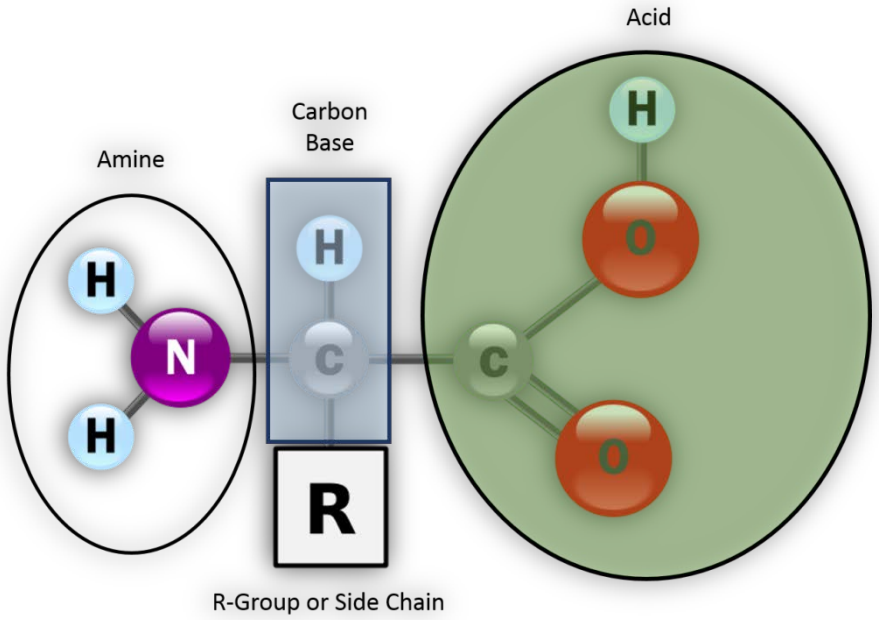

Amino Acids

Lecture No: 5

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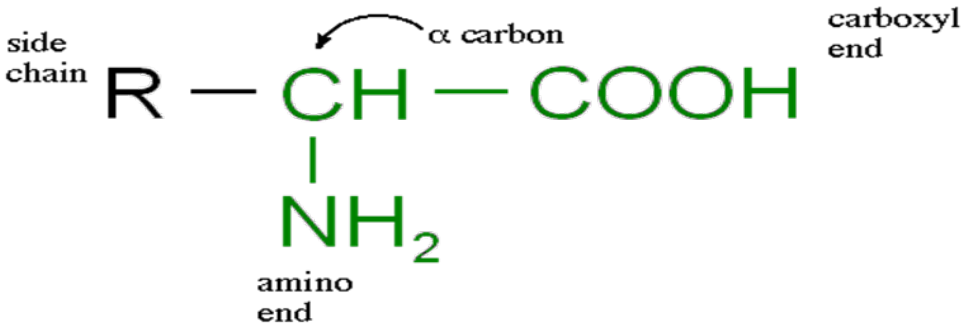
Objectives

At the end of this lecture we will understand the following points.

- The difference between Symmetry and asymmetry molecules .
- The chemical structure of amino acids and types.
- Peptide bond formation.

