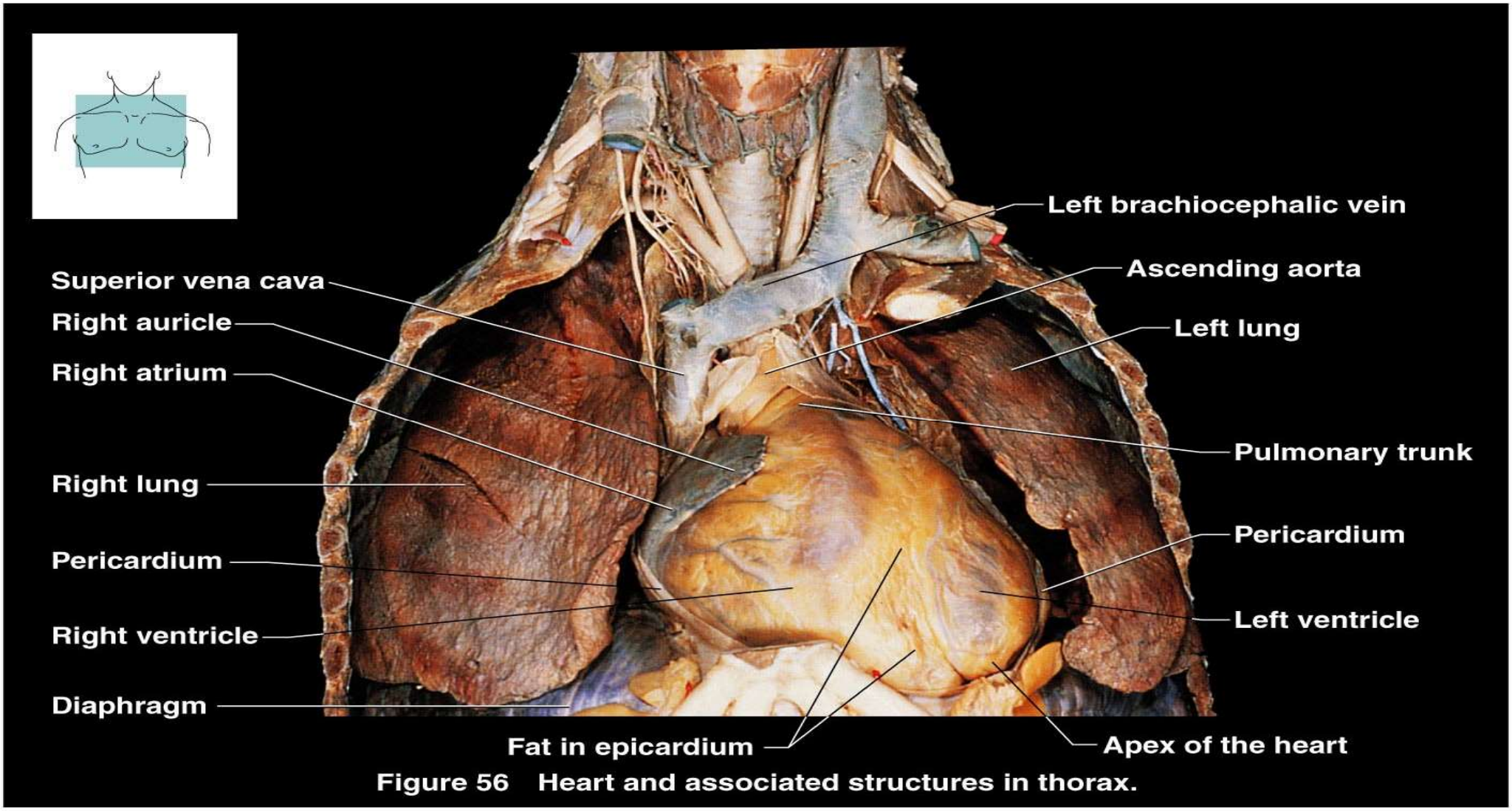


Figure 56 Heart and associated structures in thorax.

