

- N-containing molecules
- basic structure building units of proteins
- precursors of biomolecules → neurotransmitters
- utilized as energy source.

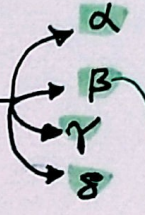
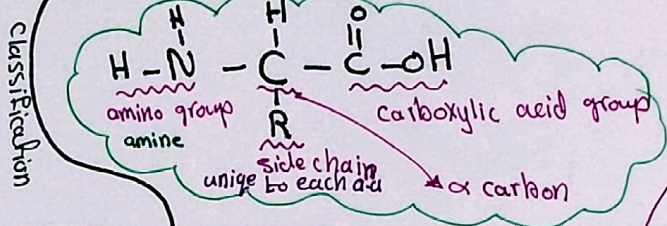
β -peptides → artificial
are used in → some antibiotics to counter resistin
→ more stable against proteolytic degradation

3 nucleotide = 1 codon = 1 amino acid.

biological significance

Amino Acid

300



β -amino acid with β -alanine is used in plants & microorganism

proteinogenic amino acid

Non-proteinogenic amino acids

Non-standard amino acid (3) (non-canonical)

- N-Formylmethionine**
 - bacteria
 - chloroplasts
 - mitochondria
- pyrrolysine**
 - human X
 - In one type of bacteria.
- selenocystein**
 - the protein which consists of it act in the body as an enzyme.

Standard amino acid (20)

- (canonical) Inatural amino acid.
- α -amino acids
 - has secondary amino group (-NH₂)
 - chiral molecules [chiral C → attached 4 different atoms or groups]
- achiral molecules [glycine]
 - achiral → can't be superposed
 - achiral → can be superposed

Isomers

molecules → molecular formula
chemical structure

constitutional structural - atoms & functional group bind together in different ways

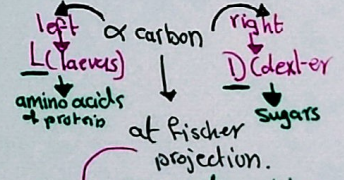
stereoisomer spatial - different in the configuration of atoms than the order of atomic connectivity

The categories of the standard amino acid according to the polarity of the R group

- with non-polar R groups 9
- with charged polar R groups 5
- with uncharged polar R groups 6

D/L amino acids

enantiomers = stereoisomers
mirror images to each other & not superimposable



representing the structure of chiral molecules

- carbohydrates
- amino acids

optical activity

- dextrorotatory**
 - enantiomer rotates the light clockwise (+) (d)
 - laevorotatory**
 - enantiomer rotates the light counterclockwise (-) (l)
- D-amino acids polypeptide bacterial cell walls to resist digestion by other organism

D/L doesn't confuse with +/- system
Racemic mixture → contain equal amounts of enantiomers

aliphatic side chain 6

- Glycine - simplest side chain: H
- Alanine - aliphatic hydrocarbon side chains
- Valine
- Methionine - has a cyclic pyrrolidine side chain
- leucine
- isoleucine

aromatic side chain 2

- Tryptophan
- phenylalanine

cyclic side chain 1

- proline
- butyl ammonium side chain
- guanidinium group
- imidazole group

positively charged 3 basic

- Lysine
- Arginine
- Histidine

negatively charged 2 acidic

- Aspartate
- Glutamate

phenolic group

Tyrosine aromatic

hydroxyl group

Serine
Threonine

amide group

Asparagine
Glutamine

thiol group

Cysteine

cystein + cystein
oxidation of 2 thiol groups
formation disulfide bond (-S-S-)

Amino Acids

Nutritional classification

Essential amino acid

can't be produced by the body.

must be supplied through diet

- Valine
- Isoleucine
- Leucine
- Lysine
- Methionine
- Phenylalanine
- Threonine
- Tryptophan

Non-essential amino acid

Can be synthesized by the body.

- Glycine
- Alanine
- Serine
- Cysteine
- Aspartic acid
- Glutamic acid
- Asparagine
- Glutamine
- Proline

Conditionally essential amino acid.

synthesized in the body in insufficient amount should be supplied in diet

[requirement] production rate essential in cases:

- Children
- Pregnant
- Lact
- Histidine
- Arginine
- Tyrosine

* phenylalanine → tyrosine

dict is deficient in phenylalanine individual is deficient in enzyme

accumulated phenylalanine is toxic to brain

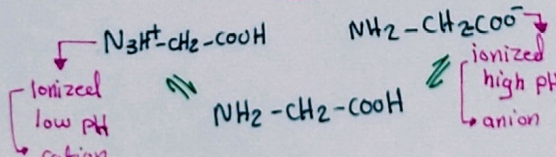
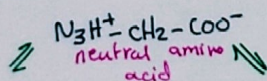
lead to intellectual disability & mental disorders

[inherited inborn congenital PKU]

