Name Notes filled in Hour

# Unit 4: The Cell Membrane

## Learning Goals

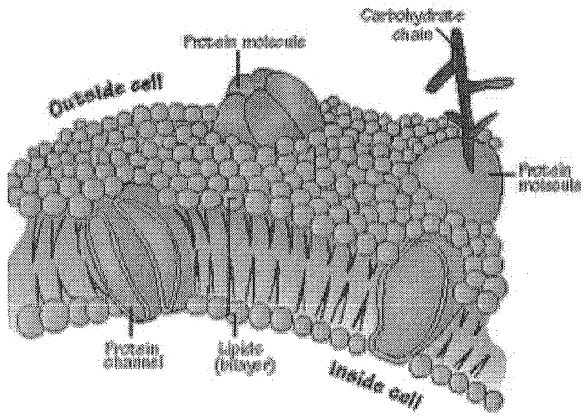
1. **I can distinguish between the four classes of macromolecules by picture.**
   *Macromolecule Review and Lipids Notes p.3 & Macromolecule Review p.5,*

2. **I can distinguish between the four classes of macromolecules by description (monomer, elements, function, examples, etc.)**
   *Macromolecule Review and Lipids Notes p.3 & Macromolecule Review p.5,*

3. **I can describe the structure and function of a cell membrane and a cell wall.**
   *The Cell Membrane and Cell Wall Notes p.6*

4. **I can distinguish between the different modes of membrane transport.**
   *The Cell Membrane and Cell Wall Notes p.6, Plasmolysis Lab (Handout), Osmosis Worksheet (Handout) & Graphic Organizer-Transport Across a Membrane (Handout)*

5. **I can predict the movement of water across a membrane based on the solution concentration of its environment.**
   *The Cell Membrane and Cell Wall Notes p.6, Egg Demo p.8, Osmosis Across a Membrane Activity p.9, Plasmolysis Lab (Handout), Osmosis Worksheet (Handout) & Graphic Organizer-Transport Across a Membrane (Handout)*




## Vocabulary

- Active Transport
- Amino acid
- Carbohydrates
- Cell membrane
- Cell wall
- Diffusion
- Endocytosis
- Equilibrium
- Exocytosis
- Facilitated diffusion
- Hydrophilic
- Hydrophobic
- Hypertonic solution
- Hypotonic solution
- Isotonic solution
- Lipid
- Monosaccharide
- Nucleic acid
- Nucleotide
- Osmosis
- Passive Transport
- Protein
- Saturated fatty acid
- Unsaturated fatty acid

# Unit 4 Warm-ups

Remember to copy down the question and answer the question completely using your notes and labs.

# Notes: Macromolecule Review & Lipids

**Organic** – Contains Carbon, relating to or derived from living matter

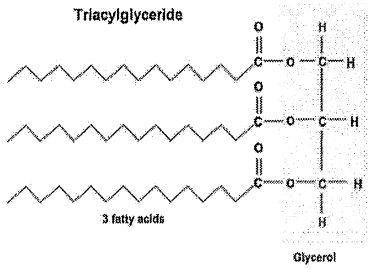
**Macromolecule** – Large molecule – most are very long chains of monomers.

**Macromolecules (we have already learned)**

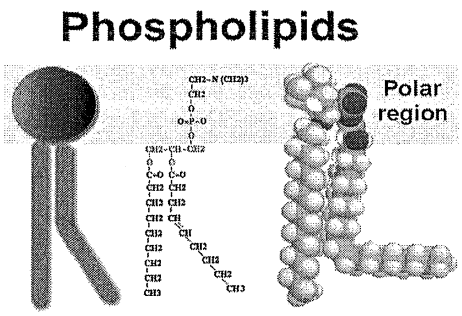
1. Carbohydrates (Chapter 2)
   - Monomer: monosaccharide (single sugar)
   - Polymer: Polysaccharide (starch/fiber)
   - Examples: glucose, fructose, cellulose, glycogen, corn starch
   - Elements: Carbon, Hydrogen, Oxygen 1:2:1 ratio
   - Shape: Chains of carbon rings
2. Proteins (Chapter 3)
   - Monomer: Amino Acid
   - Polymer: Polypeptide chain (Called protein after its folded)
   - Examples: Insulin, casein, hemoglobin, RNA polymerase
   - Elements: Carbon, Hydrogen, Oxygen, and Nitrogen
   - Shape: Folded chains of amino acids.
3. Nucleic Acids (Chapter 3)
   - Monomer: Nucleotide
   - Polymer: Nucleic Acid
   - Examples: DNA, mRNA, tRNA, rRNA
   - Elements: Carbon, Hydrogen, Oxygen, Nitrogen, and Phosphorus
   - Shape: Nucleotide Chains
4. Lipids
   - Monomer: None
   - Polymer: None
   - Examples: Oils, fats, butter
   - Elements: Carbon, Hydrogen, Oxygen (no pattern)
   - Shape: Head with it carbon chain tails.

