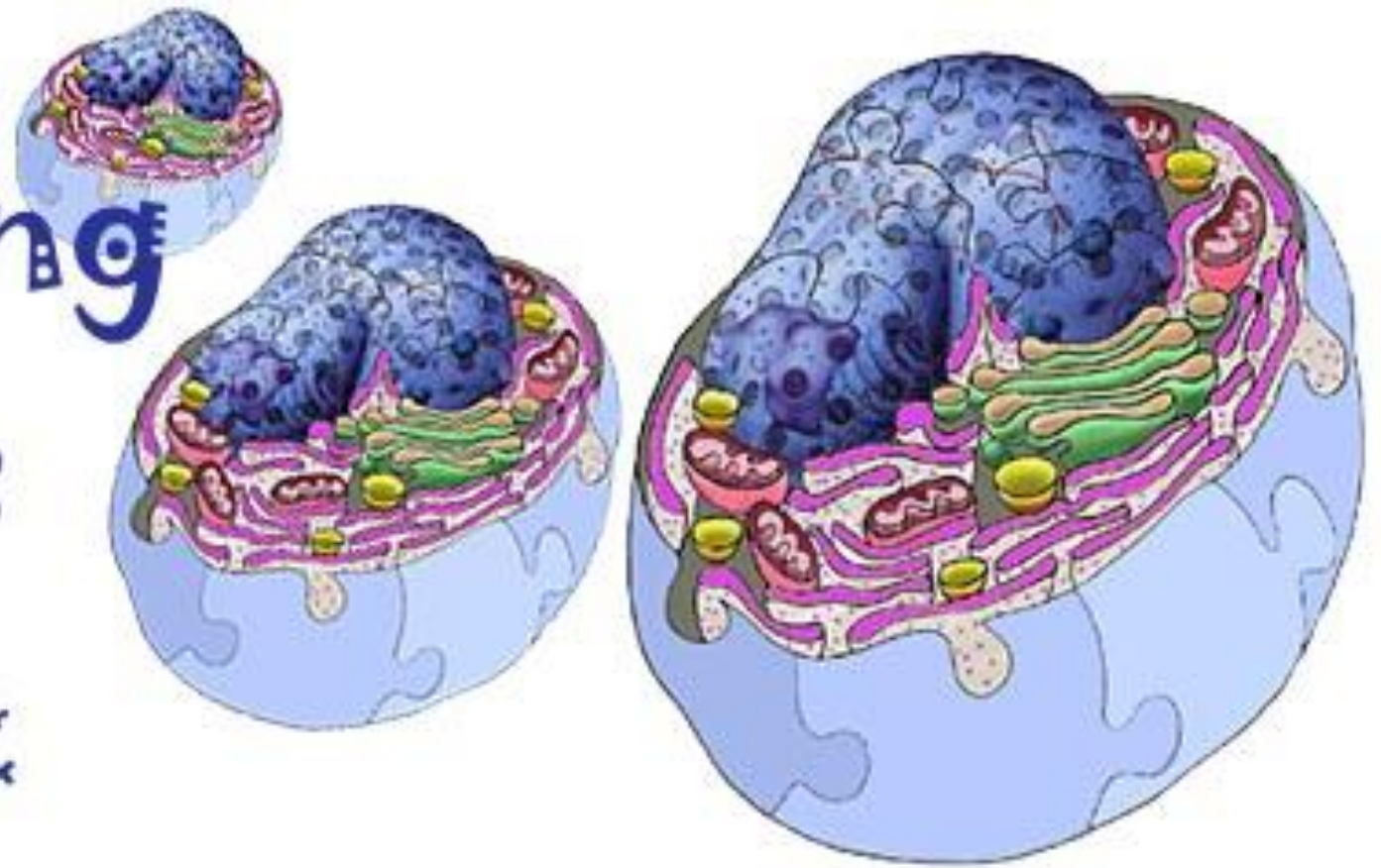
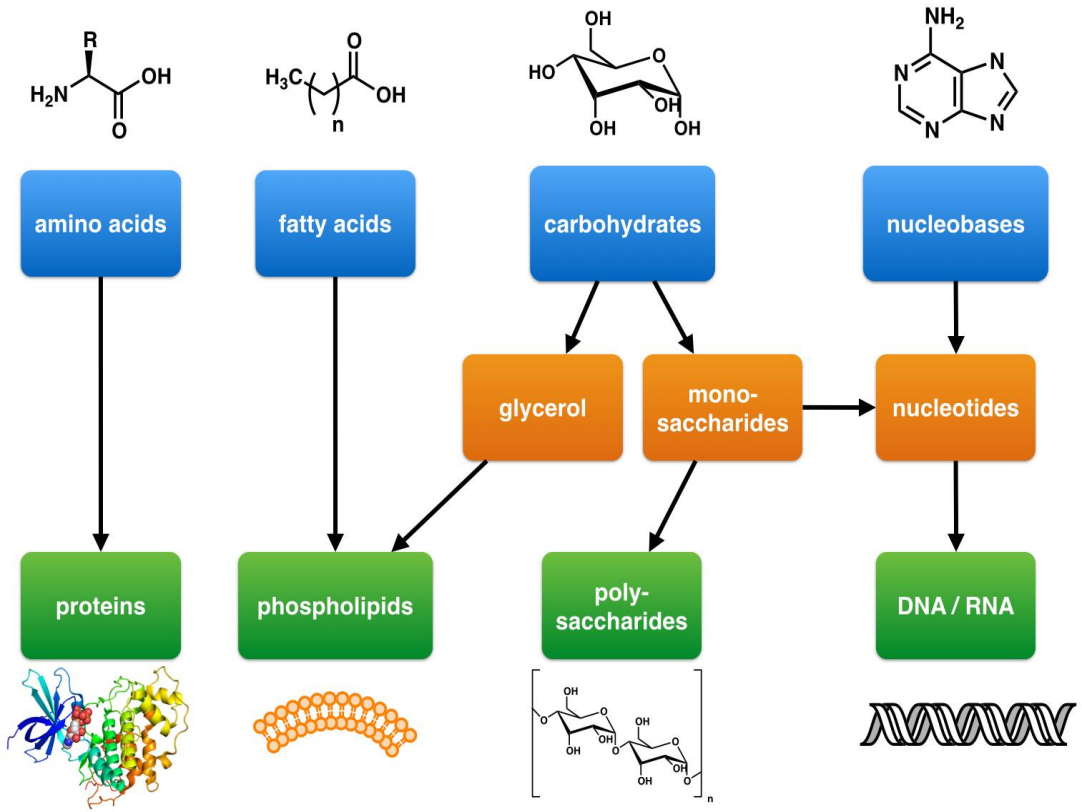
Building Blocks of Life



