Protein Metabolism

Transamination :—

Transamination is a transfer of α-amino group of an amino acid (AA_1) to an α-keto acid (KA_2) Thereby, the original amino acid is changed to a new keto acid (KA_1) While the original α-keto acid (KA_2) changed to a new α-amino acid (AA_2). Transaminase or amino transferases catalyse trans amination in mitochondria and cytoplasm of the liver, kidney, heart, testis and brain.

$$AA_1 + KA_1 \rightleftharpoons KA_1 + AA_2$$

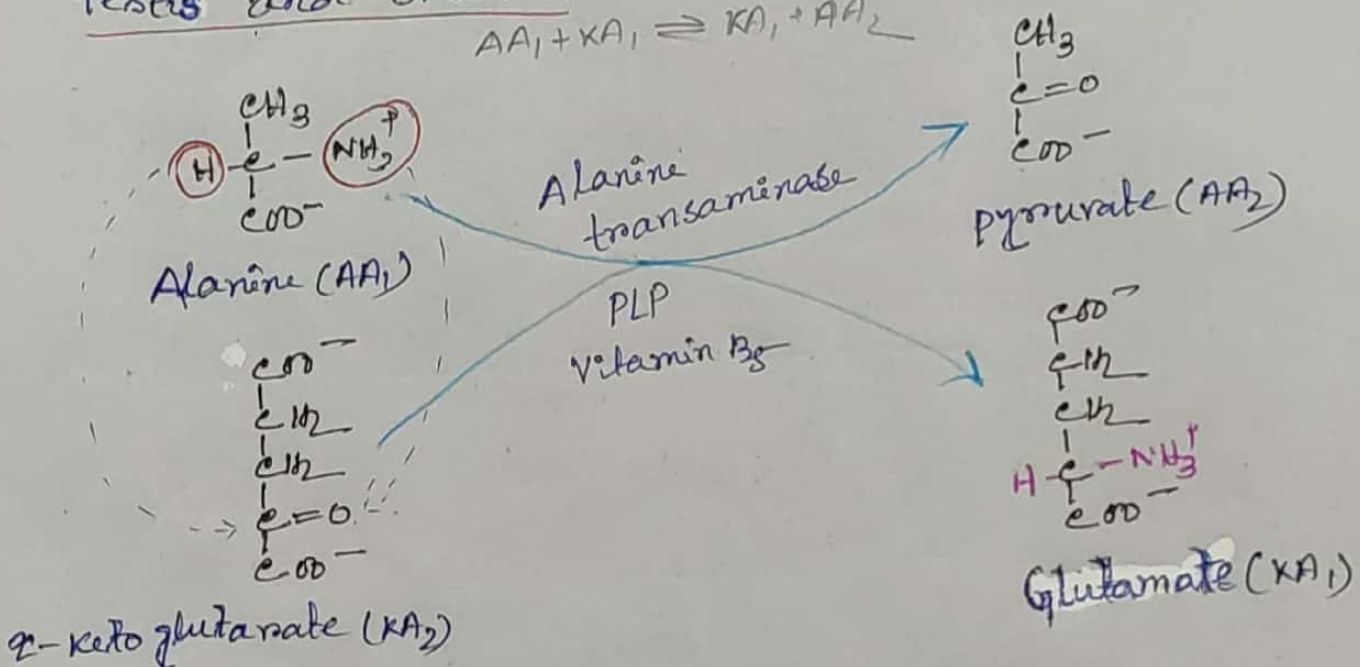


Fig:— Transamination reaction

☑ **Deamination :—** Deamination is the process by which an α-amino group is completely removed from an amino acid. It is two types

Deamination
- Oxidative deamination
- Non-oxidative deamination

1. Oxidative Deamination :—

The Flaroprotein enzyme D-amino acid oxidases catalyse oxidative deamination. For example —

