Biology Chapter 4 Study Guide

Do all cells look the same?

Cells come in many shapes and sizes. Some cells are covered by a cell wall, other are not, some have slimy coats or elongated structures that push and pull them through their environment. Some cells have a thick layer surrounding their cell. This layer is called the capsule and is found in bacteria cells.

In our body there are many different kinds of cells. We are made up of about 200 different types of cells. Our body also has non- living materials such as hair, finger nails, and the hard part of the bone and teeth. All these materials are made up of dead cells.

Taking a look inside a cell

Have you ever wondered what the inside of a cell looks like? If you think about the rooms in our homes, the inside of any animal or plant cell has many similar room-like structures called organelles.

Both plant and animal cells have many of the same organelles. In some cases, like plant cells, there are more types of organelles than are found in animal cells. All organelles in a cell perform different functions. Here are some names and descriptions of organelles commonly found in cells:

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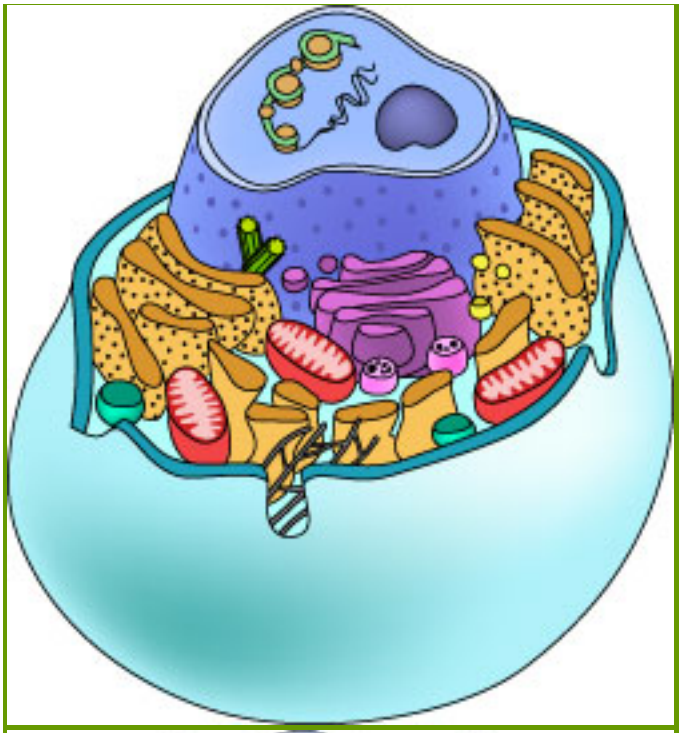

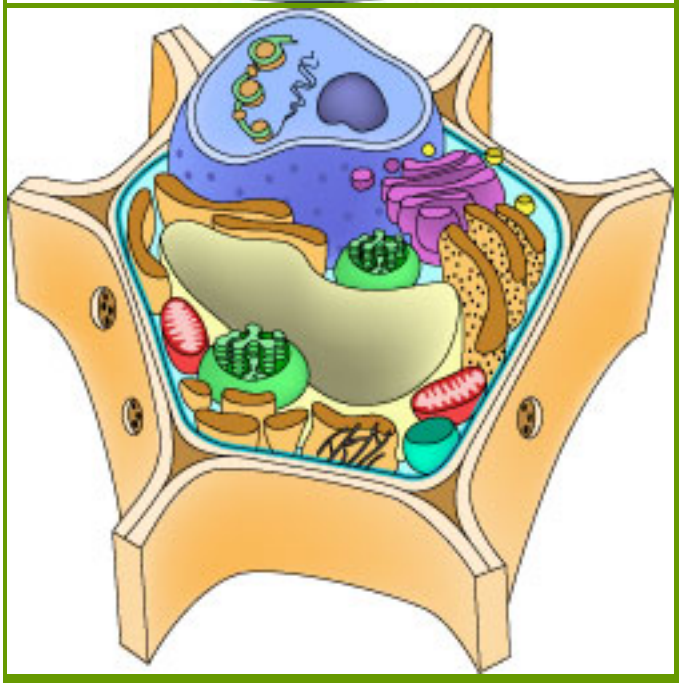

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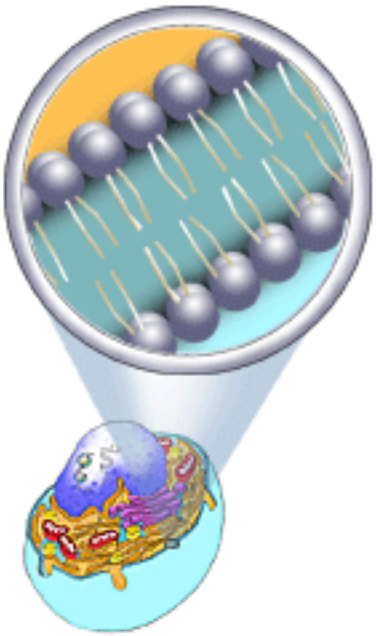
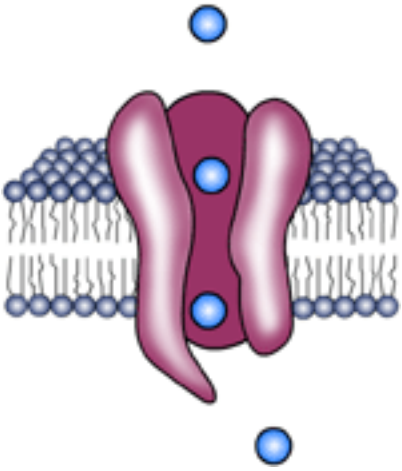
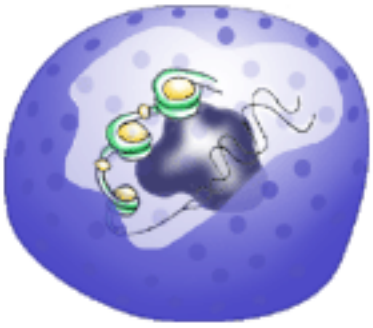


Plasma membrane- The membrane enclosing a cell is made up of two lipid layers called a "bilipid" membrane. The lipids that are present in the plasma membrane are called "phospholipids." These lipid layers are made up of a number of fatty acid building blocks. The fatty acid that makes up this membrane has two different parts to it- a small water loving head- hydrophilic head. *Hydro* stands for water and*philic* means liking or loving. The other part of this fatty acid is a long water-repelling or water hating tail.
This tail is hydrophobic- *Hydro* stands for water and *phobic* means fear. The plasma membrane is arranged in such a way so that the tails face each other on the inside and the heads face towards the outside of the membrane.