Figure 22.56

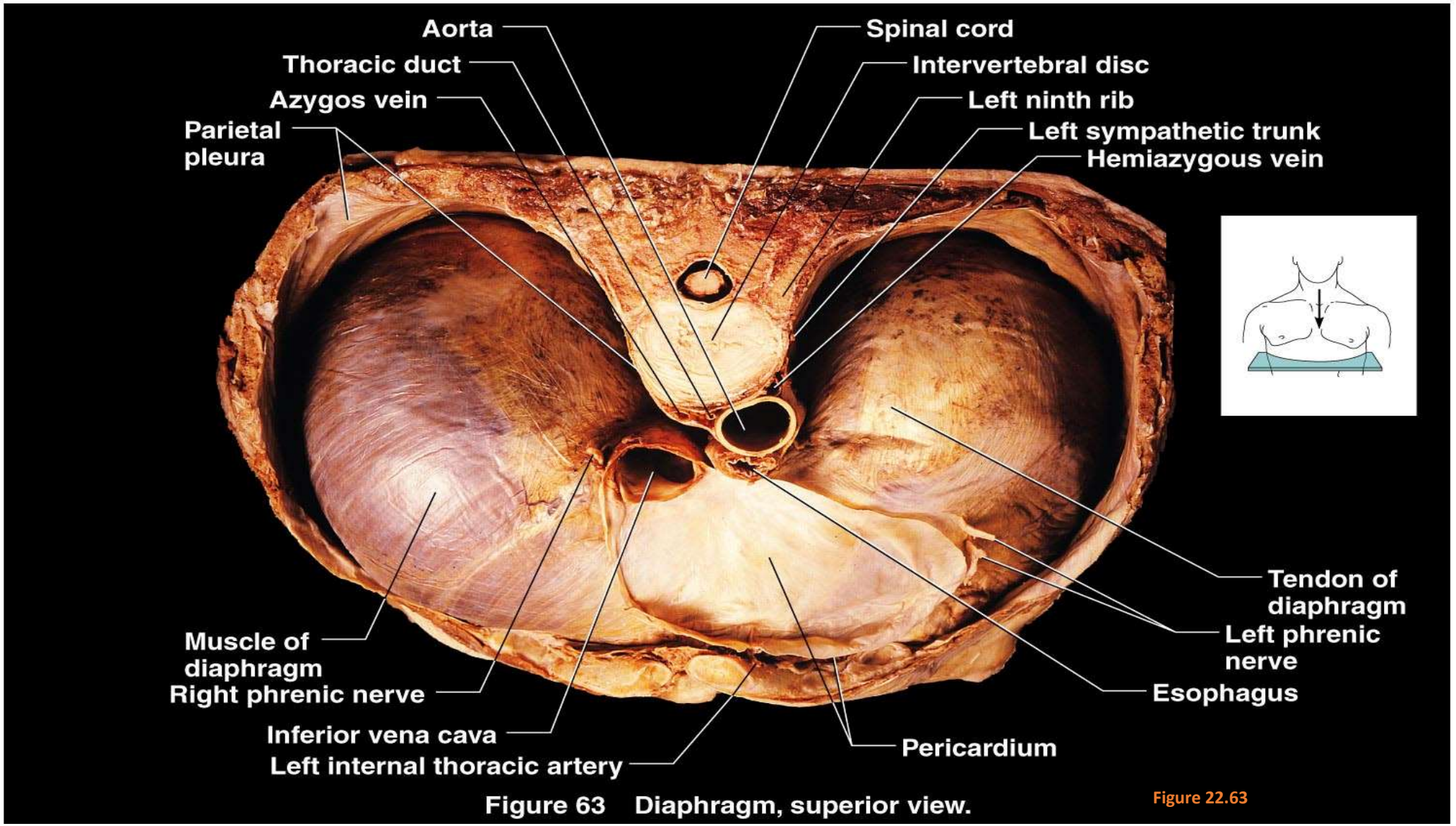
