جامعة المستقبل
AL MUSTAQBAL UNIVERSITY
كلية العلوم
قسم الفيزياء الطبية

Anatomy

The Respiratory System

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Anatomy of respiratory system

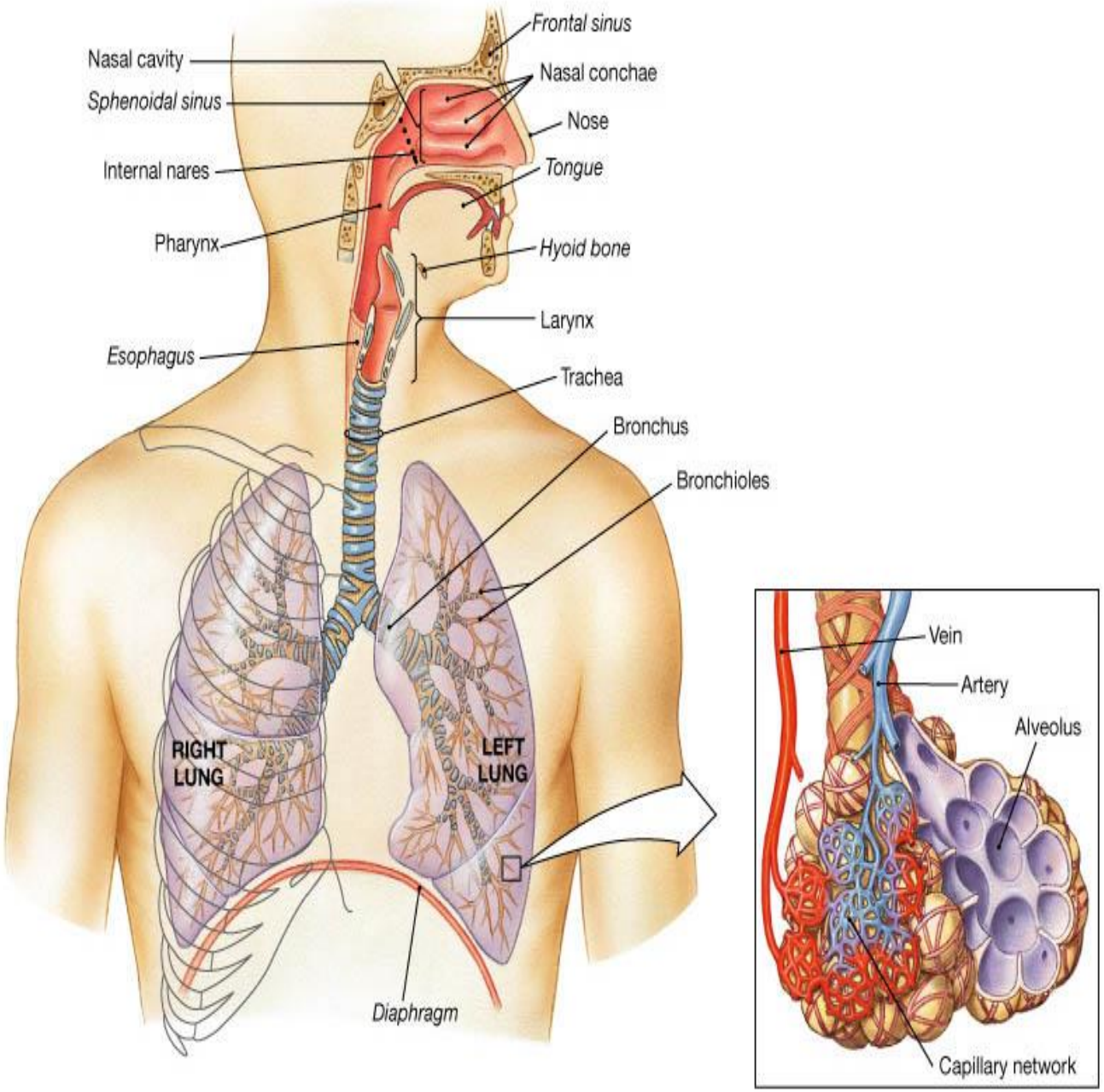
- The **respiratory system** consists of all the tissue and organs designed to bring air to the gas exchange surface where O_2 is absorbed and CO_2 is released.
- The respiratory system can be divided into:
- **Upper respiratory system** that includes the nose, nasal cavity, paranasal sinuses and pharynx
- **Lower respiratory system** that includes the larynx, trachea, bronchi and lungs.

