

# AMINO ACIDS

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# Amino Acid

- It's a group of organic compounds containing two functional groups – **amino (-NH<sub>2</sub>)** 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**

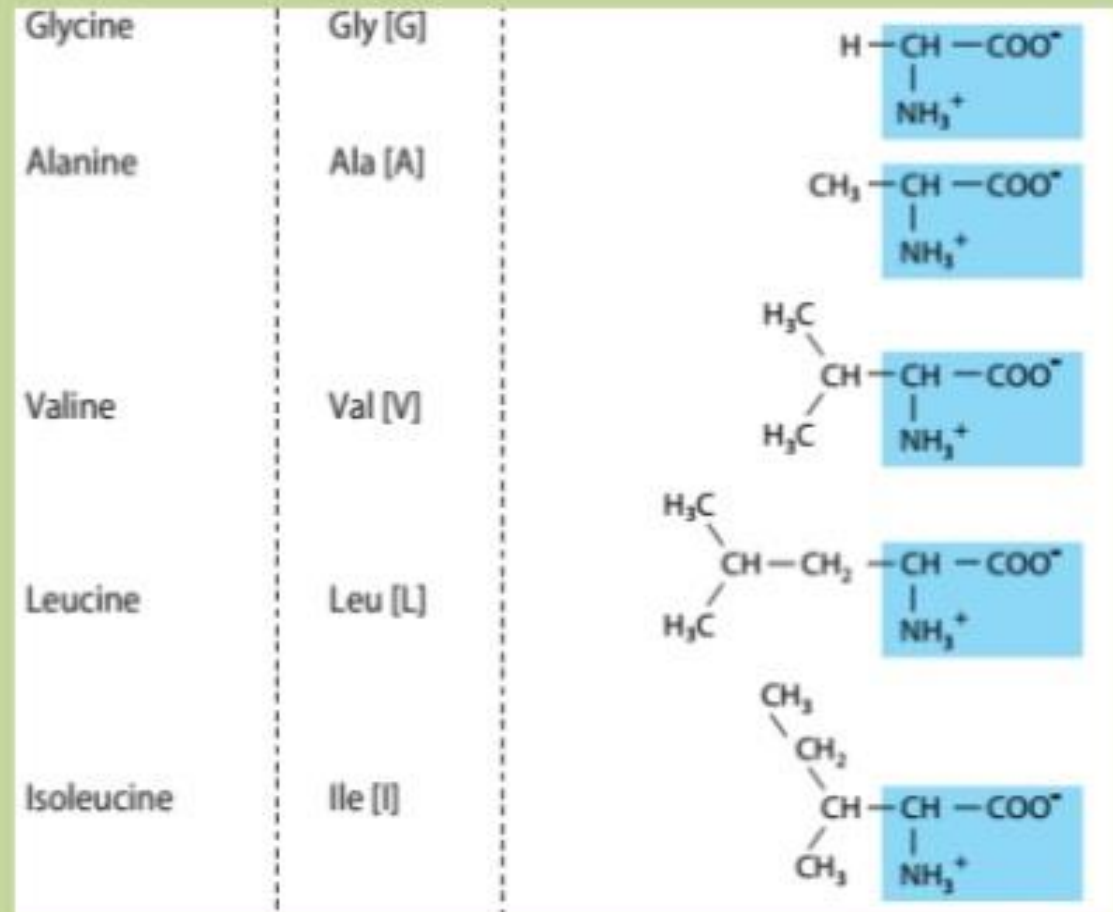


# Classification

- 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



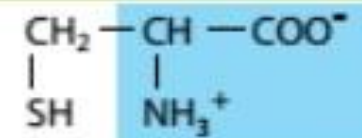
# Side Chains Containing **Hydroxylic (OH) Groups**

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

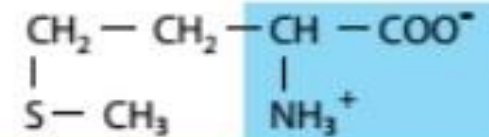
Cysteine

Cys [C]



Methionine

Met [M]