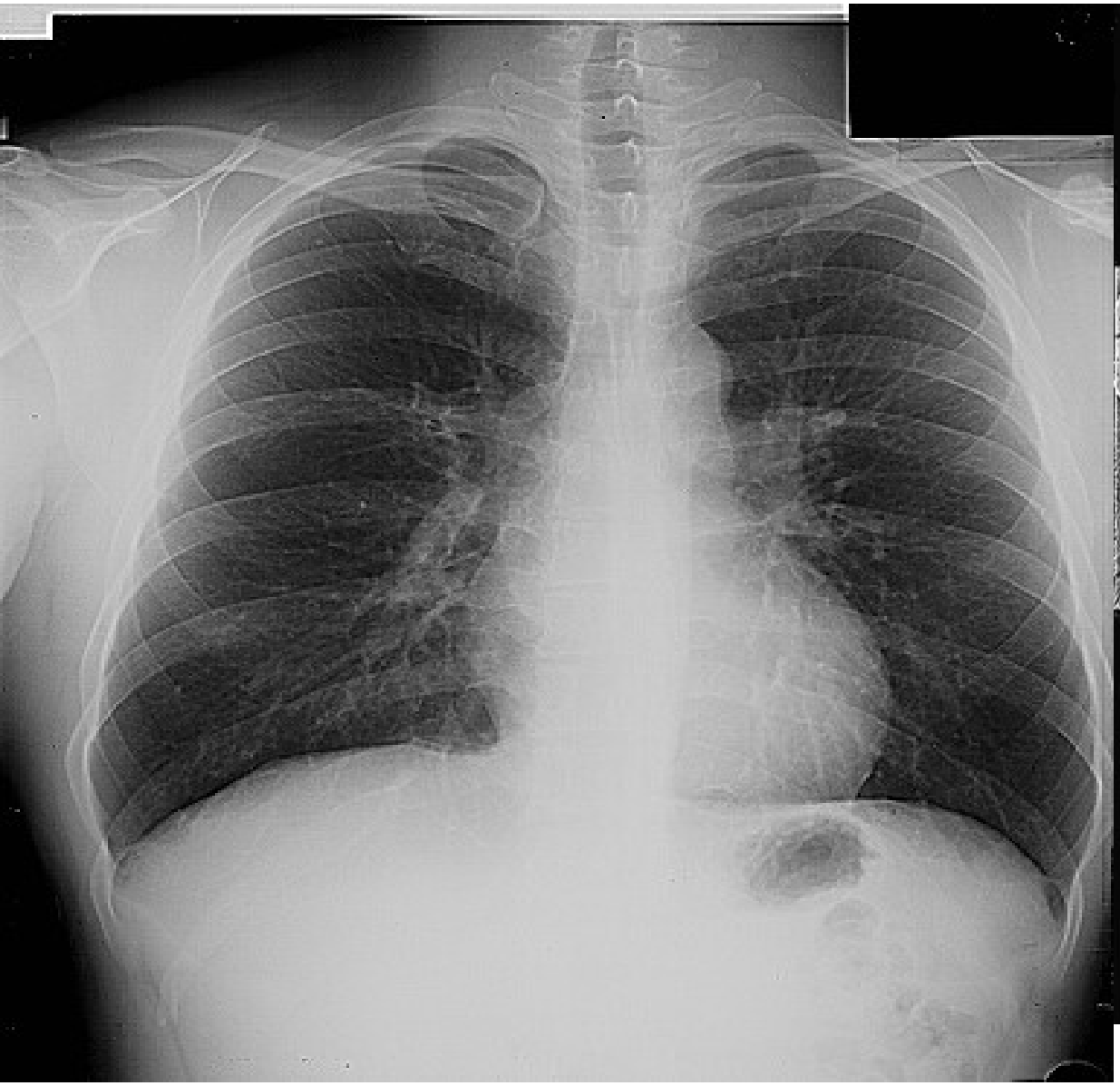
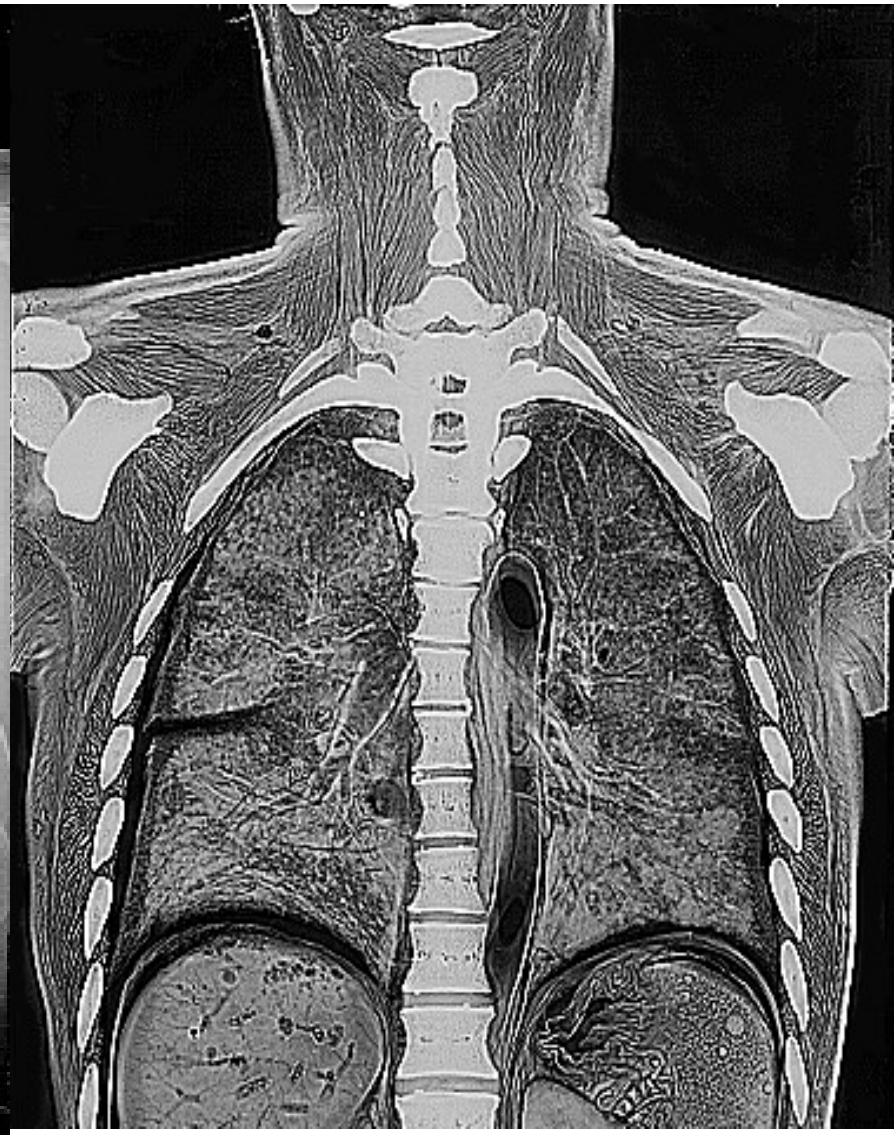


