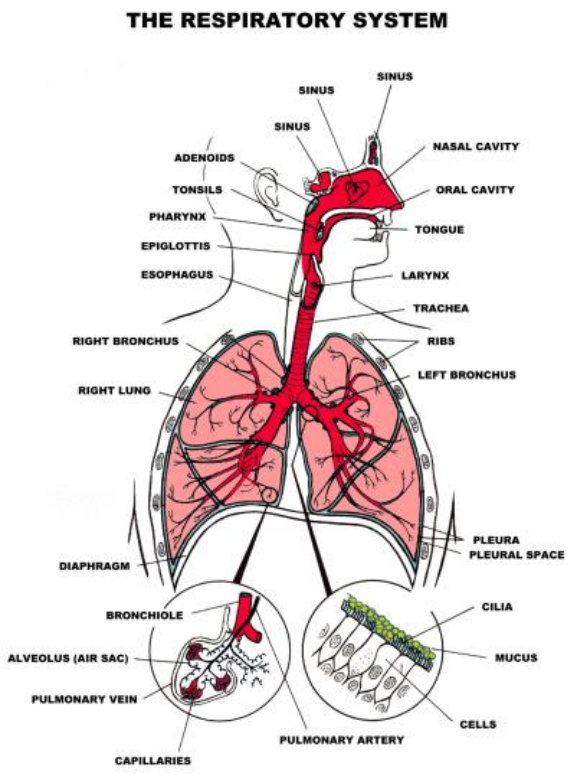
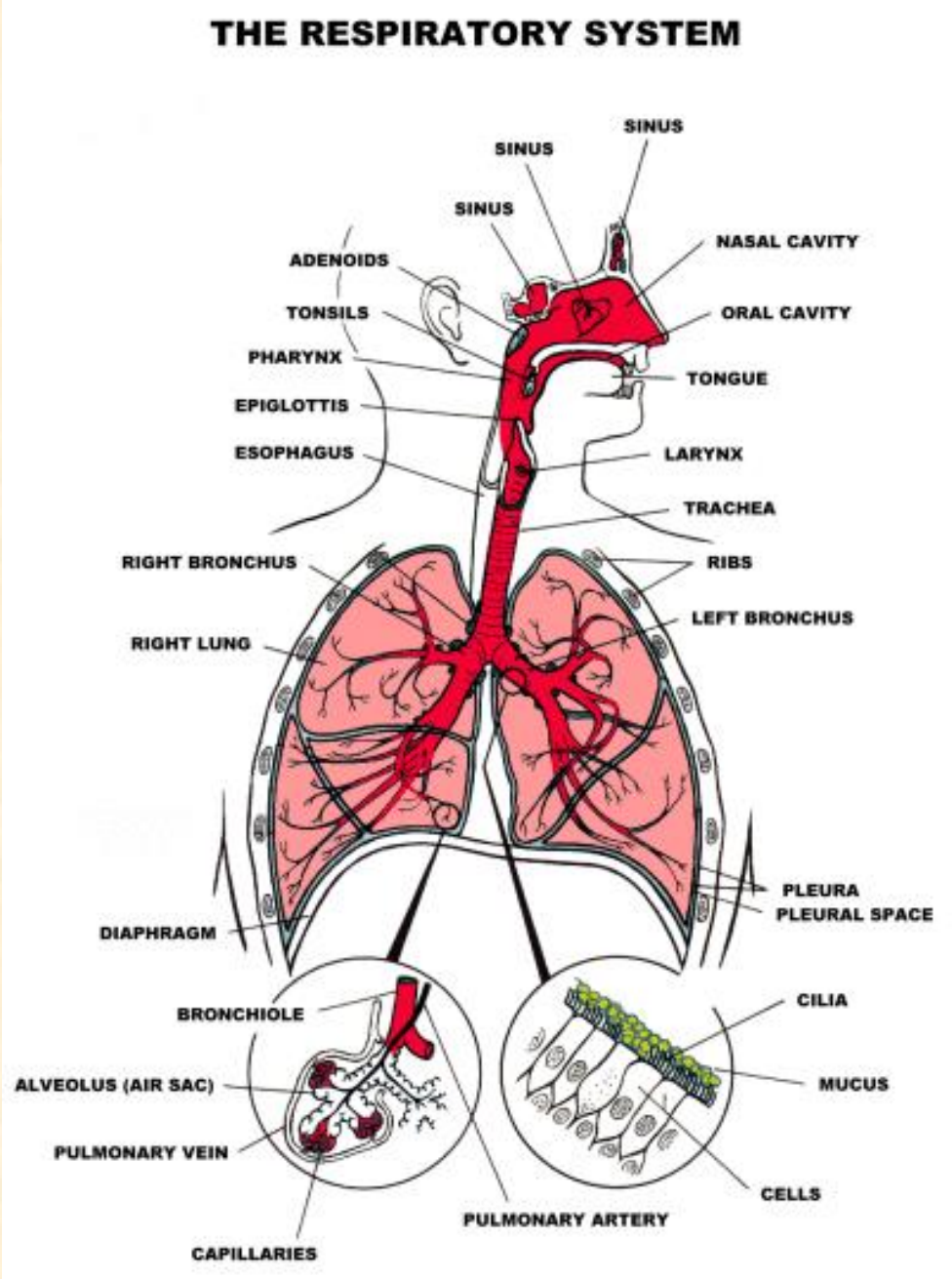
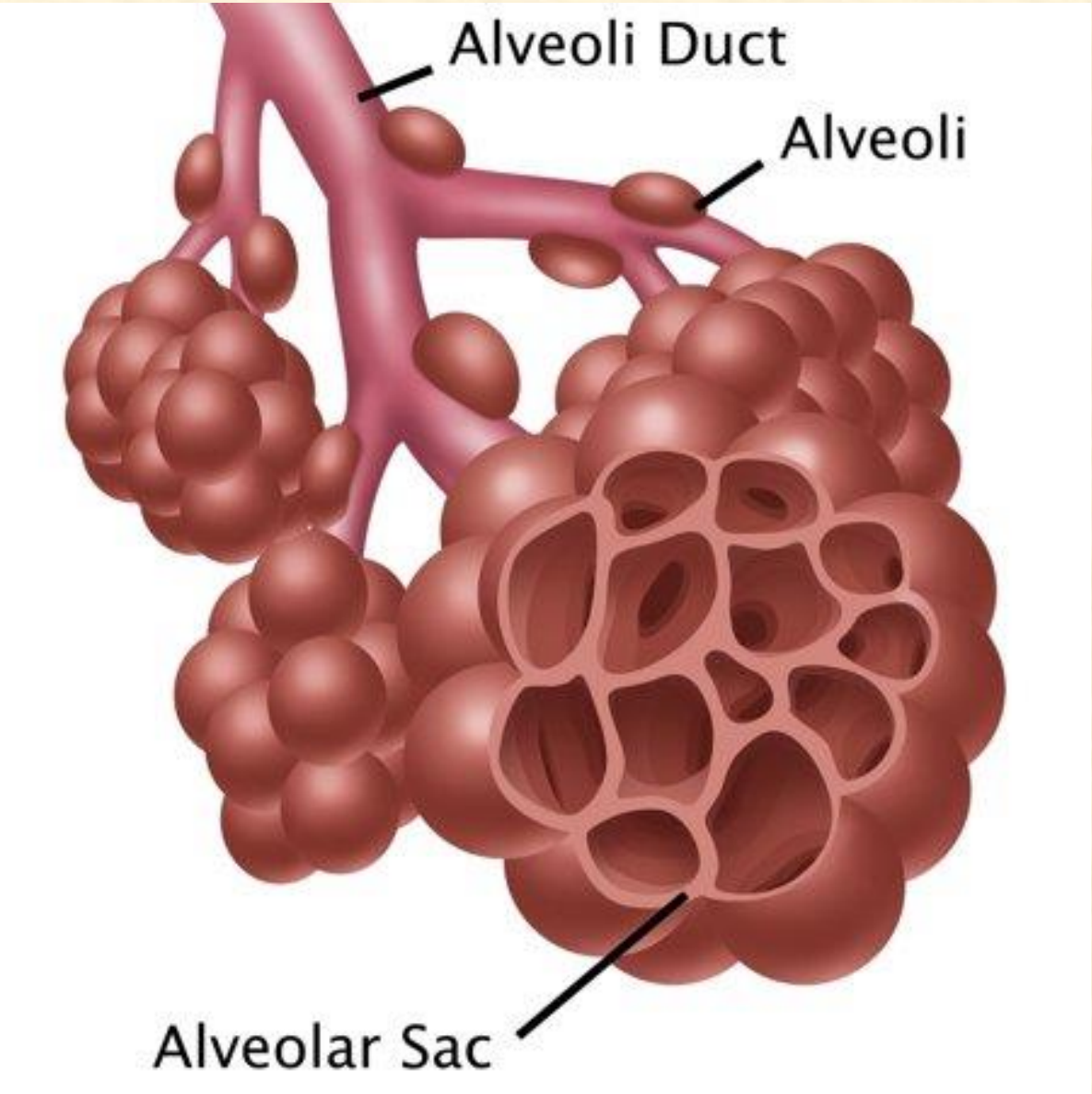
Respiratory System

