EOC Review

Biology

Standard 1.1.1

Structure and Function of Cell Organelle

Cell Organelles

- The term ***organelle*** means "little organ."
- Organelles are **small, specialized structures in a cell**. Just like your organs in your body, they carry out different jobs so the cell can function.
- You should know the organelles in ***eukaryotic*** (complex) cells, like plant and animal cells.

Organelles to Know:

ALL EUKARYOTIC CELLS

- Nucleus
- Plasma Membrane
- Mitochondria
- Vacuoles
- Ribosomes

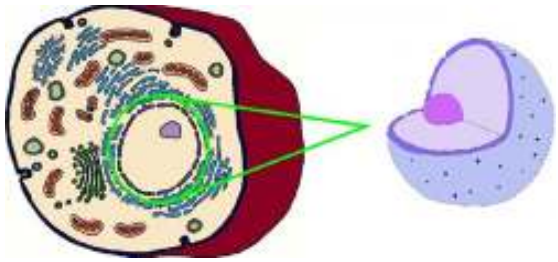
PLANT CELLS ONLY

- Chloroplast
- Cell Wall

Organelles to Know

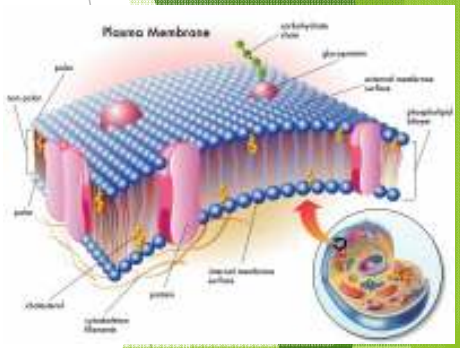
Nucleus

- **Structure**: Sphere-shaped organelle containing most of the cell's genetic information (DNA)
- **Function**: Controls cell

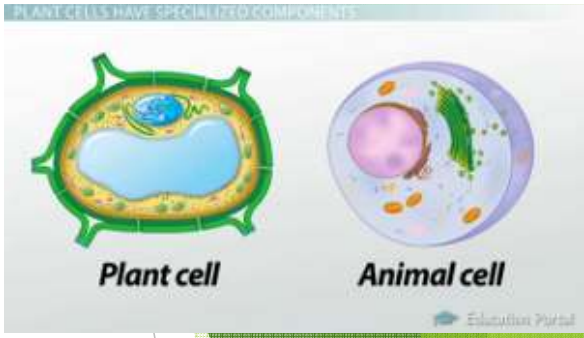


Plasma (Cell) Membrane

- **Structure:** Double membrane (bilayer) of lipids
- **Function:** Controls what goes in and out of cell (*selectively permeable*); Supports and protects cell

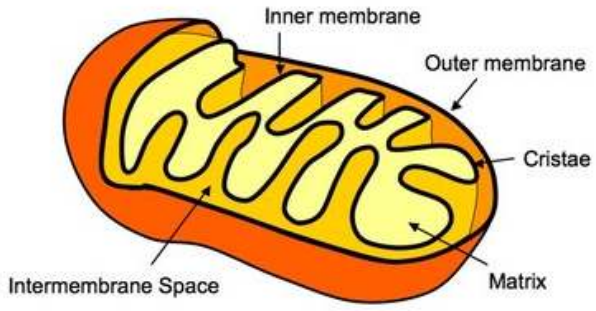


Organelles to Know



Mitochondria

- **Structure**: Oval shaped; folded inner membrane for extra surface area
- **Function**: Produce energy in cell (ATP) through the process of ***respiration***



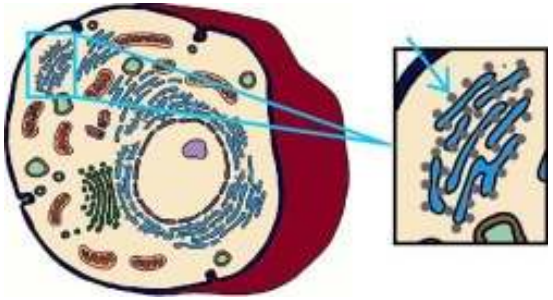
Vacuole

- **Structure:** Sac-like organelle
- **Function:** Stores water and other important materials
- **NOTE:** There are many small vacuoles in animal cells. Plants have *one large vacuole* that stores water for *turgor pressure*

