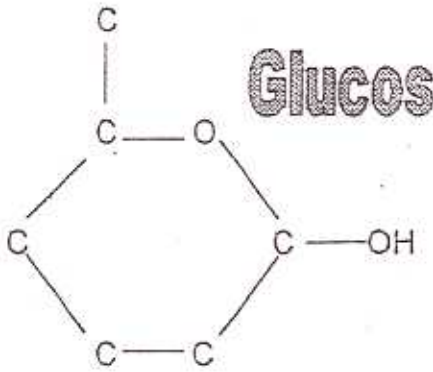
Organic Molecules

I. CARBOHYDRATES

- **Simple Sugars = <u>Monosaccharides</u>** (mono = one)

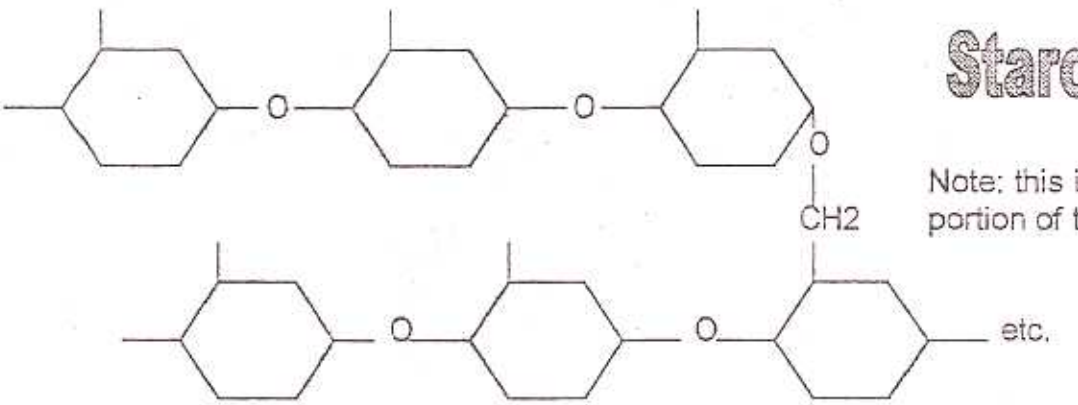
  Examples: *glucose*, *fructose*, *galactose*



Note: this representation leaves out the hydrogen atoms attached to each carbon. Remember that carbon can bond with up to four atoms.

- **Complex Sugars = *Polyscaccharides*** (poly = many)

  Examples: *starch* and *glycogen* (for energy storage); *cellulose* and *chitin* (for structural support)



Note: this is only a small portion of the molecule

[note: **disaccharides** consist of <u>two</u> monosaccharides; examples include sucrose (glucose + fructose, maltose (glucose + glucose) and lactose (glucose + galactose)]

- **Starch-Iodine Complex**

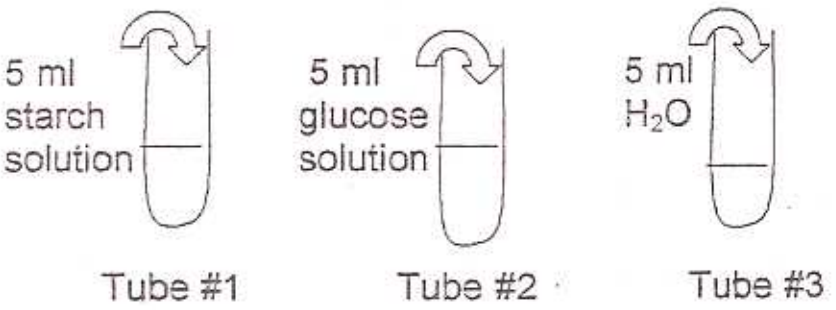
  Starch + Iodine ⇒ Purple-Blue Color (iodine binds to starch)

  Glucose + Iodine ⇒ No Color (iodine does not bind to glucose)

Starch Digestion Exercise

Hypothesis: Each starch molecule is made up of glucose monomers (or subunits)
Procedures:

1. Each group obtain three test tubes with rack and add solutions as indicated below:



2. Using a plastic pipette, place 2-3 drops of solution from each test tube onto separate depressions of a transparent slide. Add one drop of iodine reagent and record color in table below. Repeat for glucose test using test strips.

3. Next, add 1 ml of enzyme solution (contains alpha amylase and amyloglucosidase) to each test tube and incubate at 40° C in a water bath.

4. At 15, 30 and 45 minute intervals test the solutions for presence of starch and glucose (except 15 and 30 minutes) as described in step 2 and fill in results in table below:

	Starch Test			Glucose Test		
Time	Tube #1	Tube #2	Tube #3	Tube #1	Tube #2	Tube #3
O Minute						
15 Minute				----------	----------	----------
30 Minute				----------	----------	----------
45 Minute						

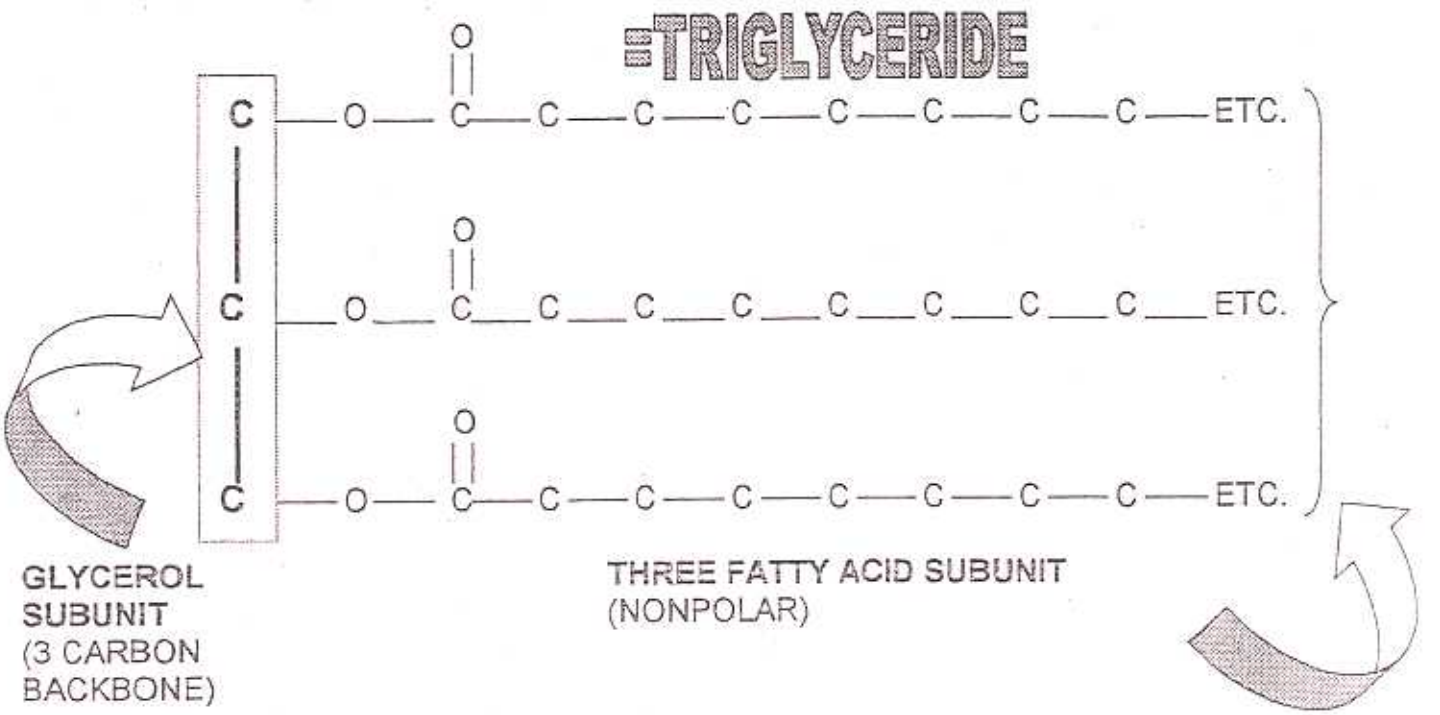
Questions:

1. Do the results support the above stated hypothesis?

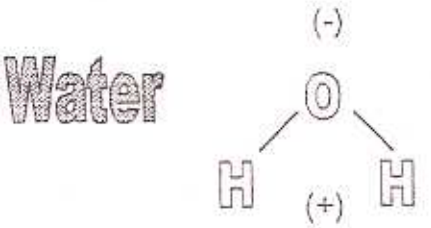
2. What was the purpose of including test tubes #2 and #3 in the experiment?

II. LIPIDS

- Lipids, which include fats and oils, are composed of molecules called triglycerides . . .



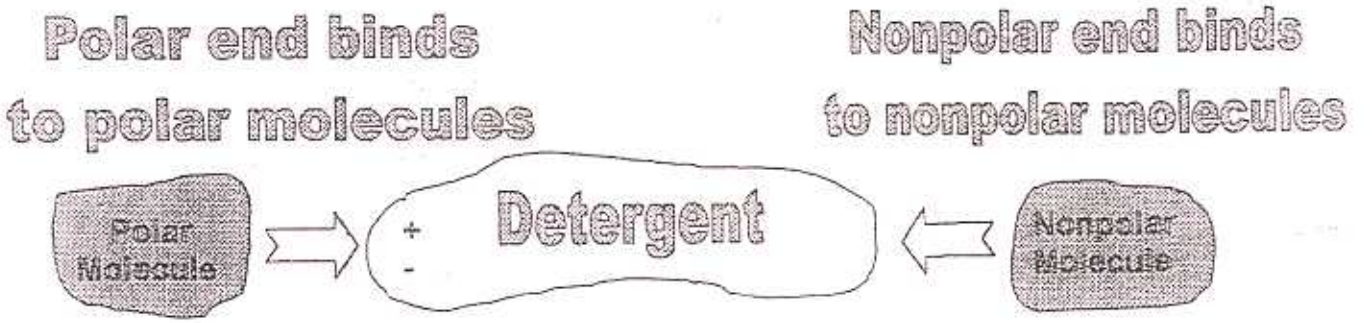
- **Nonpolar Nature of Triglycerides:** the long carbon chain of a fatty acid lacks a charge and is therefore considered nonpolar. Polar molecules, such as water, have a net negative charge on one side of the molecule and a net positive charge on the other side . . .



Substances that dissolve in water are called **hydrophiilic** since they exhibit polarity;
Substances which do not dissolve in water are said to be **hydrophobic** since they lack polarity (fat soluble)

- **Other Types of Lipids:** Waxes, Phospholipids, Steroids

- **Detergents:** Molecules that have both polar and nonpolar properties that bind simulataneously to both polar and nonpolar molecules.



Oil in Water Exercise

Hypothesis: Polar and nonpolar substances do not mix, therefore, polar substances dissolve in polar solutes whereas nonpolar substances dissolve in nonpolar solvents (like dissolves like)

Procedure:

1. Each group obtain two test tubes and add 3 ml of water and 3 ml of oil into each tube. Allow the tubes to stand for one minute and note the appearance.

2. Add ~6 drops of beet juice extract to tube #1 and ~6 drops of β-Carotene to tube #2. Allow diffusion to take place for 1-2 minutes and note the appearance of each tube.

3. Shake each tube gently and let stand for several minutes and record the appearance.

4. Next add a few drops of detergent to each tube; shake gently and allow to stand

Questions:

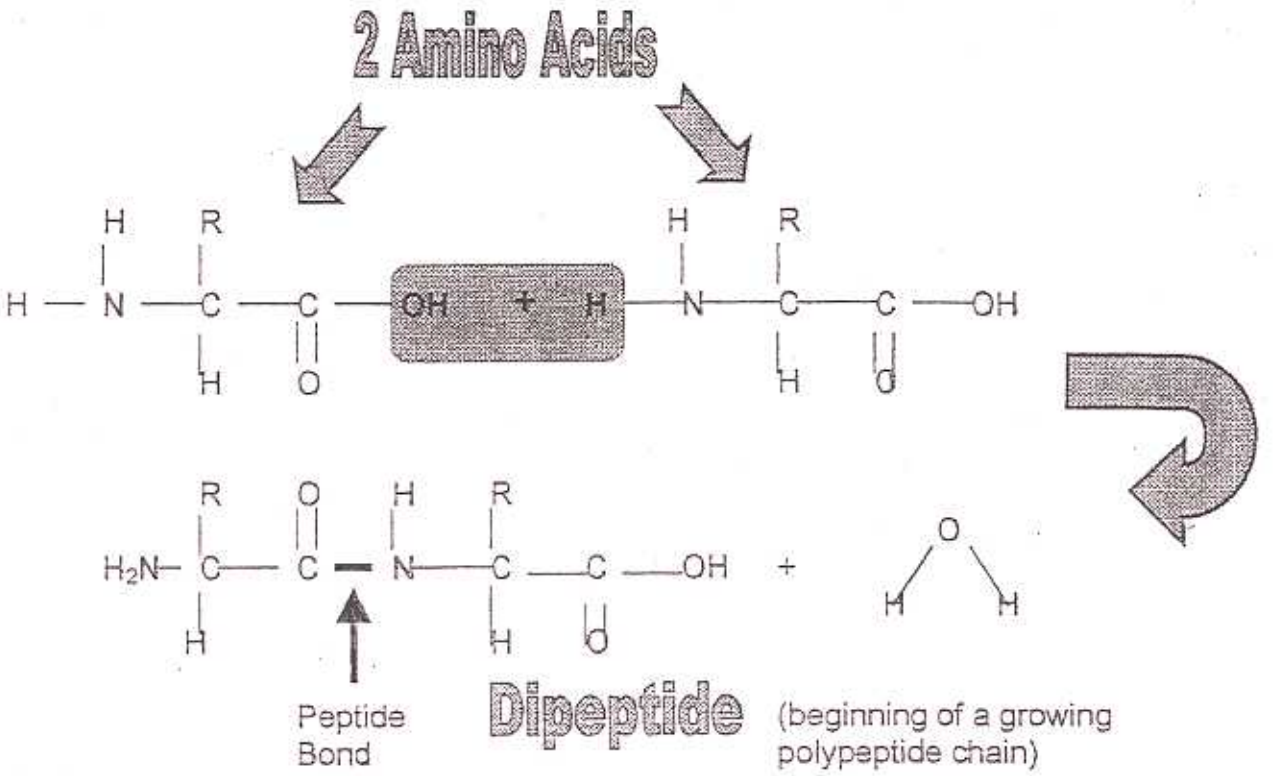
1. **What happens when lipids and water are combined? Why?**

2. **How do beet juice extract and β-Carotene differ in their chemical properties?**

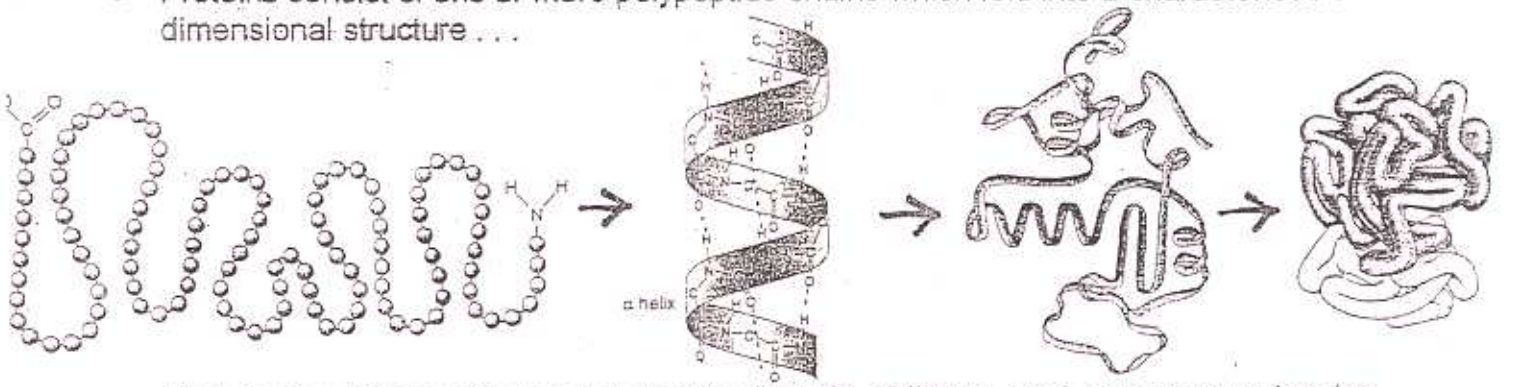
3. **Explain what happened when the tubes were shaken; what happened after the detergent was added. How can you explain these results?**

III. PROTEINS

- Proteins are made up of long chains of connected amino acids, called polypeptides . . .

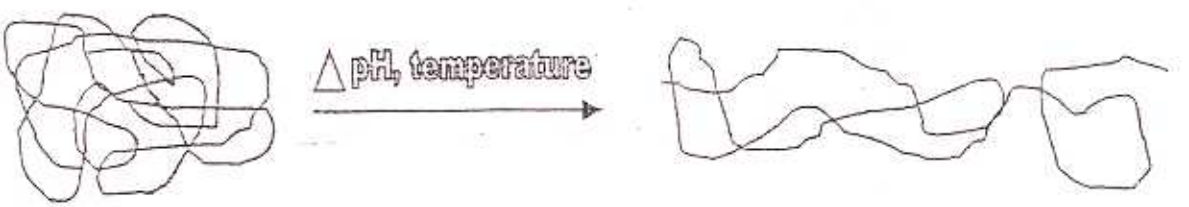


- Proteins consist of one or more polypeptide chains which fold into a characteristic 3-dimensional structure . . .



- Proteins function as structural molecules (keratin, collagen, etc.), transport molecules (hemoglobin, lipoproteins, etc.), hormones, or enzymes.

- The 3-dimensional shape of a protein can be modified by altering the pH, temperature or salt concentration of the environment. An enzyme with a modified shape from its normal configuration, and is no longer functional, is said to be denatured.



Effects of Acid on Milk Proteins Exercise

Hypothesis: The pH influences the shape, and therefore properties, of a protein

Prediction: In an acid environment the water soluble milk protein cassein will become insoluble (nonpolar) and precipitate out of solution.

Procedures:

1. Each group add ~5 ml of milk to a test tube.
2. Determine the pH using a pH test strip. [refer to page 32 in text for discussion of pH, acids, and bases]
3. Add ~2 ml of 5% acetic acid solution and gently swirl. Test the pH again.
4. Note the change in the milk solution as you swirl the contents.

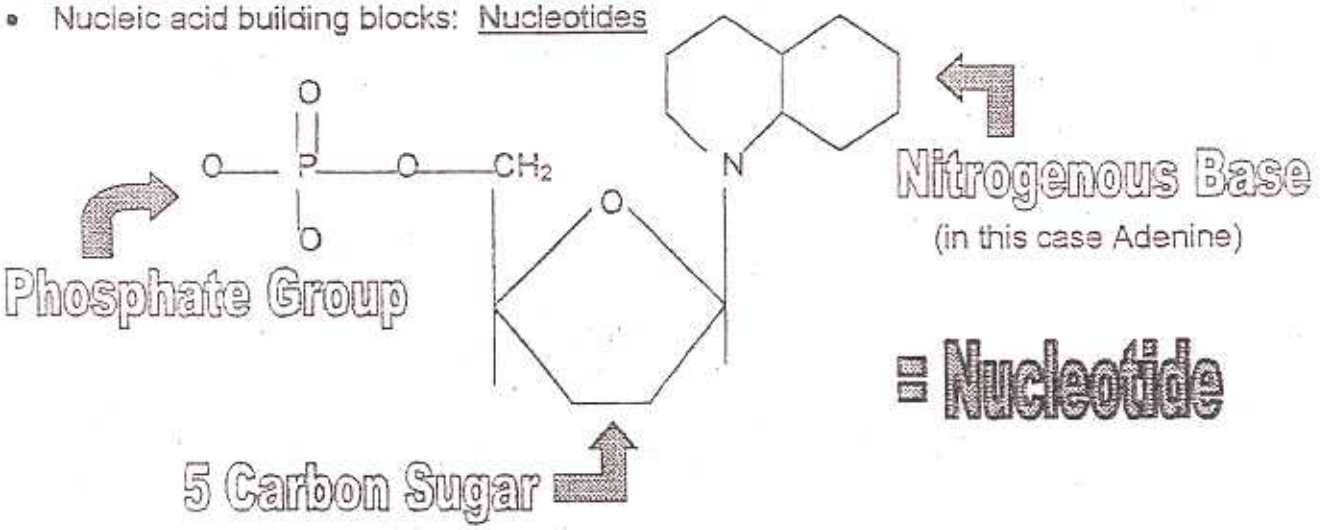
Questions:

1. **Describe what happens to the milk after the acid was added.**

2. **Explain why a precipitate formed using your knowledge of protein folding. [see page 55 in text]**

IV. NUCLEIC ACIDS

- Nucleic acid building blocks: Nucleotides



- Nucleic Acids are the information molecules consisting of Deoxyribonucleic Acid or DNA (double helix) and Ribonucleic Acid or RNA (single stranded)

- **Question: Name the four nitrogen bases of DNA and RNA**