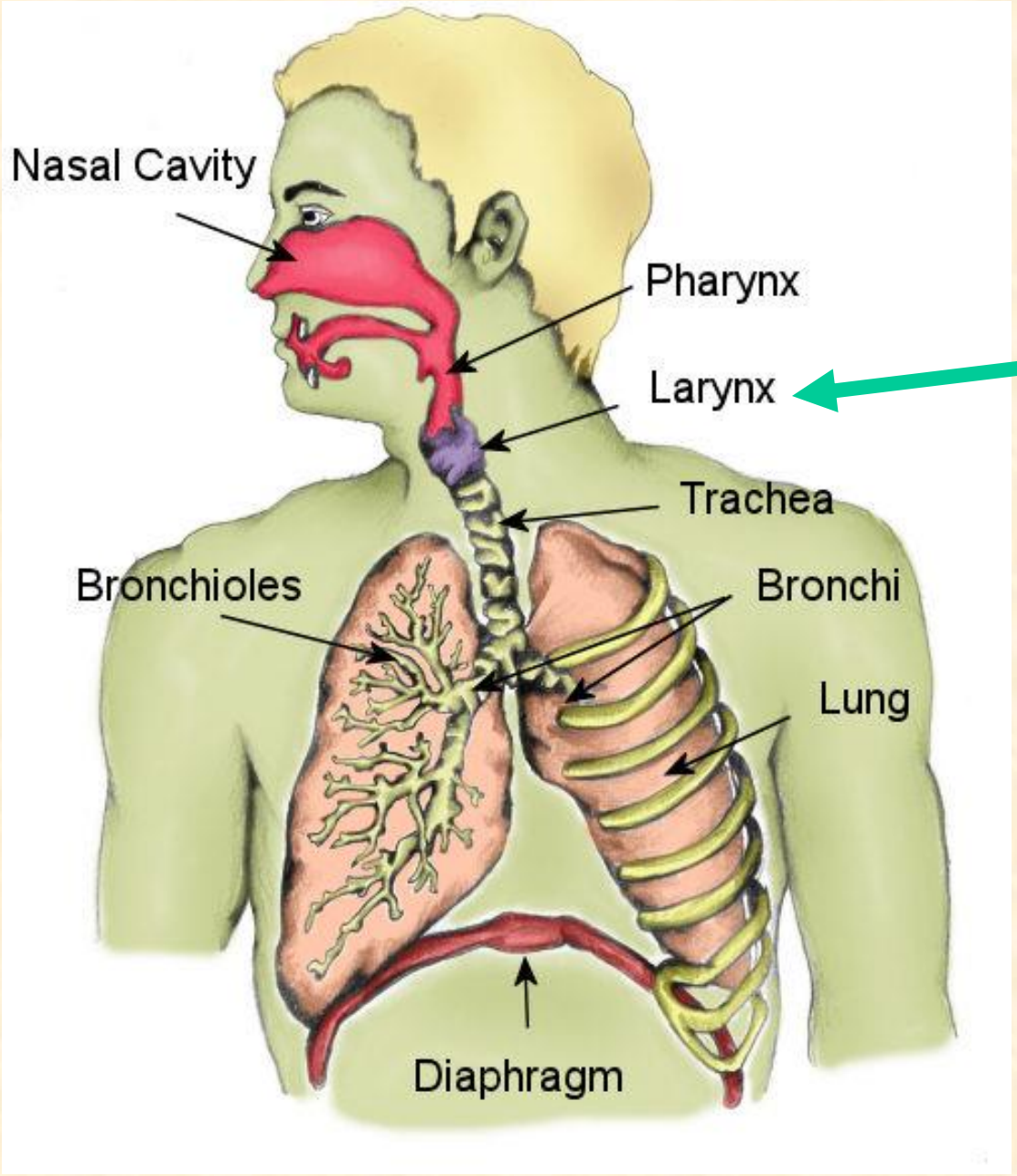


What organs make up your Respiratory System?



What do your lungs look like?

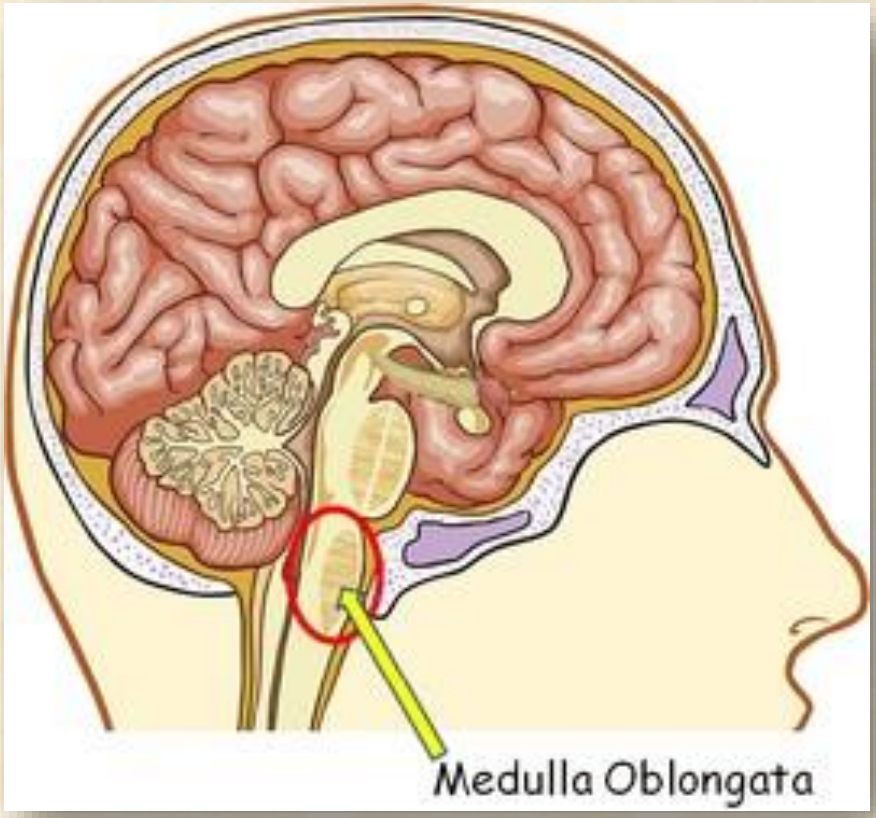




Press picture to watch the movie

Steps to Mechanical Breathing

1. Signal from the Medulla oblongata sends signals to the two muscle groups (intercostal and diaphragm) using periphery nerves



3 types of respiration

External Respiration

Oxygen goes from lung into blood, and CO_2 goes from blood into lungs (and out)

Internal Respiration

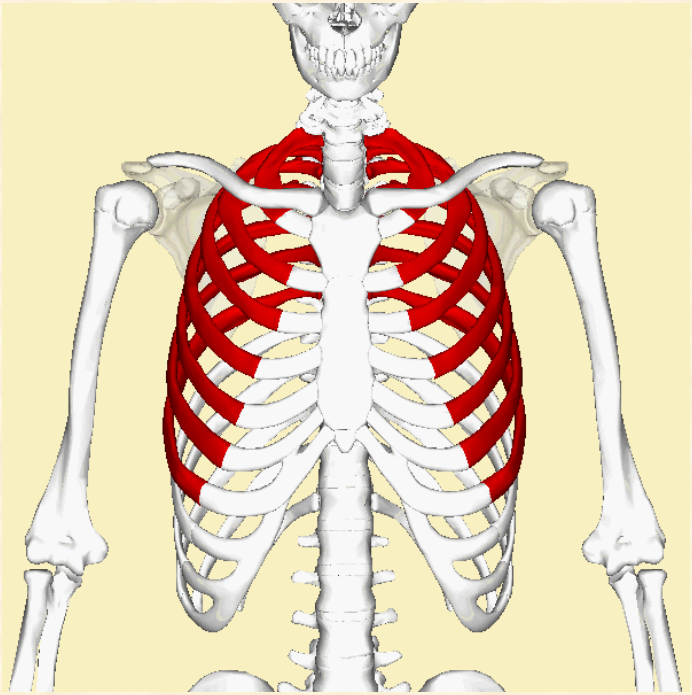
The movement of oxygen from your blood vessels into your body cells and CO_2 out of the body cell