Organelles to Know

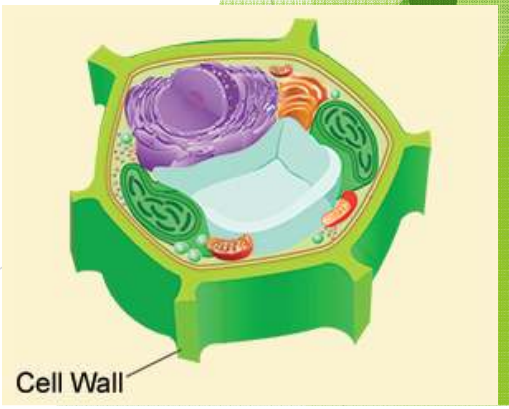
Ribosomes

- **Structure**: Tiny organelles scattered throughout the cell
- **Function**: Produces *proteins* during protein synthesis



Cell Wall (Plant Only)

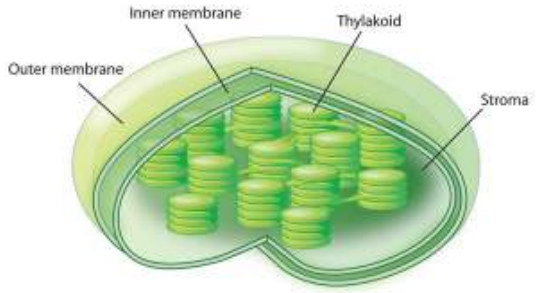
- **Structure:** Rigid, *cellulose* based structure that surrounds plasma membrane in plant cells
- **Function:** Additional protection and support for the cell



Organelles to Know

Chloroplast

- **Structure**: Green, oval organelles in plant cells
- **Function**: Perform ***photosynthesis*** for the cell by converting sunlight into glucose



Other Organelles

- **Cytoplasm**
- **Golgi Apparatus**
- **Lysosome (animal cells)**

Things to Note:

- **The structure of the organelle determines its function**
  - For example, the mitochondria has a **folded inner membrane** to increase the surface area. More surface area = more energy production for the cell.
  - What other examples can you think of?
- **Organelles may appear in higher numbers in different cells**
  - For example, you may see more mitochondria in muscle cells where more energy is needed, or more chloroplasts on the leaf cells of plants where they have access to sunlight.
- **The organelles work together to make the cell function.**
  - All organelles play a role. Consider the nucleus which controls the production of proteins, which are made on ribosomes in the cytoplasm, where the proteins can then be used as enzymes during respiration in the mitochondria.

Video Review

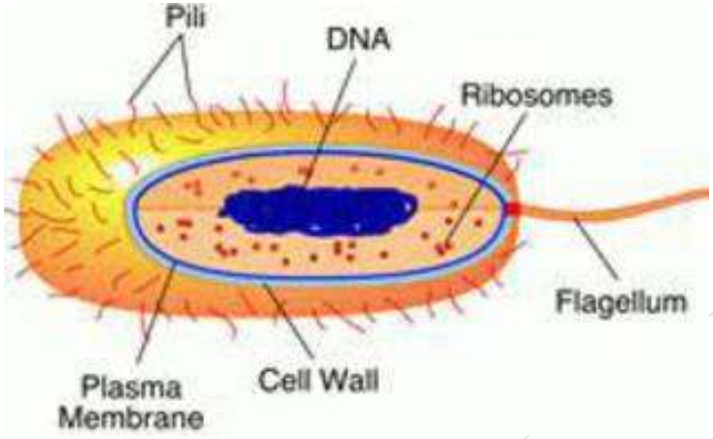
- https://www.youtube.com/watch?v=3nBtY6LR030

Standard 1.1.2

Prokaryotic vs. Eukaryotic Cells

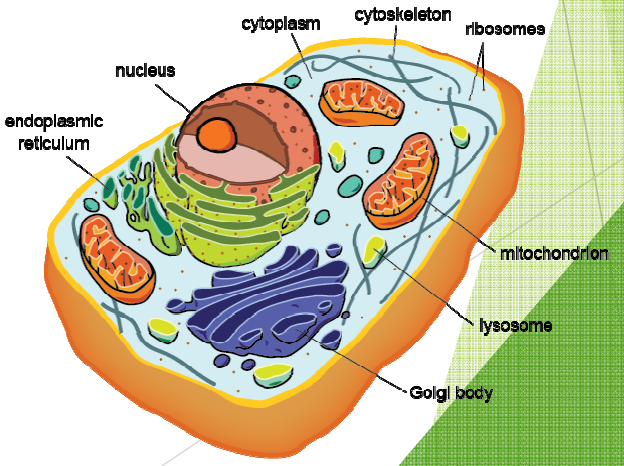
Prokaryotic Cells

- Less complex cells (simple)
- No membrane bound organelles; contains cell membrane, cytoplasm, and ribosomes
- DNA and RNA are present, but they are free floating; DNA is found in circular strands called ***plasmids***
- Smaller cells
- Example: Bacteria



