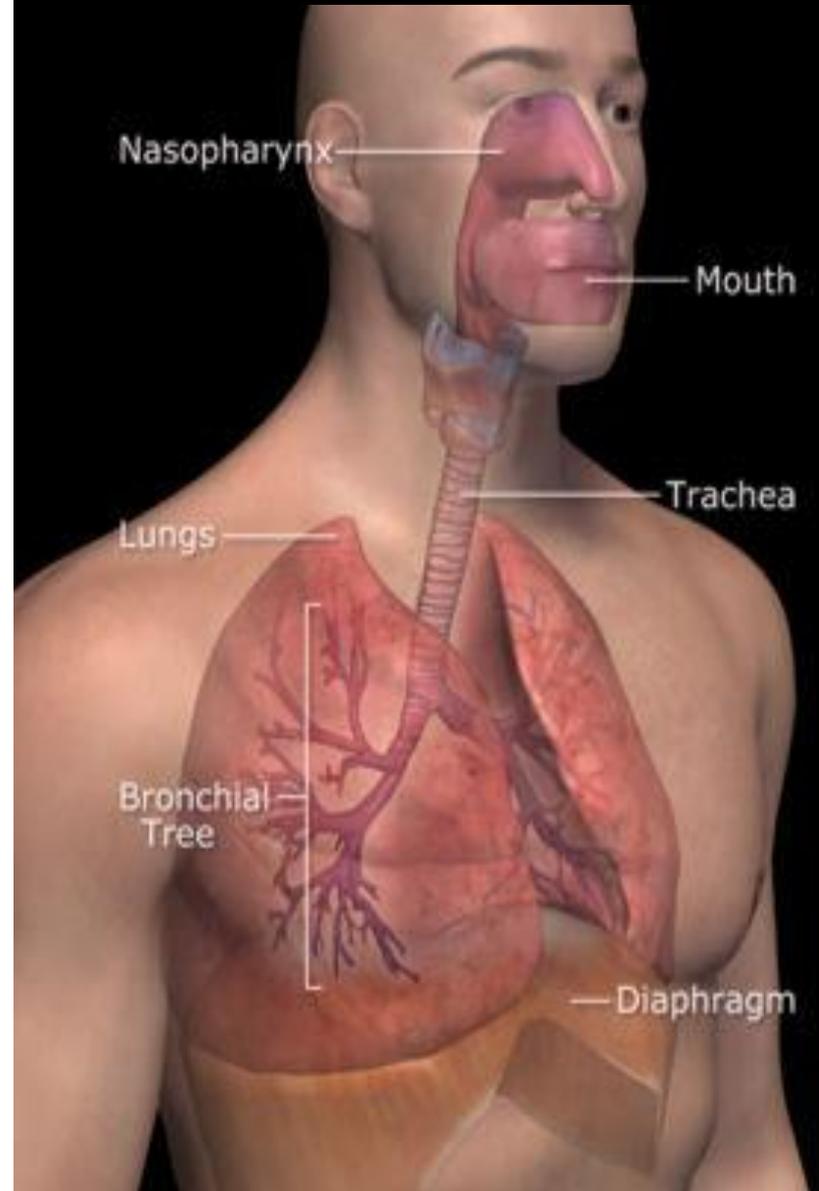
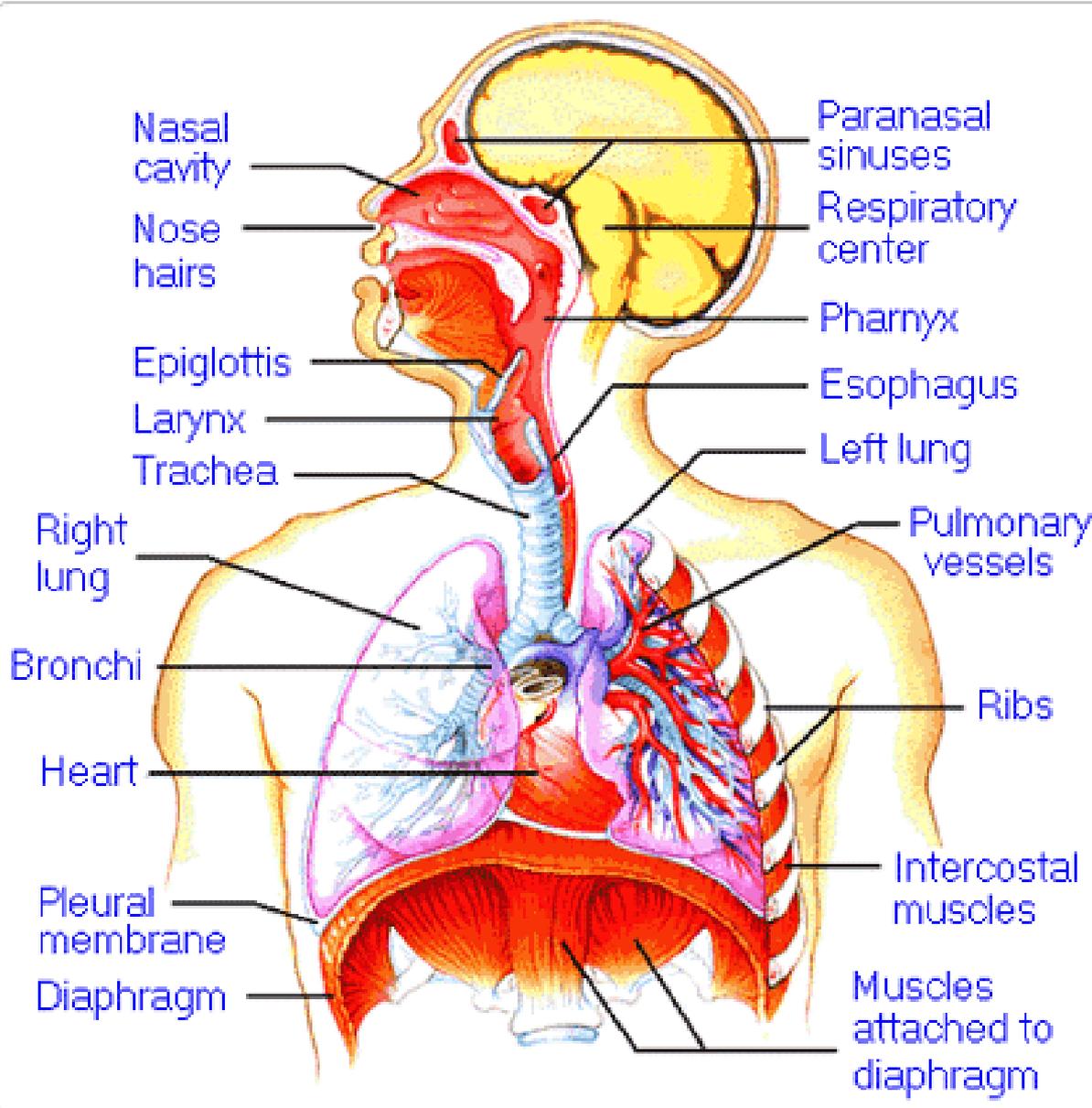


RESPIRATORY SYSTEM





RESPIRATORY SYSTEM





RESPIRATORY SYSTEM

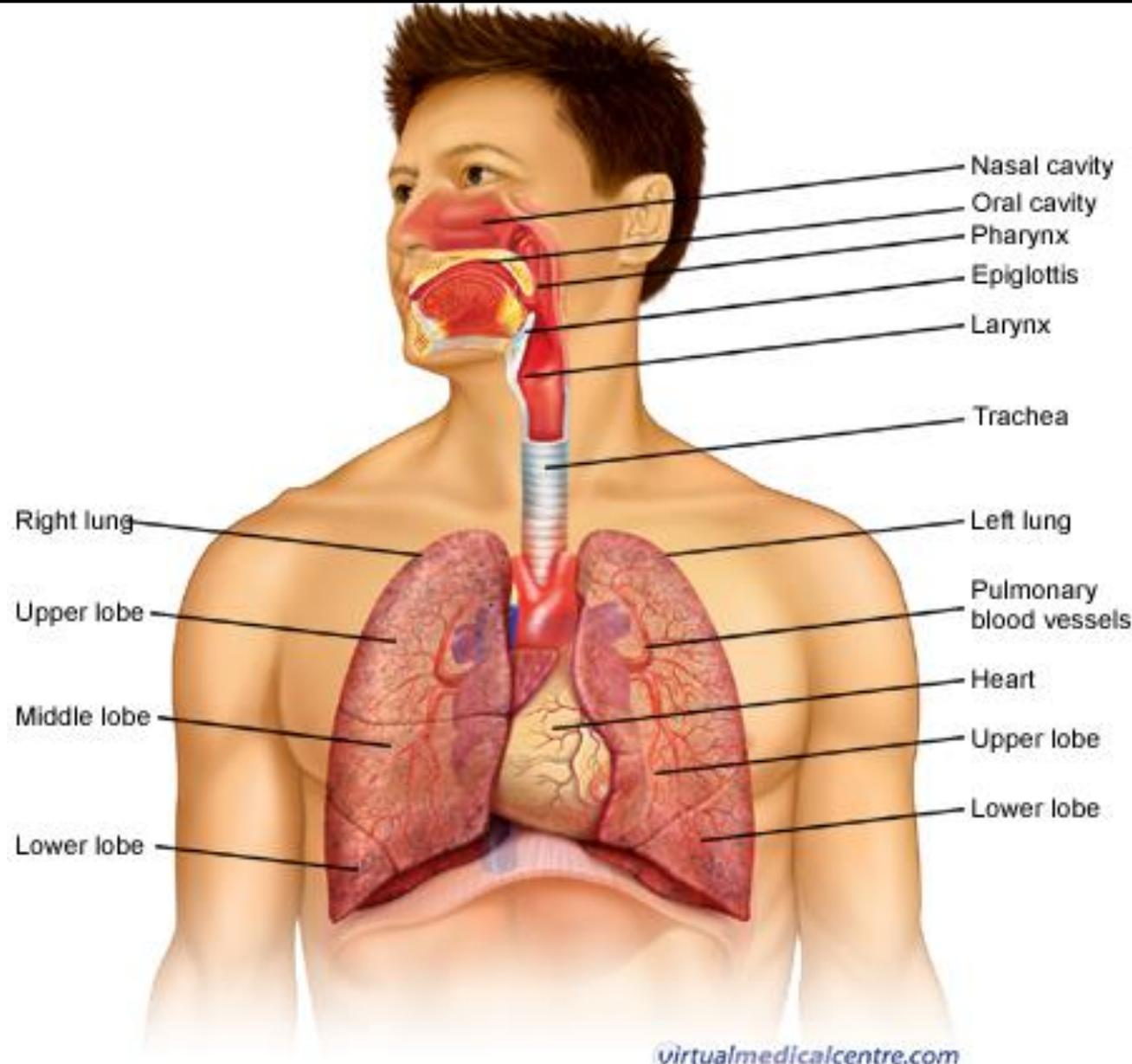
As **air** enters the body, it enters through the following structures:

1) **Nose** (or oral cavity if you breathe with your mouth)

