


Bio 115 Cells & Evolution of Life

The Basics of Life

Proteins

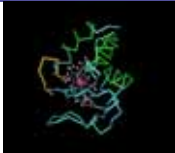


Start Audio Lecture!

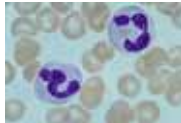
1

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Proteins are Everywhere




Cytochrome c molecule



Blood cells (V. Ereschenko)



Skeletal muscle (V. Ereschenko)



Globin protein

2

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Amino Acid Structure

R group

R

$\begin{array}{c} | \\ \text{H} - \text{N} - \text{C} \\ | \\ \text{H} \end{array}$

C

$\begin{array}{c} | \\ \text{C} - \text{OH} \\ || \\ \text{O} \end{array}$

}

The R group is different for each amino acid

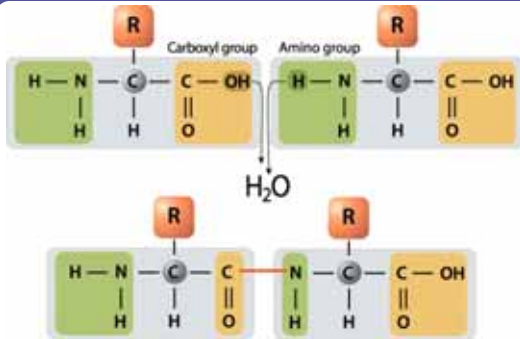
All amino acids have these chemical structures

Amino group

Carboxyl group

3

Peptide Linkage



4

Twenty Amino Acids

The diagram shows 20 amino acids grouped into categories based on their side chains (R groups):

- Nonpolar (hydrophobic):** Alanine, Valine, Isoleucine, Leucine, Methionine, Proline, Phenylalanine, Tyrosine, Tryptophan.
- Polar, uncharged (hydrophilic):** Serine, Threonine, Cysteine, Asparagine, Glutamine.
- Polar, negatively charged (hydrophilic):** Aspartate, Glutamate.
- Polar, positively charged (hydrophilic):** Lysine, Arginine, Histidine.

5

Protein Structure Determines Function

- Primary structure – the sequence of amino acids
- Secondary structure
 - Alpha helix
 - Beta pleated sheet
- Tertiary structure – bending and folding of secondary structures
- Quaternary structure – multiple polypeptide chains

6



Primary Protein Structure

(a) Primary Structure

Amino acid sequence



7

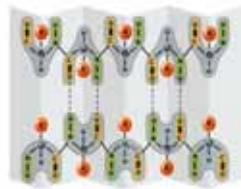


Secondary Structure

(a) Secondary Structure



a) α Helix



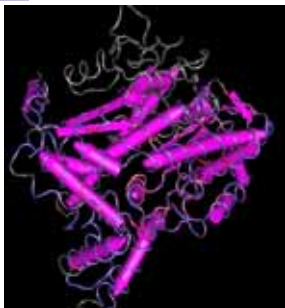
b) β Pleated sheet

Note that hydrogen bonding occurs between the δ^+ hydrogen attached to the nitrogen atom of one amino acid and the δ^- oxygen attached to the carboxyl group of another amino acid.

8



Tertiary Structure



RNA Polymerase, an enzyme

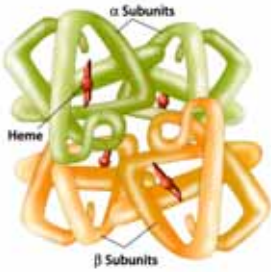
Interactions involved in tertiary structure

- Covalent disulfide bridges
- Hydrophobic interactions
- Van der Waals forces
- Ionic salt bridges

9

Quaternary Structure

(b) Quaternary Structure



Structure of hemoglobin consisting of 4 polypeptide chains: 2 alpha subunits and 2 beta subunits

10

Denaturing of Proteins



11