Cellular Respiration

The use of oxygen and glucose inside your cell to create ATP for energy

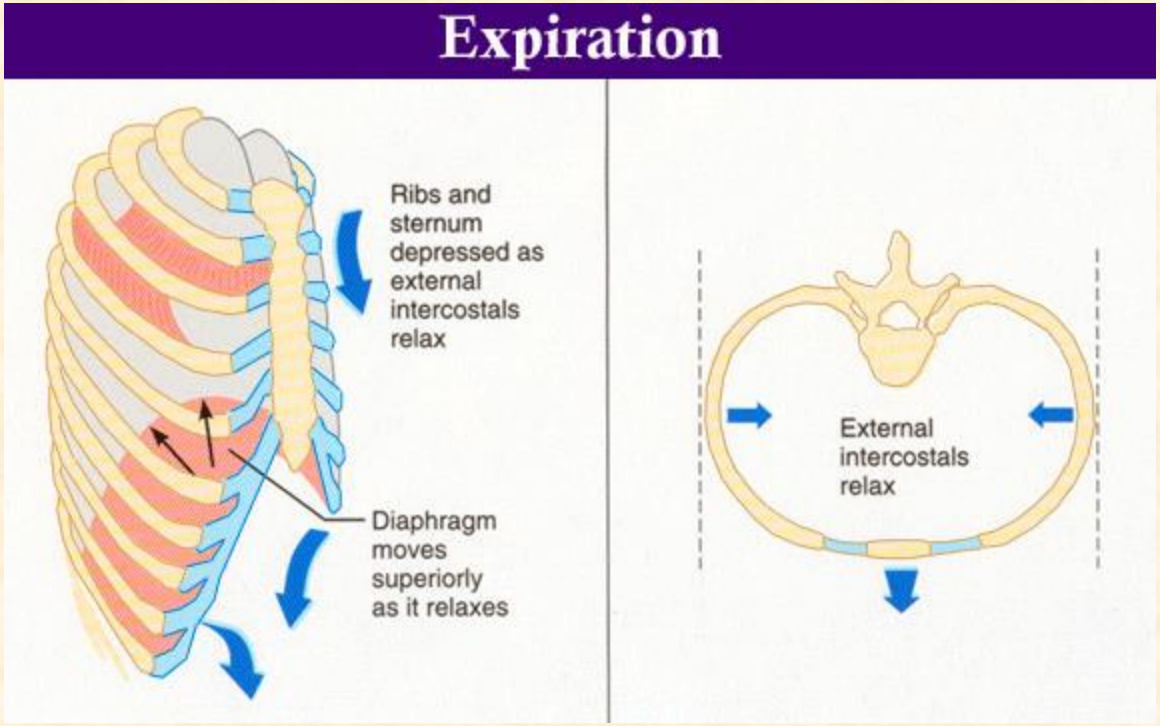
Steps to Mechanical Breathing

2. The medulla oblongata sends a nerve impulse down the spinal cord to the phrenic nerve (to diaphragm) and the intercostal nerve (to ribs)

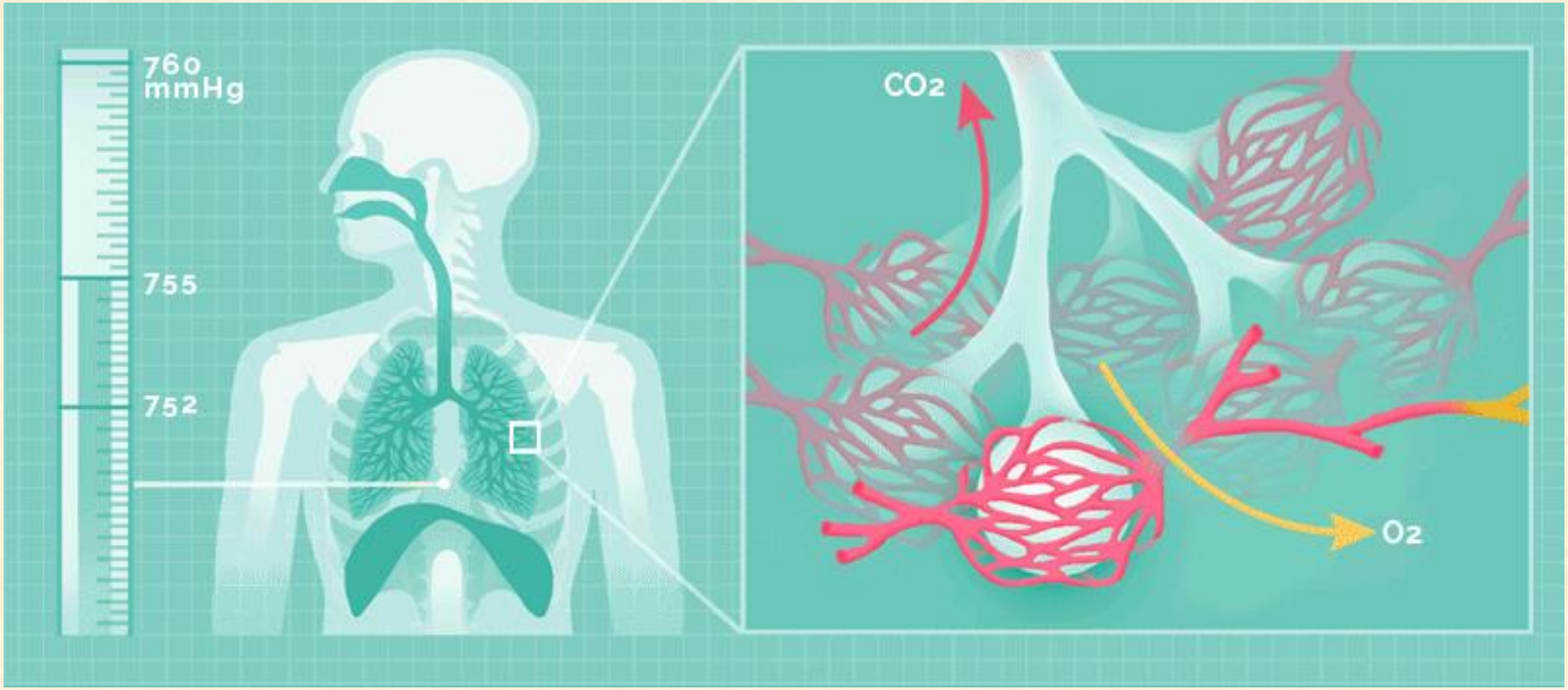


Steps to Mechanical Breathing

3. The diaphragm contracts moving the DOWN (straightens). The intercostal muscles (rib muscles) contract to move the ribs up and out. Inhalation is active (needs stimulation)

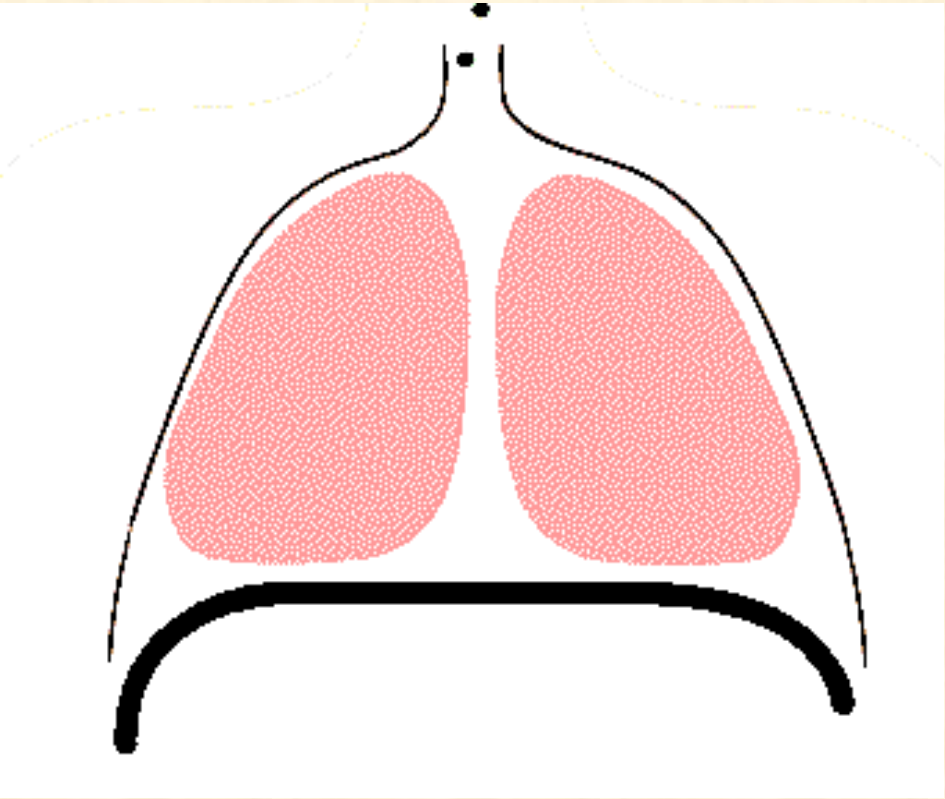


What do you notice?
What do you wonder?