2) **Pharynx**

3) **Larynx**

4) **Trachea**

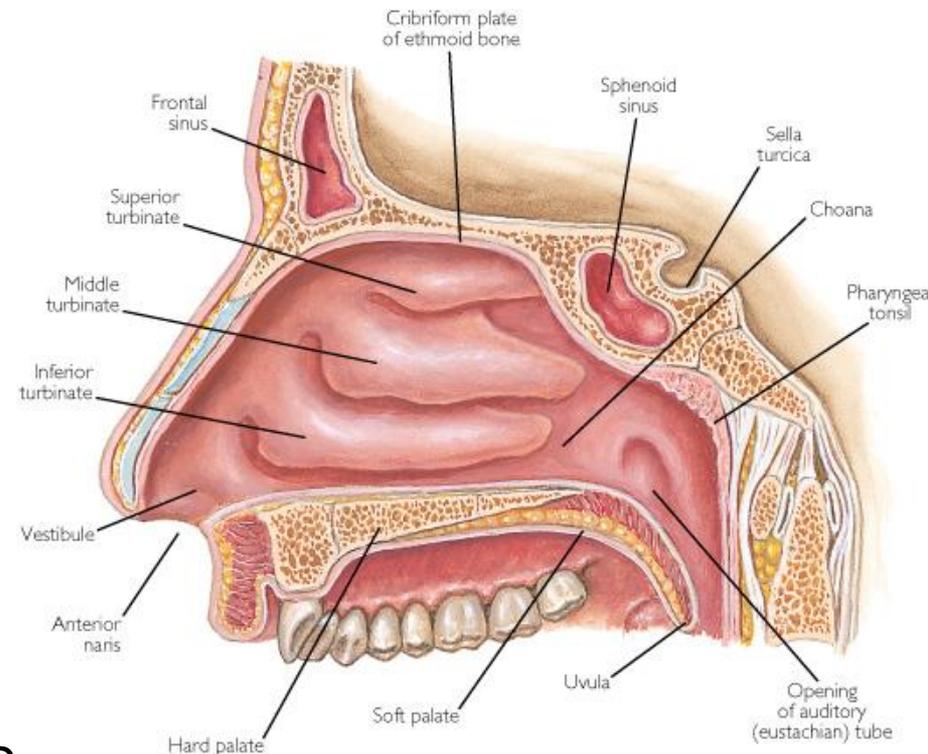


RESPIRATORY SYSTEM

Nose:

The nasal cavity has 3 main functions:

- 1) Cleans the air** – nostrils contain tiny hairs
- 2) Warms the air** – the epithelial lining and turbinate bones have capillaries that warm the air.
- 3) Moisture** – the turbinates are lined with a thin membrane that secretes a mucus that moisten the air coming in.





RESPIRATORY SYSTEM

Nose turbinates:

- Thin bones
- Increase **surface area**
- Allows air to reach more **warmed, moist surfaces** (results in cleaner, warmer air)

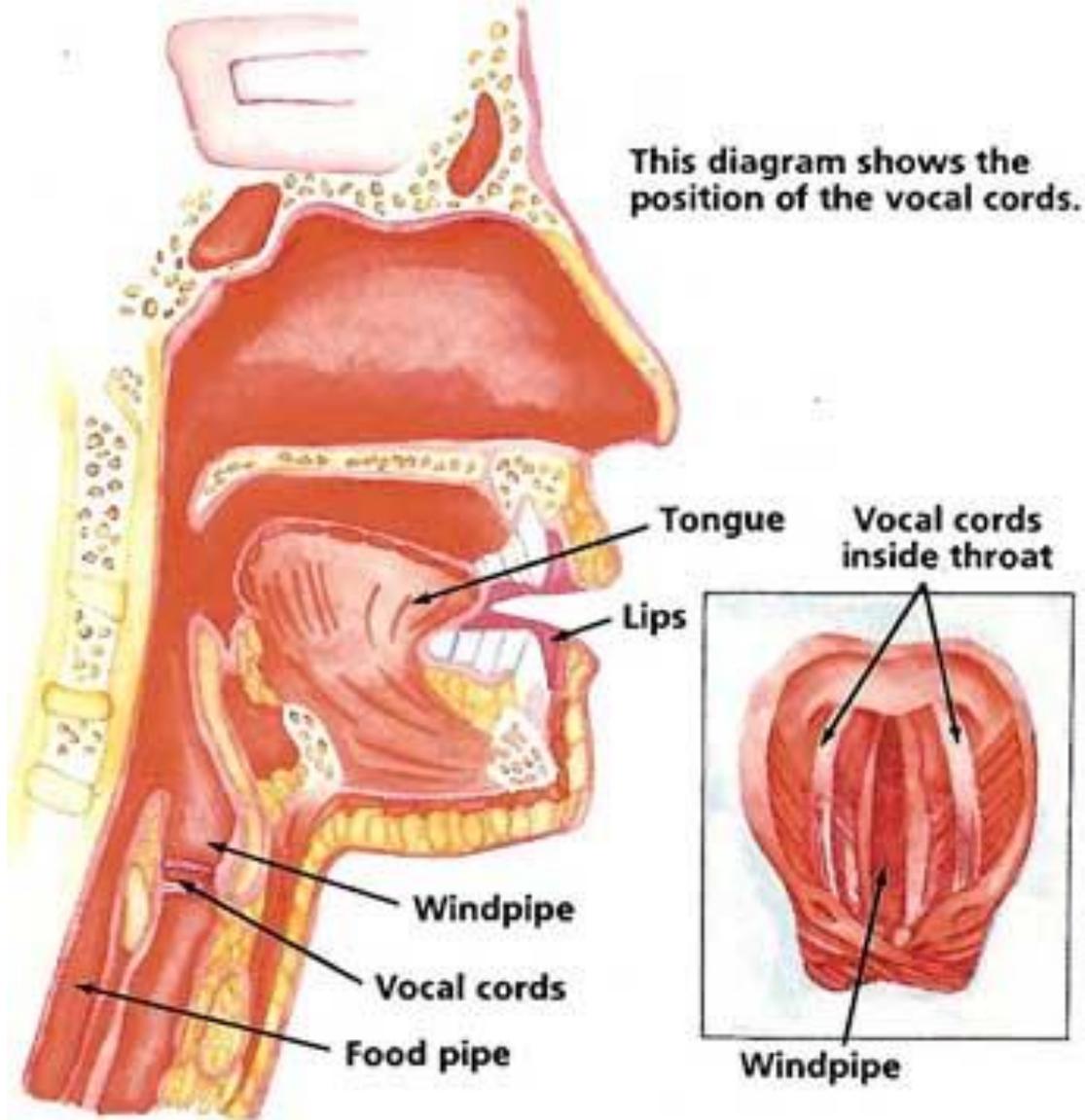
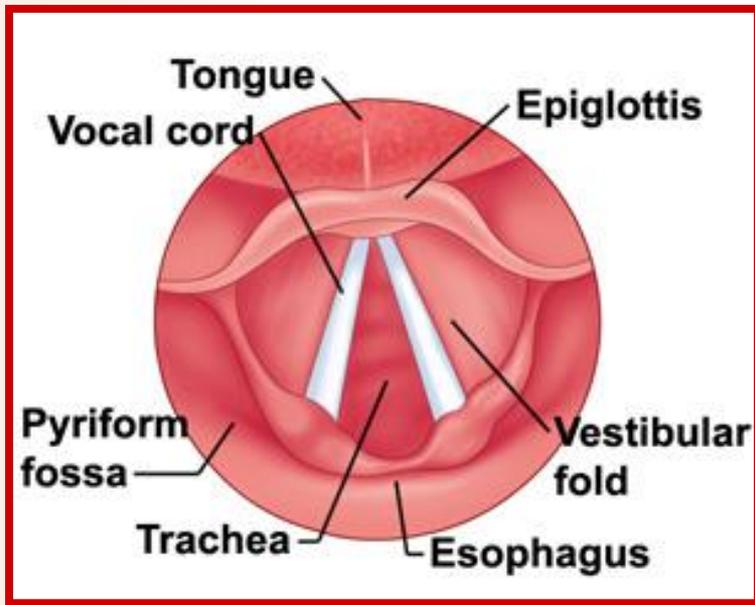




RESPIRATORY SYSTEM

Larynx ("voice box")

Houses the
vocal cords.



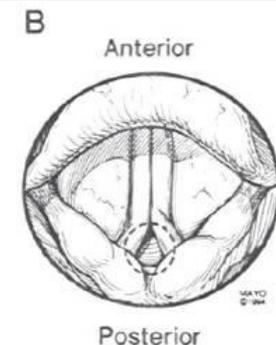
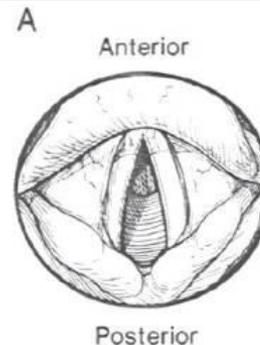
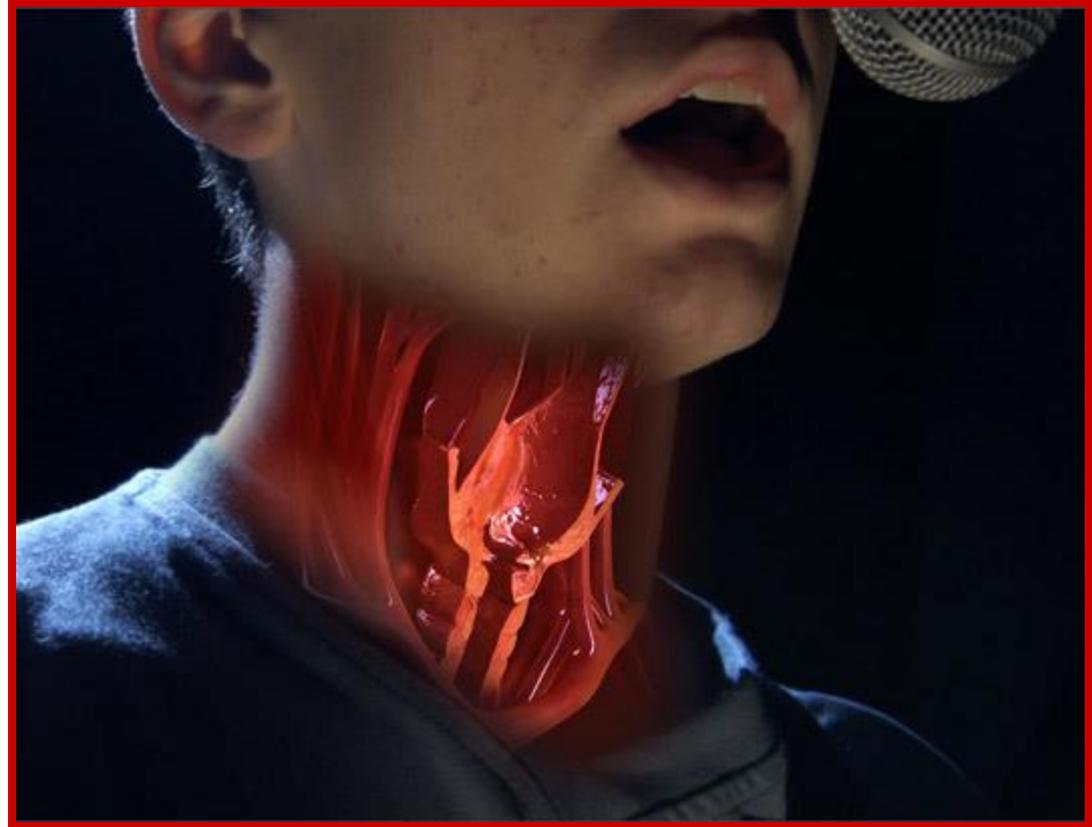


