Unit 2 - Macromolecules
FALL SEMESTER 2023

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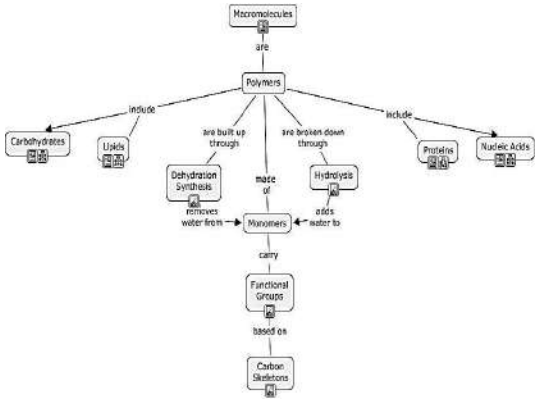
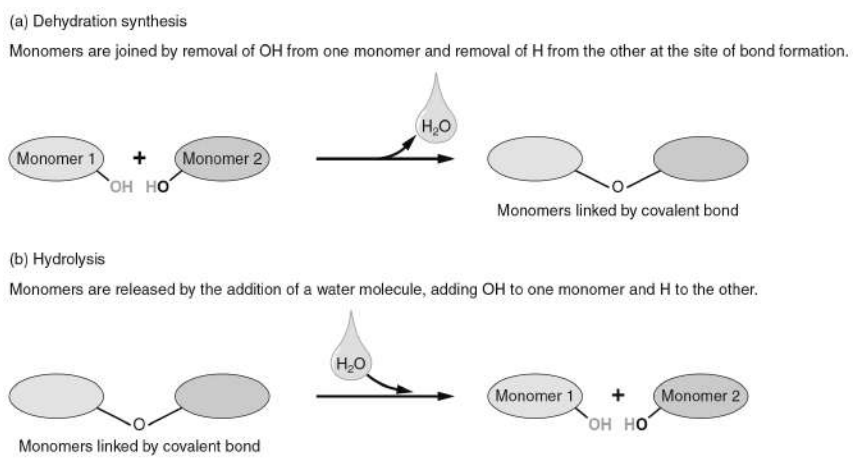
Vocabulary / Key Terms/ Concepts	Unit 2: Macromolecules Notes
• *monomers* • *polymers* • *carbohydrates* • *monosaccharide* • *polysaccharides* • *lipids* • *nucleotides* • *nucleic acids* • *proteins* • *amino acids* • *enzymes*	**Expectations** • *Compare the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids.* • *Analyze and evaluate the evidence regarding formation of simple organic molecules and their organization into long complex molecules having information such as the DNA molecule for self-replicating life.* • *Investigate and explain cellular processes including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules.* • *Identify and investigate the role of enzymes* **Macromolecules** **Characteristics** - • Large _____ molecules. 

- *activation energy*
- *catalyst*
- *substrates*
- *Macromolecules*
- *Substrate*
- *Active site*
- *inhibition*

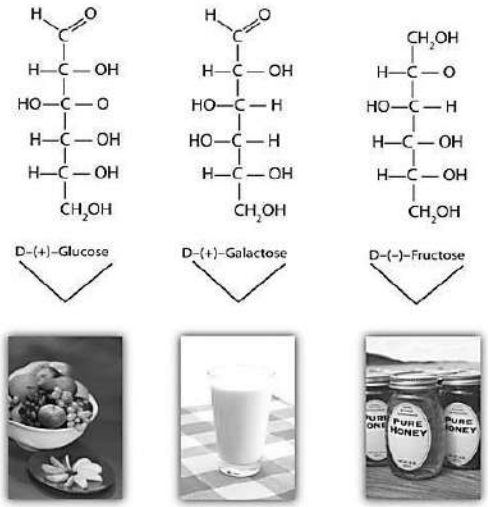
- Also called _____.
- Made up of smaller "building blocks" called _____.
- **Biological Macromolecules** are:
  1. _____
  2. _____
  3. _____
  4. _____

