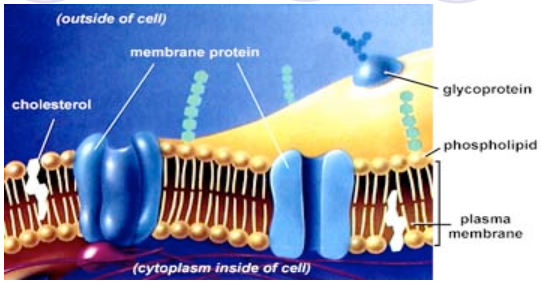
Cellular Activities

Movements through Membranes

Structure



- Phospholipid bilayer
- Proteins
- Glycoproteins
- Cholesterol

Function of cell membrane

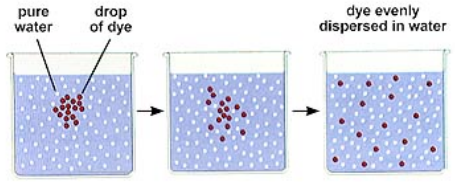
- How selective permeability is created:
  - Molecules that are watery
    - How do they get in?
      - If they are small
      - If they are large
  - Molecules that are large
  - Molecules that dissolve in fats

Background

- Structure of cell membrane – phospholipid bilayer
  - Is a fat
  - The third fatty acid is replaced with an inorganic phosphate
    - The molecule is amphiphilic

Cell Movements

- Diffusion – passive transport
  - Definition



Diffusion

- Gradient
- Equilibrium
- Examples of molecules
- Animation
  - http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_diffusion_works.html

Osmosis - passive

- Definition
- Terms
  - Hypertonic – has a high solute concentration or low water concentration
  - Hypotonic - has a low solute concentration or high water concentration
  - New definition of osmosis: movement from a hypotonic solution to a hypertonic solution
  - Isotonic – equal water concentration

Osmosis

- Animation
  - http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_osmosis_works.html

Examples of Osmosis

- Osmotic Pressure – the pressure required to stop the osmotic flow of water
  - Water moves into a hypertonic solution but what if too much water was entering and needed to be stopped.
  - Occurs in plants

Examples – see page 187

- Isotonic cells are placed in isotonic solutions:
  - Cells neither gain or lose water

Cells are placed in hypotonic solutions

- Animal cells will swell & burst
- Plant cells swell and place pressure against the cell wall
  - Why is this good in a plant cell?

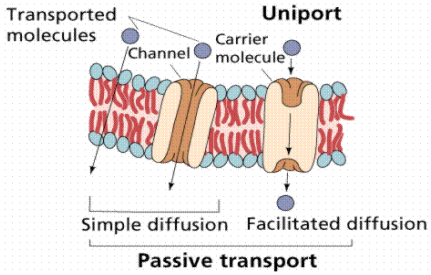
Cells are placed in hypertonic solutions

- Animal cells shrink – creanate (they undergo plasmolysis, loss of water by a cell)
- Plant cells – the vacuole collapses

Facilitated Diffusion - passive

- Definition – use of transport proteins to move materials across a membrane
- Why must it occur – some materials are hydrophilic and can not get through the bilayer
- How does it work – a channel is created by the protein so the watery materials do not contact that part of the bilayer

Example of Facilitated Diffusion

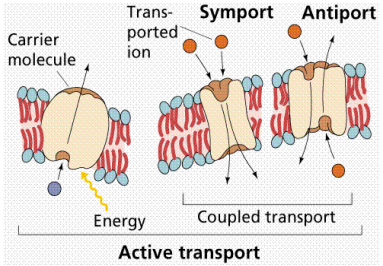


- It is passive because the movement is down a gradient.

Active Transport

- Definition – movement of materials against a gradient.

