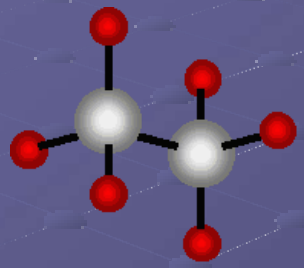
SNS COLLEGE OF ENGINEERING
Kurumbapalayam (Po), Coimbatore – 641 107
AN AUTONOMOUS INSTITUTION
Accredited by NAAC–UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

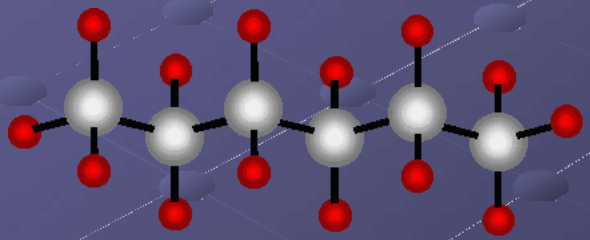
Biomolecules

- What is an organic compound?
- What is so special about Carbon?

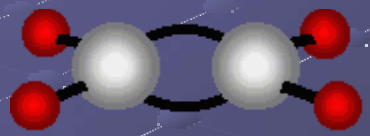
- Compounds containing C, H, O and often N, P, & S.
- Organic compounds make up all living things and are necessary for life.
- It can combine to form long chains which act as the backbone of large molecules.
- **Macromolecules** – giant molecules.

- How does carbon bond?

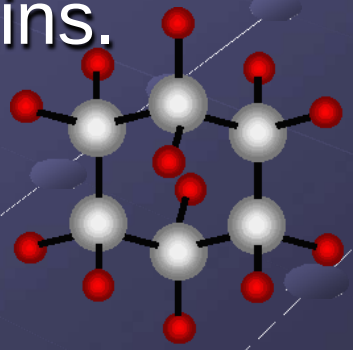


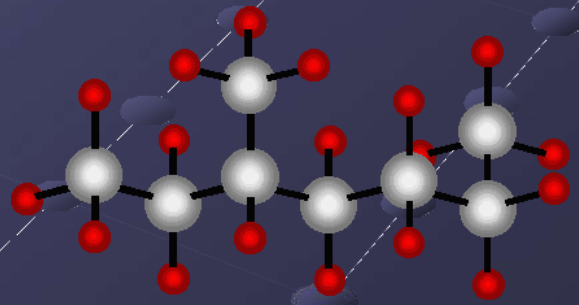


- Carbon needs to bond 4 times to fill it's outer shell.
- It can form single, double or triple covalent bonds.



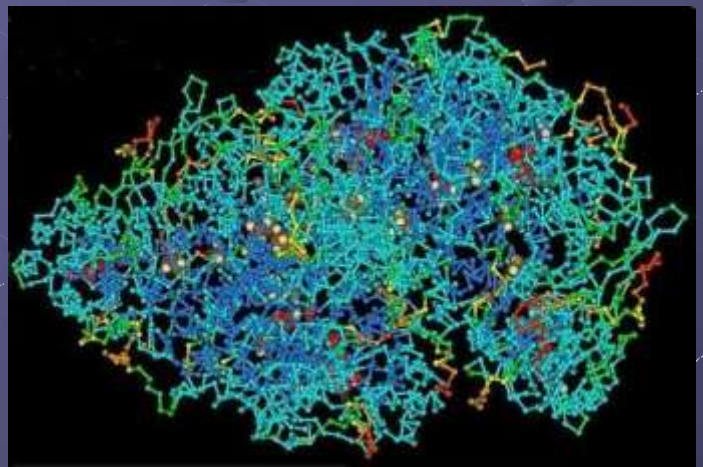
- Carbon can form straight chains, rings or branched chains.



