Respiratory system

Practical part

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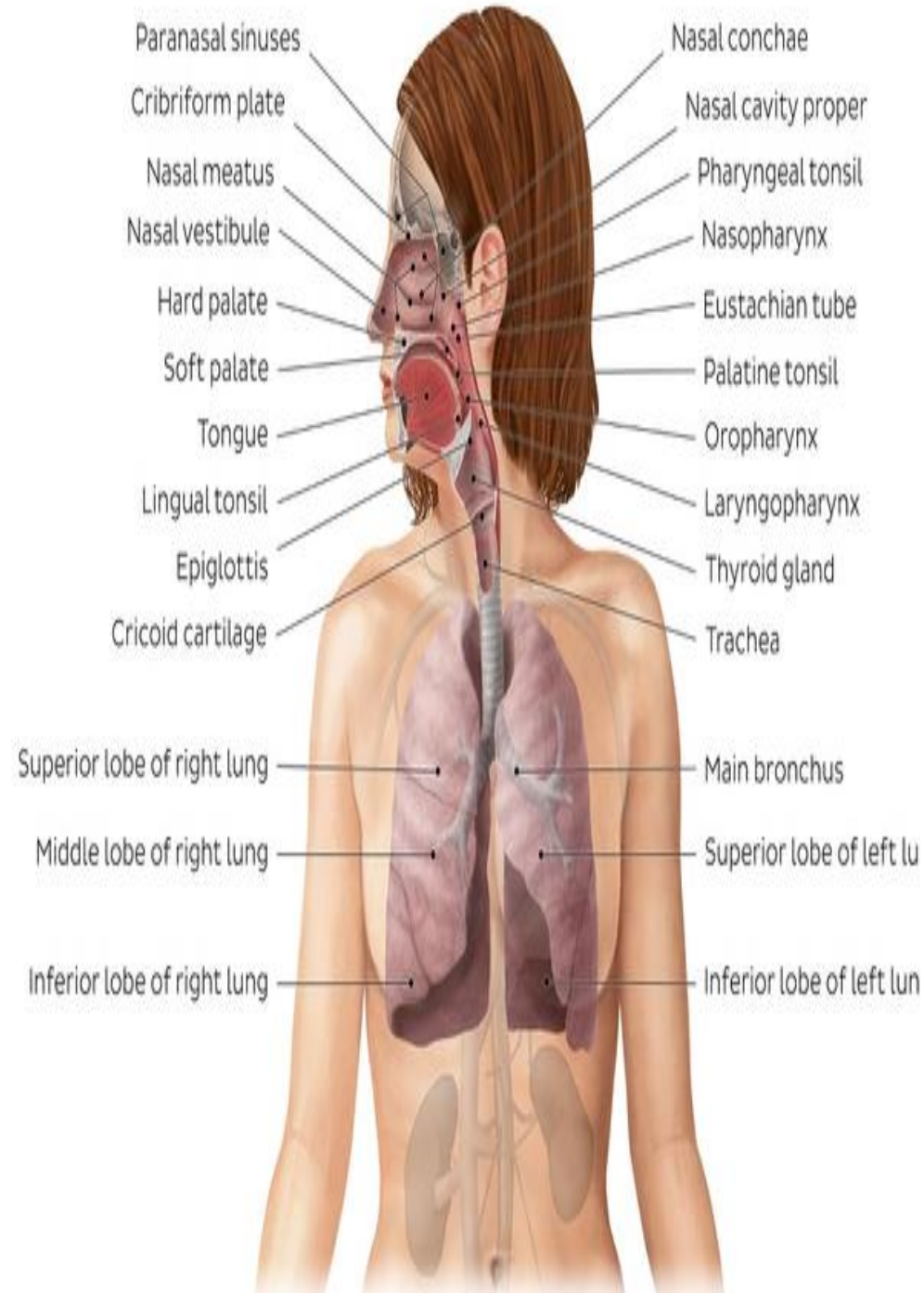
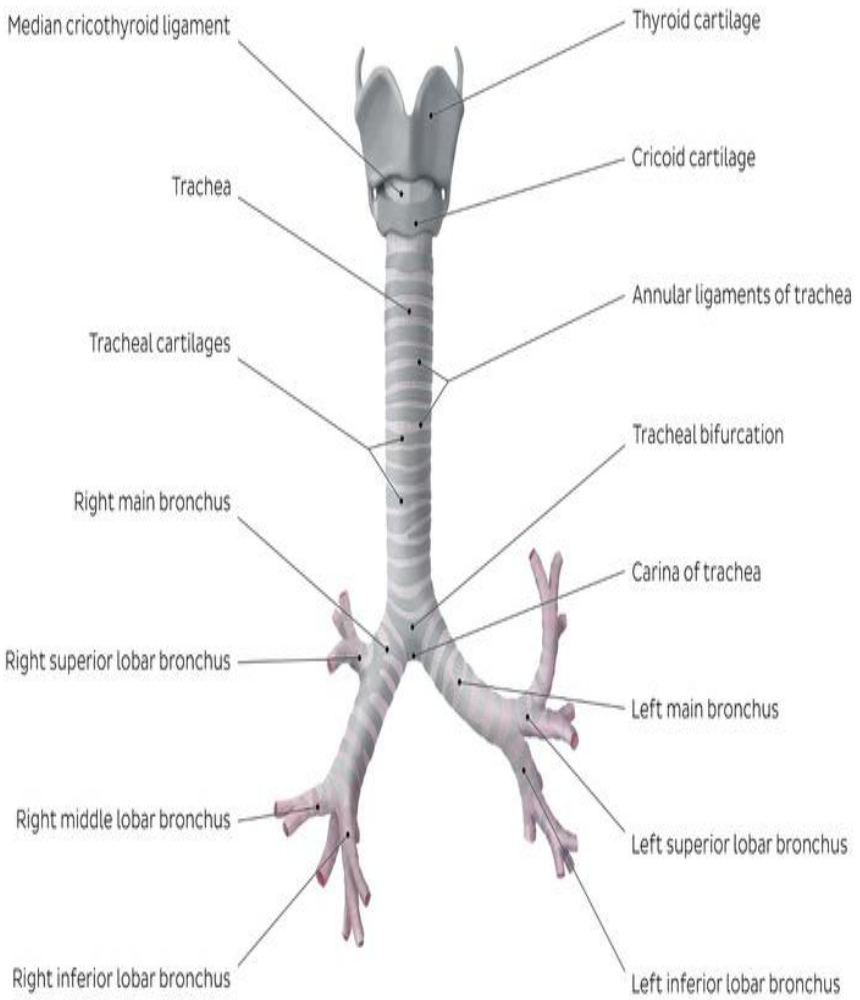




Structurally:

1) Upper respiratory tract
(external nose, nasal cavity and pharynx)

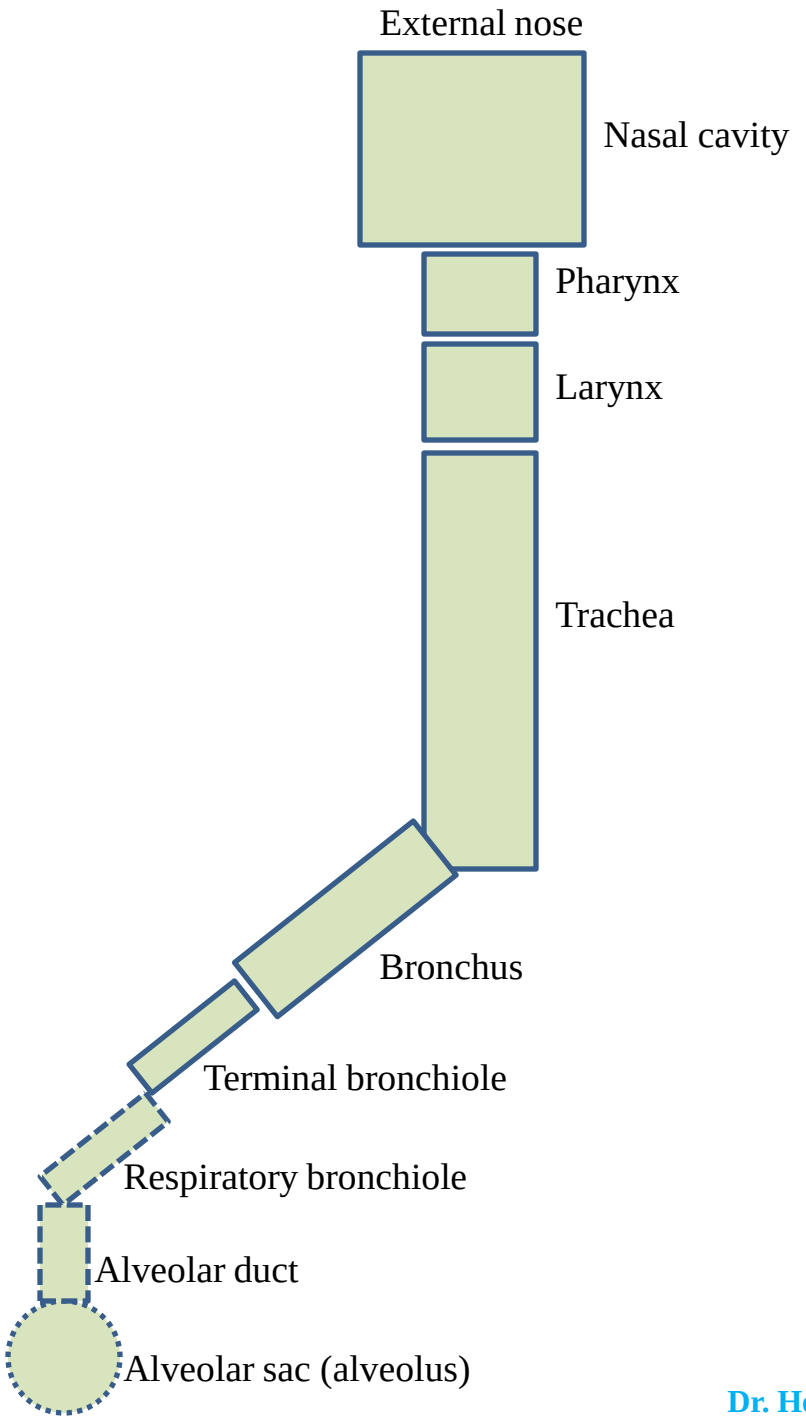
2) Lower respiratory tract
(larynx, trachea, bronchi, bronchioles and lungs).

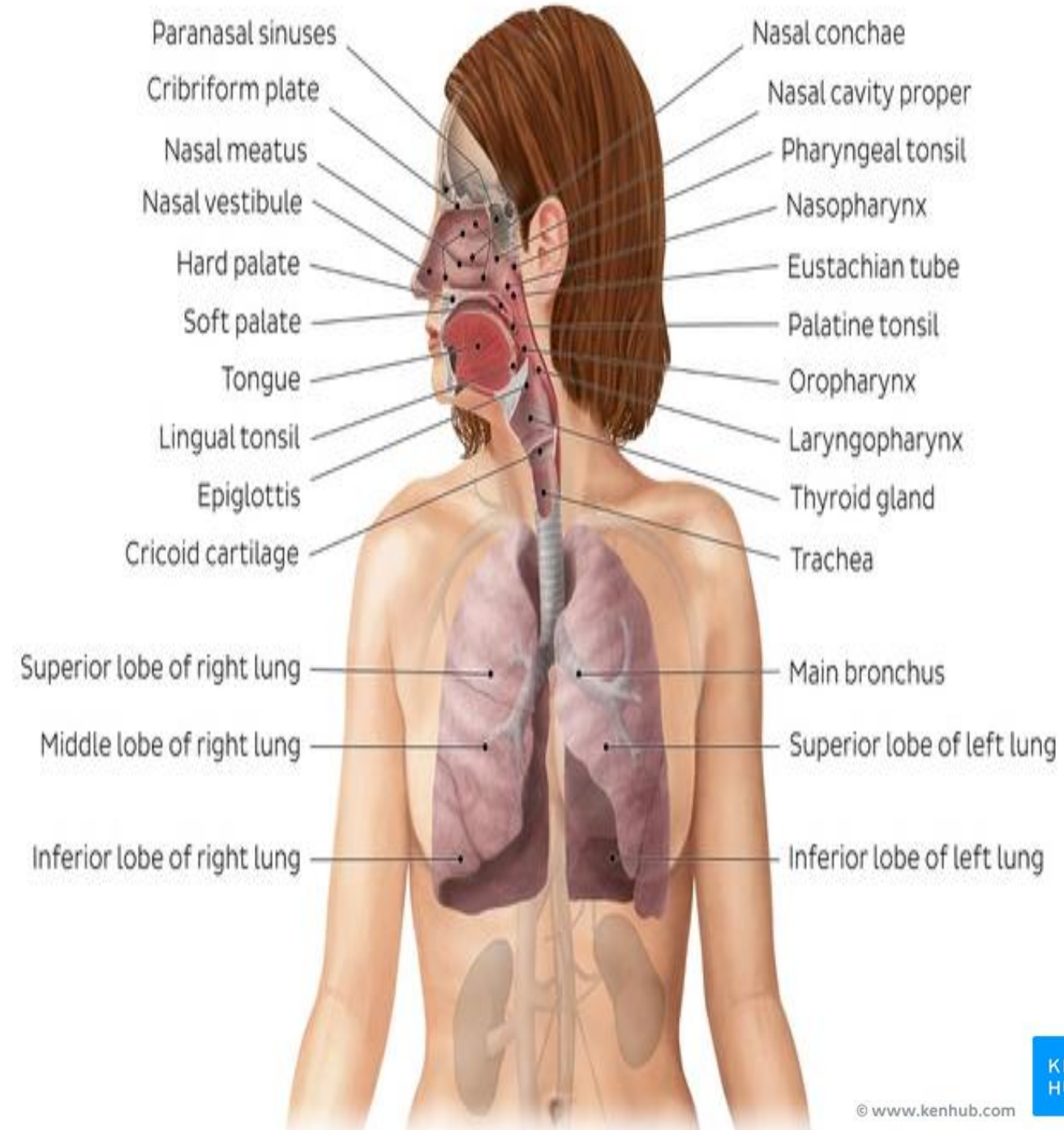
Organization of the Respiratory System

Functionally:

1) Conducting portion:
(transportation)
Includes
the external nose, nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles and terminal bronchioles

2) Respiratory portion:
(gas exchange).
Includes
small airways called respiratory bronchioles and alveolar ducts as well as air sacs called alveoli





Functions

Oxygen supplier. The job of the respiratory system is to keep the body constantly supplied with oxygen.

Elimination. Elimination of carbon dioxide.

Gas exchange. between the blood and the external environment.

Passageway. Passageways that allow air to reach the lungs.

Humidifier. Purify, humidify, and warm incoming air

Sound production

Contains receptors for smell

Helps regulate blood pH

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The Nose

The nose consists of:

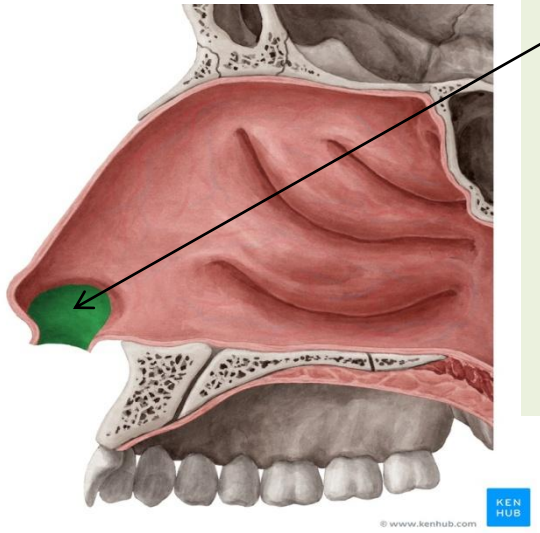
1- The **external nose**

2- The **nasal cavity**

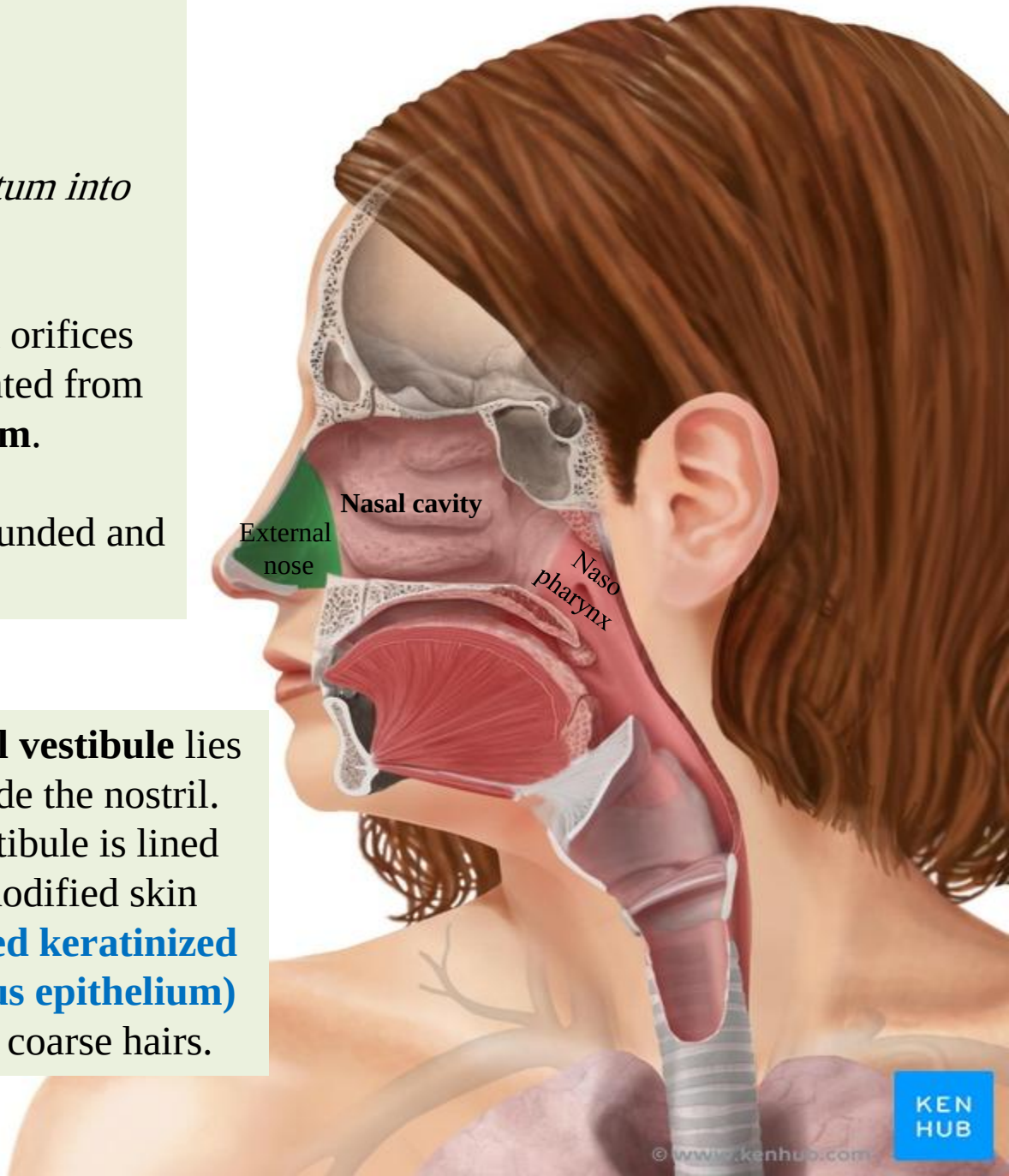
both of which are divided by a septum into right and left halves

The external nose has two elliptical orifices called the **nostrils,** which are separated from each other by the **nasal septum**.

The lateral margin, the **ala nasi**, is rounded and mobile



The **nasal vestibule** lies just inside the nostril. The vestibule is lined with modified skin **(Stratified keratinized squamous epithelium)** and has coarse hairs.