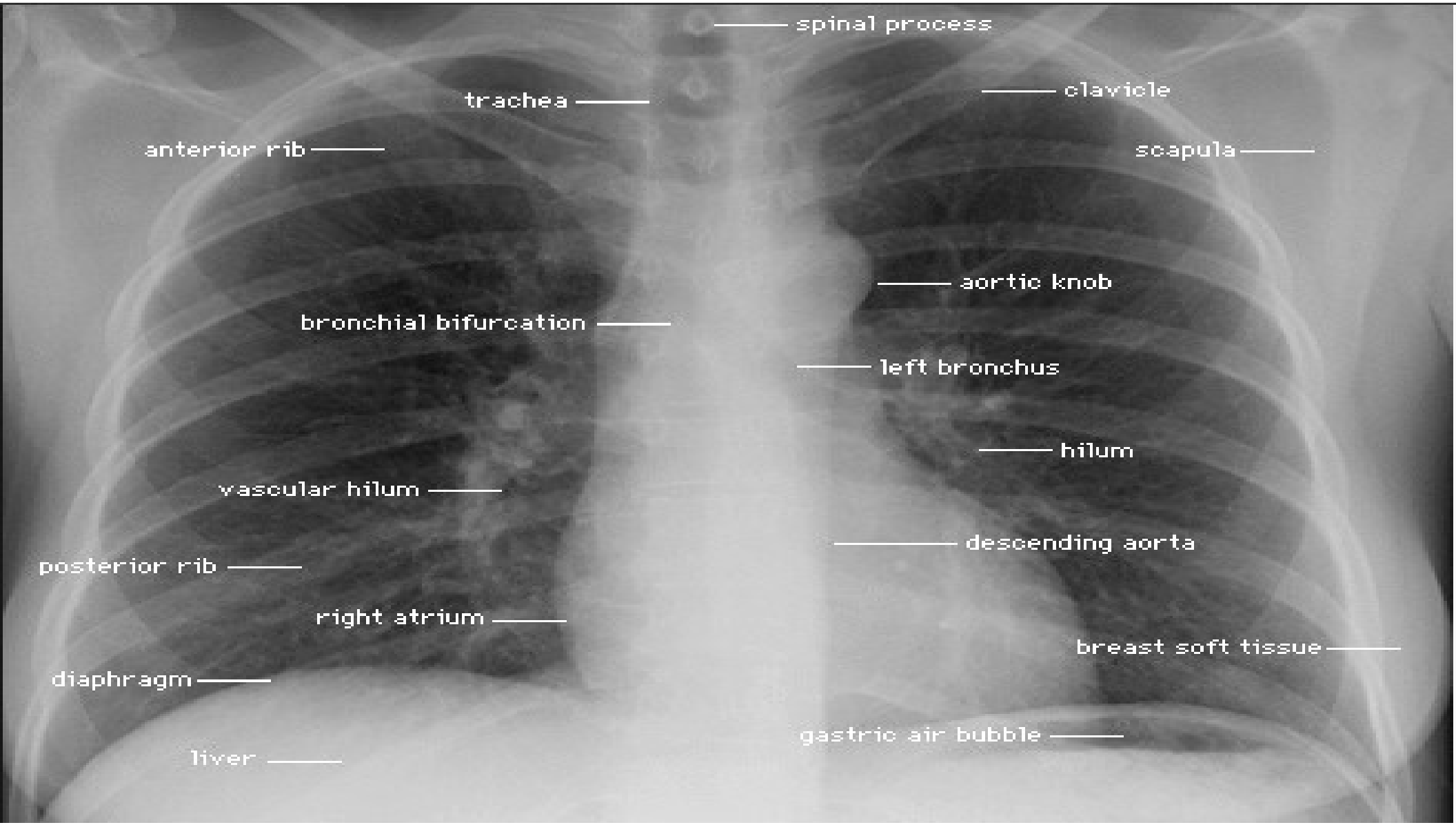
Figure 63 Diaphragm, superior view.

