

RESPIRATORY SYSTEM

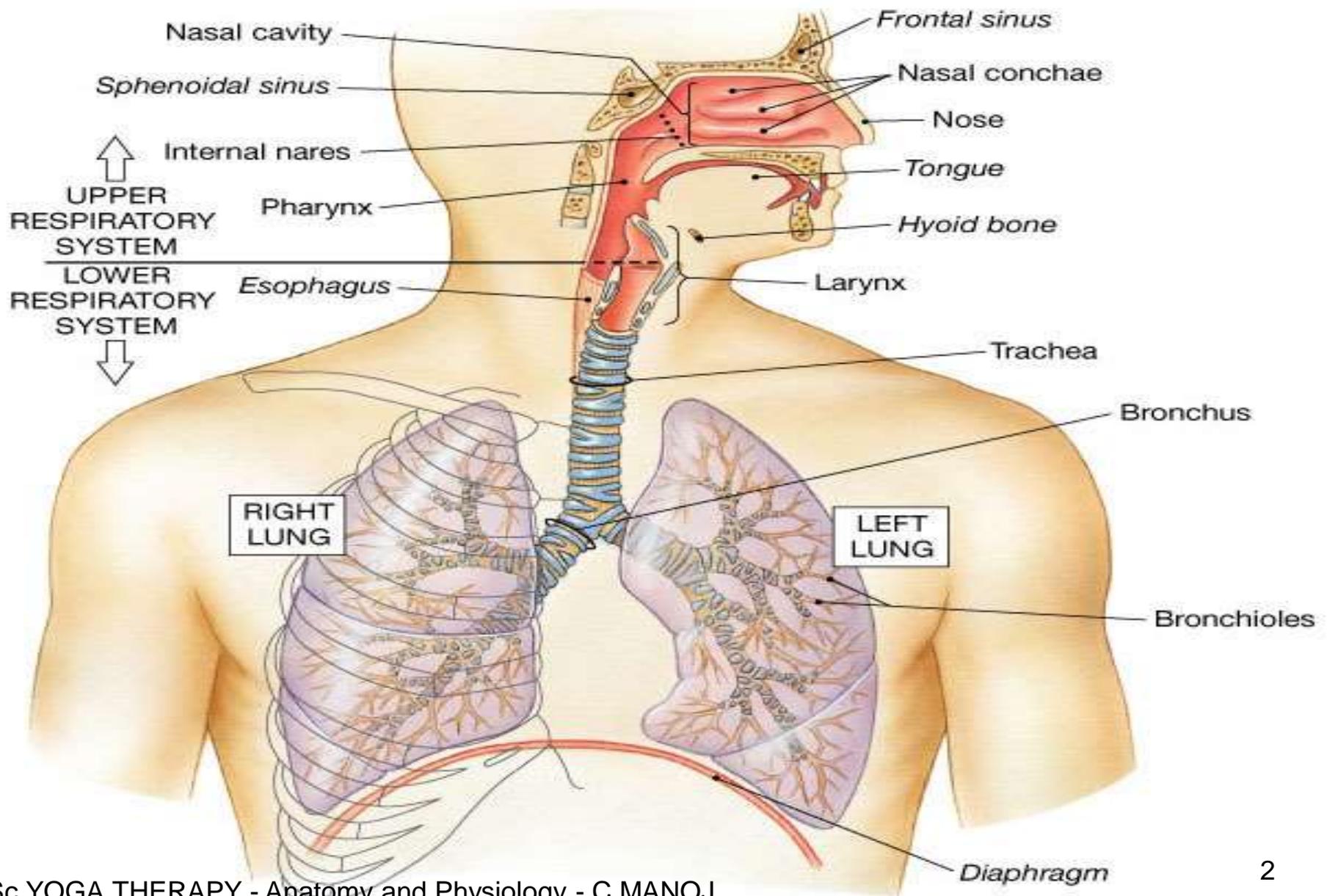
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The Components of the Respiratory System



What is the pathway that air follows?

Nose...

Pharynx...

Larynx...

Trachea...

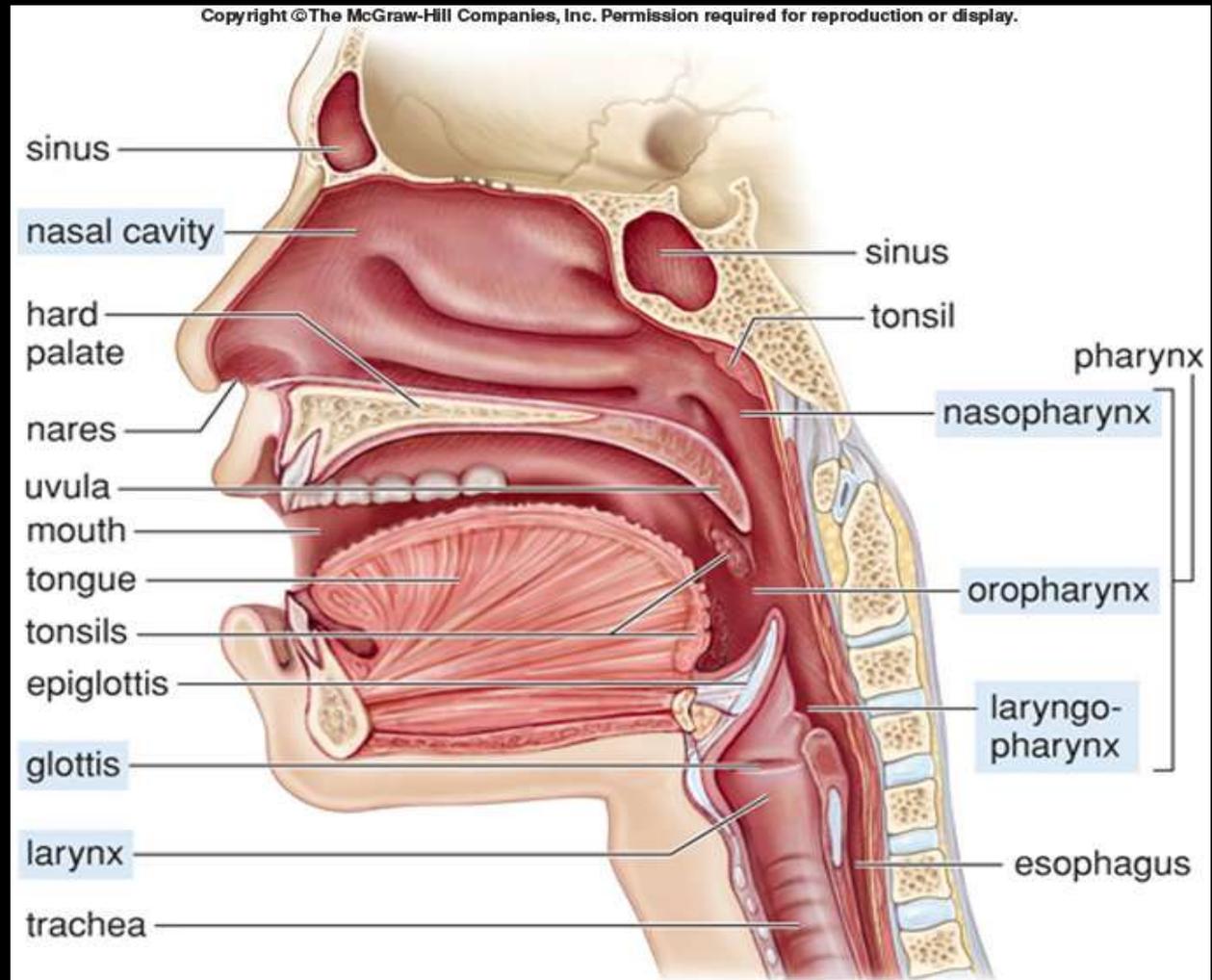
Bronchus...

