ORGANIC CHEMISTRY

Organic compounds are synthesized by cells and contain Carbon – made of carbon skeleton.

Carbon skeletons are attached at a FUNCTIONAL GROUP – which is the area that participates in chemical reactions.

Functional Group	
Hydroxyl	-OH
Carboxyl	-COOH
Amino	$-NH_2$

BUILDING macromolecules (AKA. organic compounds):

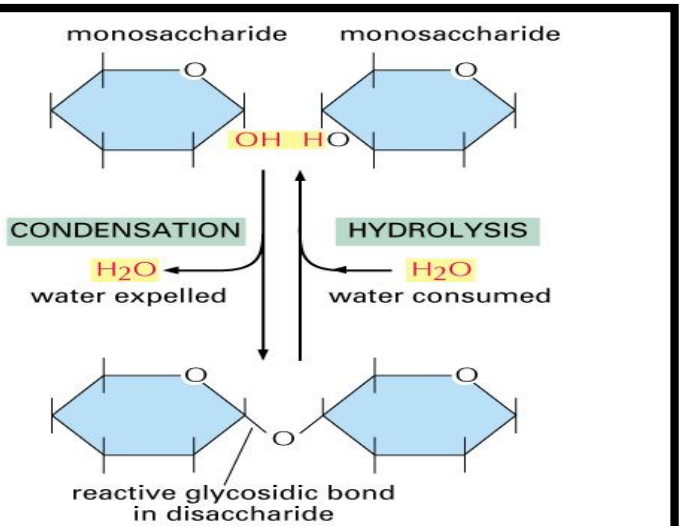


Figure 2–19. Molecular Biology of the Cell, 4th Edition.

- Macromolecules are large molecules called polymers.
- These polymers are composed of monomer subunits.

REACTIONS

Condensation (dehydration synthesis) – monomers are connected to produce polymers; releases H_2O during the reaction

Hydrolysis – polymers are broken down into their monomers; H_2O is needed for the reaction to occur

ENZYMES assist in both reactions!

4 Types of Macromolecules

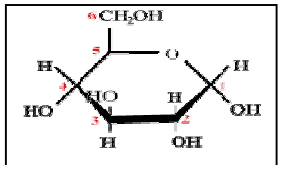
1. CARBOHYDRATES –

FUNCTION

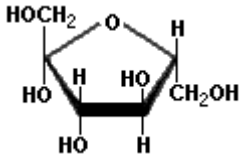
- consist of C, H, O
- Main source of energy – breakdown of sugar supplies *immediate energy* to cells; excess is stored as complex sugars in cells

Monosaccharide	Disaccharide	Polysaccharide
Simple sugar (monomer) Formula $C_6H_{12}O_6$	Complex sugars (polymer) Formed by the combination of monosaccharides	
EXAMPLES OF SACCHARIDES -		
glucose, fructose, galactose **shape of molecule will determine how it reacts**	sucrose, lactose, maltose	Cellulose stored in cell walls of plants for structural support. Glucose produced by photosynthesis is stored as Starch (amyl0se) in plants. Glycogen is stored in liver & muscle cells of animals.