- Dr. Ahmed Hasan Mohammed

- Carbon based: organic molecules
- Carbohydrates: CHO
- Lipids: CHO, water insoluble
- Proteins: CHONS, structure/function in cells
- Nucleic acids: CHONP, hereditary (genetic) information



CARBON

- Can make 4 covalent bonds
- Chains : Straight, Branched, Ring
- Hydrocarbons2 (C, H): store energy
- Functional groups

1. Attach to carbon
2. Alter chemical properties
3. Form macromolecules

CARBOHYDRATES

- Principally CHO (rare N, S and P)
- 1C:2H:1O ratio
- Energy rich (many C-H bonds)
- Monosaccharides (principal: glucose3)

1. Simple sugars
2. Principle formula: C6H12O6
3. Form rings in water solution

- Disaccharides (sucrose, lactose)
- Polysaccharides (starch, glycogen, cellulose, chitin)

LIPIDS

- C-H bonds (nonpolar) instead of C-OH bonds as in carbohydrates

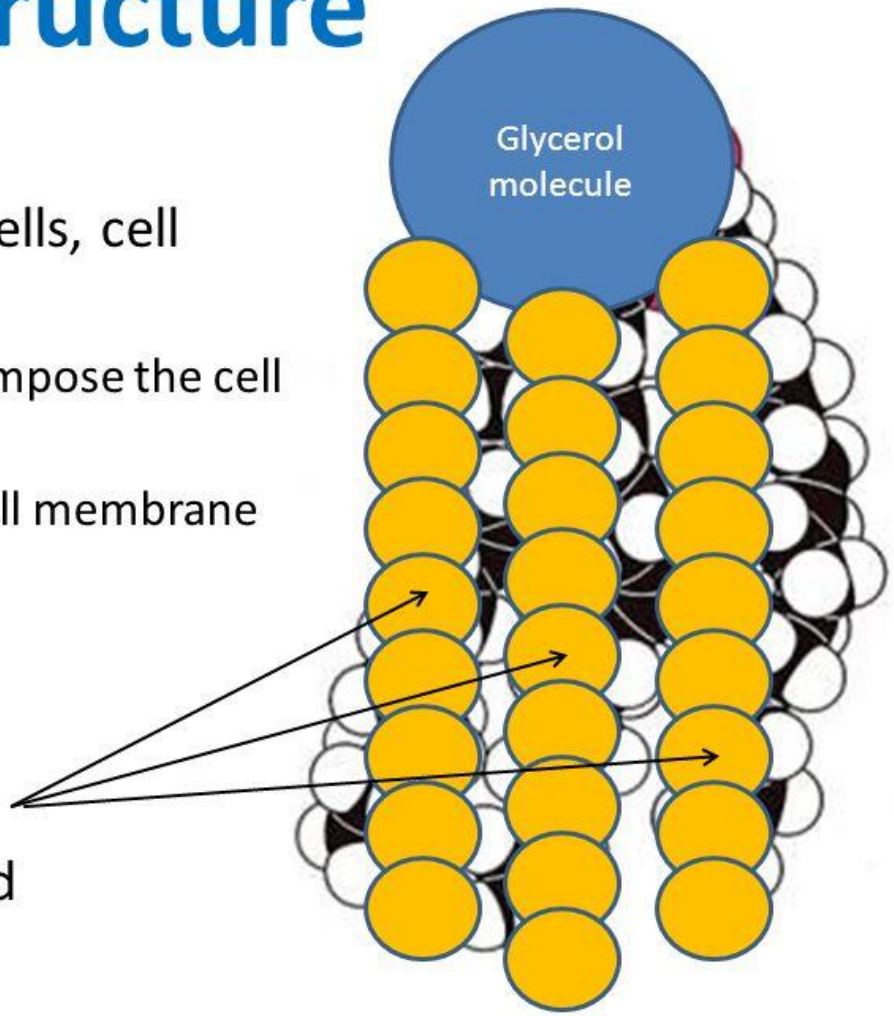
1. High energy
2. Hydrophobic (insoluble in water)

