Ministry of Higher Education and Scientific Research
AL-Mustaqbal University College of Science
Department of medical systems

Biochemistry

Lecture 3

Peptides and Proteins

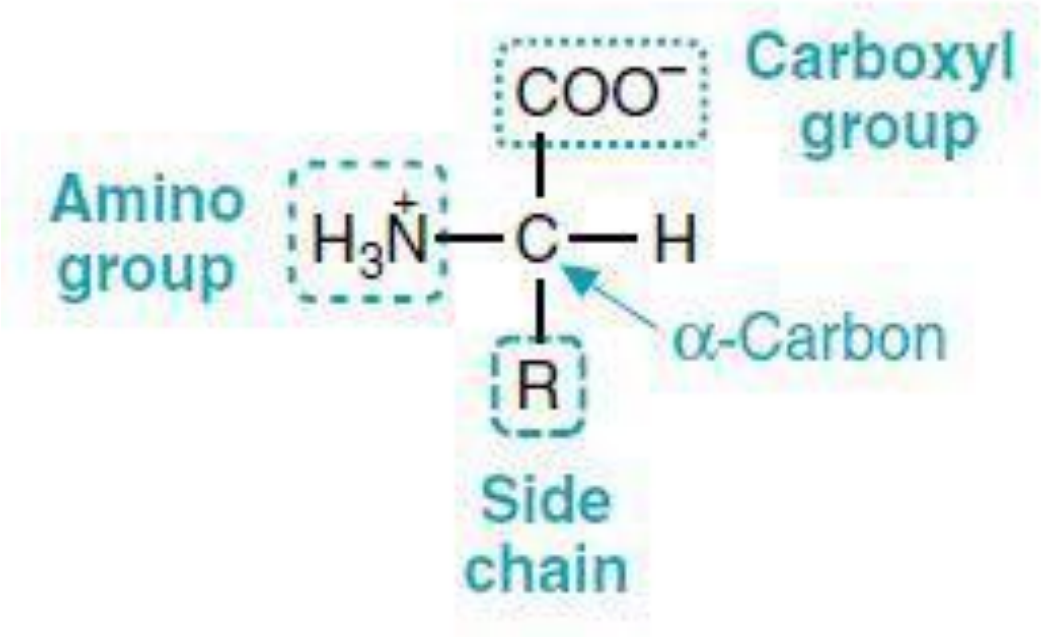
By
Dr. Assel Amer Hadi

Amino Acids and Proteins

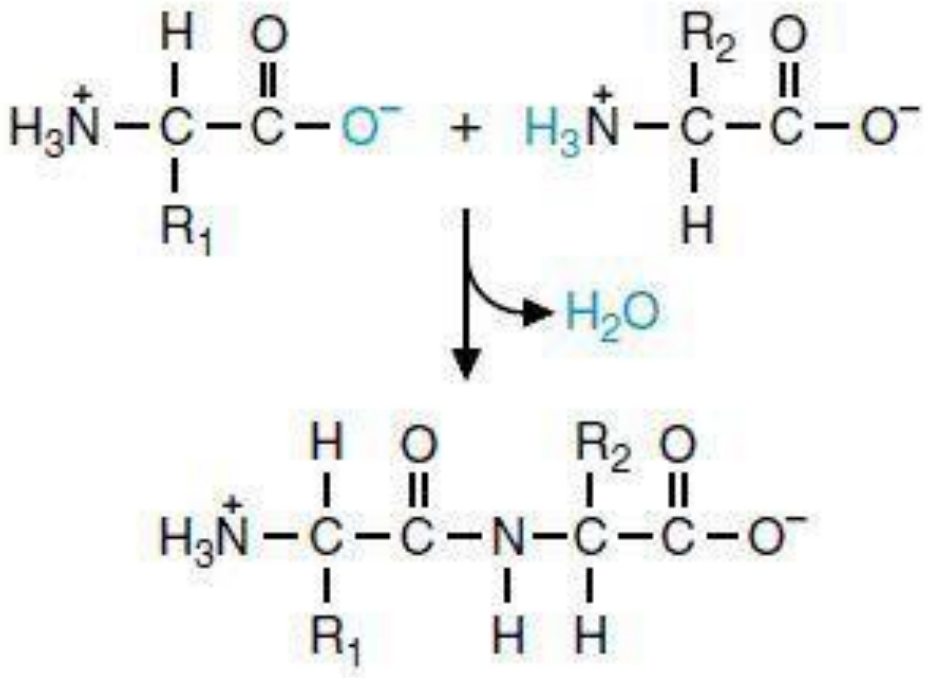
Amino Acids (AA): are the building bases of proteins