Glucose

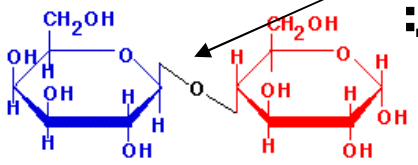


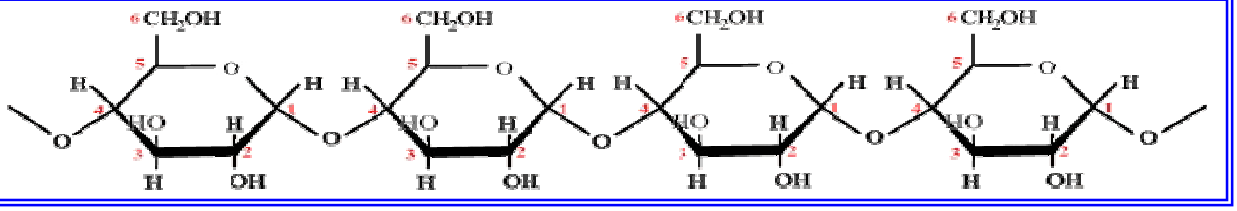
Fructose



LACTOSE

Glycosidic Linkage



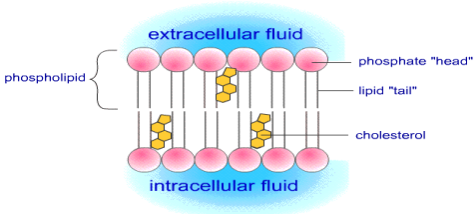


2. LIPIDS -

- consist of C, H, O
- waxes, oils, fats, steroids (cholesterol & sex hormones)
- hydrophobic – **insoluble** in water

FUNCTIONS

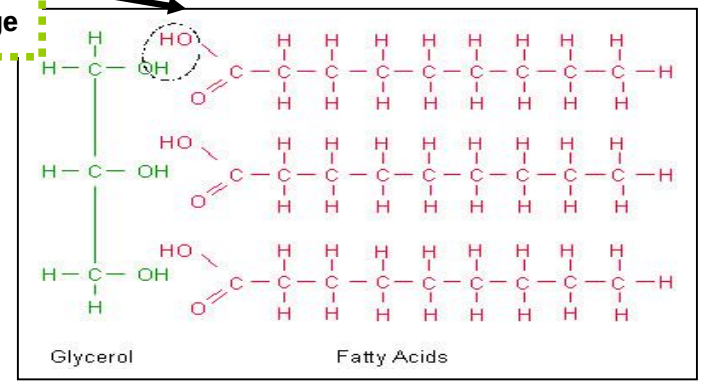
- Energy Storage – breakdown of lipids provides long-term energy supply; excess is stored in fat cells; yields twice as much energy as carbohydrates
- Component of cell membrane (phospholipids)
- provides cushions, insulates and waterproofing (wax)



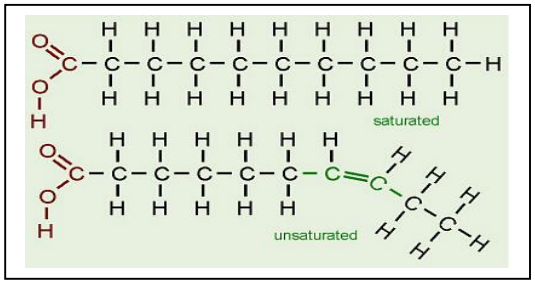
A fat is constructed from two kinds of smaller molecules, glycerol & fatty acids. (monomer)

Formation of LIPID "Triglyceride" -

Ester Linkage



Fatty acid chains can be saturated (solid at room temp) or unsaturated (liquid at room temp).

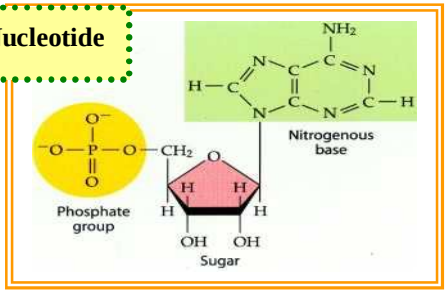


3. NUCLEIC ACIDS –

- consist of C, H, O, N, P
- polymer of nucleotides (monomer)
- stores and transmits genetic information