Bronchioles...

Alveoli...

What constitutes the upper respiratory tract?

- Nose
- Pharynx
- Larynx



The nose

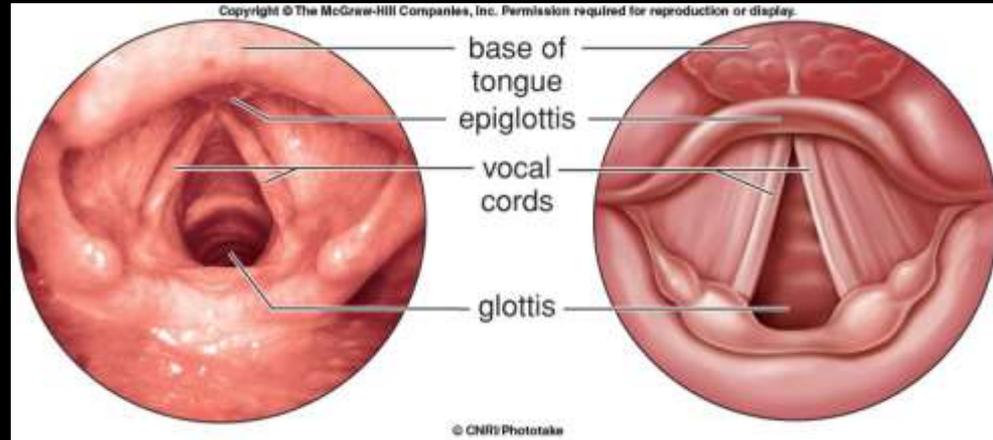
- Opens at the nostrils/nares and leads into the nasal cavities
- Hairs and mucus in the nose filters the air
- The nasal cavity has lots of capillaries that warm and moisten the air
- Specialized cells act as odor receptors
- Tear glands drain into the nasal cavities and can lead to a runny nose

The pharynx

- Funnel-shaped cavity commonly called the “throat”
- Tonsils provide a lymphatic defense during breathing at the junction of the oral cavity and pharynx