The respiratory tract can be divided into-

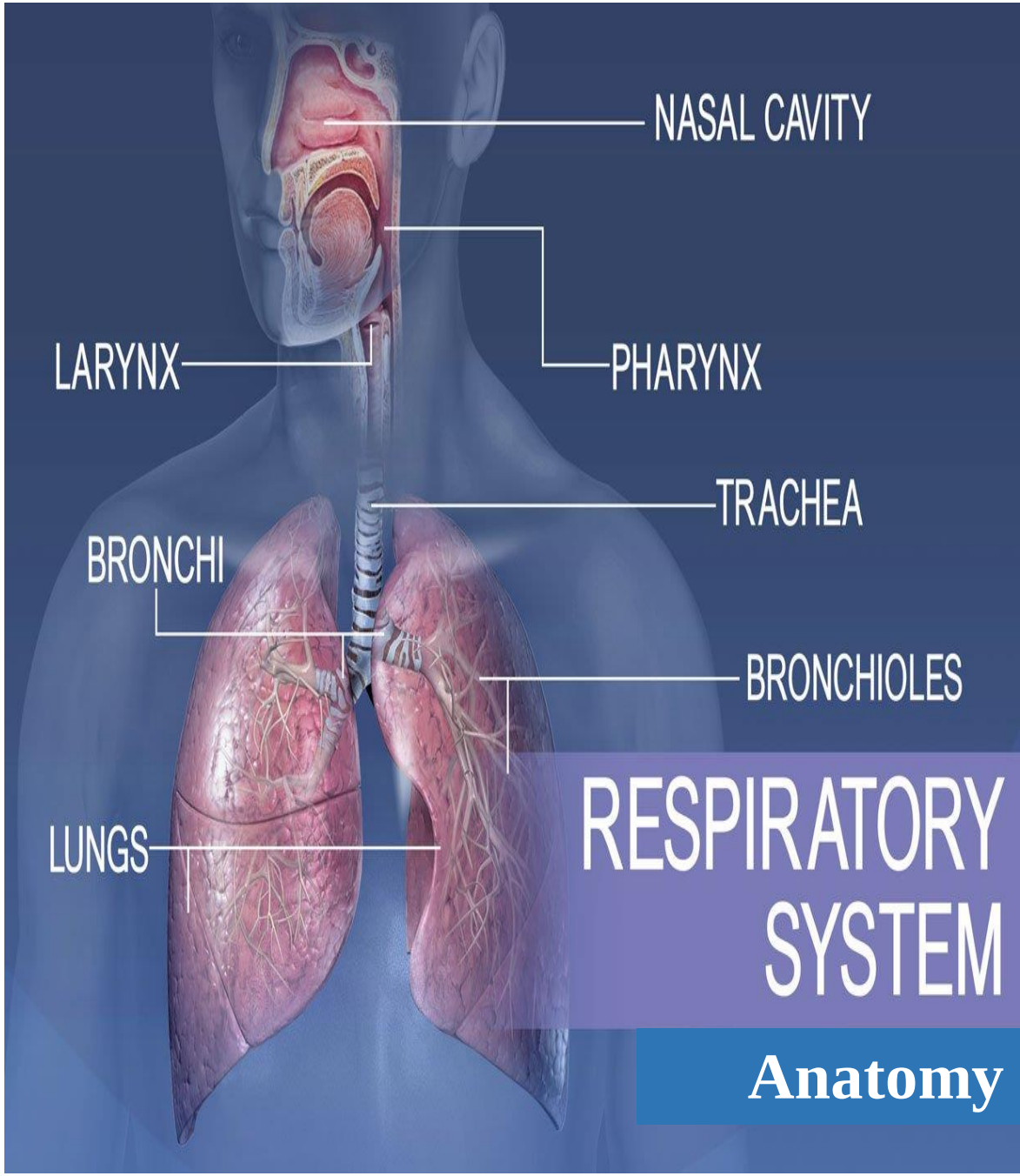
- **Conducting portion** from the nasal cavity to the terminal bronchioles through which no gas exchange occurs.
- **Respiratory portion** that includes the respiratory bronchioles and alveoli where gas exchange occurs.