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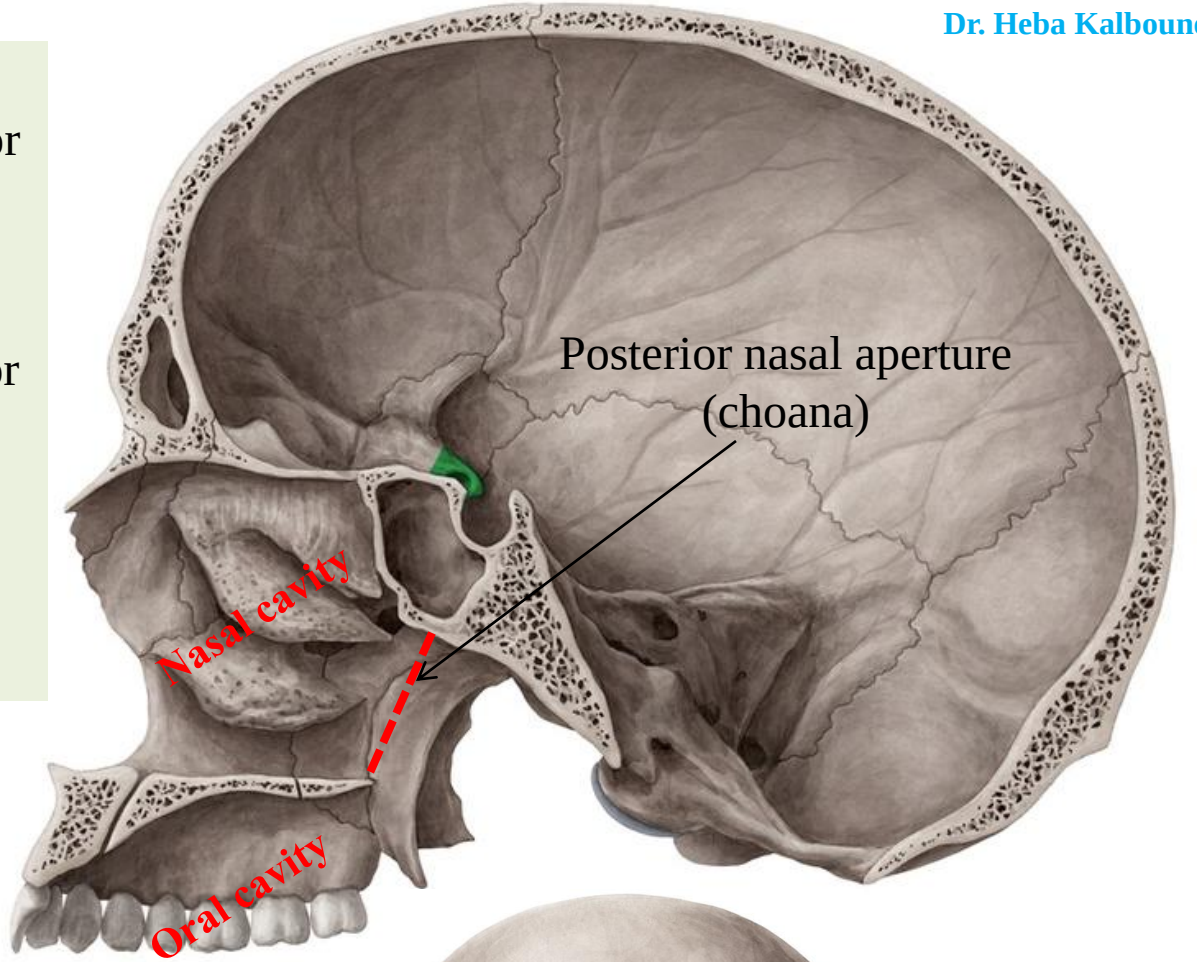
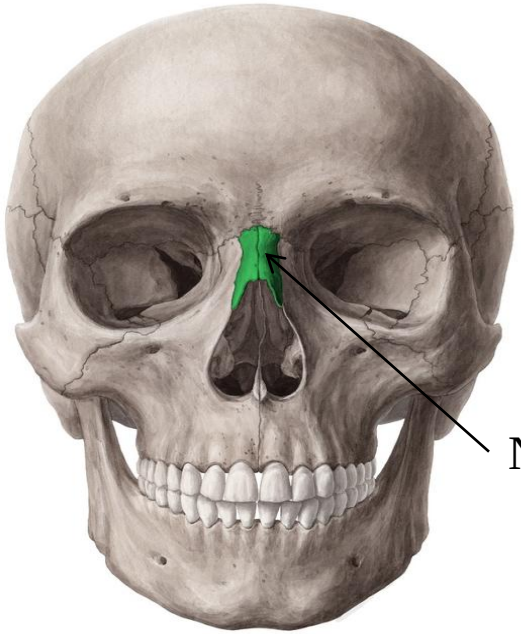
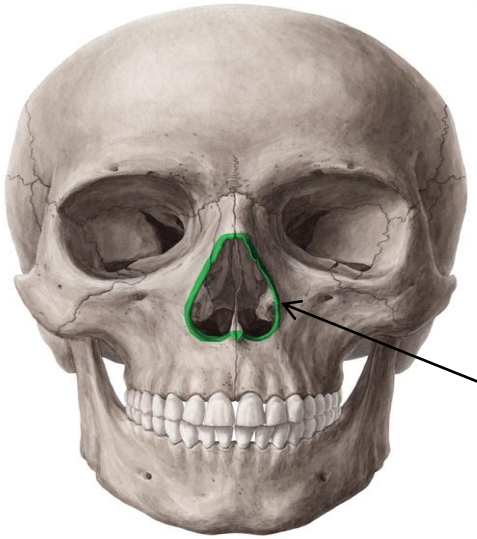
Nasal cavity: large space in the anterior aspect of the skull inferior to the nasal bone and superior to the oral cavity.

Nasal cavity extends from anterior nasal apertures in front to the posterior nasal apertures or choanae behind, where the nose opens into the nasopharynx







Walls of the Nasal Cavity

Each half of the nasal cavity has a floor, a roof, a lateral wall, and a medial (septal) wall.

Floor

The maxilla and the palatine bone

Roof

The roof is narrow and is formed anteriorly beneath the bridge of the nose by the nasal and frontal bones, in the middle by the ethmoid, and posteriorly by the sphenoid

Lateral Wall

The lateral wall has three projections of bone called the superior, middle, and inferior nasal conchae.

Medial Wall

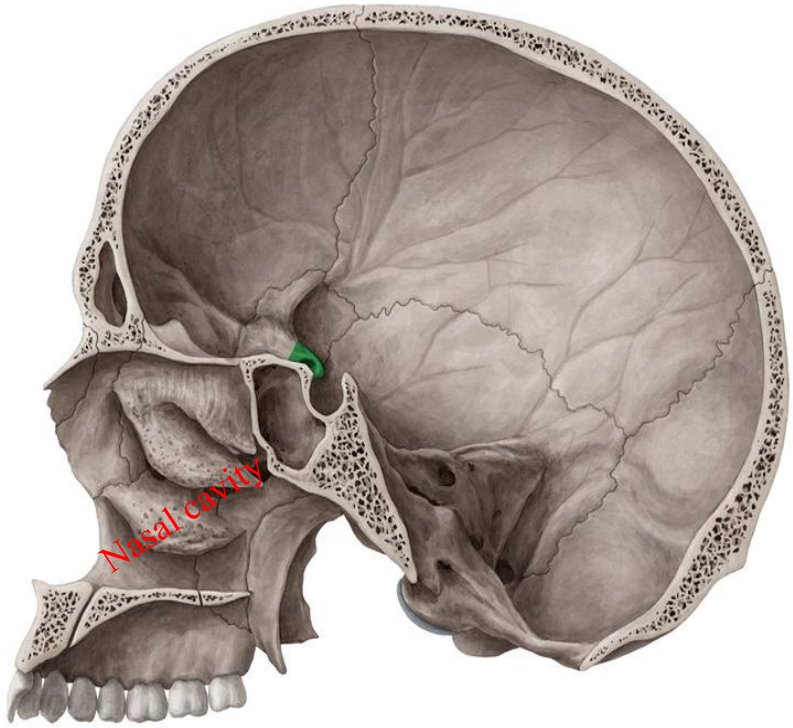
The medial wall is formed by the nasal septum.

The **posterior part** is formed by the vertical plate of the ethmoid and the vomer.

The **anterior part** is formed by the septal cartilage.

The septum rarely lies in the midline, thus increasing the size of one half of the nasal cavity and decreasing the size of the other.

The nasal cavity is divided into right and left halves by the nasal septum.



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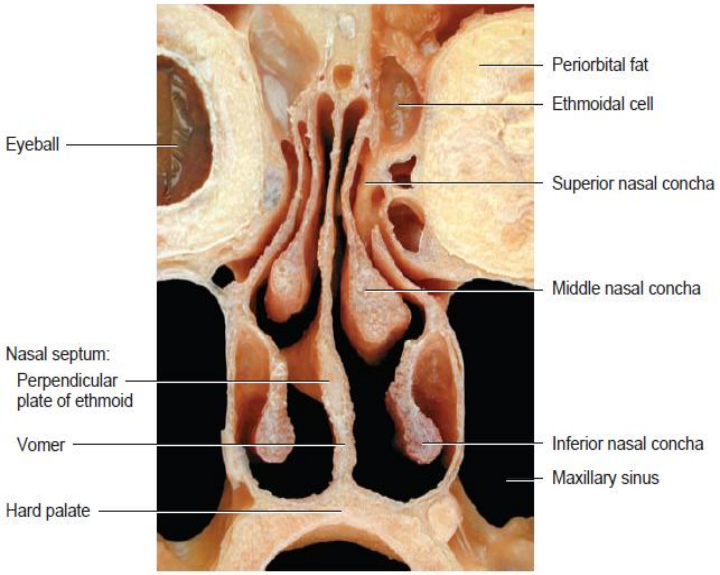
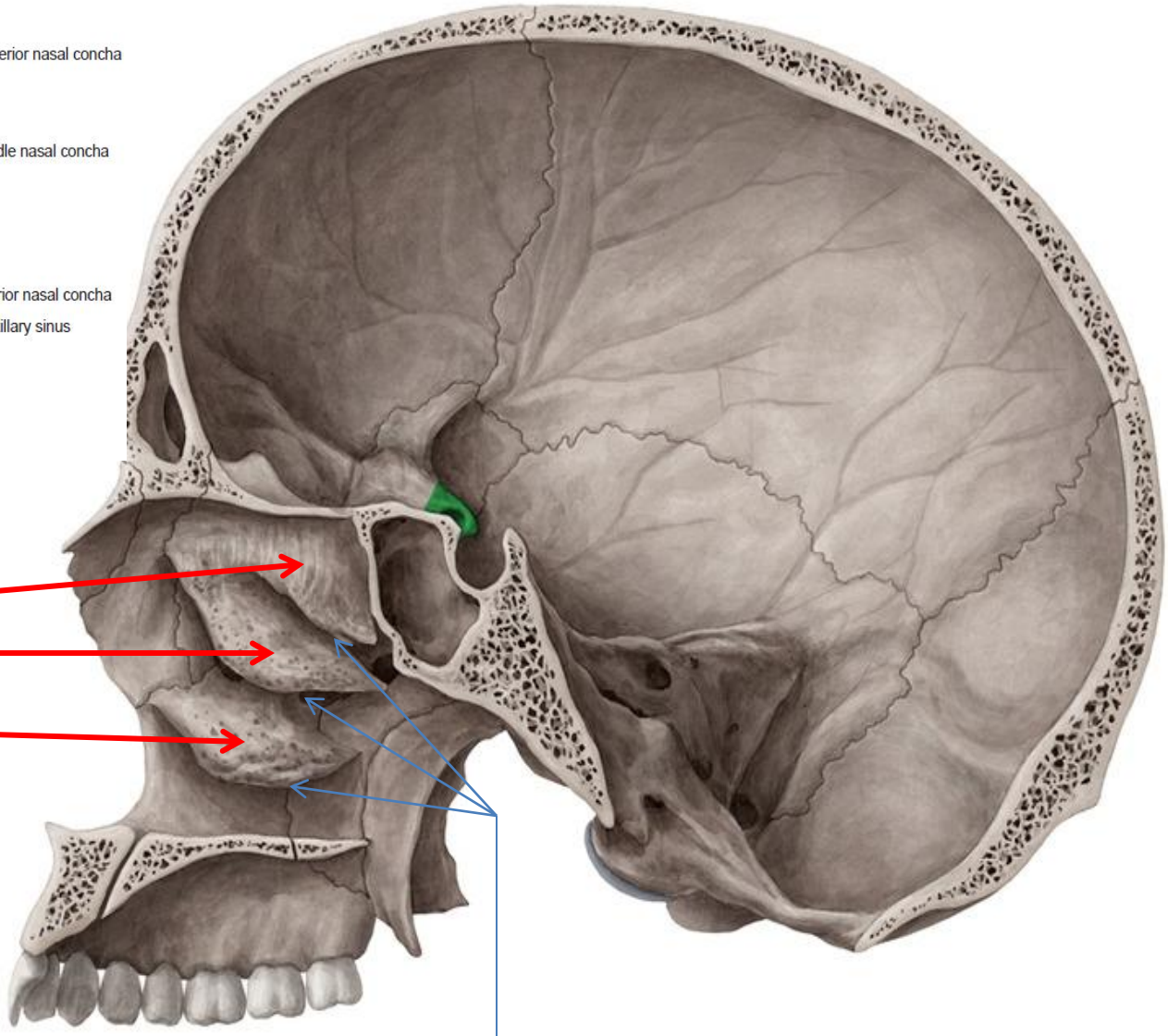


(c) Frontal section showing conchae



Superior nasal concha

Middle nasal concha

Inferior nasal concha

Lateral Wall

Note: The space below each concha is called a meatus.

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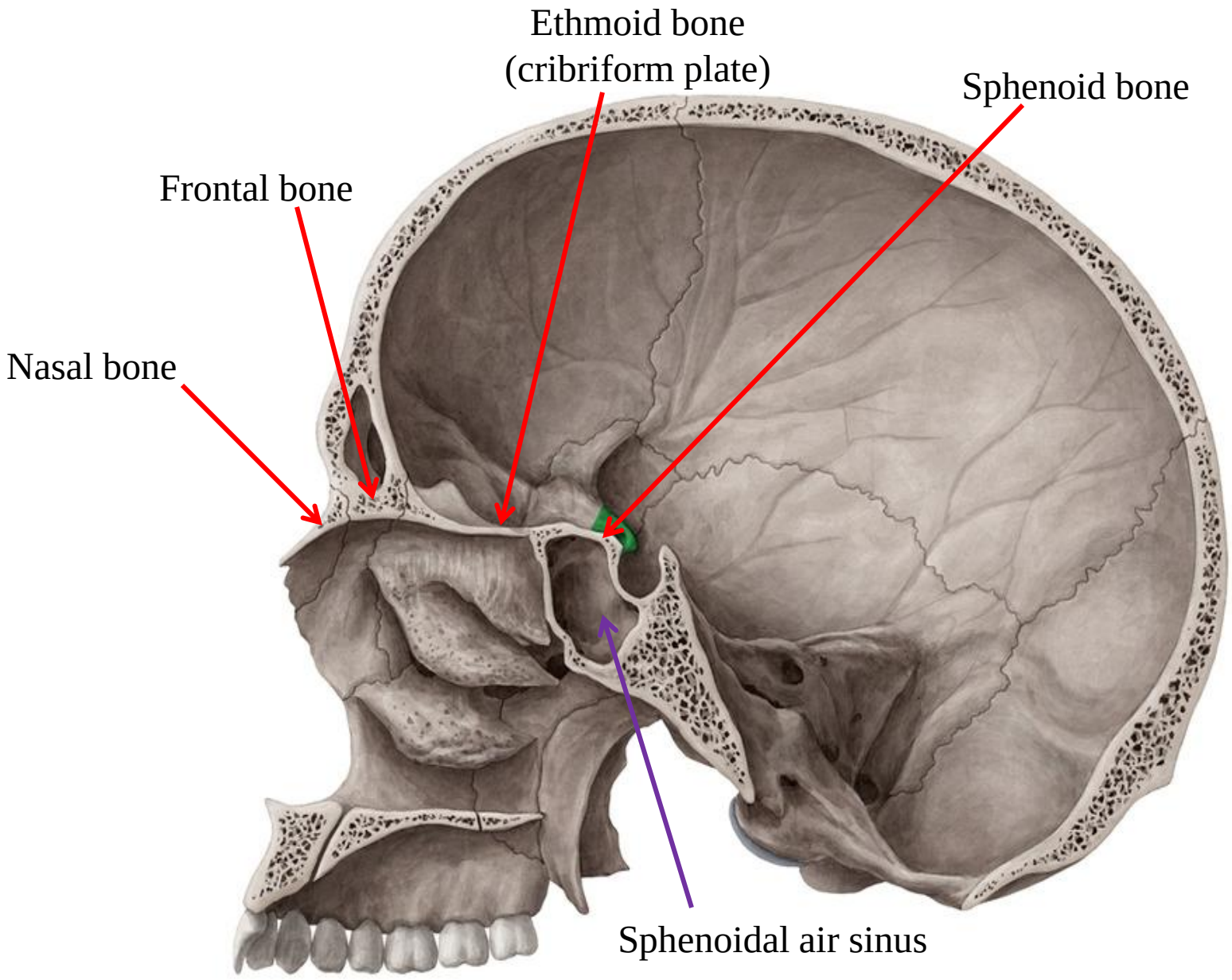
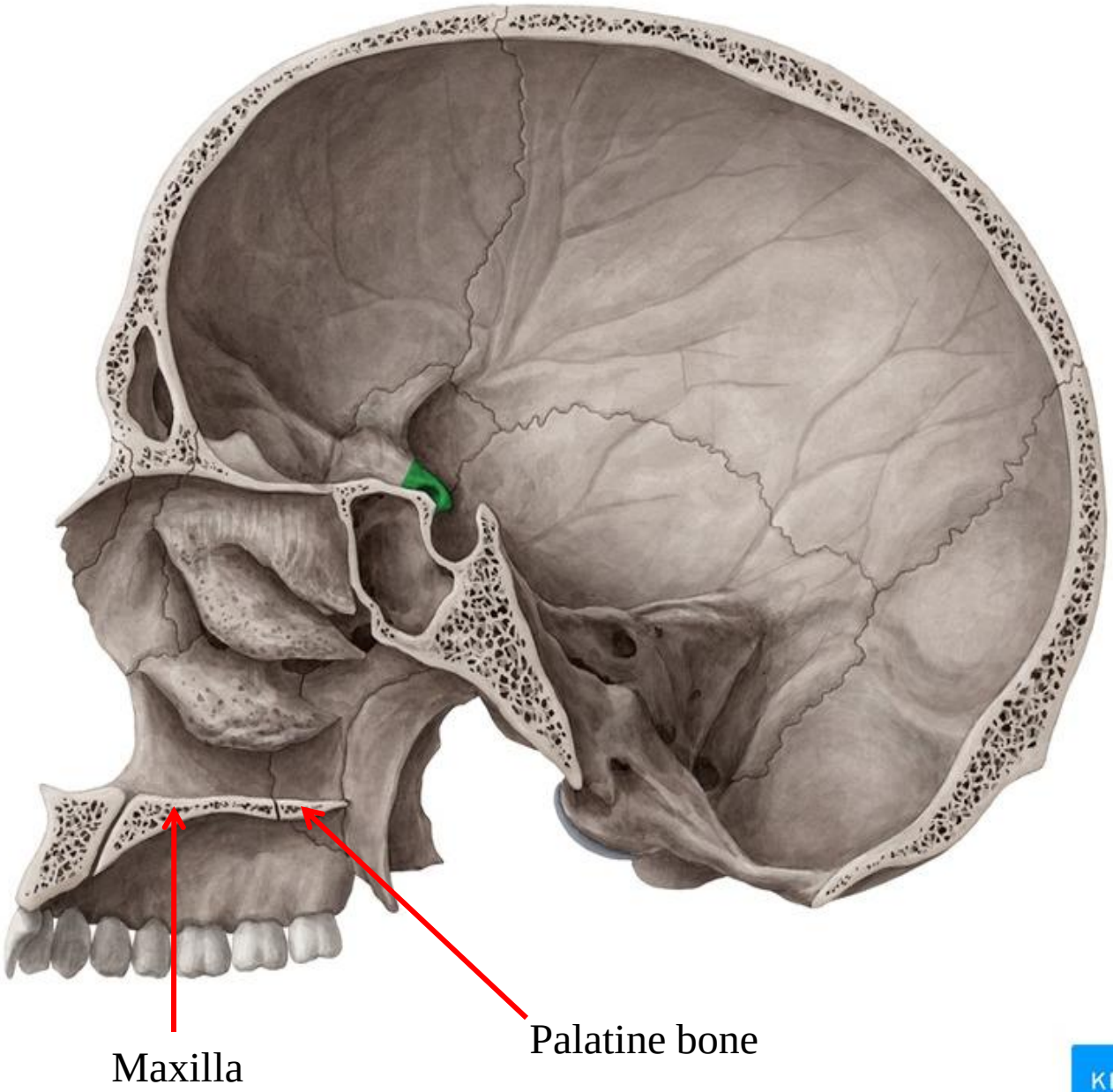
Roof