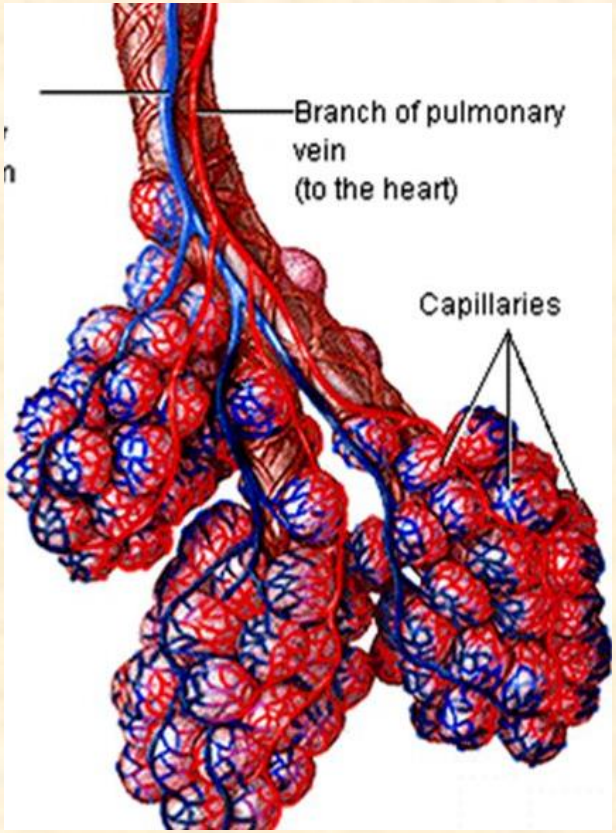
Steps to Mechanical Breathing

4. This causes a **larger volume** in the thoracic cavity which **lowers the pressure**. Air rushes in via the air passage.

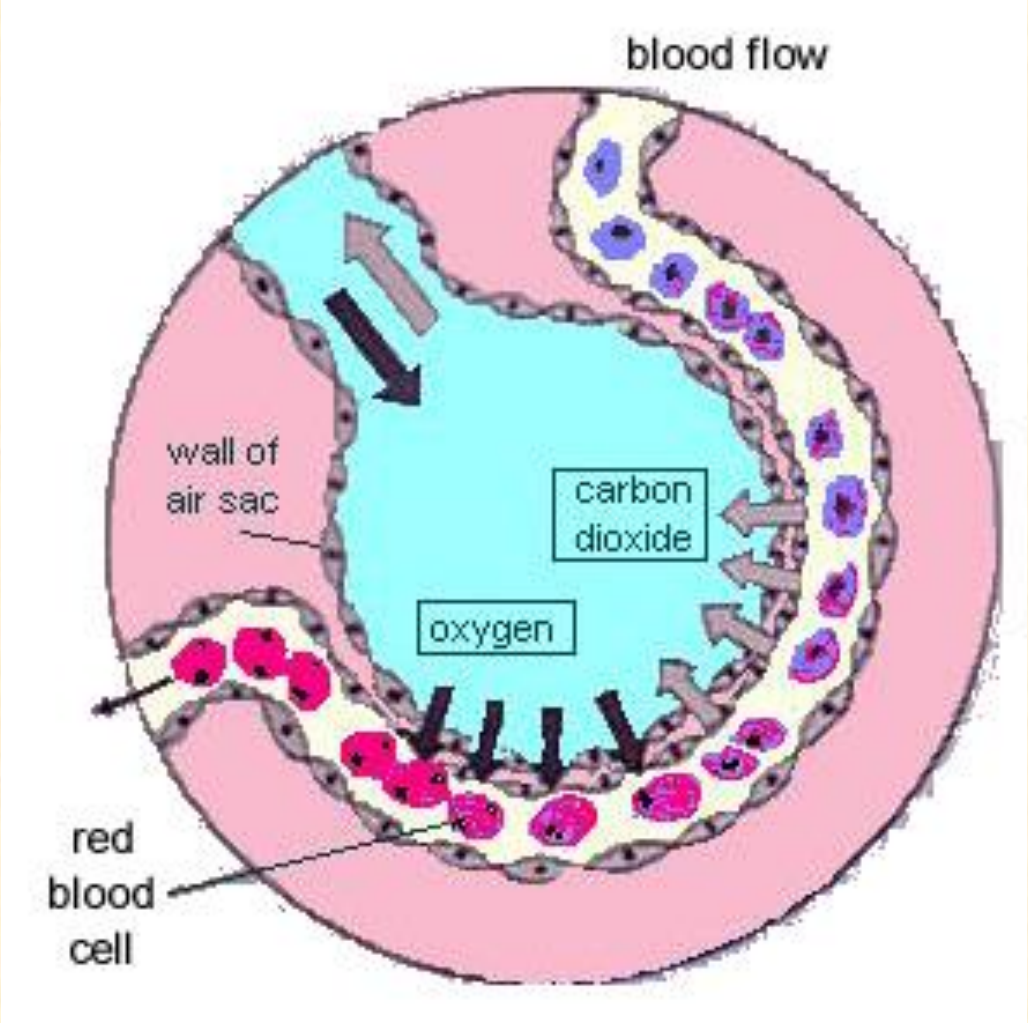


Steps to Mechanical Breathing

- The lungs fill with air until the stretch receptors of the alveoli indicate that they are full.



