The Pulmonary System: What drives our breathing?

1. Anatomy and Physiology of the Lungs---basics and Amazing facts
2. Upper and Lower Respiratory systems—normal pathway
3. How we breathe—respiratory cycle
4. What part does the nervous system play in breathing?

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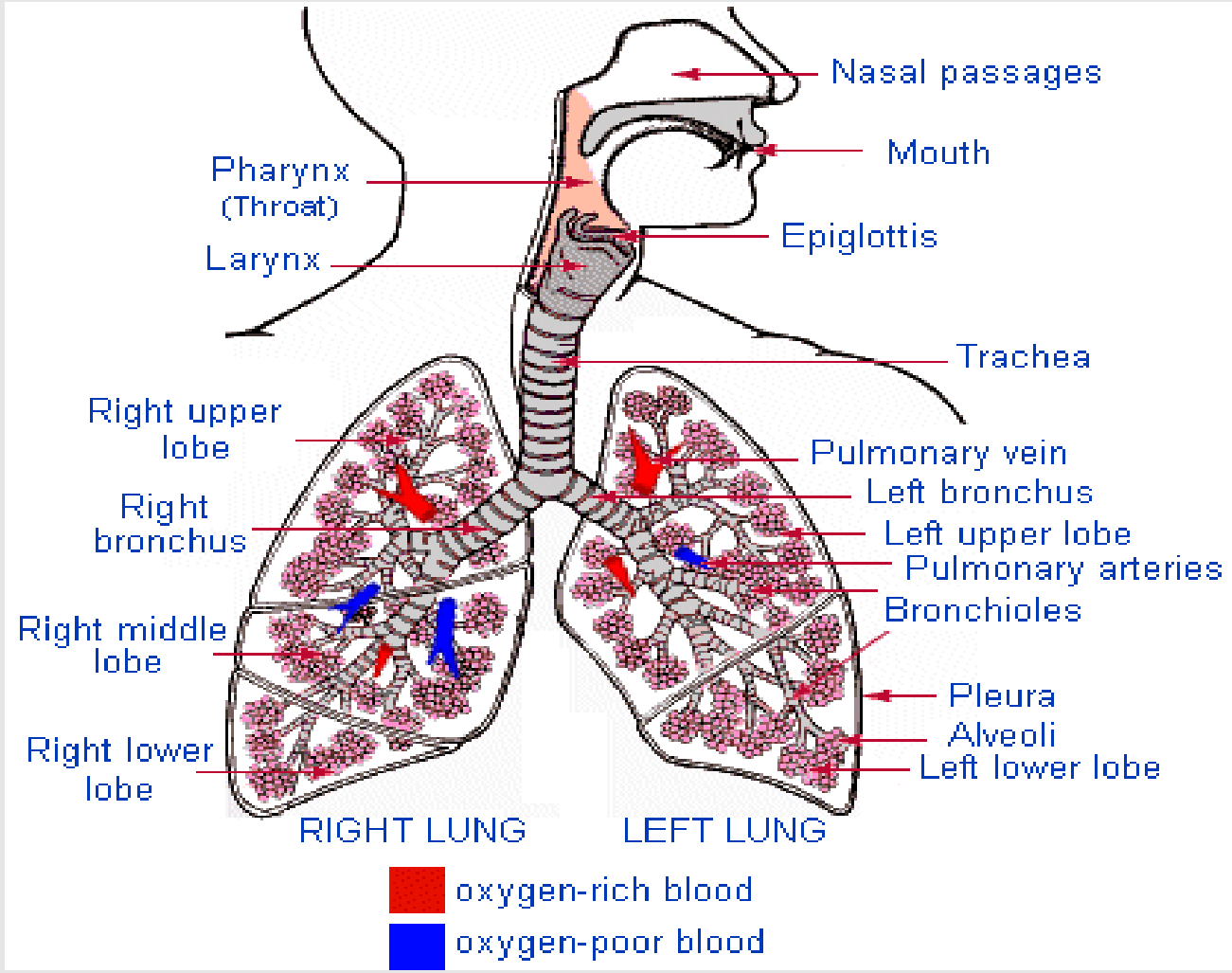
Anatomy and Structures of the Respiratory System: The basics

The main organs of the respiratory system are the lungs. There are two sides, right and left.

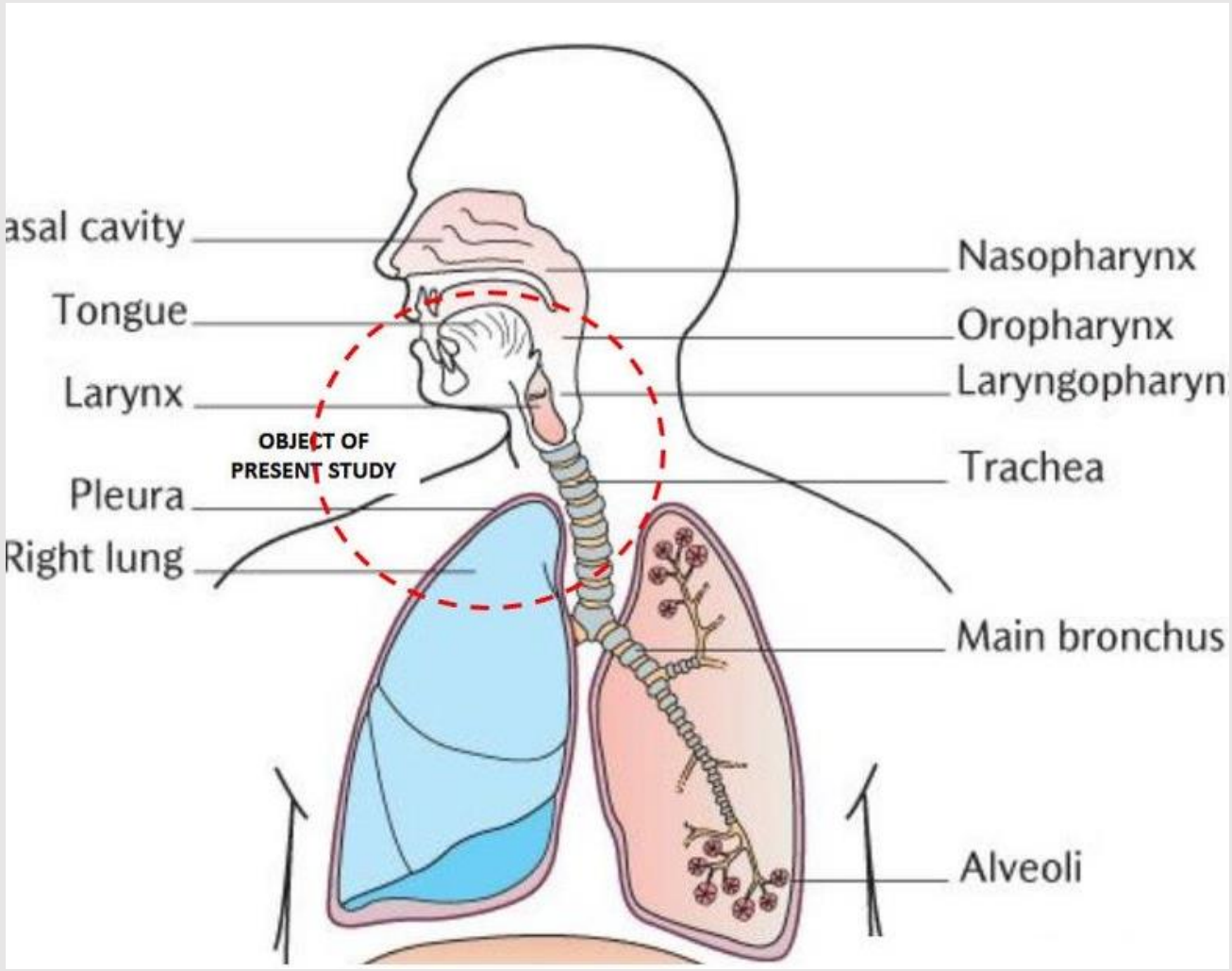
The right lung has three lobes, but the left lung has only two lobes. The right lung has three lobes and is larger, wider, and shorter than the left lung, and that is to accommodate the liver! The left lung is smaller, narrower and longer than the right lung in order accommodate the heart.