Channels/pores- A channel in the cell's plasma membrane. This channel is made up of certain proteins whose function is to control the movement of food and water into the cell. These channels are made up of certain proteins.

Nucleus- The nucleus is the control center of the cell. It is the largest organelle in the cell and it contains the DNA of the cell.



DNA (Deoxyribonucleic Acid) contains all the information for cells to live, perform their functions and reproduce.

Inside the nucleus is another organelle called the *nucleolus*. The nucleolus is responsible for making ribosomes.
The circles on the surface of the nucleus are the nuclear pores. These are where ribosomes, and other materials move in and out of the cell.

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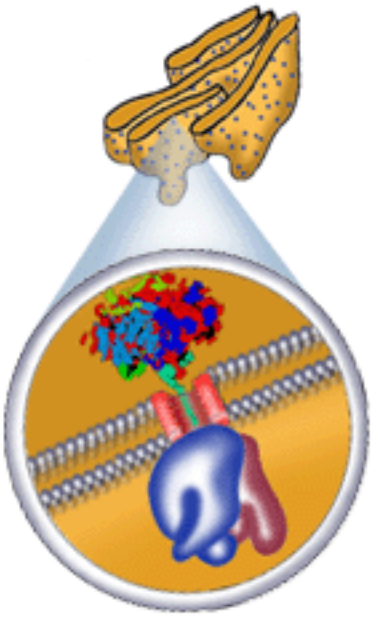
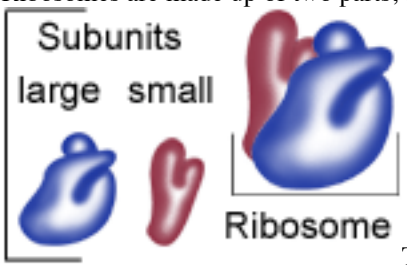
Endoplasmic reticulum (ER)- It is a network of membranes throughout the cytoplasm of the cell. There are two types of ER. When ribosomes are attached it is called rough ER and smooth ER when there are no ribosomes attached.
The rough endoplasmic reticulum is where most protein synthesis occurs in the cell. The function of the smooth endoplasmic reticulum is to synthesize lipids in the cell. The smooth ER is also helps in the detoxification of harmful substances in the cell.



Ribosomes- Organelles that help in the synthesis of proteins. Ribosomes are made up of two parts, called subunits.



They get their names from their size. One unit is larger than the other so they are called large and small subunits.
Both these subunits are necessary for protein synthesis in the cell. When the two units are docked together with a special information unit called messenger RNA, they make proteins. Some ribosomes are found in the cytoplasm, but most are attached to the endoplasmic reticulum. While attached to the ER, ribosomes make proteins that the cell needs and also ones to be exported from the cell for work elsewhere in the body.

Golgi complex- It is the organelle in the cell that is responsible for sorting and correctly shipping the proteins produced in the ER.
Just like our postal packages which should have a correct shipping address, the proteins produced in the ER, should be correctly sent to their respective address.
In the cell, shipping and sorting is done by the Golgi complex. It is a very important step in protein synthesis. If the Golgi complex makes a mistake in shipping the proteins to the right address, certain functions in the cell may stop.
This organelle was named after an Italian physician-*Camillo Golgi*. He was the first person to describe this organelle in the cell. It is also the only organelle that is capitalized.

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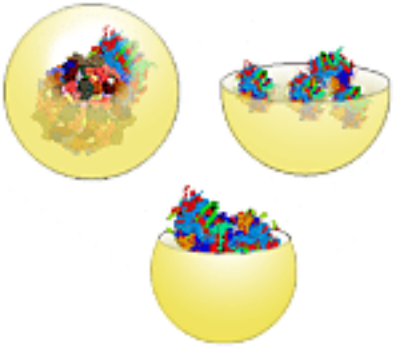
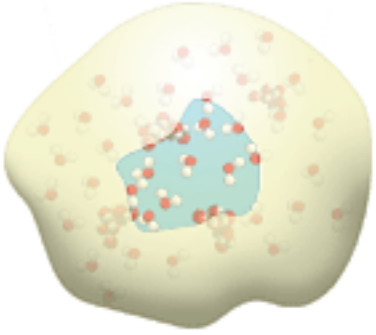
Mitochondria- This is the cell's powerhouse. This organelle packages the energy of the food into ATP molecules.
Every type of cell has a different amount of mitochondria.. There are more mitochondria in cells that have to perform lots of work, for example- your leg muscle cells, heart muscle cells etc. Other cells need less energy to do their work and have less mitochondria.

Chloroplast- The cell organelle in which photosynthesis takes place. In this organelle the light energy of the sun is converted into chemical energy.
Chloroplasts are found only in plant cells not animal cells. The chemical energy that is produced by chloroplasts is finally used to make carbohydrates like starch, that get stored in the plant. Chloroplasts contain tiny pigments called *chlorophylls*. Chlorophylls are responsible for trapping the light energy from the sun.



Vesicles- This term literally means "small vessel". This organelle helps store and transport products produced by the cell.
The vesicles are the transport and delivery vehicles like our mail and Federal Express trucks. Some vesicles deliver materials to parts of the cell and others transport materials outside the cell in a process called exocytosis.



Vacuole- Plant cells have what looks like a very large empty space in the middle. This space is called the vacuole.
Don't be fooled, the vacuole contains large amounts of water and stores other important materials such as sugars, ions and pigments.

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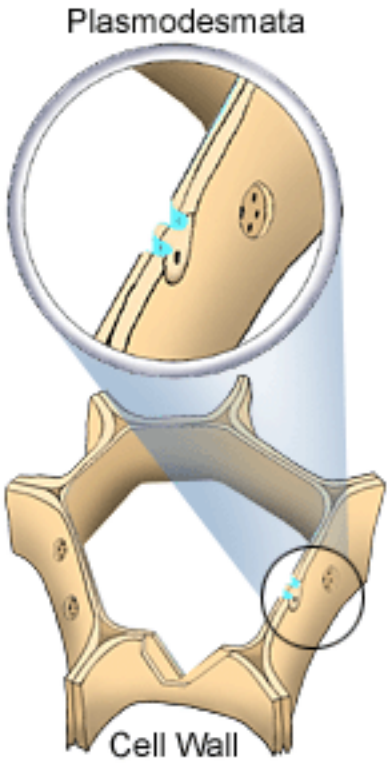
Cytoplasm- A term for all the contents of a cell other than the nucleus. Even though the cartoon drawings do not look like it, the cytoplasm contains mostly water.
Some fun facts about water and the human body:

- Adult bodies are about 50 to 65 percent water.
- A child's body has a little more water at 75 percent.
- The human brain is about 75 percent water.