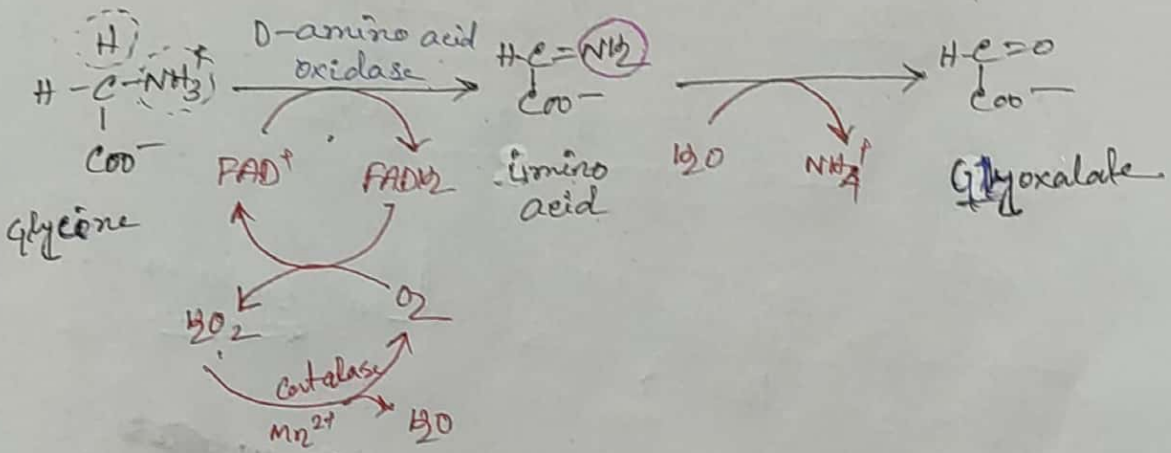


Fig:- Oxidative deamination of glycine by Amino acid oxidase.

2. Non-oxidative Deamination :—

⇒ **1. Role of Amino Acid lyases :—**

Amino Acid lyases
- Histidase
- Aspartase

(3)