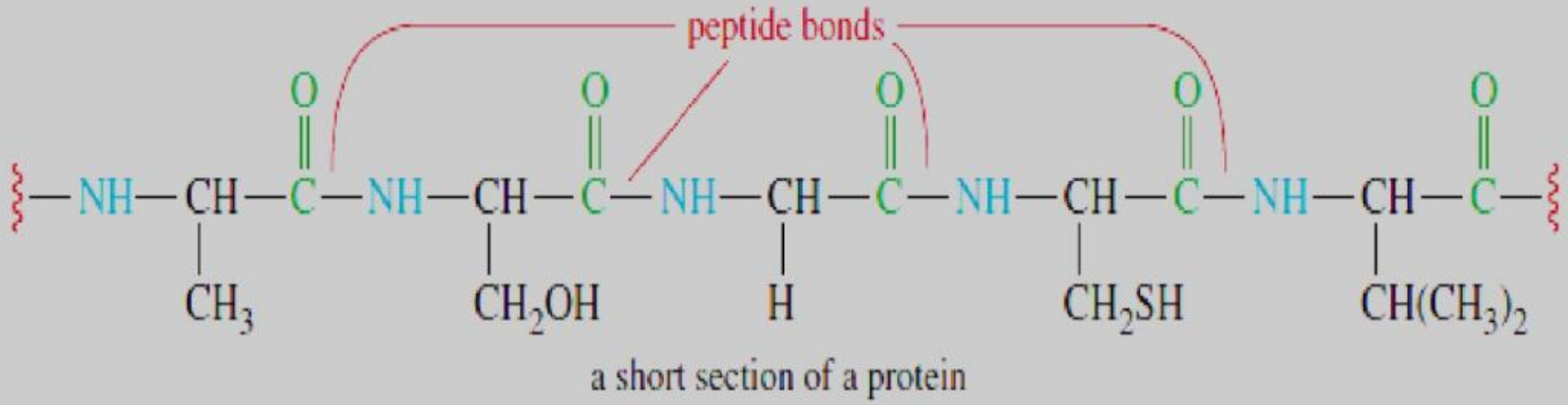
Contain:

Central carbon atom + 4 subgroups {amino group (—NH2), carboxyl group (—COOH), hydrogen atom, and side chain (R)}



Peptides and Proteins: It consists of two or more amino acids linked together by a peptide bonds from the linkage of the alpha-carboxyl group of one amino acid with the alpha-amino of another amino acid. As a result, a water molecule is released.





- **Peptides**: fewer than 50 amino acids
- **Dipeptides**: 2 amino acids
- **Tri-peptides**: 3 amino acids
- **Polypeptides**: more than 10 amino acids
- **Proteins**: more than 50 amino acids

Proteins are:

- Large molecules
- Made up from chains of amino acids
- Are found in every cell in the body
- Are involved in most of the body's functions and life processes

Protein functions include:

1- Enzymes
2- storage
3- defense against foreign substances
4- cellular communications
5- transport
6- structural support

1- Enzymatic proteins

Function: Selective acceleration of chemical reactions

Example: Digestive enzymes catalyze the hydrolysis of bonds in food molecules.

2- Storage proteins

Function: Storage of amino acids

Examples: Casein, the protein of milk, is the major source of amino acids for baby mammals. Ovalbumin is the protein of egg white, used as an amino acid source for the developing embryo.

3- Defensive proteins

Function: Protection against disease

Example: Antibodies that help destroy viruses and bacteria.

4- Transport proteins

Function: Transport of substances

Examples: Hemoglobin, the iron-containing protein, transports oxygen from the lungs to other parts of the body.

5- Structural proteins

Function: Support

Examples: Keratin is the protein of hair. Collagen and elastin proteins provide a fibrous in connective tissues.