- Categories

1. Fats: glycerol and three fatty acids
2. Phospholipids: primary component of membranes
3. Prostaglandins: chemical messengers (hormones)
4. Steroids: membrane component; hormones
5. Terpenes: pigments; structure

Lipid Structure

- Fats, Oils, Waxes
- Provide energy for cells, cell structure, insulation
  - Lipids & Proteins compose the cell membrane
  - Cholesterol: gives cell membrane flexibility
- Structure (2 parts):
  - "Head" = glycerol
  - "Tails" = fatty acids
- Monomer: Fatty Acid
- Polymer: Lipid



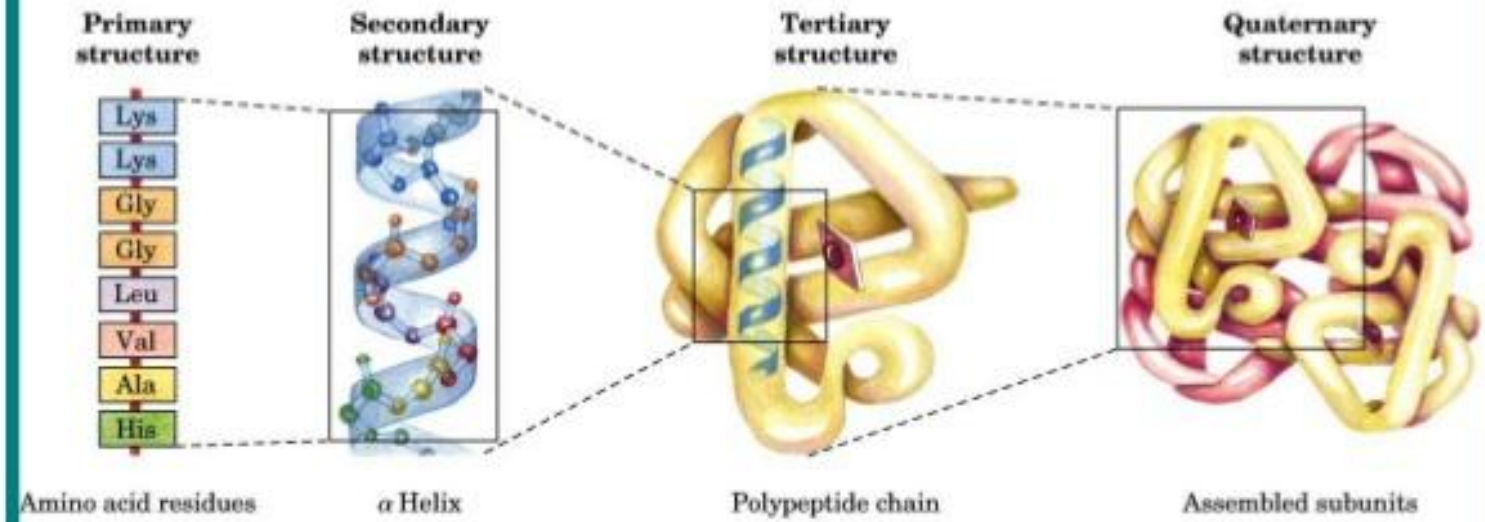
PROTEINS

- Polymer of amino acids: 21 different amino acids found in proteins, Sequence of amino acids determined by gene
- Amino acid sequence determines shape of molecule: Linked by peptide bond (covalent)
- Functions