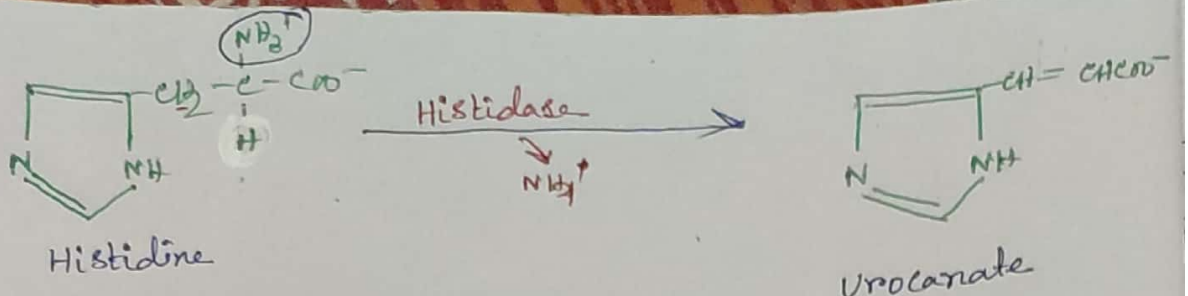


Fig:- Action of Histidase

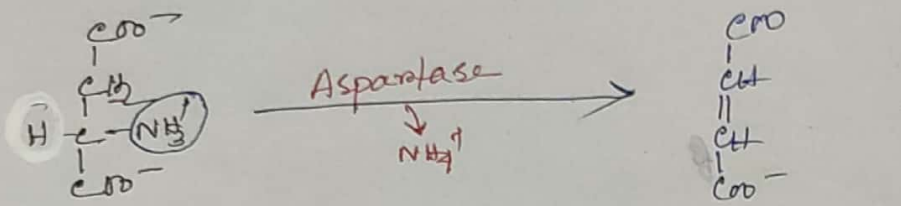


Fig:- Action of Aspartase

2. Role of Amino Acid dehydratases :—

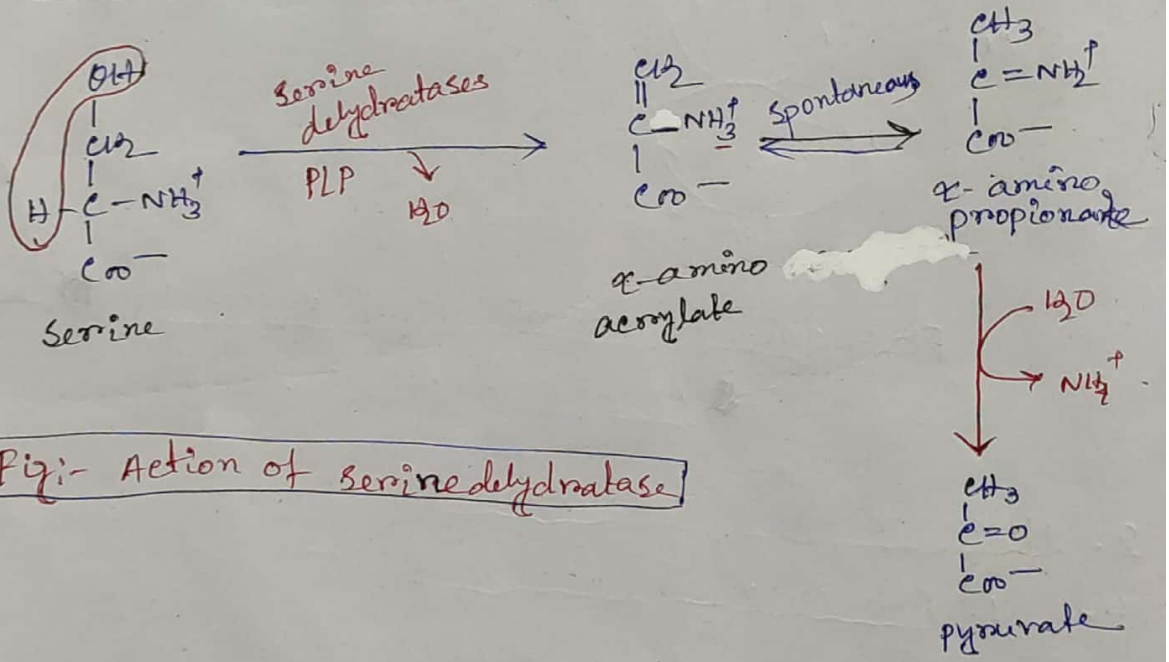


Fig:- Action of Serine dehydratase

3. Role of Amino acid hydrolases :—

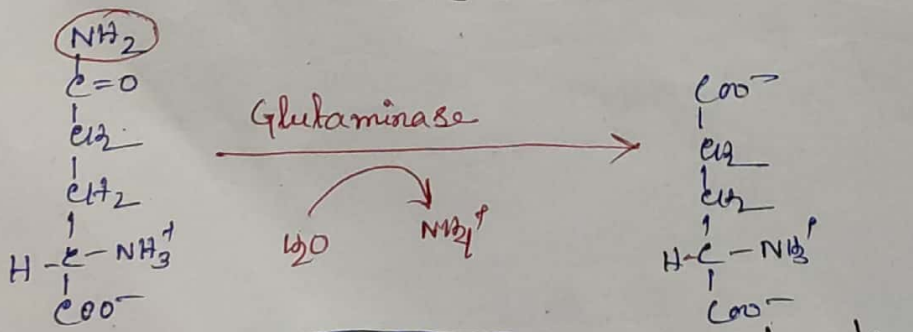


Fig:- Role of Glutaminase

Transdeamination :=

Transdeamination consists of both Transamination and oxidative deamination to release of α-amino groups from α-amino acids as NH_4^+ in the liver.

