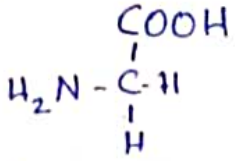
GLYCINE



Glucogenic, Non essential

Formation

① De novo synthesis

Gly is synthesized from NH_3, CO_2 and 1 C unit by Glycine synthase complex. This is a multienzyme complex

② From Serine

Gly is formed from Ser by Serine hydroxy methyl transferase

③ From Threonine

By Threonine aldolase

④ From glyoxalate

Glyoxalate is transaminated to Glycine by Glyoxalate aminotransferase (Also called Gly transaminase)

⑤ Glycine can also be produced from Choline

Utilization of glycine

① Glycine cleavage system: Cleaves Gly to NH_3, CO_2 and 1C unit.
It is a multienzyme complex

② Glucogenic pathway: Gly is converted to ser by reversal of Serine hydroxy-methyl transferase reaction.
Serine can be converted to glucose

③ Formation of Heme.

Glycine + Succinyl CoA $\xrightarrow[\text{ALA synthase}]{\text{PLP}}$ ALA

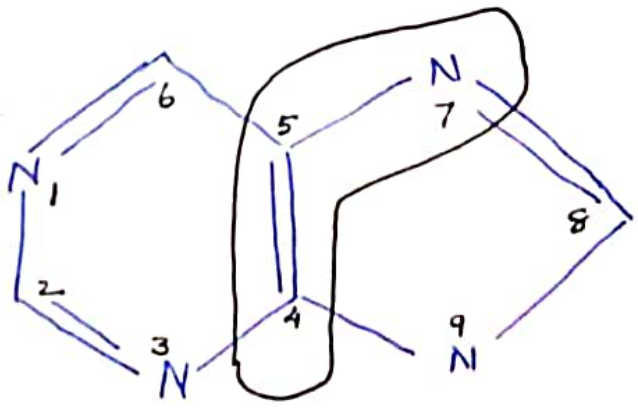
This is the first step of heme synthesis

④ Formation of glutathione

Glutathione is formed by 3 amino acids: Glu, Cys, Gly.