Structure of the Protein

Four levels of structure

- Primary structure
- Secondary structure
- Tertiary structure
- Quaternary structure

A protein's structure determines its function

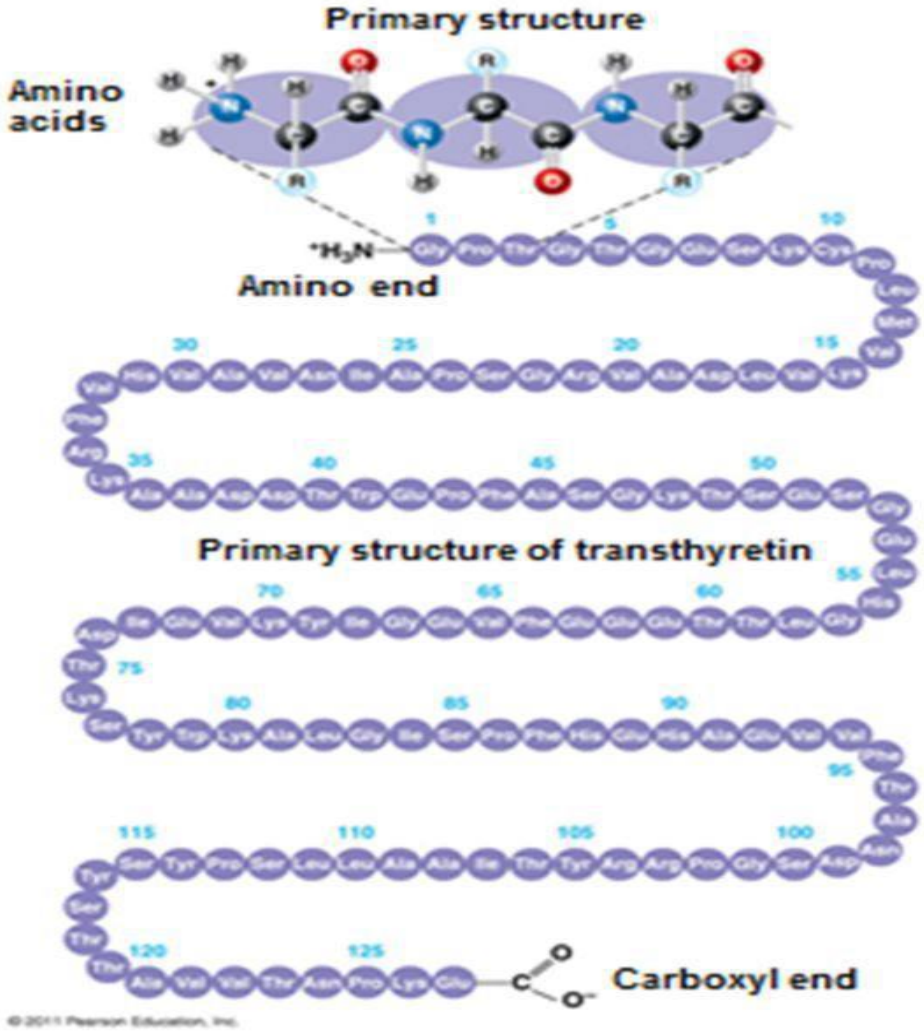
1- Primary structure consists of its unique sequence of amino acids

2- Secondary structure found in most proteins, consists of coils and folds in the polypeptide chain

3- Tertiary structure is determined by interactions among various side chains (R groups)

