Section 11.1: The Function of Respiration

SBI3UP

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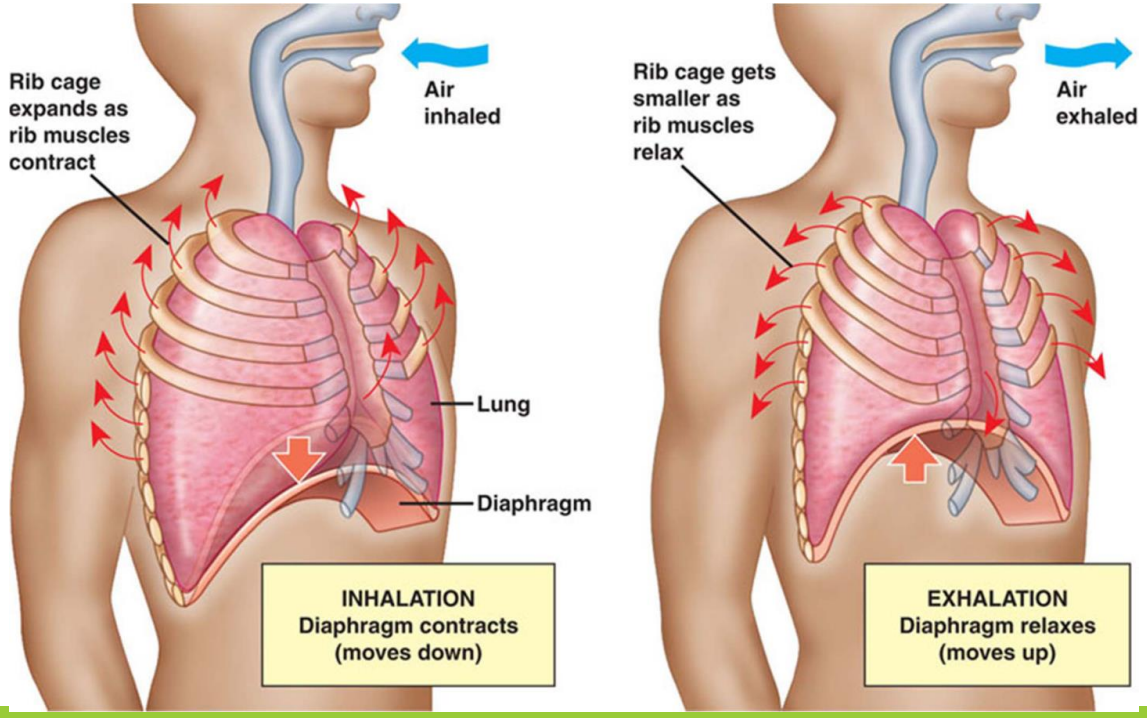
Respiration and Gas Exchange

The stages in respiration:

1. Ventilation
2. External Respiration
3. Transport
4. Internal Respiration
5. Cellular Respiration

Respiration and Gas Exchange

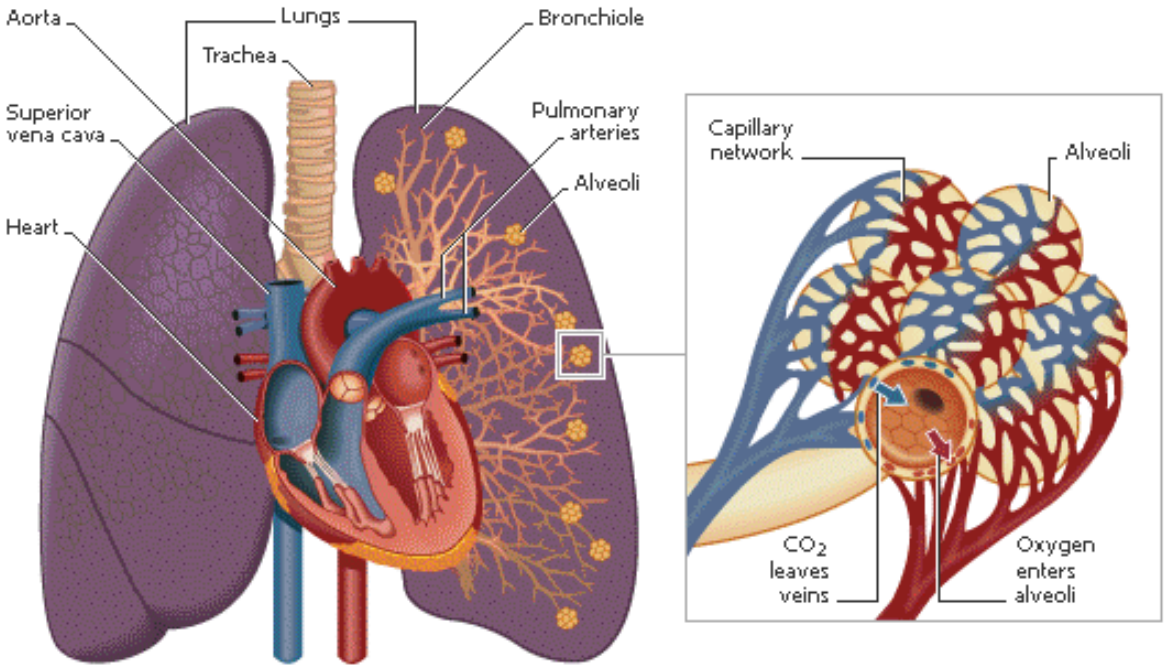
1. **Ventilation**
   - Inspiration (breathing in, inhaling)
   - Expiration (breathing out, exhaling)



This process enables both O_2 and CO_2 to enter and leave the system.