Pathway of Air

- nose ---> pharynx ---> larynx ---> trachea ---> primary bronchi ---> secondary bronchi ---> tertiary bronchi ---> bronchioles ---> terminal bronchioles ---> respiratory bronchioles ---> alveolar duct ---> alveoli


Frontal sinus
Nasal cavity
Nasal conchae
Sphenoidal sinus
Nose
Internal nares
Tongue
Pharynx
Hyoid bone
Larynx
Esophagus
Trachea
Bronchus
Bronchioles
RIGHT LUNG
LEFT LUNG
Diaphragm

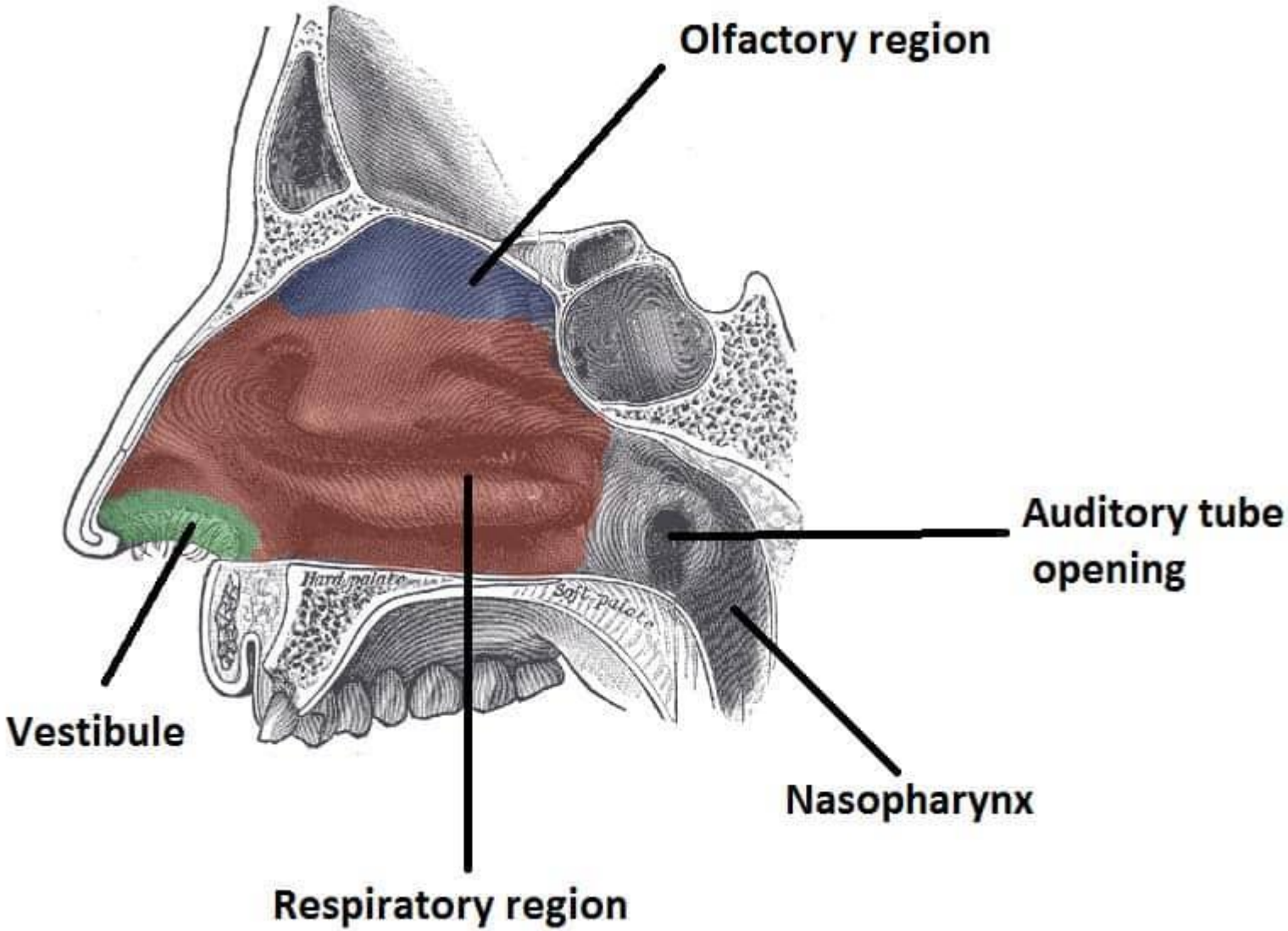
Vein
Artery
Alveolus
Capillary network


NASAL CAVITY
LARYNX
PHARYNX
TRACHEA
BRONCHI
BRONCHIOLES
LUNGS
RESPIRATORY SYSTEM
Anatomy

The **nose** is an olfactory and respiratory organ. It consists of nasal skeleton, which houses the nasal cavity. The nasal cavity has four functions:
Warms and **humidifies** the inspired air.
Removes and traps **pathogens** and particulate matter from the inspired air.
Responsible for sense of **smell.**
Drains and clears the paranasal sinuses and lacrimal ducts