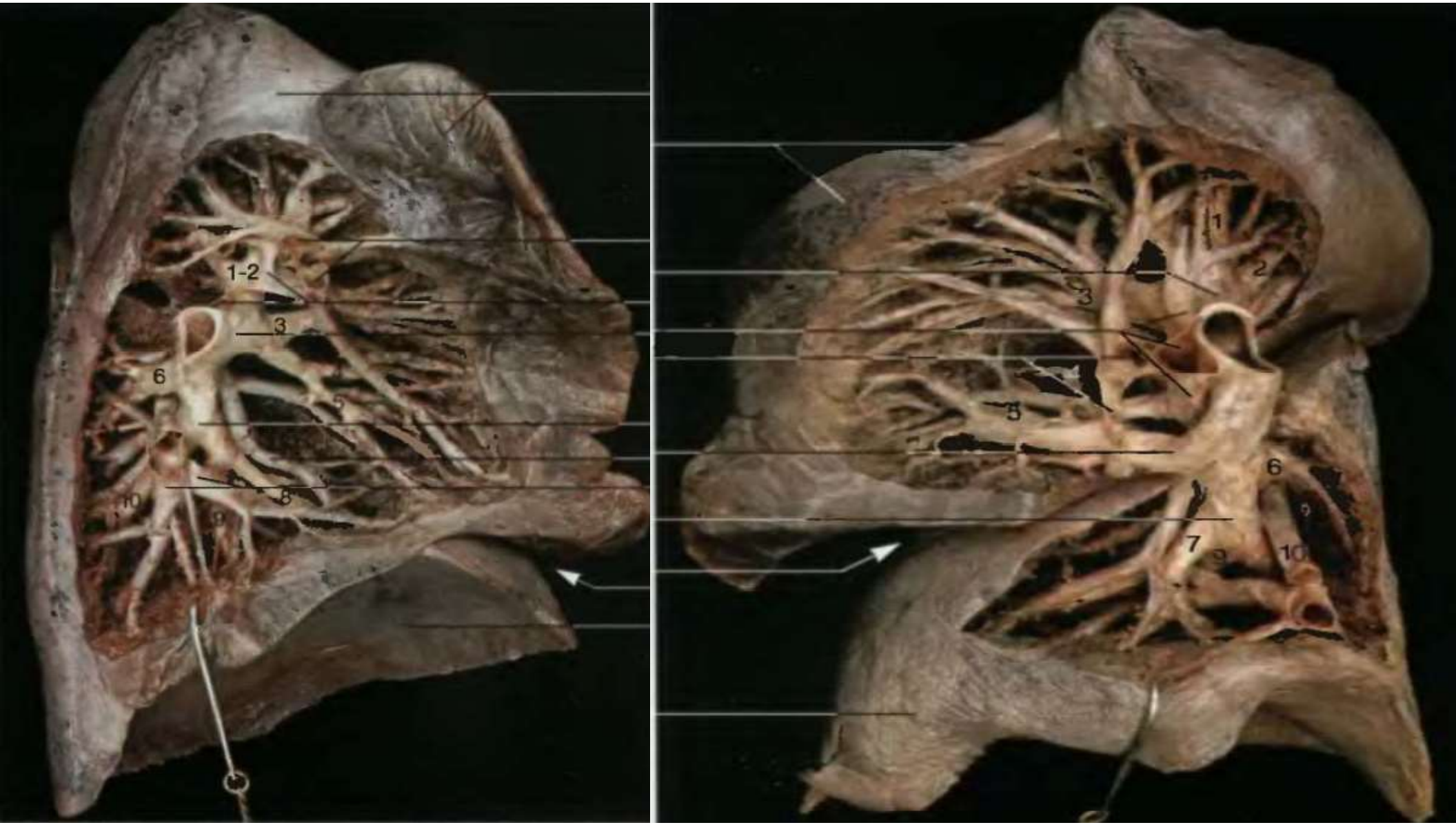
Figure 22.63





cadaver


spinal process
trachea
clavicle
anterior rib
scapula
aortic knob
bronchial bifurcation
left bronchus
hilum