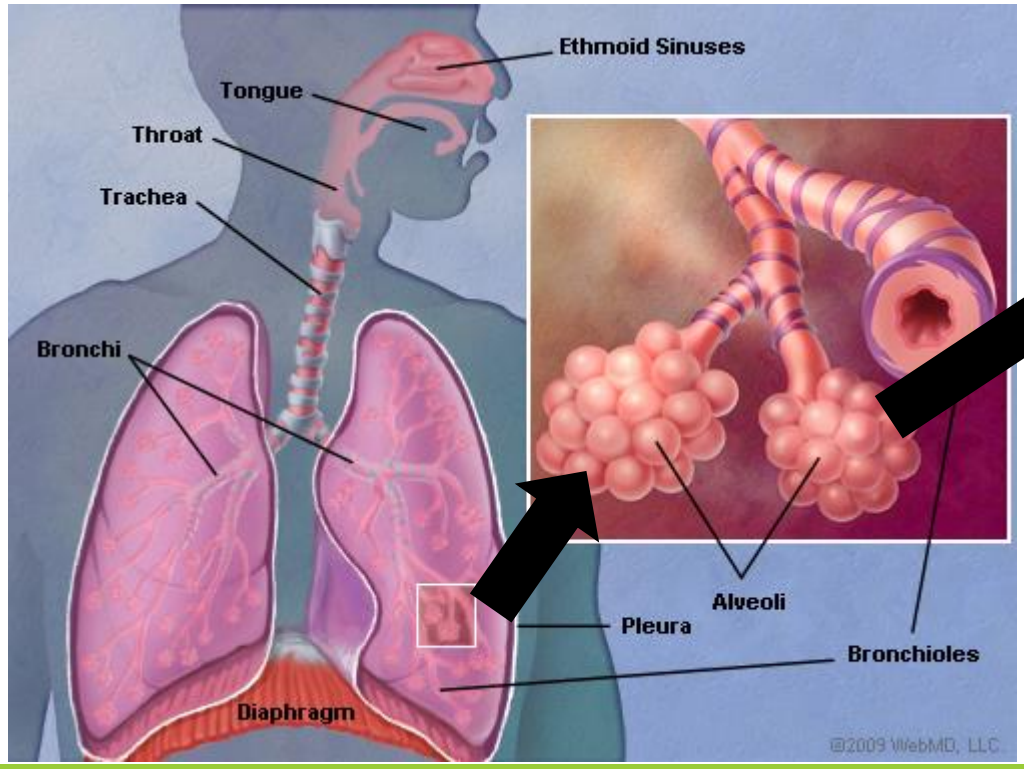
Respiration and Gas Exchange

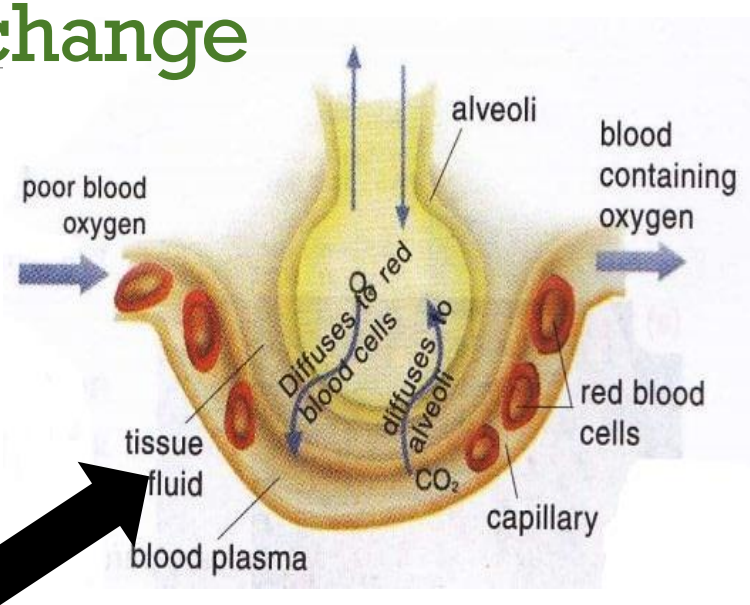
2. **External Respiration**
   - Exchange of O_2 and CO_2 between the inspired air in the lungs and the blood
   - Process if also known as ***'Gas Exchange'***



