

Introduction : Protein

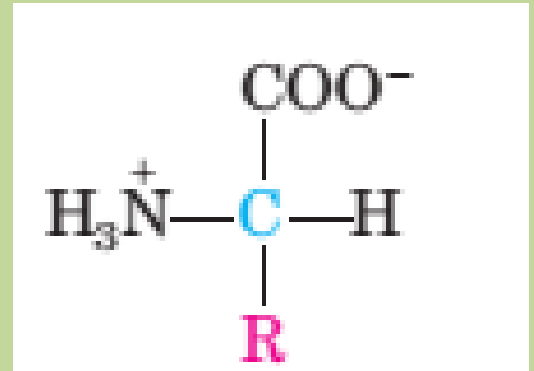
- Most abundant organic molecules of the living system
- Its fundamental basis of structures and function of life.
- 50 % of dry weight of every cell
- It's a polymer of L α -**amino acids**.
- 300 different amino acids occur in nature – only 20 as standard amino acids.
- **21st amino acid** added - **Selenocysteine**

BIOMEDICAL IMPORTANCE

- Beside forming long chain polypeptide unit of protein, amino acids have additional functions
 - nerve transmission
 - biosynthesis of porphyrins, purines, pyrimidines, and urea
 - Short polymers of AA – **peptides**
 - **Neuroendocrine system** - hormones, hormone releasing factors, neuromodulators, or neurotransmitters
 - Microorganisms : D- and L- α -amino acids
 - Therapeutic value: antibiotics **bacitracin** and **gramicidin A** and the antitumor agent **bleomycin**
 - Some may be toxic

Amino Acid

- It's a group of organic compounds containing two functional groups – **amino (-NH₂)** and **carboxyl group (-COOH)**
- Its also called **Zwitter Ion**– both **acidic and basic** functional group (dipolar ion)
- This property is known as **amphoteric** and are often called **ampholytes**
- Neither humans nor any other higher animals can synthesize 10 of the 20 common amino acids – **Essential Amino acids**