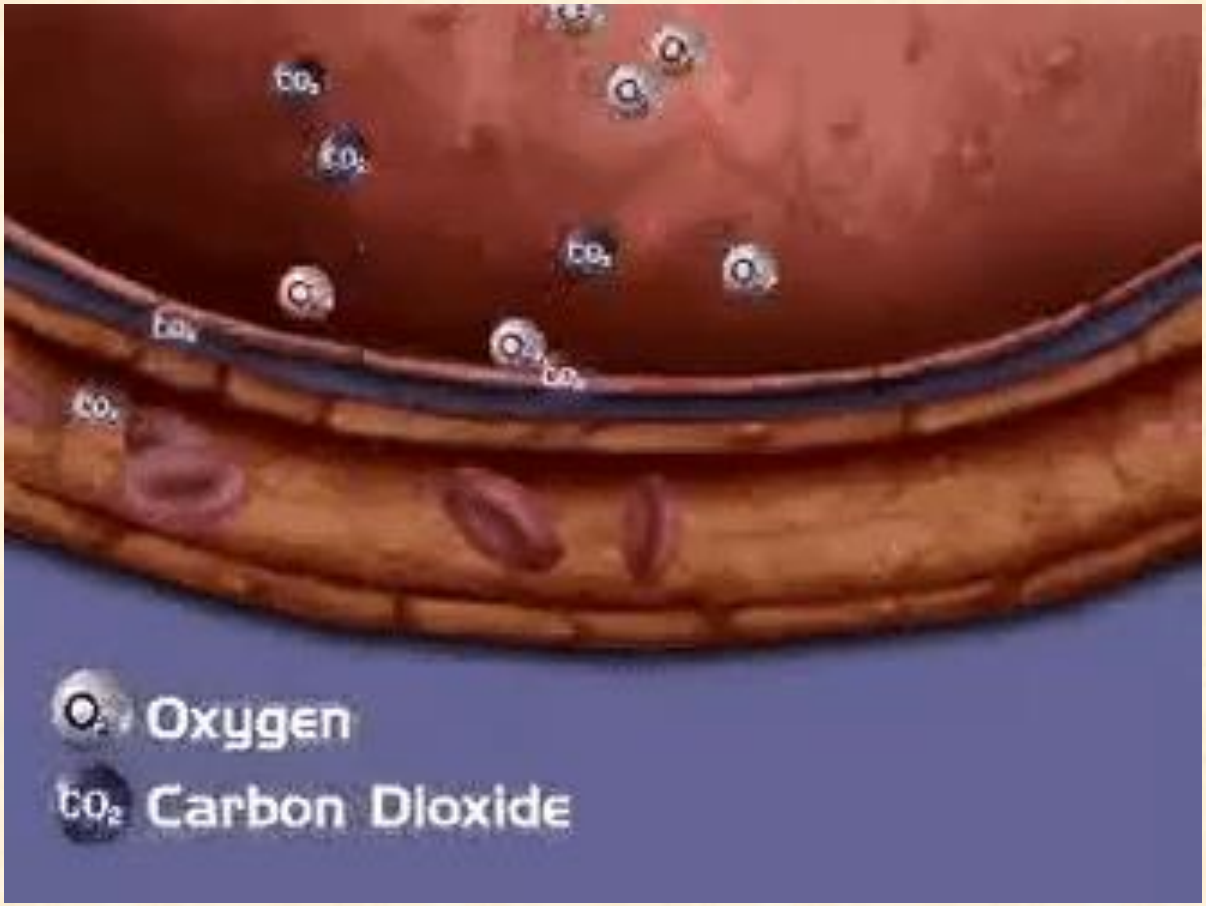
Steps to Mechanical Breathing



- Gases move from a high concentration to a lower concentration
- **O_2 to bloodstream**
- **CO_2 to alveoli**

What do you **notice**?

What do you **wonder?**



Ventilation: Quiet Breathing

Inspiration	Expiration
Diaphragm and/or external intercostal muscles contract	Diaphragm and external intercostal muscles relax and lungs recoil
Thoracic volume increases	Thoracic volume decreases
Intrapleural pressure decreases	Intrapleural pressure increases
Lungs expand into lower pressure thoracic (pleural) cavity	Lungs compressed by increased pressure in thoracic (pleural cavity)
Intrapulmonary pressure decreases	Intrapulmonary pressure increases
Air moves in	Air moves out

Expiration is normally passive

Thoracic Cavity Model

In partners, make a model of the thoracic cavity

How does the movement of the diaphragm impact the lungs?

What is coming in and out?
Gas Exchange

Gas	Inhaled	Exhaled
Oxygen	21%	15%
Carbon Dioxide	0.04%	4%
Water	1.3%	6%

What do you notice?

What do you wonder about?

Pleura and pleural fluid functions

1. **Reduces friction**

   Pleurisy – dry, inflamed pleurae

2. **Creation of pressure gradient**

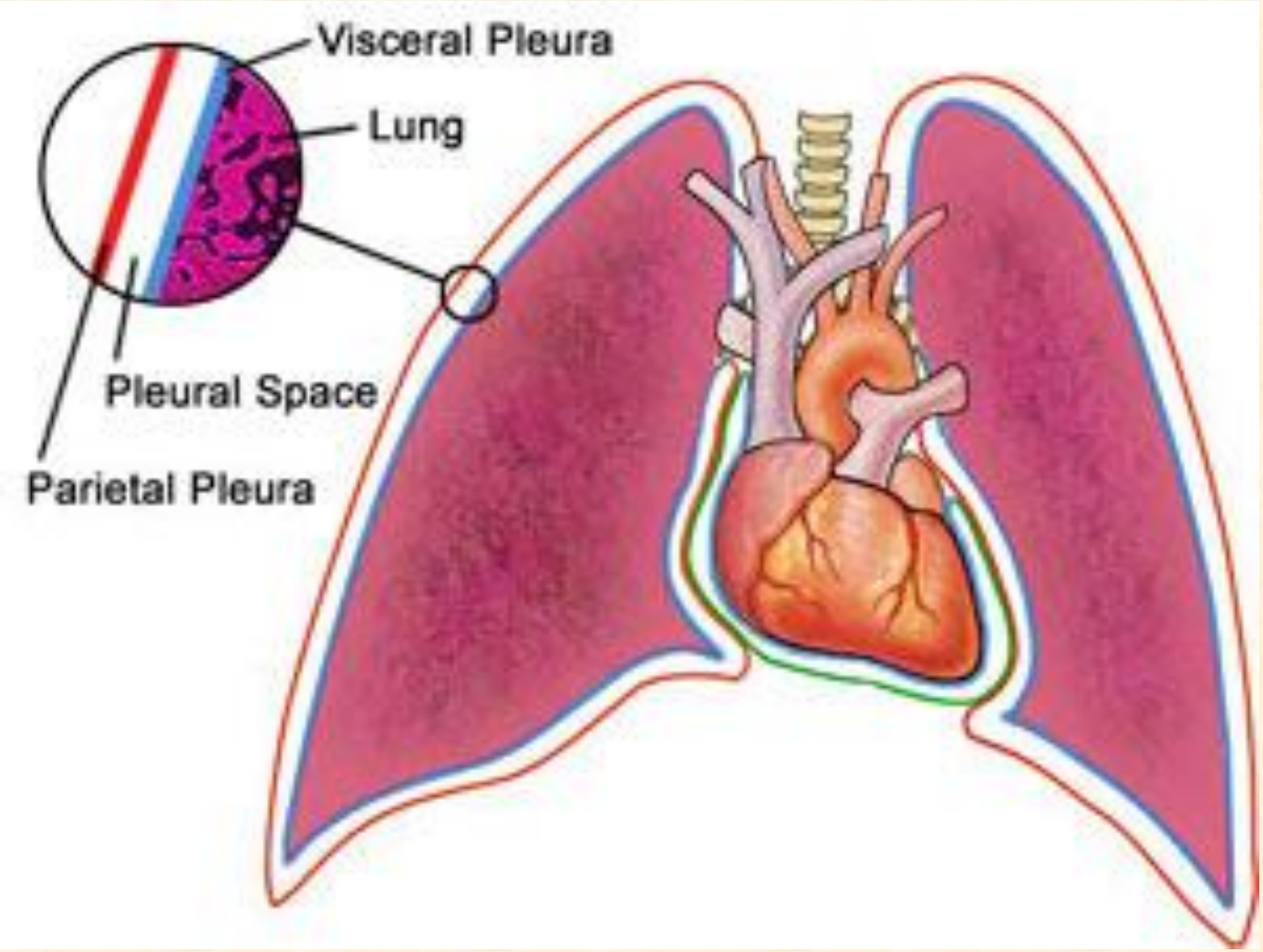
   Pressure in cavity < atmospheric pressure;