RESPIRATORY SYSTEM

Larynx ("voice box")

Act like strings of a guitar (**relaxed for lower pitch**, and **tightened for higher pitch**)

Male vocal cords grow during puberty, like thicker guitar strings, causing voice to deepen





RESPIRATORY SYSTEM

Vocal cord inflammation (laryngitis)

Can be caused by

-infection
(usually viral)

-Smoking

-Regurgitation of stomach acid during **vomiting**



Can also be caused by **overuse**

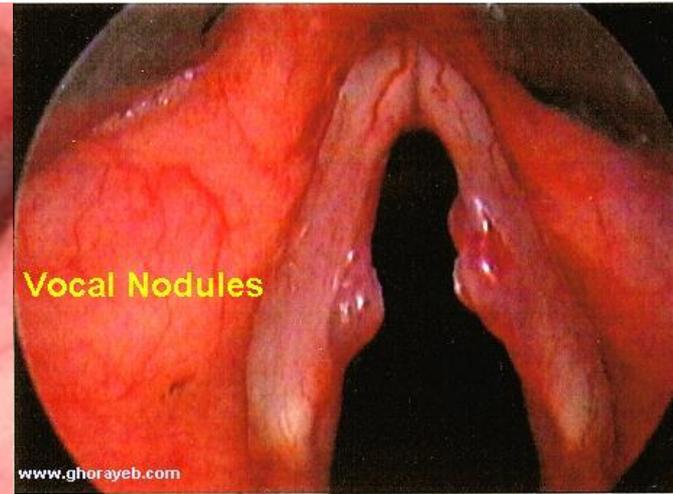
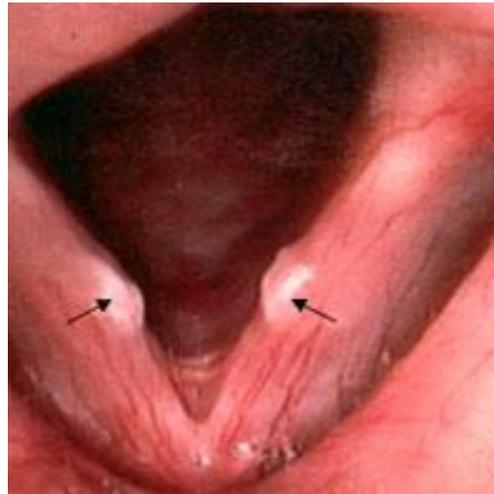


RESPIRATORY SYSTEM

Vocal cord nodules

Growths on the vocal cords.

(from constant *straining* of voices)



Respiratory System

- http://www.youtube.com/watch?v=sU_8juD3YzQ&NR=1&feature=fvwp

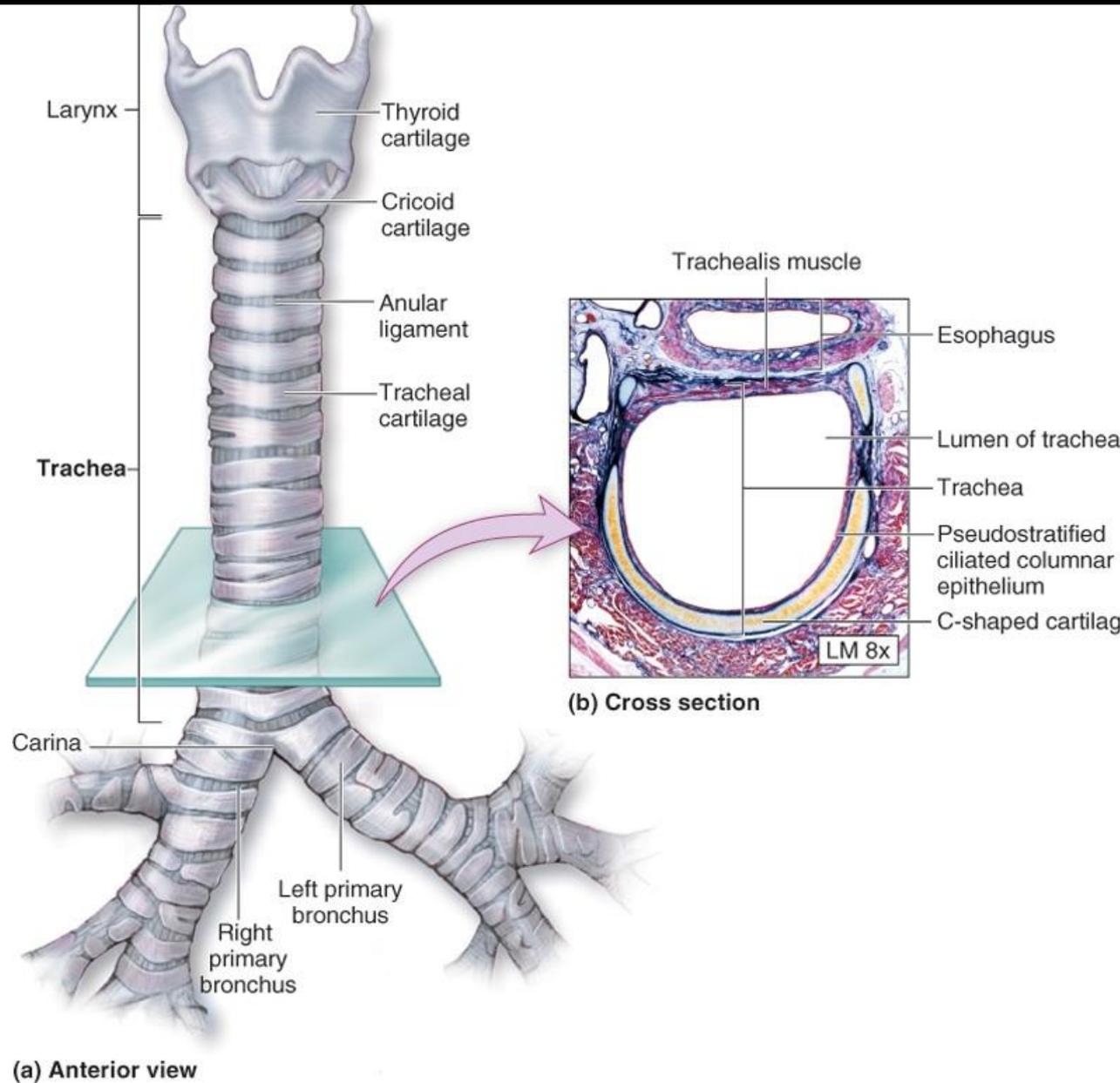


RESPIRATORY SYSTEM

Trachea:

The trachea is lined with **ciliated cells**, which brush foreign particles back upwards

It also maintains its rigidity thanks to **cartilage** (soft "bone")



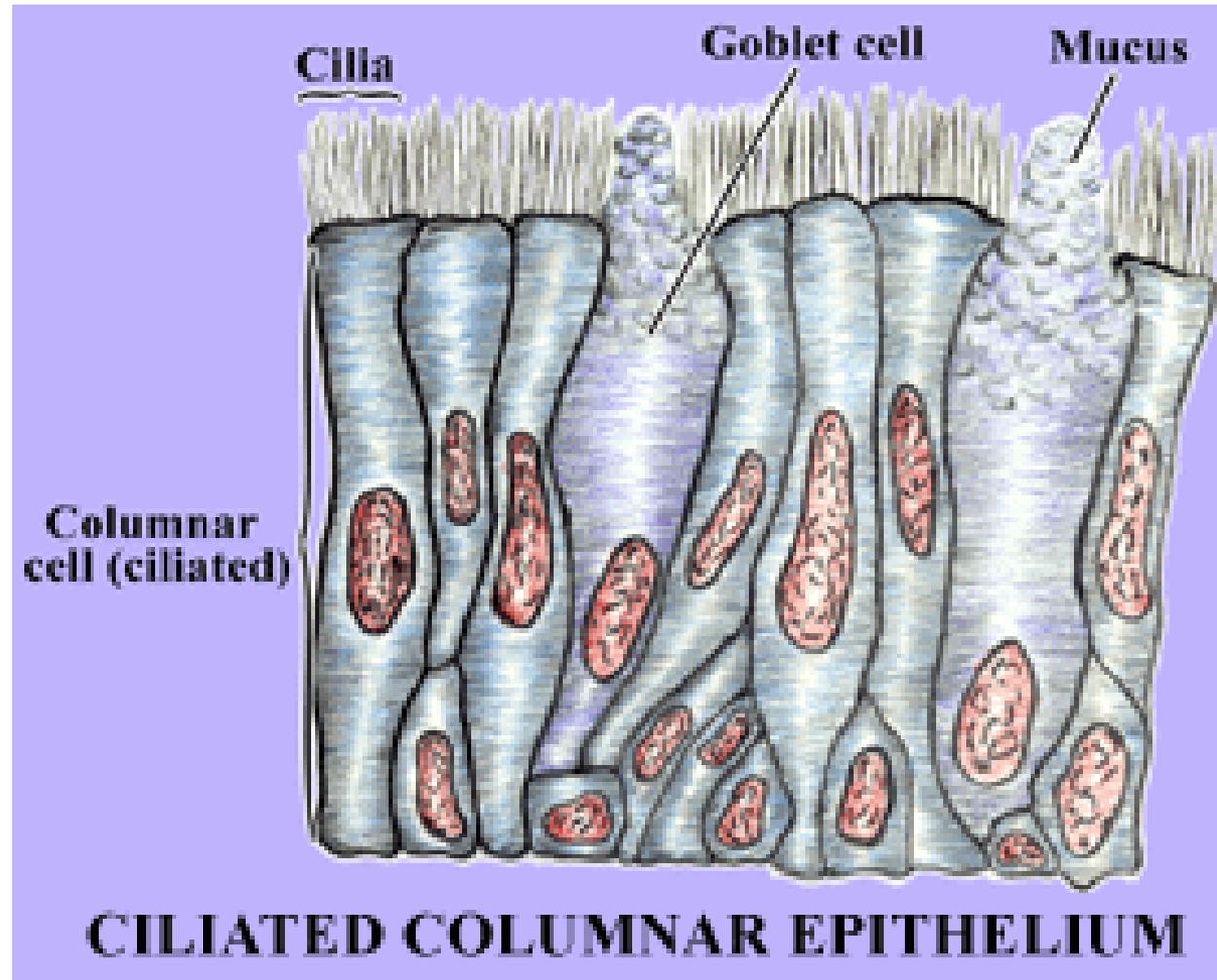


RESPIRATORY SYSTEM

Trachea:

The **epithelium** of the trachea has **mucous cells** (Goblet cells) and **cilia**.