vascular hilum
descending aorta
posterior rib
right atrium
breast soft tissue
diaphragm
gastric air bubble
liver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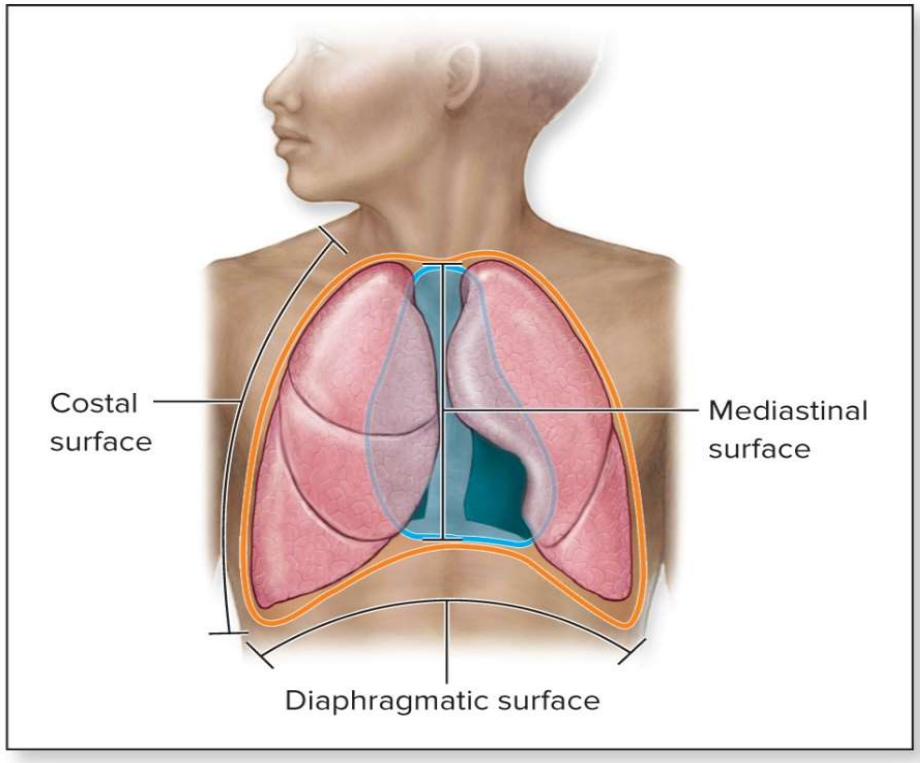