   aids lung inflation

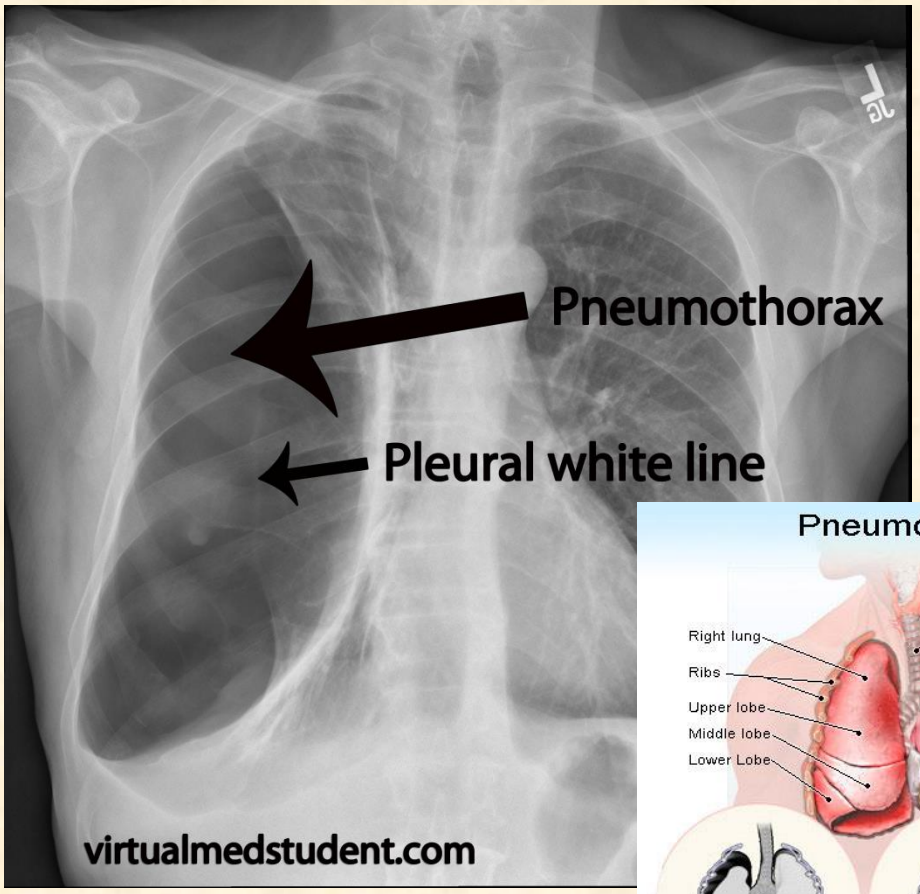
3. **Compartmentalization**

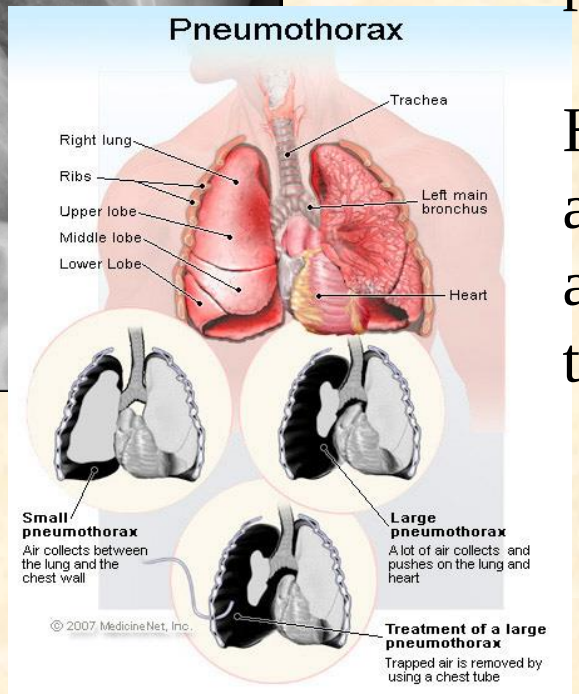
   Pleurae, mediastinum, pericardium separate; prevent infection from spreading easily to neighboring organs

Pleural cavity



Pneumothorax



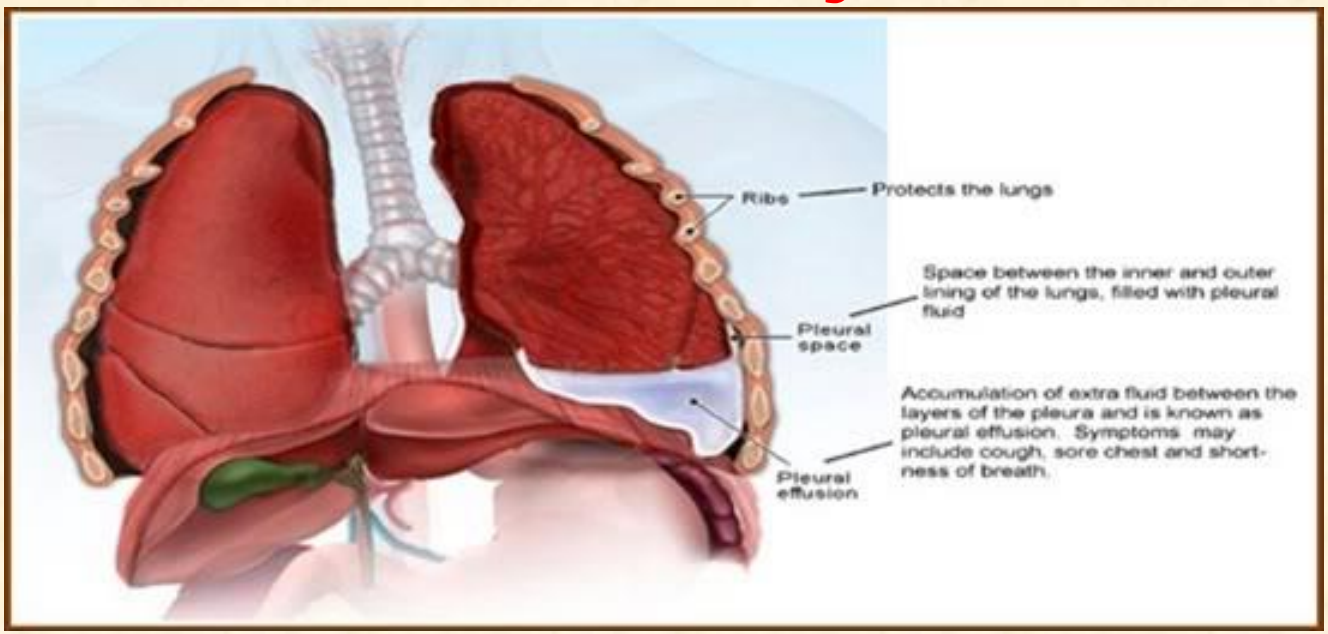


Often referred to as a collapsed lung

Air collects between lung and visceral pleura

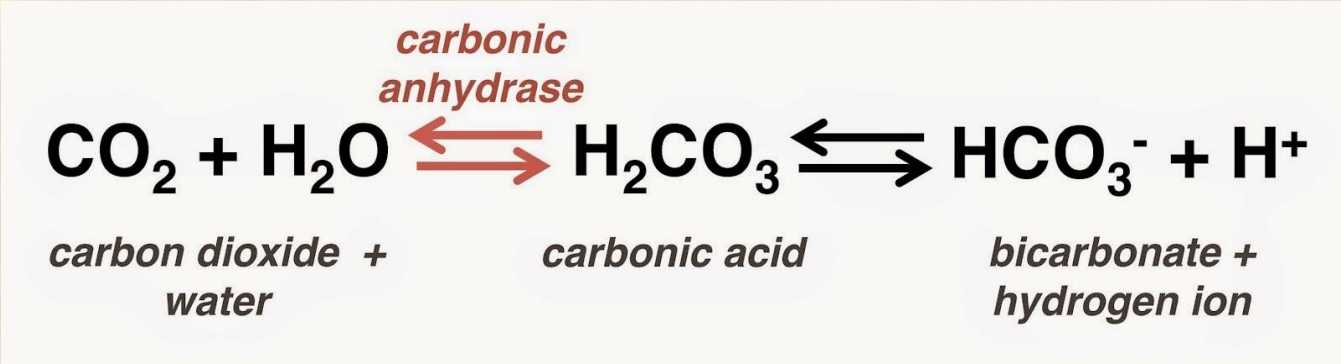
Have to go into chase and remove trapped air, lung will be able to re-inflate

Pleurisy



- Fluid gets trapped between visceral and parietal pleura
- Challenging to breathe
- Can lead to infections

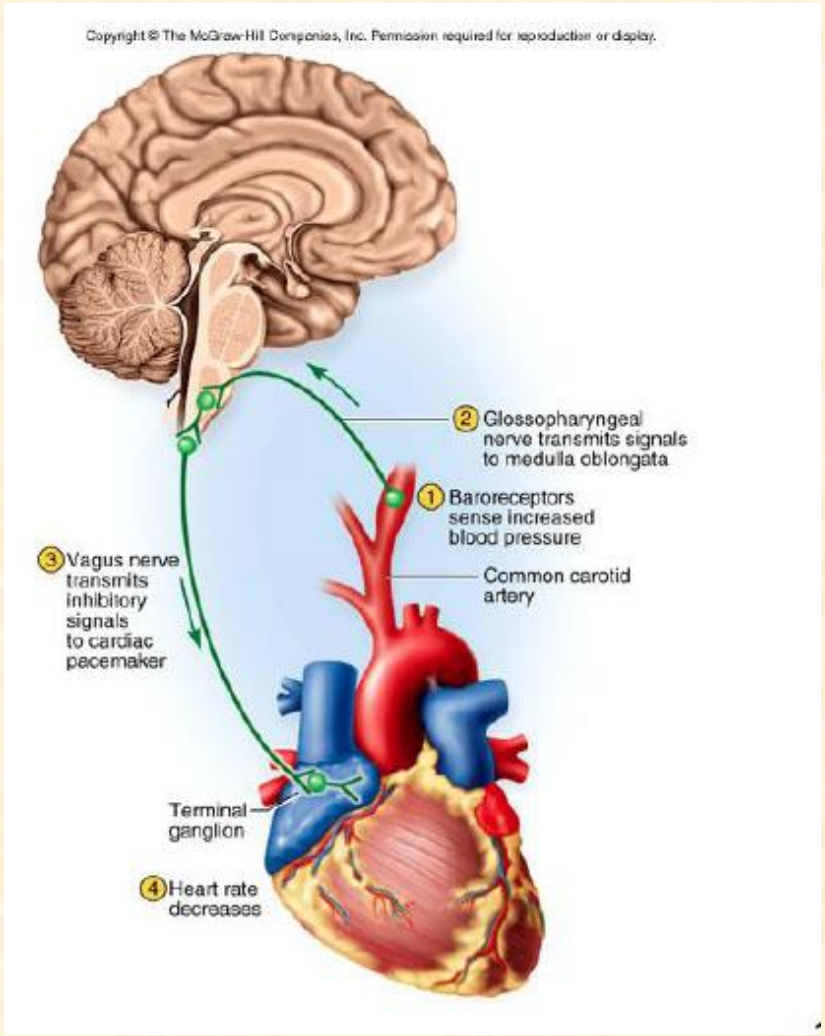
What is being monitored in your breathing?