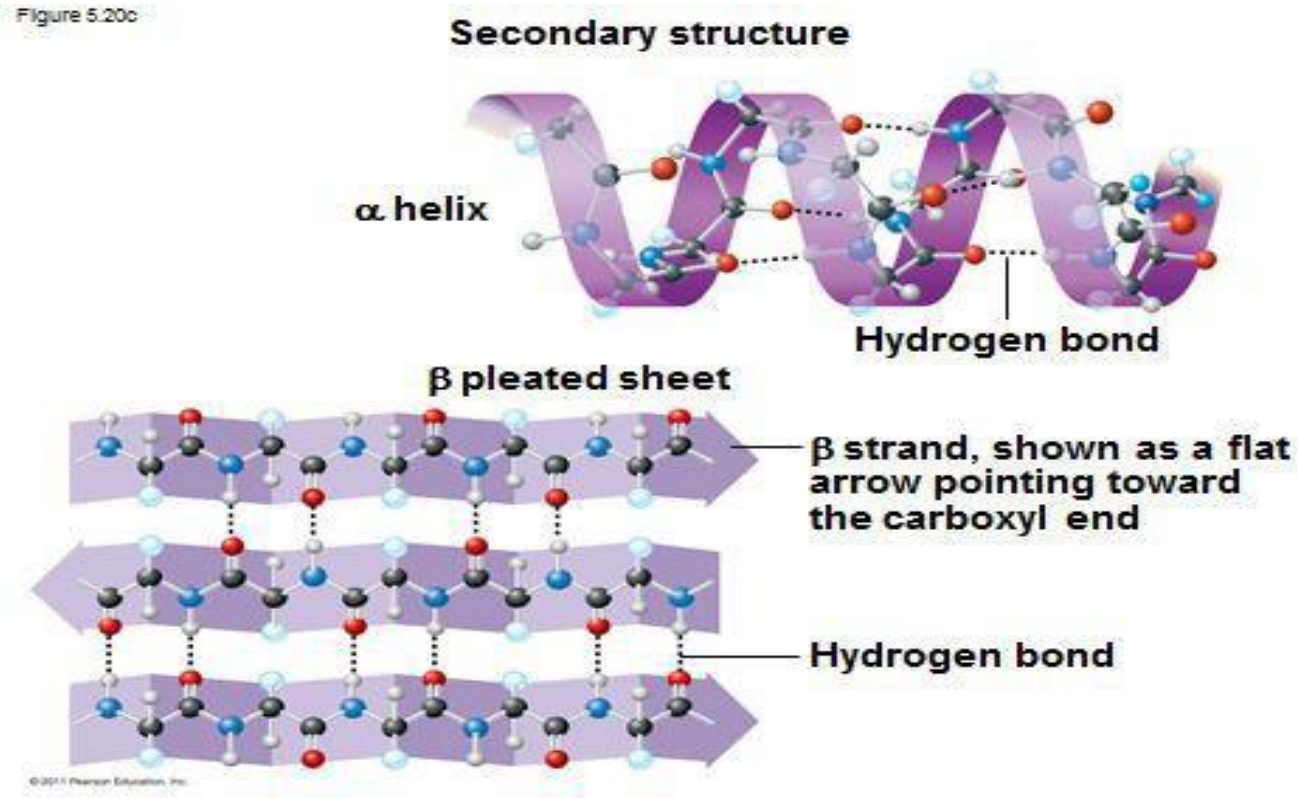
4- Quaternary structure results when a protein consists of multiple polypeptide chains

❖ **Primary Structure**, the sequence of amino acids in a protein, is like the order of letters in along word



❖ The coils and folds of **Secondary structure** result from hydrogen bonds between repeating constituents of the polypeptide backbone

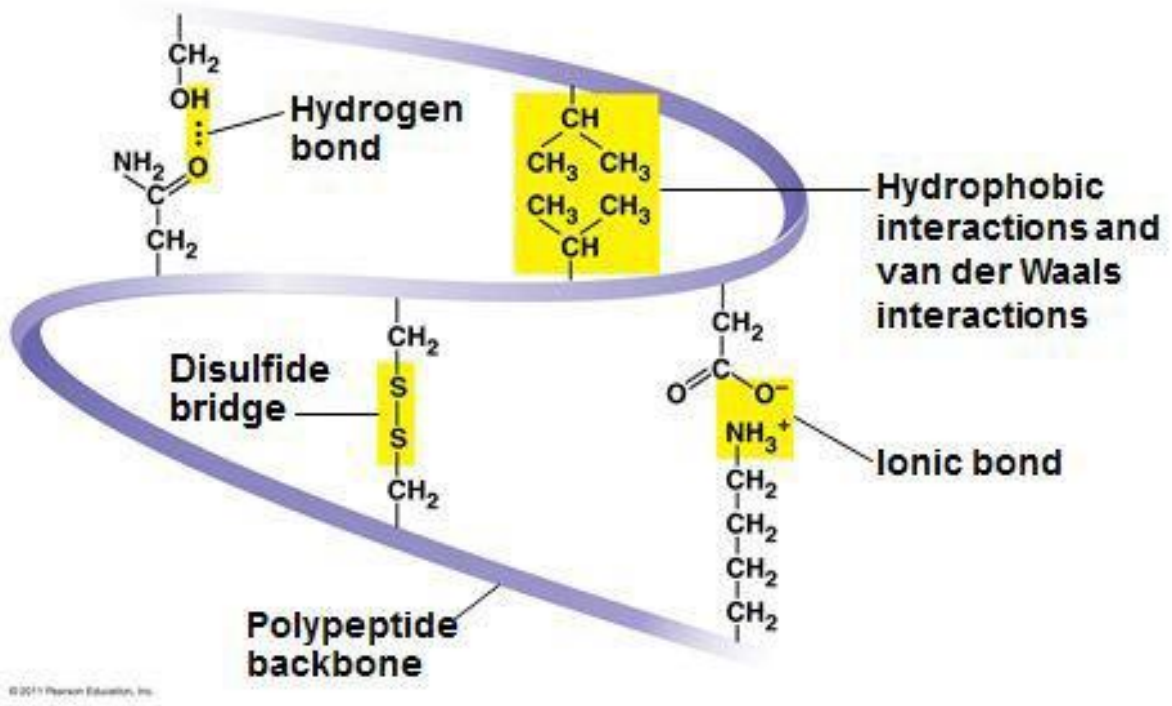
• Typical secondary structures are a coil called an **α helix**