Cell wall and Plasmodesmata- In addition to cell membranes, plants have cell walls. Cell walls provide protection and support for plants.
Unlike cell membranes materials cannot get through cell walls. This would be a problem for plant cells if not for special openings called plasmodesmata.
These openings are used to communicate and transport materials between plant cells because the cell membranes are able touch and therefore exchange needed materials.

Peroxisomes- These collect and safely break down chemicals that are toxic to the cell.

Centrioles- These are found only in animal cells and come into action when the cells divide, helping with the organization of chromosomes.

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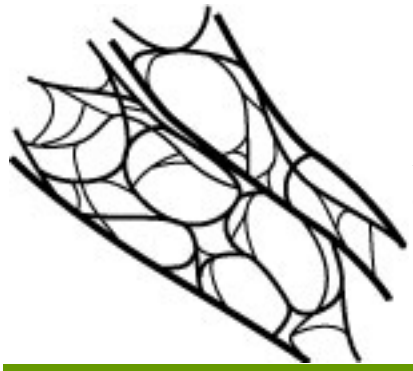
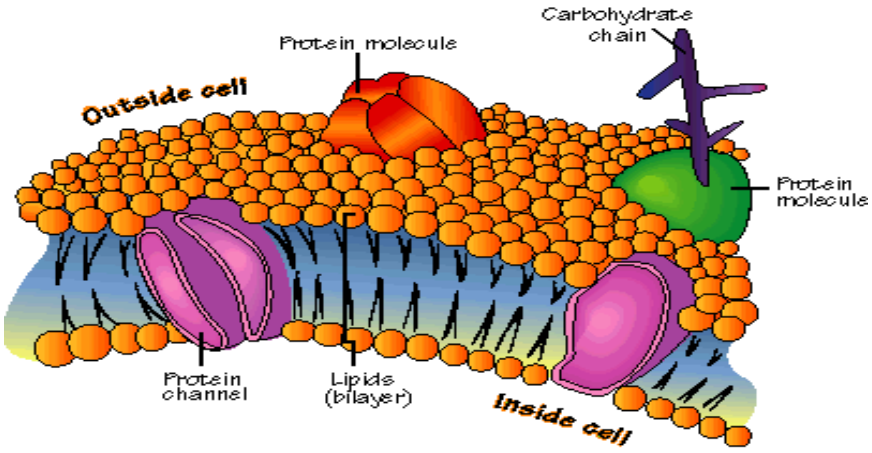
Lysosomes- Created by the Golgi apparatus, these help break down large molecules into smaller pieces that the cell can use.



Cytoskeleton- Made up of filaments and tubules, it helps shape and support the cell. It also helps move things move around in the cell. For artistic purposes, the cytoskeleton is shown in just one place when in reality it is found throughout the entire cell.

The Cell Membrane



Functions of the Cell Membrane

- ✓ **Protective barrier**
- ✓ **Regulate transport in & out of cell (selectively permeable)**
- ✓ **Allow cell recognition**
- ✓ **Provide anchoring sites for filaments of cytoskeleton**

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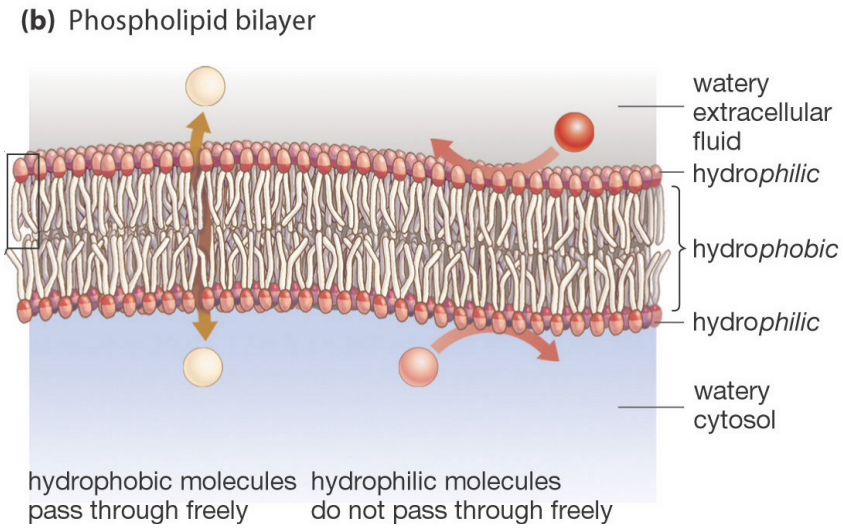

- **Polar heads are hydrophilic "water loving"**
- **Nonpolar tails are hydrophobic "water fearing"**

- **Hydrophobic molecules pass easily**
- **hydrophilic DO NOT**

Movement of Materials

1. Passive Transport
    - Diffusion: **The passive movement of material from an area of high concentration to an area of low concentration**
    - Osmosis: **The diffusion of water through a selectively permeable membrane**
    -

2. Active Transport: **Movement of materials from low concentration to high concentration using a protein carrier that <u>requires energy</u> (costs ATP)**

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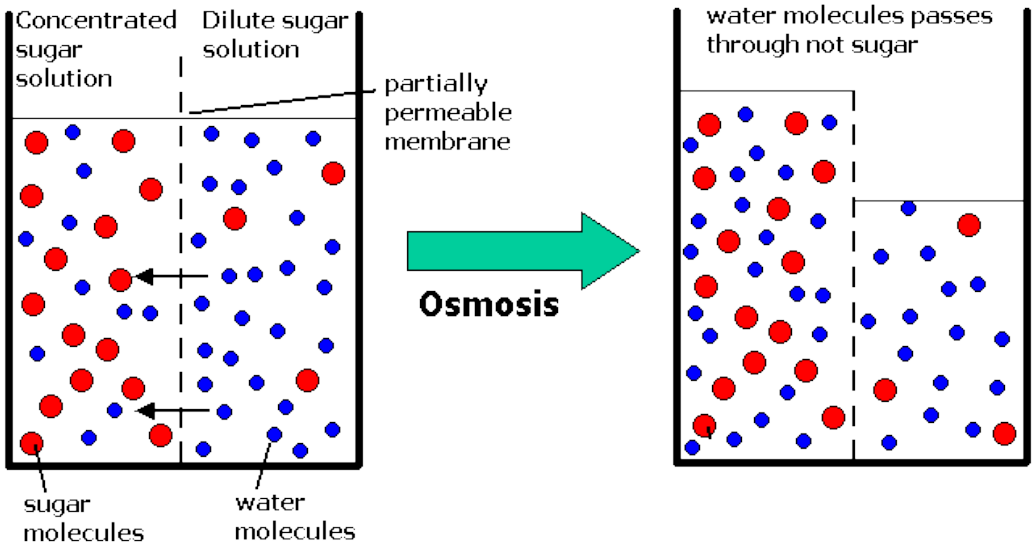