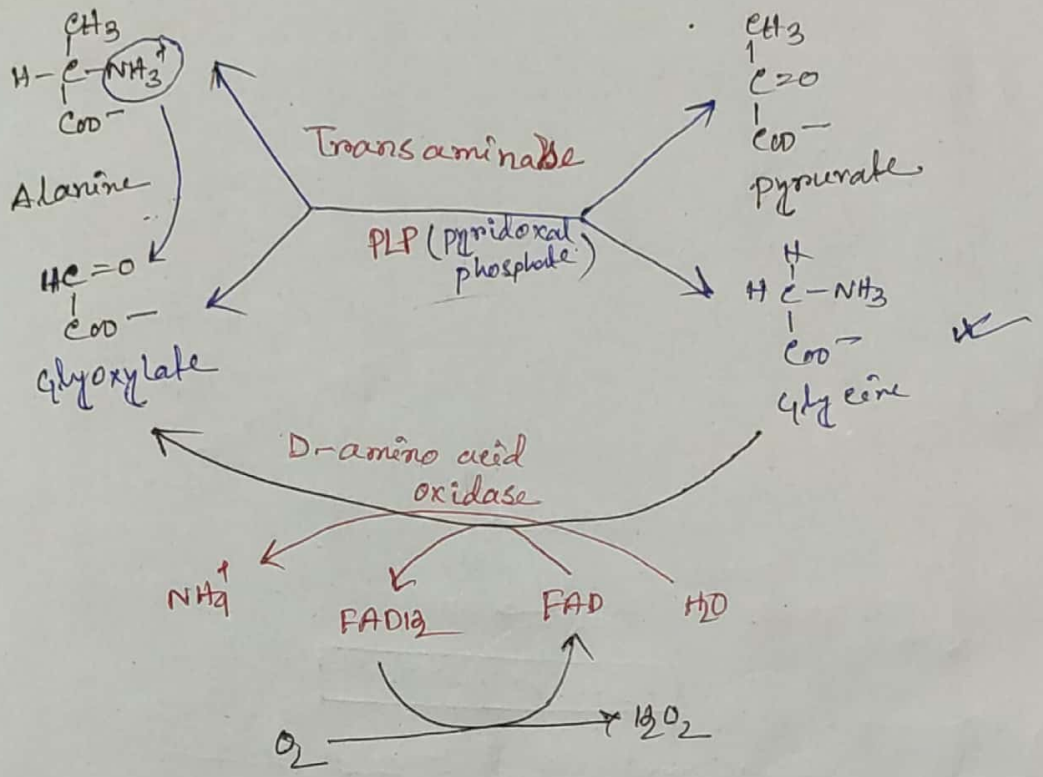
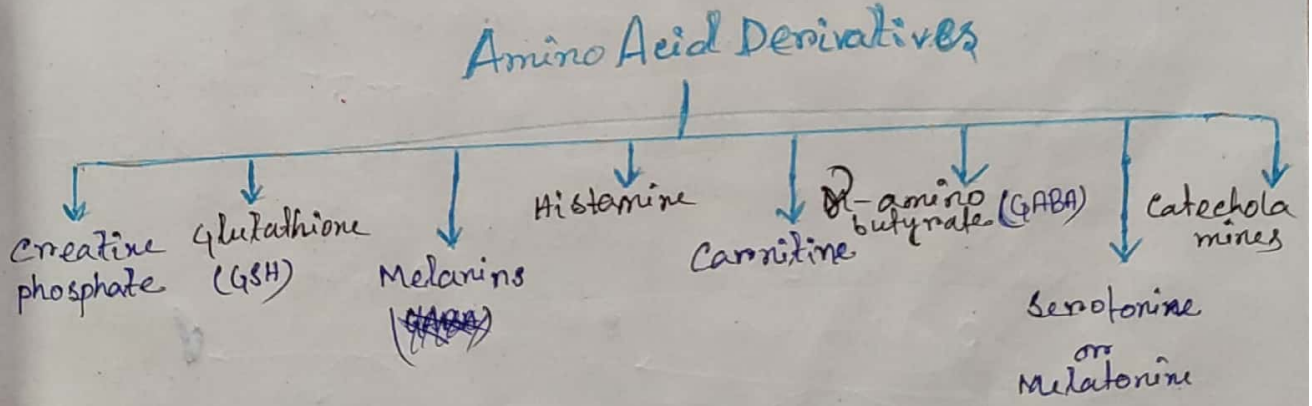


Fig:- Transdeamination of Glycine

Amino Acid Derivatives or Specialized products of Amino Acids :=



① Creatine phosphate :-

Creatine phosphate is a high energy phosphate bond (-10.3 kcal/mol) stored in striated muscles.