Respiration and Gas Exchange

Gas Exchange (External Respiration)

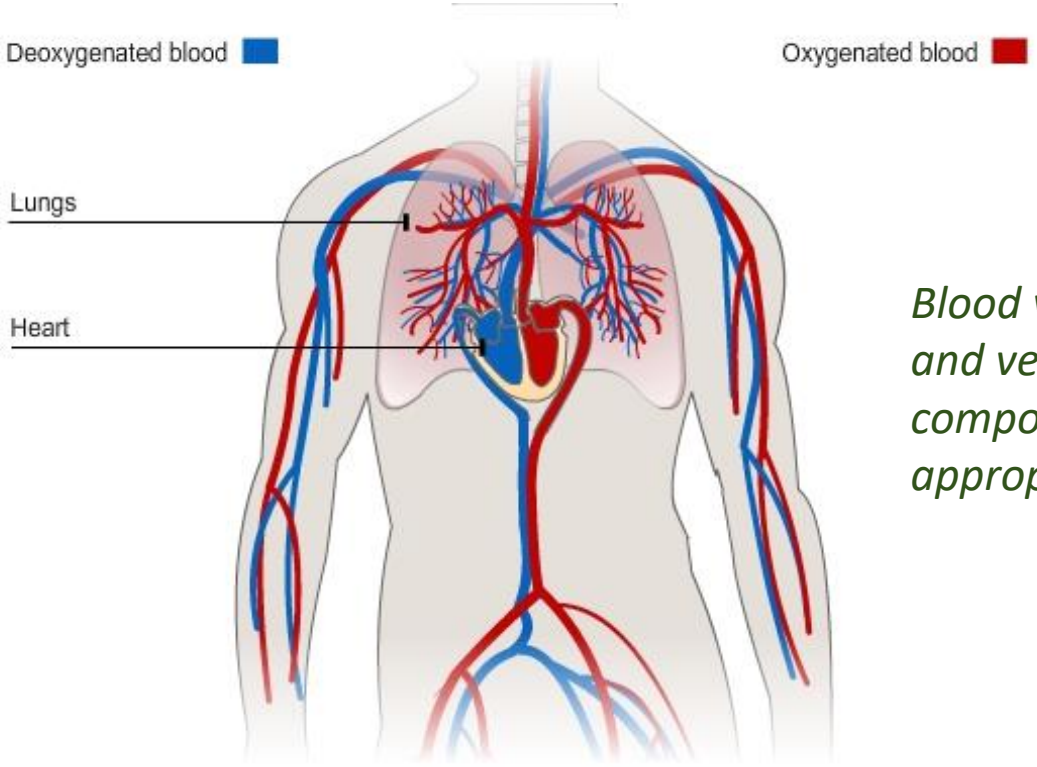




Gas exchange occurs between the alveoli and the capillaries that surround them. Both O_2 and CO_2 diffuse with their concentration gradients.

Respiration and Gas Exchange

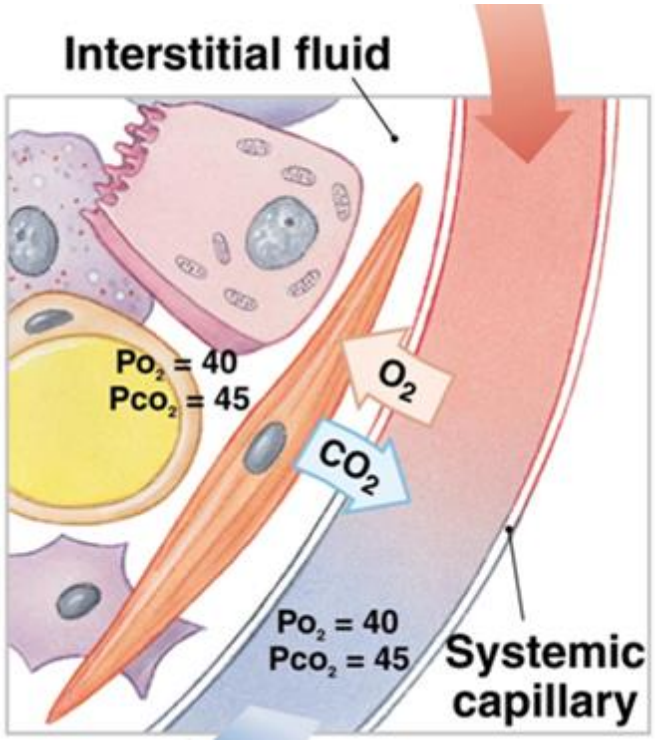
3. **<u>Transport</u>:** the movement of O_2 and nutrients in the body through the circulatory system.



Blood vessels (i.e arteries, capillaries and veins) help to transport the components in the blood to the appropriate tissues.