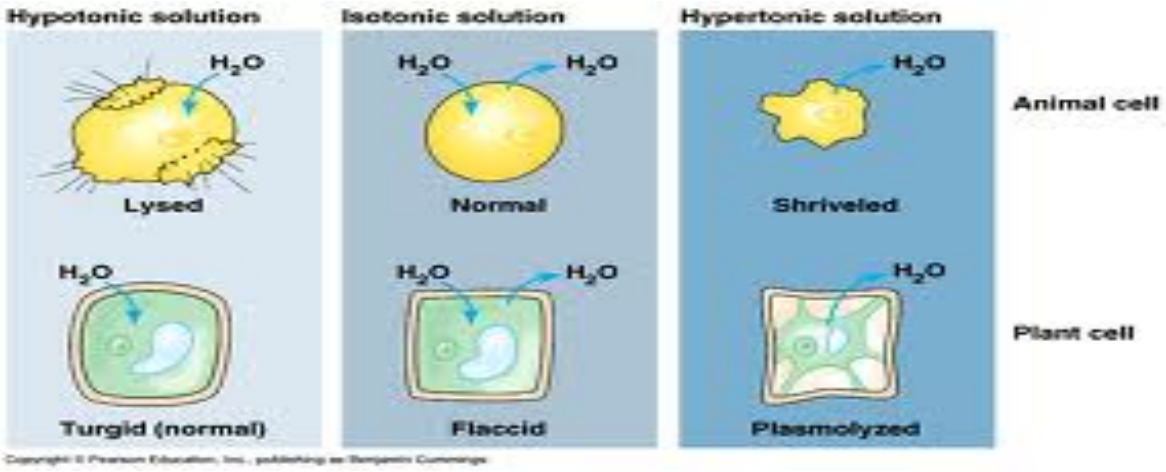

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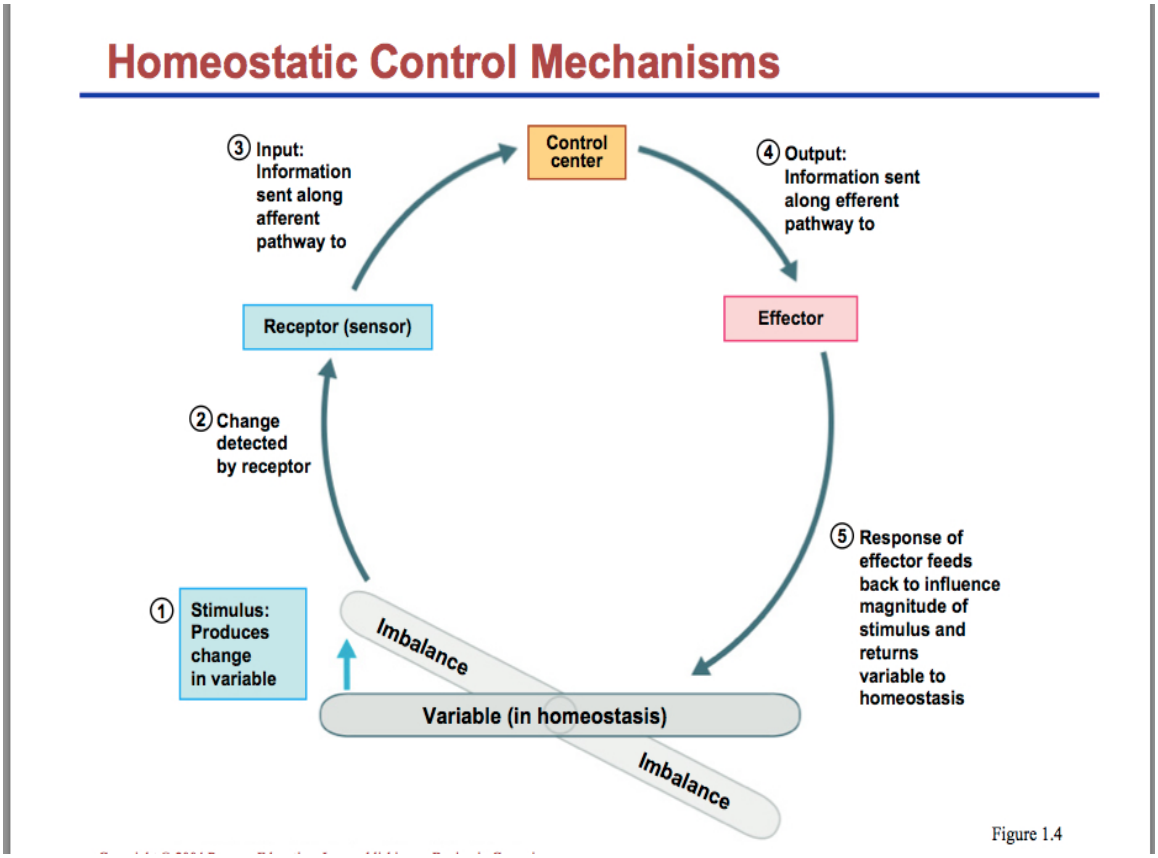

The Circulatory System

1. **Function**
2. **Main Parts**
   - **Pump (heart)**
     - **Continuously circulates blood**
   - **Network of tubes**
     - **Arteries- blood away from heart**
     - **Veins- blood back to the heart**
   - **Blood**
     - **Fluid that fills the circulatory system**
3. **Homeostasis – The following must be regulated**
   - **Heart Rate**
   - **Blood Pressure**
     - **If BP too high → vasodilation.**
     - **If BP too low → vasoconstriction.**