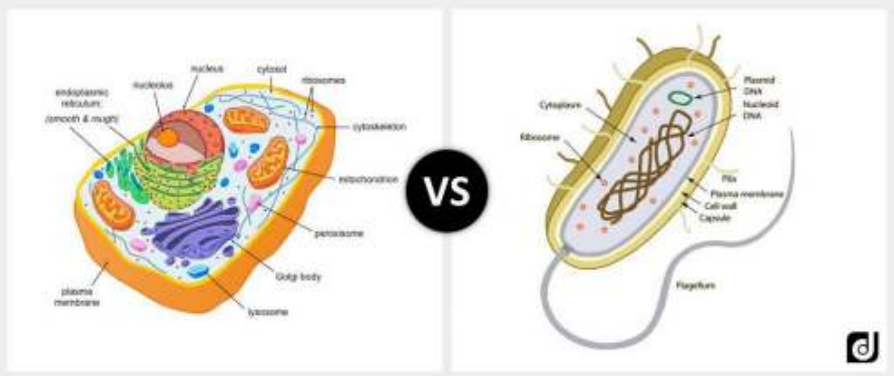
Eukaryotic Cells

- More complex cells
- Has membrane bound organelles-mitochondria, nucleus, vacuole, chloroplasts, etc.
- Has a nucleus that contains DNA; DNA is in the shape of a ***double helix*** (twisted ladder)
- Larger cells
- Example: Plant and Animal Cells



Similarities Between Prokaryotic and Eukaryotic Cells

- Both have DNA (just different shapes/locations)
- Both have ***ribosomes***
- Both have cell membrane, cytoplasm, may contain cell wall



Eukaryotic Cell vs. Prokaryotic Cell

Video Review

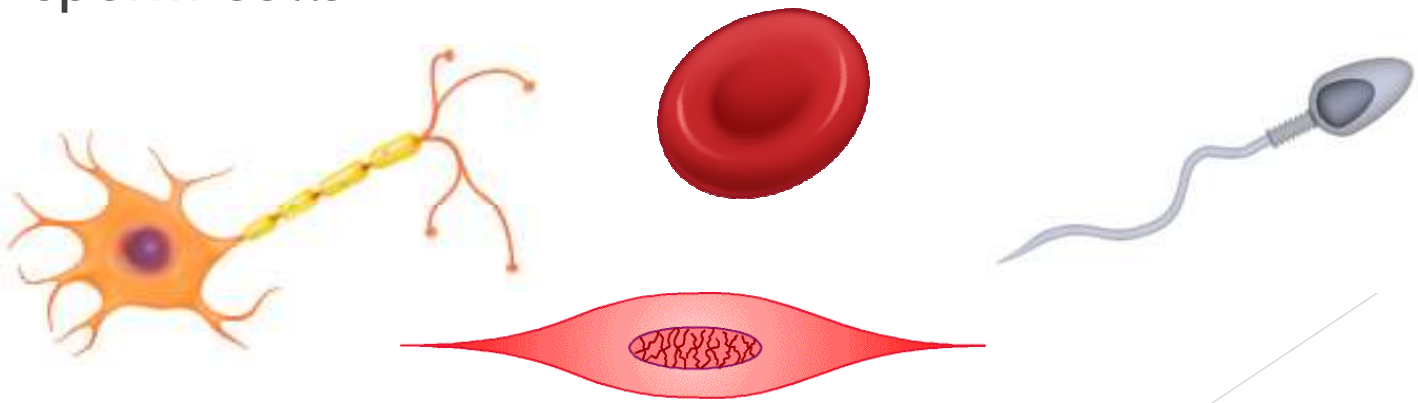
- https://www.youtube.com/watch?v=RQ-SMCmWB1s