Respiration and Gas Exchange

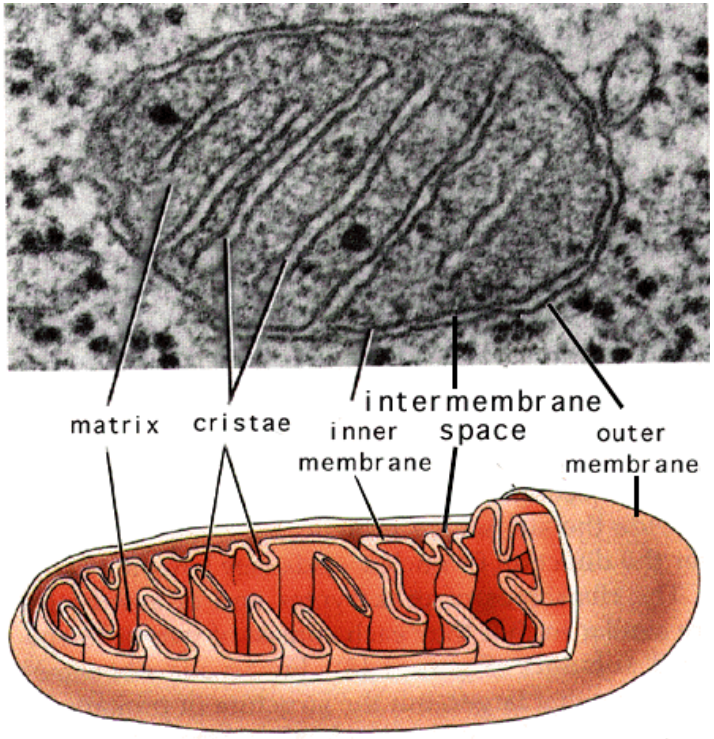
4. **<u>Internal Respiration</u>**: exchange of O_2 and CO_2 between blood and body's tissue cells



Tissues contain a large concentration of CO_2 and the capillaries a large concentration of O_2. Both CO_2 and O_2 move with their concentration gradients.

Respiration and Gas Exchange

5. **Cellular Respiration**: occurs when the mitochondria uses O_2 and glucose to produce ATP (form of energy used by the cells).



The by-products of cellular respiration are ***CO_2*** *and* ***water.***

Respiratory Surfaces

This is the location in an animal's body whereby gases are exchange. The way in which gas exchange occurs will differ depending on the type of animal.

ALL respiratory surfaces require the following to ensure successful gas exchange:

1) *Must be large enough for exchange to occur quickly*
2) *Respiration requires a moist location*

Respiratory Surfaces

***Example 1*: Outer Skin**

- Organisms do not have organs that undergo gas exchange. Its entire body is a respiratory surface.
- The O_2 diffuses across skin into capillaries; CO_2 out of the body through the skin.

Frogs and worms are "skin breathers". They must live in wet/damp environments.