Dehydration Synthesis & Hydrolysis –

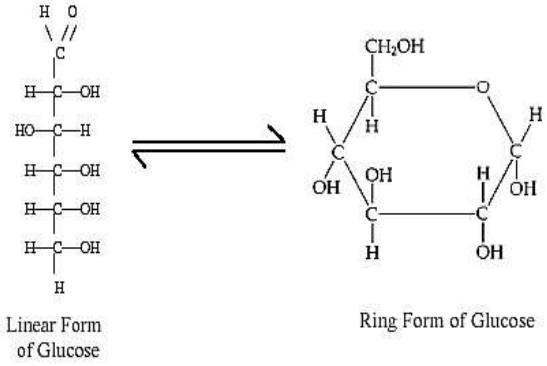
- Cells connect monomers to make macromolecules by a process called condensation or _____ (removing a molecule of water).
- Cells break down macromolecules into monomers by a process called _____ (adding a molecule of water)



Carbohydrates



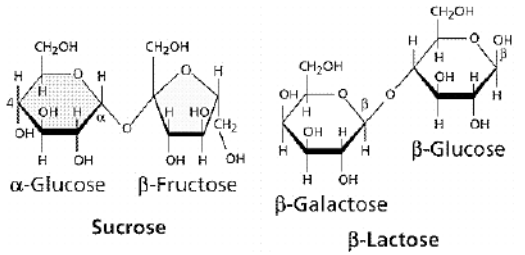
- _____can range in size from small sugar molecules to large strands of sugar molecules bonded together. A biochemical test to indicate the presence of sugar –_____ ***solution*** (indicator) – turns green, yellow, orange, or red when heated.
- Elements Used to Form:
  1. _____
  2. _____
  3. _____
- Examples:
  1. _____
     - Called **Simple Sugars *(monomer)***.
     - Include: Glucose, Fructose & Galactose.



- They have the same chemical formula, $C_6H_{12}O_6$, but have different structures.
- These three sugars are structural isomers:

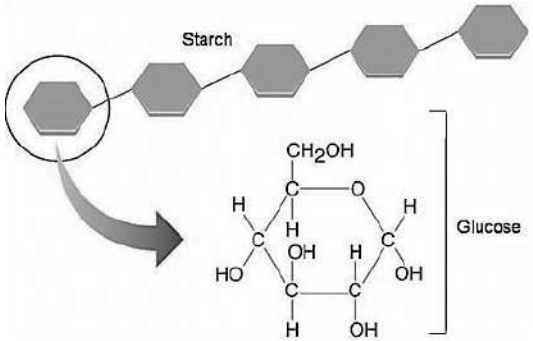
- _____is found in sports drinks.
- _____is called “milk sugar”
- _____is found in fruits.

- If the compound name ends in **– ose** means it is a sugar.
- In aqueous (watery) solutions, Monosaccharides ***form*** _____
- They are the main fuel that cells use for work.



2. Disaccharide

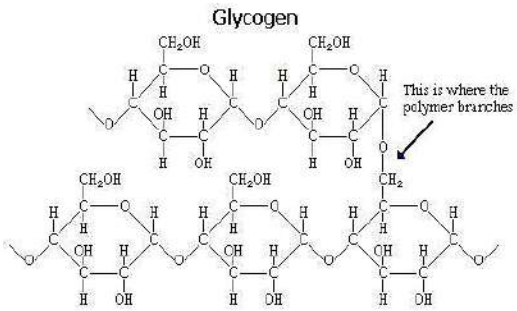
- A _____is made of two sugar molecules joined together.
- They are joined in the dehydration *process*.
- There is a glycosidic bond between the two sugars.

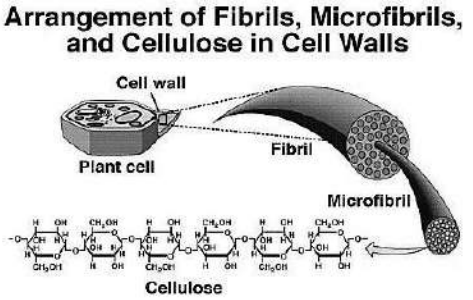


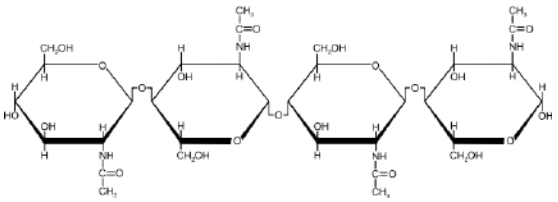
3. Polysaccharide

- _____ carbohydrates
- Composed of many sugar monomers linked together.
- _____ of monosaccharide chains.