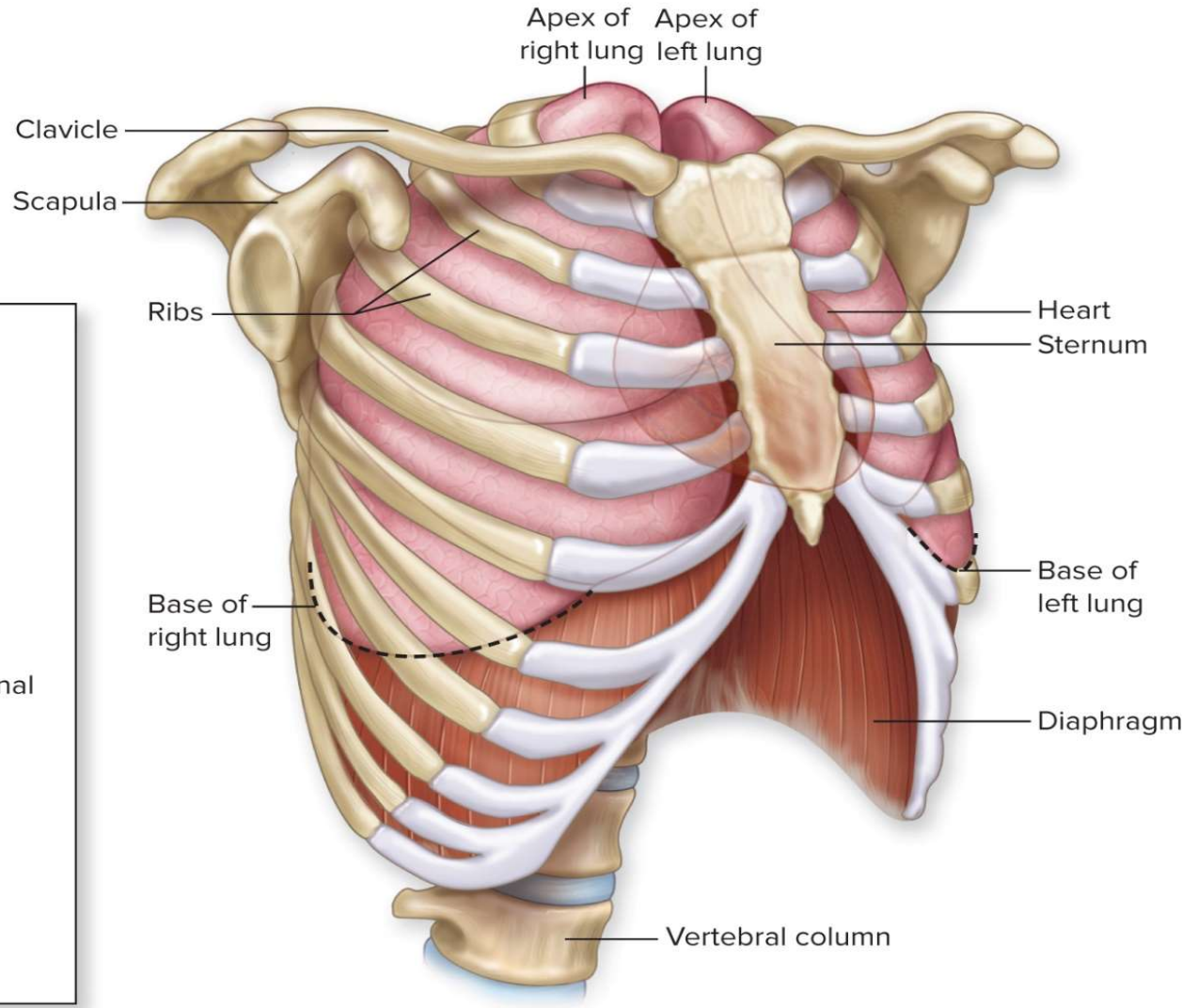
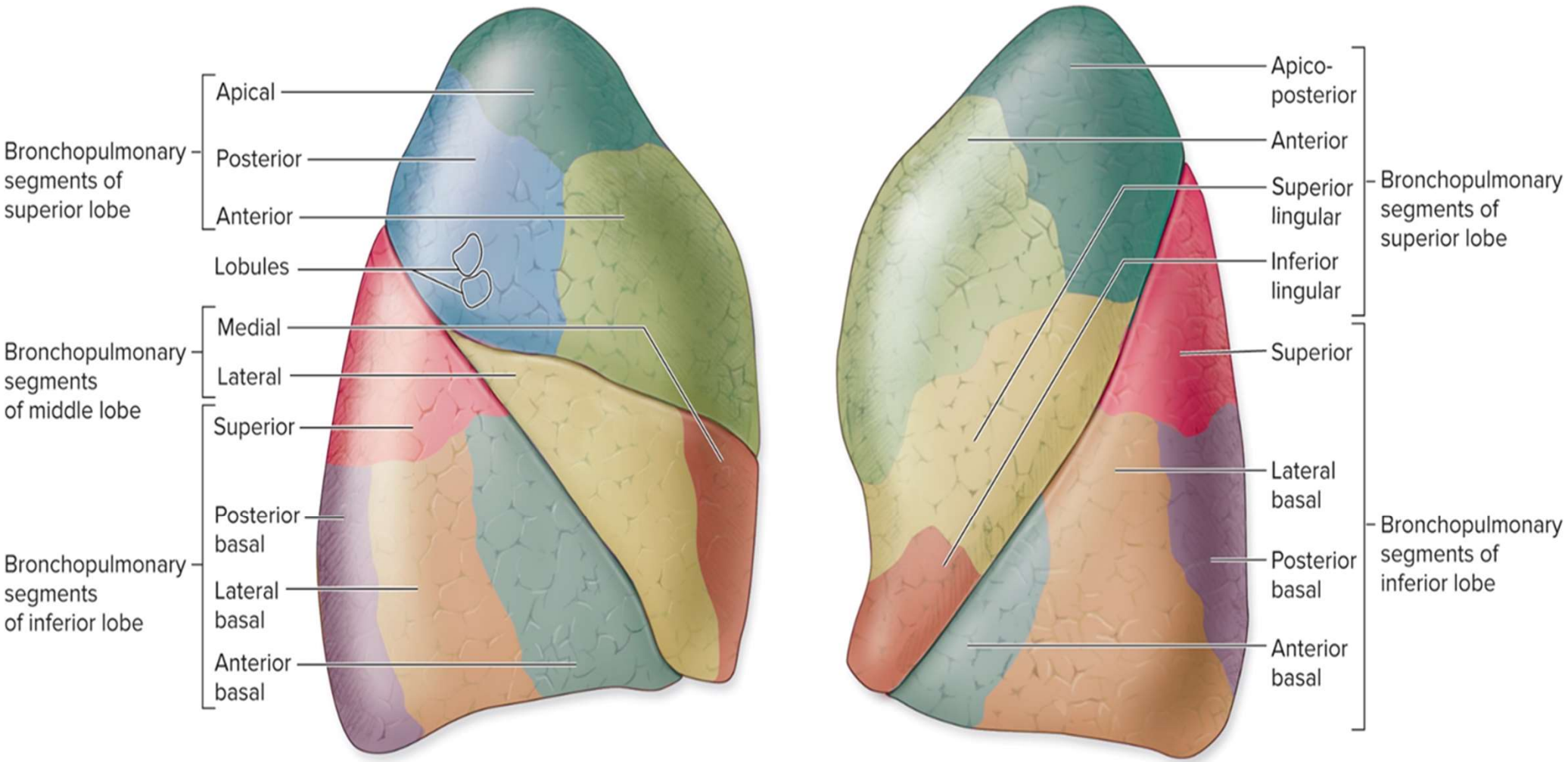
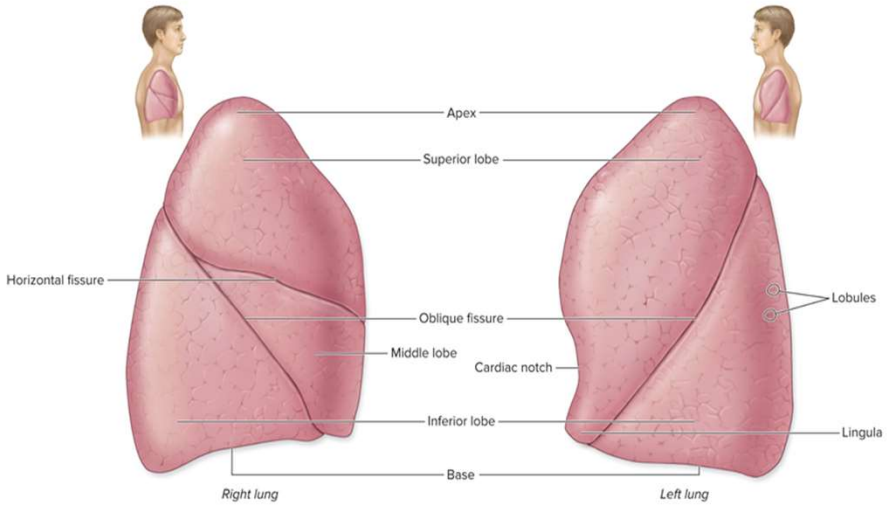
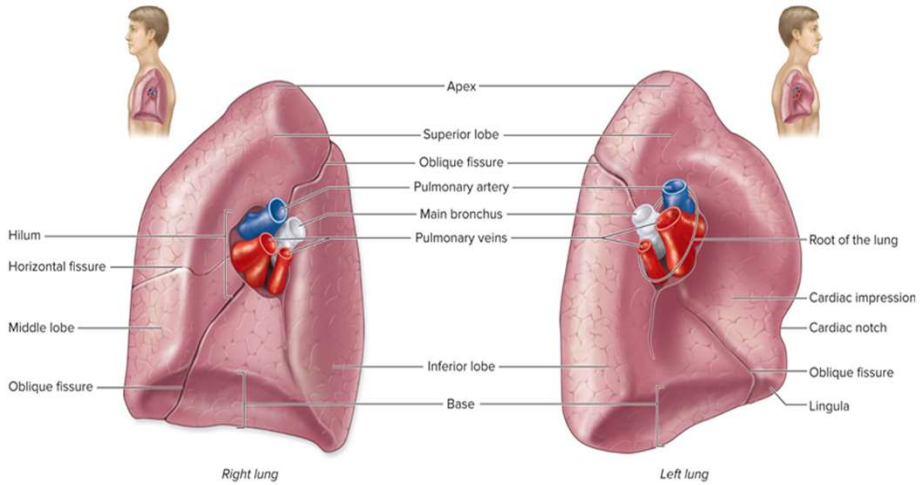