1. regulate chemical reactions and cell processes [enzymes]
2. form bone and muscle; various other tissues
3. facilitate transport across cell membrane [carrier proteins]
4. fight disease [antibodies]

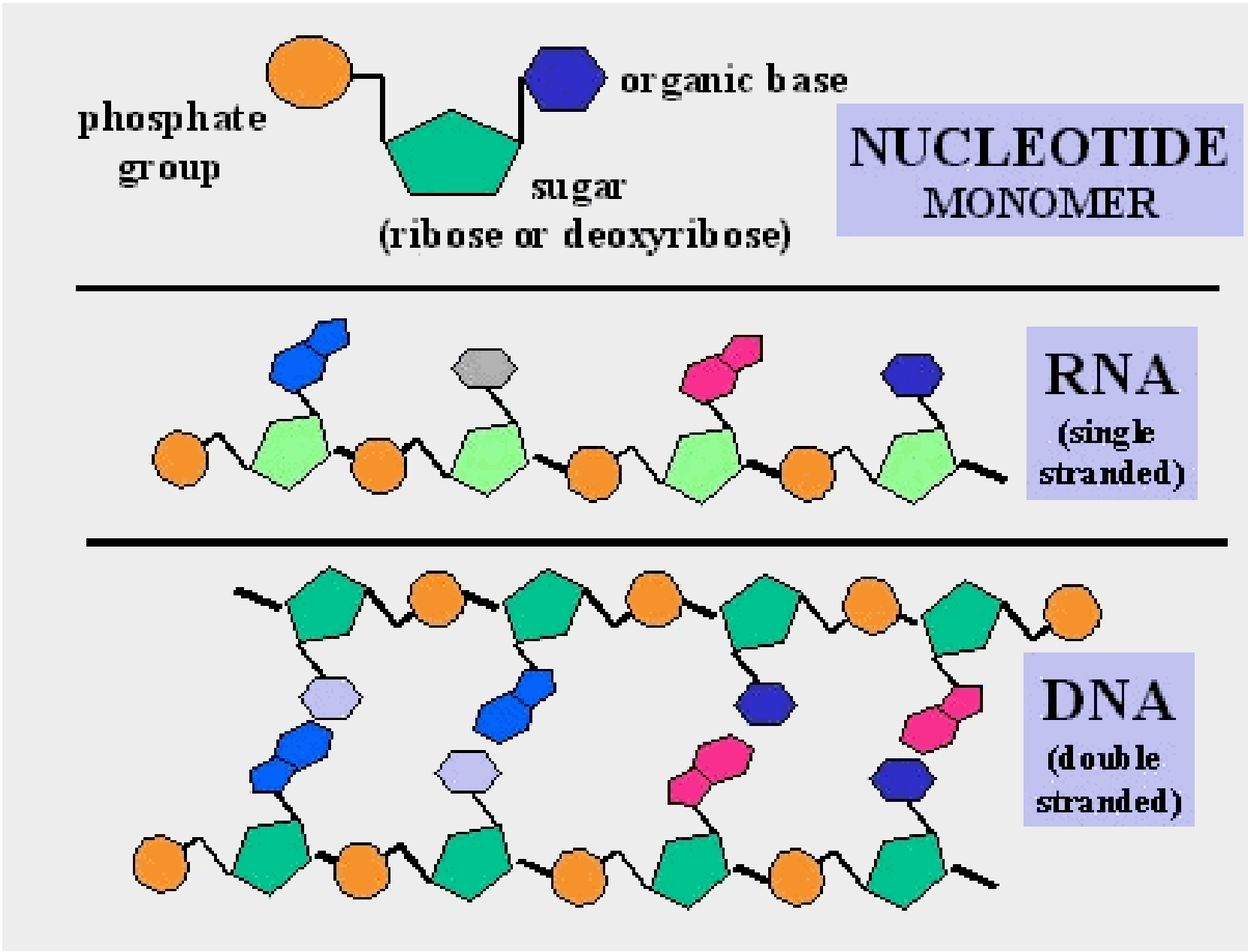
- Motifs: folding patterns of secondary structure
- Domains: structural, functional part of protein often independent of another part; often encoded by different exons
- Shape determines protein's function

Levels of protein structure



HEREDITARY (GENETIC) INFORMATION
• NUCLEIC ACIDS

- DNA: deoxyribonucleic acid
- Hereditary information of all cells
- Hereditary information for many viruses
- RNA: ribonucleic acid
- Hereditary information of certain viruses (HIV5)
- Intermediate in gene expression
- Composed of nucleotides
- Ribonucleotides
- Deoxyribonucleotides


phosphate group
organic base
sugar
(ribose or deoxyribose)
NUCLEOTIDE
MONOMER
RNA
(single stranded)
DNA
(double stranded)