FUNCTION

Nucleotide

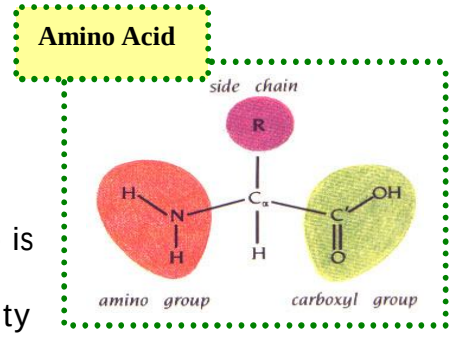


Two types of nucleic acids –
1. DNA (deoxyribonucleic acid) – double strand of genetic information
2. RNA (ribonucleic acid) – single strand copy of DNA used to build proteins

Examples of nongenetic nucleotides - plays a major role in **cell metabolism**
1. ATP (adenosine triphosphate) – carries energy for cellular activities
2. Subunits of coenzymes – enzyme helpers that transport hydrogen atoms plus electrons from one reaction site to another (examples – NAD+, FAD)

4. PROTEINS –

- consist of C, H, O, N, S
- polymers made of **amino acids** (monomer)

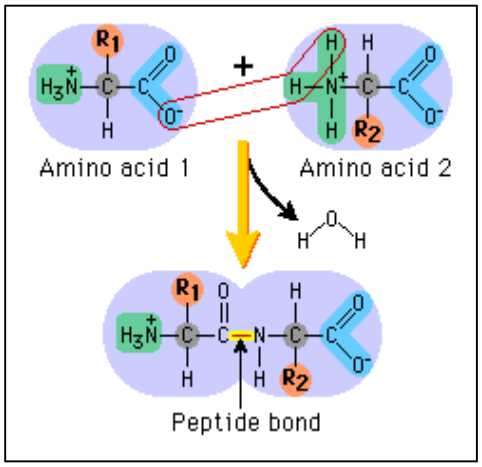


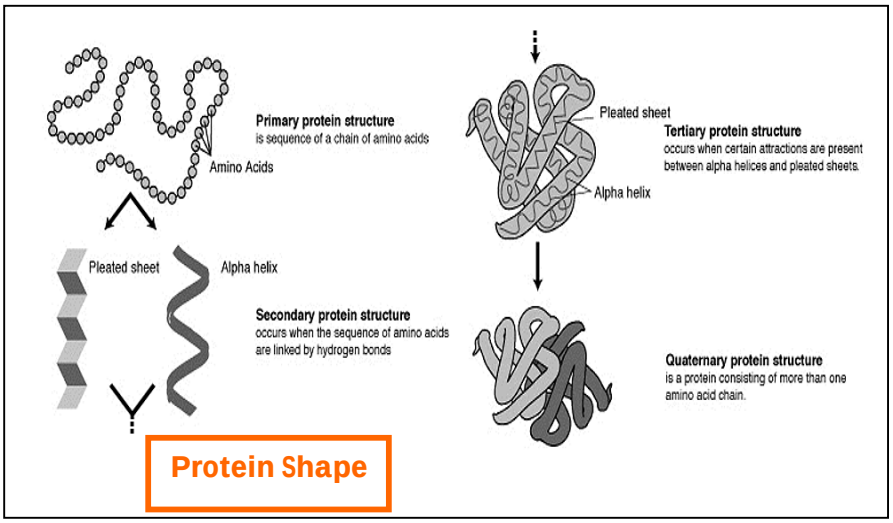
AMINO ACID

- All 20 amino acids have the same structure – but the R group is different.
- The "R" group may vary in size, shape, charge, hydrophobicity and reactivity.
- The sequence of amino acids will **determine which protein is made.**

BUILDING a protein –

- amino group bonds to a carboxyl group of another amino acid
- Bond formed between the amino acids is called a **PEPTIDE bond**.





Function of a protein depends on shape and its ability to recognize and bind to some other molecule.

FUNCTIONS

- Structural element of hair/nails (keratin) & bone/cartilage (collagen)
- Increase rate of reaction as an enzyme (biological catalyst)
- Transport and storage of molecules
- Control of metabolism
- Receptor proteins - signaling from cell to cell
- Tissue defense (antibodies)