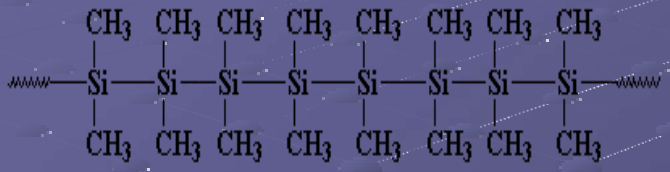


- Very large molecules.
- Carbon compounds can vary greatly in size. Some contain just one or two C atoms, others can have 10 or even 1000 C atoms.

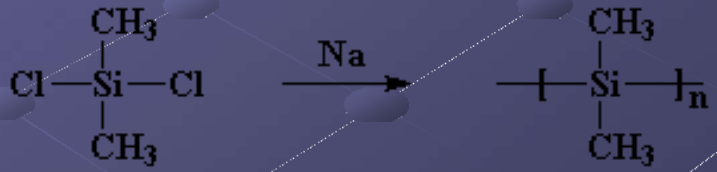
- Macromolecules form when many smaller molecules bond together.



- What is a polymer?



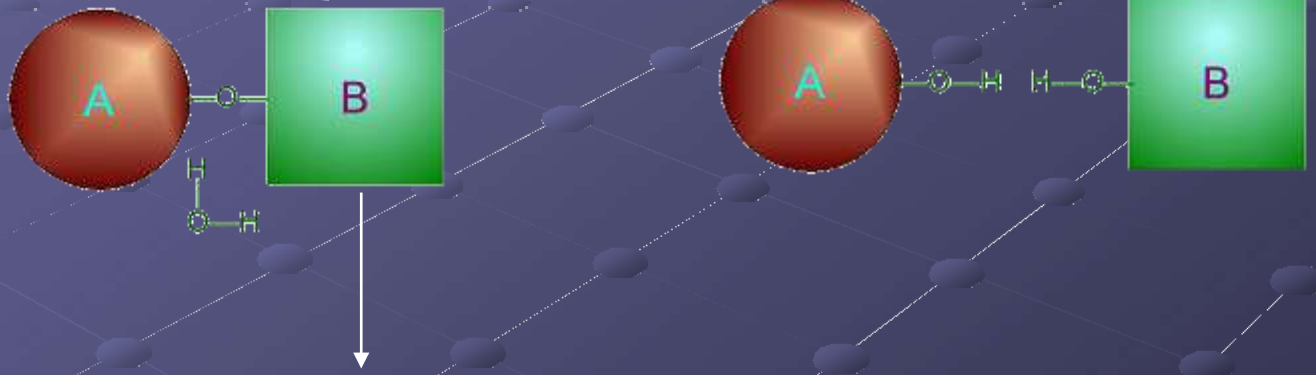
- What is a monomer?



- A molecule made up of many smaller molecules.
- Formed by a reaction called dehydration synthesis – which means water must be removed to bond them together.
- The building block of a polymer. Varies depending on the type of molecule being built

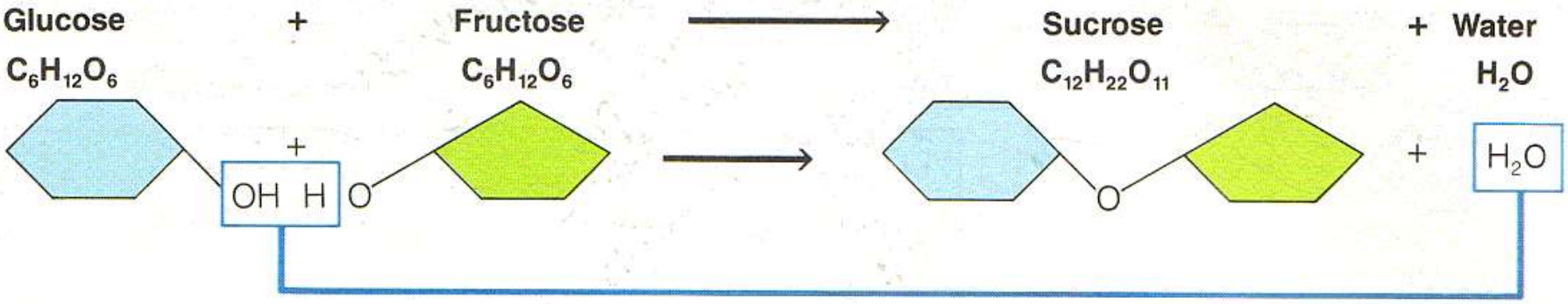
- How are polymers broken down?
- By a chemical reaction known as hydrolysis. Water is added back in and the monomers separate.