The mucus **traps foreign particles**, and cilia brush the mucus up the trachea (*like mopping the floor*)





RESPIRATORY SYSTEM

Trachea:

We sneeze to **expel mucus** that has trapped foreign particles, as well as other **inhaled particles**



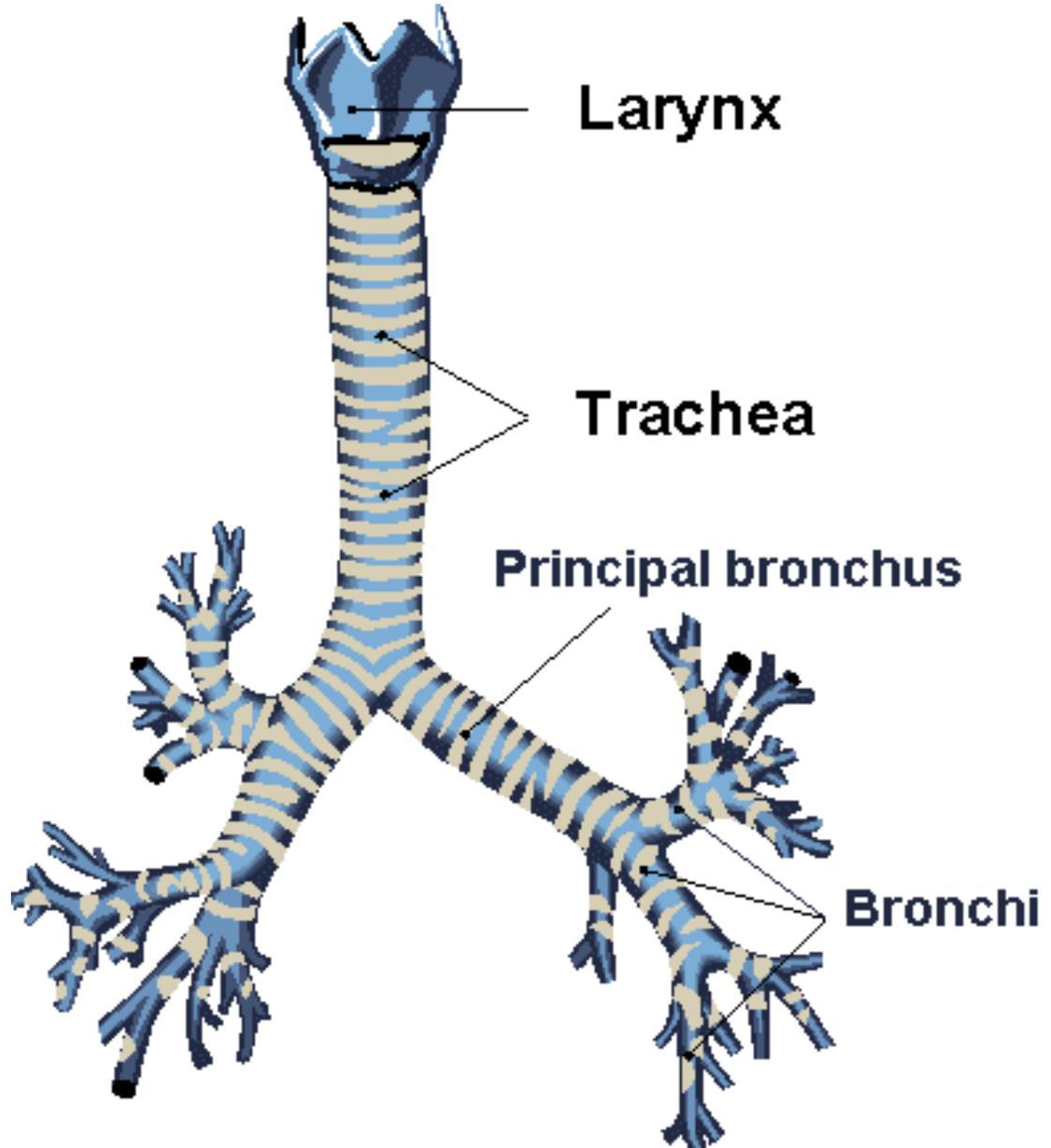


RESPIRATORY SYSTEM

Bronchus:

The trachea leads into the **bronchus** (*like a fork in the road*), which further divides into smaller **bronchi**.

The structures are also reinforced with **cartilage**.

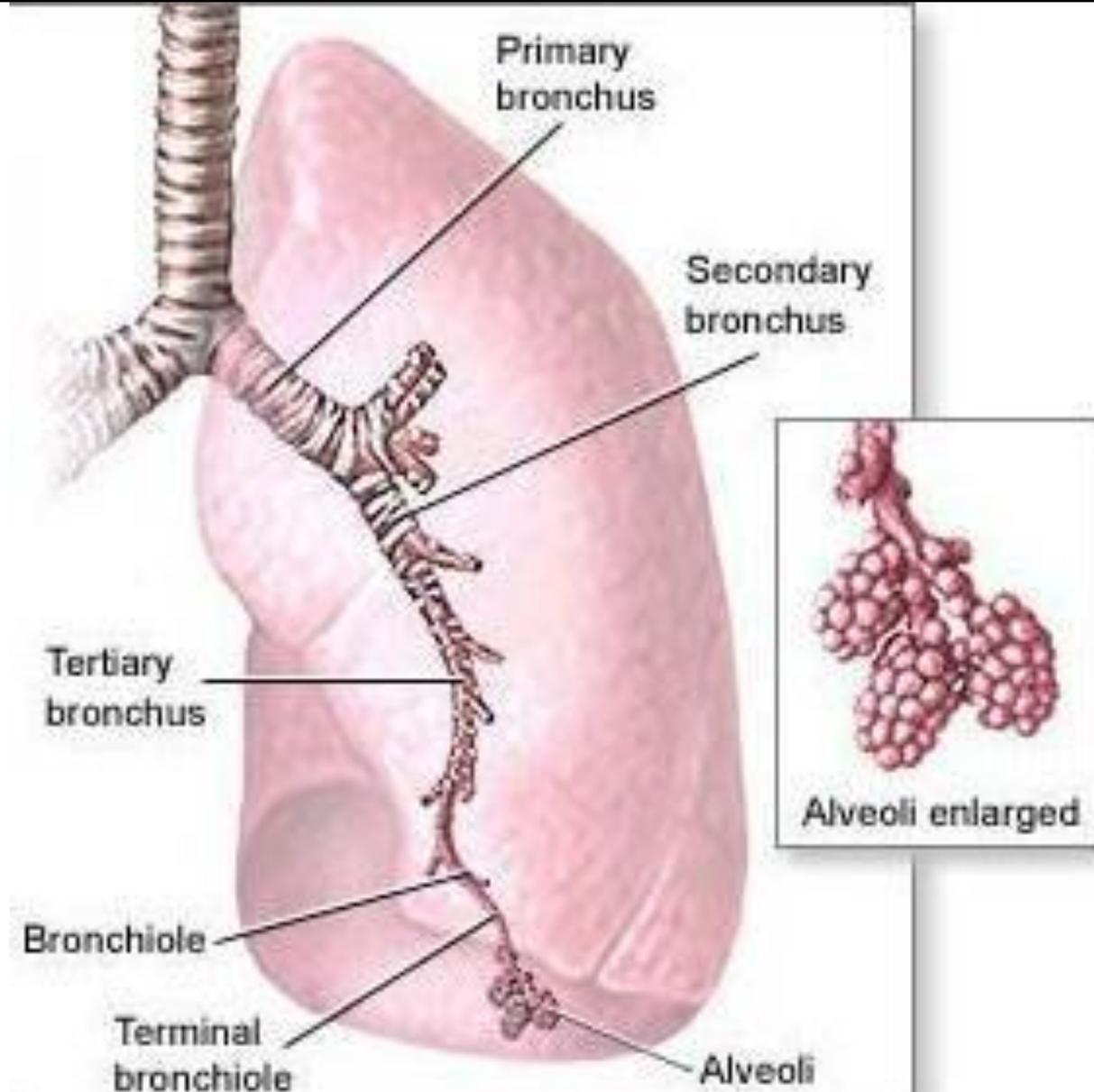
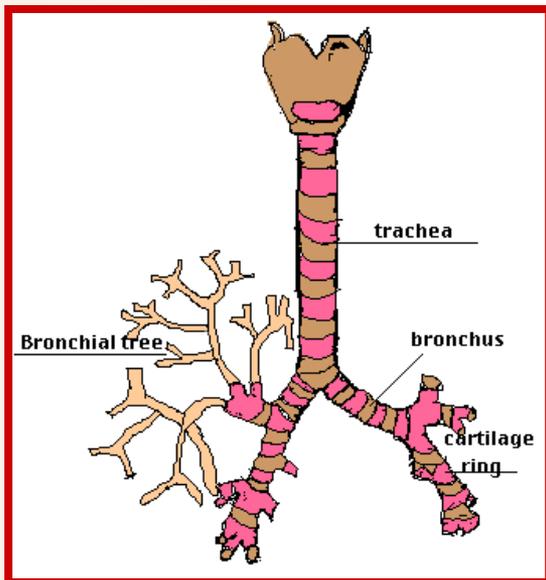




RESPIRATORY SYSTEM

Bronchiole:

The **bronchiole** branch into the lungs, eventually reaching the **alveoli**.



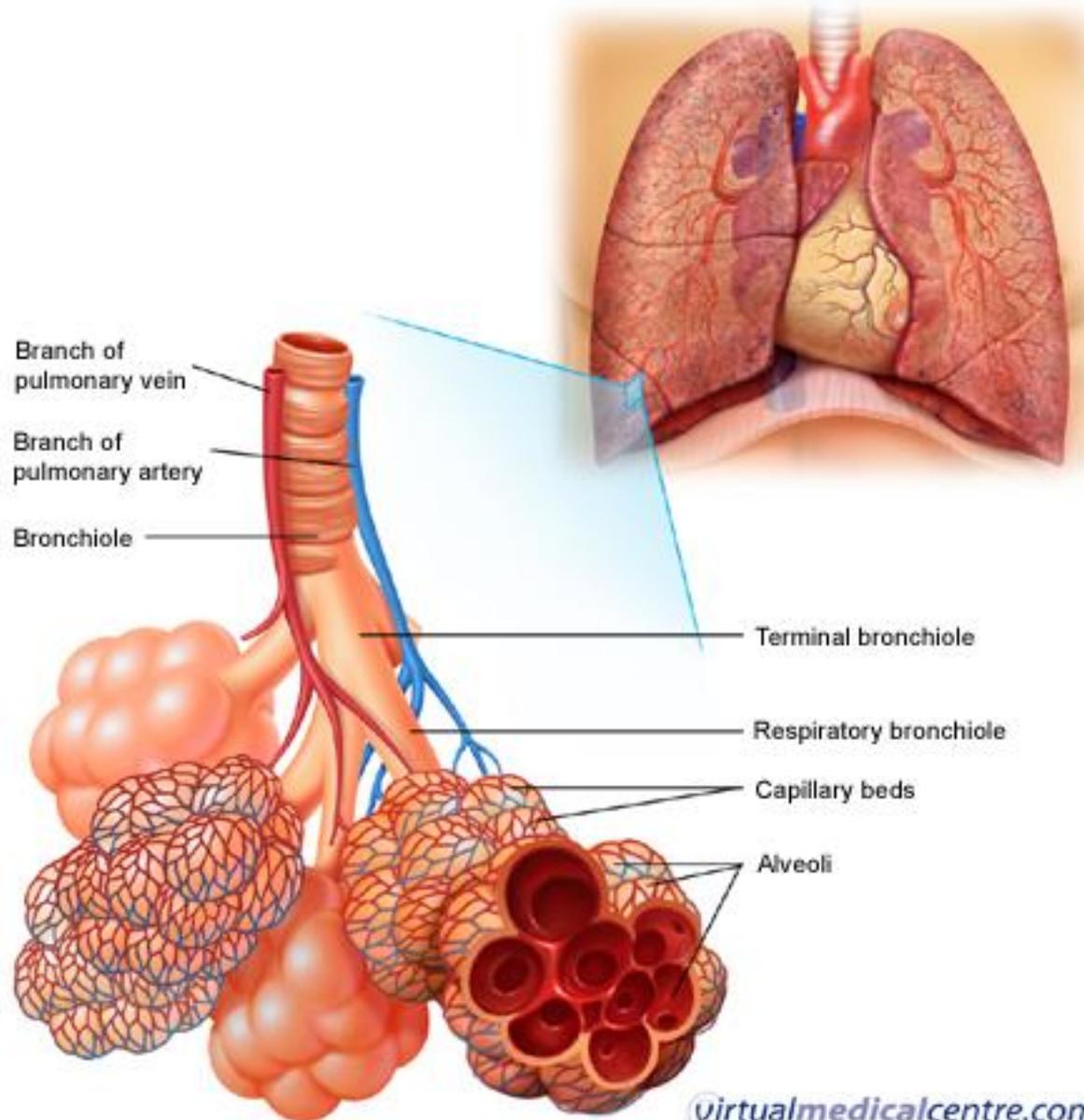


RESPIRATORY SYSTEM

Alveoli:

The **alveoli** (singular: *alveolus*) are spherical hollow cavities which increase surface area for gas exchange.

Capillaries (tiny blood vessels) line the alveoli to make gas exchange possible.



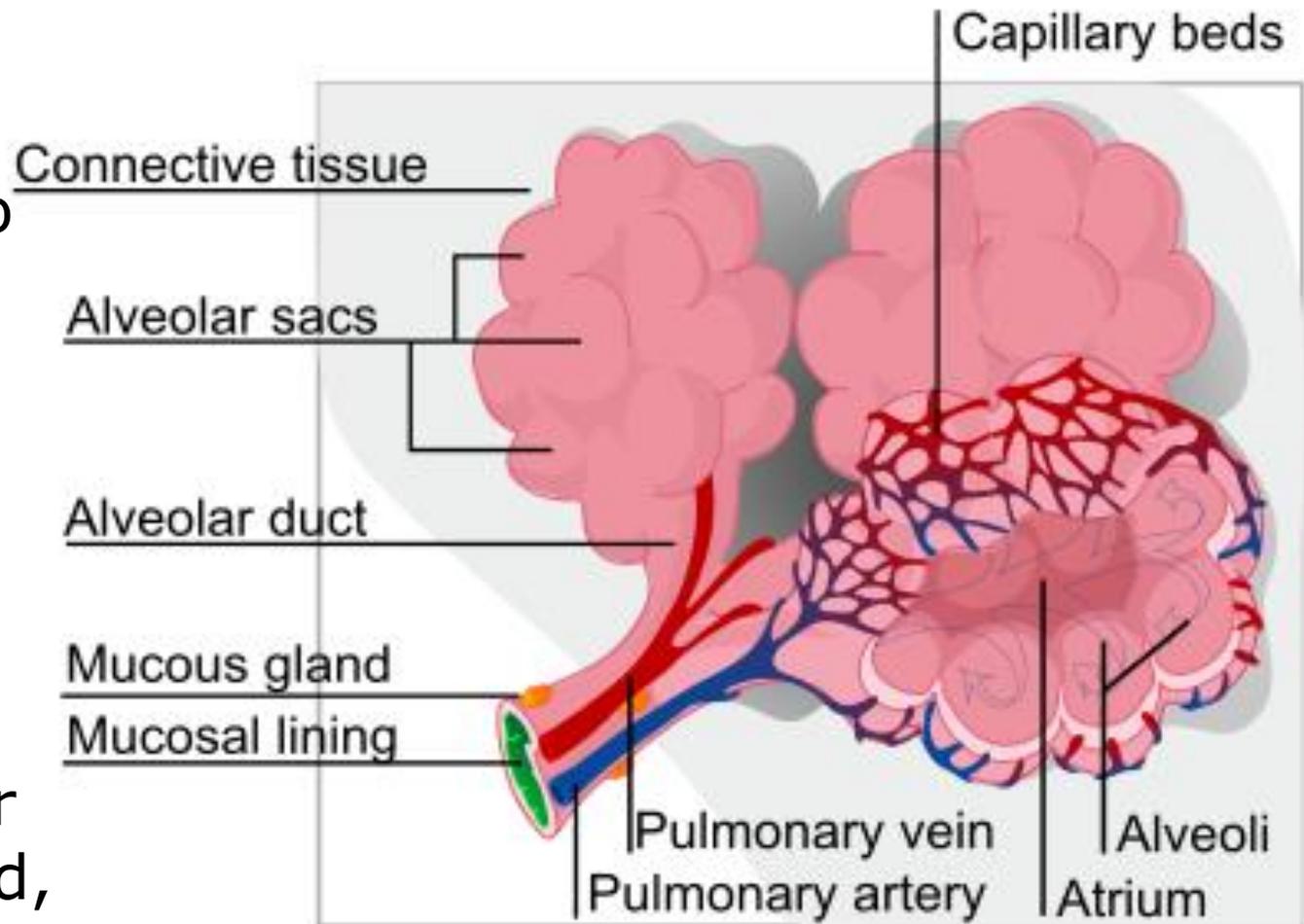


RESPIRATORY SYSTEM

Alveoli:

Low-oxygen blood (**bluish color**) travels to the **alveoli** where carbon dioxide is released.

At the same time, oxygen from inhaled air enters the blood, making it look **red**.





RESPIRATORY SYSTEM

Alveoli:





RESPIRATORY SYSTEM

Gas exchange:

Carbon dioxide

(a waste product) leaves the blood vessel into the alveolus.

Oxygen goes into the blood vessel.



Alveolus



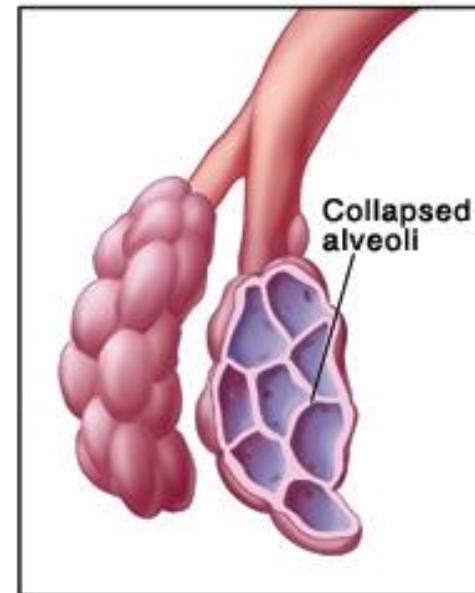
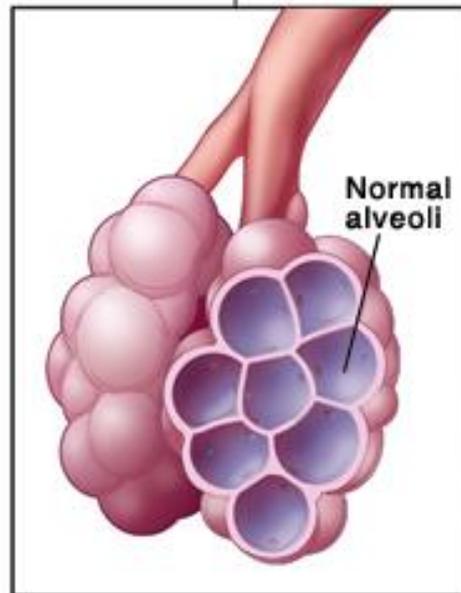
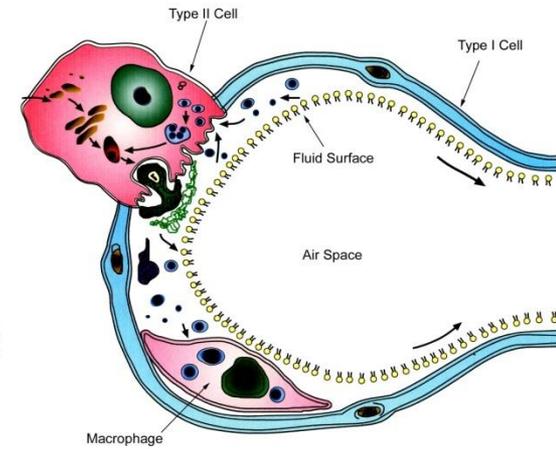
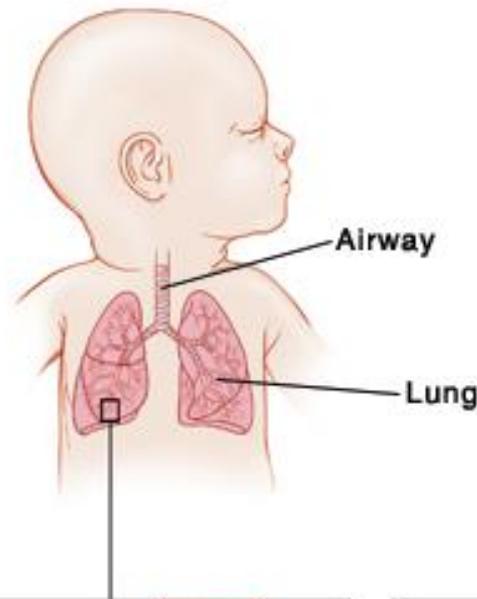
Blood vessel

RESPIRATORY SYSTEM

Lung surfactant:

Surfactant helps to *lower surface tension* in the airways and this helps *keep the lung alveoli open*.

Also has **immune cells** to defend against bacteria, viruses, and other infectious agents.