Divisions
The nasal cavity is the most superior part of the **respiratory tract**. It extends from the vestibule of the nose to the nasopharynx, and has three divisions:

Vestibule – the area surrounding the anterior external opening to the nasal cavity.
Respiratory region – lined by a ciliated psudeostratified epithelium, interspersed with mucus-secreting goblet cells.
Olfactory region – located at the apex of the nasal cavity. It is lined by olfactory cells with olfactory receptors.

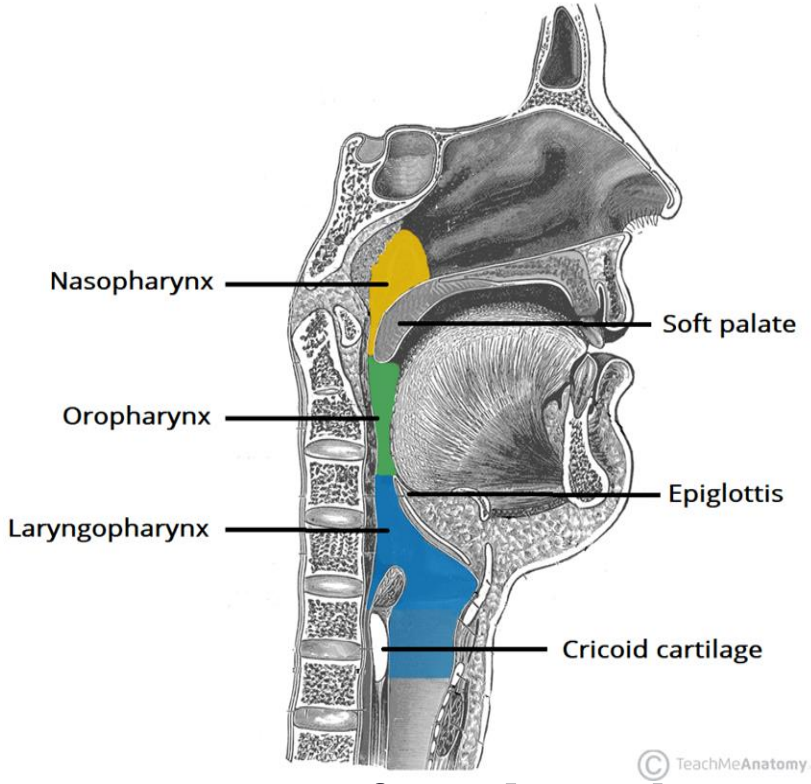


Nasal Cavity Divisions

The **pharynx** is a muscular tube that connects the oral and nasal cavity to the larynx and oesophagus.

The pharynx is comprised of three parts (superior to inferior):
Nasopharynx Oropharynx Laryngopharynx

The nasopharynx is continuous with the nasal cavity and performs a respiratory function by conditioning inspired air and propagating it into the larynx. It is lined with respiratory epithelium; ciliated pseudostratified columnar epithelium with goblet cells.