Monomers

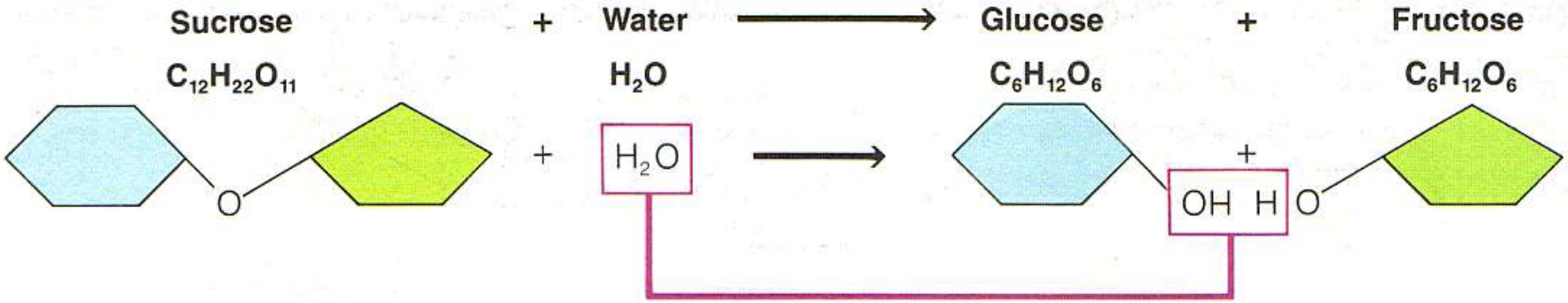


- This is dehydration synthesis

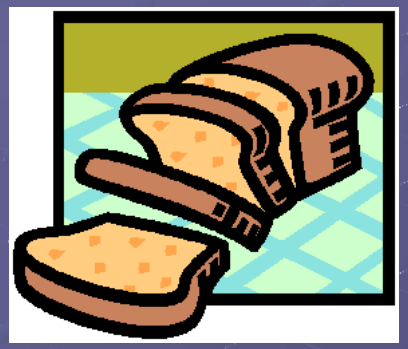
DEHYDRATION SYNTHESIS



HYDROLYSIS

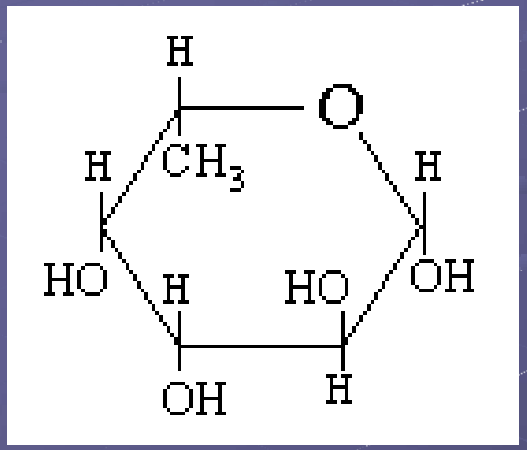


- What is a carbohydrate?



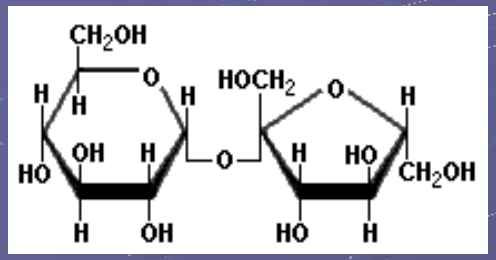
- Organic compound composed of C, H, & O in a 1:2:1 ratio
- $C_6H_{12}O_6$
- 3 types – monosaccharides, disaccharides and polysaccharides.
- Function: main source of energy for all living things.
- Some structure (ex plant cell walls)

- What is a monosaccharide?