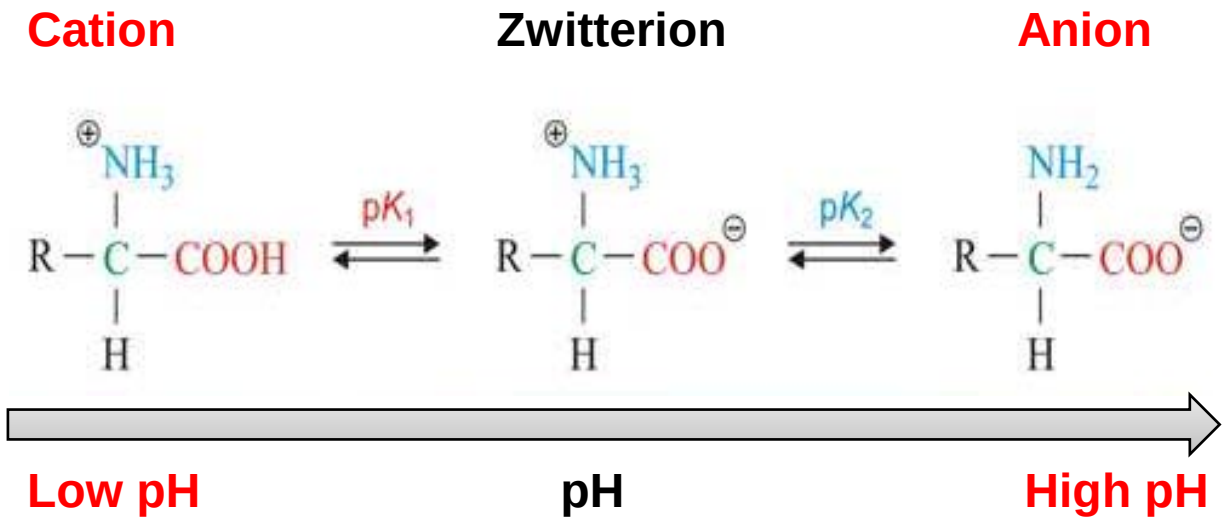
General properties

- Amino acids are derivatives of carboxylic acids.
- Each amino acid contains a central C atom, an amino group (NH_2), a carboxyl group (COOH), and a specific R group.
- The R group determines the characteristics (size, polarity, and pH) for each type of amino acid.
- Peptide bonds form between the carboxyl group of one amino acid and the amino group of another through dehydration synthesis.



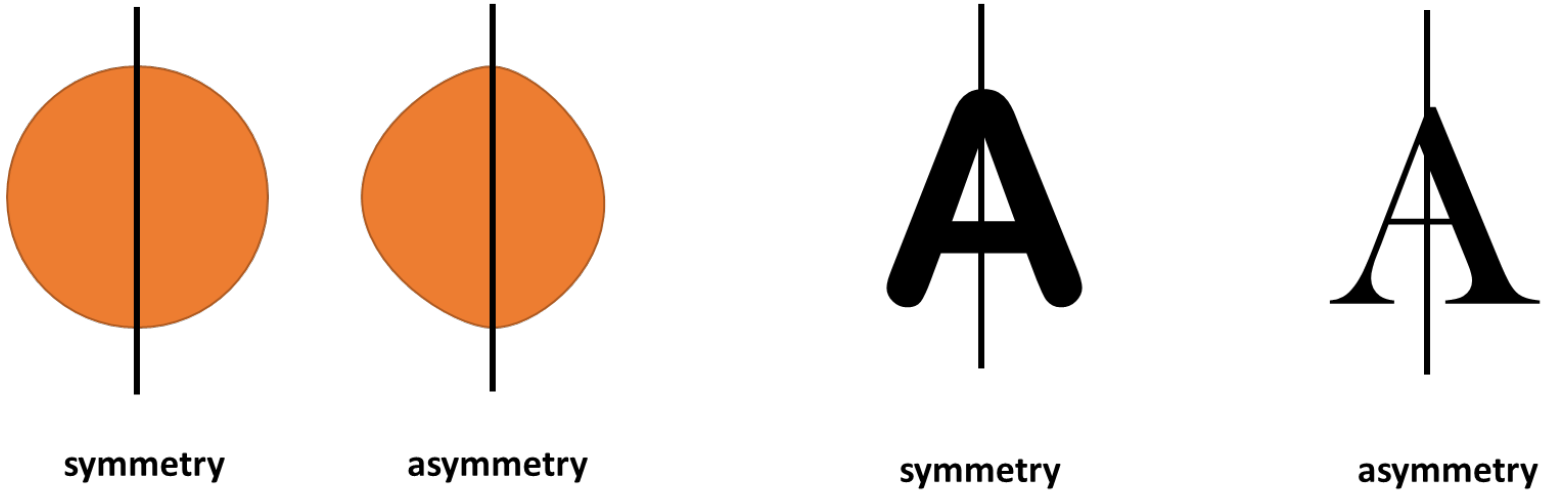
Biochemistry - Year 2

Amino acids are **amphoteric**, which means they have **acidic** and **basic** groups. The carboxyl group is able to lose a proton and the amine group is able to accept a proton.