The trachea is the tube that entrains air from the mouth, and nose, through the pharynx to the main bronchus of the lungs that divide again into smaller branches down to the bronchioles, and eventually the alveoli.



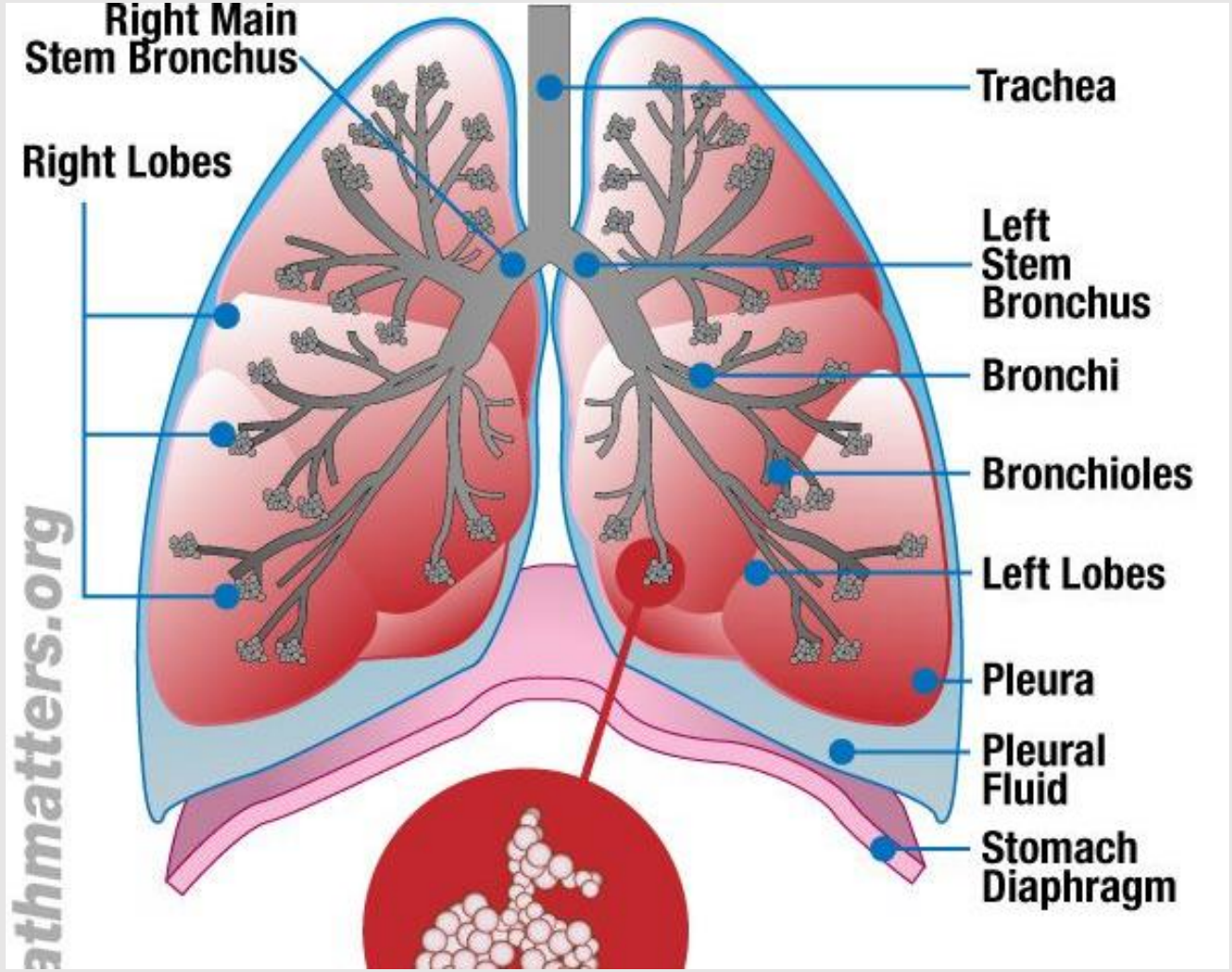
The Structures of the Upper Respiratory system

1. This system starts at the oral and nasal cavities. That is where the humidification and filtration of air begins.
2. The air then passes over the oro- and naso- pharynx. The air then passes down through the laryngopharynx to the trachea.
3. From the trachea air moves down to the first bifurcations called the Bronchi. The air then goes right and left.
4. All the while air is moistened and the filtration of the air continues.



Structures of the lower respiratory system- Pulmonary Tree

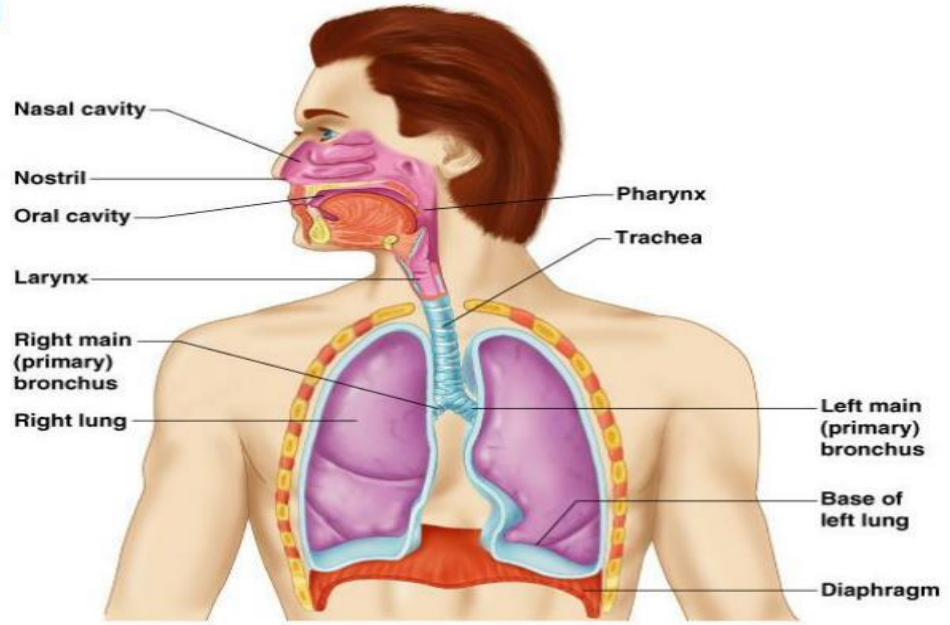
1. The lower Respiratory System begins with the bifurcations of right and left stem Bronchus.
2. As air continues downward it passes through ever smaller ducts called bronchioles.
3. From there the air reaches its destination, the alveoli. At this level gas exchange takes place. O2 and CO2 are exchanged. This process is where O2 and CO2 move between the bloodstream and the lungs. This is the main function of the respiratory system.