- Simple sugar – only one sugar.
- Contains 3 – 7 carbon atoms in their skeleton.
- Can take ring form or straight chain form.
- **<u>** monosaccharides are the building blocks for all larger carbs **</u>**

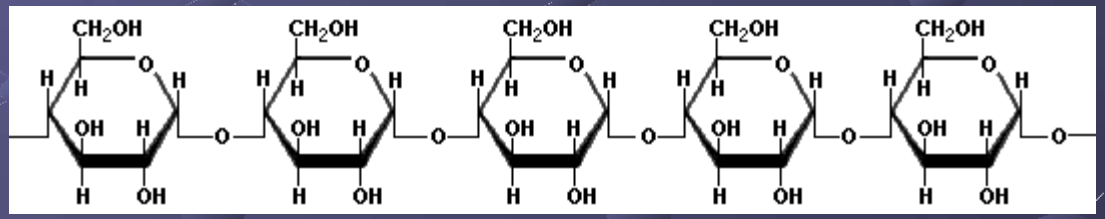
- What is a dissaccharide?



- What is a polysaccharide?

- Two monosaccharides combined minus water.
- Sucrose = glucose + fructose

- When many monosaccharides combine to form a large carbohydrate.
- Have no fixed size, but must be broken down into simple sugars to be used by the cell.
- Ex. Starch and cellulose



- **Summary – 3 Types of Carbohydrates**
- 1. monosaccharides – single sugar.
  - Ex. Glucose, fructose, galactose
  - Aka – simple sugars
- 2. Disaccharide: 2 simple sugars
  - Ex. Sucrose (table sugar) maltose
- 3.polysaccharides: 3 or more sugars (complex carbs)
  - Ex. Cellulose – used in cell walls
  - Starch stores energy in plants
  - Glycogen – stored energy in animals

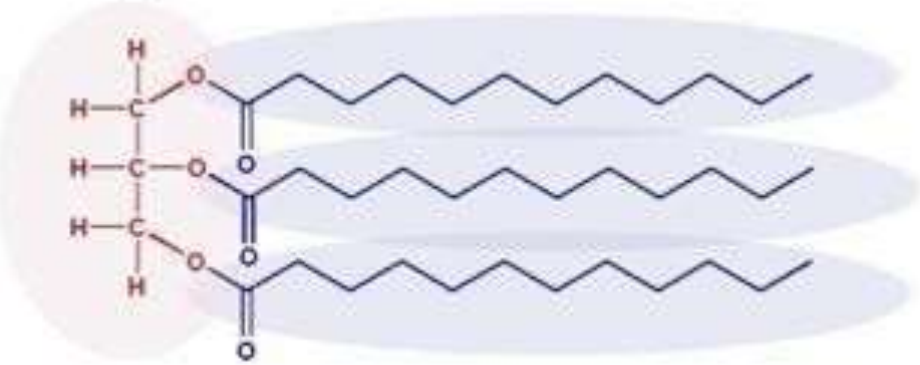
- What are lipids?

- Organic compounds made up of C, H, & O, but not in any fixed ratio.
- **The building blocks of lipids are fatty acids.**
- Usually 3 fatty acids combine with one glycerol to form a triglyceride.
- properties of fats and oils are determined by the fatty acids that make them up.