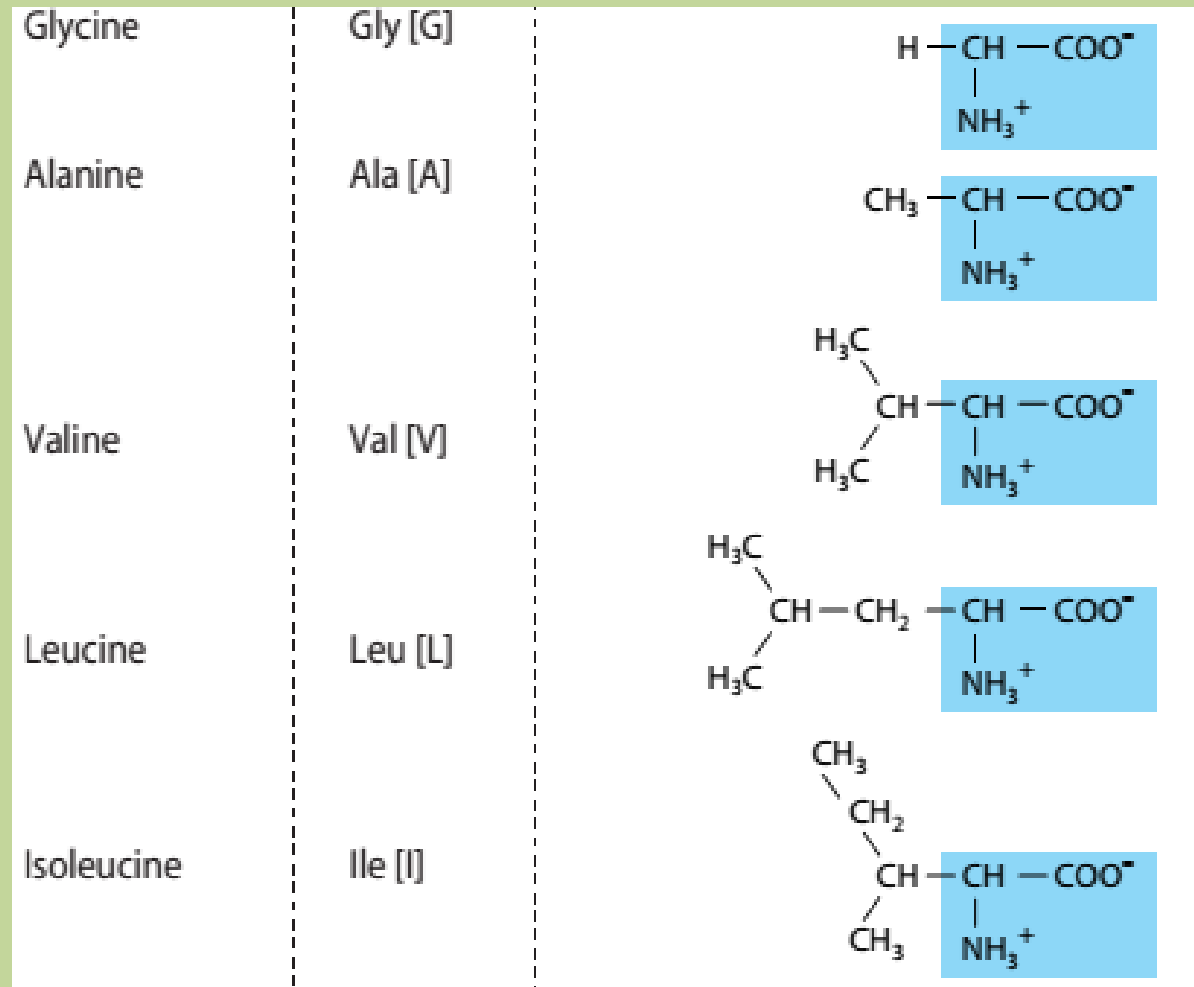


Classification

- Amino acid has been classified under various ways
 - Structure
 - With side chain containing **Aliphatic Side Chains**
 - With Side Chains Containing **Hydroxylic (OH) Groups**
 - With Side Chains Containing **Sulfur Atoms**
 - With Side Chains Containing **Acidic Groups or Their Amides**
 - With Side Chains Containing **Basic Groups**
 - Containing **Aromatic Rings**
 - **Imino Acid**
 - Polarity
 - Non Polar
 - Polar
 - Nutritional
 - Essential and Non-essential

Side chain containing **Aliphatic Side Chains**

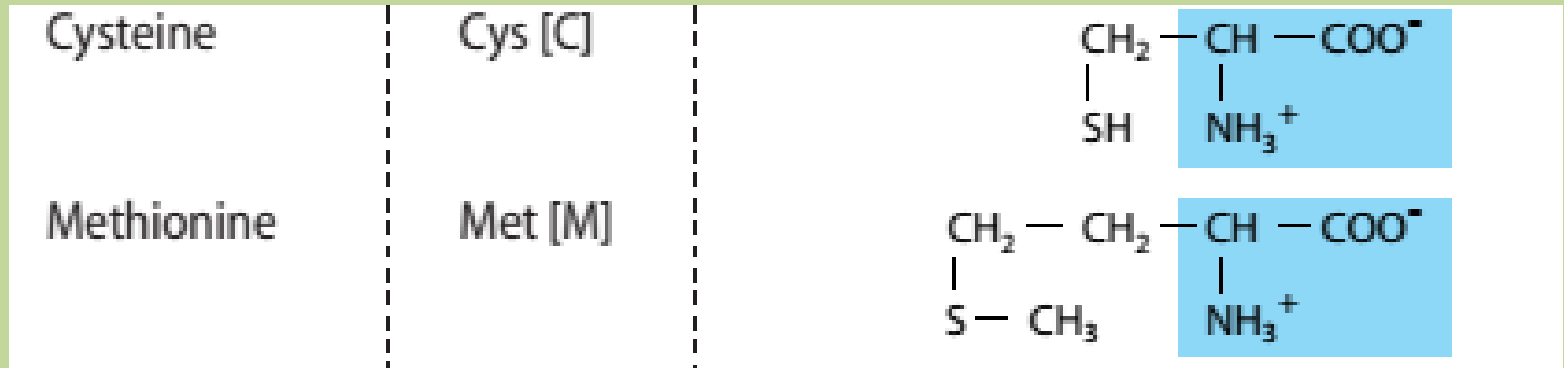
- Simplest amino acids
- Contains branched chain of hydrocarbons



Side Chains Containing **Hydroxylic (OH) Groups**

Serine	Ser [S]	$\begin{array}{c} \text{CH}_2 - \text{CH} - \text{COO}^- \\ \quad \\ \text{OH} \quad \text{NH}_3^+ \end{array}$
Threonine	Thr [T]	$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH} - \text{COO}^- \\ \quad \\ \text{OH} \quad \text{NH}_3^+ \end{array}$
Tyrosine	Tyr [Y]	See below.