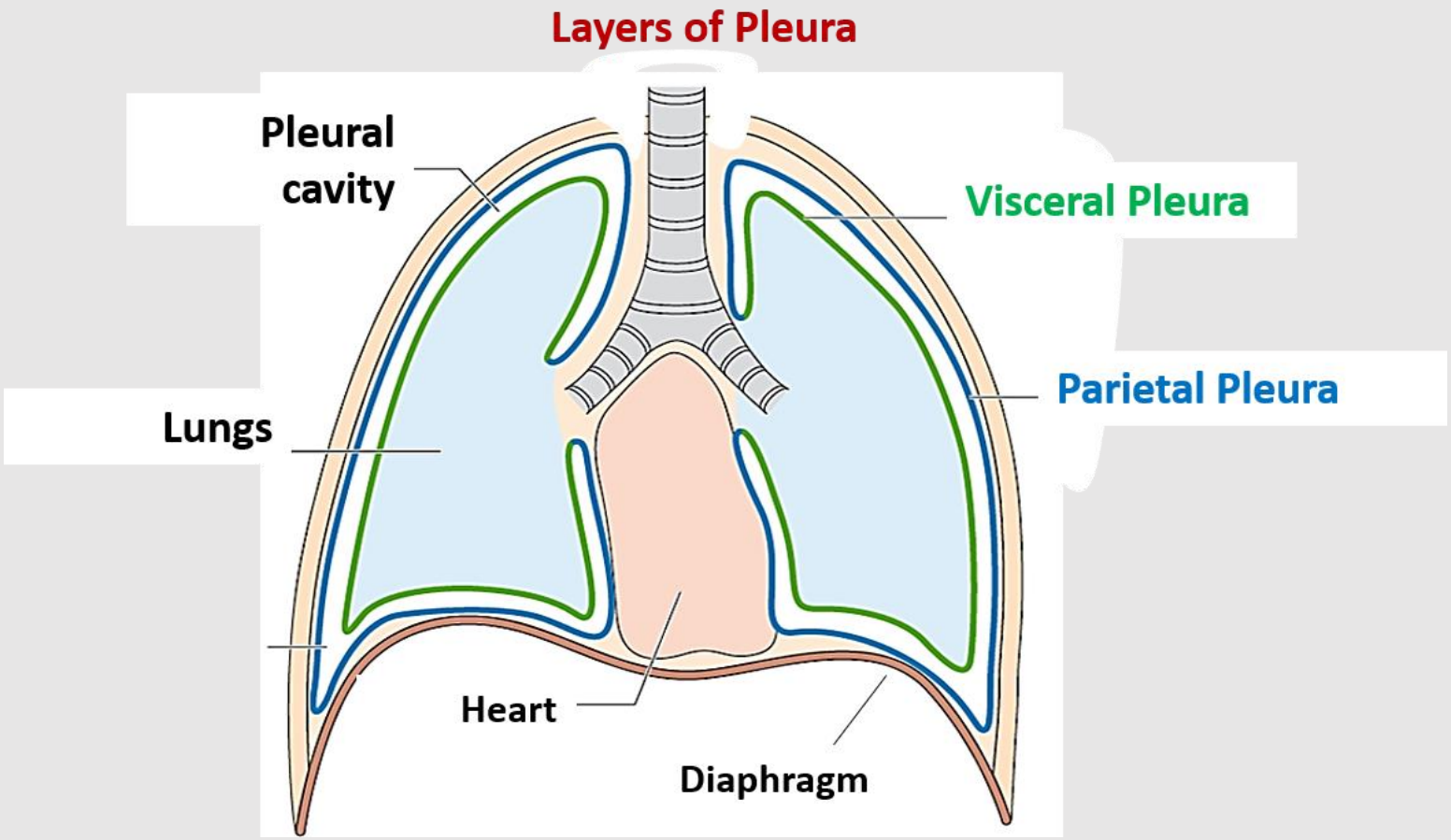
Another look at the pathway air takes to move into and out of our body:

Organs of the Respiratory System

* Nose
* Pharynx
* Larynx
* Trachea
* Bronchi
* Lungs – alveoli

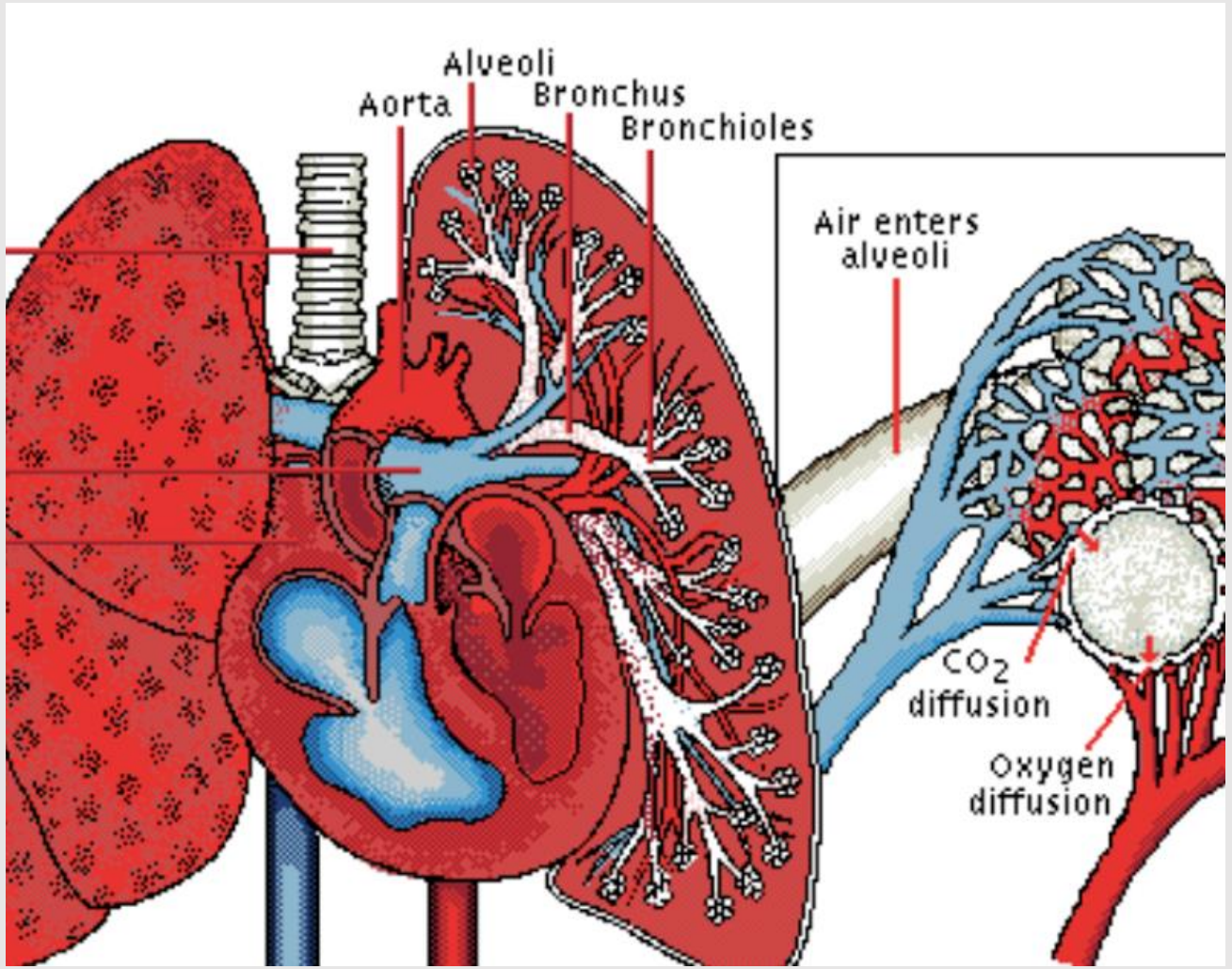


The Pleura is a protective lining that is filled with fluid to help protect and lubricate the lungs

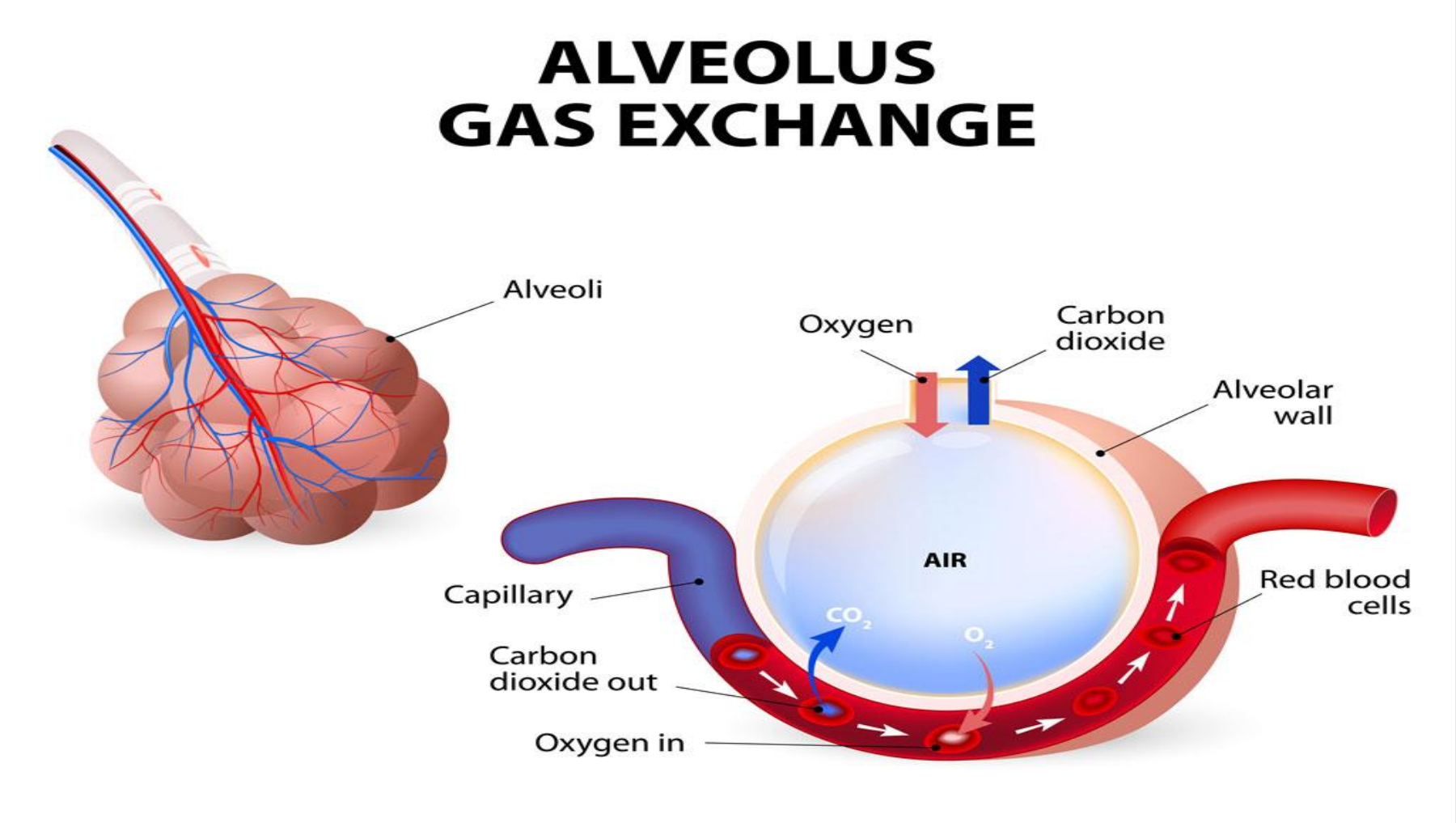


Basic physiology of gas exchange

1. Physiology of Gas Exchange.
The alveolar sacs contains capillaries that supply the pulmonary artery (which takes UNOXYGENATED blood to the lungs to receive oxygen) and pulmonary vein (which takes OXYGENATED blood back to the heart to replenish the body). These capillaries have a thin membrane that allows the transport of oxygen and carbon dioxide.