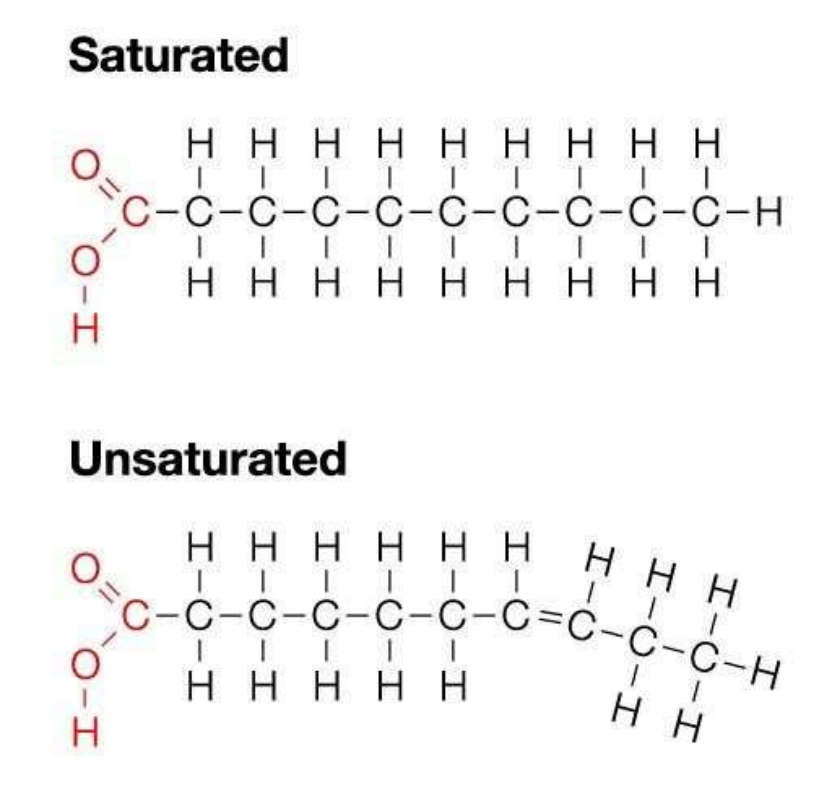
Glycerol

A "free" Fatty Acid

Triglyceride



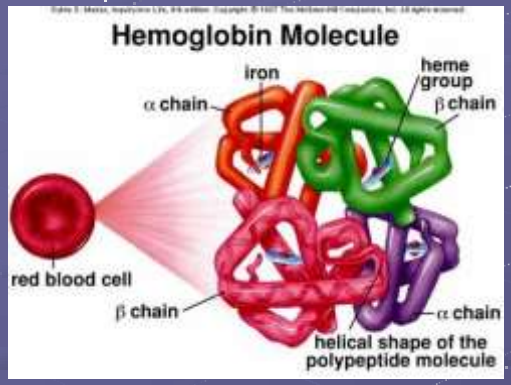
- What is a saturated fat?
- What is an unsaturated fat?
- All the carbon atoms are joined by single bonds (usually solid fats)
- The carbon chain contains double or triple bonds (usually oils)



- What is the function of lipids?

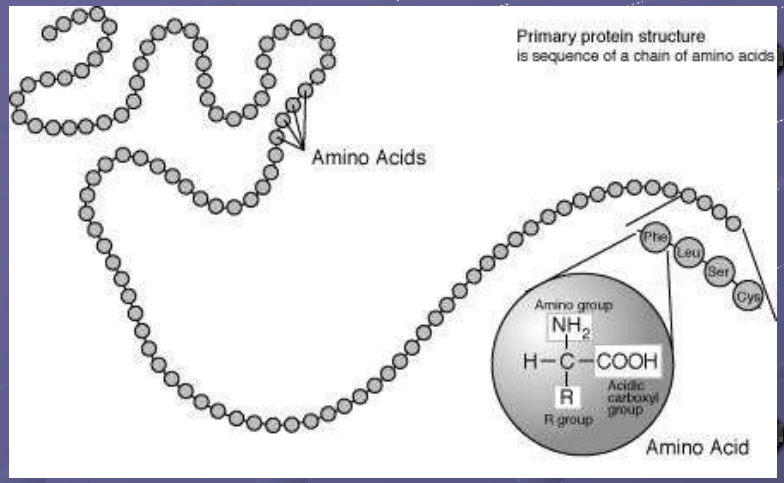
- Lipids are often called fats or oils, but are large macromolecules with 2 primary functions:
- 1. long term energy storage
- 2. building cell membranes.

