Amino Acids

By: Raghad Farraj

Non-polar

Non polar

Aliphatic

Not branched

Glycine (Gly)

- Simplest and smallest amino acid
- A derivative of Acetic acid
- The only achiral amino acid

Alanine (Ala)

- Second simplest
- Methyl group (-CH3) side chain
- Not reactive

Branched

Valine (Val)

β-carbon is branched

Leucine (Leu)

γ-carbon is branched

Isoleucine (Ile)

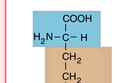
β-carbon is branched

These are essential amino acids since the body cannot synthesize them (we get them from diet)

Valine's R group looks like an upside down V

With sulfur

Methionine (Met)



It can form **S-Adenosyl-L-Methionine (SAM)** which serves as a methyl donor in reactions.

The sulfur's placement looks like an ether group so we call it a Thioether group

Cyclic

Proline (Pro)

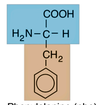
- The only cyclic amino acid [rigid]
- The nitrogen is secondary because it's attached to two carbons

When Proline is hydroxylated it forms **Hydroxyproline** which is part of collagen structure

Aromatic

One ring

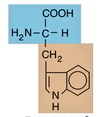
Phenylalanine (Phe)



Contains a phenyl ring

Two rings

Tryptophan (Trp)



- The largest amino acid
- Has an indole group that consists of two fused rings and an NH group

Tryptophan serves as the precursor for the synthesis of Neurotransmitters
- **Serotonin** (neurotransmitter-sedative)
- **Melatonin** (day-night cycle)

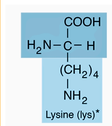
Charged

Charged

Positively charged (NH)

Aliphatic side chain

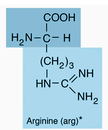
Lysine (Lys)



Ends with a primary amino group

When Lysine is hydroxylated it forms **Hydroxylysine** which is part of collagen structure

Arginine (Arg)



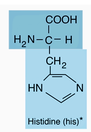
Ends with a guanidinium group –NH–C(=NH_2^+)–NH_2 [has resonance]

L-arginine is the precursor of **Nitric oxide (NO)** which has the following functions: Vasodilation, inhibition of platelet adhesion, anti-inflammatory

Lysine and arginine have relatively long side chains that terminate with groups that are positively charged at a neutral pH.

Aromatic side chain

Histidine (His)



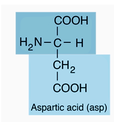
Contains an imidazole group, an aromatic ring that can be positively charged [the nitrogen can get protonated]

Precursor of **Histamine** which acts as a neurotransmitter and causes allergic symptoms (a major causes for asthma)

Negatively charged (COOH)

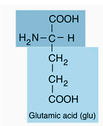
Acidic side chains

Aspartic acid (Asp)



Called Aspartate when charged

Glutamic acid (Glu)



Called Glutamate when charged [glut = 5 carbon molecule]

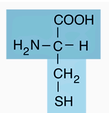
- It is a precursor of **γ-aminobutyric acid (GABA)**, an inhibitory neurotransmitter.
  - It has relaxing, anti-anxiety and anti-convulsive effects
- Glutamate residues of some blood proteins factors are carboxylated to form **γ-carboxyglutamate (Gla)** residues. This carboxylation is essential for blood clotting
  - Vitamin K is essential for the process [Vitamin K is called that because coagulation in Latin is spelled with K]
- **Monosodium glutamate (MSG)** is a Glutamic acid derivative:
  - A flavor enhancer, meat tenderizer
  - MSG causes a physiological reaction in some people (chills, headaches, and dizziness)
  -> Chinese restaurant syndrome

Polar but not charged

Depending on R group

sulfhydryl or thiol (-SH) group

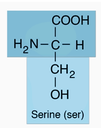
Cysteine (Cys)



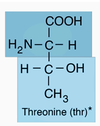
The sulfhydryl group is reactive

Hydroxyl groups (OH)

Serine (Ser)



Threonine (Thr)

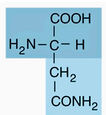


β-carbon is branched

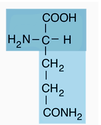
The hydroxyl groups on serine and threonine make them hydrophilic and reactive

Terminal carboxamide ($CONH_2$)

Asparagine (Asn)



Glutamine (Gln)

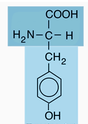


Asparagine and glutamine are uncharged derivatives of aspartate and glutamate.

Each contains a terminal carboxamide in place of a carboxylic acid

Aromatic ring with a Hydroxyl group

Tyrosine (Tyr)



It is derived from Phenylalanine (the hydroxyl group is reactive)

Can be converted into

- Catecholamine neurotransmitters:
  - **Dopamine**
  - **Norepinephrine**
  - **Epinephrine** (fight or flight)
- **Melanin** (skin color):
  - Eumelanin (brown color)
  - Pheomelanin (red color)
- **Thyroxine** (hormone)

Names of R groups, derivatives and **processes** that made the derivatives are important

اللهم إني أستودعتك ما حفظت وما قرأت وما تعلمت فرده إلي عند حاجتي إليه، إنك على كل شيء قدير، سبحانك اللهم وبحمدك أشهد أن لا إله إلا انت أستغفرك وأتوب إليك، لا تنسونا من صالح دعائكم ♡

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