Respiratory Surfaces

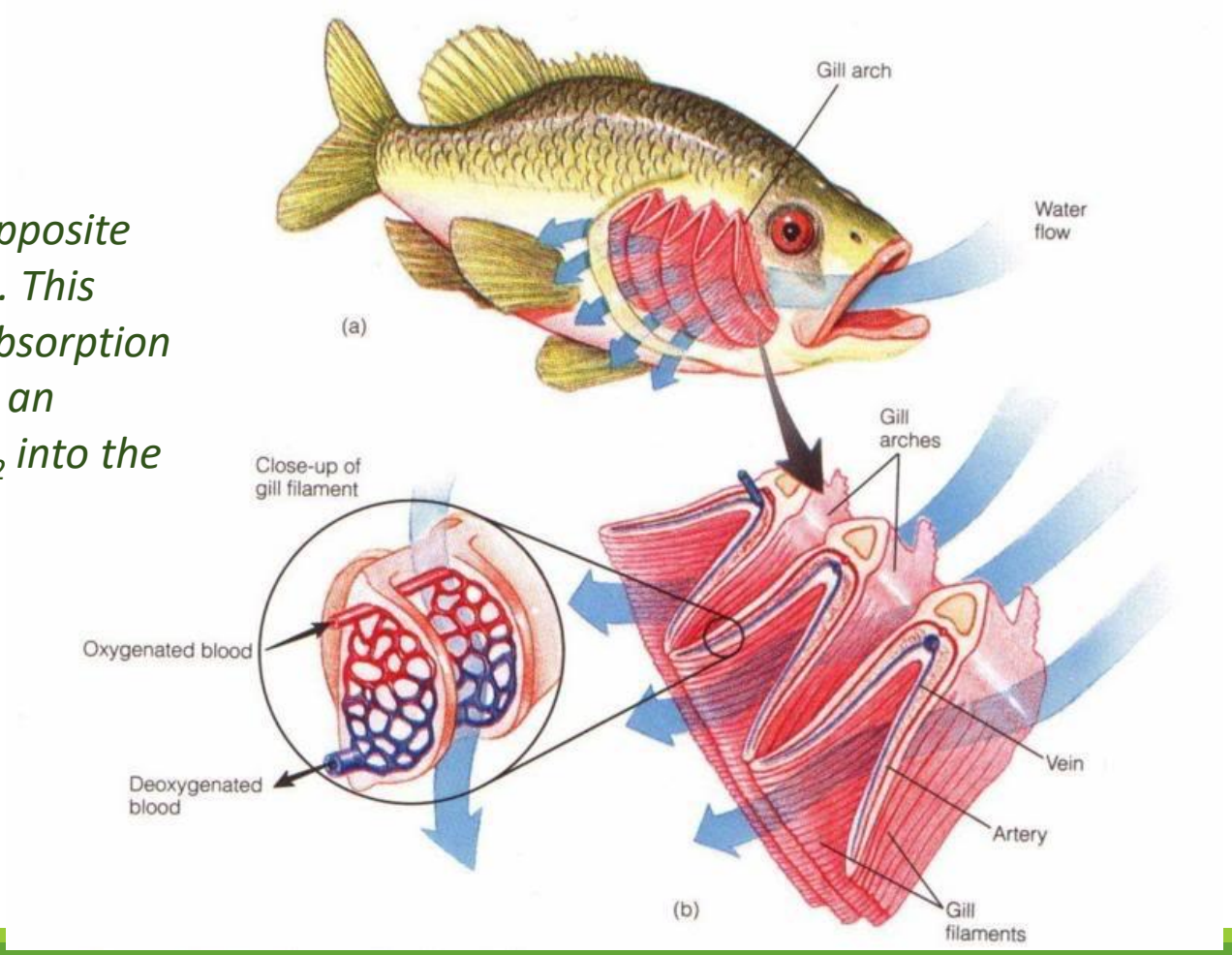
Example 2: Gills

- Gills are extensions/folds that increase surface area for gas exchange. These are typically found in aquatic organisms.

Fish and many aquatic invertebrates like clams, mussels and crayfish have gills.

Respiratory Surfaces

The water flows in the opposite direction from the blood. This enables the maximum absorption of oxygen into the blood an maximum release of CO_2 into the water.