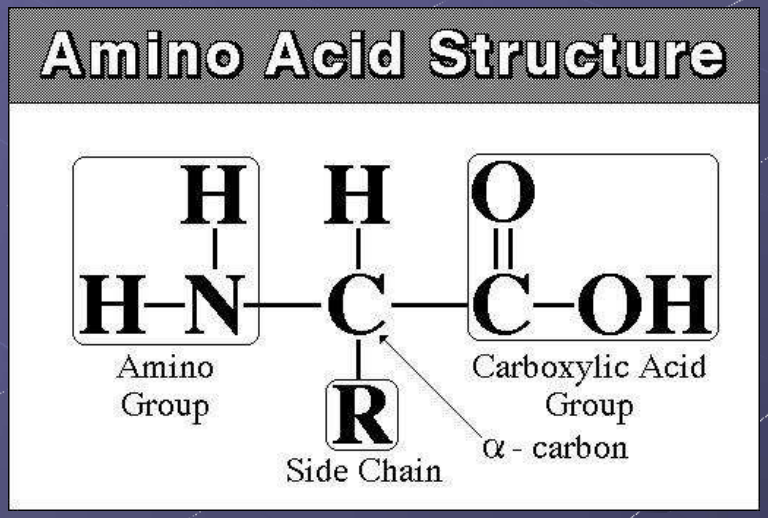
- What are proteins?



- Organic compounds that contain C, H, O & N.
- Every cell contains protein.
- Functions of protein:
  - Used in structural components.
  - Messengers and receptors on the cell membrane
  - Defend against disease
  - Act as facilitators for chemical reactions (ENZYMES)

- What are amino acids?