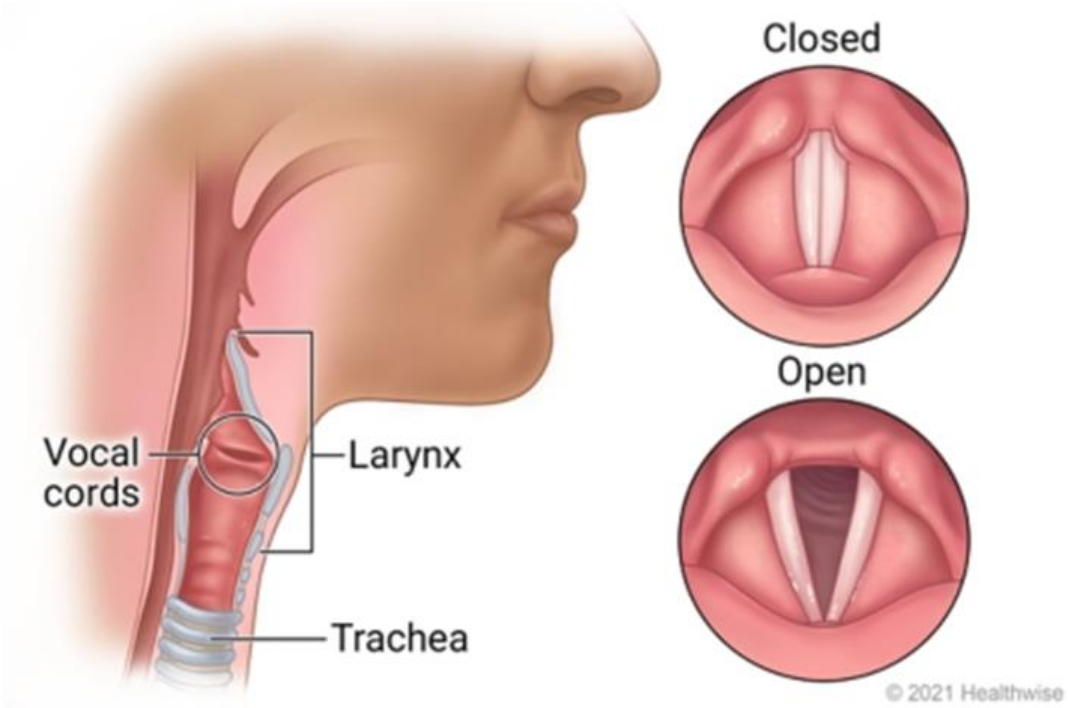


The oropharynx : The oropharynx is involved in the voluntary and involuntary phases of swallowing.

The most distal part of the pharynx, the **laryngopharynx** which is continuous inferiorly with the esophagus. It is posterior to the larynx.

The larynx (voice box) is a component of the respiratory tract, located in the anterior neck. suspended from the hyoid bone, and spanning between C3 and C6.

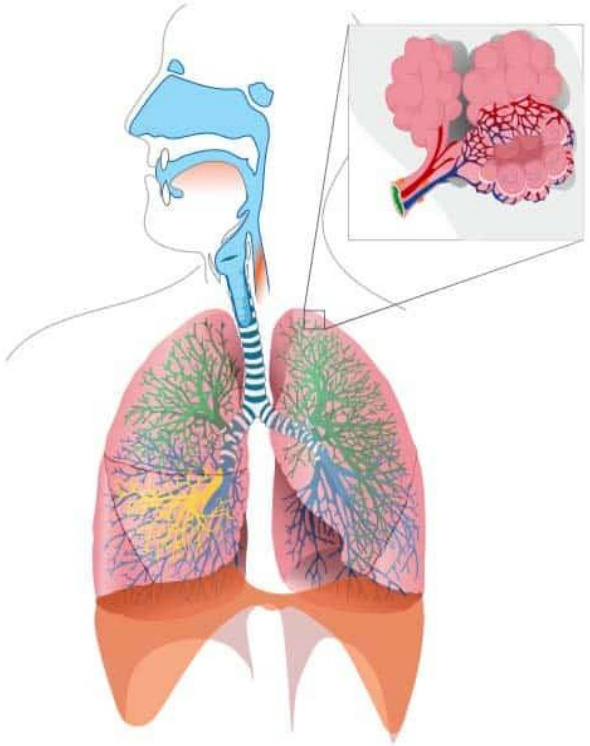
It is continuous inferiorly with the **trachea**, and opens superiorly into the laryngeal part of the pharynx. The larynx is formed by a cartilaginous skeleton, which is held together by ligaments and membranes. The laryngeal muscles act to move the components of the larynx for phonation and breathing.



The Tracheobronchial Tree

The trachea, bronchi and bronchioles form the **tracheobronchial tree:** a system of airways that allow passage of air into the lungs, where gas exchange occurs. These airways are located in the neck and thorax.

The trachea marks the beginning of the tracheobronchial tree. It arises as a continuation of the larynx. It travels inferiorly, bifurcating at the level of the sternal angle (forming the right and left main bronchi), at this bifurcation a ridge of cartilage called the **carina.** The trachea is held open by cartilage, here in C-shaped rings.