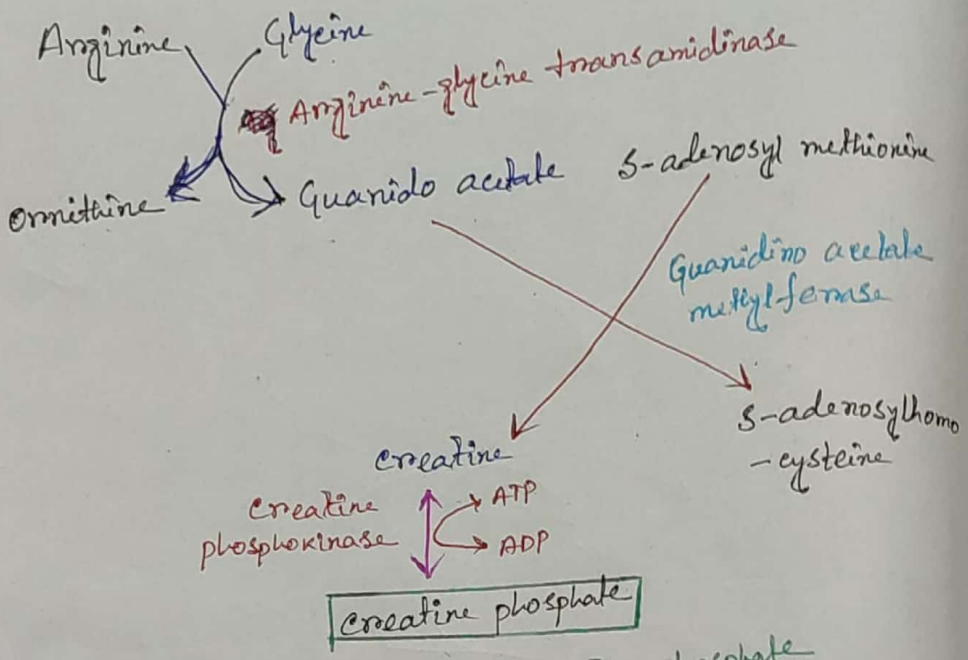


Fig:- Synthesis of creatine phosphate

Significance :- During muscle contraction, creatine phosphate transfer its phosphate to ADP to form ATP.

2. Glutathione (GSH) :-

It is synthesized from glutamate, cysteine and glycine in the cytosol. GSH acts a redox buffer in tissues by donating H^+ and e^- to substrates. It helps in protecting many enzymes from oxidation and participate in scavenging the ROS (Reactive oxygen species)

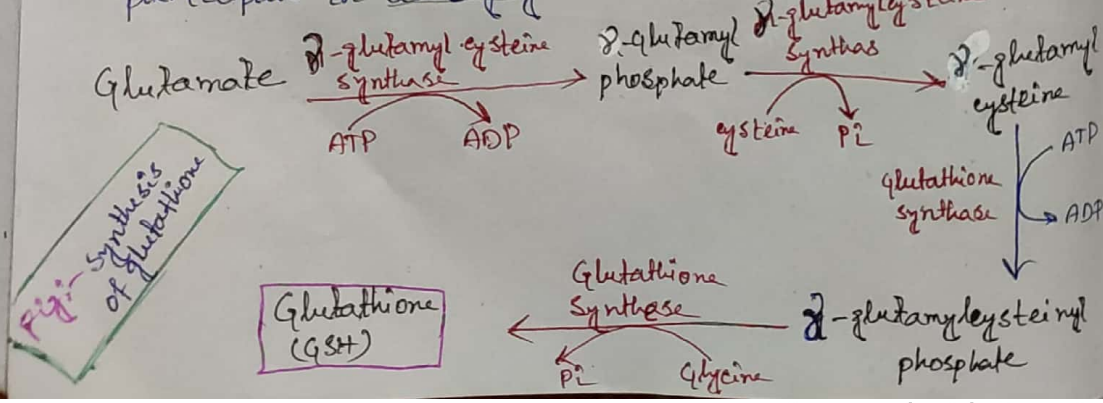


Fig:- Synthesis of glutathione

3. Melanins :— These are protein bound pigments of skin melanocytes, hair etc. Black eumelanins and red or brown pheomelanine occur as melanine polymers. It's synthesized form tyrosin amino acid.