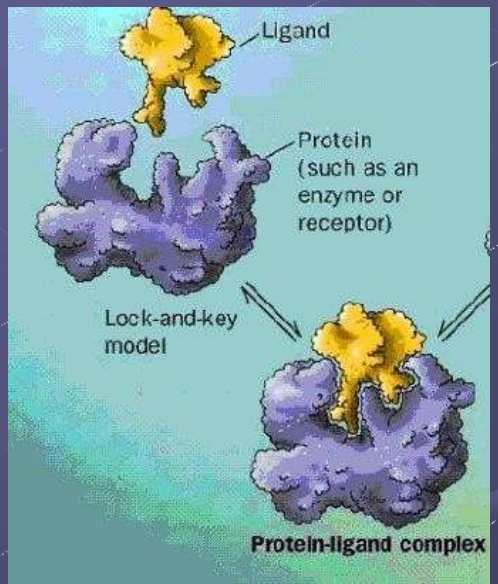


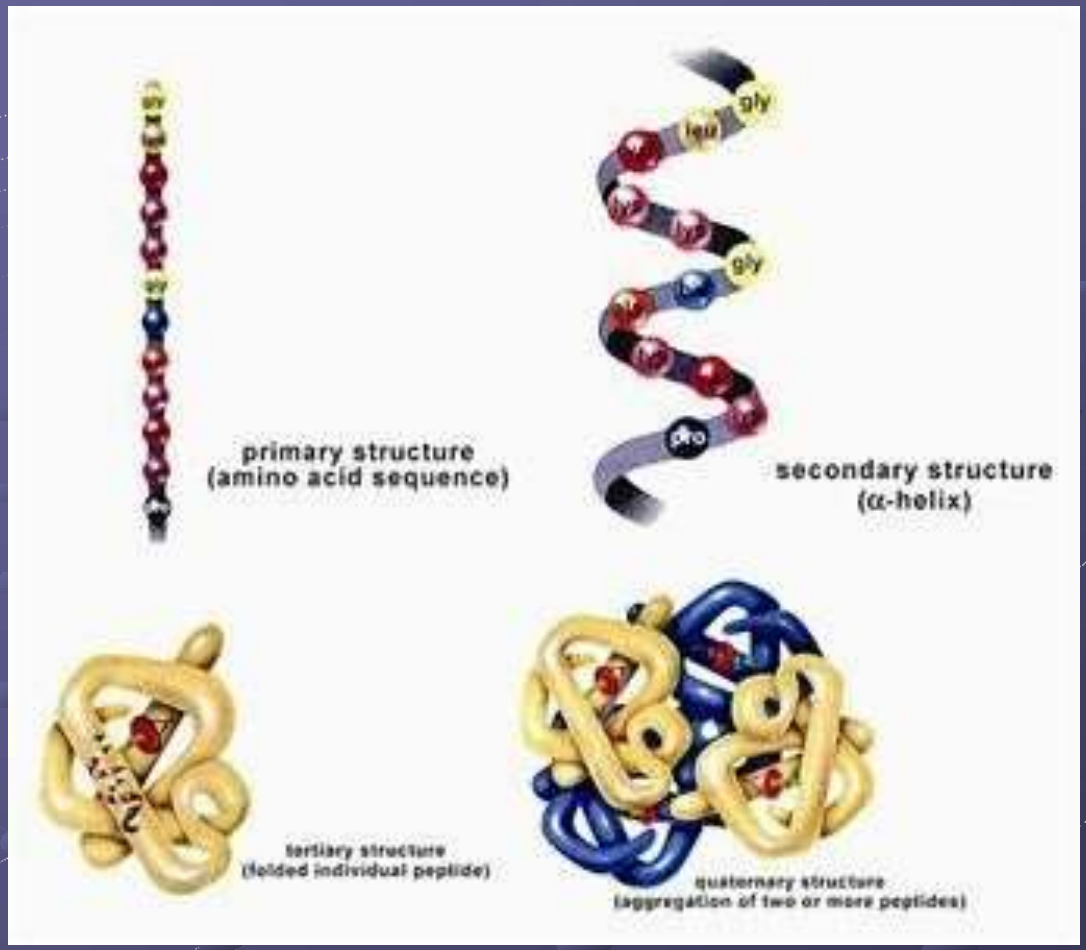
- **<u>Amino acids the building blocks of proteins!!</u>**
- They consist of a central carbon atom with a H, a –COOH, a NH_2 and a “R” group attached.
- The “R” group is different for each of the 20 different amino acids.

- What is a peptide bond?

- The bond that holds together amino acids into a large macromolecule called a polypeptide.
- Longer polypeptides are called proteins and can be made up of 50 – 300 amino acids.

- The order of amino acids give a protein its shape. The shape determines the protein's function.
- Even one amino acid out of place will prevent a protein from doing its job.
- Proteins that speed up the rate of chemical reactions
- Without enzymes chemical reactions would occur too slowly for life to exist.

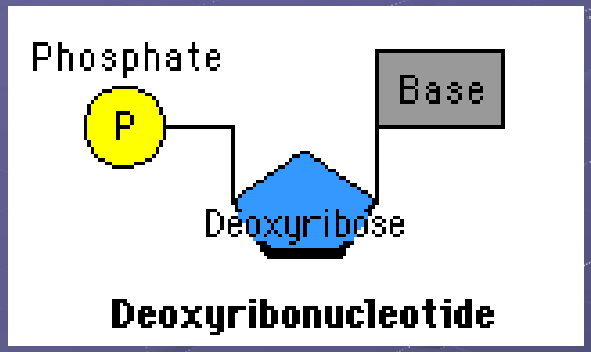



primary structure
(amino acid sequence)
gly
gly
pro
secondary structure
(α-helix)
tertiary structure
(folded individual peptide)
quaternary structure
(aggregation of two or more peptides)

- What are nucleic acids?

- Organic molecule made up of C,H,O,N,& P
- Nucleic acids are passed from parent to offspring, you get one copy from each parent for a total of 2 complete sets.
- Nucleic acids dictate amino acid sequence in proteins which in turn control all life processes.
- DNA forms the genes or units of genetic material that determine your characteristics.