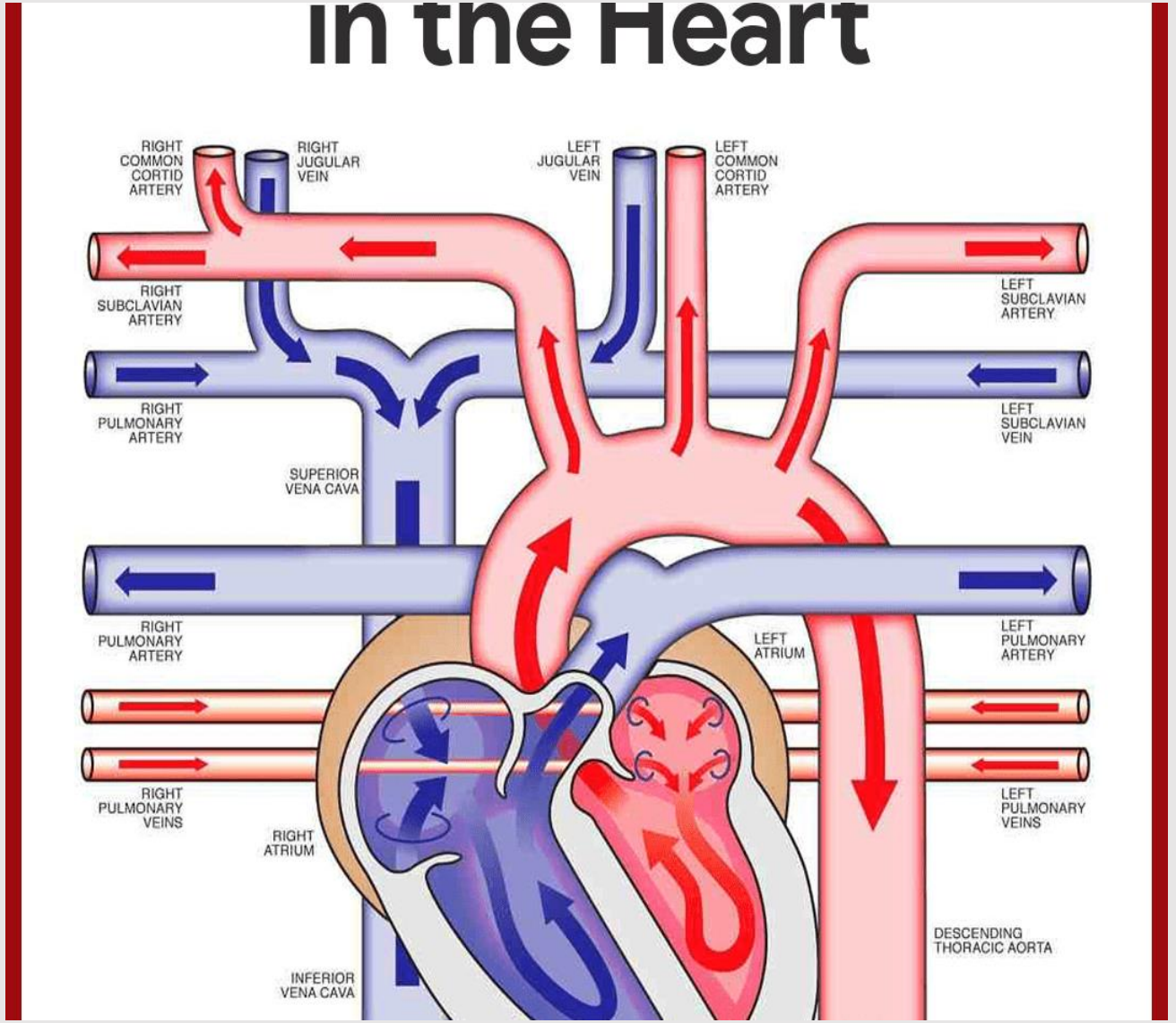


Gas Exchange at the capillary beds of the Alveoli. Diffusion plays a part in gas exchange.



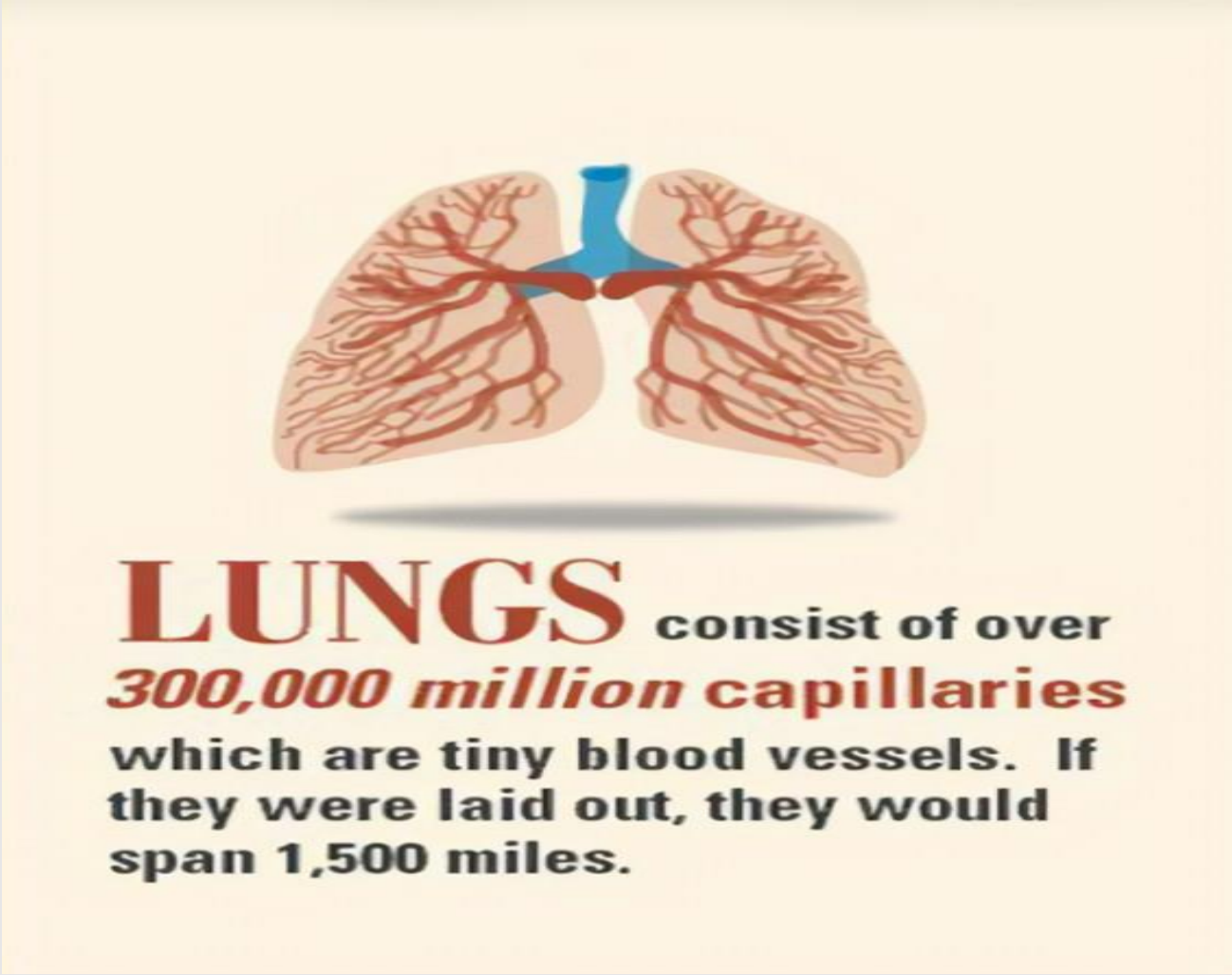
What relationship does the heart have with the Lungs?