❖ **Tertiary structure** is determined by interactions between R groups, rather than interactions between backbone constituents

• These interactions between R groups include actual *ionic bonds and* strong

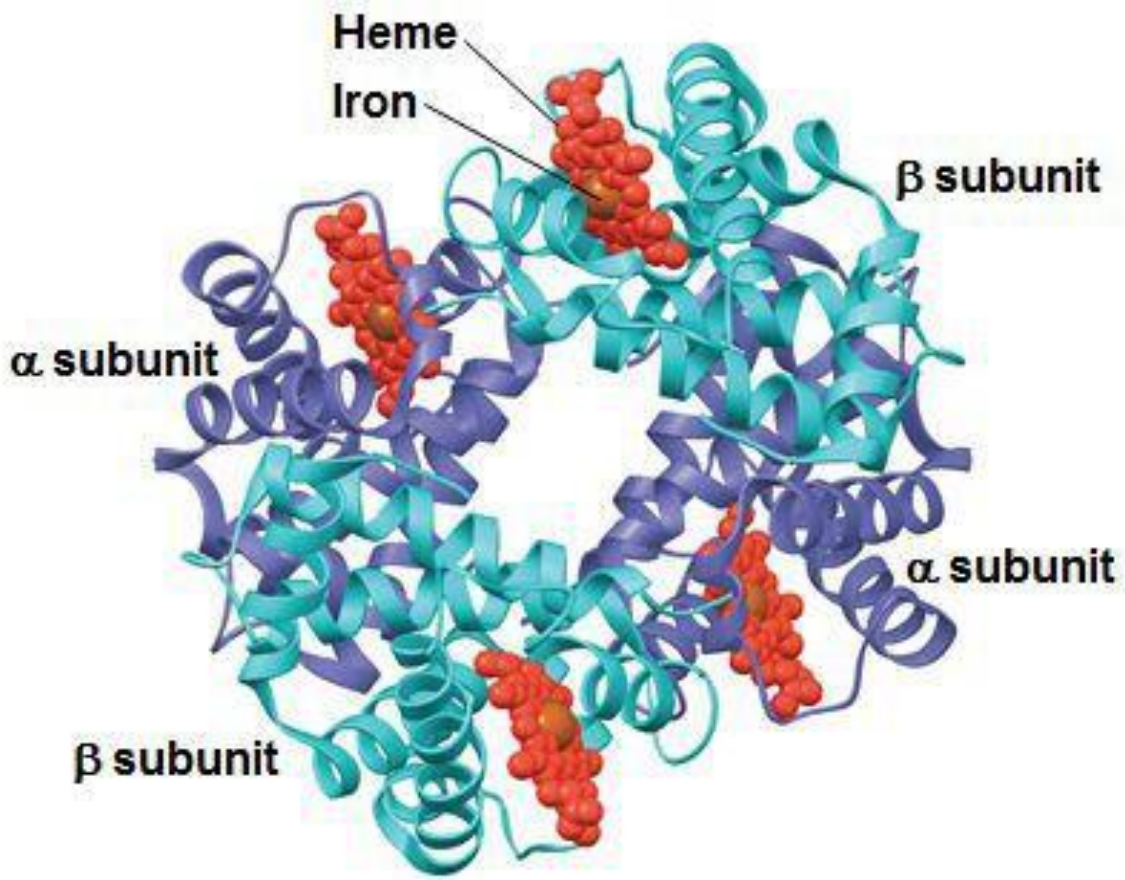
covalent bonds called **disulfide bridges** which may *reinforce* the protein's structure.



❖ **Quaternary structure** results when two or more polypeptide chains form one macromolecule.

• Collagen is a fibrous protein consisting of three polypeptides coiled like a rope.

• Hemoglobin is a globular protein consisting of four polypeptides: two alpha and two beta chains



Hemoglobin

- In addition to primary structure, physical and chemical conditions can affect structure

- Alterations in pH, salt concentration, temperature, or other environmental factors can cause a protein to unravel

- This loss of a protein's native structure is called **denaturation**

- A denatured protein is biologically inactive

Thank you