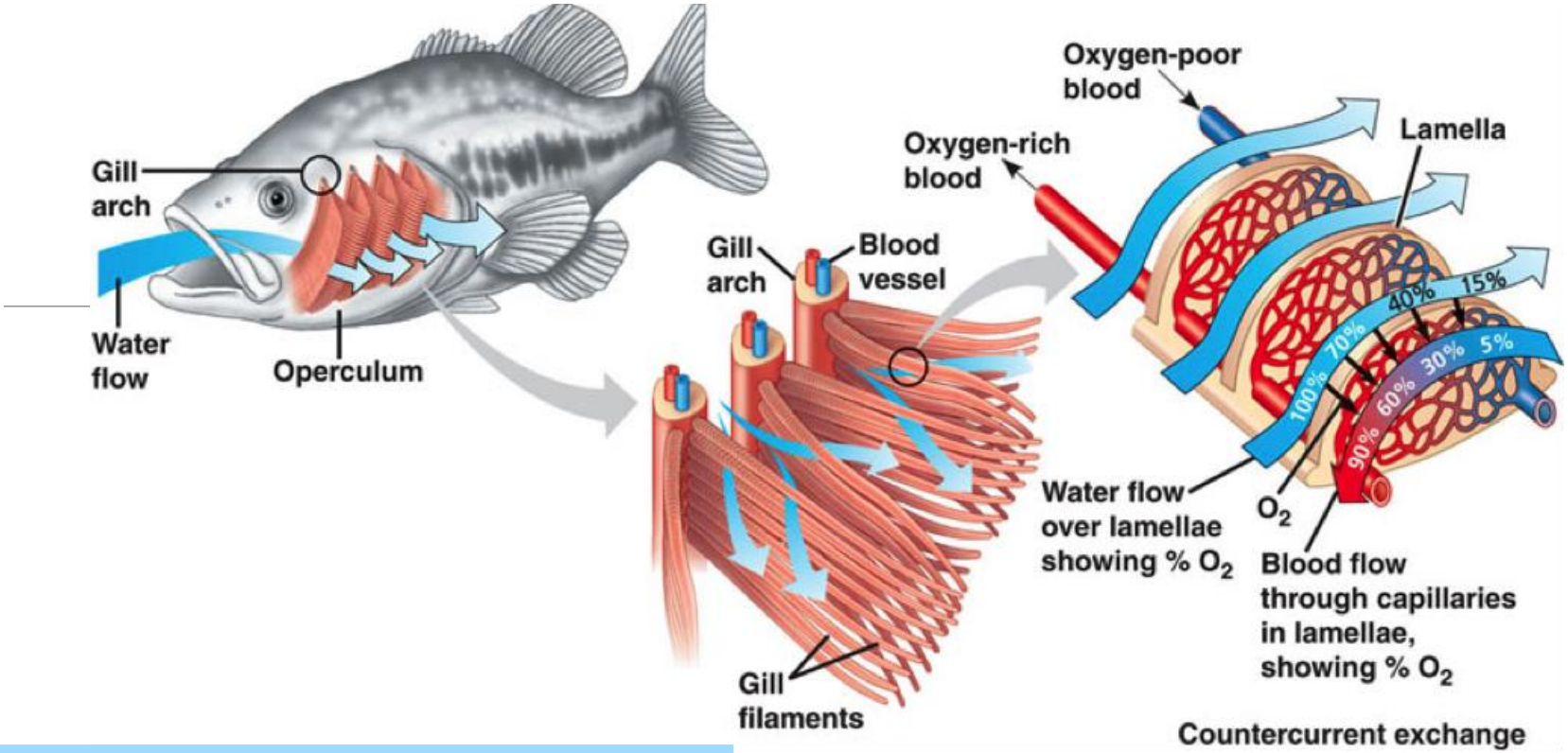


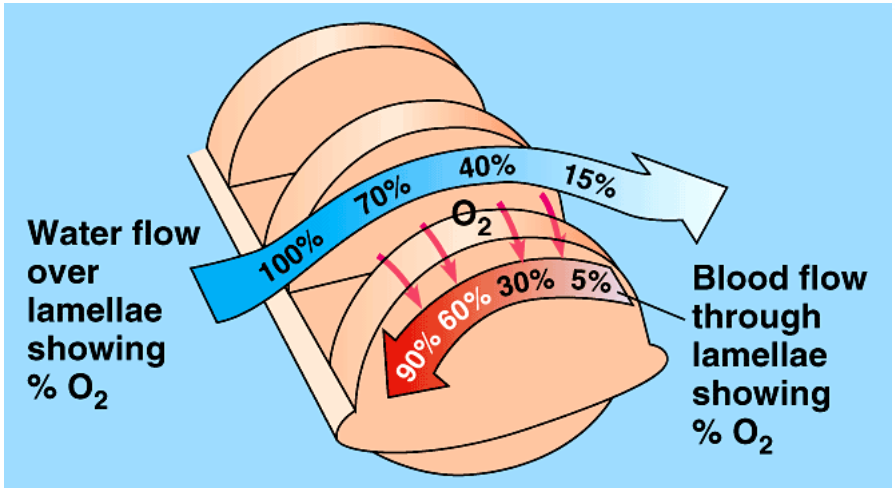
Aquatic Gas Exchange

Diffusion Gradient: when a dissolved substance of higher [ ] moves to an area of lower [ ]

Counter Current Flow: blood flows in opposite direction than water passing the gills (w/ dissolved O_2)

- Results in high diffusion gradient
- More O_2 will diffuse into capillaries



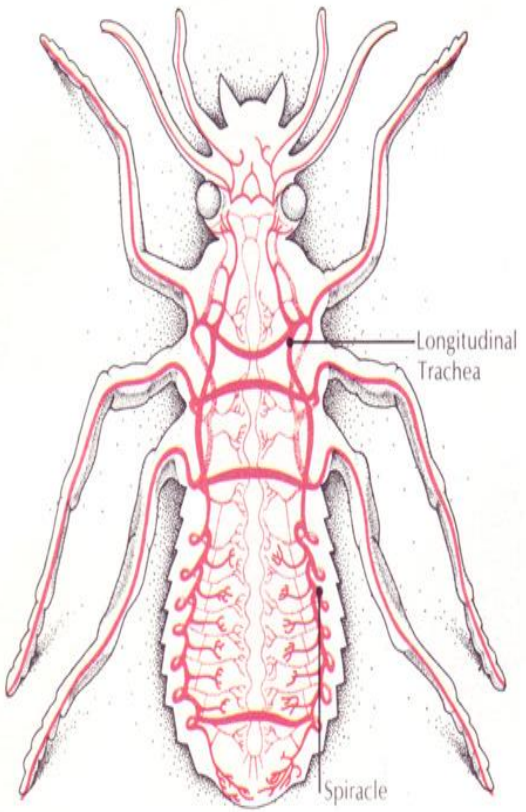


The countercurrent mechanism enables maximum absorption of O_2 into the capillaries.