1. Blood from the body(deoxygenated) moves to the R side of the heart.
2. From the R side of the heart it enters the Pulmonary Artery.
3. From there the blood moves into the lungs to be reoxygenated at the level of the capillary bed.
4. Once exchange of gases takes place the blood comes back to the L sid eo the hear via the pulmonary veins.
5. From the L side of the heart the reoxygenated blood moves to the entire body.



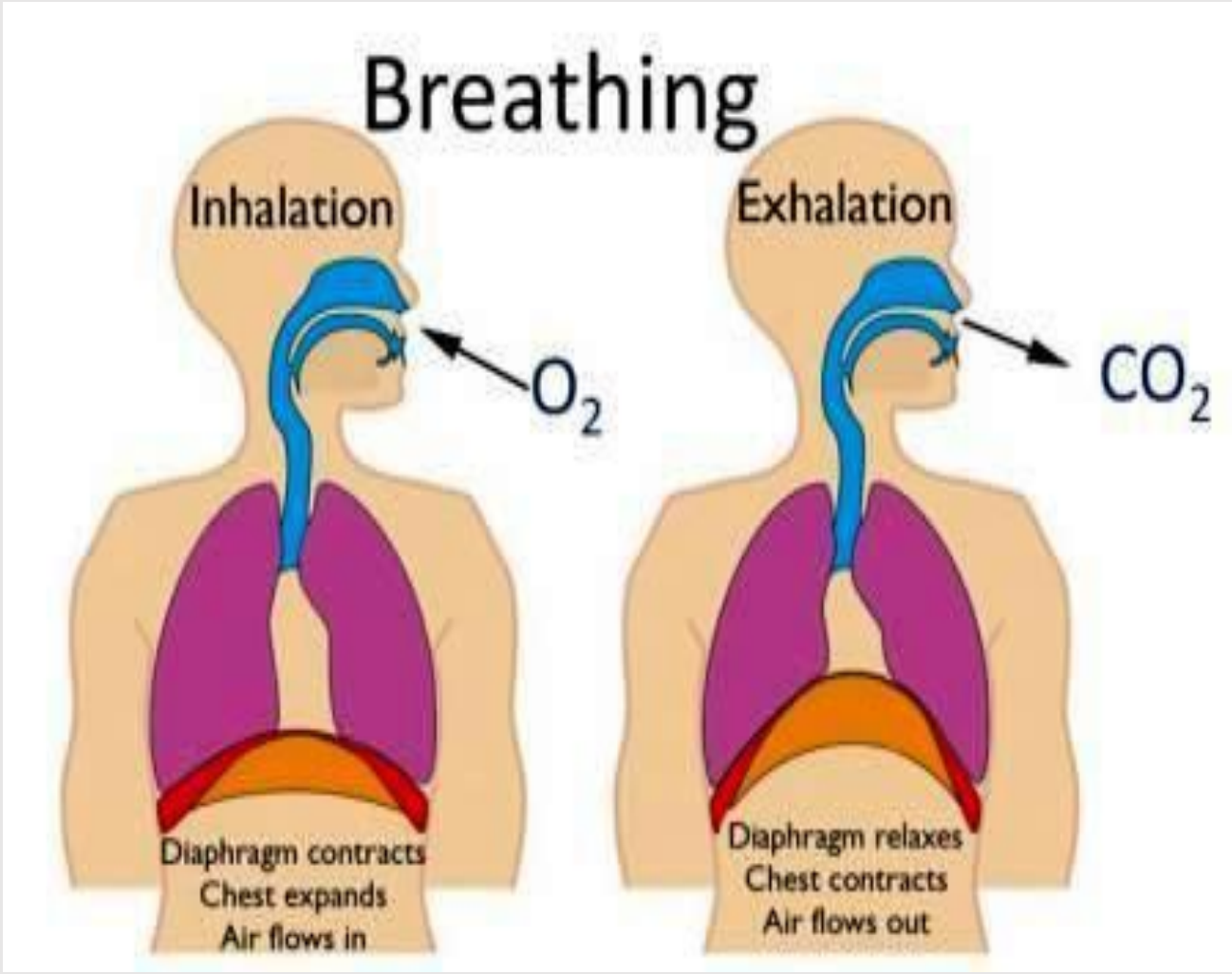
Some Amazing facts about our lungs:

- Our lungs are huge! If you opened them out flat they'd fill a tennis court. Your lungs are also buoyant.
- Not only do our lungs bring in oxygen, but 70% of our waste is eliminated simply by exhaling, on average 17.5 mls per hour.
- Every minute you breathe in 13 pints of air, including whatever is in that air(bacteria, pollutants, molds). We have specialized mucus producing cells and cilia to help trap these particles and eventually cough them up!



How we Breathe

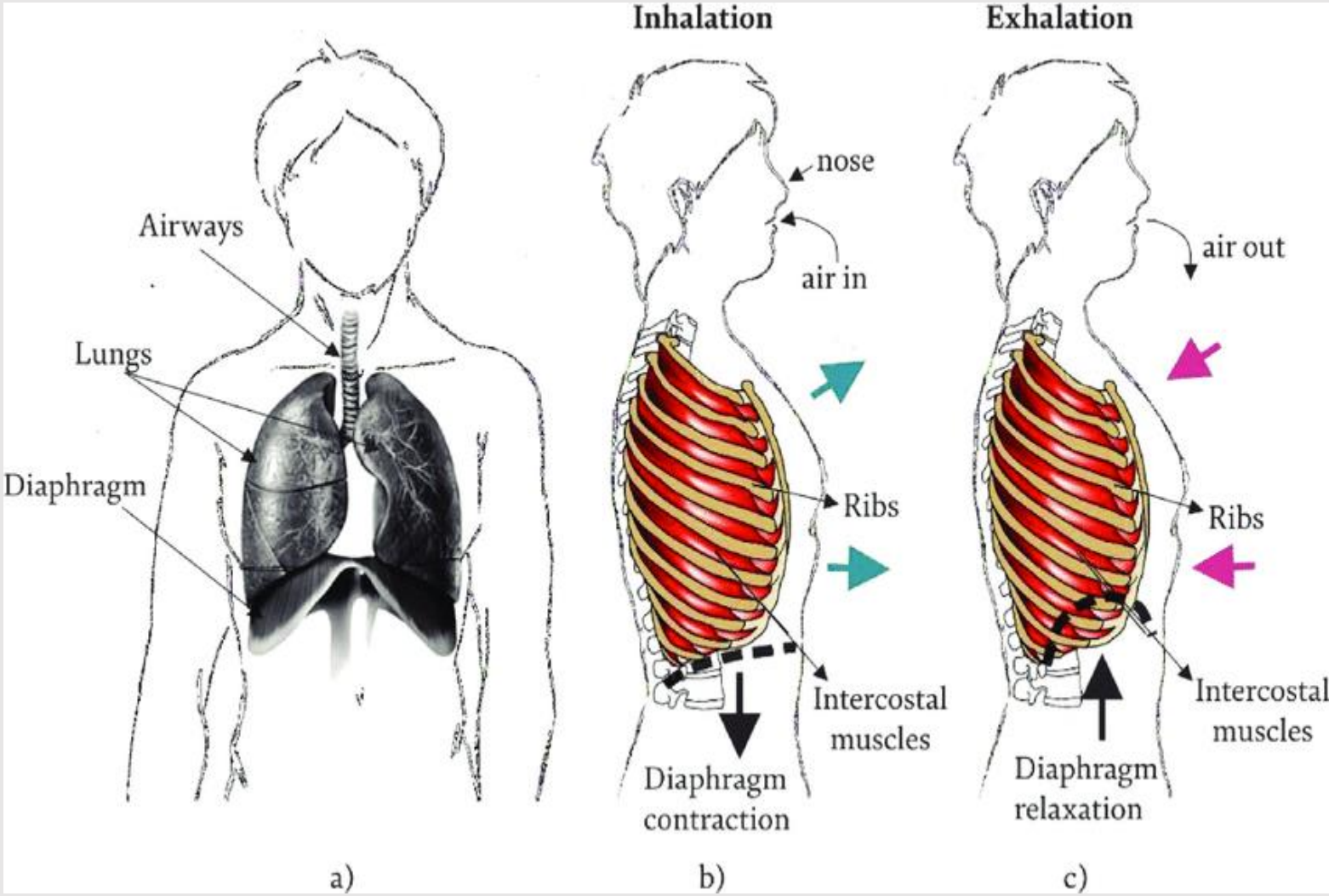
- Respiration has three basic processes.
- #1 Ventilation. It is the movement of air between the outside atmosphere and the lungs. This is done in two phases: inspiration(into) and expiration(out of).
- #2 involve the exchange of gases withing the body. There is the exchange of gases between the lungs and the blood, internal respiration.
- #3 The third process is the internal respiration, or the exchange of gasses between the blood and the cells of the body.