**Lipid – Examples:**

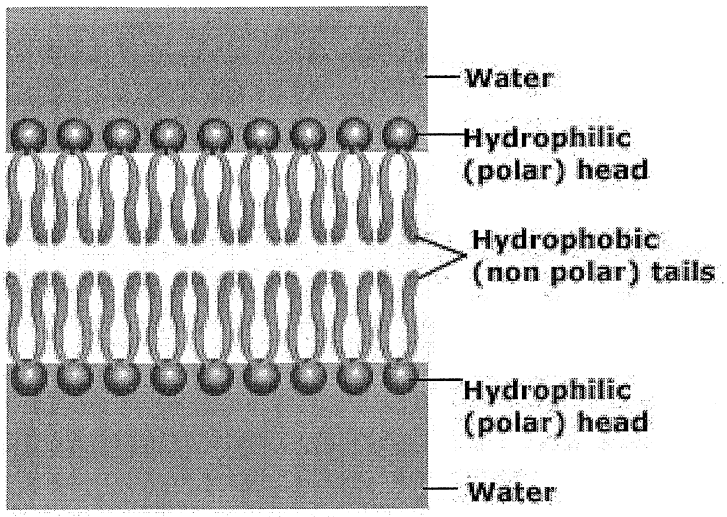
- Triglyceride
  - Head: Hydrophilic (water-loving)
    - Glycerol
  - Tail: Hydrophobic (water-hating)
    - fatty acid – long carbon chains.



- Phospholipids
  - Hydrophilic head ( phosphate )
  - Hydrophobic tails ( fatty acid chain )