4. Serotonine and Melatonine :—

Serotonin is a vasoconstrictor amine called neurotransmitter. Synthesized from trypotophan in liver, kidneys and GI tract. Melatonine is synthesized in Pineal gland from Serotonine.

5. Catecholamines :—

Dopamine, nor-adrenaline and adrenaline are synthesized from tyrosine, these are called neurotransmitter of adrenal medulla.

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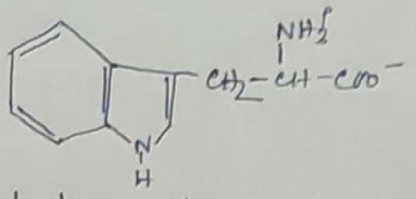
Melatonin

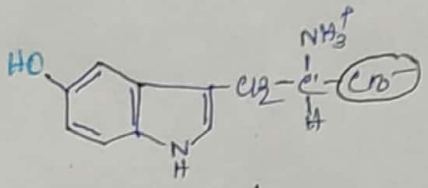


L-tryptophan

H_4-biopterin

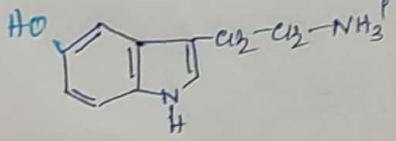
O_2 → Tryptophan hydroxylase → H_2-biopterin

H_2O



5-OH-tryptophan

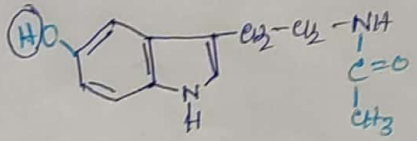
PLP → L-amino acid decarboxylase → CO_2



Serotonin

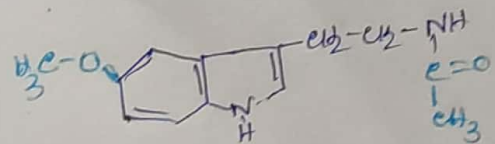
$CH_3-C=O$

S-CoA Acetyl CoA → Serotonin N-acetylase → CoASH



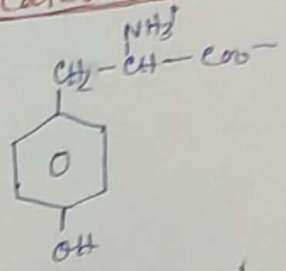
N-Acetylserotonin

S-adenosyl methionin → N-acetylserotin O-Methylferase → S-adenosyl homocystin



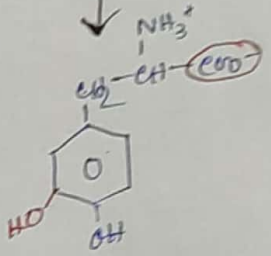
Melatonin

Catecholamine



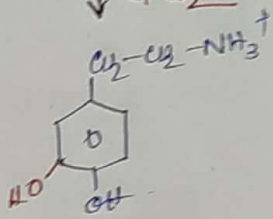
Tyrosin

H_4-biopterin → Tyrosine hydroxylase → H_2-biopterin



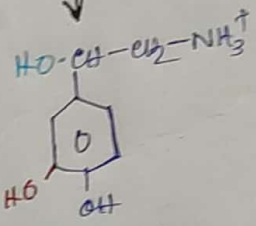
DOPA

L-amino acid decarboxylase → CO_2



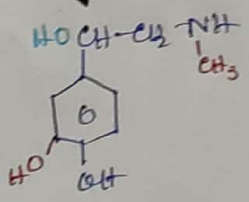
Dopamine

Cu^{2+}, L-Ascorbat → Dopamine β-hydroxylase

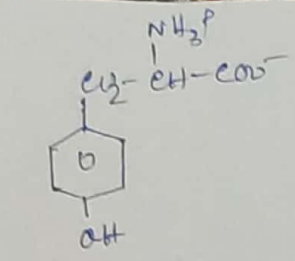


Non-adrenaline

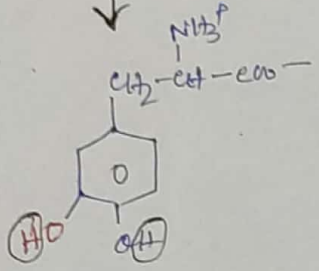
S-adenosyl methionin → phenylethanolamine N-methylferase → S-adenosyl homocystin