What role does the diaphragm and intercostals play?

- During inspiration the diaphragm pushes downward and forward over the internal organs below.
- The thoracic cavity increases in size and the external intercostals contract lifting the sternum and ribcage outward. This movement allows for the stretching out of the lungs. This movement allows for the gases to spread out and fill all the spaces.
- This results in the decrease of gas pressure, which causes a vacuum that sucks air into the lungs.

Introduction to Anatomy and Physiology. Rizzo, Donald, 2012

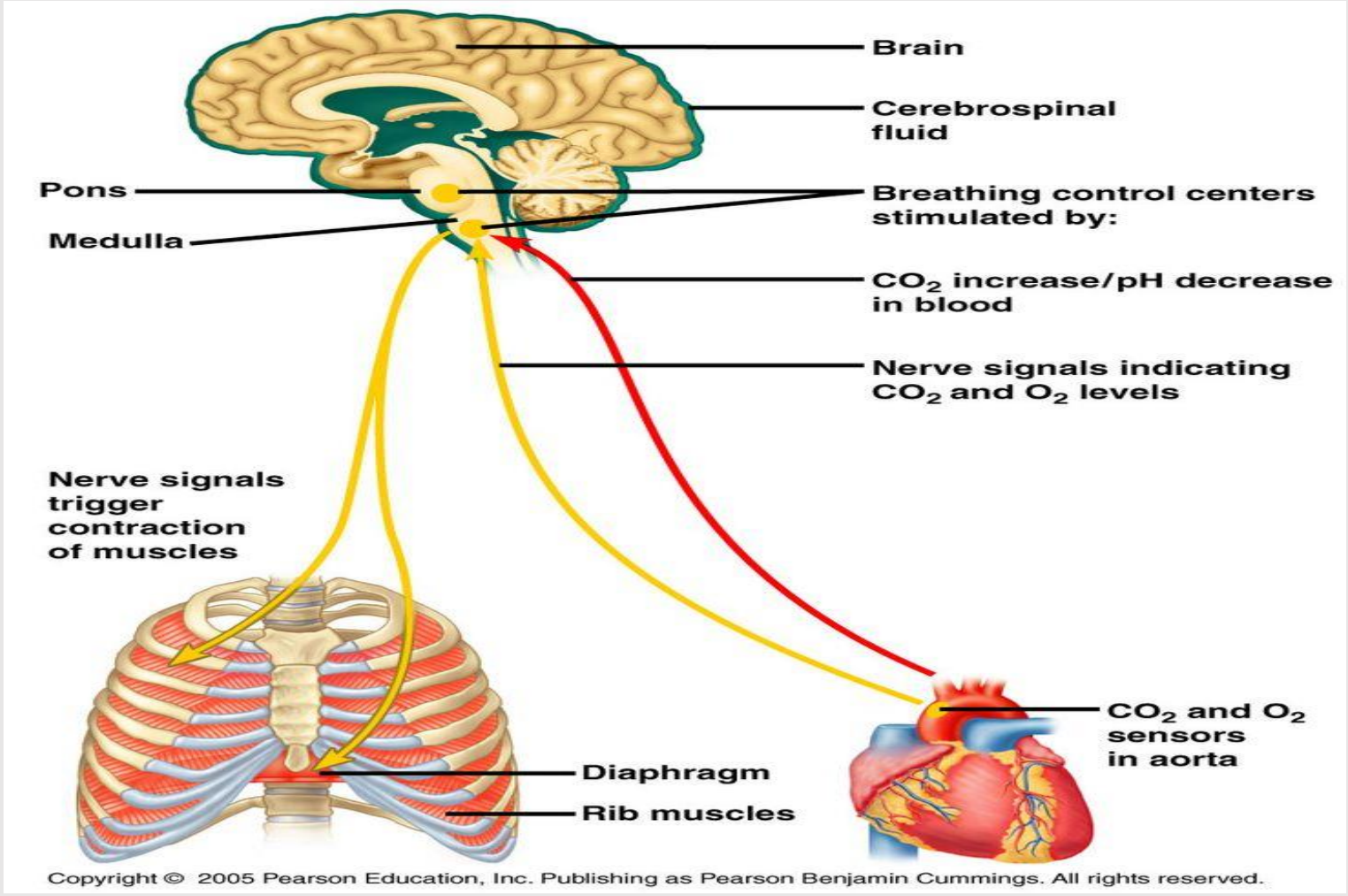


How we breathe continued……

- The process of expiration, or breathing out is the opposite of the process of inspiration. The difference is that the internal intercostal muscles contract to help further decrease the size of the rib cage. What then happens, as all the structures relax pressure inside the lungs increases, causing air to flow out of the lungs and into the atmosphere. This part of the mechanics of breathing is mostly passive.
- Diffusion plays a big part here. Gases flow from an area of higher concentration to that of a lower concentration. The press. Of oxygen in the alveoli is higher than the pressure of oxygen in the blood. That is why oxygen can move from the lungs to the blood stream. The same is applied with CO2 in the blood stream to Co2 in the alveoli.