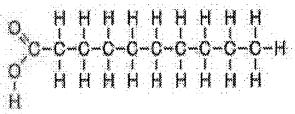



Phospholipid Bilayer



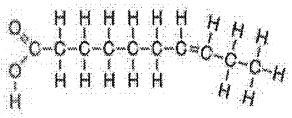

**Fatty acids - Tails**

Saturated



- No Double Bonds
- No Kinks

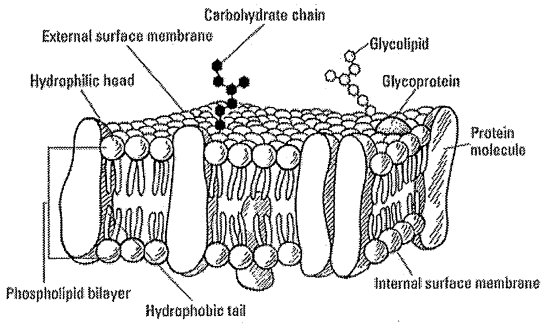
Unsaturated

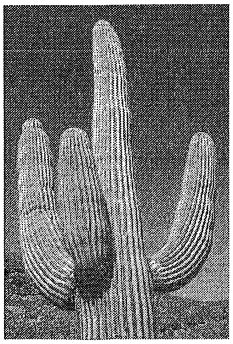


- At least one Double Bond
- Double bonds create Kinks

**Functions of Lipids**

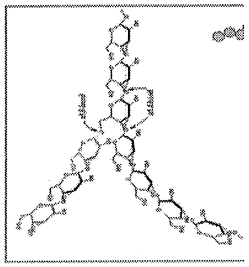
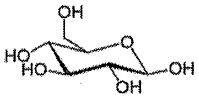
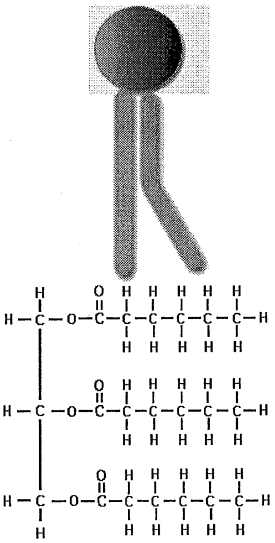
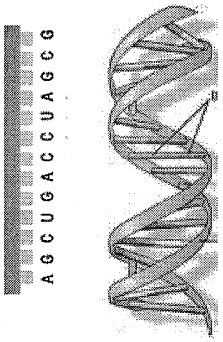
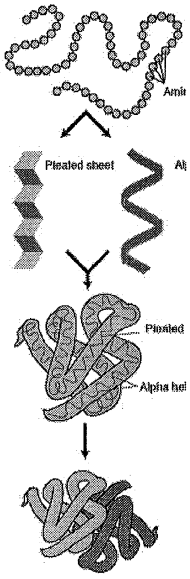
- Energy ! – from the breakdown of lipids.
- Membranes and Waterproofing - because they are oily (waxy coating on leaves)
- Steroids / Hormones - chemical messengers (like cortisol).



# Macromolecule Review

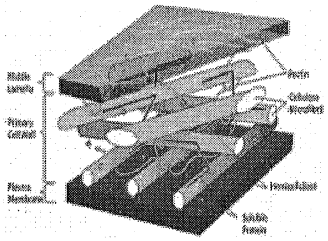
Color all boxes associated with ...
Carbohydrates – red, Proteins – purple, Nucleic acids – green and Lipids – yellow.
All rows will have one of each except the examples section.

| Macro-molecules | Carbohydrates | Proteins | Nucleic Acids | Lipids |
|---|---|---|---|---|
| Elements | C, H, O | C, H, O | C, H, O, N | C, H, O, N, P |
| Monomer | Nucleotides | Amino acids | Doesn't have one | Monosaccharides |
| Picture |   |  |   |   |
| Function in cells | Makes up the majority of membranes and biological coverings. Also stores energy. | Codes for proteins and is involved in protein synthesis. | Storage, transport, sending and receiving messages, speeding up chemical reactions, structural, etc. | Main source of energy for making ATP. |
| Contains | Peptide bonds | Saturated and unsaturated forms | A ratio of 1Carbon: 2Hydorgen: 1Oxygen | Hydrogen bonds |
| Examples | mRNA | Actin | Insulin | Polysaccharide |
| | Amylase | Sucrose | Saturated fat | rRNA |
| | Keratin | Hemoglobin | tRNA | Ovalbumin |
| | Glucose | DNA | Starch | Oil |
| | Unsaturated fat | Phospholipid | Wax | Cellulose |

# Notes: The Cell Membrane & Cell Wall

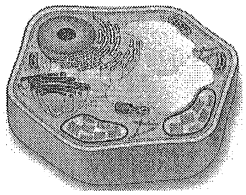
**CELL WALL – Overall Structure:**

Porous + Rigid Structure found on outside of cell membrane in plants + fungi + bacteria



**CELL WALL – Overall Function:**

Provides shape + support strength to the organism. (like an egg shell)



| Cell Type: | Molecule in Cell Wall: |
|---|---|
| - Plants | - Cellulose (fiber) |
| - fungus | - Chitin |
| - Bacteria | - Peptidoglycan |

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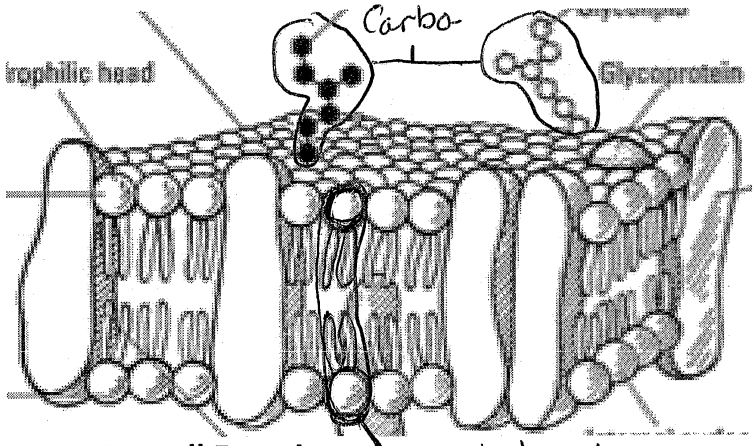
**CELL MEMBRANE – Overall Structure:**

- Thin flexible phospholipid bilayer that surrounds ALL cells.
- Contains lipids, proteins + carbohydrates.