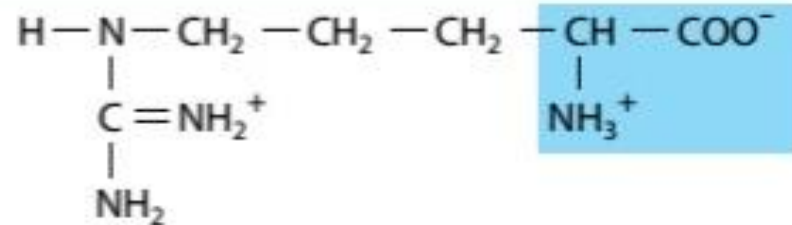
# Side Chains Containing Acidic Groups or Their Amides

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

# Side Chains Containing Basic Groups

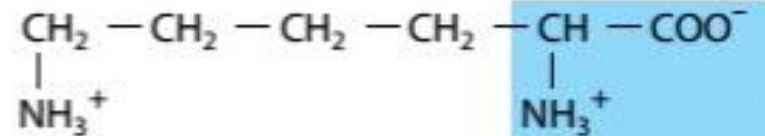
Arginine

Arg [R]



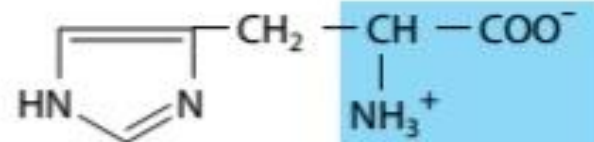
Lysine

Lys [K]



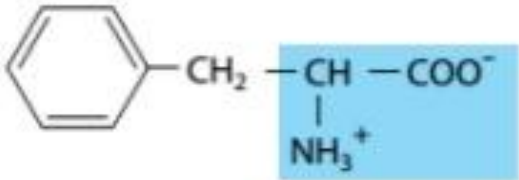
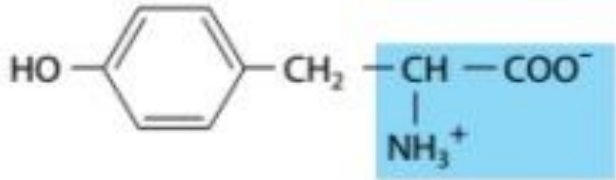
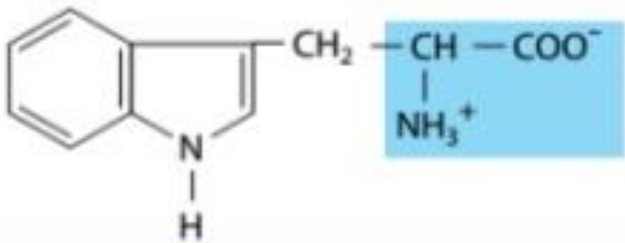
Histidine

His [H]





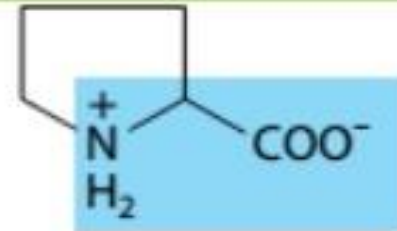
# Containing Aromatic Rings

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

# Imino Acid

Proline

Pro [P]



# Classification : Polarity

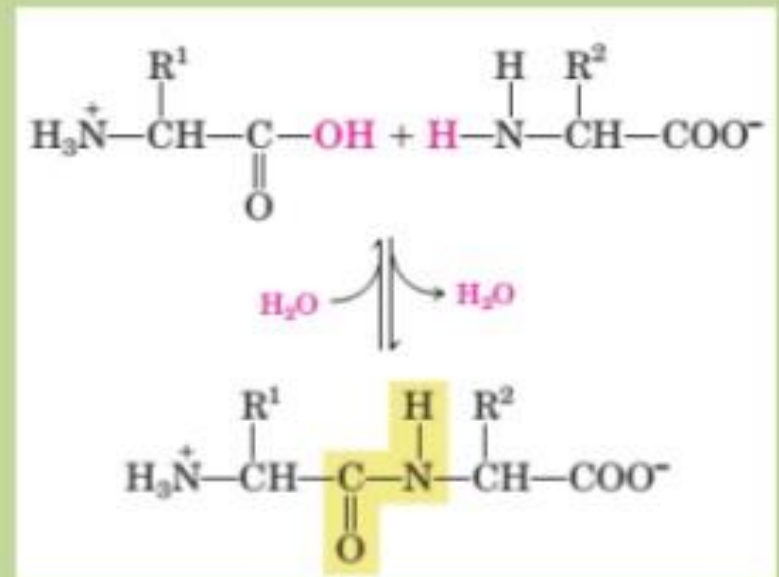
- **Non- polar group** : No charge on R group. Ex: *Alanine, leucine. Isoleucine, valine, methionine, phenylalanine, tryptophan and proline*
- Polar group
  - **No charge on R** : no charge on R but posses group such as hydroxyl, sulfhydryl and amide. Ex: *Glycine, serine, threonine, cysteine, glutamine,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