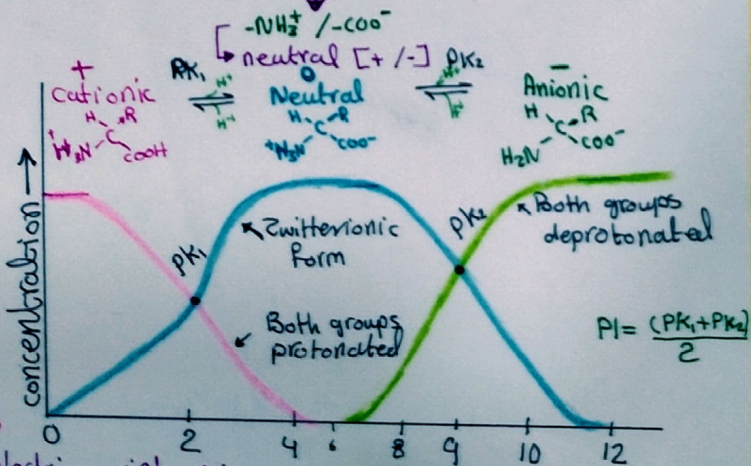
Amphoteric property of Amino Acids

amphoteric → $[-COOH]$ acidic group, $[-NH_2]$ basic group

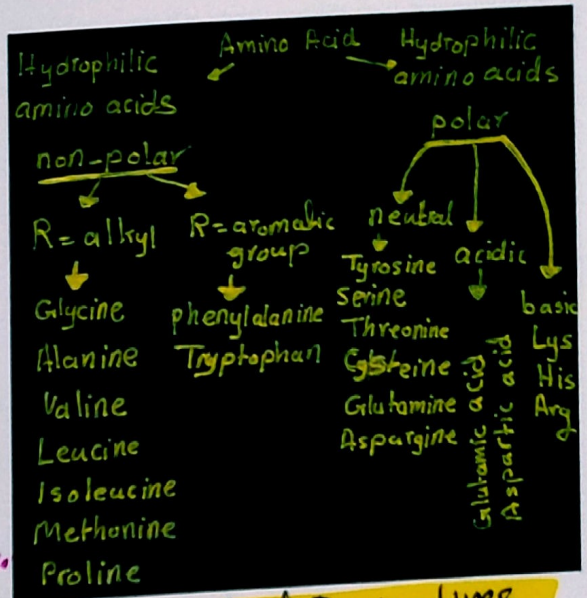
ionization → PH value.



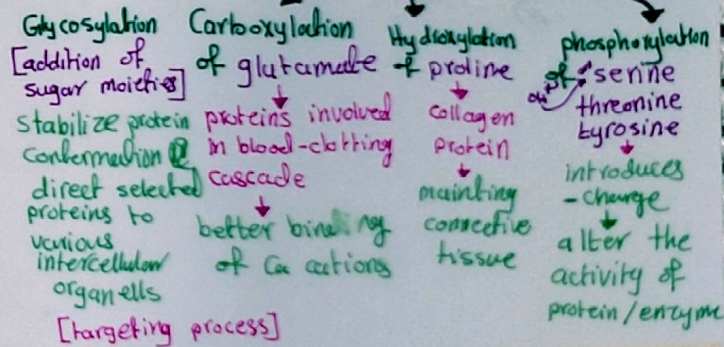
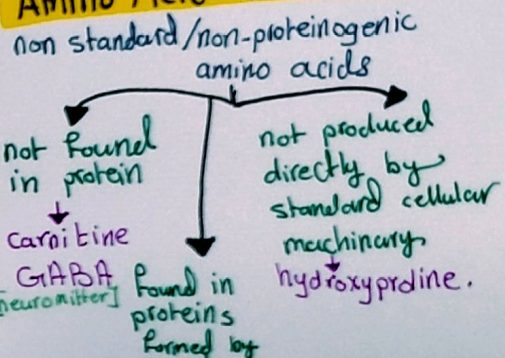
* Amino Acids as [Zwitterions] [dipolar molecules]



overall charge = 0
 Isoelectric point (pI) the pH at which molecules carry no net electric charge
 pI = $\frac{pK_1 + pK_2}{2}$
 Zwitterion is the dominant form of the amino acids



Amino Acid Derivatives



Non protein Function.

- * non-standard intermediates in the metabolic pathway → standard amino acid catabolism (e.g. Urea cycle part of amino acid catabolism)
- * amino acids synthesize amino acid derivatives [molecules]
 - Examples:
 - Tryptophan → serotonin [neurotransmitter]
 - Tyrosine → thyroxine [thyroid hormone], dopamine, adrenaline, noradrenaline [catecholamine neurotransmitter]
 - histidine → histamine [released during allergy] (via decarboxylation)
 - glutamate → GABA [major inhibitory NT in brain] (via γ -aminobutyric acid)