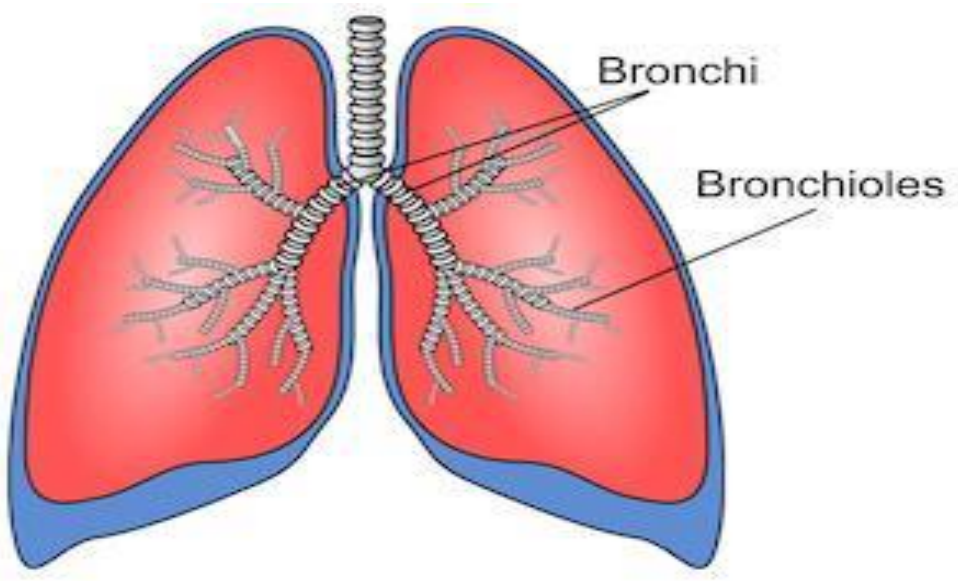


The trachea and bronchi are lined by ciliated pseudostratified columnar epithelium, interspersed by goblet cells, which produce mucus.
The combination of sweeping movements by the cilia and mucus from the goblet cells forms the functional mucociliary escalator. This acts to trap inhaled particles and pathogens, moving them up out of the airways to be swallowed and destroyed.

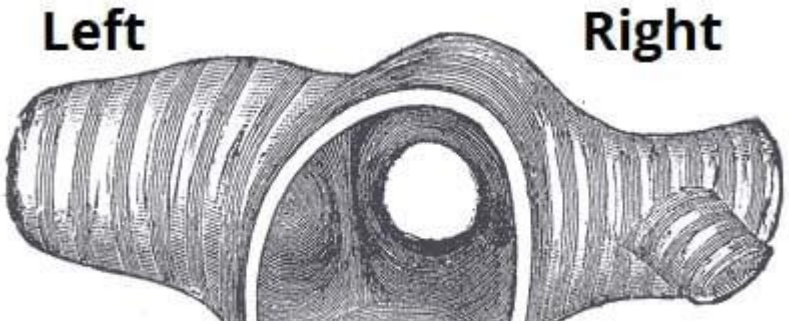
Bronchi

At the level of the sternal angle, the trachea bifurcates into the right and left main bronchi. They undergo further branching to produce the secondary bronchi. Each secondary bronchi supplies a lobe of the lung, and gives rise to several segmental bronchi.