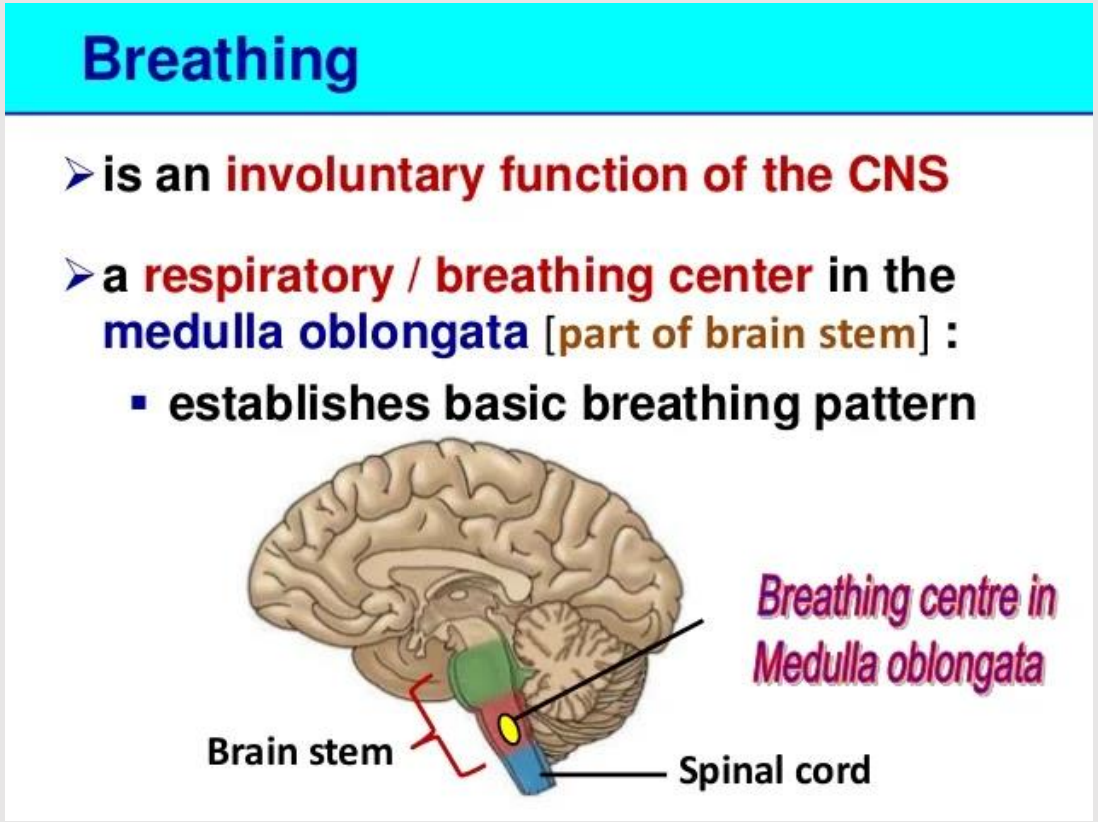
A short video on the mechanics of breathing

What role does the brain play in regulating Breathing?



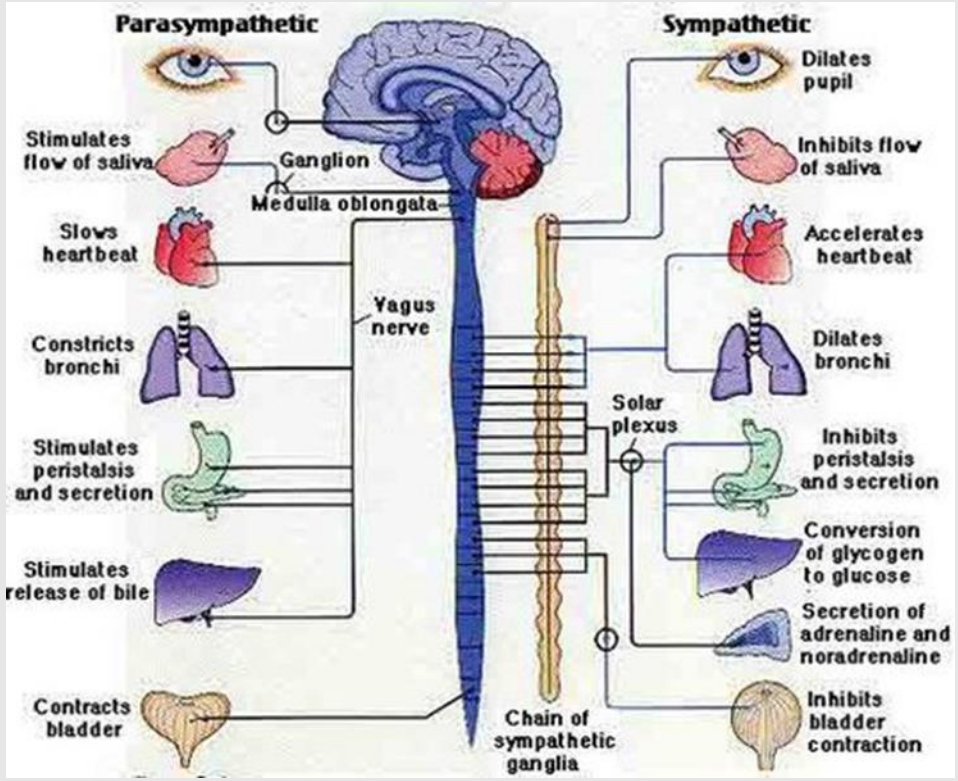
What parts of the brain are responsible for Respiration?

- The structures of the Brain stem are responsible for breathing and these include the following:
- Medulla Oblongata, Pons, and the Midbrain.
- The Medulla and the Pons are responsible for many automatic bodily process, including the heart and the lungs. Heart and lung are tied together.
- Basically the Medulla detects changes in O2 and CO2 in the body and makes adjustments accordingly. Impulses sent to the diaphragm and intercostal muscles, can tell them to either speed up or slow down according to the situation. You can imagine the consequences of damage to these structures of the brain.



What part does the tenth cranial nerve play? Vagus nerve

- The **Vagus Nerve, Cranial Nerve X**, Allows for greater synchronization of breathing with heartbeat. This synchronization helps in the delivery process of oxygen to the rest of the body.
- This function is more active when the body is relaxed. When the body is stressed in a variety of ways, this synchronization process is altered.
- This process allows some voluntary control over breathing, as well. This brings on relaxation and slowing down of heartrate and respiratory rate.



Lets review and recap……

- The Respiratory system is made up of several structures within the body.
- The Respiratory system has an upper section and a lower section.
- The Respiratory system is much like and upside-down tree.
- The functional unit of the Lungs is the alveoli.
- Air exchange is the movement of CO2 from alveolar sac to the bloodstream and O2 into the bloodstream from the alveolar sac.
- Respiration is three part process of inspiration, external respiration, and finally internal respiration.

Review and Recap continued……

- Respiration also has a brain and nervous system component.
- This involves the brainstem: Medulla and Pons and Midbrain.
- The Vagus nerve(cranial nerve X) plays a part in slowing down breathing and heartrate to better synchronize with each other and allow improved oxygen delivery.
- The movement of the gases depends on diffusion and the pressure of gases from an area of higher concentration to an area of lower concentration.

Questions??????????