Standard 1.1.3

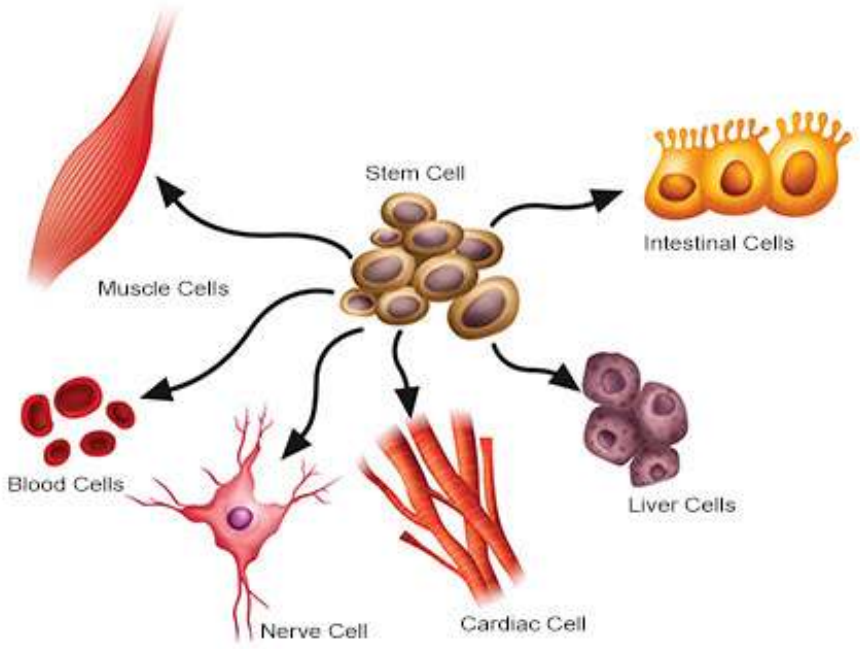
Cell Specialization and Differentiation

Specialized Cells

- All the cells in your body are eukaryotic with the same DNA! However, they can be ***specialized***, meaning they can have a specific job or purpose in your body.
- Examples: Nerve cells, muscle cells, blood cells, sperm cells



All cells in your body have the same DNA, so how do they become specialized…?



Cell Differentiation

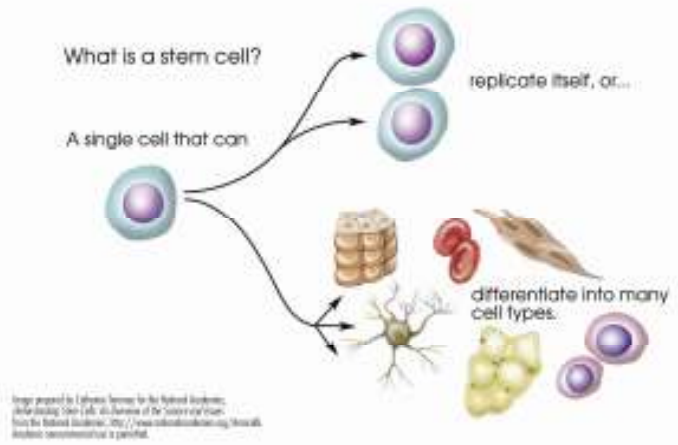
- Multicellular organisms begin as masses of cells that are ***undifferentiated***: not different from each other
- The variation (difference) in how DNA is expressed and gene activity determines their ***specialization***: role in the cell
- ***Differentiation***: All cells have the same DNA. In each cell, some parts of the DNA is activated (turned "on") to determine the cell's function

Differentiation: Things to Note

- All cells have same DNA in your body
- Different parts of genetic instructions used in different types of cells, influenced by cell environment
- Could potentially be anything, but once differentiated, it **cannot** be reversed!