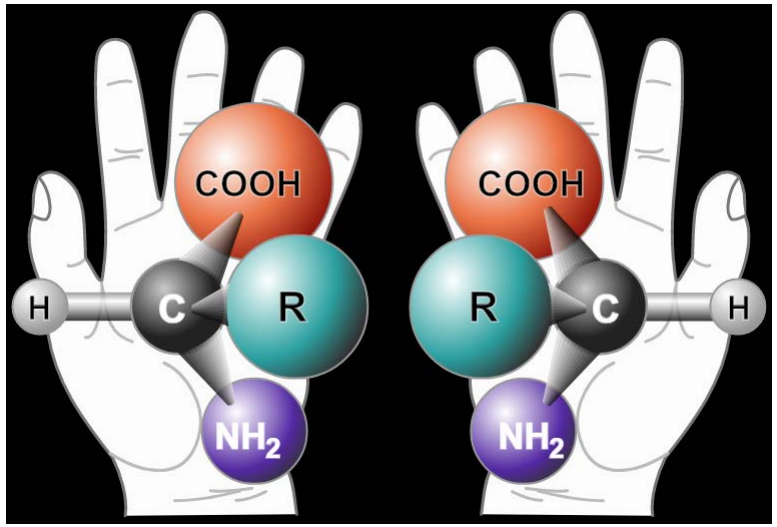
Symmetry and asymmetry molecules

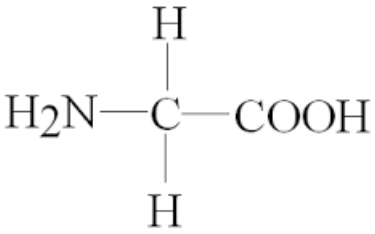
A compound capable of optical rotation is said to be optically active. All pure chiral compounds are optically active. eg: (R)-Lactic acid (1) is chiral and rotates the plane of plane-polarized light.



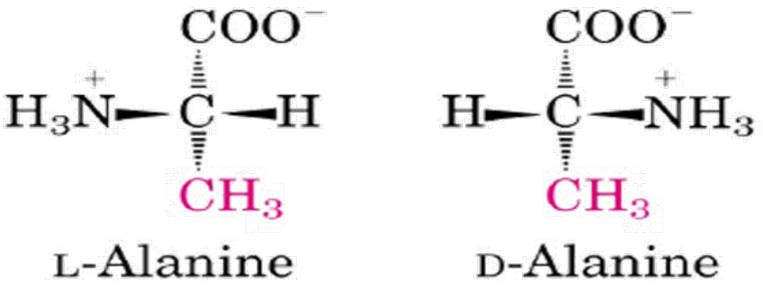
Symmetry and asymmetry molecules

Amino acids are optically active molecules and asymmetry of their mirror images is not superimposable (except in the case of glycine where the R-group is hydrogen)





glycine



L-Alanine D-Alanine

Separation of amino acids

Position of amino group − α-amino acids exist in two enantiomeric forms. Only L-(S-) acids are found in nature.

Essential (unexpendable) − organism is not able to synthesize these AA but accept from food.

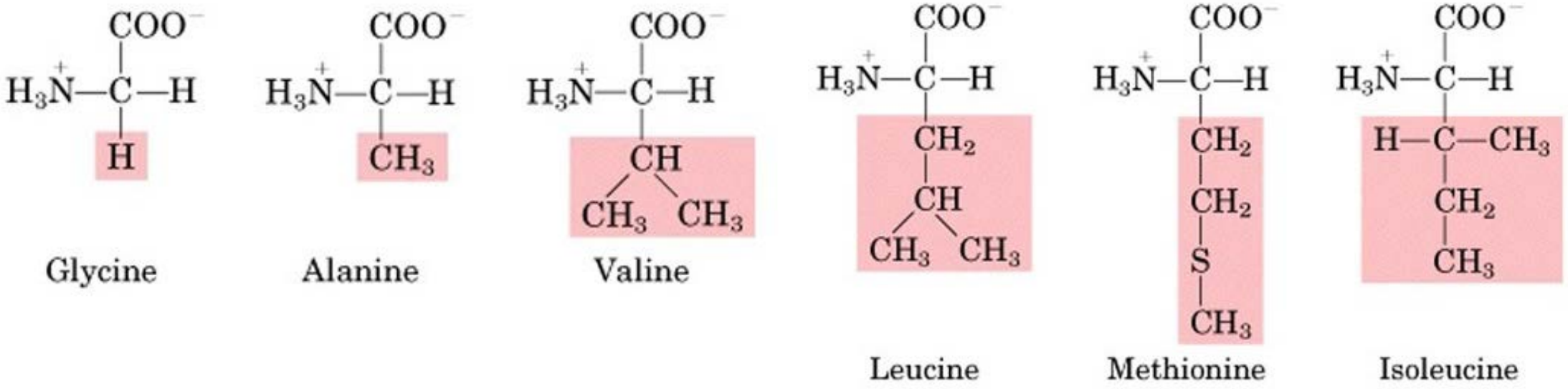
Nonessential (expendable) − organism produced from essential AA by transamination.