Floor



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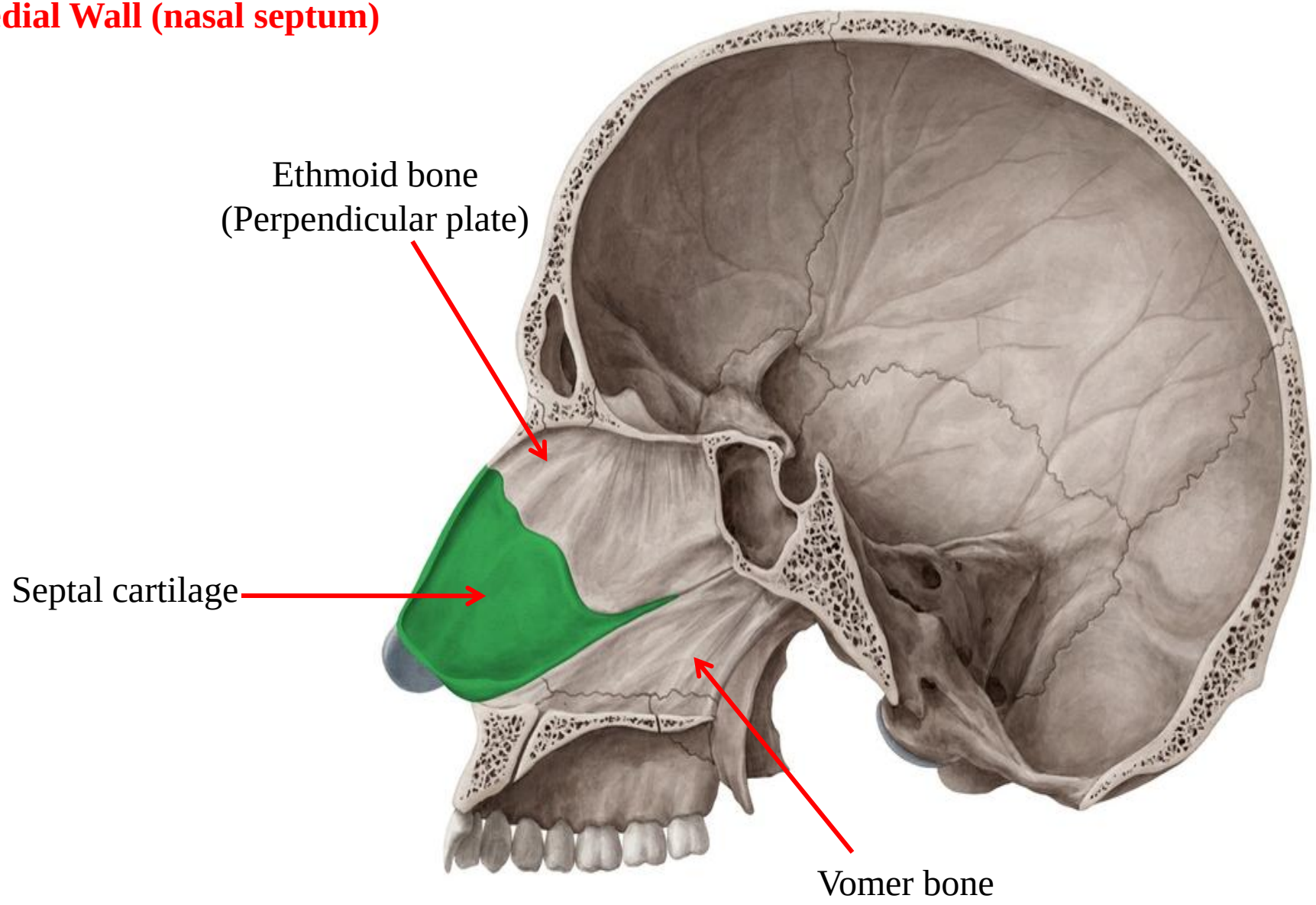
Medial Wall (nasal septum)



Ethmoid bone

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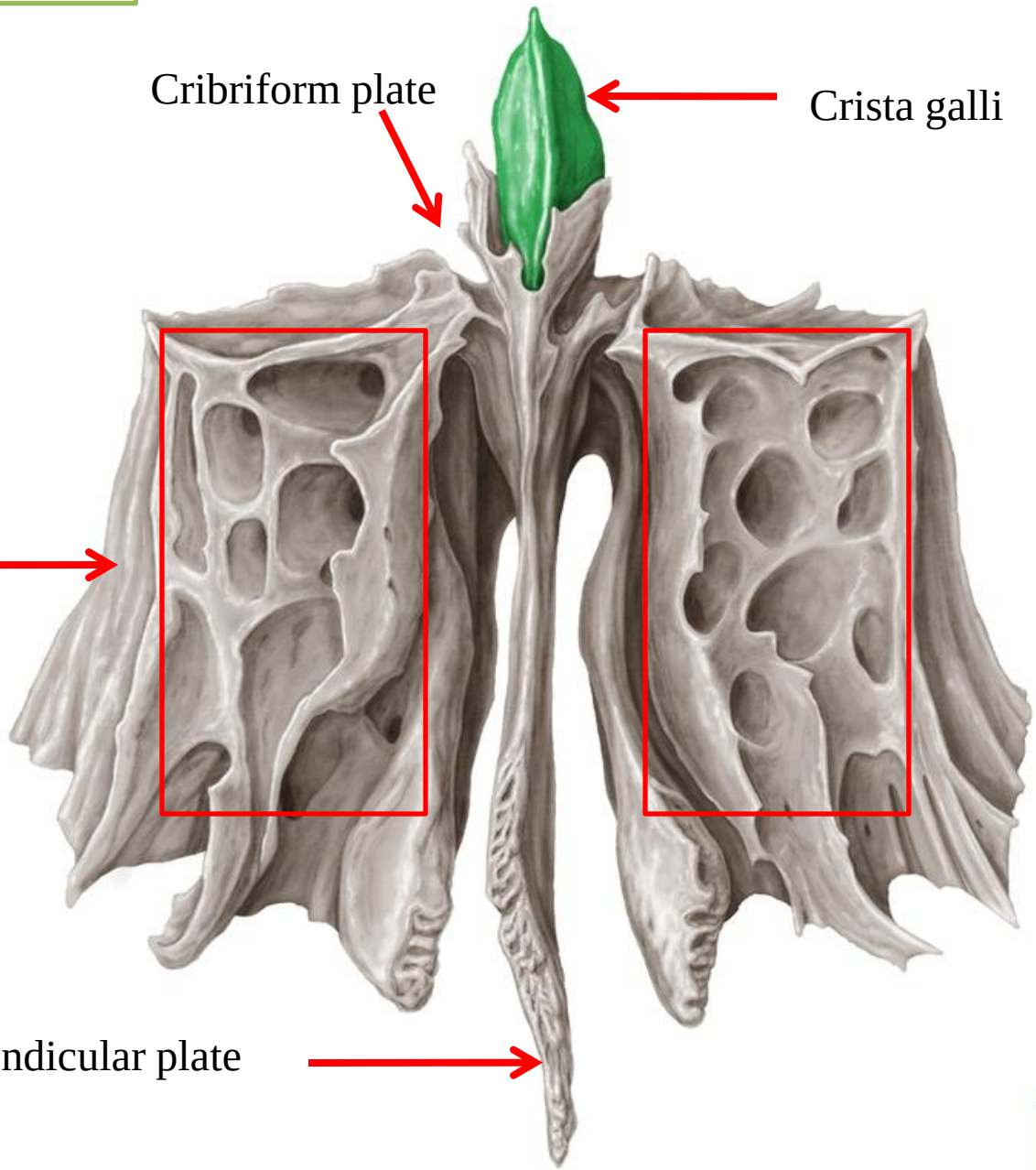
Ethmoid bone



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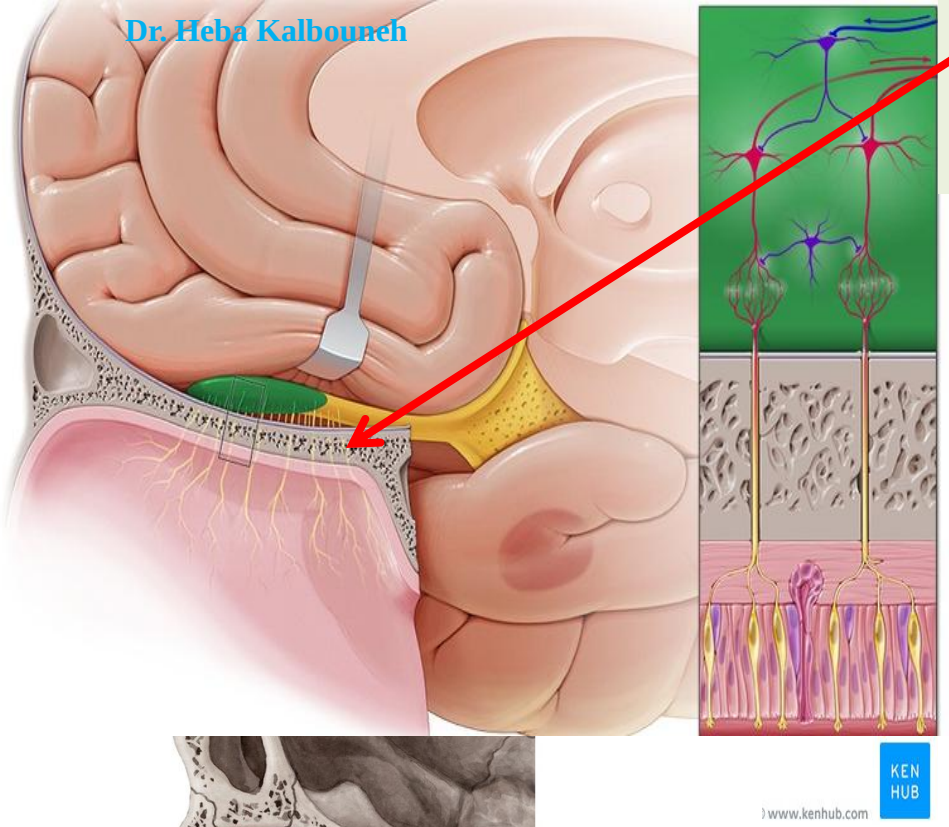
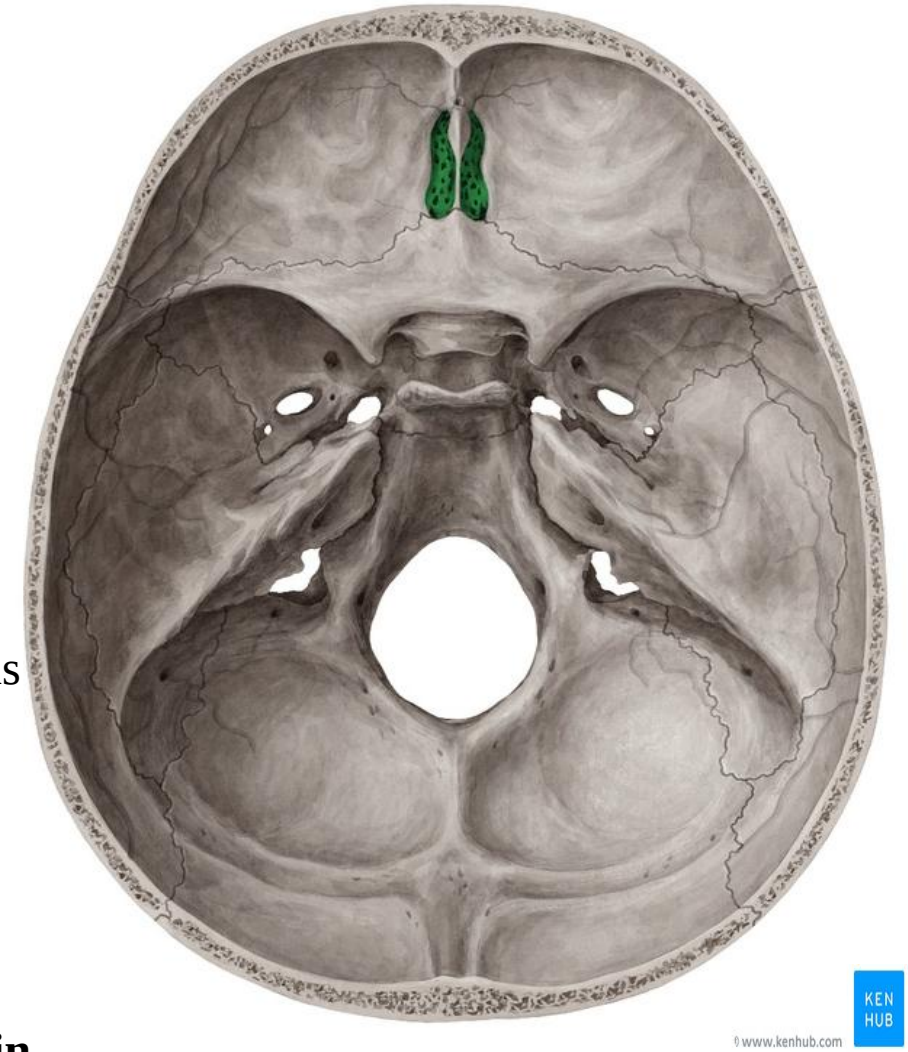
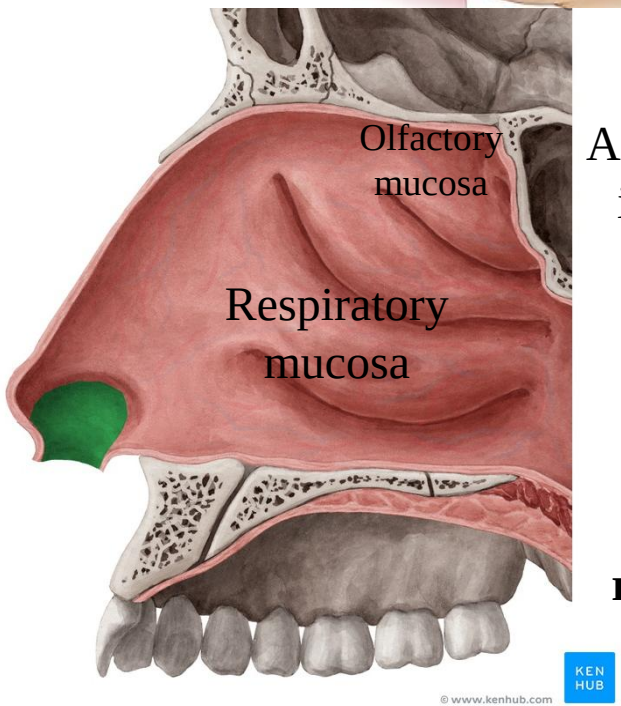
Cribriform plate of ethmoid lies at the roof of the nasal cavity, is perforated by foramina for the passage of the **olfactory nerves**

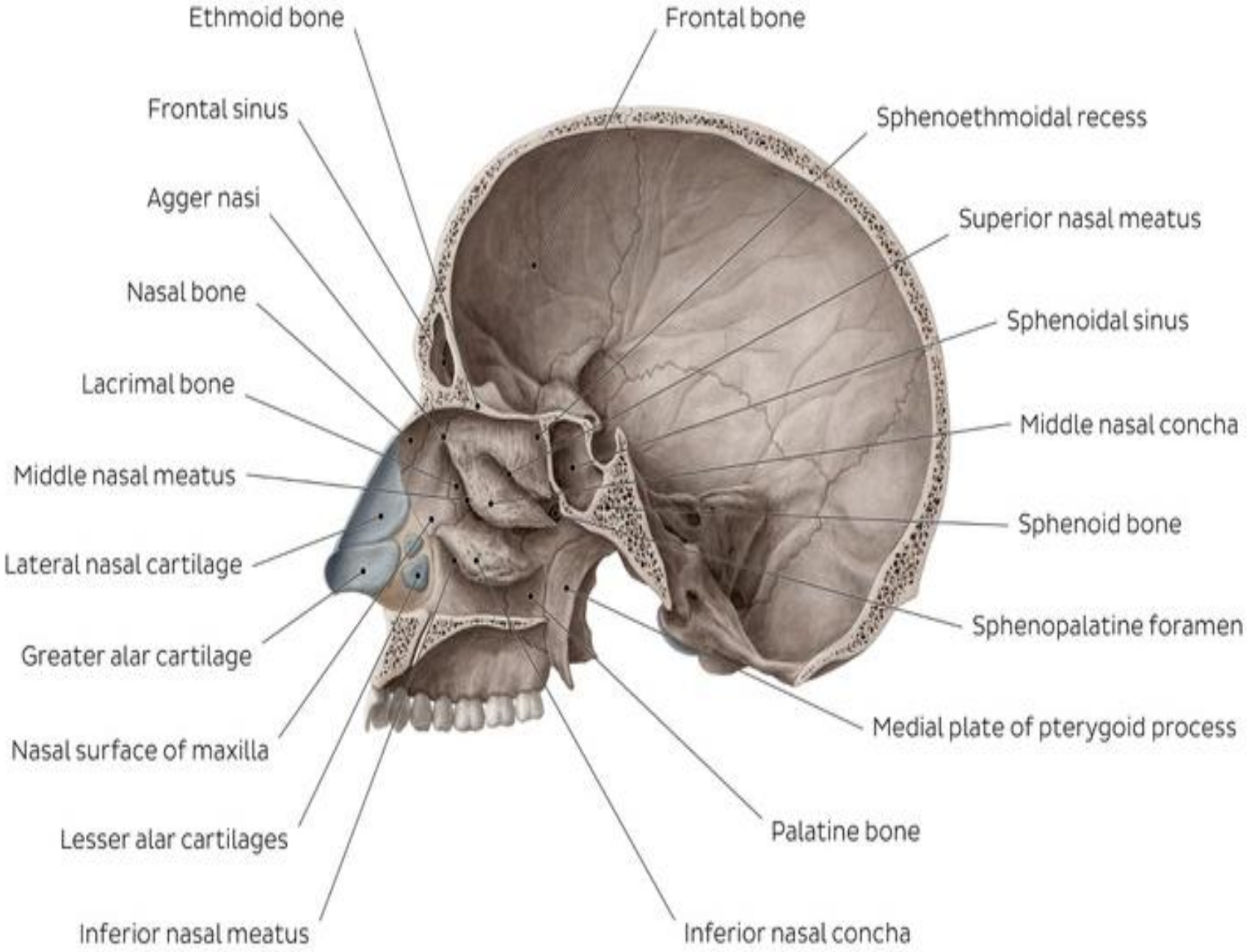


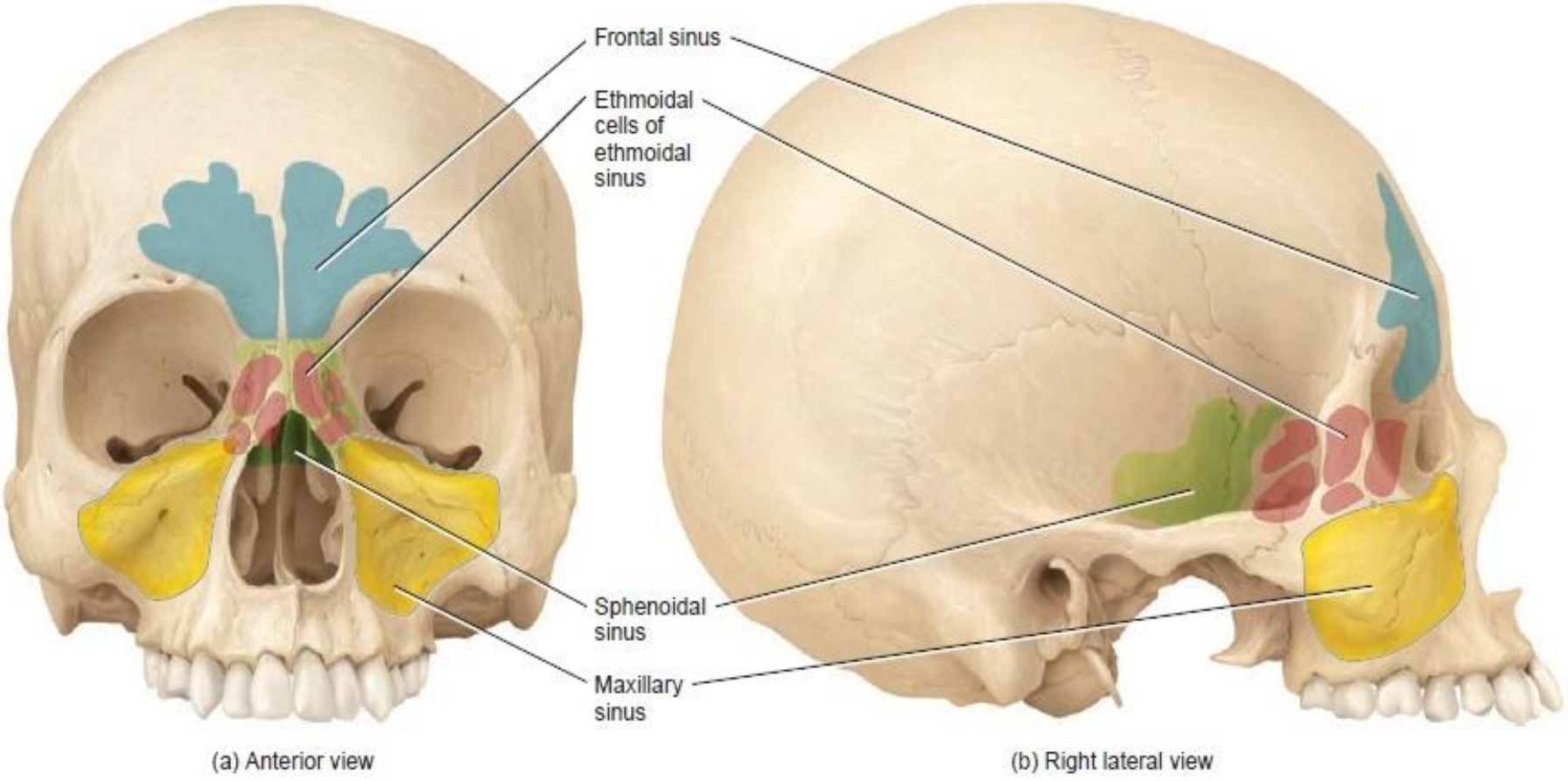




A large plexus of veins in the submucous is present in the respiratory region.