# Essential Amino Acid (EAA)

- It can't be synthesized in the body and therefore need to be supplied through diet
- Proper growth and maintenance of the individual
- Ex. **A**rginine, **V**aline, **H**istidine, **I**soleucine, **L**eucine, **L**ysine, **M**ethionine, **P**henylalanine, **T**hreonine, **T**ryptophan
- **Mnemonics** : AV hill, MP TT
- **Semi-essential amino acid**: Adults can synthesize 2 amino acid and not by growing children. Ex: Arginine and histidine
- So in all 8 are essential and 2 semi essential

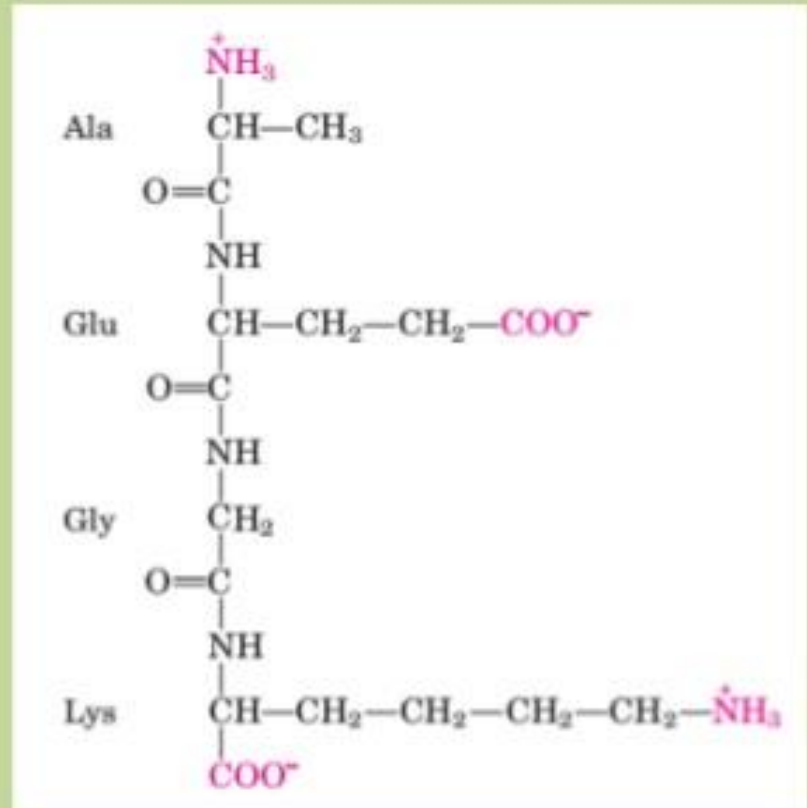
# PEPTIDES

- Two AA covalently joined through a substituted amide linkage – **peptide bond**
- **Dehydration** – removal of  $\text{H}_2\text{O}$ 
  - $\text{OH}^-$  Carboxyl group of one AA
  - $\text{H}^+$  from amino group of another AA
- Example of a **condensation reaction** – common biological reactions



# POLYPEPTIDES

- Two AA reacts to form **dipeptides**, Three AA can be joined by two peptide bonds to form a **tripeptide** and so on.
- **Oligopeptide:** When a few AA are joined by various peptide linkage
- When many amino acids are joined, the product is called a **polypeptide**.
- **Proteins** may have thousands of amino acid residues



**Tetrapeptide**

**THANK  
YOU**