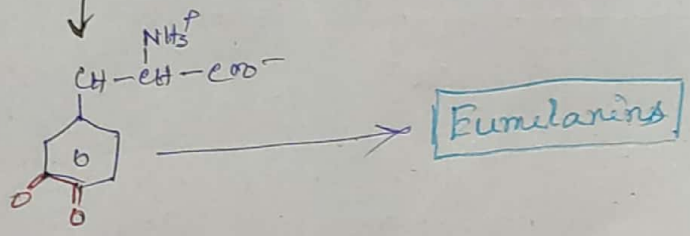
Adrenalin



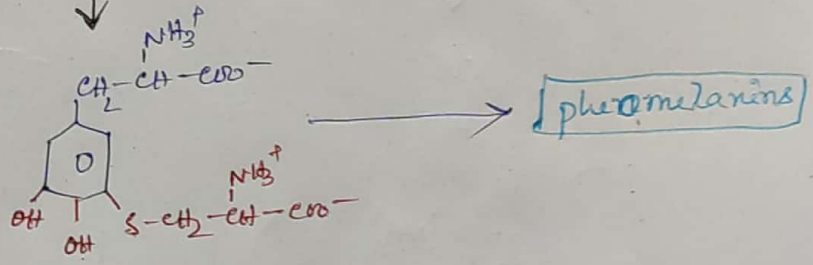
Tyrosin



DOPA



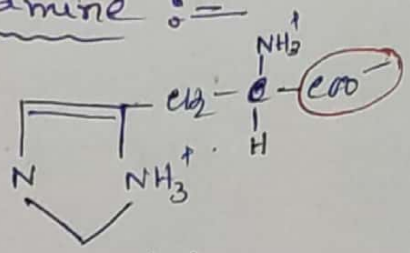
DOPA quinone



5-S-cysteinyl-DOPA

Fig :- Melanins Synthesis

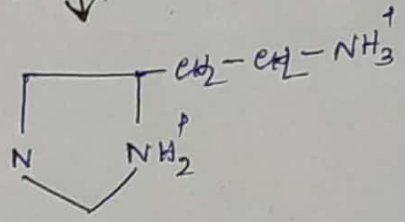
Histamine :=



L- Histidine

Histidine decarboxylase

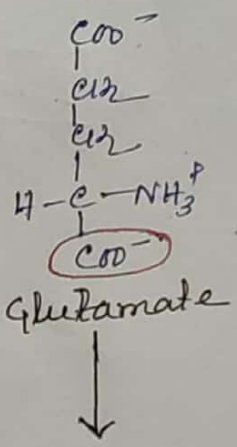
CO_2



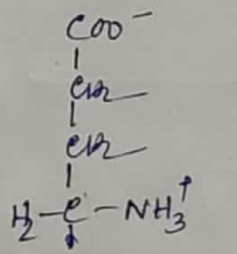
Histamine

Fig:- Formation of Histamine

γ- amino butyrate (GABA) :=