Swell and congest in response to allergy or infection


Ethmoid bone
Frontal bone
Frontal sinus
Sphenoethmoidal recess
Agger nasi
Superior nasal meatus
Nasal bone
Sphenoidal sinus
Lacrimal bone
Middle nasal concha
Middle nasal meatus
Sphenoid bone
Lateral nasal cartilage
Sphenopalatine foramen
Greater alar cartilage
Medial plate of pterygoid process
Nasal surface of maxilla
Palatine bone
Lesser alar cartilages
Inferior nasal meatus
Inferior nasal concha



Paranasal sinuses

- Four bones of the skull contain paired air spaces called the paranasal sinuses - **frontal, ethmoidal, sphenoidal, maxillary**
- Decrease skull bone weight
- Warm, moisten and filter incoming air
- Add resonance to voice.
- Communicate with the nasal cavity by ducts.
- Lined by **pseudostratified ciliated columnar epithelium (respiratory epithelium)**

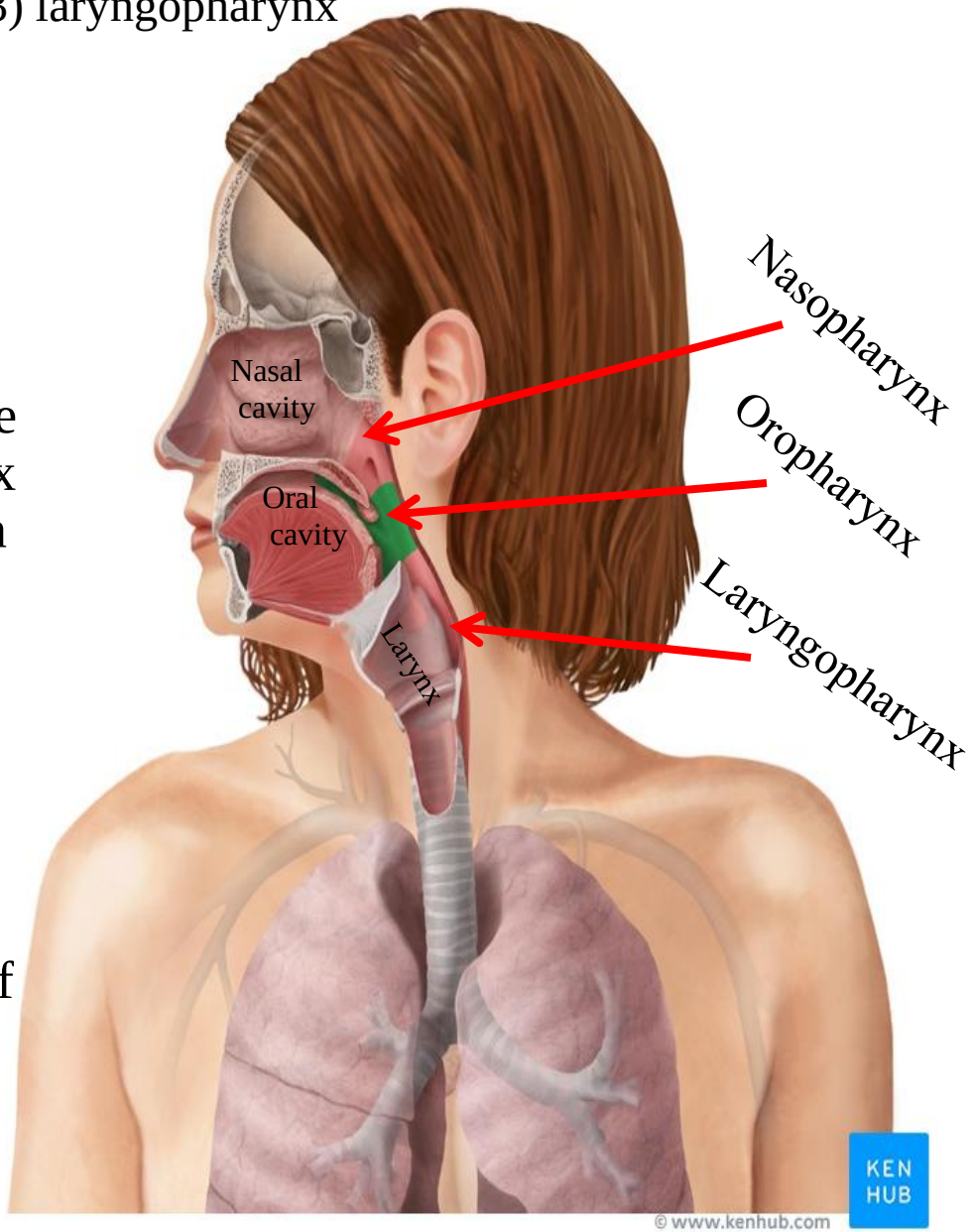
Pharynx

Three regions:

1) nasopharynx
2) oropharynx
3) laryngopharynx

- The pharynx is situated behind the nasal cavities, the mouth, and the larynx
- The pharynx is funnel shaped, its upper, wider end lying under the skull and its lower, narrow end becoming continuous with the esophagus opposite the sixth cervical vertebra. The pharynx has a musculomembranous wall, which is deficient anteriorly.

Here, it is replaced by the posterior openings into the nose (choanae), the opening into the mouth, and the inlet of the larynx



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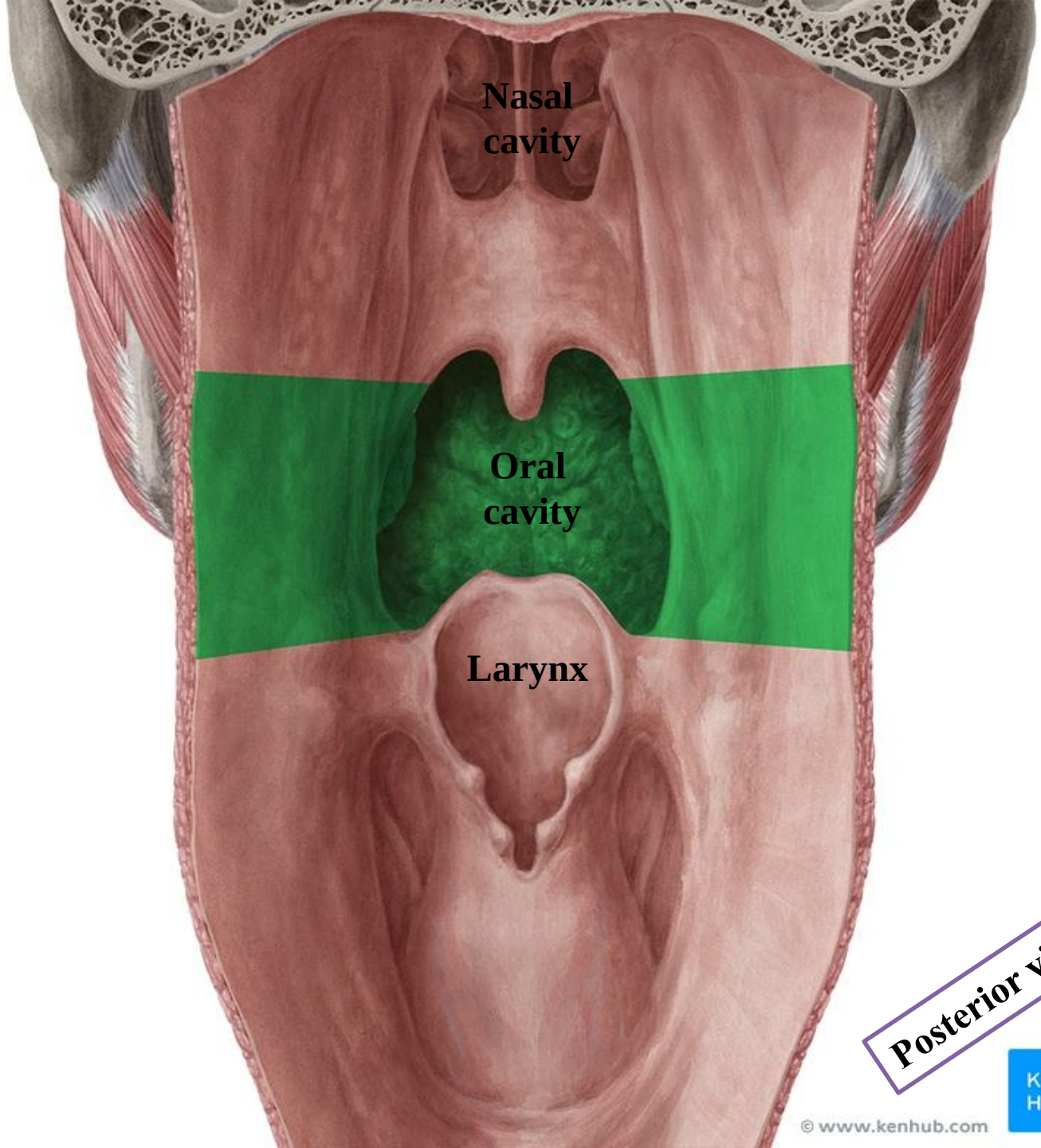
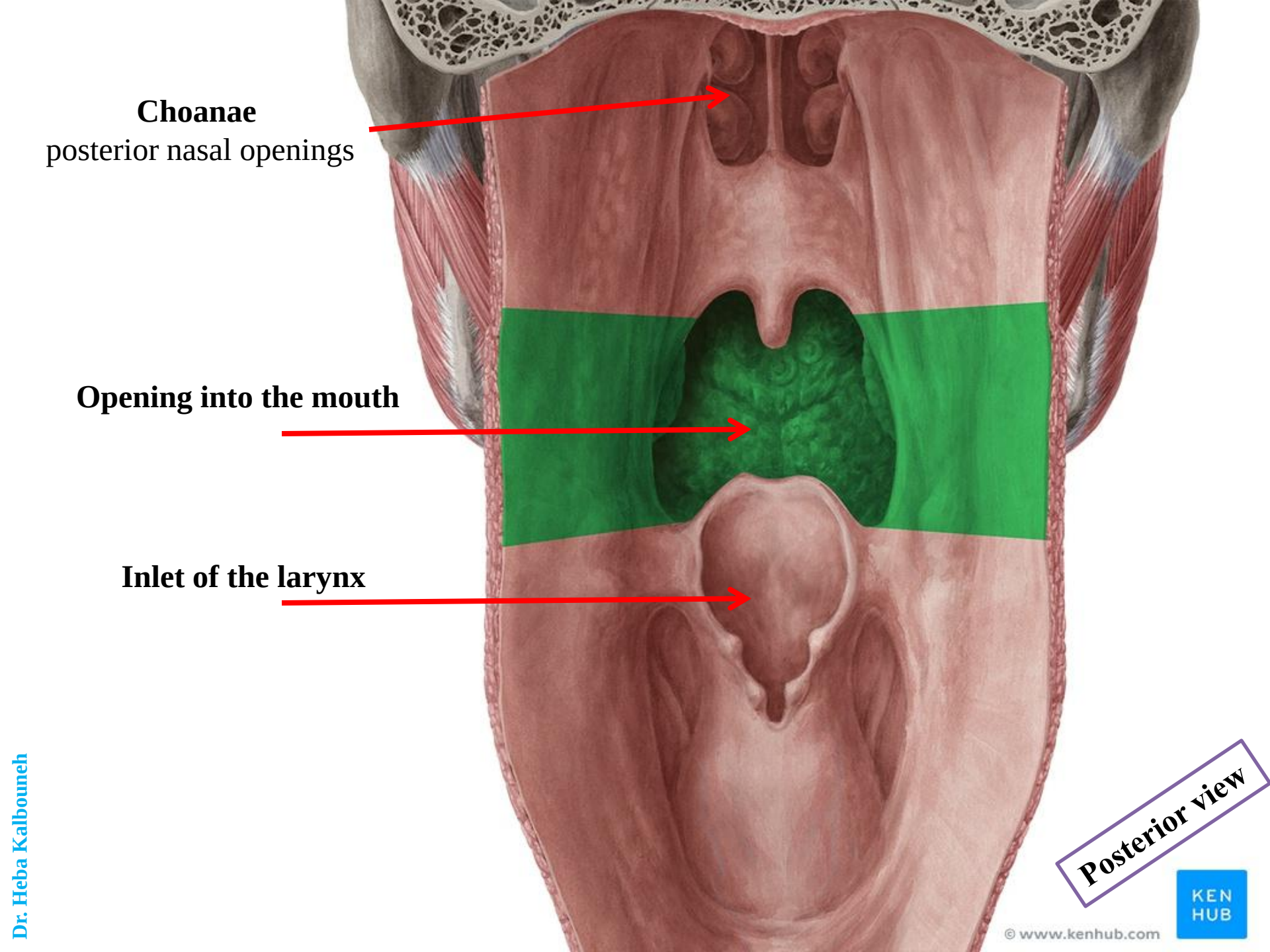
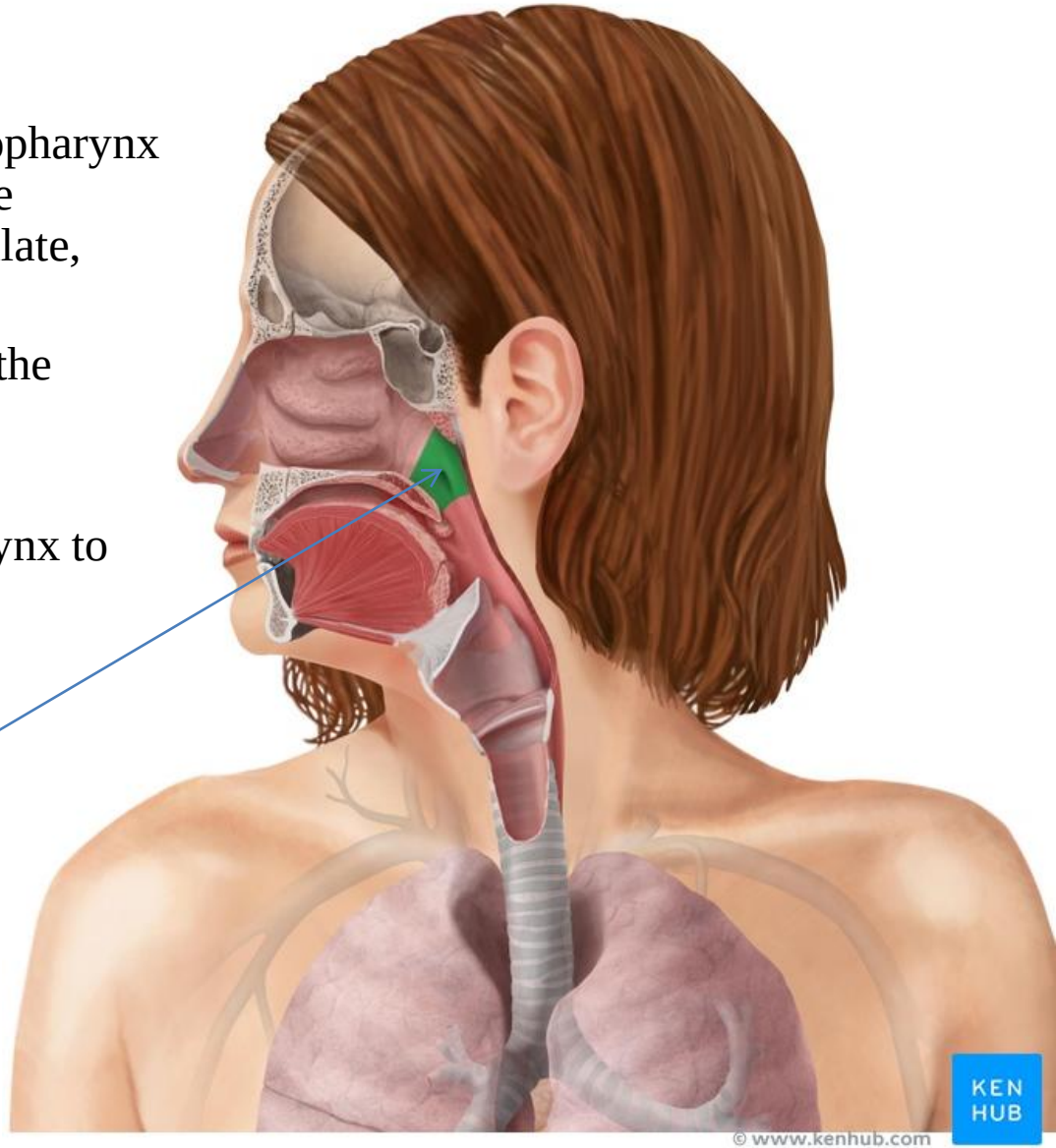




Nasopharynx

- Superior-most region of the pharynx
- Located directly posterior to the nasal cavity and superior to the soft palate
- Normally, only air passes through.
- Material from the oral cavity and oropharynx is typically blocked from entering the nasopharynx by the **uvula** of soft palate, which elevates during swallowing.
- On the lateral wall is the opening of the auditory tube (pharyngotympanic or eustachian tubes)

Eustachian tubes connect the nasopharynx to the middle ear



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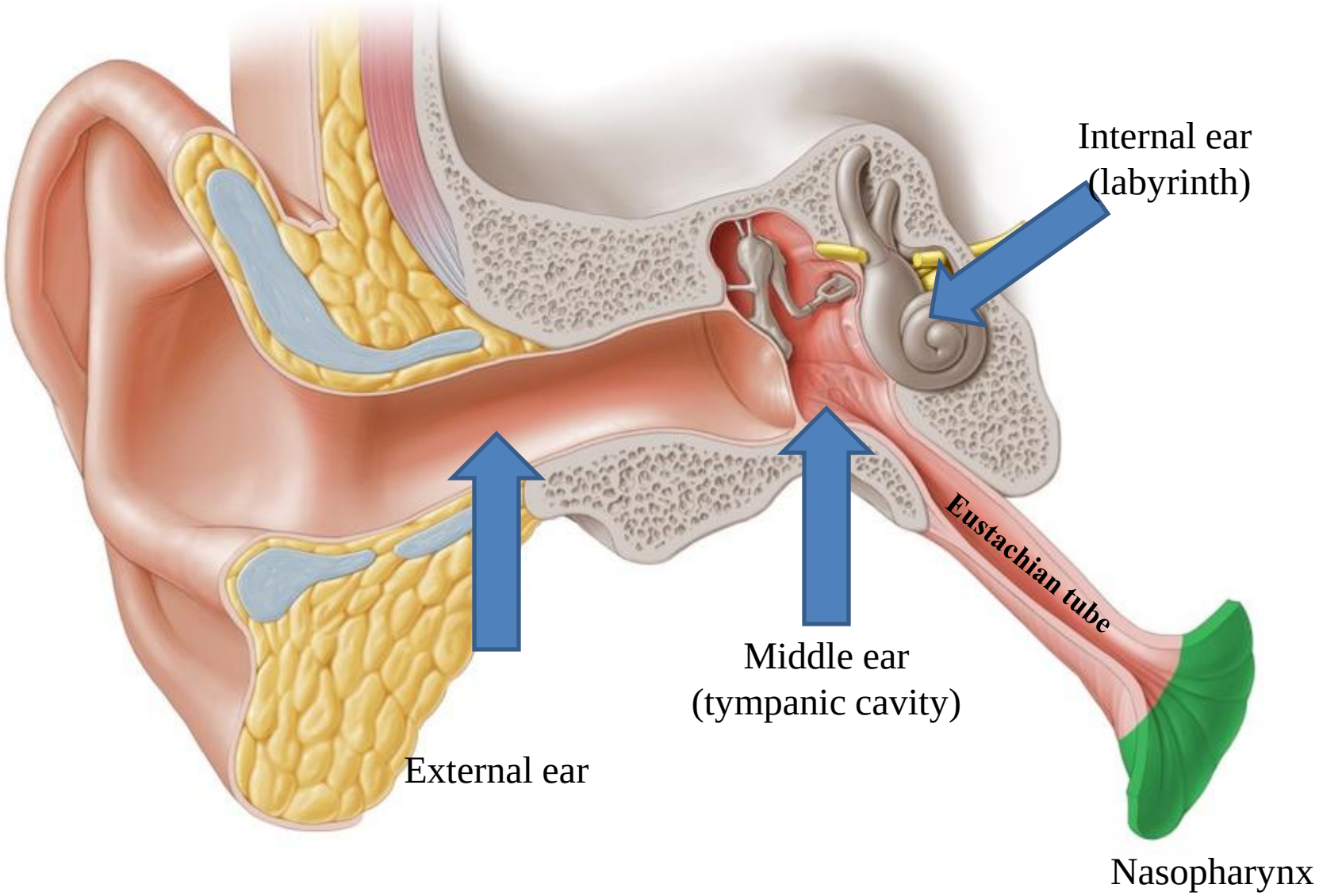
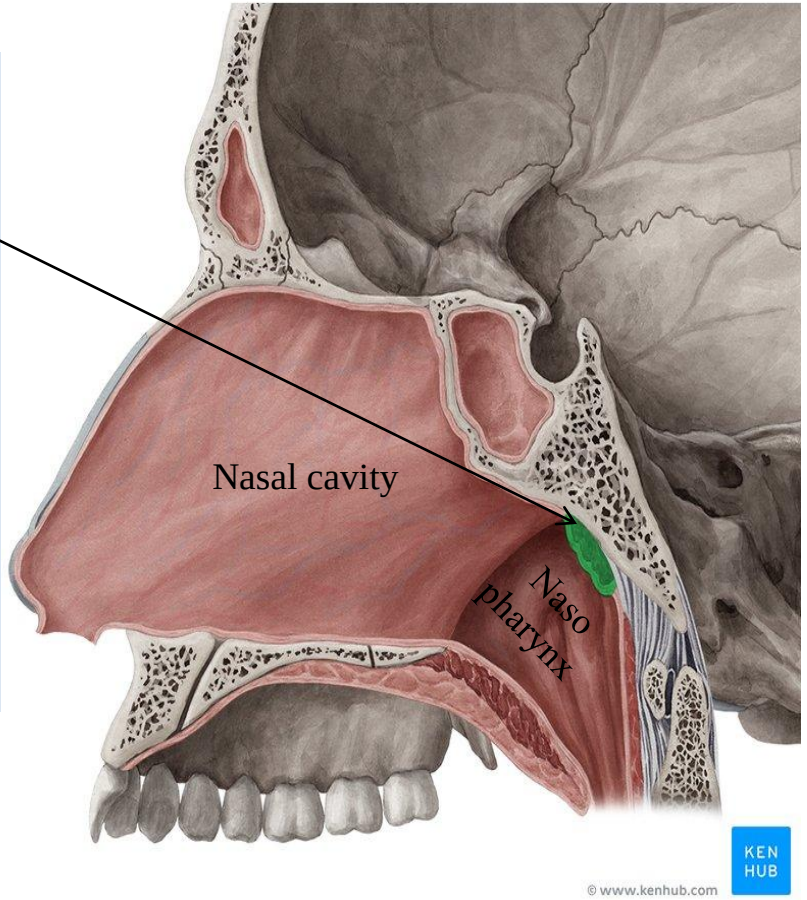


Pharyngeal tonsils

a collection of lymphoid tissue, located in the posterior wall of the nasopharynx.
It is most prominent in children, but begins to atrophy from the age of seven.
Hypertrophied regions of pharyngeal tonsils resulting from chronic inflammation are called ***adenoids***.