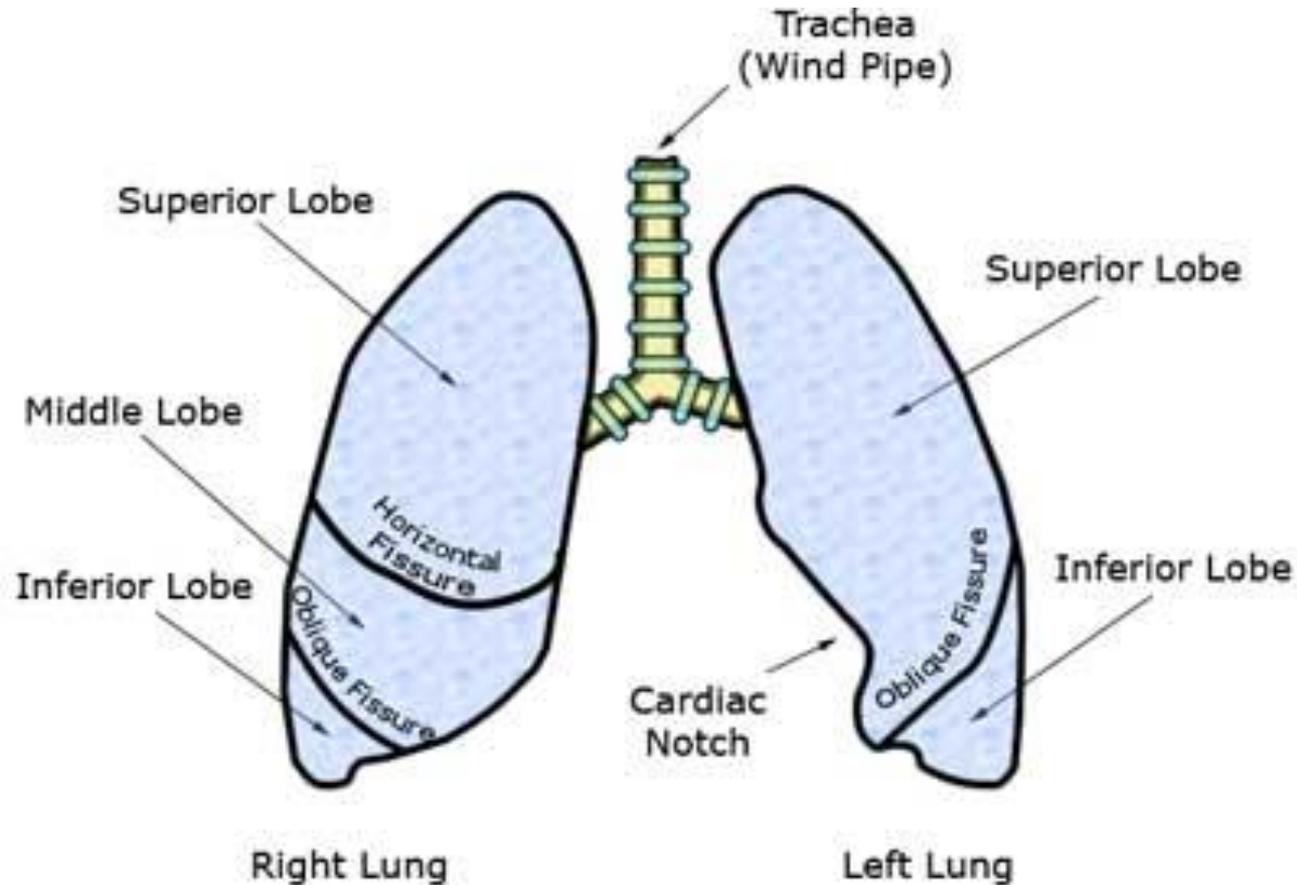
RESPIRATORY SYSTEM

The Lung:

Each lung is divided into lobes.

The right lung has **three** lobes.

The left lung has **two** lobes (to accommodate the heart).



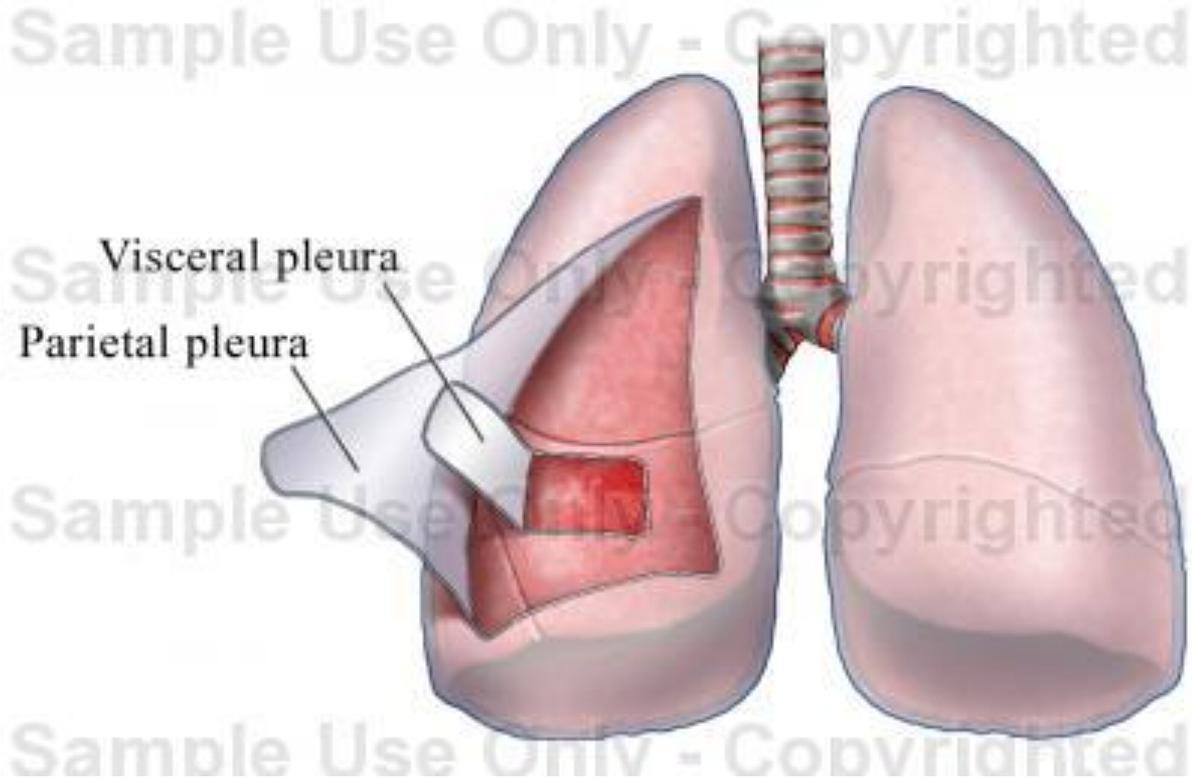


RESPIRATORY SYSTEM

Pleura:

The lungs are protected by a layer called the **pleura**.

Pleura is a **flexible** membrane that permits the lung to expand and contract during **inspiration** and **expiration**.

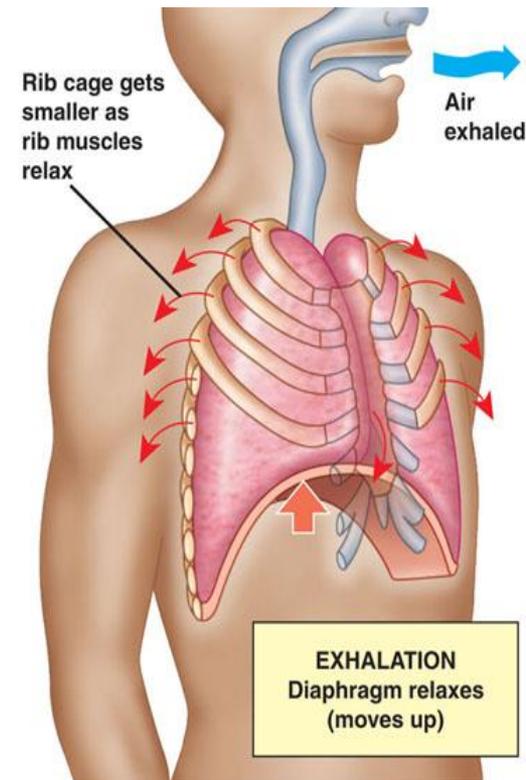
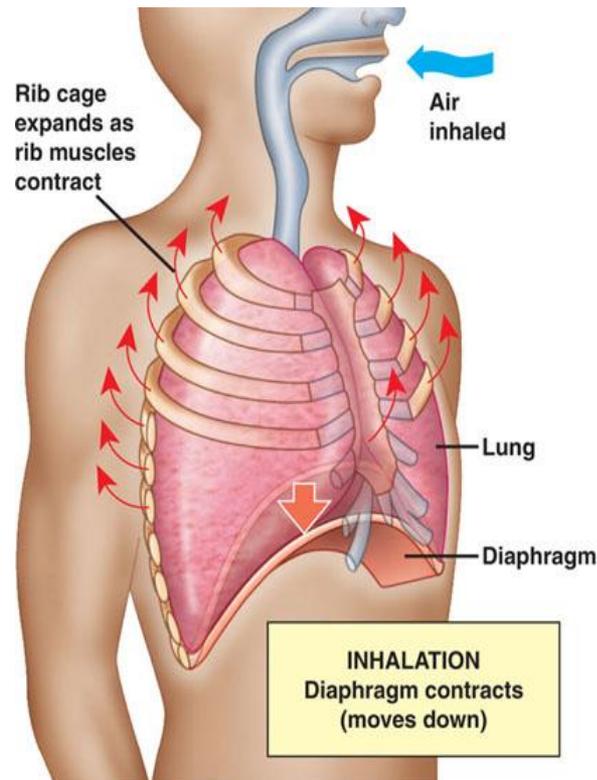


RESPIRATORY SYSTEM

Breathing:

When we breathe we use two sets of muscles:

- 1) **Diaphragm** – separates the lungs (thoracic cavity) from the stomach and liver
- 2) **Intercostal muscles** (ribcage muscles)

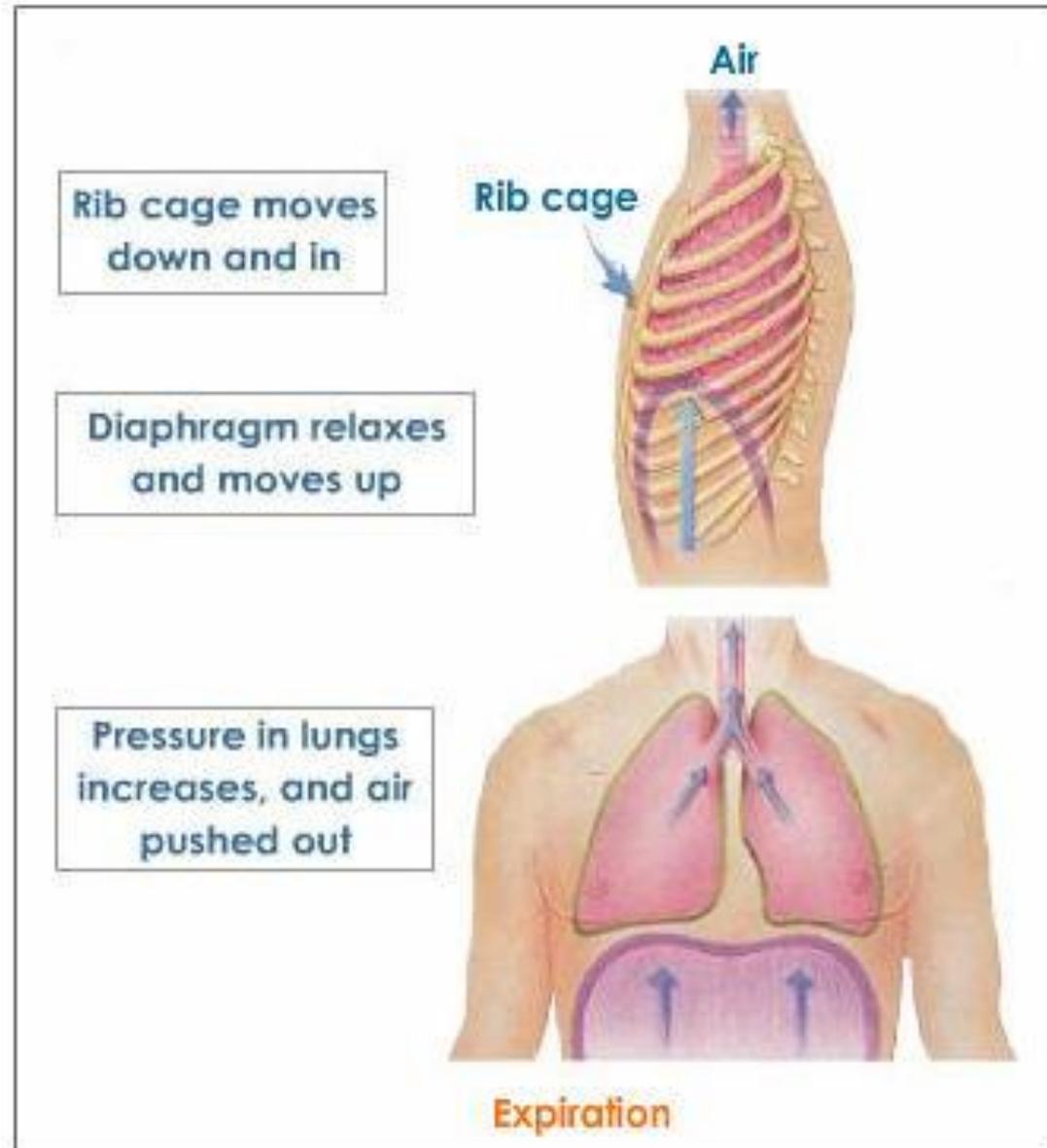


RESPIRATORY SYSTEM

Breathing:

Inspiration –
taking air into the
lungs (*inhalation*)

Expiration – the
act of breathing
out (*exhalation*)



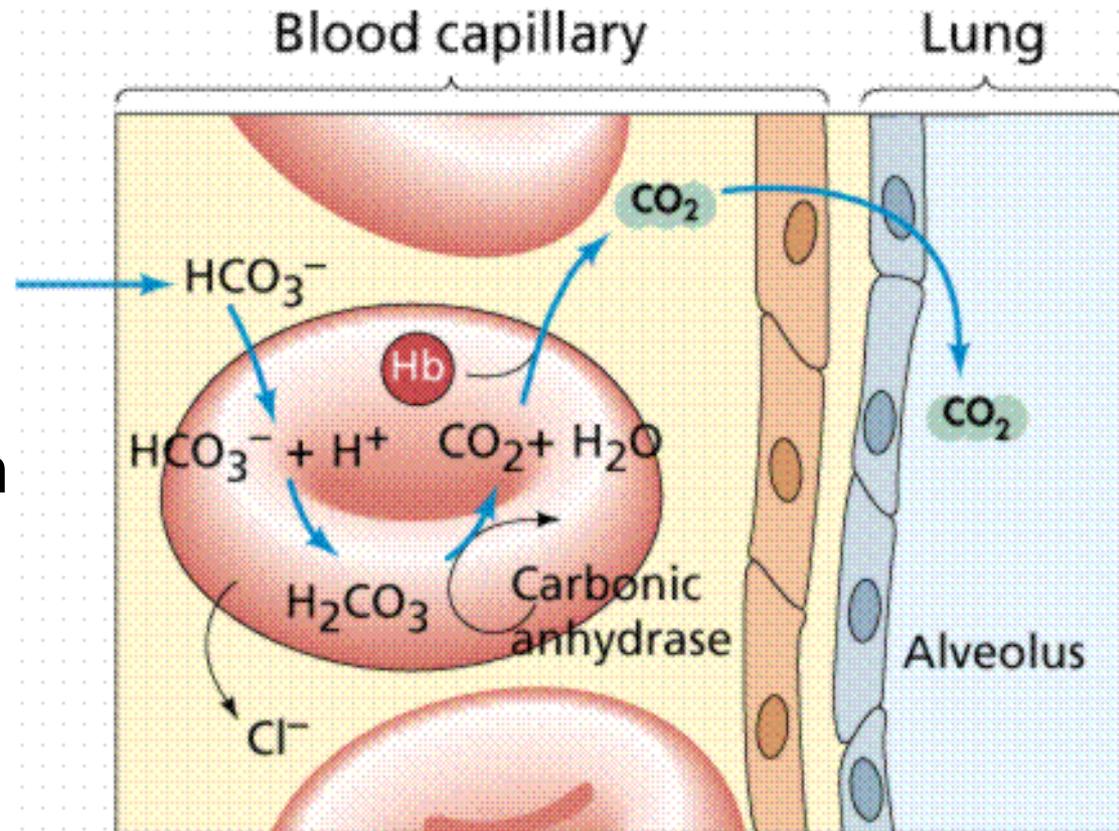
RESPIRATORY SYSTEM

4 types of respiration

1) breathing

2) **External
respiration**

-The exchange of oxygen and carbon dioxide between the air (alveoli) and blood

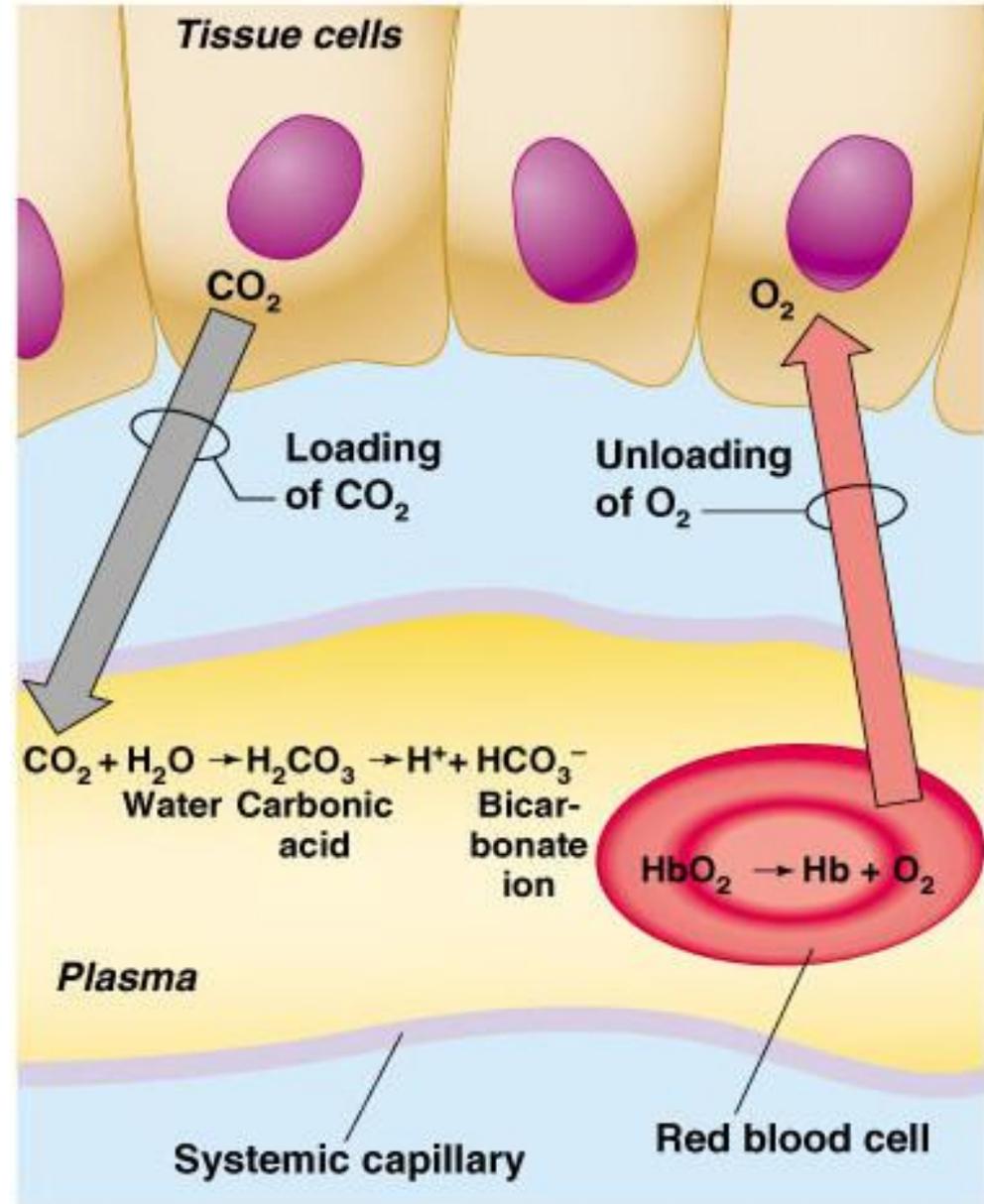


RESPIRATORY SYSTEM

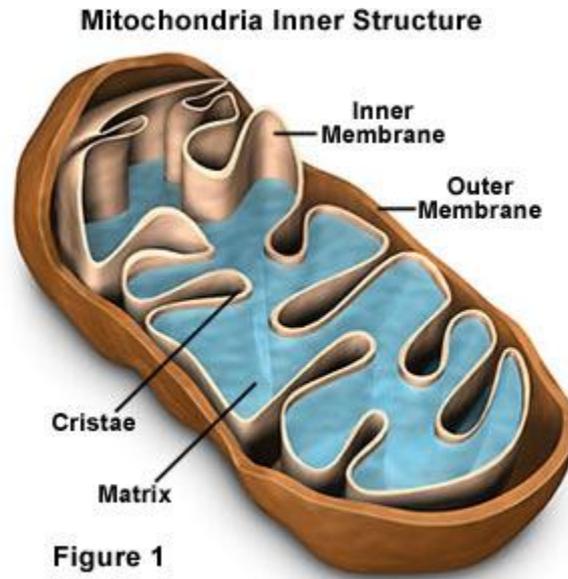
4 types of respiration

3) Internal respiration

-The exchange of oxygen and carbon dioxide between the blood and the cells.