- Three types of polysaccharides are: starch, glycogen, and cellulose.
  - _____ – in ***iodine*** (indicator) turns dark blue or black
    - Starch is an example of a polysaccharide in plants.
    - Plant cells store starch for energy.
    - Potatoes and grains are major sources of starch in the human diet.
  - _____
    - Animals store excess sugar in the form of glycogen.
    - Glycogen is similar in structure to starch because both are made of glucose monomers.
  - _____
    - Cellulose is the most abundant organic compound on Earth.
    - It is the structural component of plants.
    - It forms cable-like fibrils in the tough walls that enclose plants.
    - Many animals cannot digest cellulose.
    - It is also known as dietary fiber.



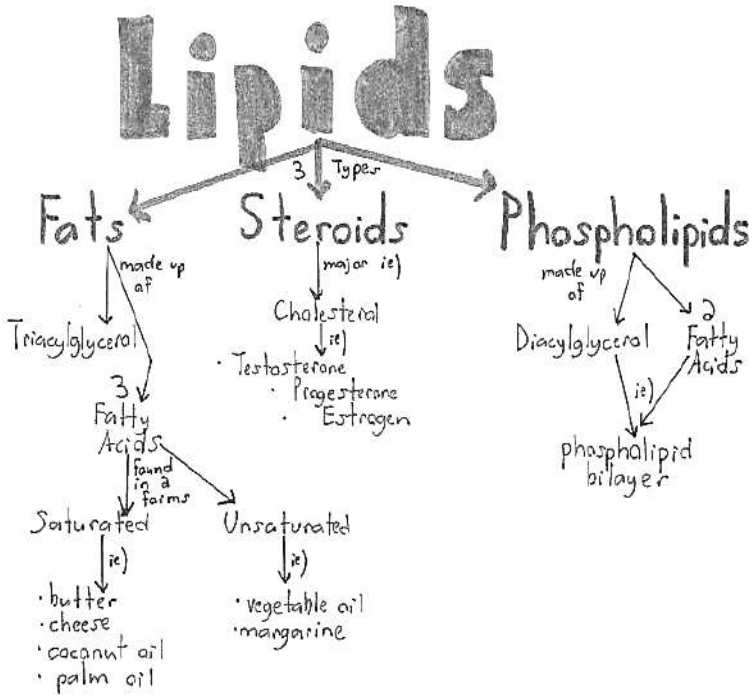




- _____
  - Chitin is made of _____ linked together in a chain.
  - Partly derived from non-sugars (nitrogen).
  - Composes _____ of insects, lobsters, and shrimp.
  - The cell walls of _____ are also made from chitin.
  - Chitin fibers are also used for _____ .

Lipids

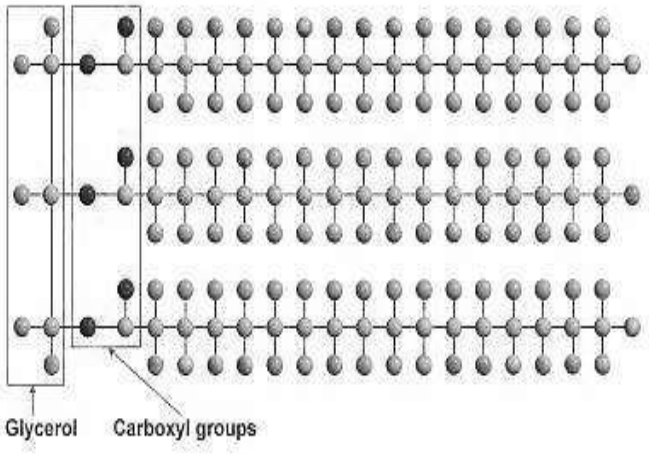
- **Characteristics**
  - Lipids are _____–"water fearing".
  - Do not mix with water.
  - Includes fats, waxes, steroids, oils & _____.
  - Stores the most energy.
  - Composed of: _____
- **Six functions of lipids:**
  1. Long term _____



2. Protection against _____loss (insulation)
3. Protection against _____loss
4. Protection against physical _____
5. Chemical messengers (_____)
6. Major component of membranes (_____)

Fatty Acids –

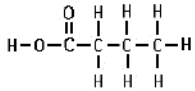
- _____: a long chain of Hydrogen and Carbon make up lipids. The exception to the monomer/polymer rule is lipids. Lipid base units are not considered monomers. One type of lipid glycerol molecules in a 3:1 ratio. The bonding of three fatty acids to one glycerol molecule creates a triglyceride



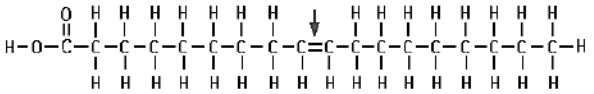
Types of Fatty Acids

1. _____ : if each Carbon is bonded by single bonds to other Carbons inside the fatty acid, the fatty acid is said to be saturated.
2. **Mono or** _____ **Acid**: If a double bond is present, then it is said to be mono-saturated or unsaturated.