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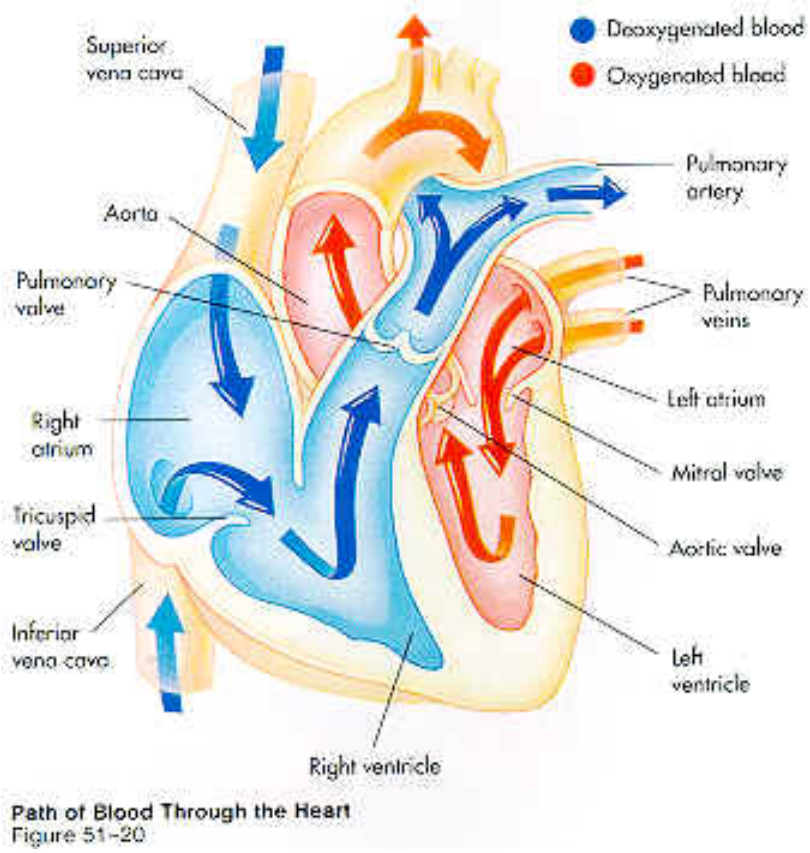
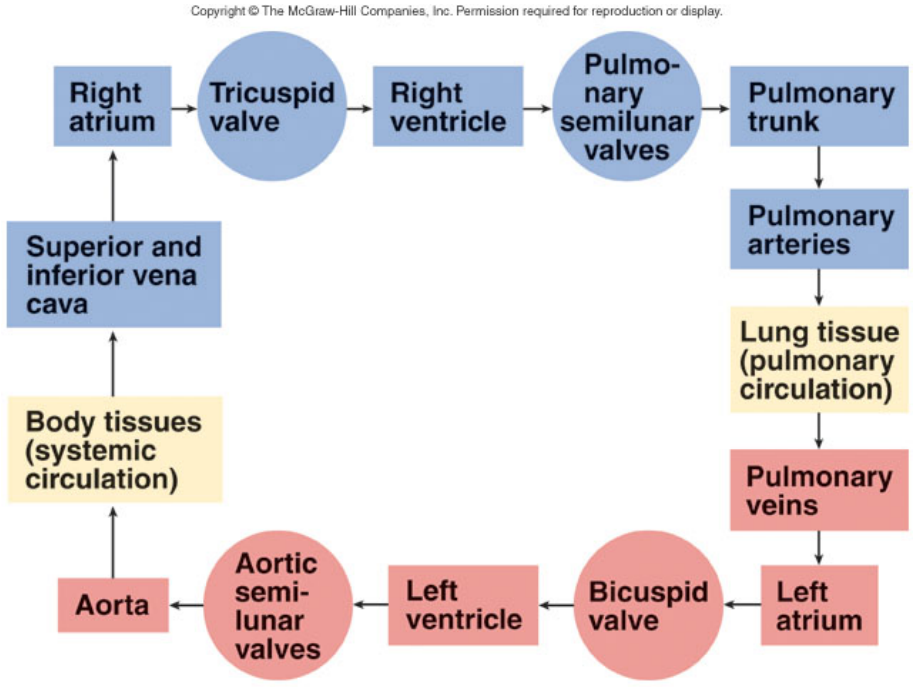


Path of Blood Through the Heart
Figure 51–20

KNOW THE PATHWAY OF BLOOD FLOW AS OUTLINED BELOW!!!



What needs to be regulated in the body

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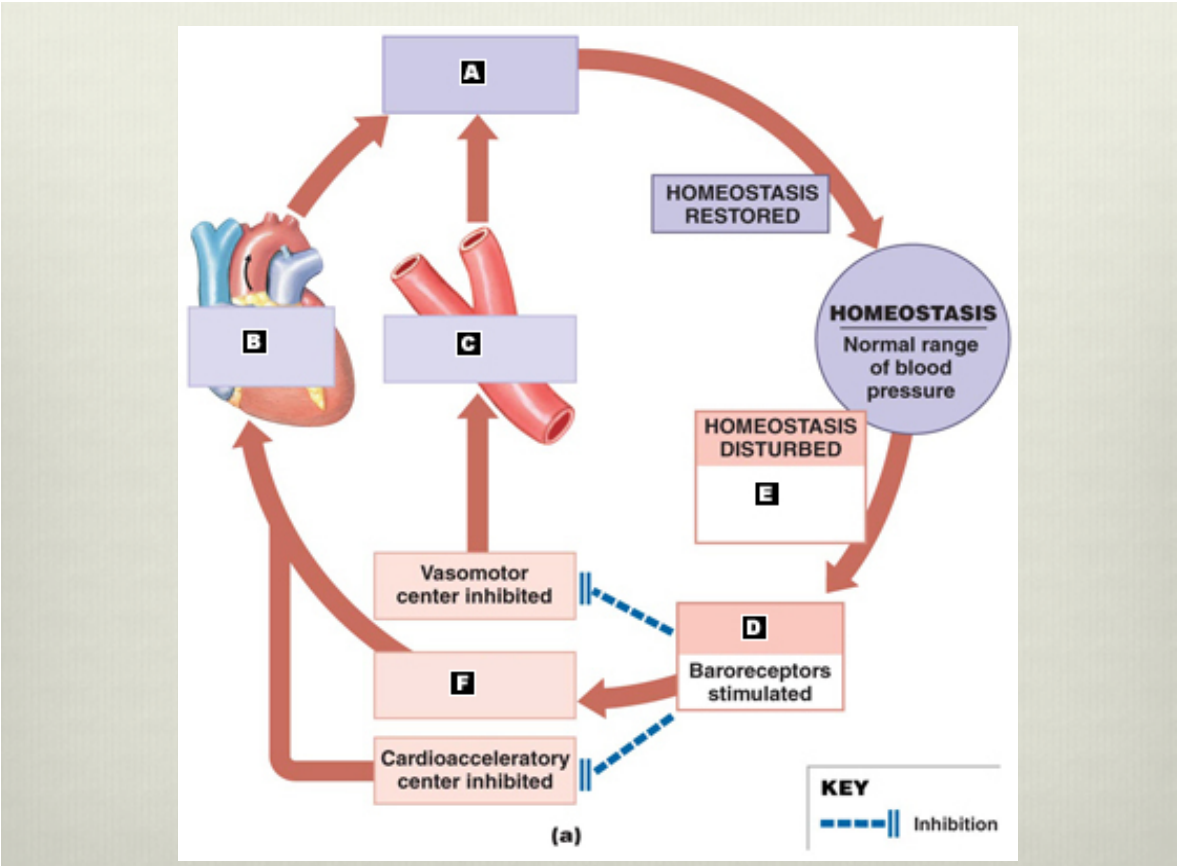