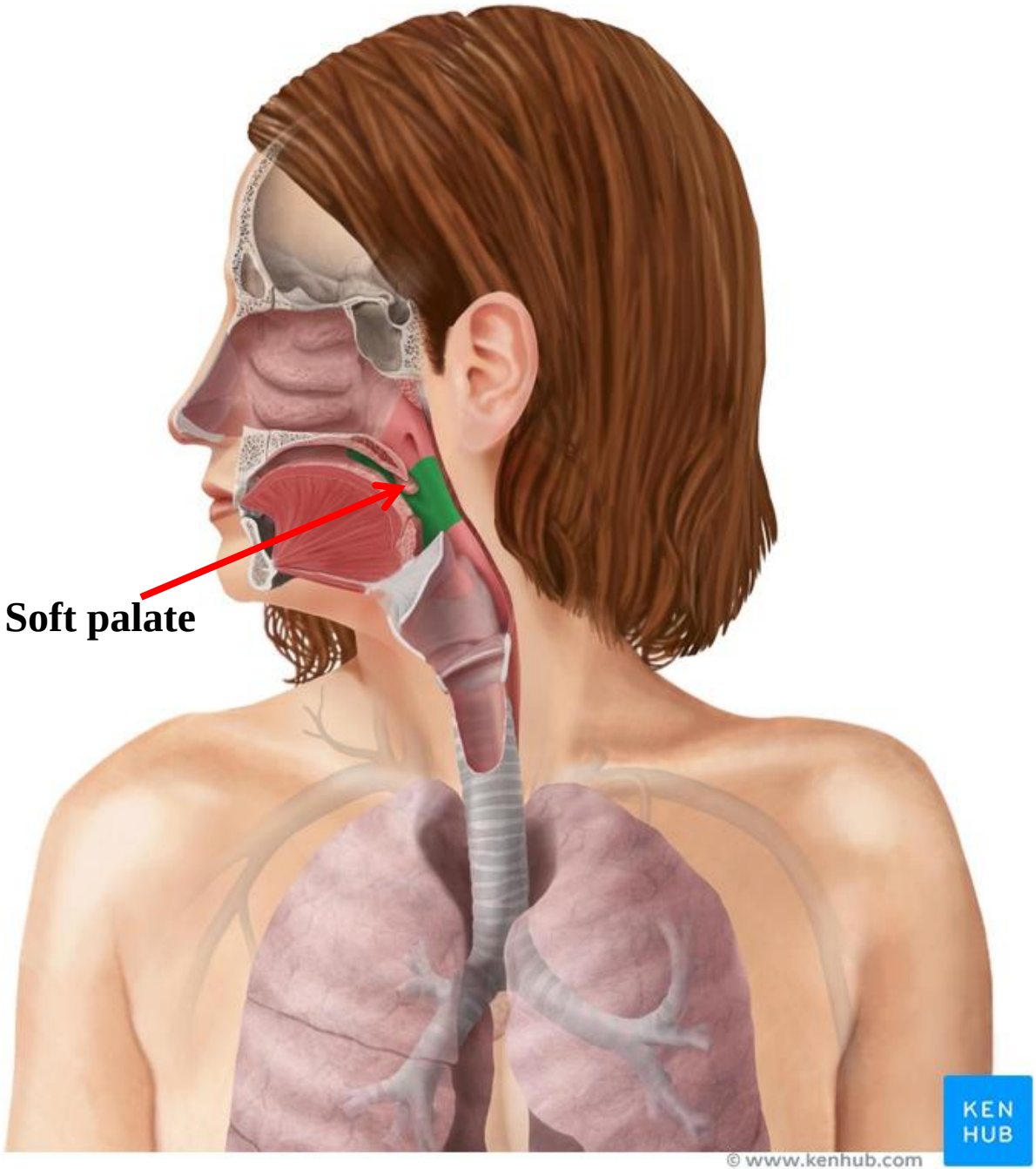
Adenoids

Excessive hypertrophy of the lymphoid tissue, usually associated with infection, causes the pharyngeal tonsils to become enlarged; they are then commonly referred to as adenoids. Marked hypertrophy blocks the posterior nasal openings and causes the patient to snore loudly at night and to breathe through the open mouth. The close relationship of the infected lymphoid tissue to the auditory tube may be the cause of recurrent otitis media. Adenoidectomy is the treatment of choice for hypertrophied adenoids with infection.

Oropharynx

- The middle pharyngeal region.
- Immediately posterior to the oral cavity.

Palatine tonsils are on the lateral wall between the palatine arches, and the **lingual tonsils** are at the base of the tongue.



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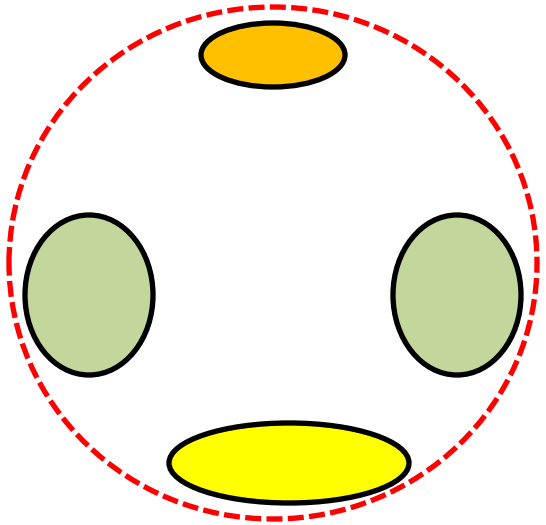
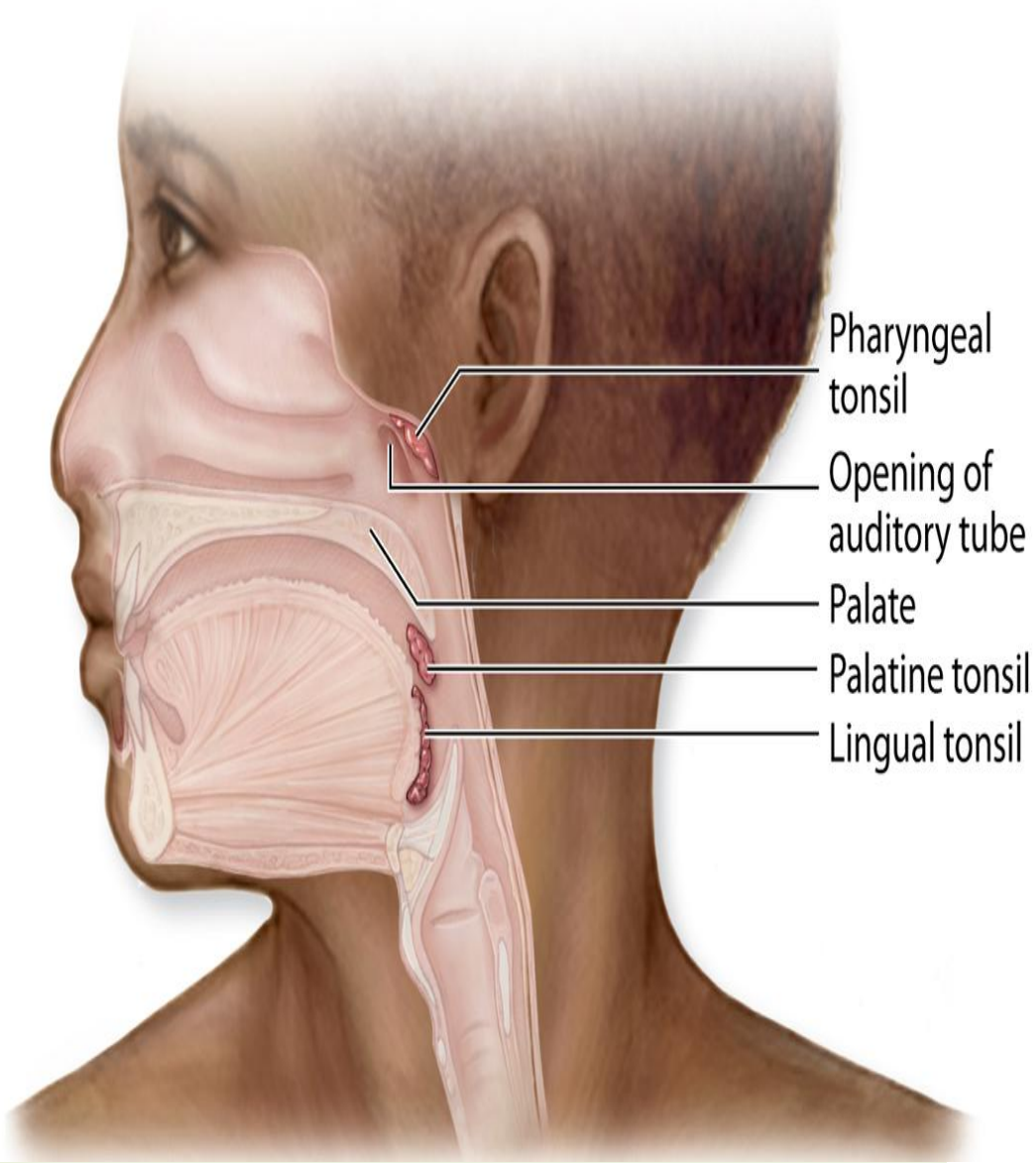
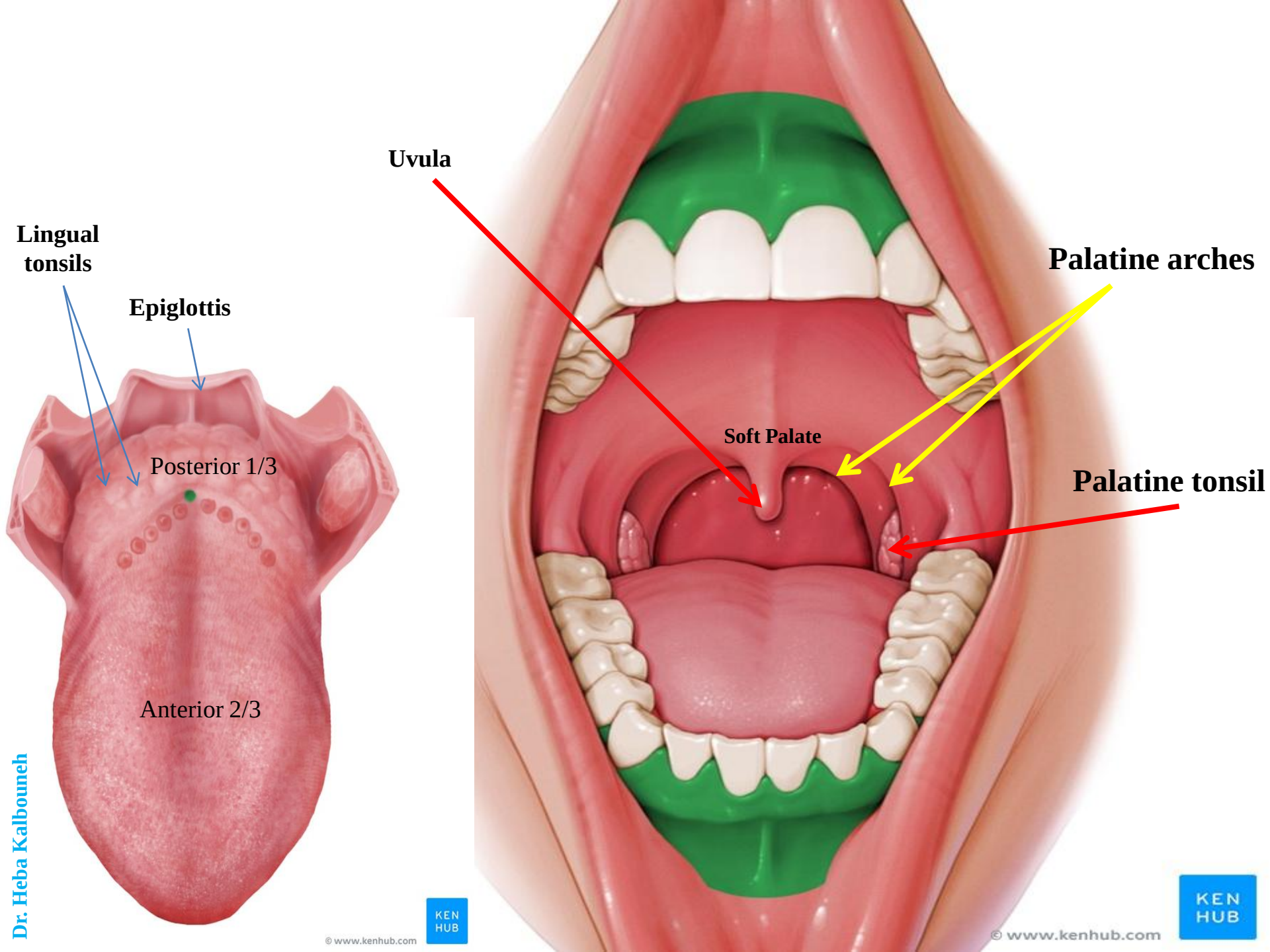
Waldeyer's tonsillar ring (Waldeyer's lymphatic ring) is a ringed arrangement of lymphoid tissue

In the nasopharynx, oropharynx, and base of the tongue.



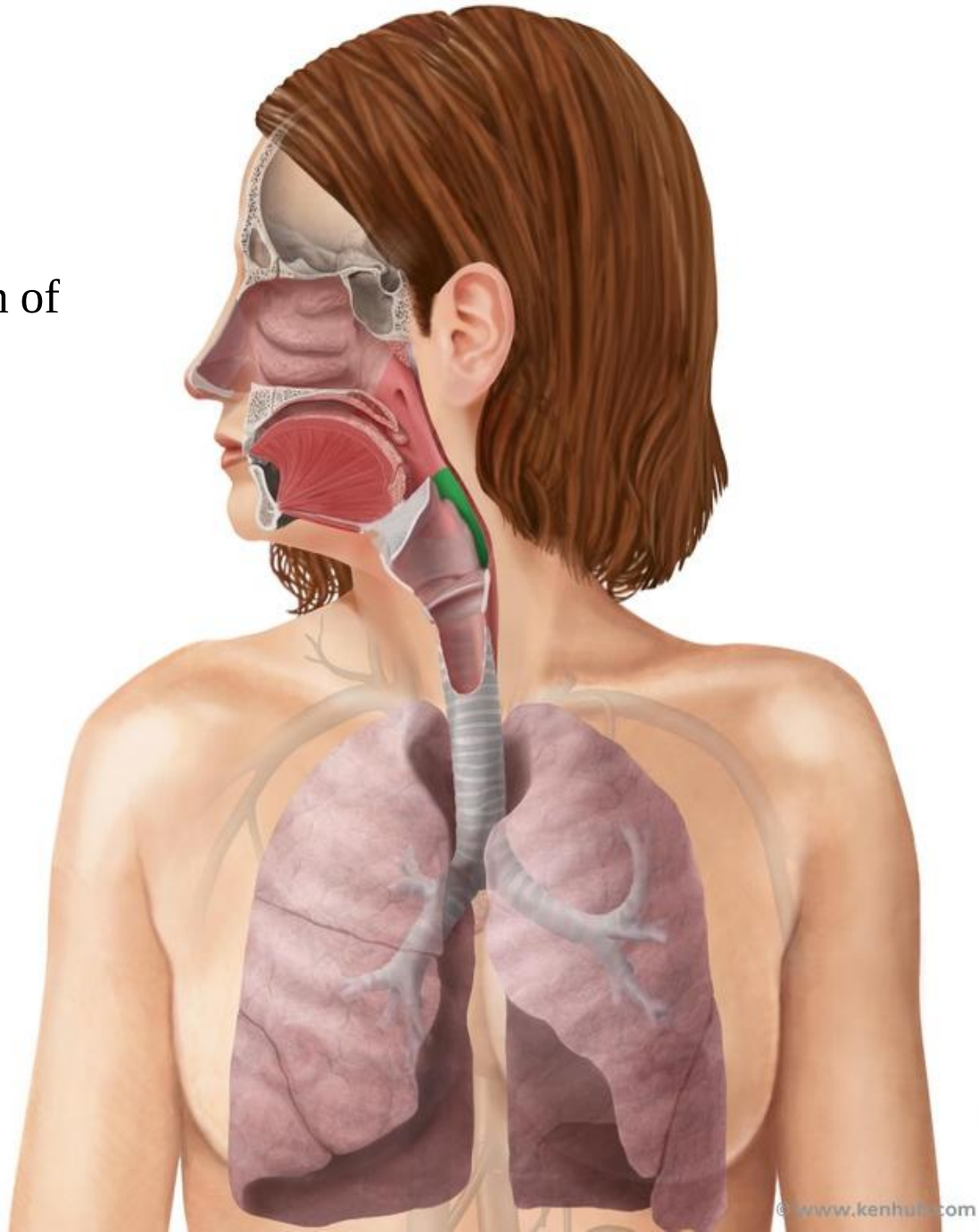


Lymphatic organs here provide the first line of defense against ingested or inhaled foreign materials.



Laryngopharynx

- Inferior, narrowed region of the pharynx.
- ls continuous with the esophagus posteriorly



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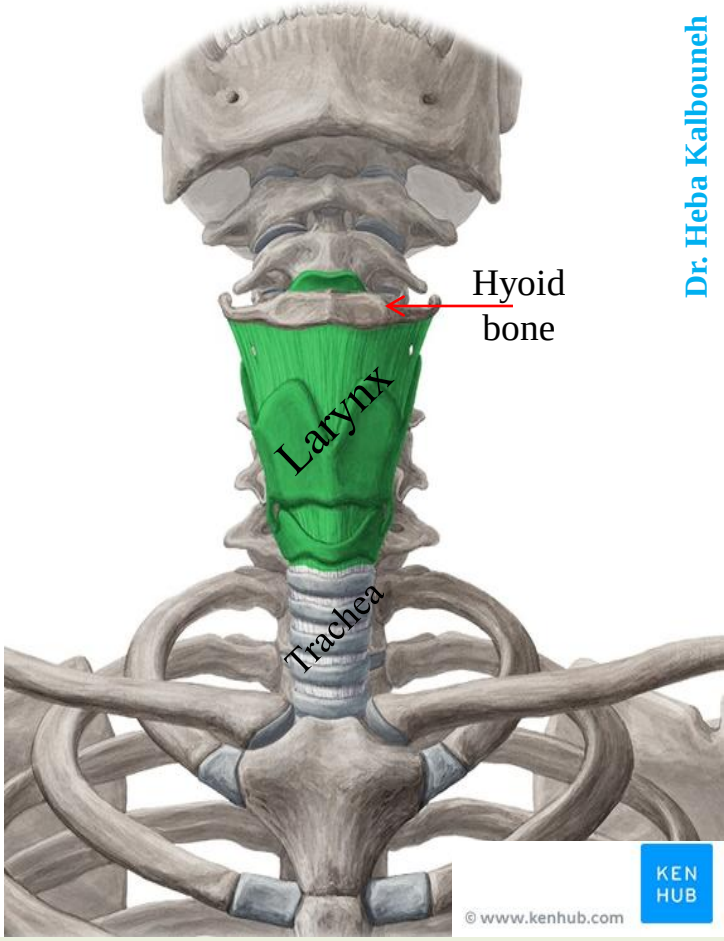
Larynx (Voice box)

- Is a short, cylindrical airway
- Midline of the neck anterior to C4-C6
- It opens above into the laryngeal part of the pharynx, and below is continuous with the trachea.
- Prevents swallowed materials from entering the lower respiratory tract **(protective sphincter)**
- Conducts air into the lower respiratory tract.
- Produces sounds.
- The larynx is covered at the sides by the thyroid gland
- Supported by a framework of nine pieces of cartilage (three single and three paired cartilages) that are held in place by ligaments and muscles.