Respiratory Surfaces

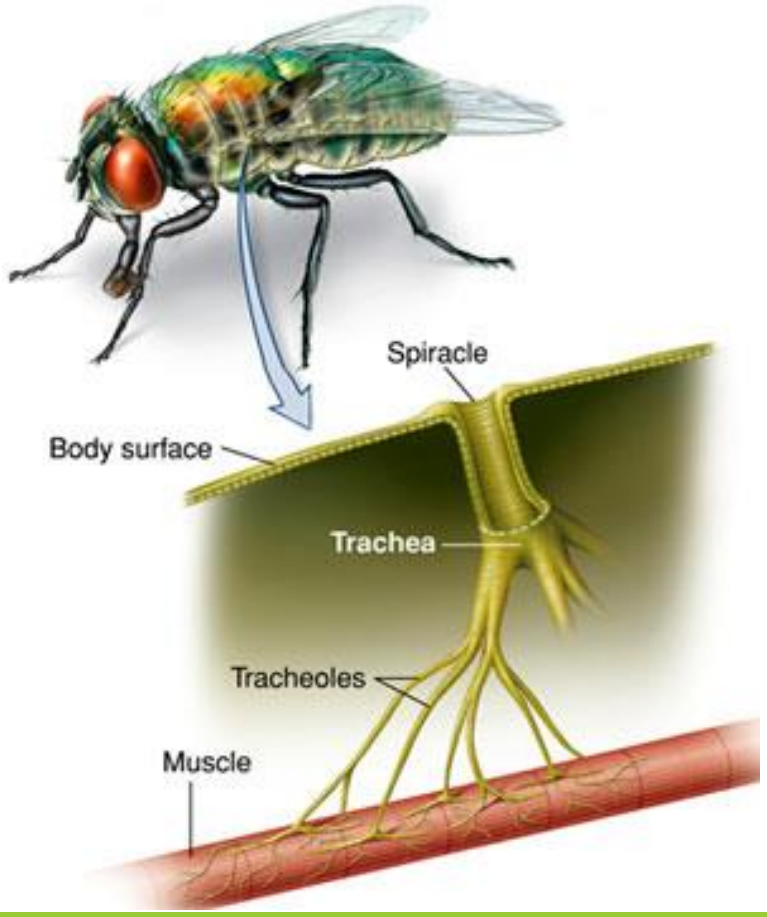
Example 3: Trachea System

- Consists of an internal system of branched tubes called ***trachea.*** The trachea have opening that enable the gases to move outside of the body.
- Openings are known as ***spiracles***.
- O_2 enters through spiracles and diffuses into trachea which is connected to the appropriate body tissues.



Insects have tracheal systems

Respiratory Surfaces



Considering that the trachea is directly connected to the tissue, the circulatory system is not involved.

The O_2 will enter the spiracle into the trachea, whereas the CO_2 will diffuse out of the muscle tissue and out through the spiracle.

Respiratory Surfaces

Example 4: Lungs

- Lungs are typically found in larger land animals. They contain a ***trachea*** that branches into a pair of lungs.
- The top of each trachea there are ***alveoli*** surrounded by ***capillaries*** whereby gas exchange occurs.

Mechanisms of Breathing

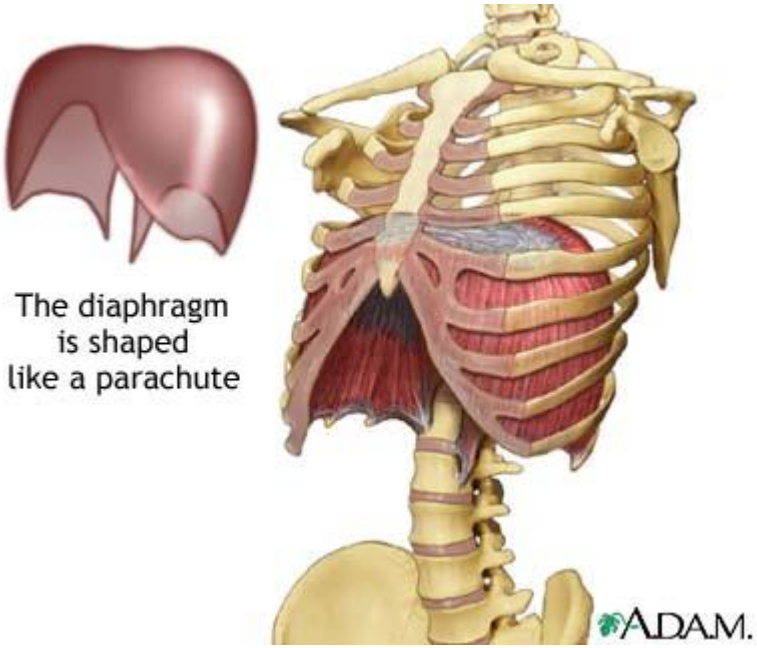
In order for mammals to breath efficiently the brain, diaphragm and rib muscles must be involved.