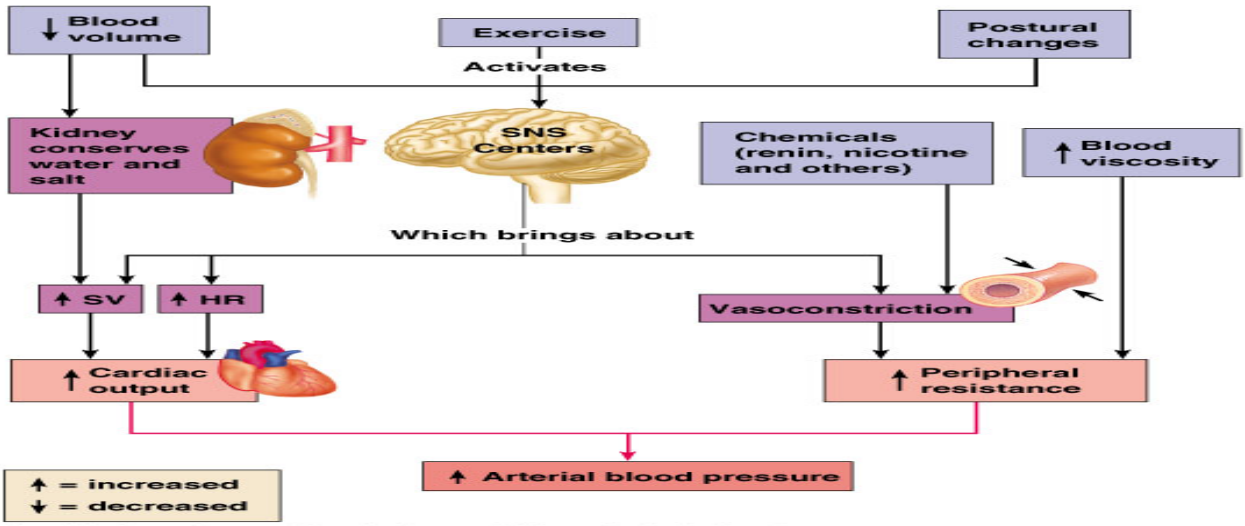

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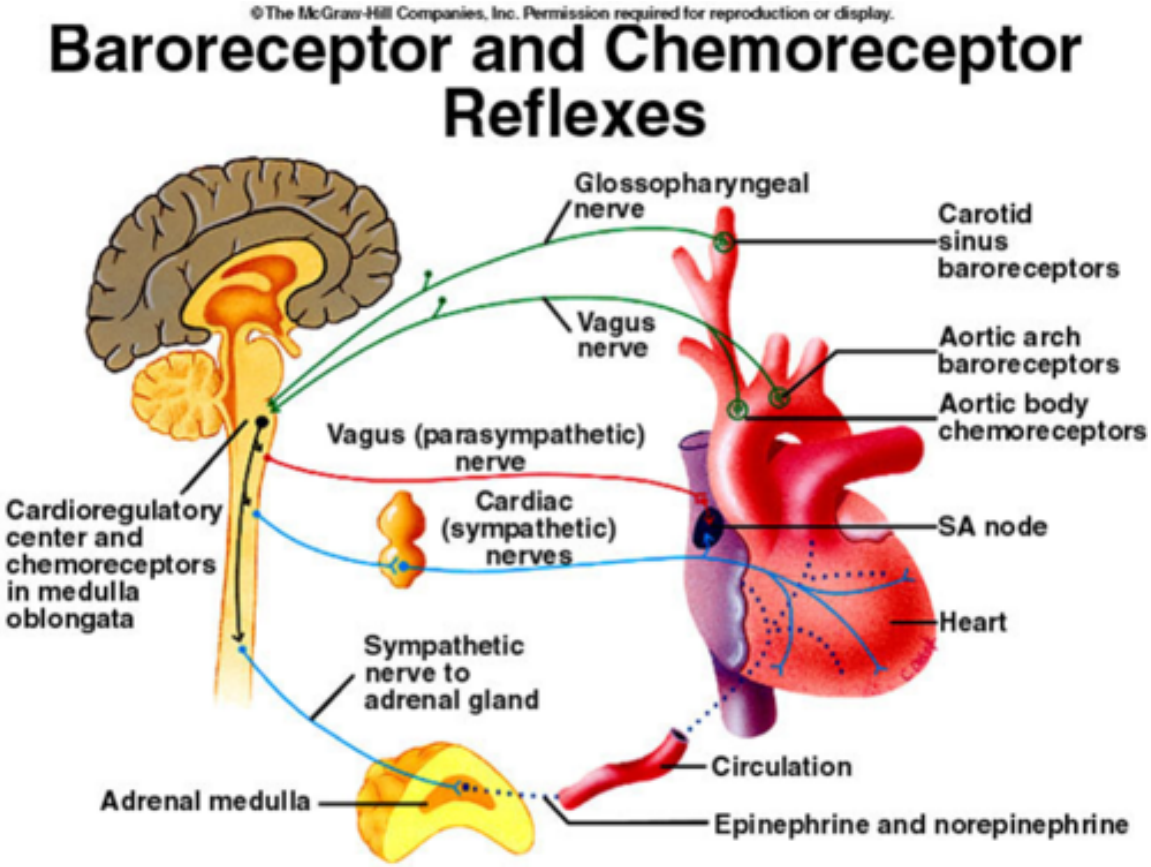

- **Baroreceptors = DETECT PRESSURE**
- **Chemoreceptors = DETECT pH**

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- pH = measure of how acidic a compound is
    - High pH = less acid (a.k.a. more basic)
    - Low pH = more acidic (a.k.a. less basic)

It is important for the body to maintain acid-base homeostasis because the body's proteins may denature (unfold) if the pH is too high or too low. All proteins work best at certain pH, depending on the type of protein it is.