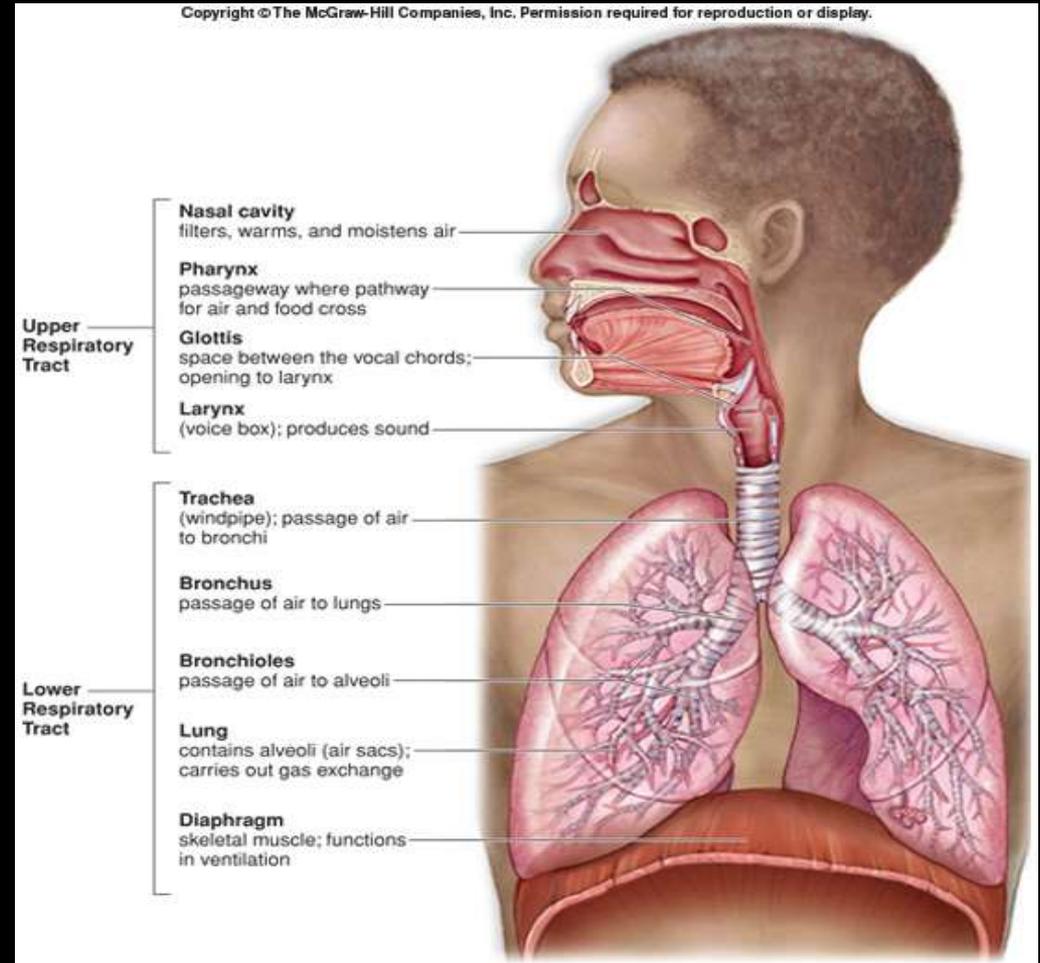
The larynx

- Triangular, cartilaginous structure that passes air between the pharynx and trachea
- Called the voice box and houses vocal cords



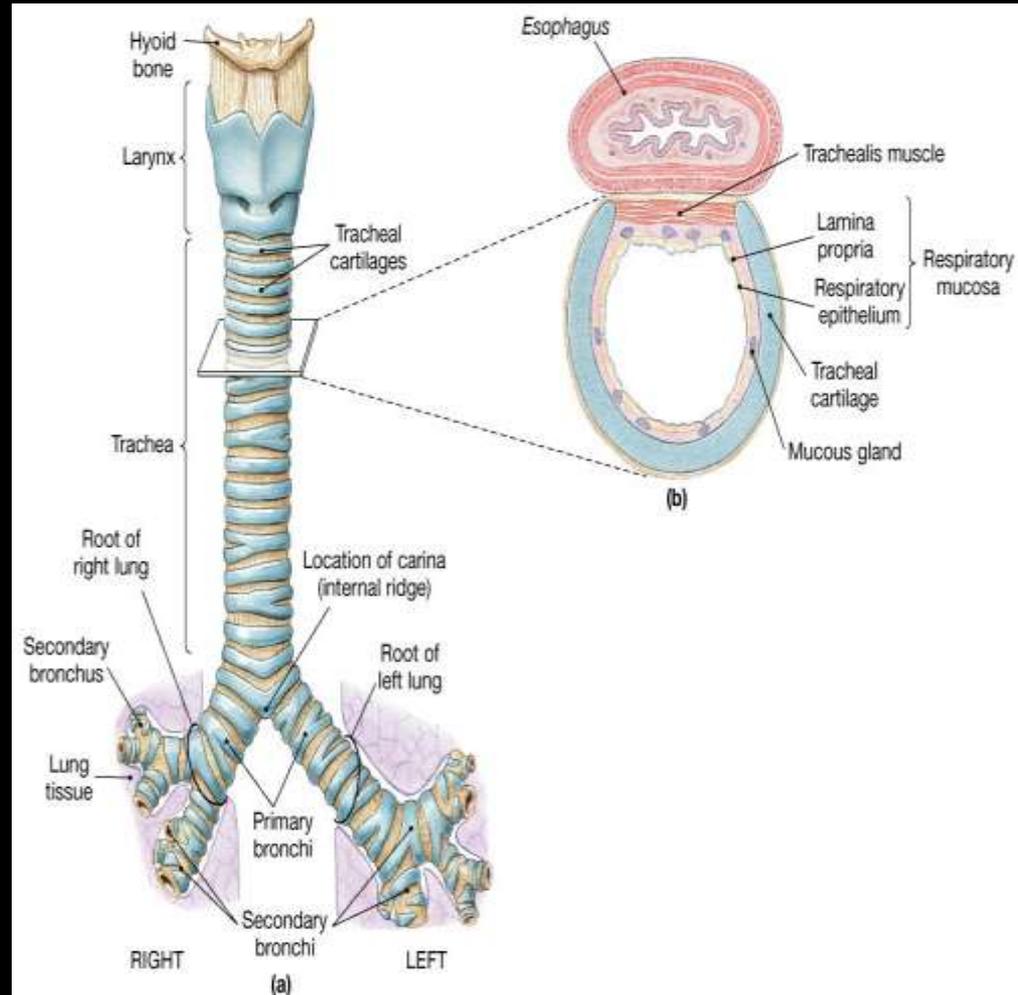
What constitutes the lower respiratory tract?