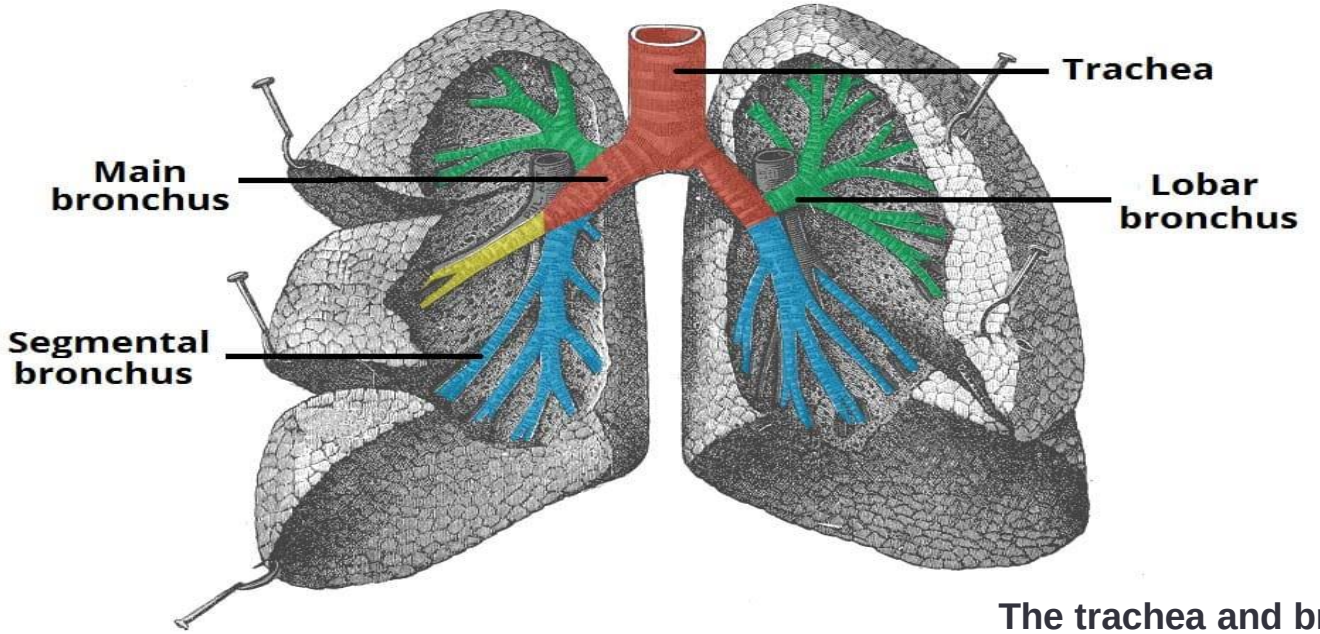
Right main bronchus: wider, shorter, and descends more vertically than its left-sided counterpart. Clinically, this results in a higher incidence of foreign body inhalation.



The structure of bronchi are very similar to that of the trachea, though differences are seen in the shape of their cartilage. In the main bronchi, cartilage rings completely encircle the lumen. However in the smaller lobar and segmental bronchi cartilage is found only in crescent shapes.



Transverse section of the trachea, showing its bifurcation



The trachea and bronchi

Bronchioles

The segmental bronchi undergo further branching to form numerous smaller airways, called **the bronchioles.** The smallest airways, bronchioles do not contain any cartilage or mucus-secreting goblet cells. Instead, **club cells** produce a **surfactant lipoprotein** which is instrumental in preventing the walls of the small airways sticking together during expiration.

Initially there are many **conducting bronchioles**, which transport air but not involved in gas exchange. Conducting bronchioles then eventually end as **terminal bronchioles.** These terminal bronchioles branch even further into **respiratory bronchioles**, which are distinguishable by the presence of **alveoli** extending from their lumens.

Alveoli are tiny air-filled pockets with thin walls (simple squamous epithelium), and are the sites of gaseous exchange in the lungs. Altogether there are around 300 million alveoli in adult lungs, providing a large surface area for adequate gas exchange.

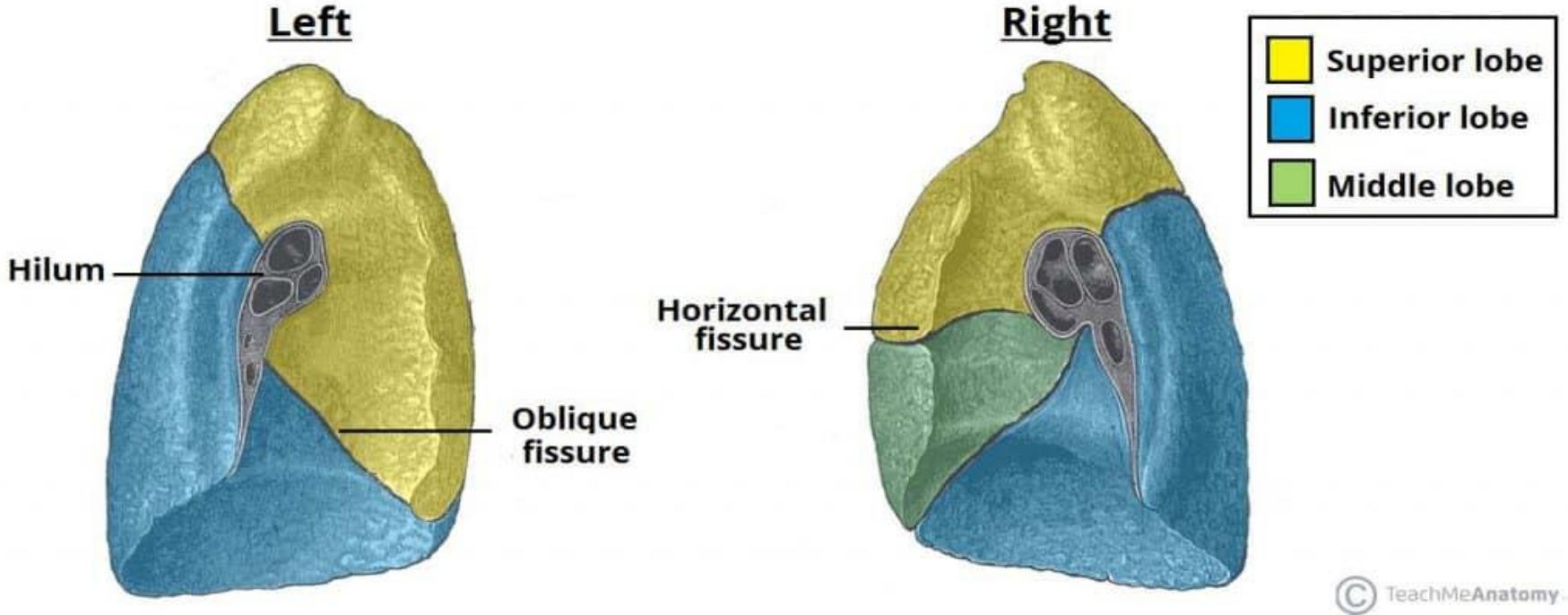
The **lungs** are the organs of respiration. The function of the lungs is to **oxygenate** blood. They achieve this by bringing inspired air into close contact with oxygen-poor blood in the pulmonary capillaries. The lungs lie either side of the mediastinum, within the thoracic cavity. Each lung is surrounded by a pleural cavity, which is formed by the visceral and parietal pleura.