If body:

- **Has too much CO_2**, the blood becomes ACIDIC → Hyperventilation to get rid of excess CO_2
- **Has not enough CO_2**, the blood becomes ALKALINE (or more BASIC) → Hypoventilation to reduce CO_2 release
- **pH detected by CHEMORECEPTORS**

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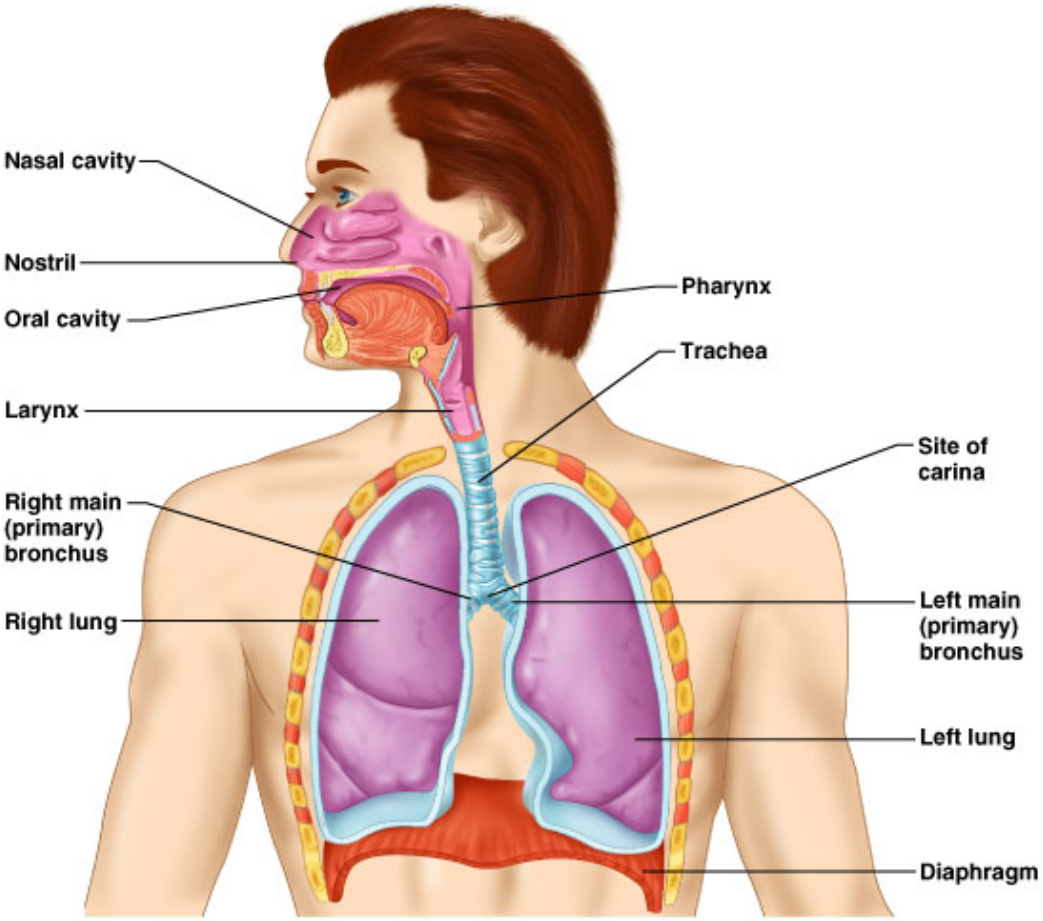
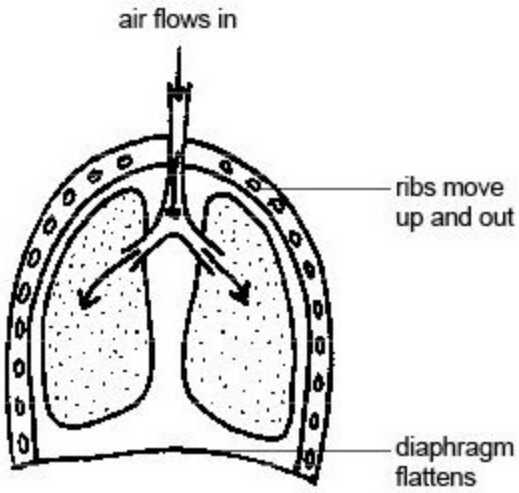
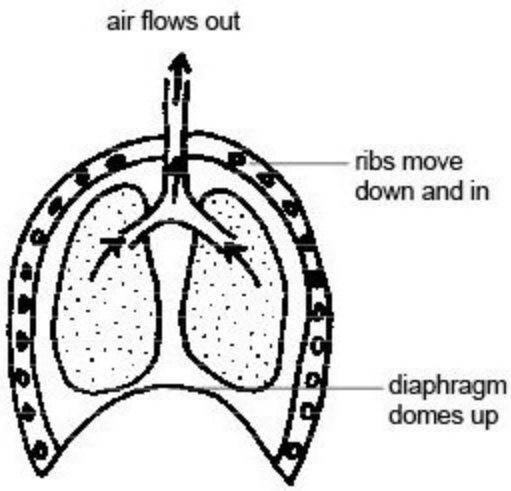
RESPIRATORY SYSTEM







INSPIRATION

-Negative pressure inside of lungs
-Positive pressure outside of lungs
-Air flows in

EXPIRATION

-Positive Pressure inside of lungs

-"Negative pressure" outside of lungs (relative to inside of lungs)
-Air flows out