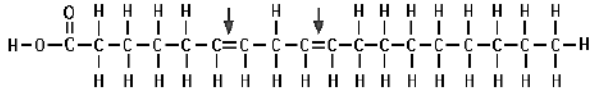
3. _____ **Acid** - More than one double bond



Butyric Acid-Saturated Fatty Acid



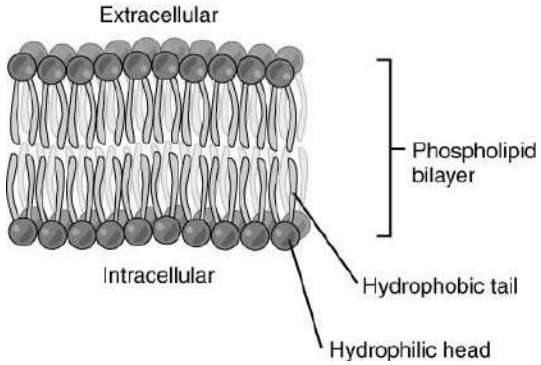
Oleic Acid- Monounsaturated Fatty Acid



Linoleic Acid- Polyunsaturated Fatty Acid

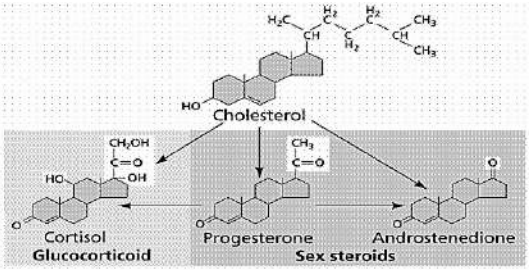
- Most <u>animal fats</u> have a high proportion of saturated fatty acids & exist as solids at room temperature (butter, margarine, shortening).
- _____ (indicator) can turn a variety of colors in the presence of lipids.
- Most <u>plant oils</u> tend to be low in saturated fatty acids & exist as liquids at room temperature (oils).

4. _____ - Cell membranes are made of lipids called phospholipids.



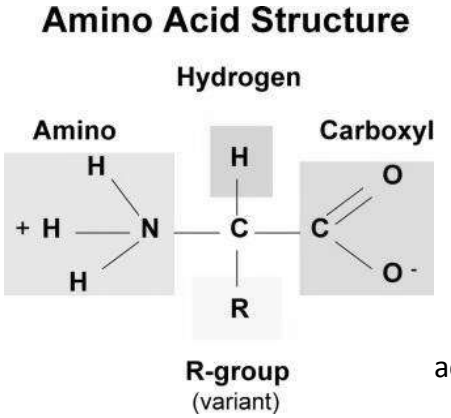
- Phospholipids have a head that is polar & attract water (_____).
- Phospholipids also have 2 tails that are nonpolar and do not attract water (_____)
- _____–
  - The carbon skeleton of steroids is bent to form 4 fused rings.

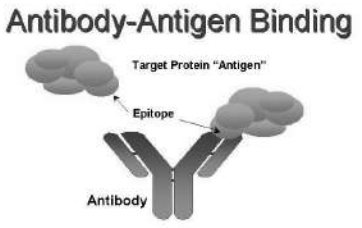
- _____is the "base steroid" from which your body produces other steroids.