Stem Cells

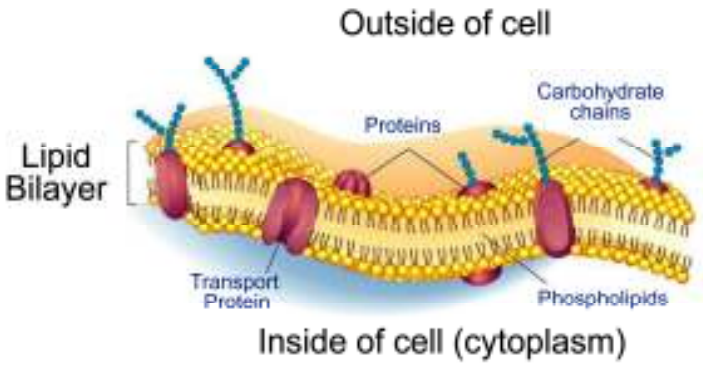
- ***Stem cells*** are <u>undifferentiated</u> cells that can reproduce themselves and have the ability to **<u>differentiate into a specialized cell</u>**
- ***Embryonic stem cells***: Embryonic cells that have yet to differentiate. The cause of much debate within the genetic engineering community!
- ***Adult stem cells***: Stem cells found in adults (ex. Bone marrow)
- Scientists have shown that both types, under right conditions, can differentiate into specialized cells!



Standard 1.2.1 and 1.2.3

Homeostasis

Plasma Membrane Structure

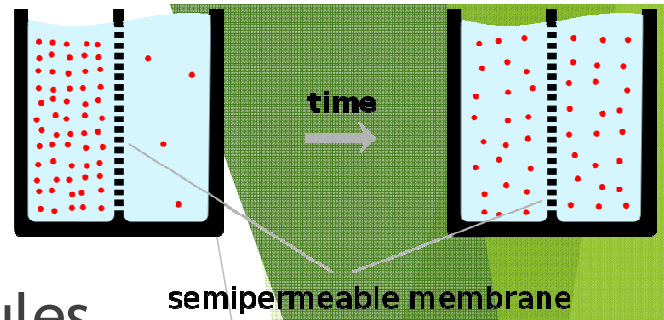


- Made up of ***lipids***: fatty acids
  - Examples: phospholipids, steroids
- Lipids in the Plasma Membrane are called ***phospholipids***. They are arranged in a bilayer that includes many moving parts.
  - The Fluid Mosaic Model!
- The phospholipids always arrange themselves with the heads out (***hydrophilic***) and the tails in (***hydrophobic***)
- Protein channels and pumps allow larger molecules to move through the membrane

How Do Cells Maintain Homeostasis?

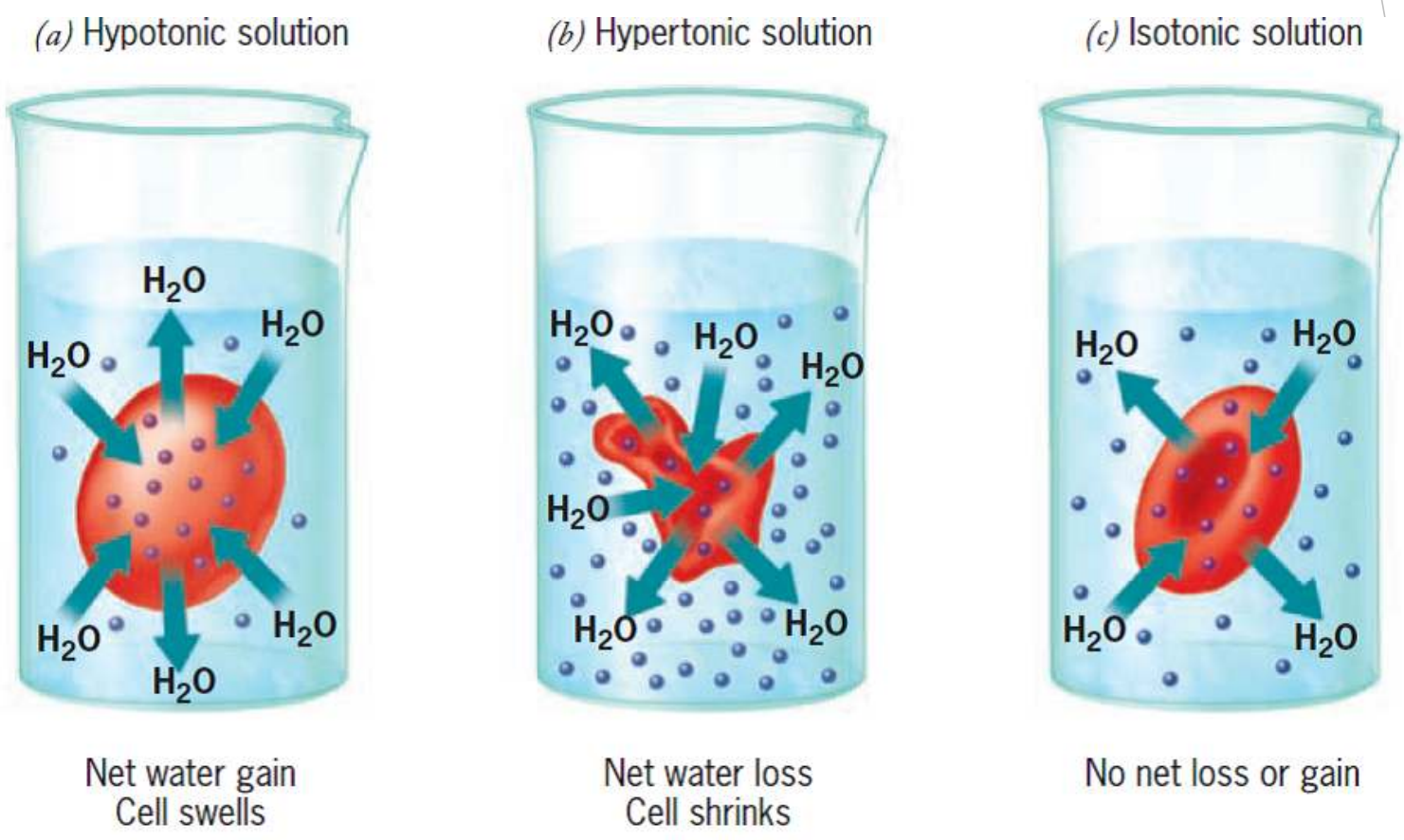
- ***Homeostasis*** means to maintain balance in a cell. This is required for life!
- Cells have ***buffers*** that regulate pH in the cell
- The plasma membrane regulates what goes into and out of the cell using active and passive transport. This helps maintain homeostasis!