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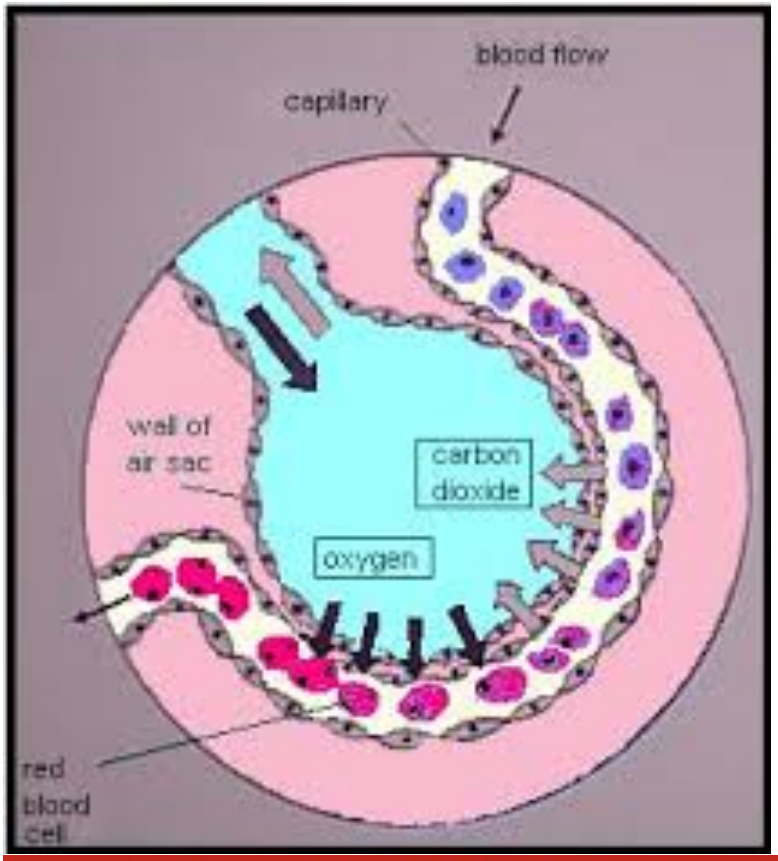
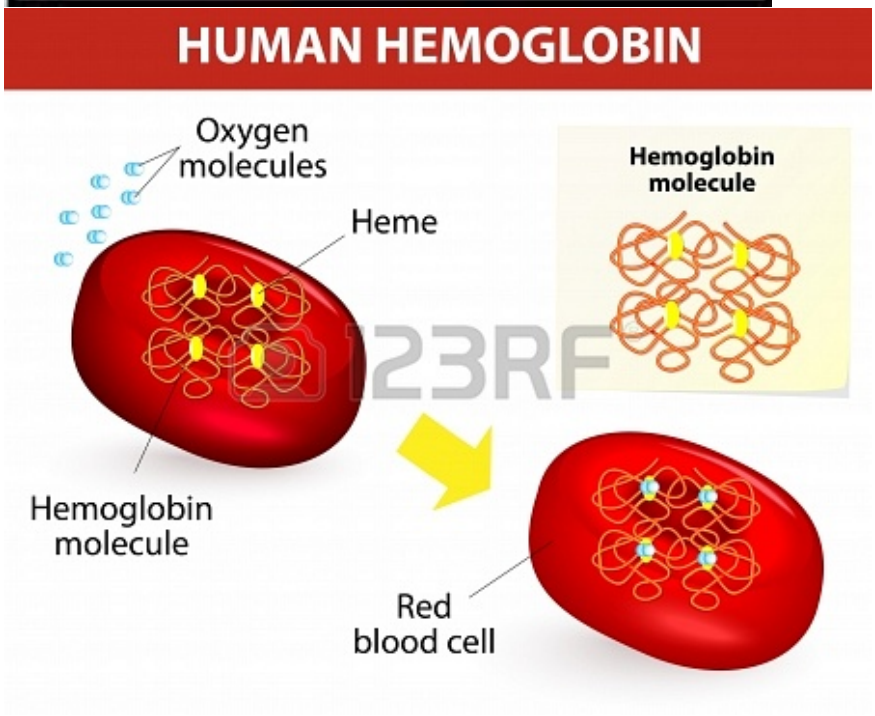
At the alveoli:





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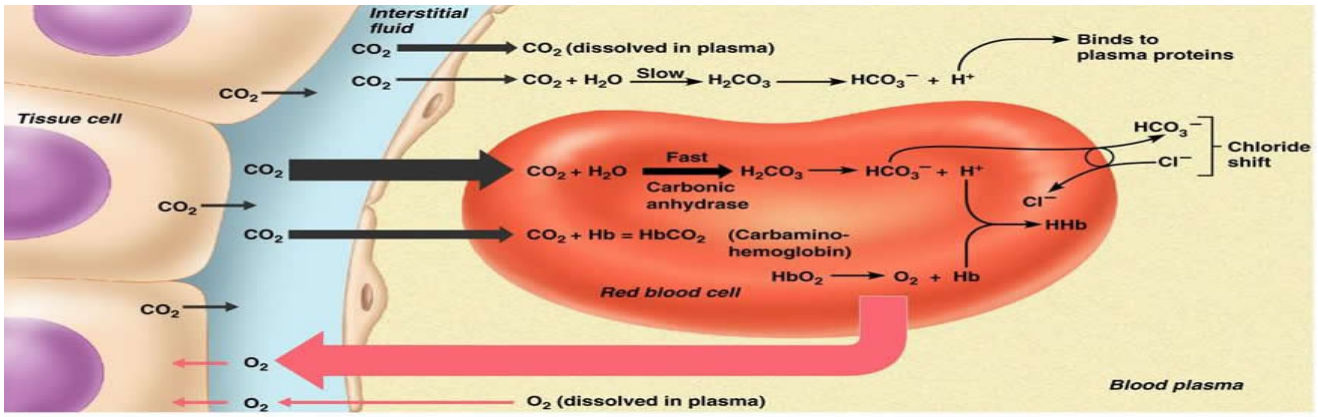
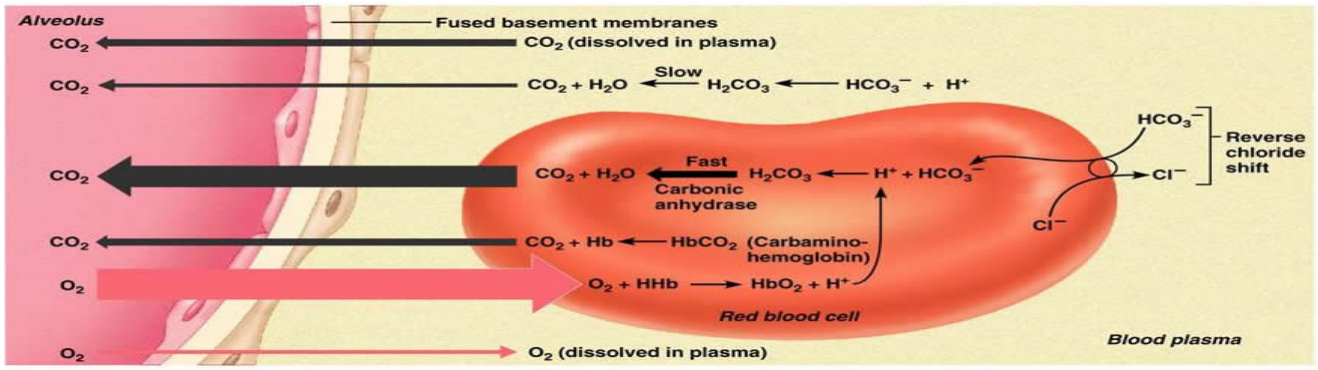


(a) Oxygen release and carbon dioxide pickup at the tissues



(b) Oxygen pickup and carbon dioxide release in the lungs

Other study tips:

1. STUDY YOUR WEBQUESTS!!!

2. Review the PowerPoint slides posted online (http://aofscience.weebly.com/chapter-4-homeostasis-maintaining-dynamic-equilibrium-in-living-systems.html)

3. Watch the videos I posted online