Pick three different colors. Color each molecule on the key a different color. Use the key you created to color-code the image of a cell membrane below. Don't forget your key and functions!




| KEY |
|---|
| Carbohydrates |
| Proteins |
| Phospholipids |

**CELL MEMBRANE - Overall Function:** phospholipids

- Regulates what enters and leaves the cell
- "Selectively Permeable"

| Function of the Cell Membrane Parts | | |
|---|---|---|
| **Protection** | Phospholipids | The phospholipids create a barrier between the cell's internal parts and the surrounding environment |
| **Regulation** | Proteins | The cell membrane is considered selectively permeable, meaning it only lets certain things in and out of the cell. The proteins embedded in the cell membrane act like little doors that allow certain molecules in and out of the cell. |
| **Identification** | Carbohydrates | The carbohydrates on the surface of the cell membrane act like ID cards to let other cells know who or what they are. |

## CELL MEMBRANE – Transport Processes:

I. **Diffusion** - the process by which molecules spread from areas of high concentration to areas of low concentration to reach a state of equilibrium.

A. Equilibrium- when the molecules are spread evenly throughout a space or evenly on opposite sides of a membrane

B. Example: oxygen & Carbon Dioxide can enter the cell freely through diffusion

C. No ENERGY required, No Protein required

II. **Osmosis** - Diffusion of water across a selectively permeable membrane

A. No Energy required, No Protein required

B. Types of solutions:

1. Isotonic- concentrations of solutes is the SAME inside and outside the cell
   a. There is equilibrium
   b. Water moves into and out of the cell in equal amounts
2. Hypertonic- solution has a Higher solute concentration than the cell.
   a. "Hyper" means High
   b. Water moves OUT of the cell
   c. Plant cell: Plasmolysis - Contents and membrane pull away from cell wall. Cell wall is strong enough to maintain shape without being full (weaker)
   d. Animal cell: Shrinks / Shrivels
3. Hypotonic- solution has a Lower solute concentration than the cell
   a. "Hypo" means Low
   b. Water moves INTO the cell
   c. Plant cell: SWELLS Slightly but will not burst because of the cell wall
   d. Animal cell: SWELLS + May Burst

III. **Facilitated Diffusion** - Movement from areas of high concentration to low concentration across a cell membrane through a Protein Channel

A. Examples: Large molecules (like glucose) cannot diffuse through the cell membrane alone, so glucose moves through the protein channel instead

B. NO ENERGY required, PROTEIN required

C. Link: http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_facilitated_diffusion_works.html

**IV. Active Transport** – Movement from areas of LOW concentration to HIGH concentration (backwards) across a cell membrane through a protein pump.

A. Ex: Sodium / Potassium pump fuels your muscles

B. Protein required, Energy required

C. Link: http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_the_sodium_potassium_pump_works.html

**V. Endocytosis** – process of taking material Into the cell by means of infoldings or pockets of the cell membrane

A. Energy required, No Protein required

B. Link: http://www.youtube.com/watch?v=ZmWIMxW-GkQ

**VI. Exocytosis** – membranes surrounding the vacuole fuses with the cell membrane, forcing contents OUT of cell

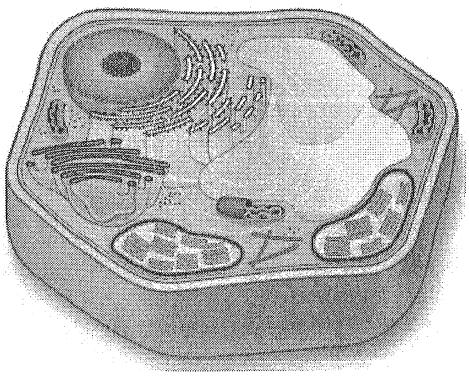
A. ENERGY required, NO PROTEIN required

B. Link: http://www.youtube.com/watch?v=U9pvm_4-bHg

# Lab: Normal and Plasmolyzed Cells

**Background Information**

The diffusion of water molecules across a cell's membrane from areas of high water concentration to areas of low water concentration is called osmosis. This movement of water may be harmful to cells. If too much water is lost from the cell, the cell membrane and the cell contents will shrink away from the cell wall. This is called plasmolysis. Plasmolysis may lead to death of the cell. Most cells live in an environment where movement of water in and out of the cell is about equal. Therefore there are no harmful effects to the cell. Plant cells have a single large vacuole. Vacuoles hold materials that the cell does not need. In a plant cell, the vacuole contains mostly water. When the vacuole is full it inflates the cell making the cell membrane push up against the cell wall. This makes plants stand up tall. If the vacuole is not filled with water, the plant looks wilted.