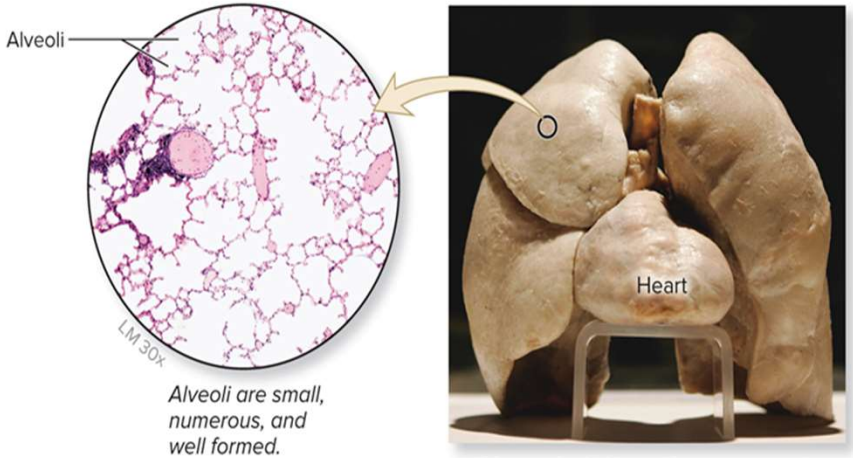




(a) Lateral views



(b) Medial views



Alveoli are small, numerous, and well formed.

(a) *Nonsmoker's lungs: Lungs appear tan or pinkish.*

Alveoli are enlarged, are less numerous, and contain black deposits.

(b) *Smoker's lungs: Lungs are blackened.*

Table 23.2 Respiration Processes

Process	Description	Body Systems
Pulmonary ventilation	Movement of air between atmosphere and the alveoli • Net movement of oxygen from atmosphere to alveoli during inspiration (step 1) • Net movement of carbon dioxide from alveoli to atmosphere during expiration (step 8)	Respiratory, skeletal, muscular, and nervous
Alveolar gas exchange	Exchange of respiratory gases between alveoli of the lungs and the blood • Oxygen diffuses from alveoli into blood (step 2) • Carbon dioxide diffuses from blood into alveoli (step 7)	Respiratory and cardiovascular
Gas transport	Blood transport of respiratory gases between lungs and systemic cells of the body • Oxygen is transported from lungs to systemic cells (step 3) • Carbon dioxide is transported from systemic cells to lungs (step 6)	Cardiovascular
Systemic gas exchange	Exchange of respiratory gases between blood and systemic cells • Oxygen diffuses from blood into systemic cells (step 4) • Carbon dioxide diffuses from systemic cells into blood (step 5)	Cardiovascular