According R- functional group

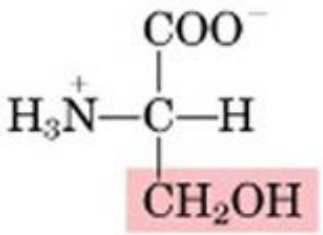
- Nonpolar (hydrophobic)
- Polar (hydrophilic) – better soluble in water
- Basic – contains more atoms of nitrogen
- Acidic – contains more carboxyl groups

Essential amino acids	Nonessential amino acids
Valin	Alanine
Leucin	Asparagine
Isoleucine	Aspartate
Threonine	Cysteine
Lysin	Glutamate
Methionin	Glutamine
Phenylalanine	Glycine
Tryptophan	Proline
Arginine	Serine
Histidine	Tyrosine

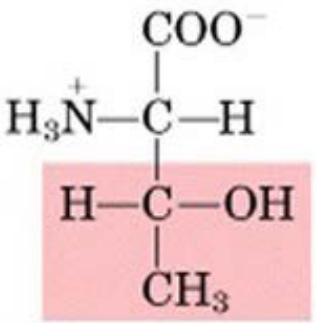
Nanpolar, aliphatic R groups



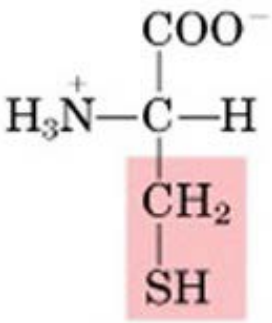
Polar, aliphatic R groups



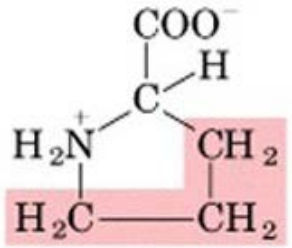
Serine



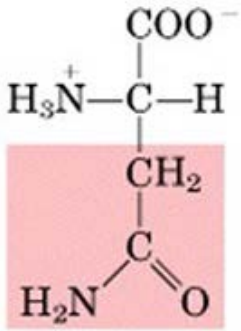
Threonine



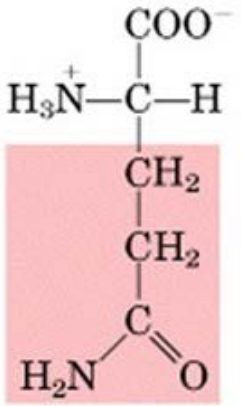
Cysteine



Proline

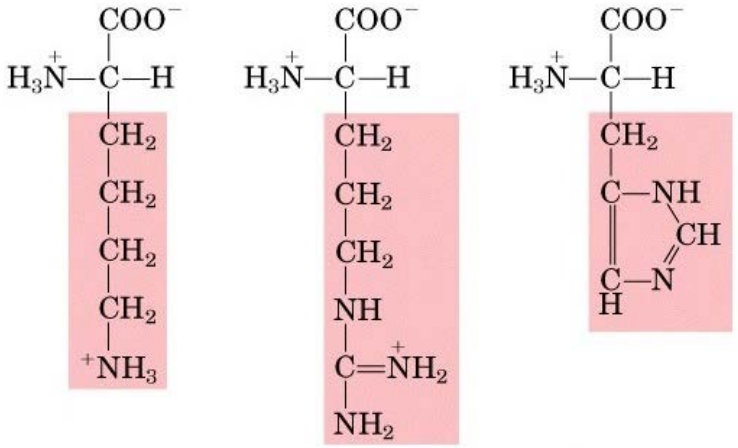


Asparagine

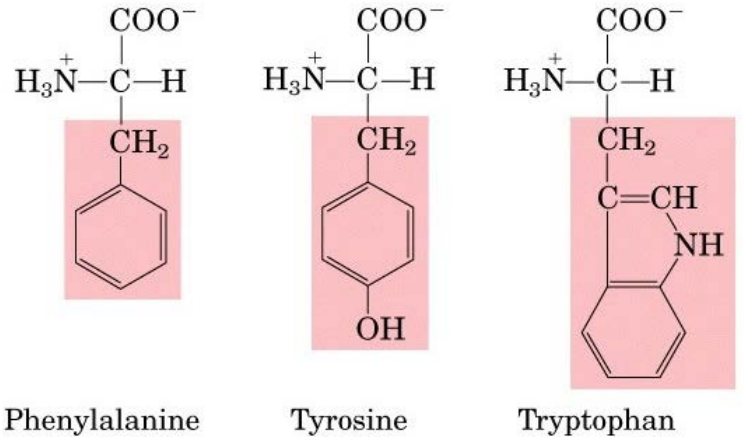


Glutamine

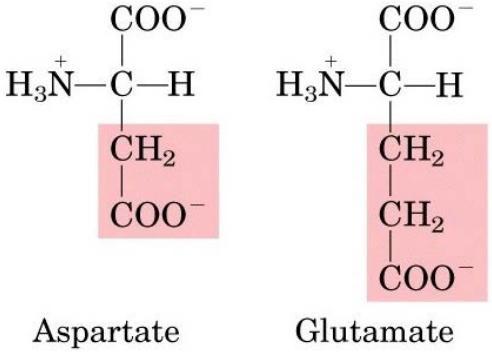
Basic R group



Aromatic R group