Brain:

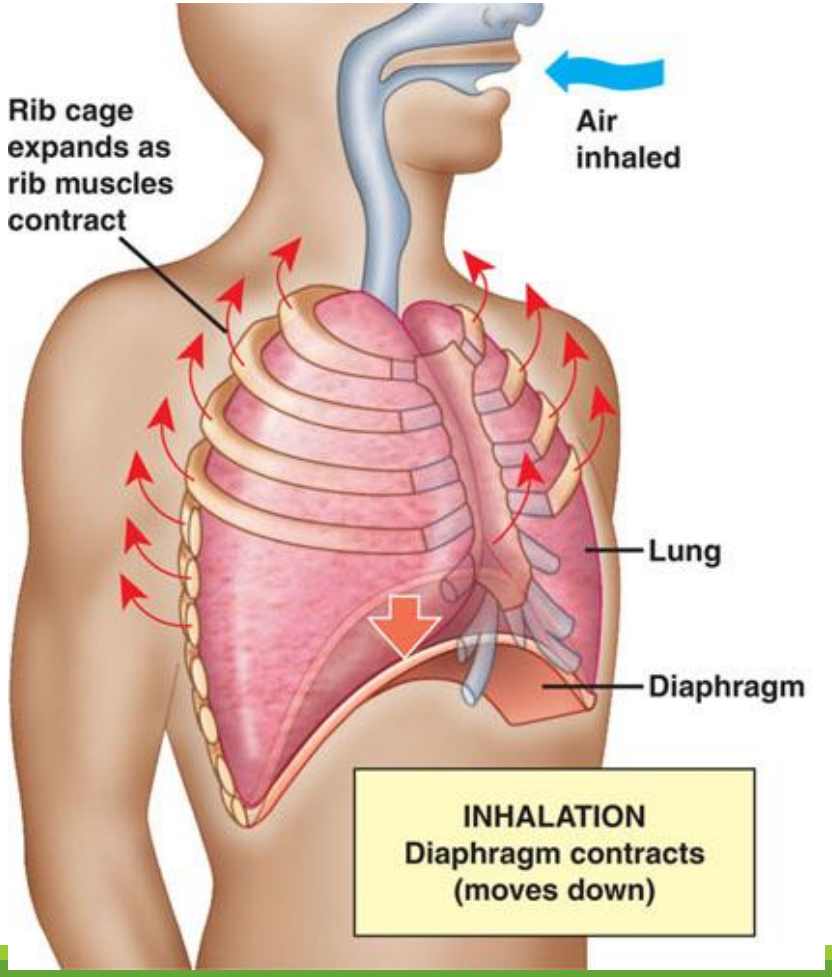
- co-ordinates breathing movements
- Monitors volume of air in the lungs
  gas in the blood

Diaphragm and Rib Muscles

- Control air pressure in lungs



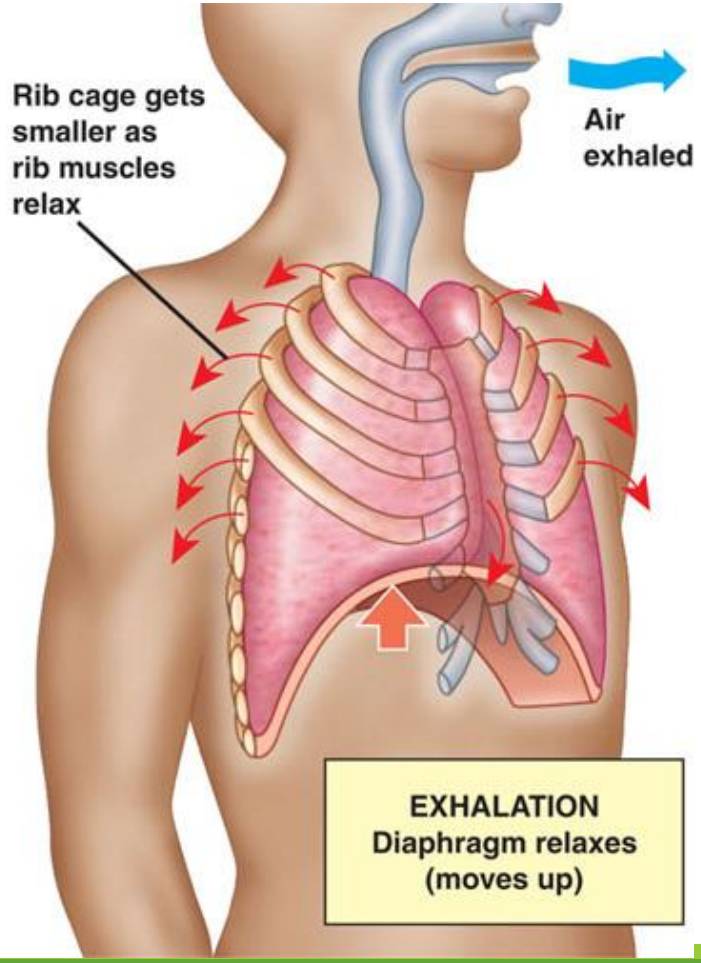
Mechanisms of Breathing - Inhalation



The **diaphragm** contracts and moves downwards. The **intercostal muscles** move up and out.

Both movements help to *increase the volume* and thus *decrease pressure*.

Mechanisms of Breathing - Exhalation



The **diaphragm** relaxes and moves up. The **intercostal muscles** move down and in.

Both movements help to *decrease the volume* and thus *increase pressure*.

Homework

Textbook: pg. 444 #1-6 and pg. 447 #7-12