Active vs. Passive Transport

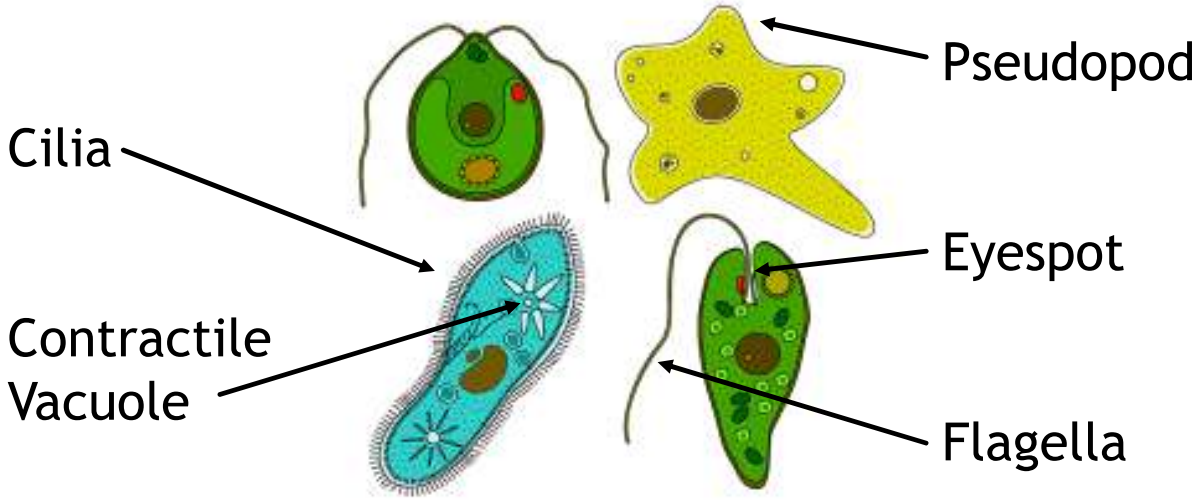


- ***Active Transport***: The cell transports molecules against the concentration gradient using protein pumps. Required energy! (ATP)
- ***Passive Transport***: The cell moves molecules with the concentration gradient. Requires no energy.
  - ***Diffusion***: Particles moves from high to low concentration
  - ***Facilitated Diffusion***: Particles move from high to low concentration through proteins
  - ***Osmosis***: The movement of water from high to low concentration across a membrane

Osmosis Solutions



How Do Unicellular Organisms Maintain Homeostasis?



- ***Chemotaxis***: Movement toward or away from chemicals
- ***Phototaxis***: Movement toward or away from light
- All of these adaptations allow the cell to maintain homeostasis.