- Blood acidity is monitored by:
  - Chemoreceptors
    - Aortic bodies (in aorta) and carotid bodies (in carotid artery)
    - Spend a chemical message to medulla oblongata about blood acidity

Chemoreceptors

- A rise in CO_2 in blood will lower pH (become more acidic)
- This will be sensed by aortic bodies and carotid bodies
- Message sent to M.O.
- Will cause “exhalation” to remove CO_2



Issues with Blood pH

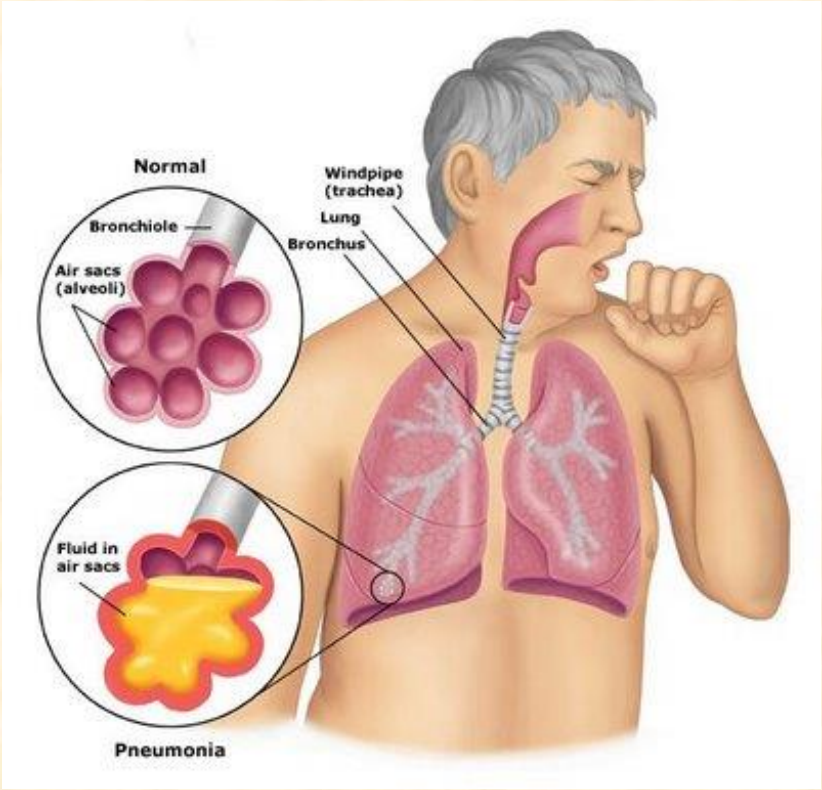
- The blood needs pH to be constant ~7.4
- What can happen?
  - Alkalosis- Result of hyperventilation
    - High pH ….. decrease in H^+
    - Dizziness and twitching
  - Acidosis- Hypoventilation
    - Increase in H^+
    - Coma and die
    - Can also bind to hemoglobin
    - Decrease in HHb (reduced hemoglin)