Proteins

- **Characteristics**
  1. Composed of
     - _____
  2. Monomer
     - _____
       - 20 different (1 mod)
       - Most structural variation
- **Functions**
  1. Essential to Life – _____(indicator) turns purple/lavender with protein, pink with amino acid.
  2. Build _____
  3. _____:
     - Makes up _____tissue
  4. _____:
     - Carries oxygen in an organism (hemoglobin).
  7. _____:





- Helps fight off foreign invaders
- antibodies

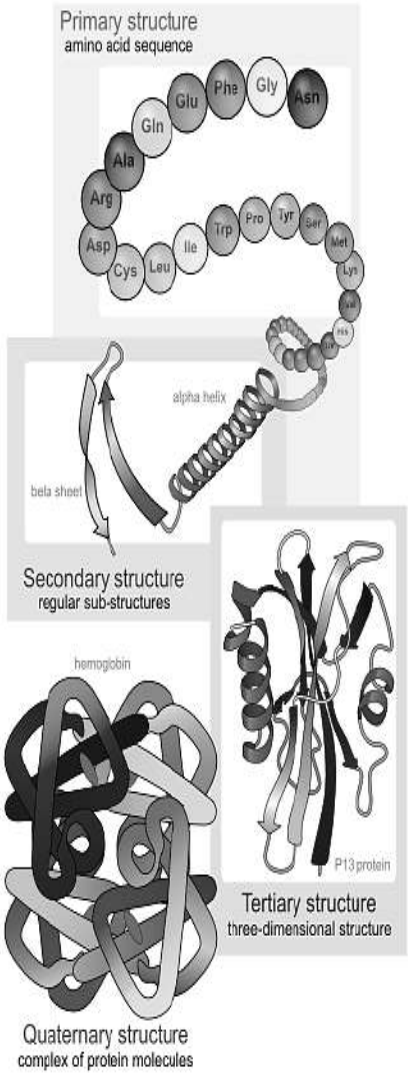
8. _____: (more below)

- Speed up chemical reactions
- amylase and pepsin

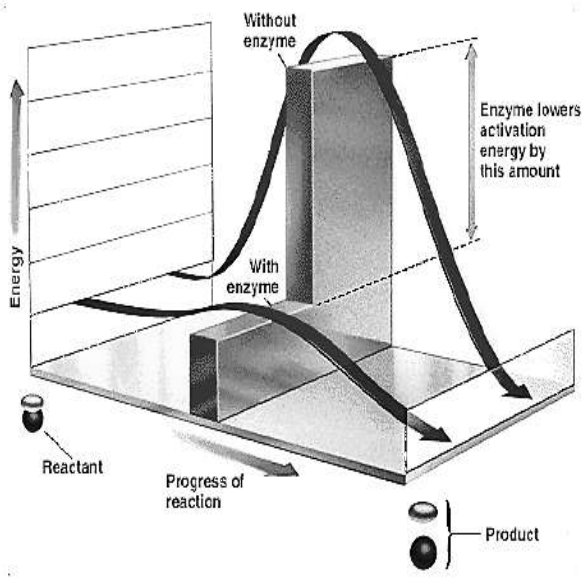
9. _____source

- 1 gram = 4 kcal of energy

- **Polymer**: **Polypeptide**
  - _____bonding links
  - _____Bond
- _____**Shapes**
  - The _____**structure** is the specific sequence of amino acids in a protein. Called a _____.
  - _____**protein structures** occur when protein chains coil(helix) or fold(pleated)
  - When protein chains called polypeptides join together, the _____**structure** forms because R groups interact with each other.



- Secondary structures bent and folded into a more complex 3-D arrangement of linked polypeptides
- Bonds: H-bonds, ionic, disulfide bridges (S-S)
- _____**Structure**: Composed of 2 or more "subunits".