Laryngeal cartilages

Thyroid cartilage – (1) Adam's apple, hyaline, the largest cartilage of the larynx , attached to hyoid bone by the **thyrohyoid membrane.**

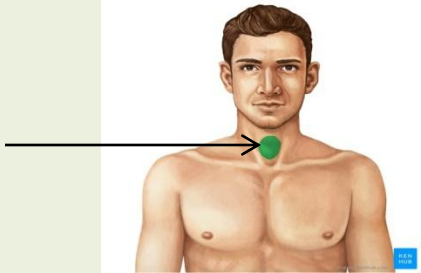
Cricoid cartilage – (1) ring-shaped, hyaline, lies below the thyroid cartilage, attached to first ring of cartilage of the trachea by the **cricotracheal ligament and** connected to the thyroid cartilage by the **cricothyroid ligament**

Arytenoid cartilages – (2)

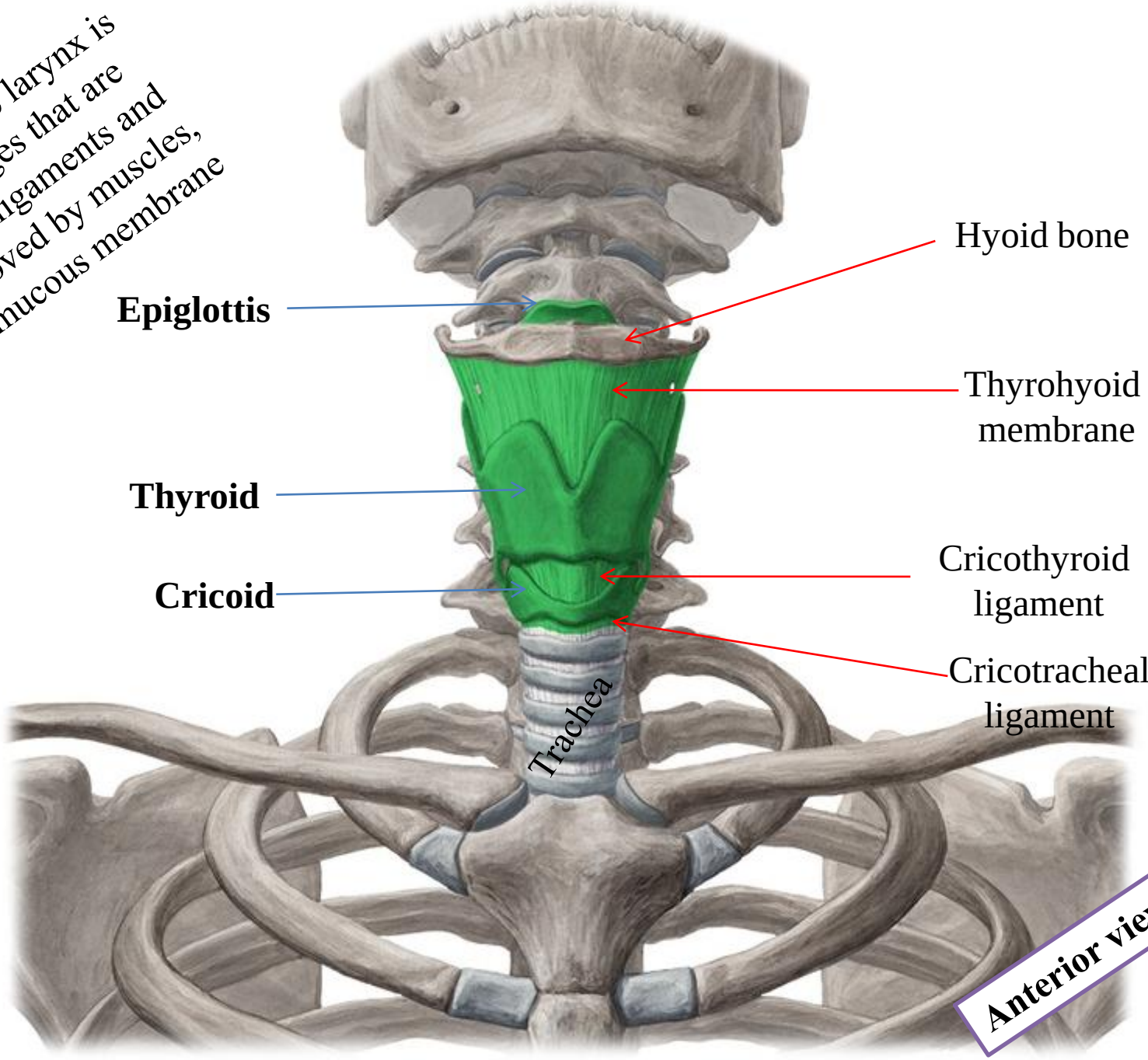
Corniculate cartlages - (2)

Cuneiform cartilages - (2)

Epiglottis – (1) elastic cartilage**,** leaf-shaped, lies behind the root of the tongue



The framework of the larynx is formed of cartilages that are held together by ligaments and membranes, moved by muscles, and lined by mucous membrane



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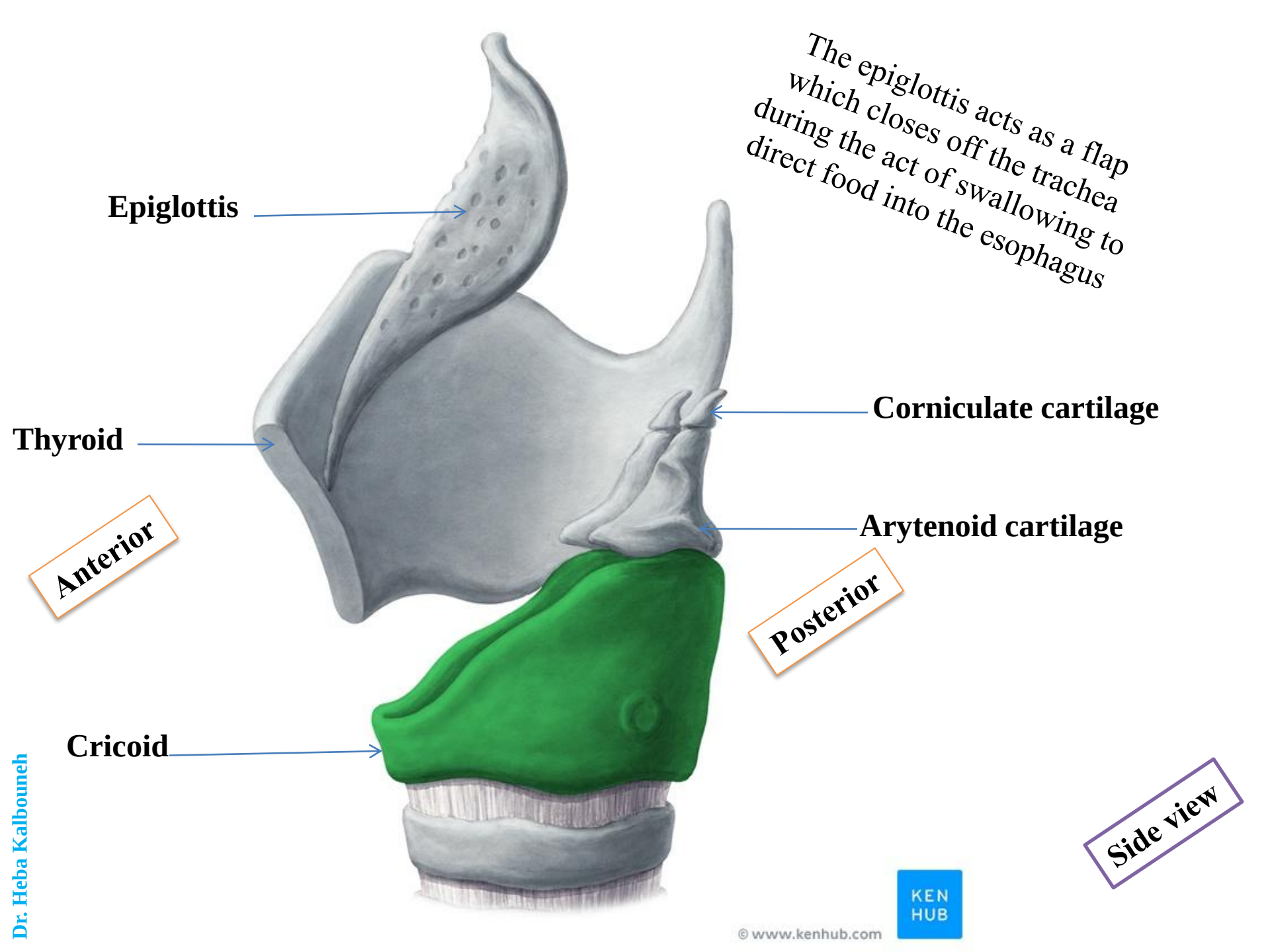
The epiglottis acts as a flap which closes off the trachea during the act of swallowing to direct food into the esophagus
Epiglottis
Thyroid
Corniculate cartilage
Arytenoid cartilage
Anterior
Posterior
Cricoid
Side view
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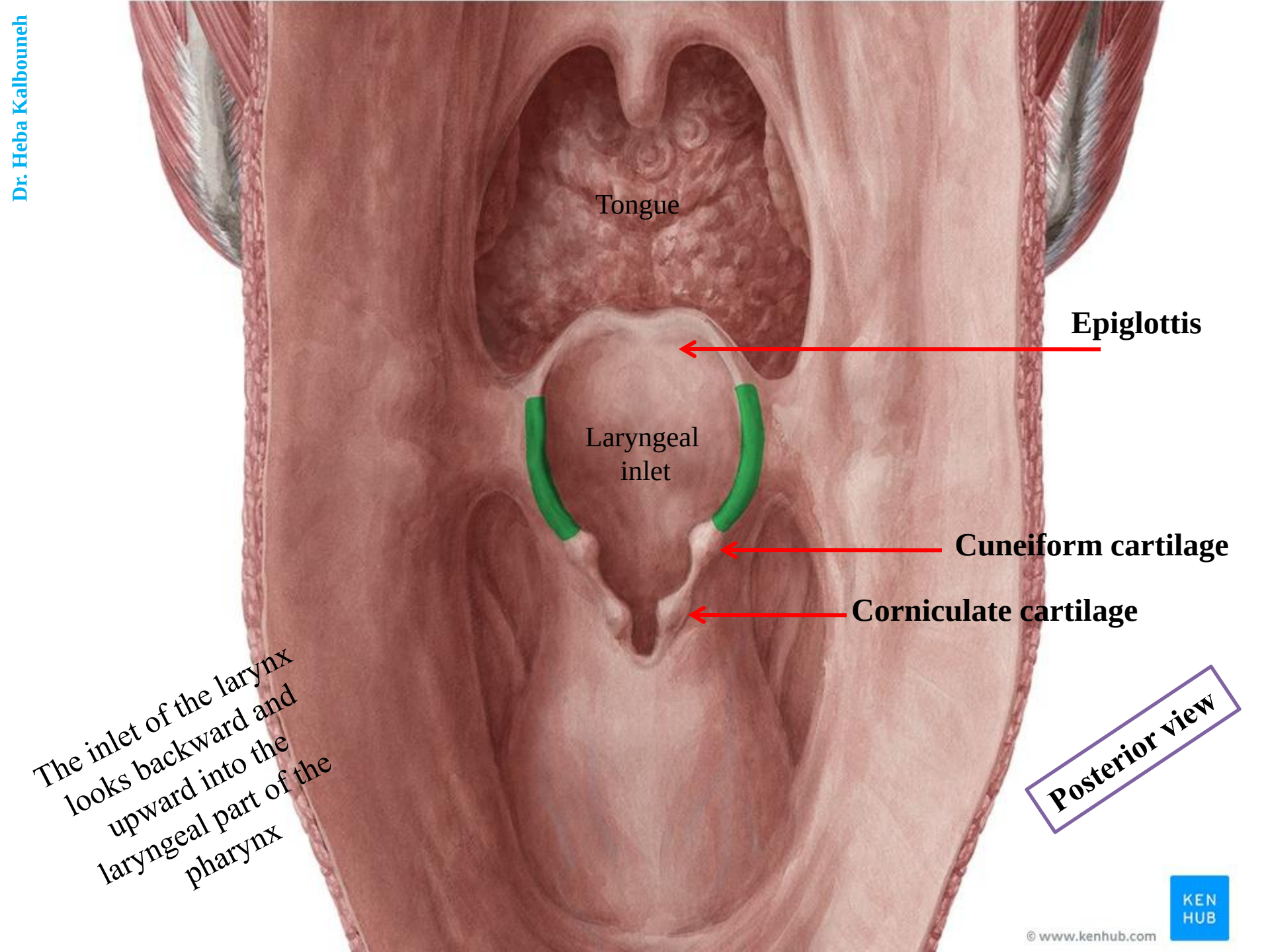
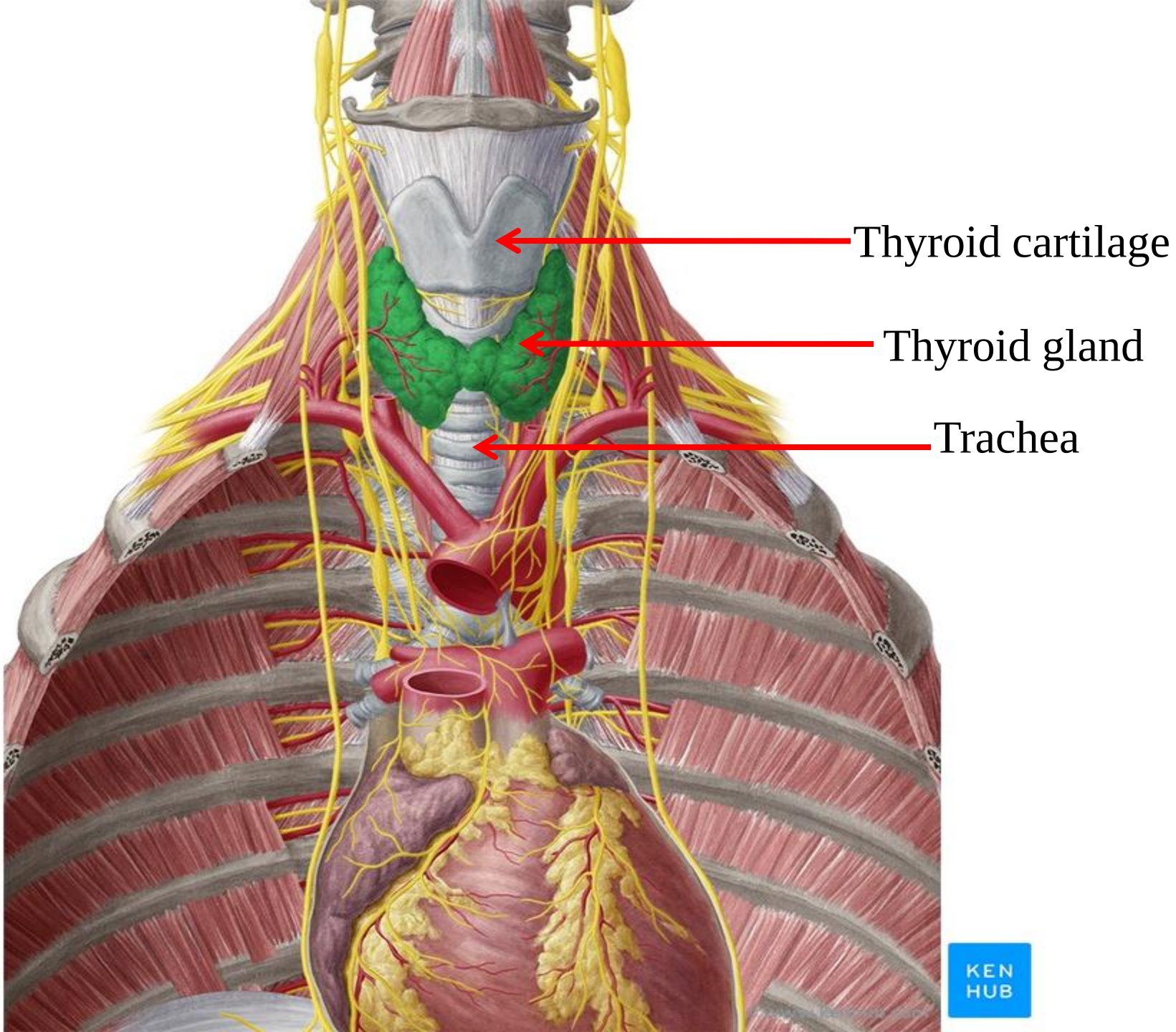


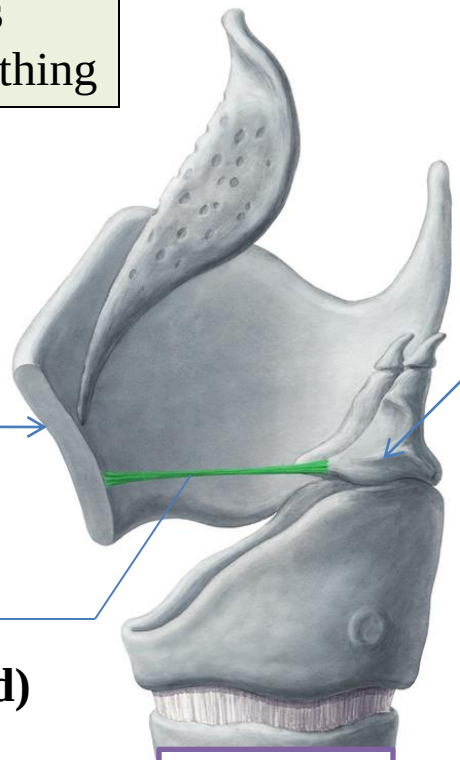
The inlet of the larynx looks backward and upward into the laryngeal part of the pharynx



If food or liquid contacts the vocal folds it causes a cough reflex to expel the matter in order to prevent pulmonary aspiration.

Vocal cords
Open when breathing

Vocal cords
Vibrating for speech



Side view

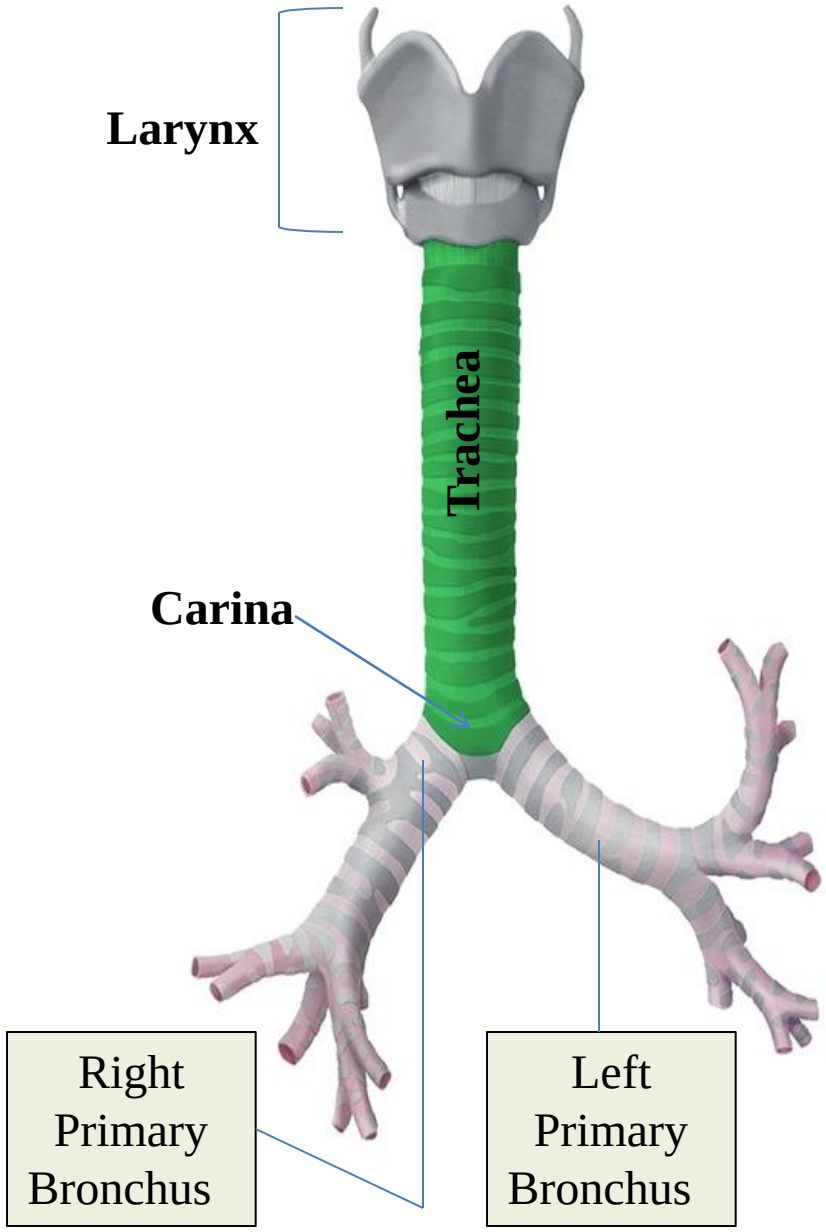
✓The vocal fold is a mobile fold on each side of the larynx and is concerned with voice production.