**Objectives**

- Observe plasmolysis in the cell as salt solution is added.
- Observe the reversal of plasmolysis as the salt solution is diluted.
- Diagram and compare normal cells in tap water with plasmolyzed cells in salt solution.

**Procedure**

1. Observe normal cells in water. Note the location of the chloroplasts in relation to the cell wall.
   Diagram one cell in the data and observations section. Label the cell wall, cell membrane and chloroplasts.
2. Observe cells that have had a solution with a high salt concentration added. Again note the location of the chloroplasts in relation to the cell wall. Diagram one cell in the data and observations section. Label the cell wall, cell membrane and chloroplasts.
3. Observe cells that have had plain water added again.

**Data and Observations**

| Cell in Tap Water | Cell in Salt Solution |
|---|---|
| | |

**Analysis**

1. The super salty salt solution is _____ compared to the cytoplasm in the plant cells.
   The tap water is _____ compared to the cytoplasm in the plant cells.
2. Which organelle could we see under the microscope?_____
   Why was that the only one we could see?_____
3. Describe the location of the chloroplasts in the normal plant cell (in tap water).
4. Describe the location of the chloroplasts in the plasmolyzed cell (in salt solution).
5. What did you observe when salt solution was added to the plant cells?
6. In which direction (into or out of the cell) did the water move when the salt solution was added?
7. What did you observe when the tap water diluted the salt solution?
8. In which direction did the water move when tap water diluted the salt solution?
9. Describe the process of plasmolysis.
10. Which organelle in the plant cell holds a large amount of water?_____ How does the plant look if that organelle is not full?_____

11. Being hydrated is very important. Our cells do not function well when they are dehydrated. Often, when you are very sick you get dehydrated because you don't feel like eating or drinking. If you go to the hospital the first thing they will do is give you IV fluids to help you feel better. Using the concepts we have just studied, explain in detail why you are given an IV of saline (salt) solution instead of just plain water when you go to the hospital. (2pts EC)

# Lab: Eggs in Hypotonic and Hypertonic Solutions

Day 1: We put the eggs in _____ so that we can _____ the shell and expose the eggs' _____.

Day 2: We put egg one in _____ which is a _____ solution compared to the _____ inside the egg.

We put egg two in _____ which is a _____ solution compared to the _____ inside the egg.

Day 3: The egg in the _____ looks:_____

because:_____

The egg in the _____ looks:_____

because:_____

Data: Initial mass of egg one:_____ Initial mass of egg two:_____

Final mass of egg one:_____ Final mass of egg two:_____

Mass change of egg one:_____ Mass change of egg two:_____

What process was happening to make the eggs change?

In the boxes below draw a picture of what was happening to make each egg change.

| Egg One | Egg Two |
|---|---|
| | |

# Osmosis Across a Membrane

**Materials:**
Paper background = water
Yarn circle = cell membrane
Fuzzies = molecules dissolved in water

1. Make a pile of fuzzies in the center of your paper. Does this show equilibrium? _____

2. Spread the fuzzies out evenly across the paper. What process did you just do? _____ Does this show equilibrium? _____

3. Clear the fuzzies off your paper, put the yarn circle on the paper, follow the directions in the table below.

| | | | | |
|---|---|---|---|---|
| 1. Create a hypertonic solution outside of the cell. Draw what you did → | | 4. Set up a hypertonic solution again. Show what the cell will do to achieve equilibrium. Draw it → | | Describe what you just drew: |
| 2. Create a hypotonic solution outside of the cell. Draw what you did → | | 5. Set up a hypotonic solution again. Show what the cell will do to achieve equilibrium. Draw it → | | Describe what you just drew: |
| 3. Create an isotonic solution outside of the cell. Draw what you did→ | | 6. Set up an isotonic solution again. Show what the cell will do to achieve equilibrium. Draw it → | | Describe what you just drew: |