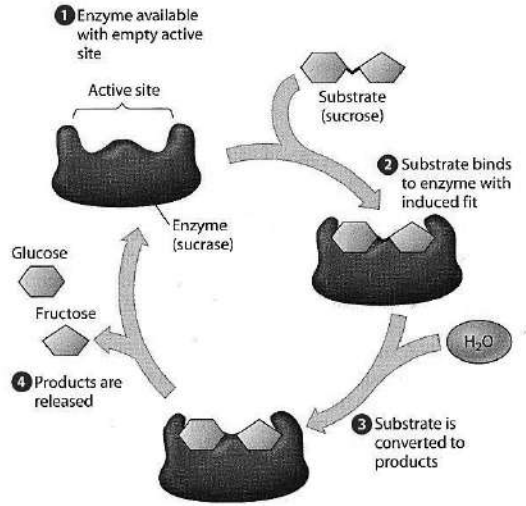


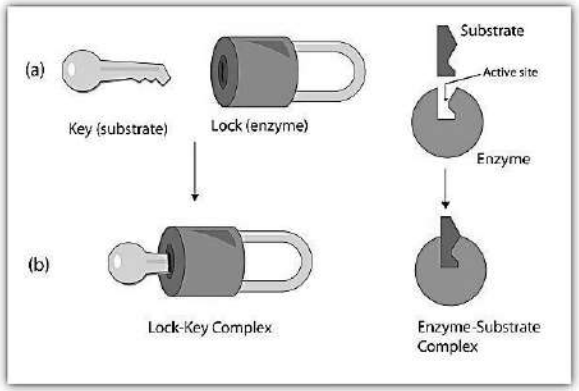
_____Activity

- **Many proteins act as biological catalysts or enzymes.**
  1. Thousands of different enzymes exist in the body.
  2. Enzymes control the rate of chemical reactions by weakening bonds, thus _____the amount of _____energy needed for the reaction.
  3. This is accomplished by binding to the reactants.
  4. They will then twist or bend the material, lowering the energy needed to split it.
- **The enzyme contains an opening called its _____(active) site.**
  1. This site is specific for the object it will hold, called the _____.
  2. There are just as many enzymes as there are substrates.

3. The enzyme system is the enzyme and substrate combined.

- Most are _____.
- They _____the activation energy of a reaction.
- They _____the reaction…
- They are _____to the substrate.
  - They allow the substrate to fit into the active site like a ball into a glove, holding it tight. (_____ ***Model***)
  - They can be reused – _____.
  - Some Common Enzymes:



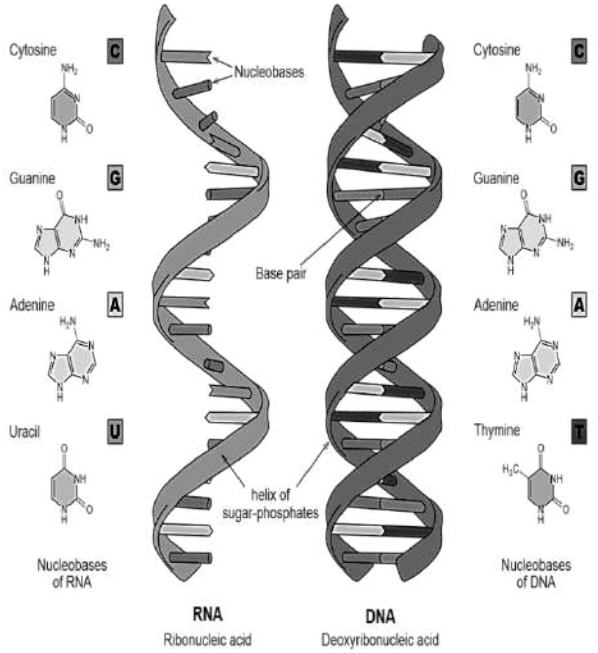


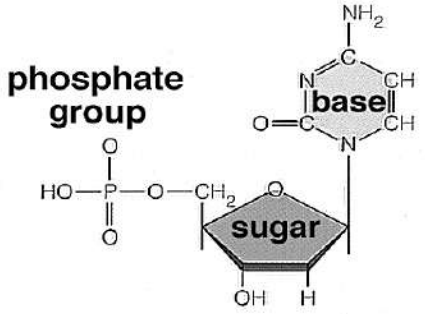
Active Site	Enzyme	Effect on Food
mouth	*salivary amylase*	breaks down starches into disaccharides

stomach	*pepsin*	breaks down proteins into peptides
small intestine (from pancreas)	*amylase*	continues starch breakdown
small intestine (from pancreas)	*trypsin*	continues breakdown of protein
small intestine (from pancreas)	*lipase*	breaks down fat
small intestine	*maltase, sucrase, lactase*	breaks down remaining disaccharide into monosaccharide
small intestine	*peptidase*	breaks down di-peptides into amino acids

_____

- **Two types:**
  1. **_____ acid (_____-double helix)**
  2. **_____acid (_____-single strand)**
- **Nucleic acids** are composed of long chains of _____(monomer) linked by dehydration synthesis.
- Composed of the Elements:_____



	● **Nucleotides** include: – A _____group – A _____sugar (5-carbon) – A _____bases: – _____(A) – _____(T) - ***DNA only*** – _____(U) - ***RNA only*** – _____(C) – _____(G) 
Notes Summary	
