Classification and structure of proteins

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This article has been translated from WikiSkripta; ready for the **editor's review**.

> Proteins are macromolecular organic substances formed by a **chain of amino acids**' connected to each other peptide bond. It connects the amino group of one amino acid and the carboxyl group of the other amino acid by a simple covalent bond. **Polycondensation *creates a chain of different lengths of amino acids terminated on one side by a free amino group, the ``N-end*, and on the opposite side by a free carboxyl group, the *C-end*.**
>
> Peptides are shorter chains of amino acids than proteins (less than 100) and have a molecular weight of less than 10,000.

Protein Classification

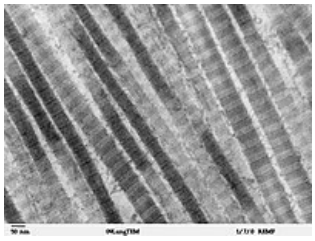
> Proteins can be divided into two basic groups according to their composition.

Simple proteins

Simple proteins contain chains made up of only '*amino acids*. We distinguish:

- **Fibrillar proteins** - scleroproteins

  Fibrillar proteins, **insoluble** in water, mainly perform structural functions. Individual peptide chains are interconnected by crosslinks so that they form parallel fibers. Examples of fibrillar proteins are collagen or keratin, found in hair, skin or nails.



- **Globular proteins** - spheroproteins

  The globular protein chain has a **spherical shape** allowing the hydrophobic parts of the molecule to wrap inside. They are therefore **soluble** in water, eg albumin.

Complex proteins

Complex proteins contain, in addition to the protein part, another non-protein structure. We distinguish:

- **Glycoproteins** - containing a glycosidically bound carbohydrate;
- **Metalloproteins** - containing a metal ion (Fe, Cu), for example ferritin or transferrin;
- **Chromoproteins** - containing pigment as a prosthetic group, for example hemoglobin, cytochromes or myoglobin;
- **Nucleoproteins** - containing bound nucleic acids;
- **Lipoproteins** - containing lipids.

Structure of proteins

We can distinguish several structures in the protein molecule:

Primary Structure

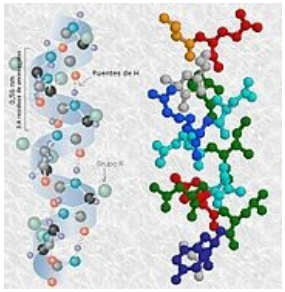
Primary structure is determined by the **sequence of amino acids** in the protein chain. We read their order from N- to C-end. The amino acids of the chain are connected to each other by peptide bonds.

Secondary Structure

The secondary structure is conditioned by the **formation of hydrogen bridges'** between the NH– and C=O groups of the peptide bond. The most common secondary structures include the alpha-helix and the beta-folded sheet.

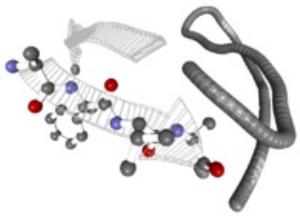
- **Alpha-helix'**

  The protein chain is coiled into a right-handed or left-handed **helix** with a single helix length of 3.6 amino acid residues. The side chains protrude outward from the helix.



- **Beta-Folded Sheet'**

  Strings are **two'**, arranged parallel and antiparallel. They are mutually **stabilized by H-bridges'**.



In addition to these two secondary structures, there are many others, such as **Zn-finger'' *or*** *Leu-zip*.

Tertiary Structure

Tertiary structure describes the spatial arrangement of a molecule conditioned by interactions between side groups of the chain – electrostatic forces, H-bridges, SH-bonds, non-polar interactions, etc.

Quaternary Structure

Quaternary structure describes the spatial arrangement of protein subunits composed of more than one chain. The subunits are not linked to each other by peptide bonds.

Denaturation is an event in which all higher protein structures except the primary one are disrupted. The protein loses its functionality, but its energy value remains. Causes may include high temperature, pH change, or the presence of heavy metal salts.