Acidic R group



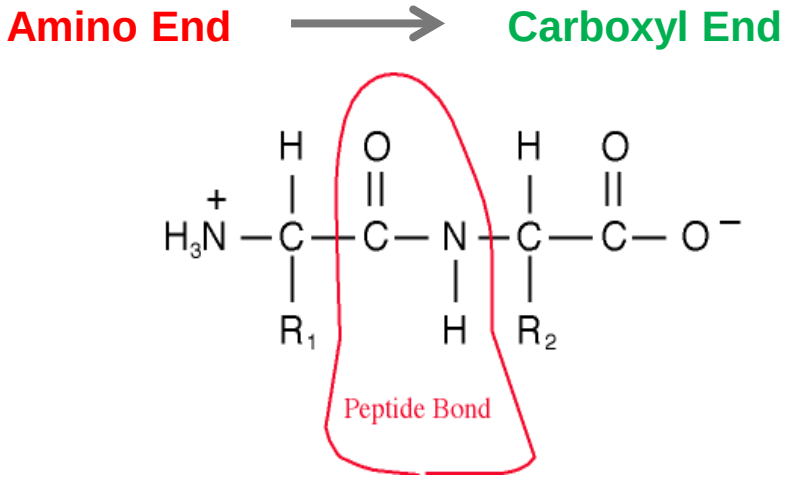
Reactions of amino acids

Polymerization - form peptides, proteins and enzymes
A condensation reaction between the carboxyl of one amino acid and the amino group of another forms a peptide bond.

Oligopeptides − condensation of 2 – 10 amino acids units

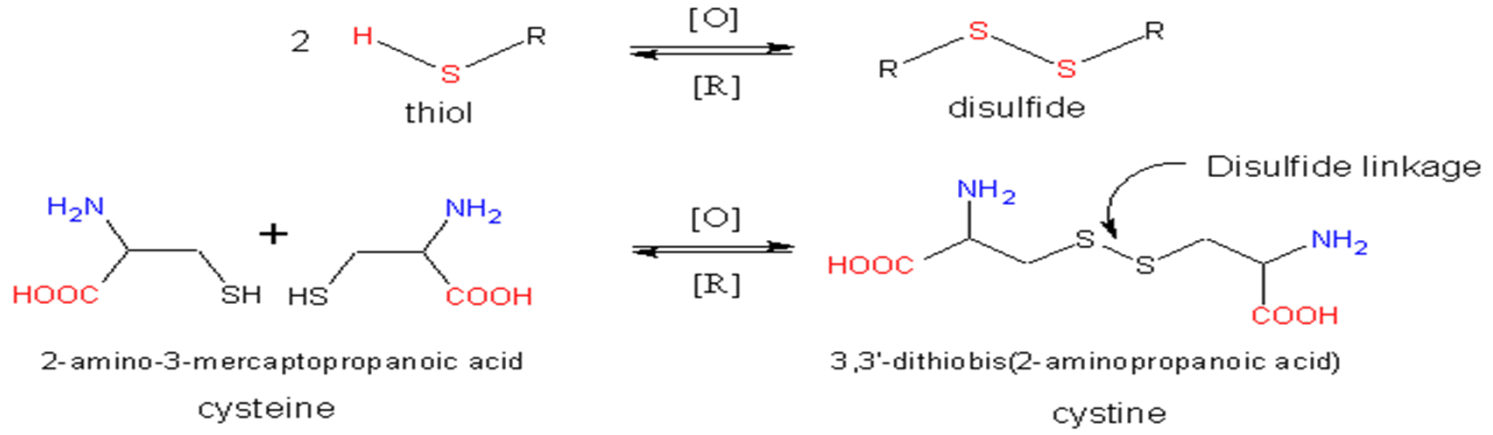
Polypeptides − condensation of 11 – 100 amino acids units

Proteins − more than 100 amino acids units



Disulfide linkage : conversion of cysteine to cystine is like a conversion of thiols to disulfides by mild oxidizing agents. This conversion can be reversed by mild reducing agents.

- Disulfide bonds stabilize protein structure by providing cross-link.



Recap

- Amino acids are derivatives of carboxylic acids.
- Each amino acid contains a central C atom, an amino group (NH_2), a carboxyl group (COOH), and a specific R group.
- Amino acids are optically active molecules.
- Amino acids are amphoteric.