Lobes

The right and left lungs do not have an identical lobular structure.

The right lung has; superior, middle and inferior. The lobes are divided from each other by two fissures: Oblique fissure and Horizontal fissure.

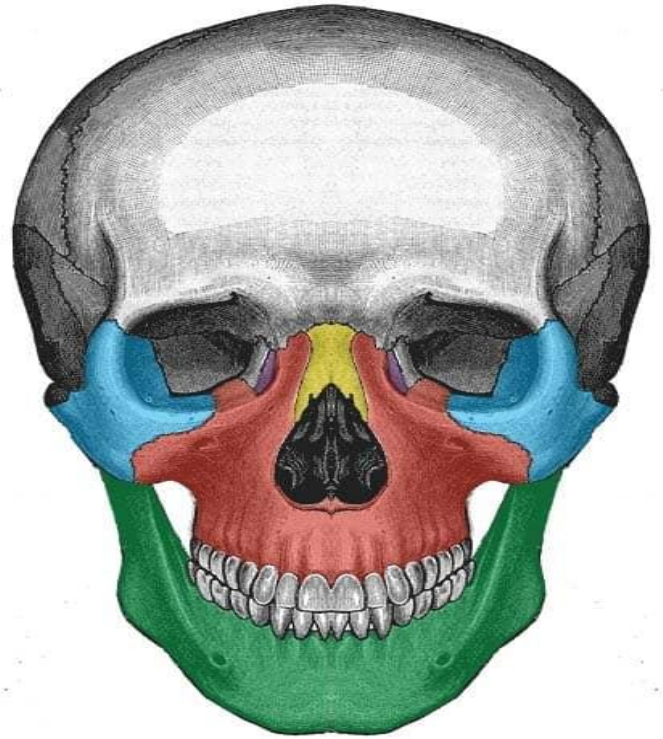
The left lung contains superior and inferior lobes, which are separated by oblique fissure



The pleurae refer to the **serous membranes** that line the lungs and thoracic cavity. They permit efficient respiration. There are two pleurae in the body: one associated with each lung.
Each pleura can be divided into two parts:
Visceral pleura: covers the lungs.
Parietal pleura: covers the internal surface of the thoracic cavity.
There is a potential space between the viscera and parietal pleura, known as the **pleural cavity**. It contains a small volume of serous fluid.

Mediastinum
The mediastinum, or mediastinal cavity, is a visceral compartment of the thoracic cavity. It completely separates the **two pleural cavities** by being placed longitudinally between them. It extends from the superior thoracic aperture to the diaphragm. The main mediastinal contents are the heart, esophagus, trachea, thoracic nerves and systemic blood vessels.

THANK YOU!



Zygomatic
Maxilla
Nasal
Lacrimal
Mandible