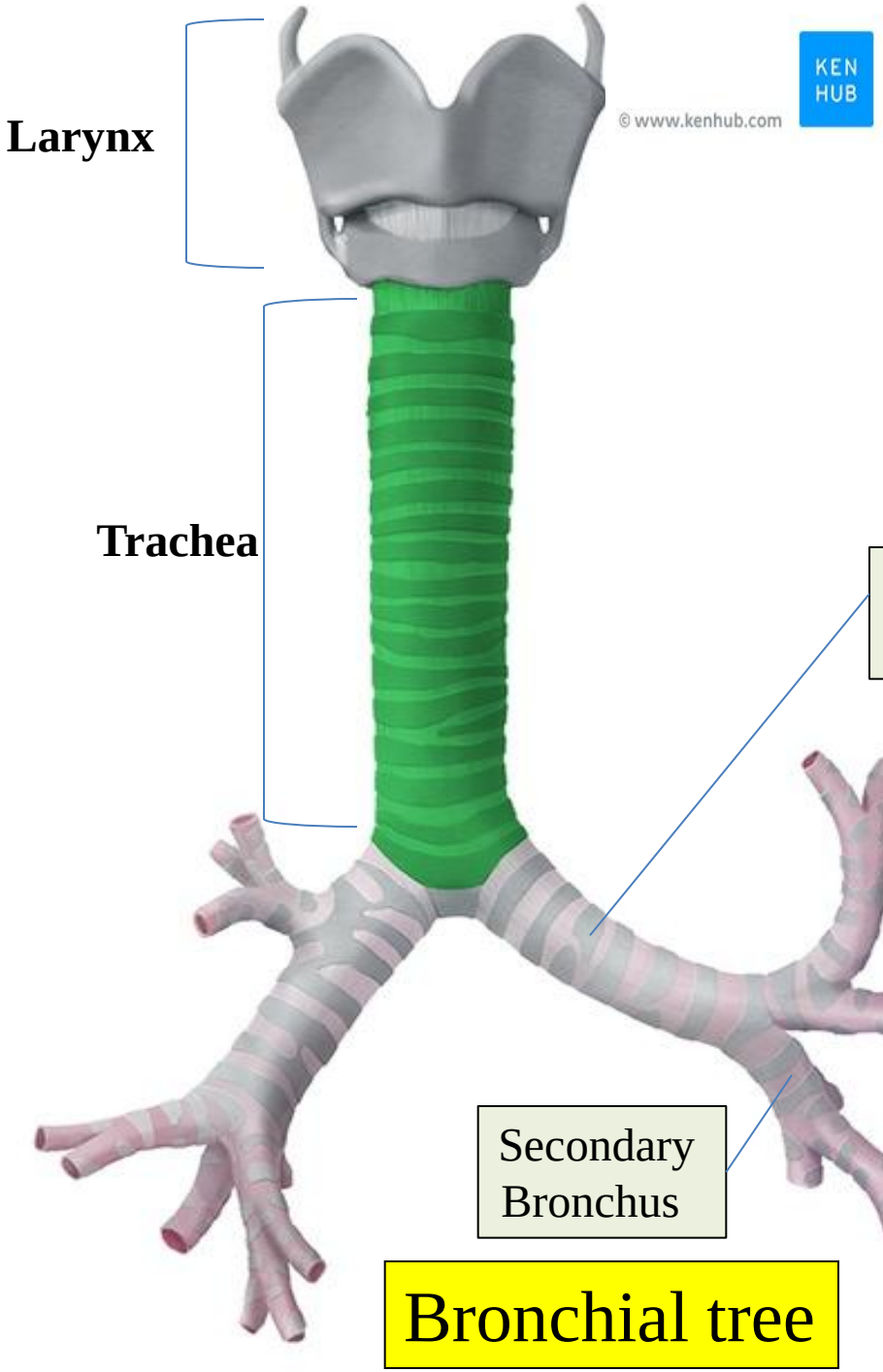
✓ Extends from thyroid cartilage to arytenoid cartilage

The Trachea

- Is a mobile cartilaginous and membranous tube
- It begins as a continuation of the larynx at the lower border of the cricoid cartilage at the level of the sixth cervical vertebra.
- It descends in the midline of the neck.
- In the thorax the trachea ends at the **carina** by dividing into right and left primary (main) bronchi at the level of the sternal angle (T4-T5)
- The trachea is kept patent by the presence of U-shaped cartilaginous bar (rings) of hyaline cartilage embedded in its wall.
- The posterior free ends of the cartilage are connected by smooth muscle, the **trachealis** muscle.
- The mucous membrane of the trachea is lined with pseudostratified ciliated columnar epithelium and contains many goblet cells and tubular mucous glands

(respiratory epithelium)





Bronchial tree

Note:

Right primary bronchus is shorter, wider, and more vertically oriented than **the left primary bronchus.**

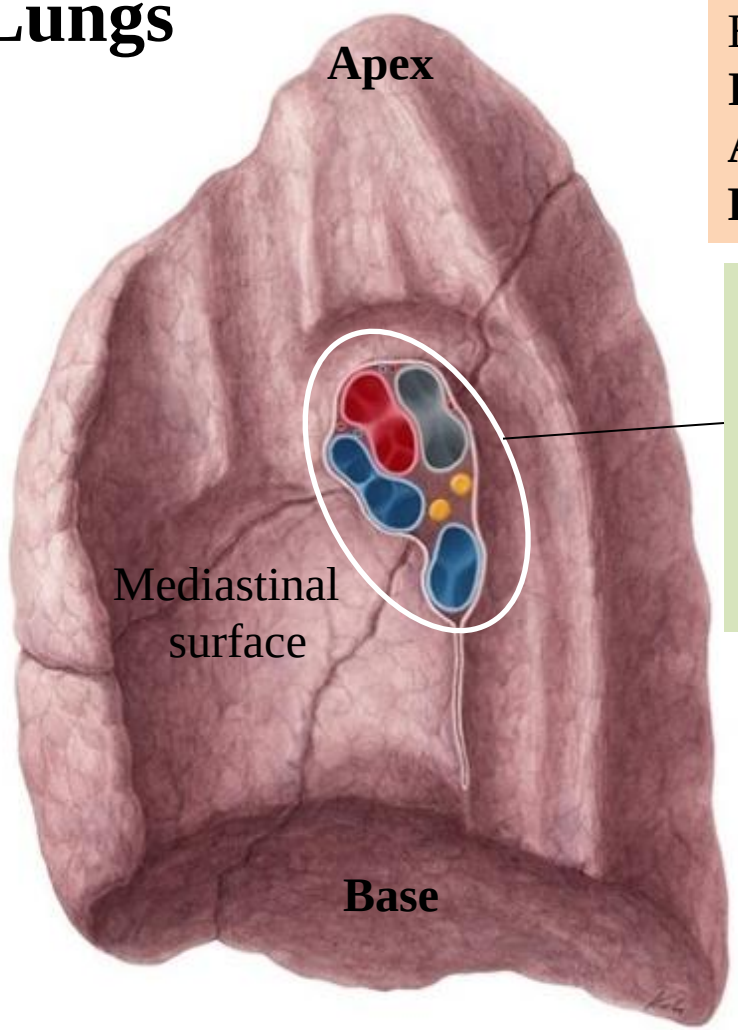
Foreign particles are more likely to lodge in the right primary bronchus.

Primary Bronchus → The primary bronchus enters the **hilus** of the lung

Note:

Incomplete rings of hyaline cartilage support the walls of the bronchi to ensure that they remain open.

Lungs



Each lung has three borders:
Inferior border: sharp
Anterior border: thin
Posterior border: thick (beside the vertebral column)

At about the middle of mediastinal surface is the **hilum**, a depression in which the bronchi, vessels, and nerves that enter and leave the lung.

Each lung has:
A blunt apex, which projects upward into the neck for about 1 in. (2.5 cm) above the clavicle
A concave base that sits on the diaphragm
A convex costal surface, which corresponds to the concave chest wall
A concave mediastinal surface, which is molded to the pericardium and other mediastinal structures.

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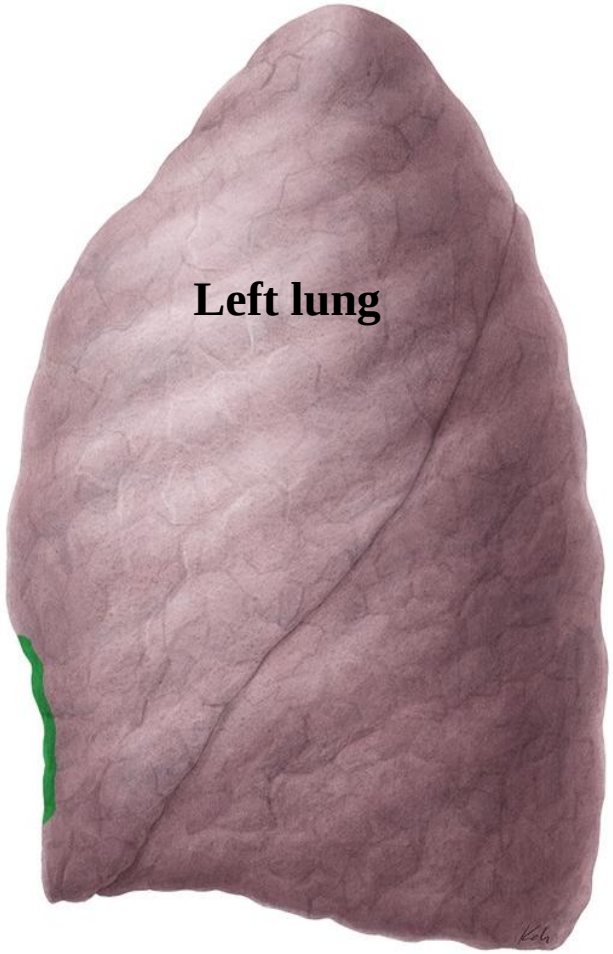
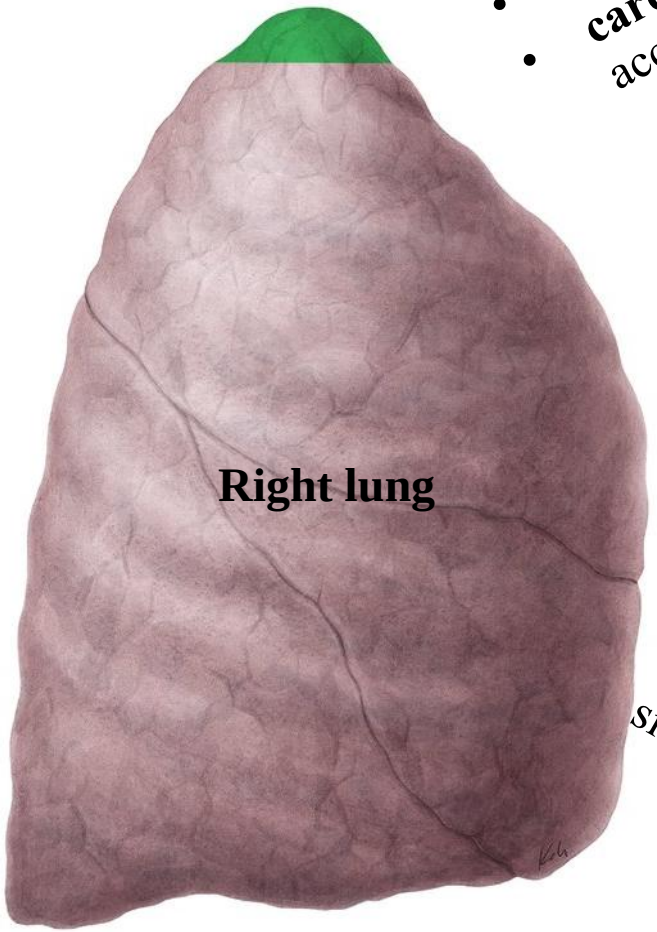
Left lung

- divided into 2 lobes by **oblique fissure**
- smaller than the right lung
- **cardiac notch** accommodates the heart





Right lung

divided into 3 lobes by **oblique and horizontal fissure**

located more superiorly in the body due to liver on right side

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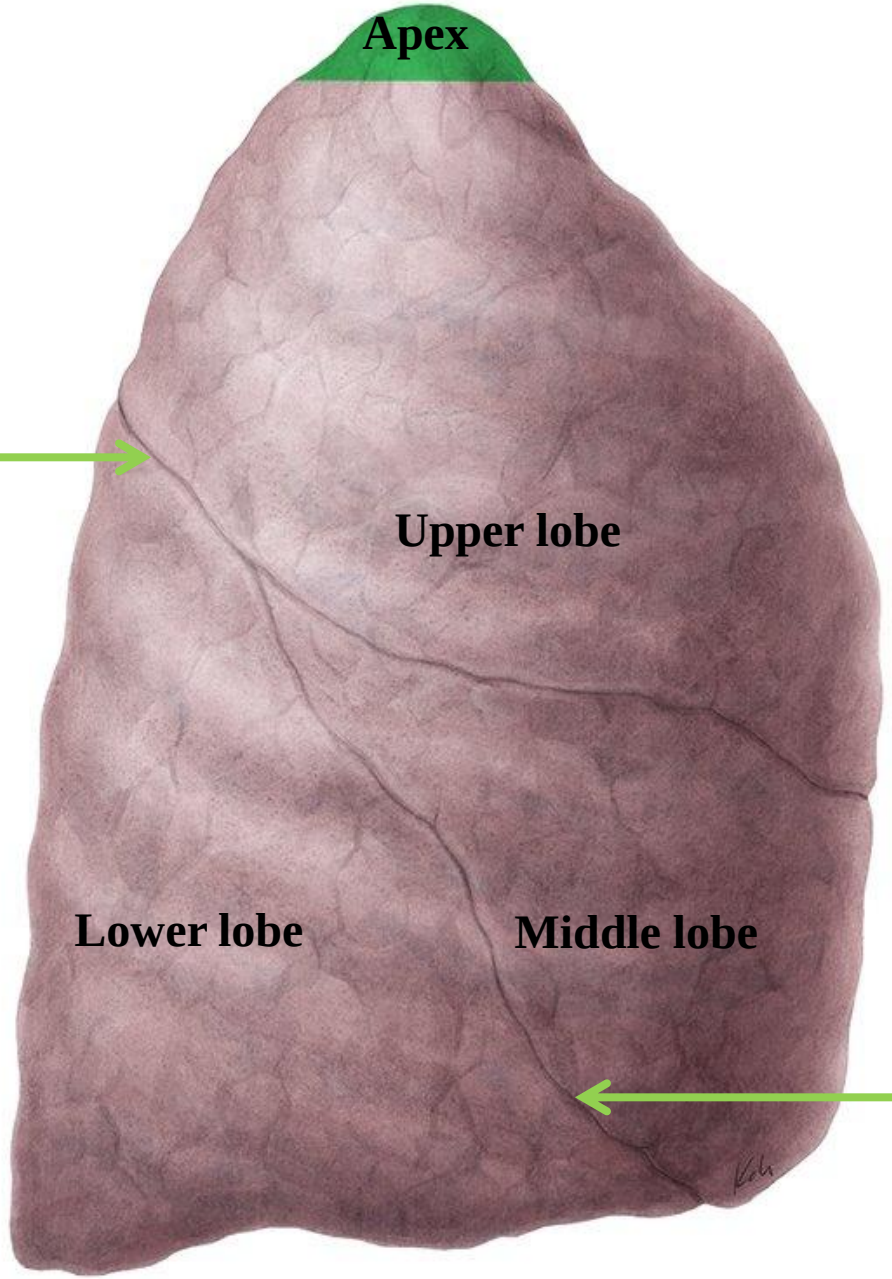
Right lung

Lateral view



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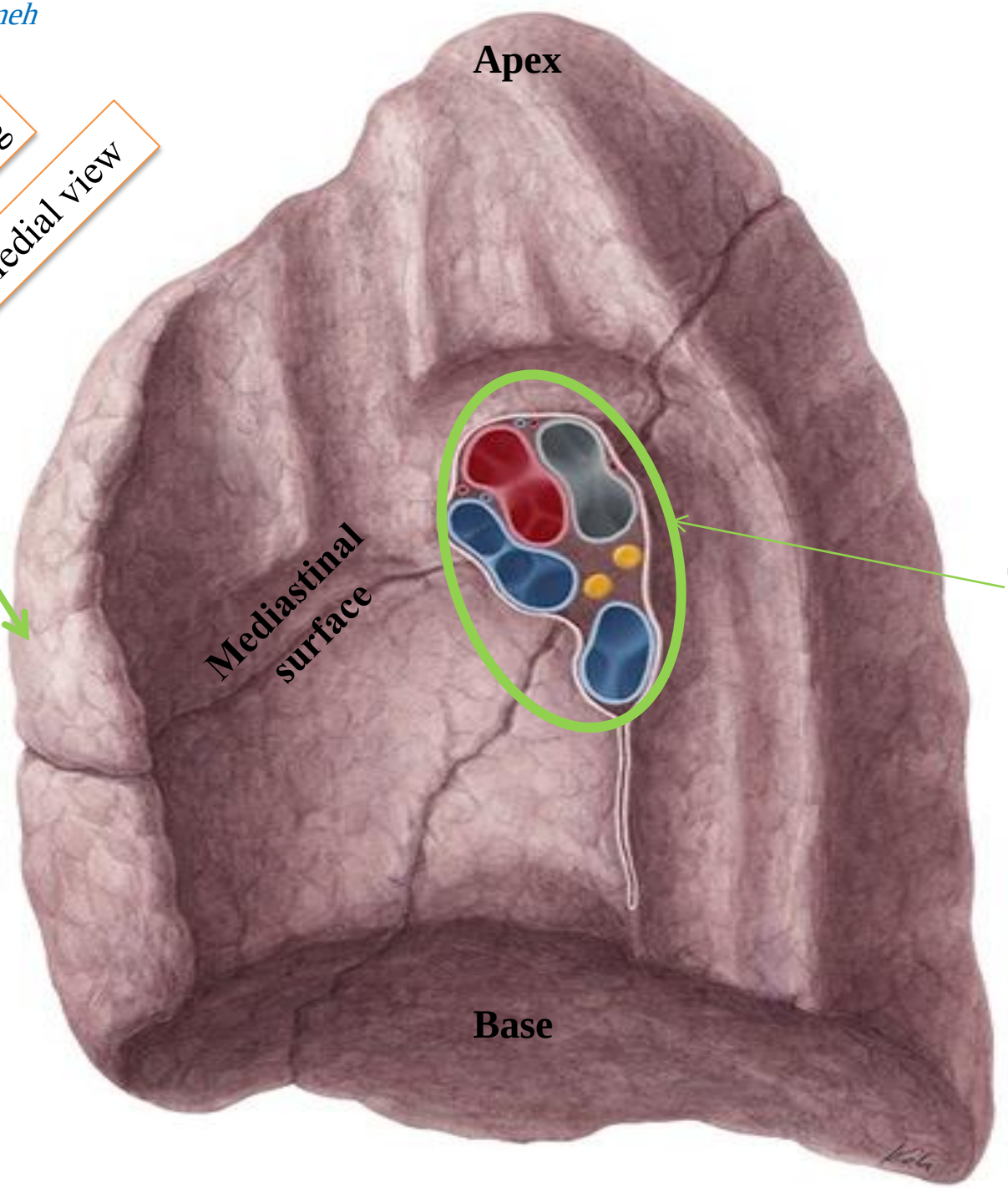
Right lung

Medial view



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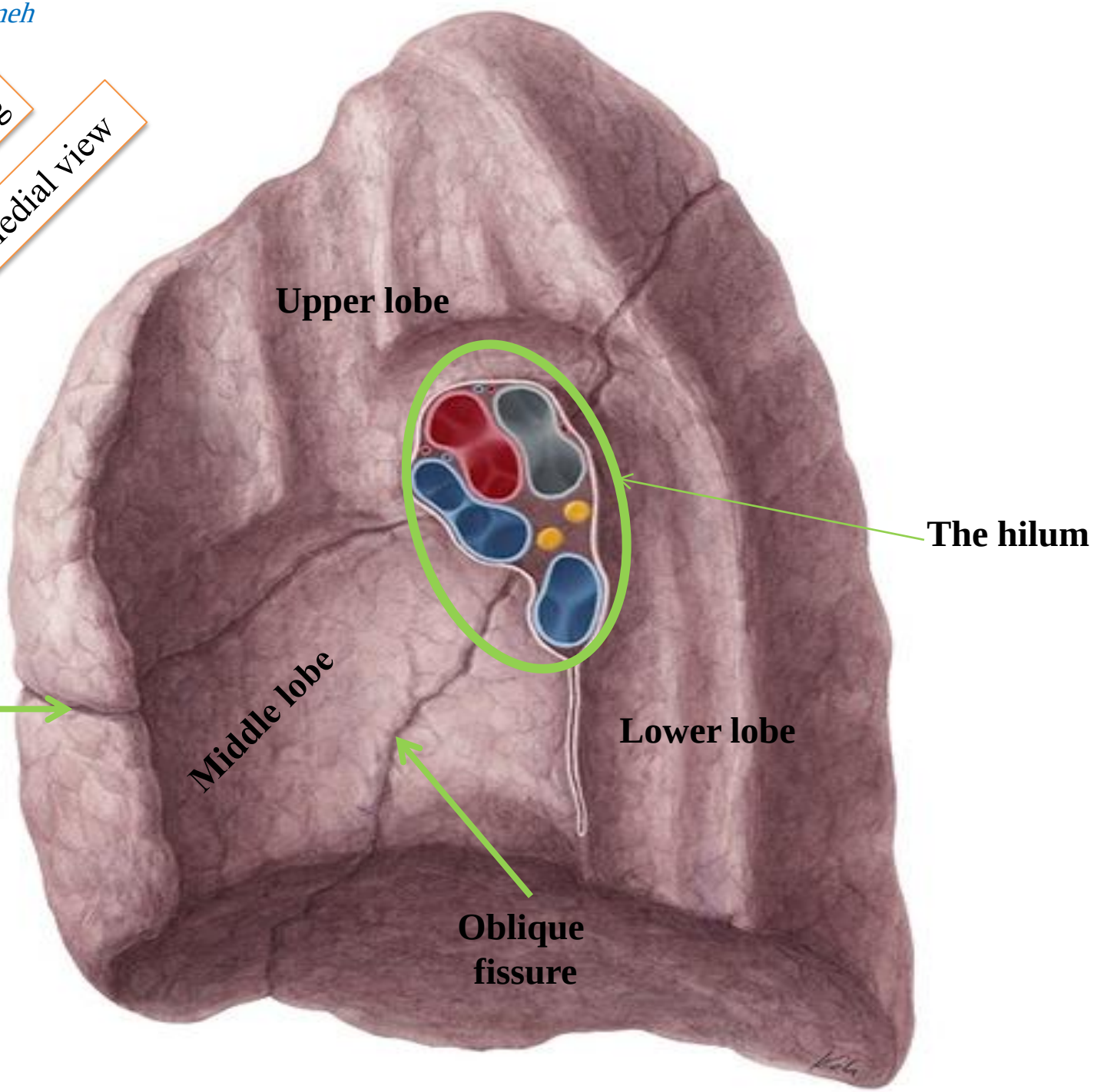
Right lung