- Trachea
- Bronchial tree
- Lungs



The trachea

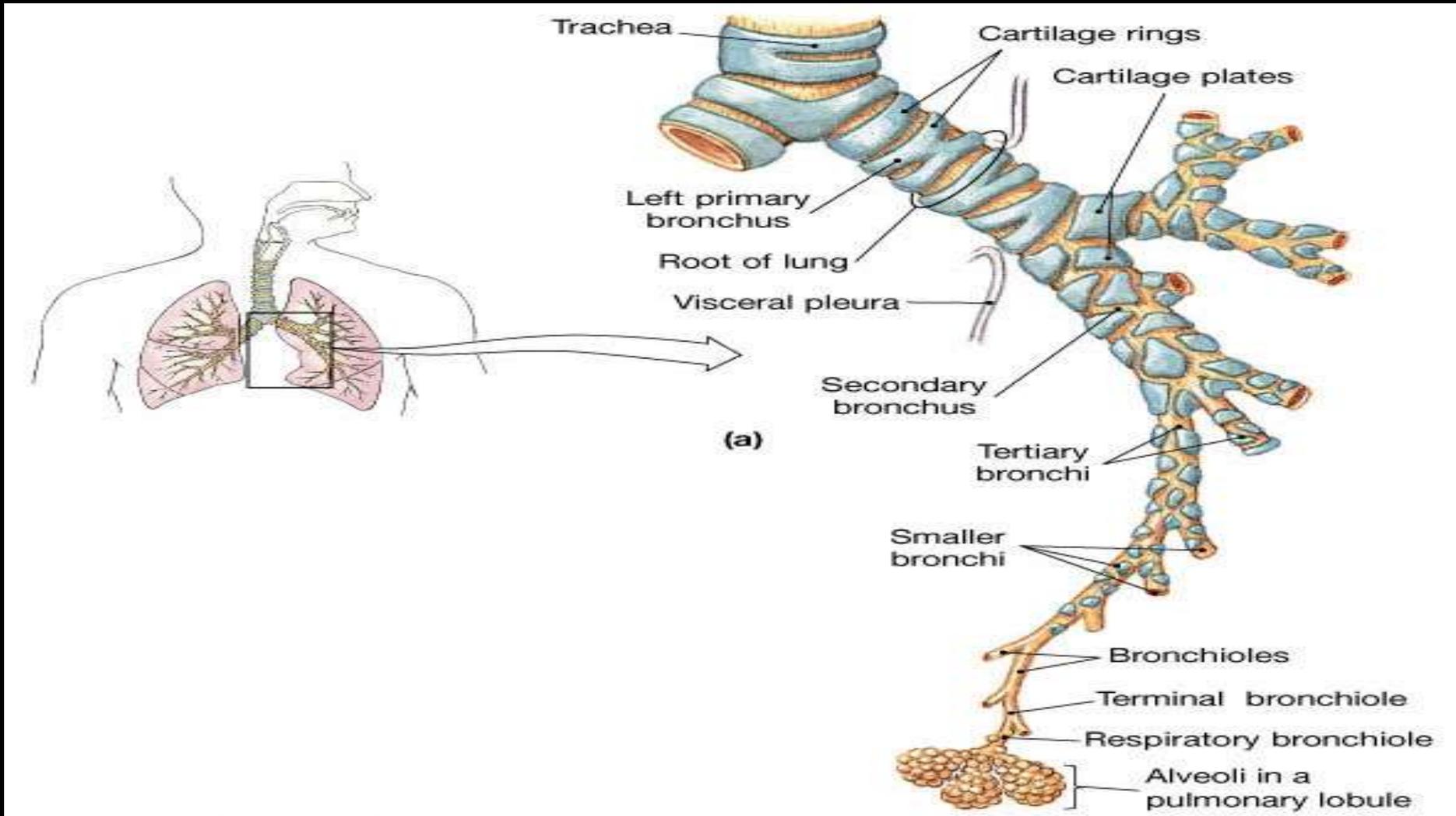
- A tube, often called the windpipe, that connects the larynx with the 1° bronchi
- Made of connective tissue, smooth muscle, and cartilaginous rings
- Lined with cilia and mucus that help to keep the lungs clean
- **Tracheostomy**—a breathing tube may be inserted into the trachea when a person is choking due to a blocked windpipe.



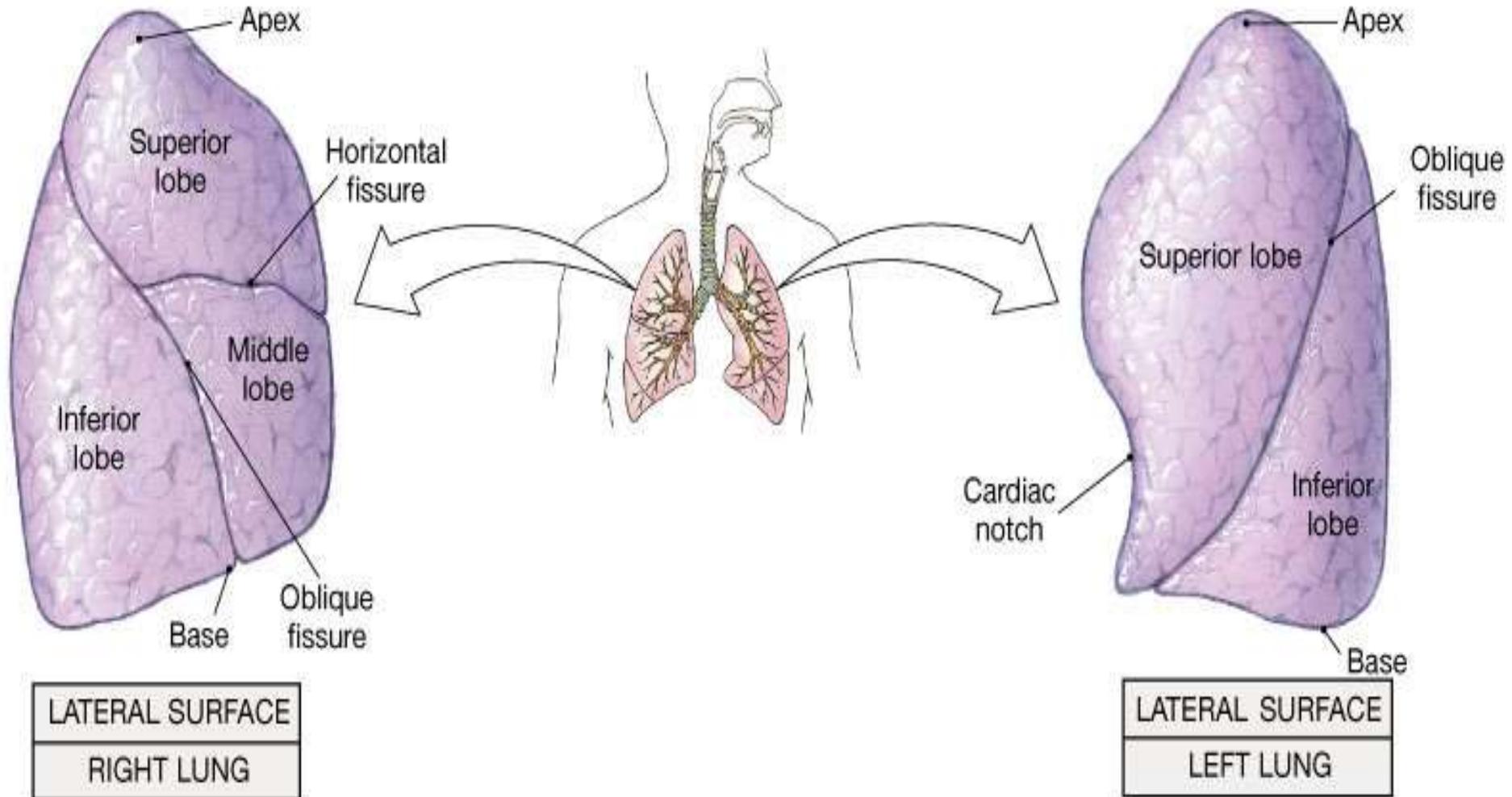
The bronchial tree

- Starts with **two main bronchi** that lead from the trachea into the lungs
- The bronchi continue to branch until they are small **bronchioles** about 1mm in diameter with thinner walls
- Bronchioles eventually lead to elongated sacs called **alveoli**