Pneumonia

Accumulation of fluid in the alveoli

Does not allow gases to move across from alveoli to capillaries

Leads to bacterial infection in the lungs

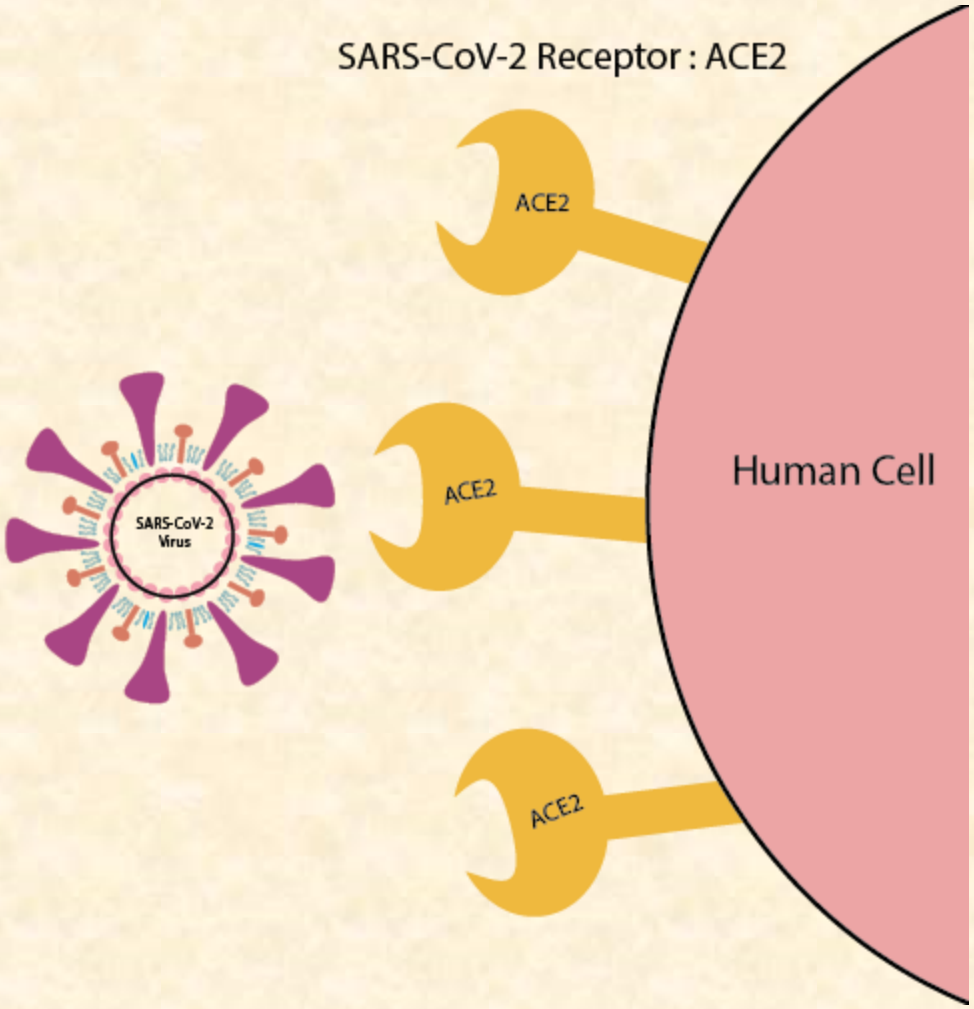


COVID

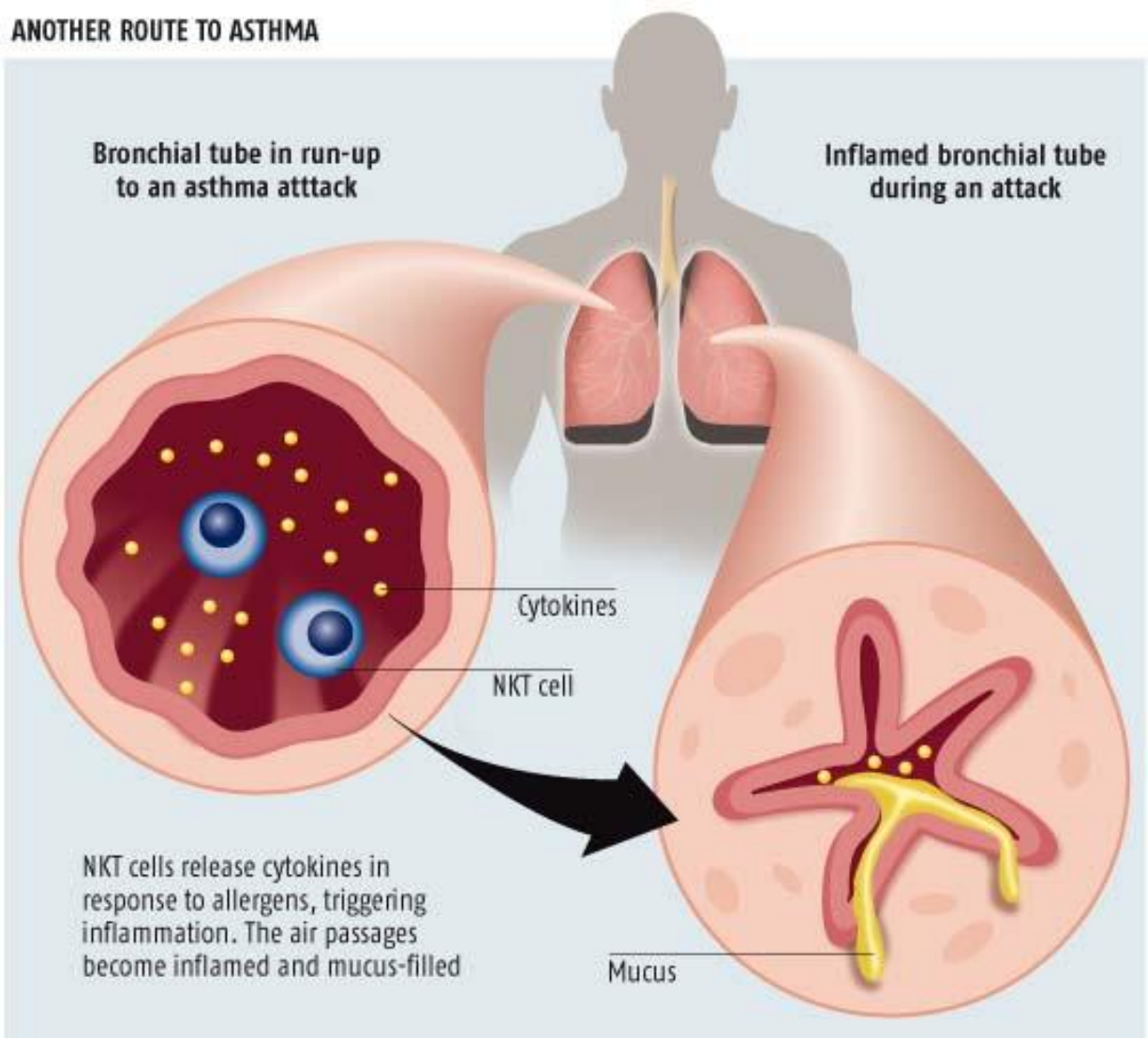
Antigens on the outside of respiratory cells – ACE-2

This is the protein that COVID connects to in the human body

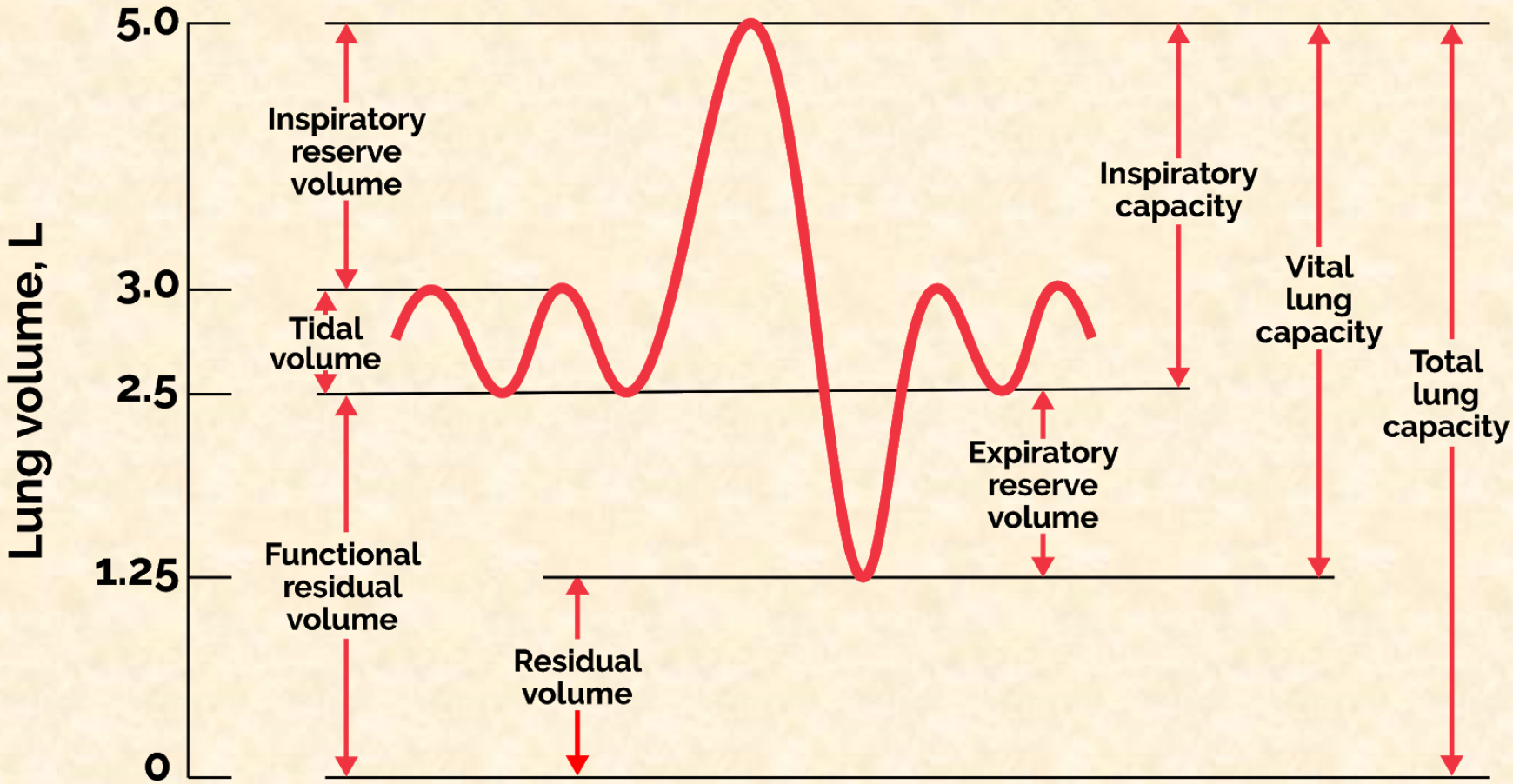
ACE-2 proteins are common in the upper throat and lower lungs



Asthma

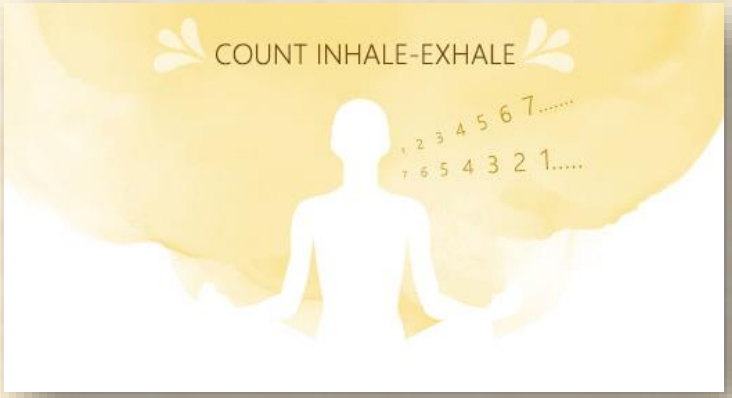

ANOTHER ROUTE TO ASTHMA
Bronchial tube in run-up to an asthma atttack
Inflamed bronchial tube during an attack
Cytokines
NKT cell
NKT cells release cytokines in response to allergens, triggering inflammation. The air passages become inflamed and mucus-filled
Mucus

What volume of air can your lungs handle?



Respiratory Exploration

- **What is your breathing rate?**
  - Count how many breaths you take in a minute when:
    - Lying down
    - Sitting
    - Standing
    - 3 minutes moderate exercise (squats, jumping jacks, etc)
    - 3 minutes intense exercise (sprinting, burpees, etc)



Watch for homework: