

Protein Structure

Overview

- Proteins are complex molecules that play crucial roles in the body.
- They're made up of amino acids and are the building blocks of life.

Protein structure can be classified into four levels:

1. **Primary Structure**
2. **Secondary Structure**
3. **Tertiary Structure**
4. **Quaternary Structure**

Secondary: Alpha Helix

Structure: Forms a right-handed helical structure.

Backbone Conformation: The peptide backbone twists into a spiral, resembling a *coiled spring*.

Hydrogen Bonding: Stabilized by hydrogen bonds between the carbonyl oxygen of one amino acid and the amide hydrogen of an amino acid three residues away.

Stability: Relatively stable due to the regular hydrogen bonding pattern and compact structure.

Amino Acid Side Chains: Project outward from the helix, allowing for potential interactions with other molecules.

Secondary: Beta Sheet

Structure: Consists of extended strands of peptide chains connected by hydrogen bonds forming a *flat, sheet-like structure*.

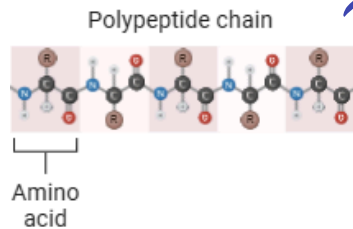
Hydrogen Bonding: Stabilized by hydrogen bonds between adjacent strands, with the carbonyl oxygen of one strand interacting with the amide hydrogen of an adjacent strand.

Directionality: Strands can be *parallel* (all N-termini aligned) or *antiparallel* (alternating N- and C-termini).

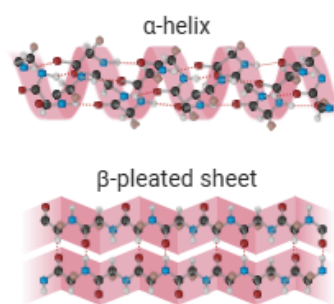
Amino Acid Side Chains: Project alternately above and below the plane of the sheet.

Stability: Can be stable, especially in the presence of other secondary structure elements like alpha helices.

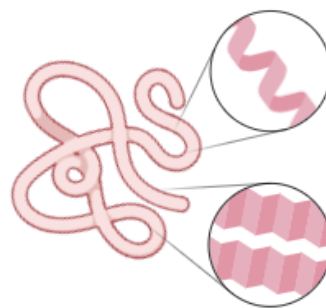
Primary structure



Secondary structure



Tertiary structure



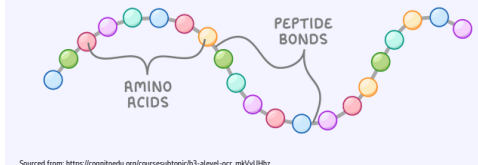
Quaternary structure



Sourced from: https://www.wikidoc.org/index.php/Filter_binding_assay

Primary Structure

Primary Structure: sequence of amino acids that make up a protein

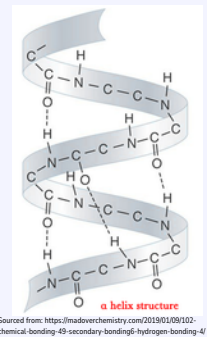


Sourced from: https://cognitioedu.org/coursesubtopic33-level-ocr_mkVjJhZ

Secondary Structure

Secondary Structure: the coiling or folding of the amino acid chain

- Stabilized by **hydrogen bonds** between the amide and carbonyl groups of the backbone
- Examples include **alpha-helices** and **beta-sheets**

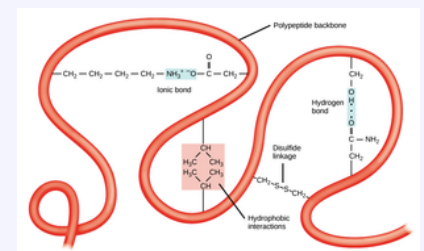


Sourced from: <https://madoverchemistry.com/2019/01/09/102-chemical-bonding-49-secondary-bonding6-hydrogen-bonding-4/>

Tertiary Structure

Tertiary Structure: 3D structure of a protein

- Formed by the further bending and folding of the protein
- Determined by a variety of bond interactions between side chains:
 - Hydrogen bonds**
 - Ionic bonds**
 - Disulfide bridges**



Sourced from: <https://www.khanacademy.org/science/biology/macromolecules/proteins-and-amino-acids/a/orders-of-protein-structure>

Quaternary Structure

Quaternary Structure: structure formed by the assembly of multiple protein subunits

- Not all proteins have a quaternary structure

LETTER TO THE STUDENT

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To maximize the benefits of this resource, we recommend that you read carefully through the topics, focusing on *bolded terminology, compound structures, and diagrams*. Although this resource ideally will cover all testable content as of the 2024-2025 academic year, we cannot guarantee this and strongly encourage you to cross-reference with class material and notes.

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We appreciate you using our resource! Best of luck on your exams :)

-The WebStraw team

 Note to Instructors: If this resource has been created for your course and you would like to collaborate with us, please email us at team@webstraw.org

biochem 2280.

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BY WEBSTRAW

a handmade guide

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Questions? Ask us at team@webstraw.org