The Bronchi and Lobules of the Lung



The Gross Anatomy of the Lungs

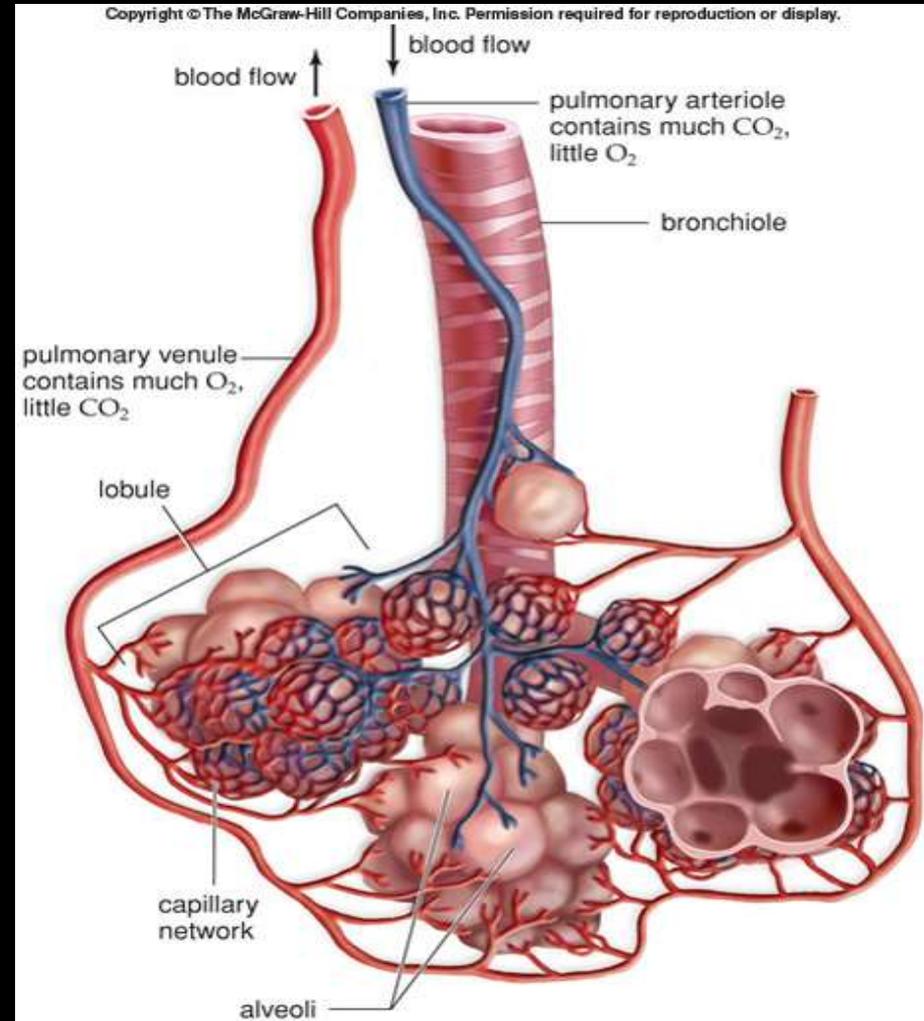


The lungs

- The bronchi, bronchioles, and alveoli beyond the 1° bronchi make up the lungs
- The right lung has 3 lobes while the left lung has 2 lobes that divide into lobules
- Each lung is enclosed by membranes called **pleura**