Medial view



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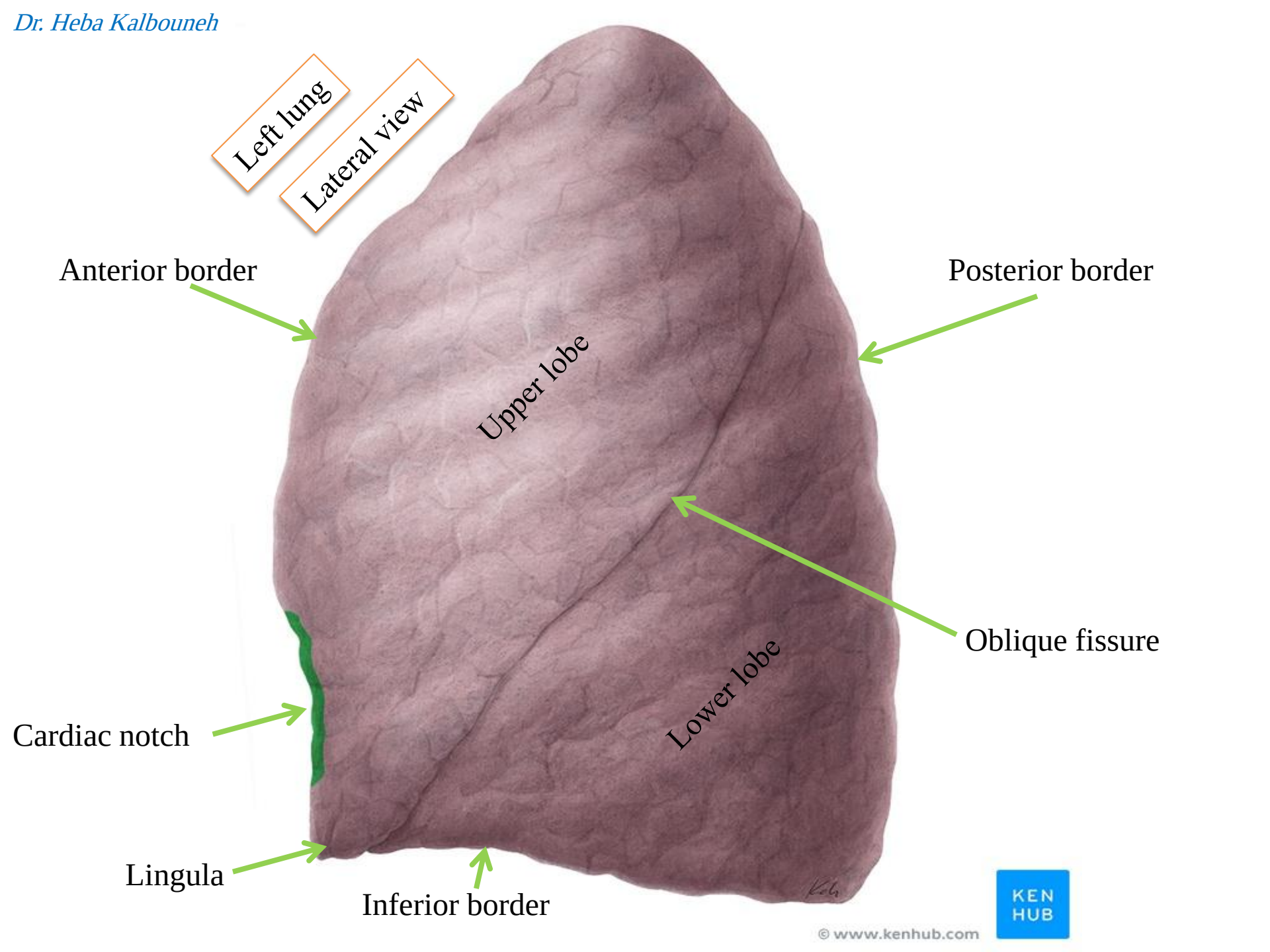

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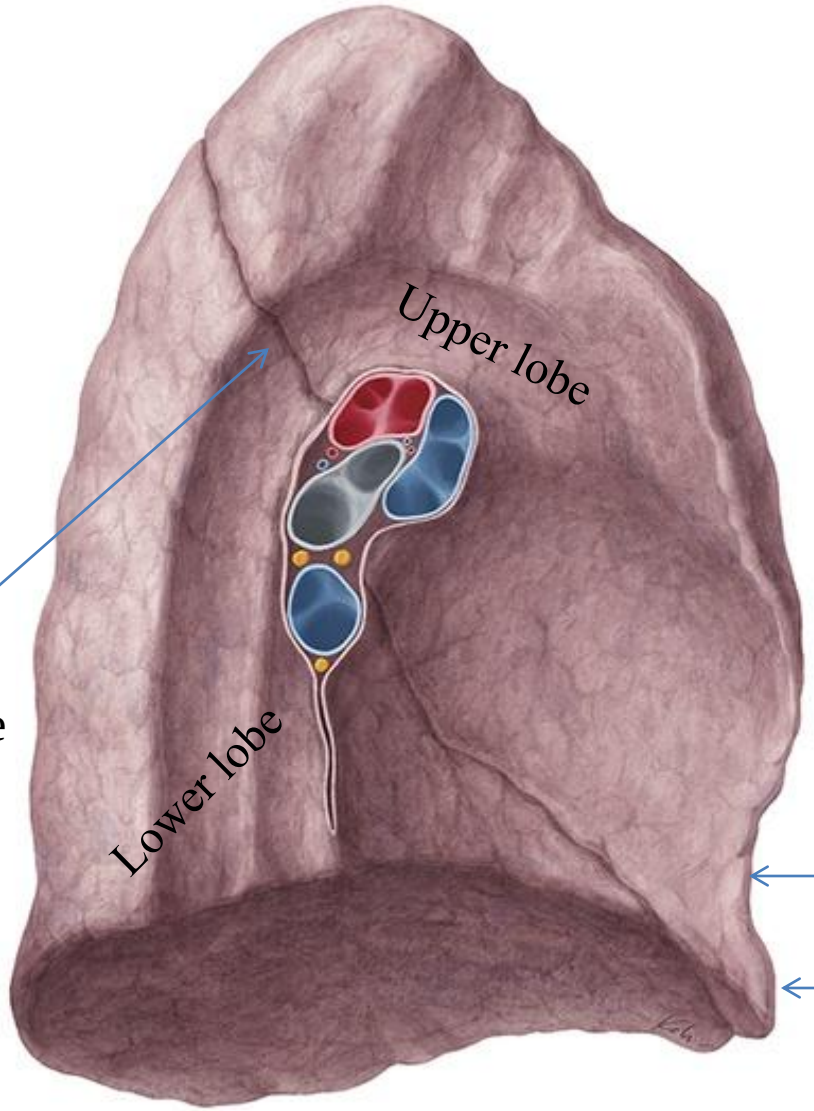
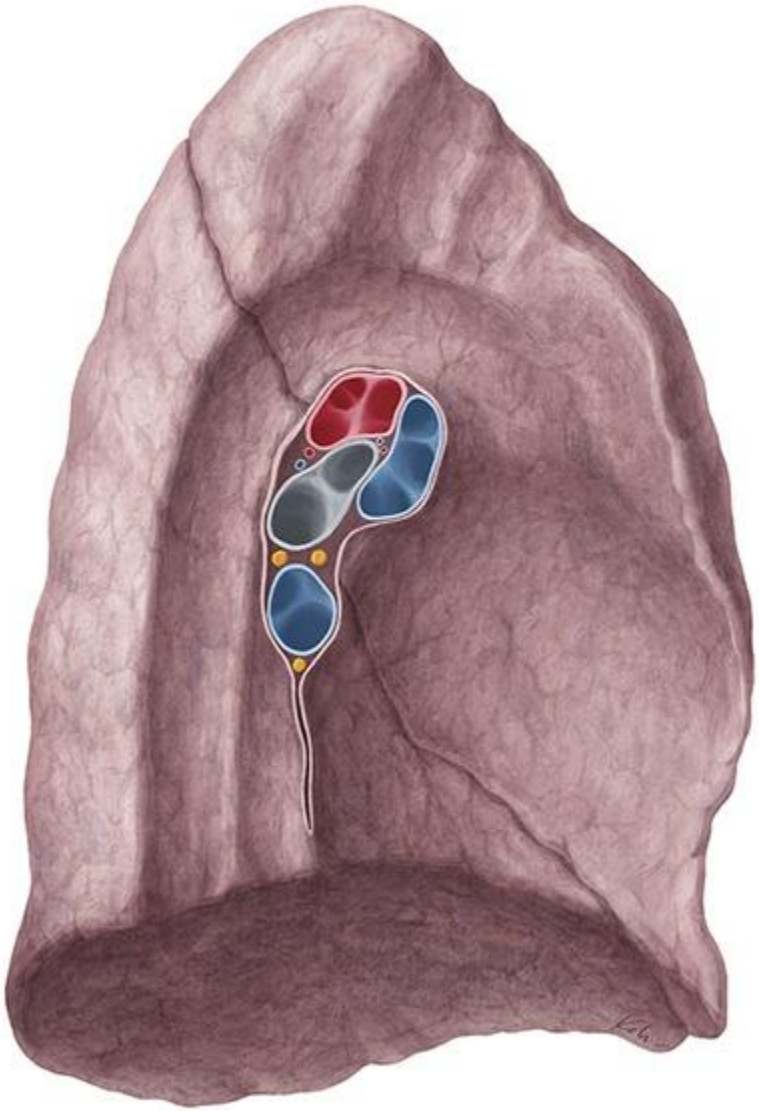
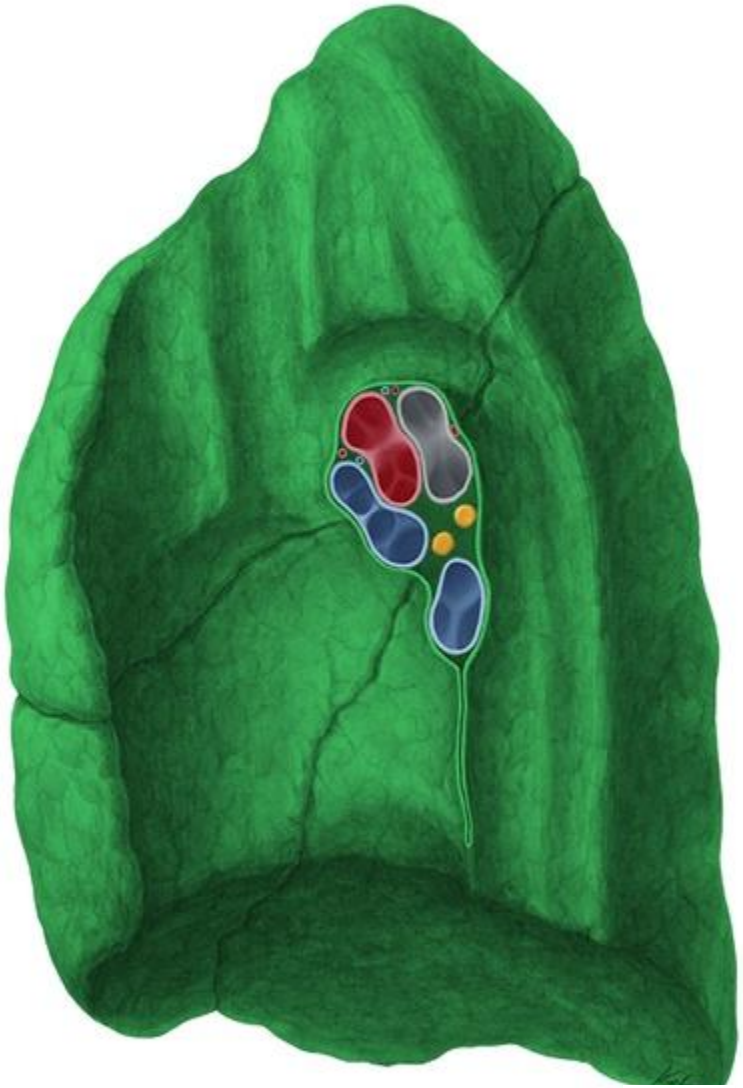
Left lung

Medial view

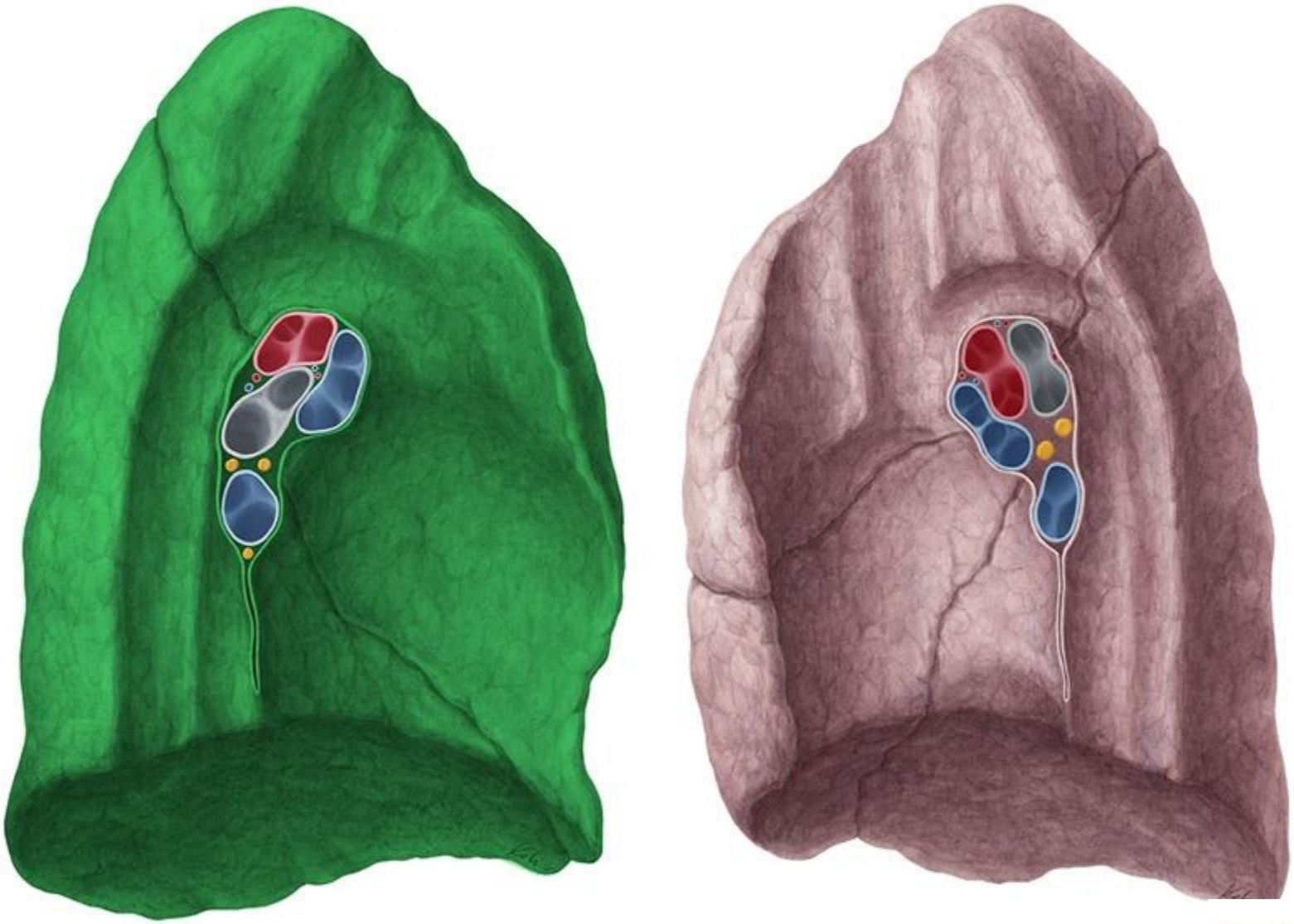


Right lung

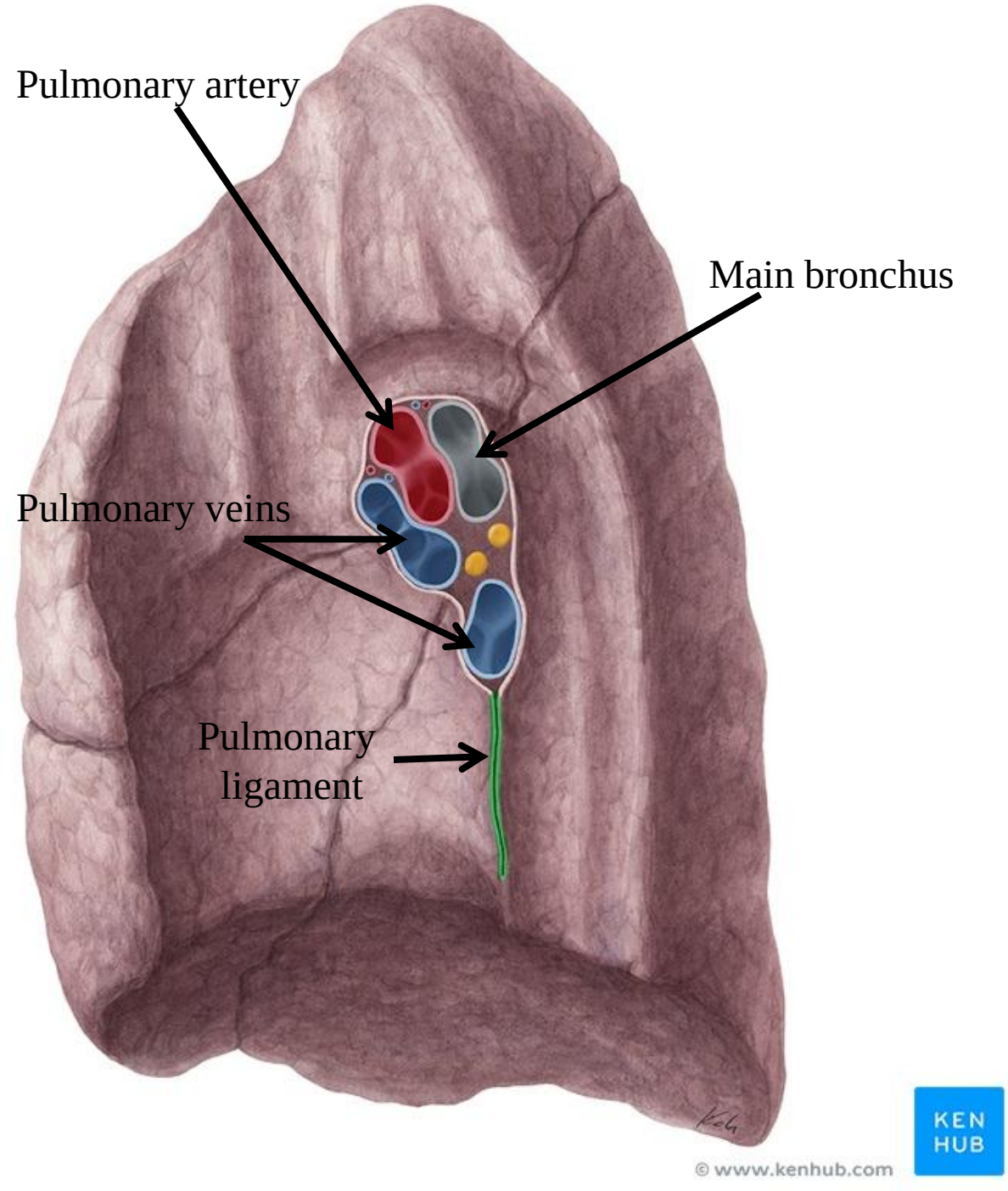




Left lung



Lung hilum



- **Pulmonary ligament:**
  - Thin blade-like fold of pleura
  - Stabilizes the position of the inferior lobe
- Structures enter and leave
  - Pulmonary artery (superior)
  - Two pulmonary veins (inferior)
  - Main bronchus (posterior)
  - Nerves
  - Lymphatics