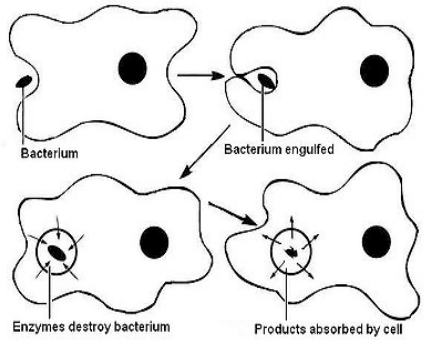
Pumps



- The membrane protein moves the material across the membrane either by binding to the material to b transported or by physically changing the shape of the channel to fit the material needed to be moved.
- Example – sodium-potassium pump

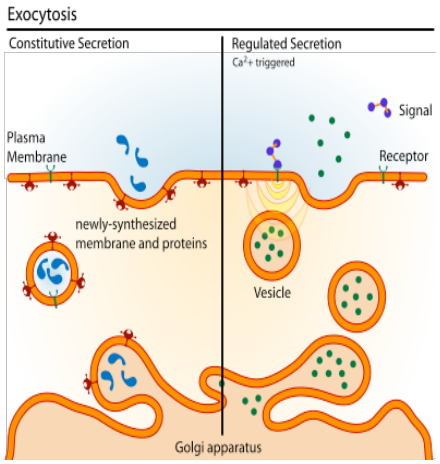
Movements of the Membrane

- Endocytosis – the cell engulfs the particle and moves the particle inside
  - Types:
    - Phagocytosis
    - Pinocytosis



Movements of Membrane

- Exocytosis – a vesicle forms around a large solid particle and it is removed from the cell.



Metabolism

- Definition – all the reactions that occur in the cell
  - Include making and breaking large molecules

Types of Metabolic Reactions

- Hydrolysis/Catabolism
  - Breaking large molecules into smaller molecules by adding water
  - EXAMPLE:
    - Breaking a disaccharide into two monosaccharides:
      - sucrose + water -> glucose + fructose
  - BEST EXAMPLE: cellular respiration – breaking glucose to release energy.

Types of Metabolic Reactions

- Condensation/Dehydration Synthesis/ Catabolism
  - Joining small molecules to form large molecules by removing water
  - EXAMPLE:
    - Building a disaccharide from two monosaccharides:
      - glucose + fructose -> sucrose + water
  - BEST EXAMPLE: photosynthesis – producing glucose by using the sun's energy

Homeostasis

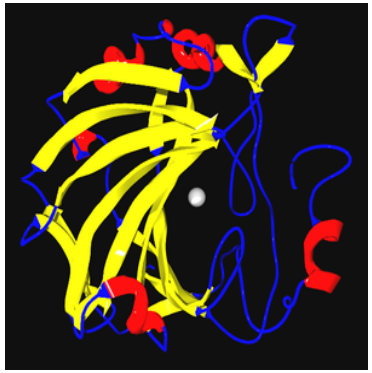
- Definition – maintaining a steady internal environment
  - How is it maintained – by letting materials pass in and out of the cell.

Enzyme Reactions – chapter two

- Enzymes
  - Provide activation energy in living things
  - *Activation energy – energy necessary to start a reaction.*
    - How enzymes provide activation energy:
      - Increase the number of collisions between atoms and molecules; therefore bonds can be broken and new bonds formed.
  - Composition – proteins (tertiary or quartenary)

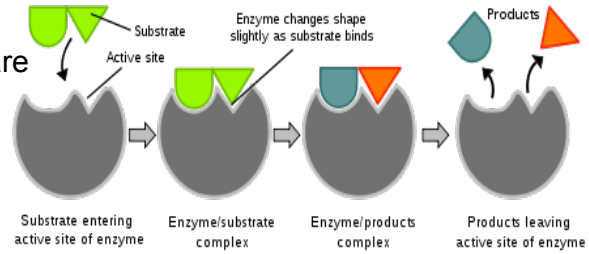
Structure of enzyme

- Have active sites



Enzyme Action

- Lock and key hypothesis
  - Shows enzymes have active sites
  - Shows enzymes are reusable
  - See p. 52



Enzyme Regulations

- Necessity
  - Enzyme regulation by pepsin
    - Illustrates need for regulation
  - Types:
    - pH – optimal pH
    - Temperature – enzymes have an **optimal temperature**
      - **One at which the shape will not be destroyed but the greatest number of collisions occur**
      - **Denaturing an enzyme**
    - pH – optimal pH

Enzyme Regulations

- Competitive inhibition – another molecule is shaped like the substrate and competes for the enzyme
- Feedback inhibition – an accumulation of products inactivates the first enzyme in a series
- Precursor activation - the presence of the first substrate activates all enzymes in the series.
- Animation of enzyme action -http://programs.northlandcollege.edu/biology/Biology1111/animations/enzyme.html