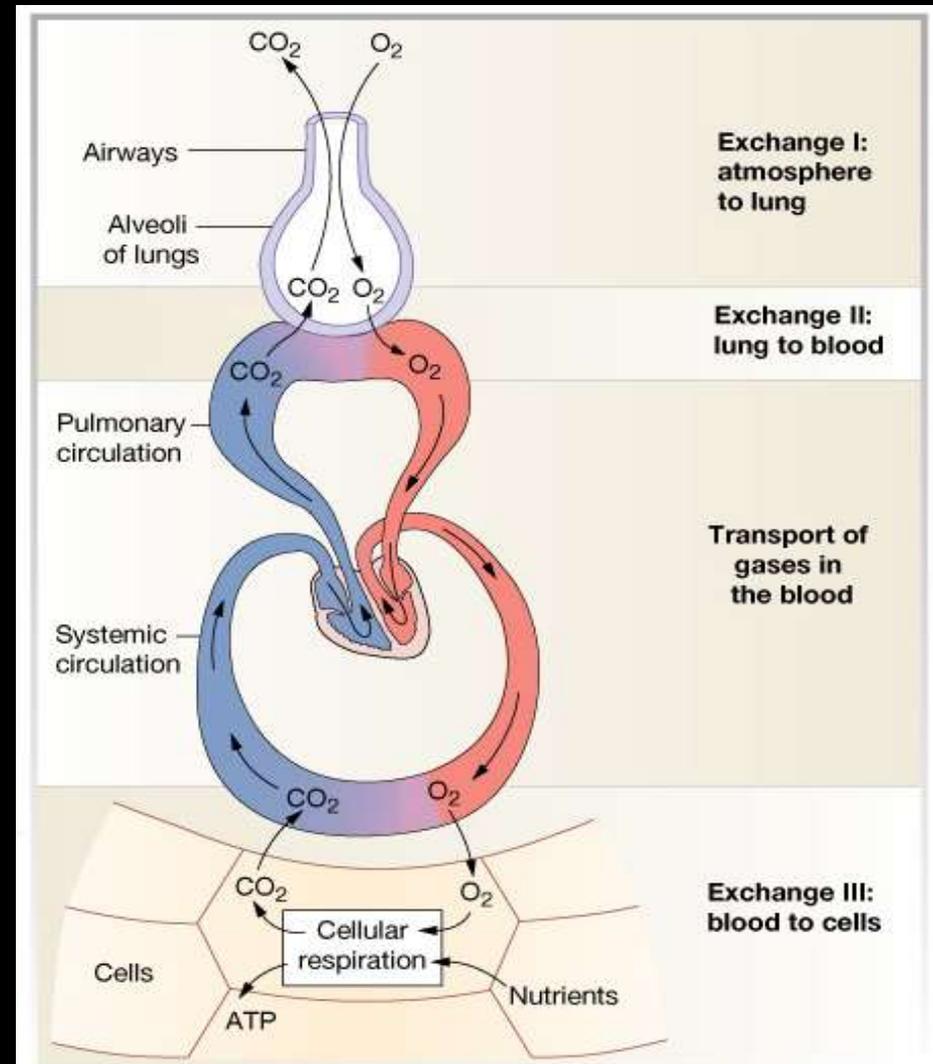
The alveoli

- > 300 million in the lungs that greatly increase surface area
- Alveoli are enveloped by blood capillaries
- The alveoli and capillaries are one layer of epithelium to allow exchange of gases



Functions of the Respiratory System

- Exchange O_2
 - Air to blood
 - Blood to cells
- Exchange CO_2
 - Cells to blood
 - Blood to air
- Regulate blood pH
- Vocalizations
- Protect alveoli



Function Contd...

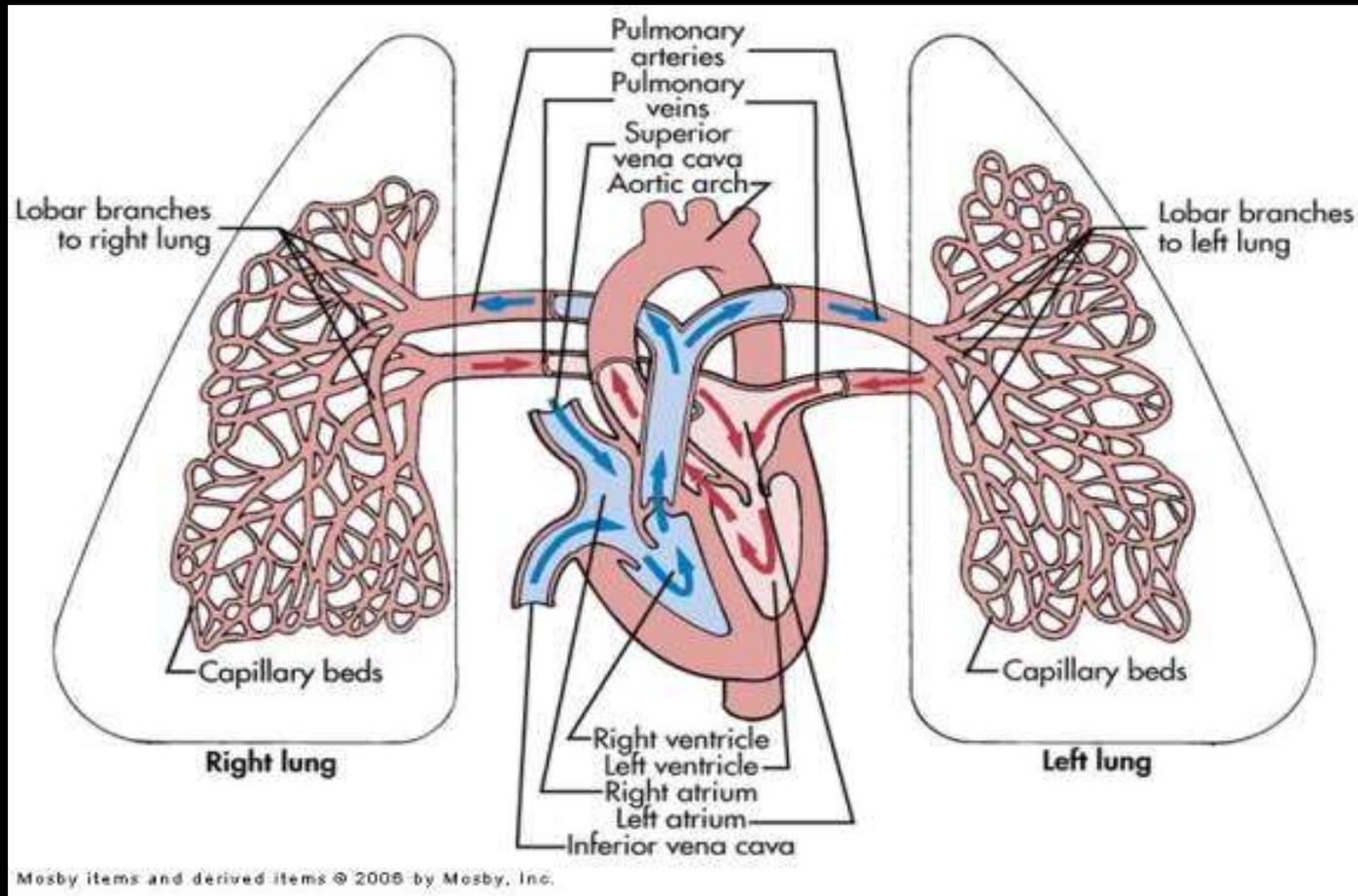
The function of the **respiratory system** is to exchange gases with the cardiovascular system.

The respiratory system involves both external respiration and internal respiration.

External respiration is the exchange of gases between the atmosphere and the blood.