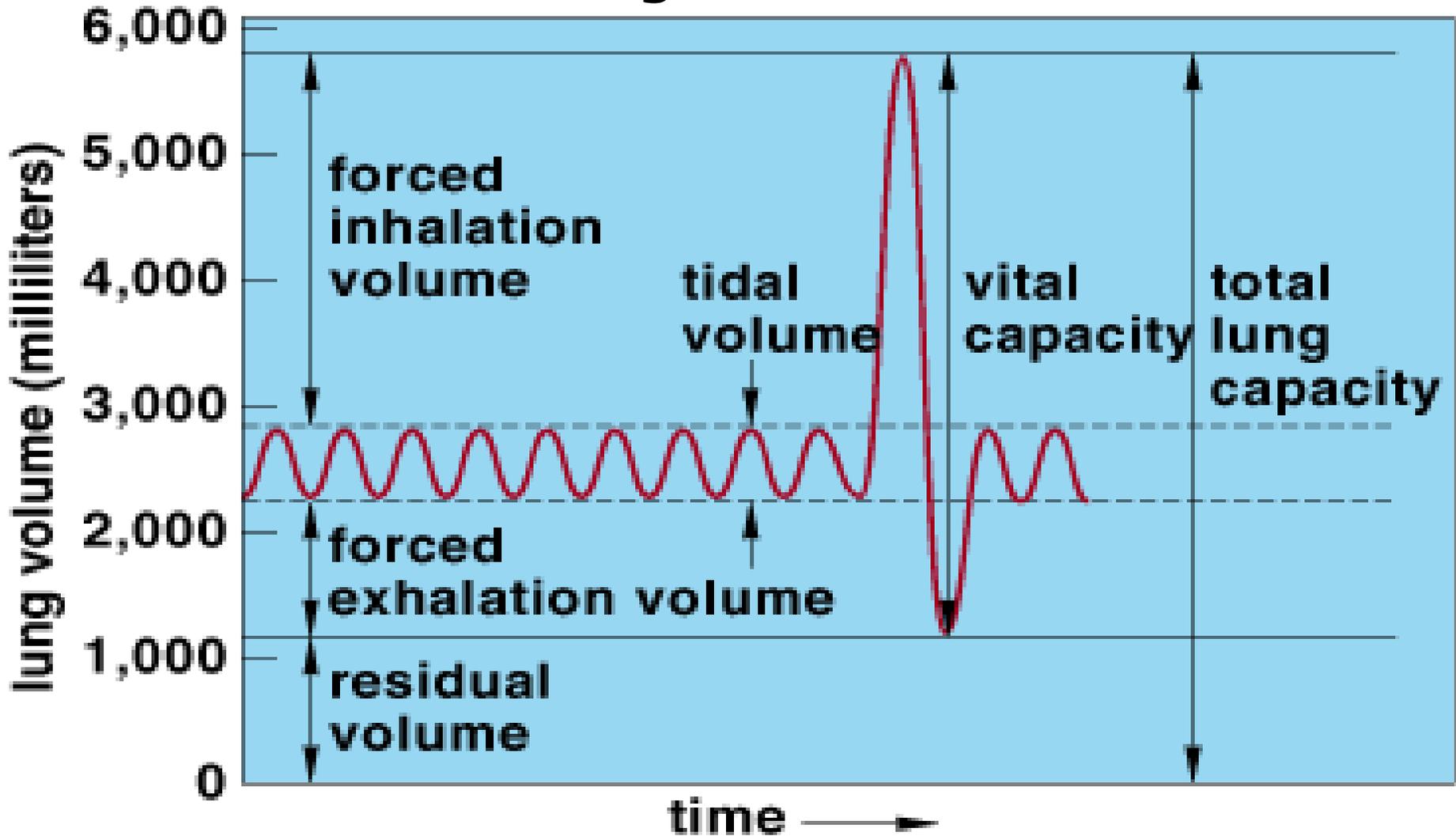
4) Cellular Respiration





RESPIRATORY SYSTEM

Lung volumes



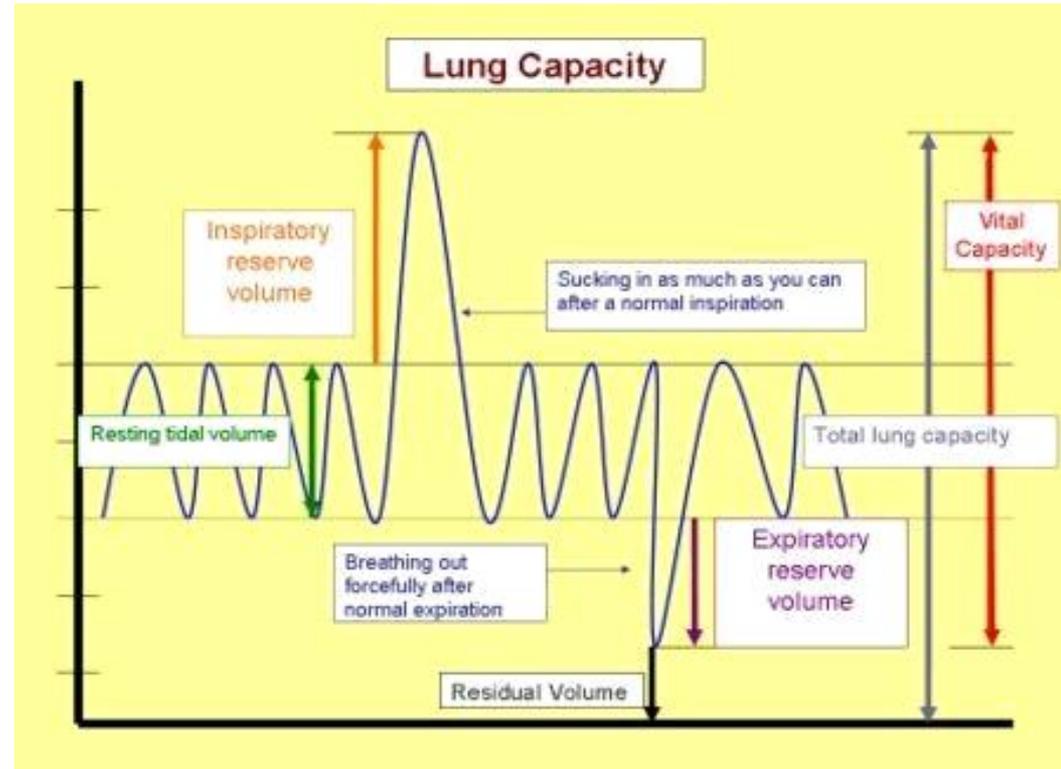


RESPIRATORY SYSTEM

Lung volumes

Tidal Volume – the volume of air inhaled and exhaled in a normal breathing movement.

Inspiratory Reserve Volume – the additional volume of air that can be taken in, beyond a regular or tidal inhalation.

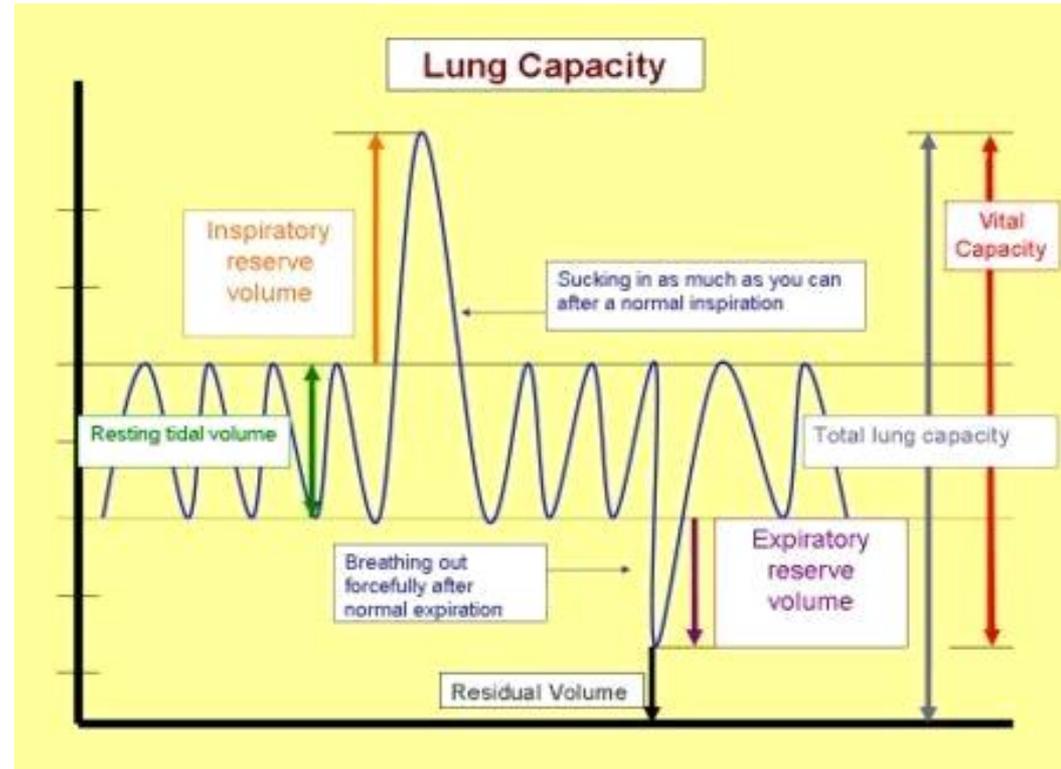


RESPIRATORY SYSTEM

Lung volumes

Expiratory Reserve Volume – the additional volume that can be forced out of the lungs, beyond a regular or tidal exhalation.

Vital Capacity – the total volume of gas that can be moved in or out of the lungs.



Equation:

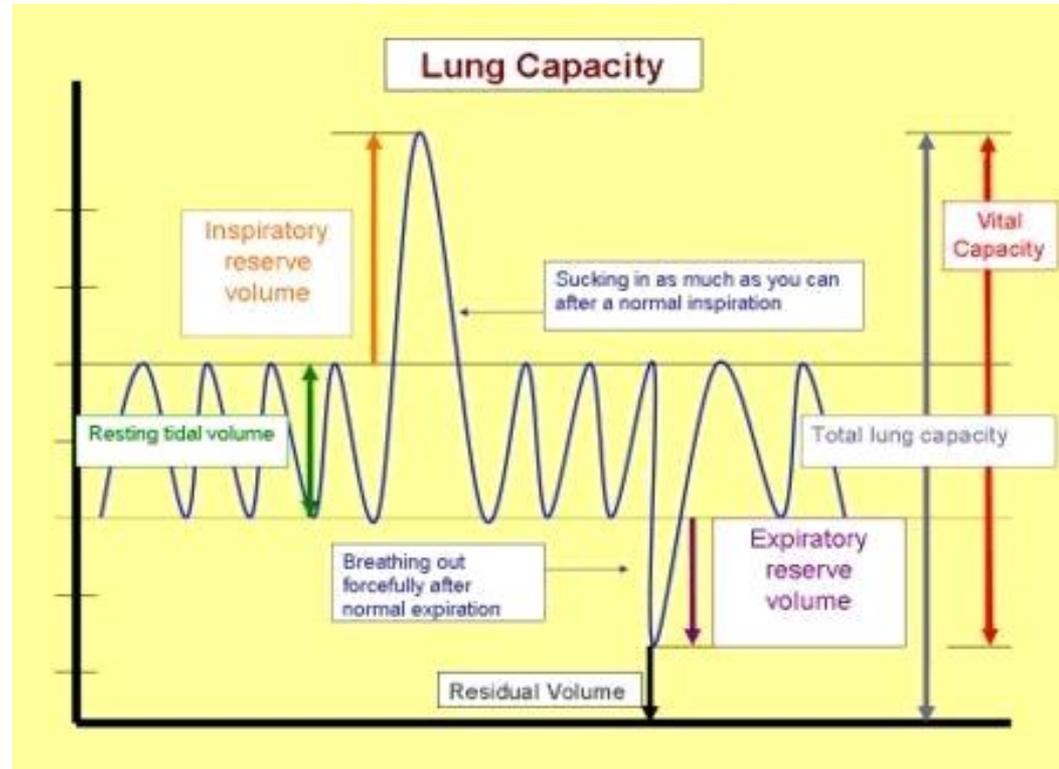
$$\text{Tidal volume} + \text{inspiratory reserve volume} + \text{expiratory reserve volume} = \text{vital capacity}$$

RESPIRATORY SYSTEM

Lung volumes

Residual Volume – the amount of gas that remains in the lungs and the passageways of the respiratory system even after a full exhalation.

This volume **NEVER** leaves the respiratory system, if it did the lungs would collapse.





RESPIRATORY SYSTEM

Lung volumes

Spirometer – a device that measures the amount of air inspired and expired by the lungs.