Side Chains Containing Sulfur Atoms



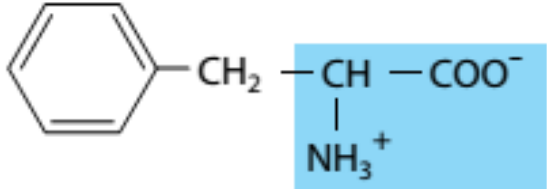
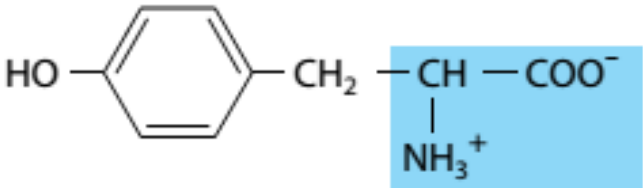
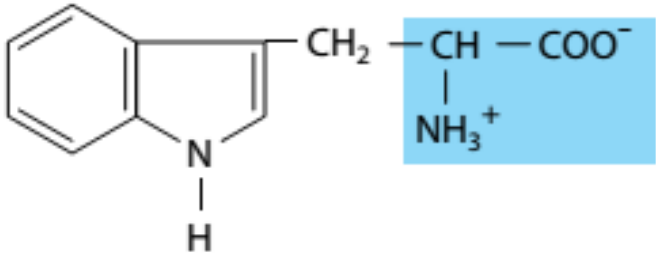
Side Chains Containing Acidic Groups or Their Amides

Aspartic acid	Asp [D]	$\begin{array}{c} \text{}^{-}\text{OOC} - \text{CH}_2 - \text{CH} - \text{COO}^{-} \\ \\ \text{NH}_3^{+} \end{array}$
Asparagine	Asn [N]	$\begin{array}{c} \text{H}_2\text{N} - \text{C} - \text{CH}_2 - \text{CH} - \text{COO}^{-} \\ \quad \\ \text{O} \quad \text{NH}_3^{+} \end{array}$
Glutamic acid	Glu [E]	$\begin{array}{c} \text{}^{-}\text{OOC} - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{COO}^{-} \\ \\ \text{NH}_3^{+} \end{array}$
Glutamine	Gln [Q]	$\begin{array}{c} \text{H}_2\text{N} - \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{COO}^{-} \\ \quad \\ \text{O} \quad \text{NH}_3^{+} \end{array}$

Side Chains Containing Basic Groups

Arginine	Arg [R]	$\begin{array}{c} \text{H} - \text{N} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{COO}^- \\ \\ \text{C} = \text{NH}_2^+ \\ \\ \text{NH}_2 \end{array}$
Lysine	Lys [K]	$\begin{array}{c} \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$
Histidine	His [H]	$\begin{array}{c} \text{HN} \text{---} \text{CH} \text{---} \text{N} \\ \diagup \quad \diagdown \\ \text{---} \text{CH}_2 - \text{CH} - \text{COO}^- \\ \\ \text{NH}_3^+ \end{array}$

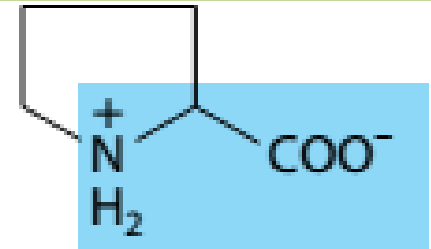
Containing Aromatic Rings

Histidine	His [H]	See above.
Phenylalanine	Phe [F]	
Tyrosine	Tyr [Y]	
Tryptophan	Trp [W]	

Imino Acid

Proline

Pro [P]



Classification : Polarity

- **Non- polar group** : No charge on R group. Ex: *Alanine, leucine. Isoleucine, valine, methionine, phenylalanine, tryptophan and proline*
- Polar group
 - **No charge on R** : no charge on R but posses group such as hydroxyl, sulfhydryl and amide. Ex: *Glycine, serine, threonine, cysteine, glutamine, asparigine and tyrsoine*
 - **Positive R-** Lysine, arginine, and histidine
 - **Negative R** – asparatic acid and glutamic acid