Internal respiration is the exchange of gases between the blood and the cells of the body

Pulmonary and Bronchial Circulation

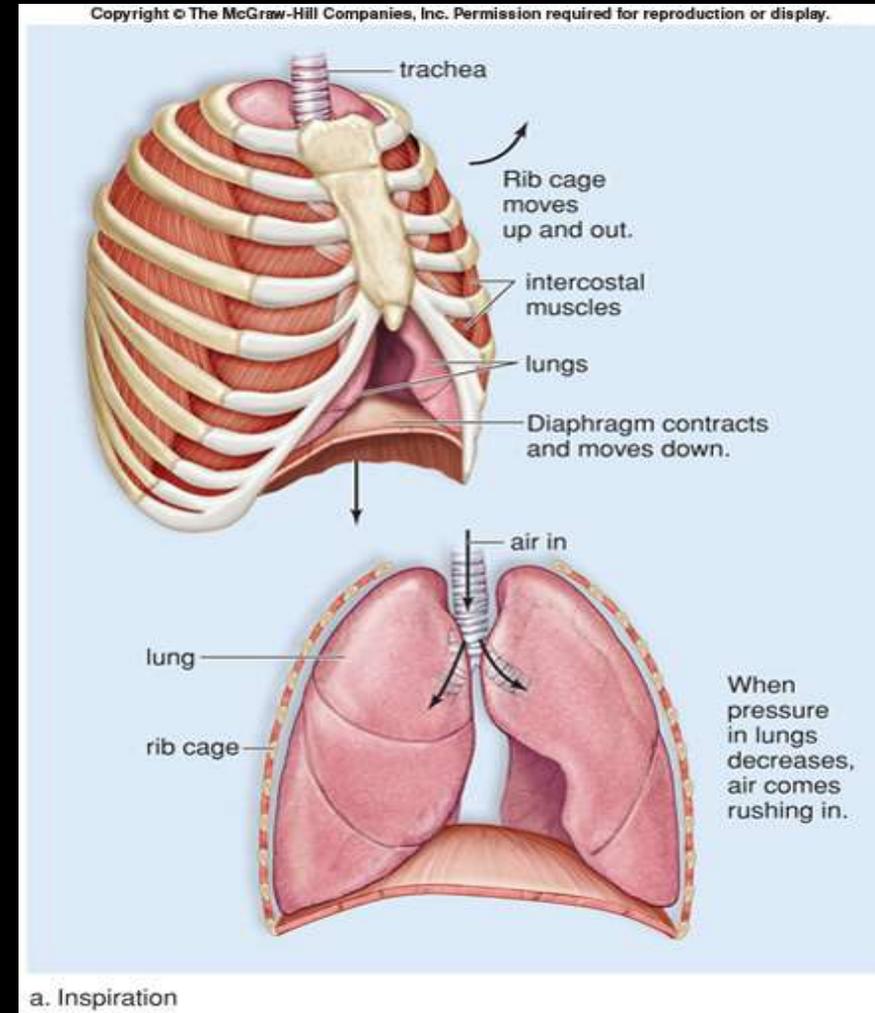


Two phases of breathing/ventilation

1. **Inspiration** – an active process of inhalation that brings air into the lungs
2. **Expiration** – usually a passive process of exhalation that expels air from the lungs

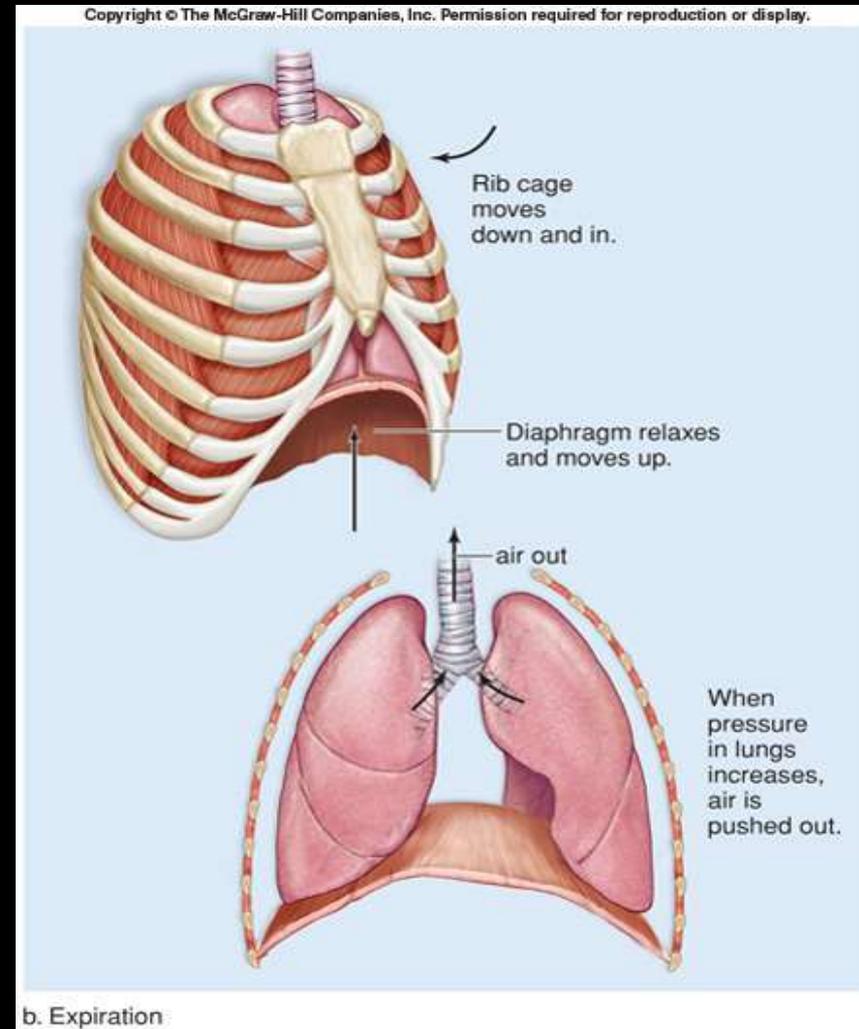
Inspiration

- The diaphragm and intercostal muscles contract
- The diaphragm flattens and the rib cage moves upward and outward
- Volume of the thoracic cavity and lungs increase
- The air pressure within the lungs decrease
- Air flows into the lungs