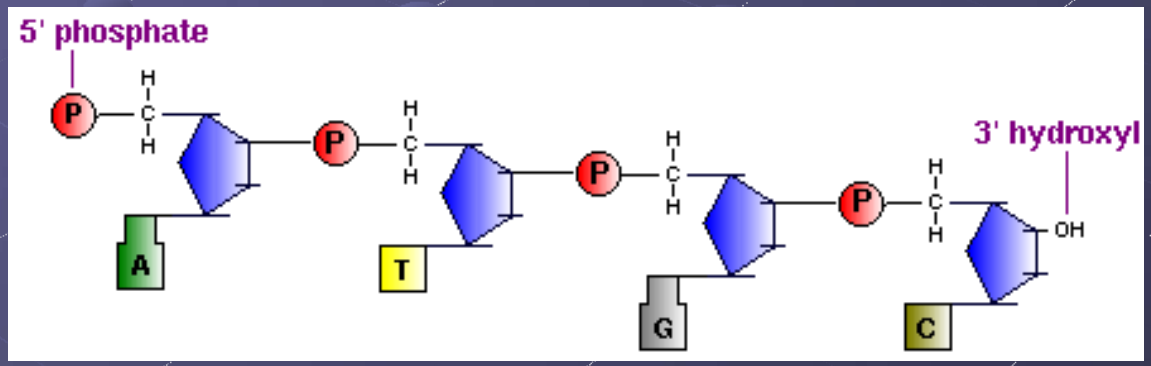
- What is a nucleotide?



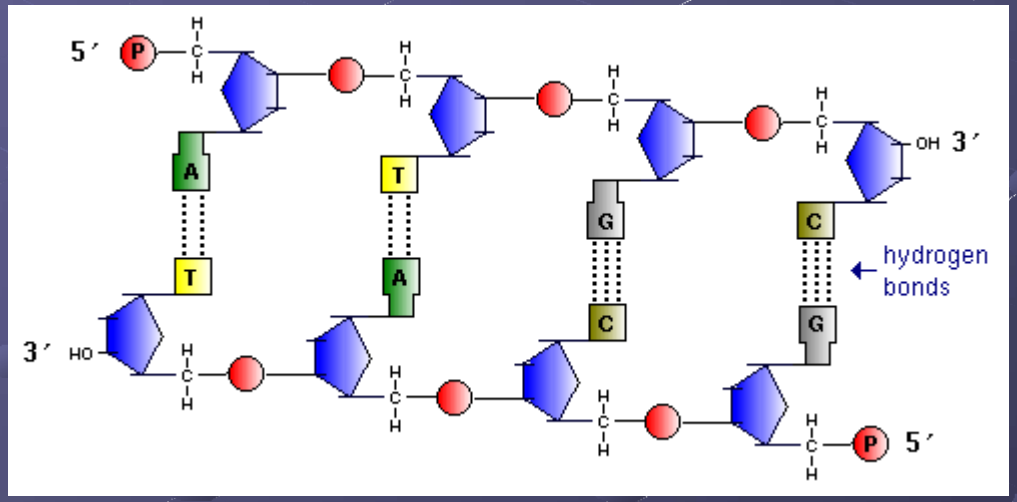
- **<u>Nucleotides are the building blocks of Nucleic acids</u>**.
- Each nucleotide is made up of 3 parts:
  - A 5 Carbon sugar (deoxyribose or ribose)
  - A phosphate group
  - A nitrogen base (a ring containing C, H, & N)

- What are the different types of nucleotides?

- Adenine, guanine, cytosine thymine, and uracil.
- Thymine is only in DNA, uracil is only in RNA.
- Adenine pairs with thymine (uracil)
- Guanine pairs with cytosine.
- Nucleotides link together between sugars and phosphates, nitrogen bases stick out.



- What is DNA?
  - Deoxyribonucleic acid
  - Contains the sugar deoxyribose.
  - The molecule of heredity.
  - Double stranded, sugar and phosphates form the back bone, paired nitrogen bases hold the two strands together.
  - The shape is called a double helix.



- What is RNA?
  - Ribonucleic acid
  - Contains the sugar ribose, uracil replaces thymine.
  - Single stranded.
  - 3 types each with a different function
    - Ribosomal
    - Transfer
    - messenger