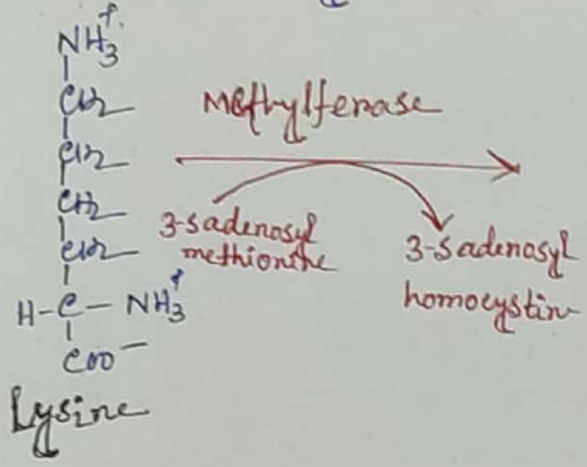
Glutamate

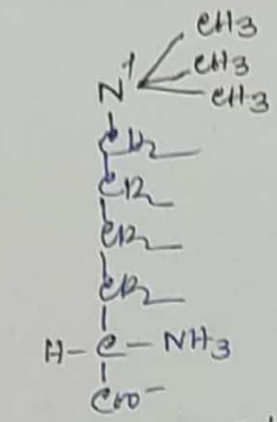


GABA

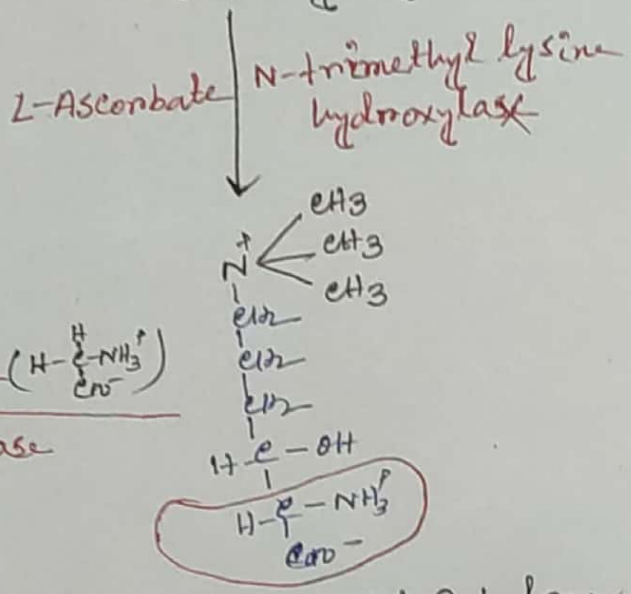
Fig:- Formation of GABA

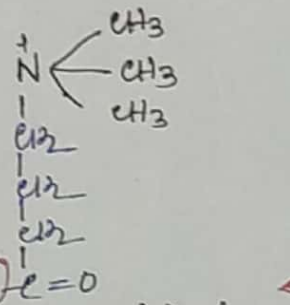
Carnitine Synthesis :—



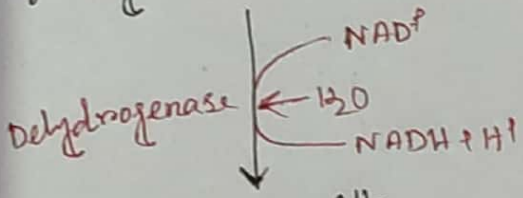


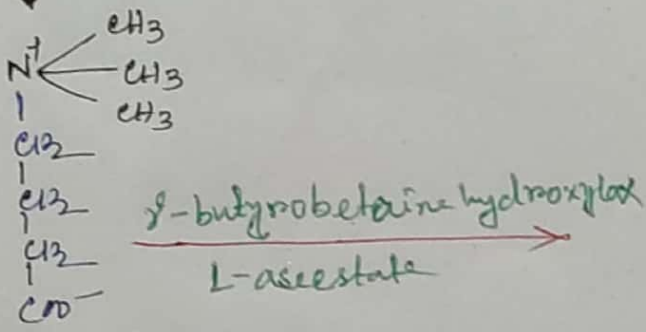
N-trimethyl lysine



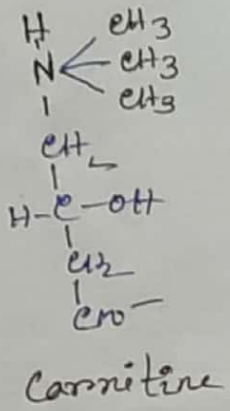


γ-butyrobetaine aldehyde





γ-butyrobetaine



Carnitine

Fig:- Synthesis of Carnitine