Expiration

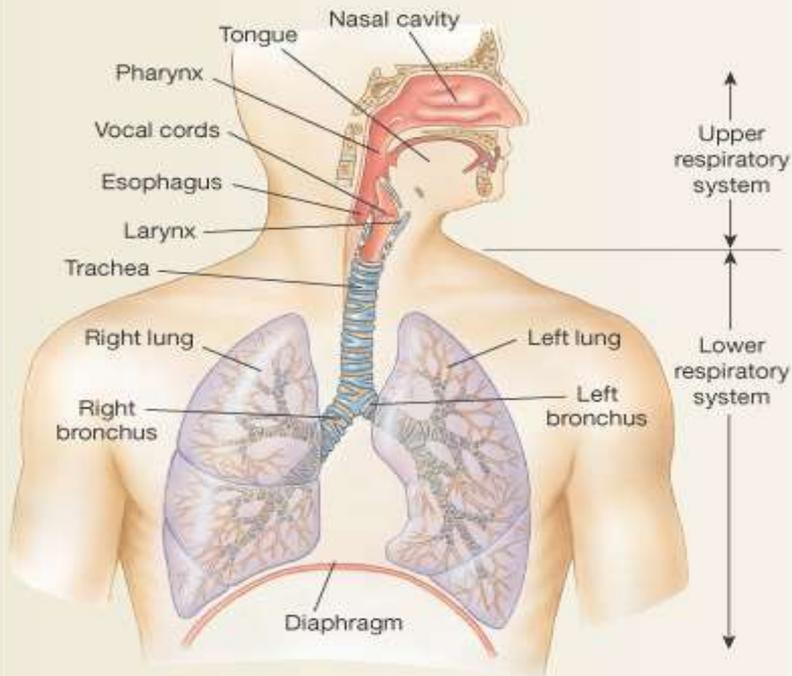
- The diaphragm and intercostal muscles relax
- The diaphragm moves upward and becomes dome-shape
- The rib cage moves downward and inward
- Volume of the thoracic cavity and lungs decrease
- The air pressure within the lungs increases
- Air flows out of the lungs



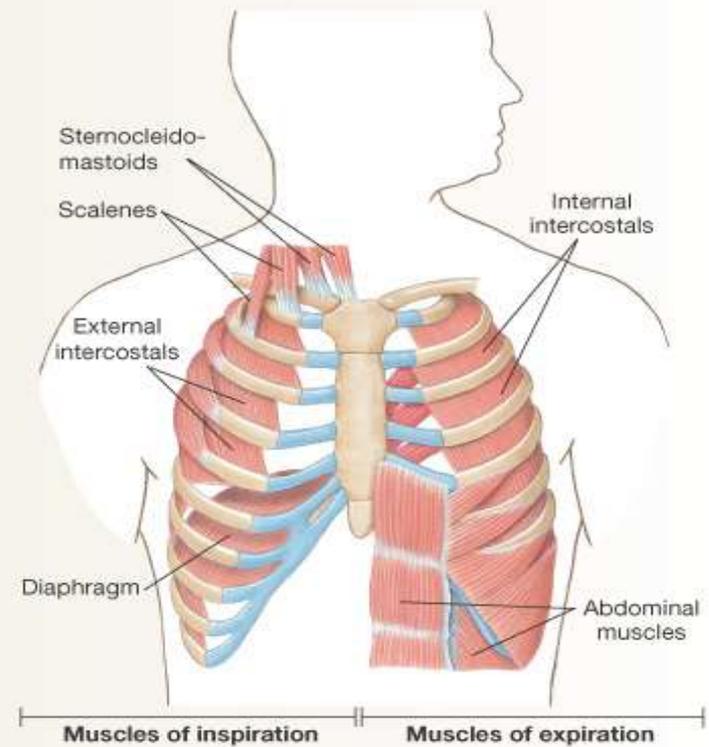
Respiratory System

STRUCTURE OF THE LUNGS AND THORACIC CAVITY

(a) The respiratory system



(b) Muscles used for ventilation



LUNG VOLUMES

- Tidal Volume (TV): 500 ml
- Inspiratory reserve volume (IRV): 3 liters
- Inspiratory capacity (IC): 3.5 liters
- Expiratory reserve volume (ERV): 1 liter
- Residual volume (RV): 1.2 liters
- Functional Residual Capacity (FRC): 2.2 l
- Vital Capacity (VC): 4.5 liters
- Total Lung Capacity (TLC): 5.7 liters

LUNG VOLUMES

- **The tidal volume** (TV), about 500 ml, is the amount of air inspired during normal, relaxed breathing.
- **The inspiratory reserve volume** (IRV), about 3,100 ml, is the additional air that can be forcibly inhaled after the inspiration of a normal tidal volume.
- **The expiratory reserve volume** (ERV), about 1,200 ml, is the additional air that can be forcibly exhaled after the expiration of a normal tidal volume.
- **Residual volume** (RV), about 1,200 ml, is the volume of air still remaining in the lungs after the expiratory reserve volume is exhaled.

LUNG VOLUMES

- **The total lung capacity** (TLC), about 6,000 ml, is the maximum amount of air that can fill the lungs ($TLC = TV + IRV + ERV + RV$).
- **The vital capacity** (VC), about 4,800 ml, is the total amount of air that can be expired after fully inhaling ($VC = TV + IRV + ERV =$ approximately 80% TLC).
- **The inspiratory capacity** (IC), about 3,600 ml, is the maximum amount of air that can be inspired ($IC = TV + IRV$).
- **The functional residual capacity** (FRC), about 2,400 ml, is the amount of air remaining in the lungs after a normal expiration ($FRC = RV + ERV$).

LUNG VOLUMES: RELATIONSHIPS

- $IC = IRV + TV$
- $FRC = ERV + RV$
- $VC = IRV + TV + ERV$
- $TLC = VC + RV$

THANK YOU