⑤ Formation of purine ring

C_{5}, $_{6}$ and N_7 of purine ring is contributed by Glycine



⑥ Formation of creatine

Creatine is formed from Gly, Arg, Met

⑦ Conjugating agent

Glycine is involved in conjugation of Bile acids, Benzoic acid etc

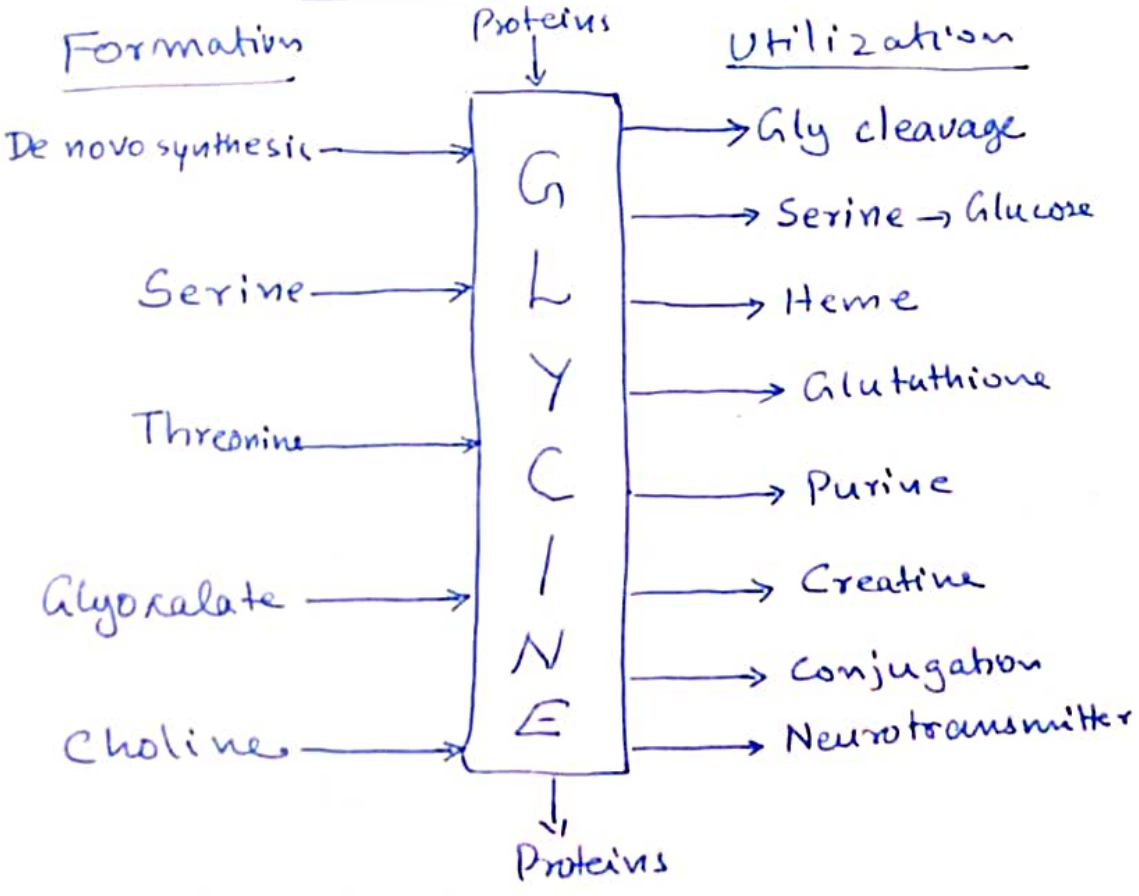
⑧ Formation of proteins

Gly is required for formation of many proteins.

In Collagen, every 3rd amino acid is glycine

⑨ Glycine is a neurotransmitter

SUMMARY



Disorders of Glycine metabolism

① Non ketotic Hyperglycinemia

Defect in Glycine cleavage system

↑ed Gly in blood

→ Neurological defects
→ Mental retardation
→ Early death

② Primary Hyperoxaluria

Due to defective protein targeting of the enzyme Glyoxalate amino transferase.

Glyoxalate ↑ → Converted to Oxalate

↓

Excreted in urine

↓

Urinary stones

↓

Renal damage

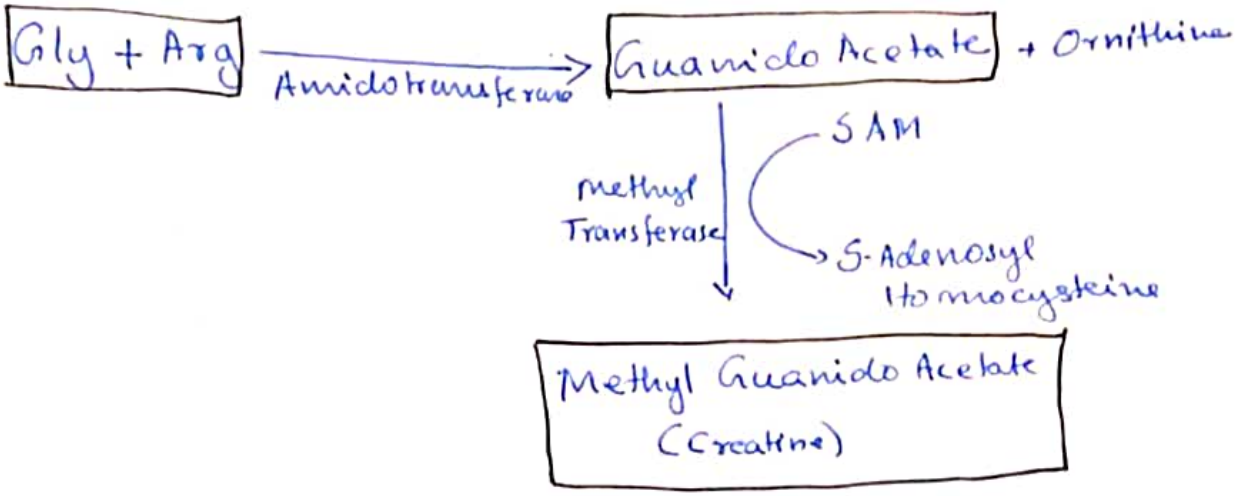
③ Glycinuria

Defect in renal tubular reabsorption of Glycine.

CREATINE AND CREATININE

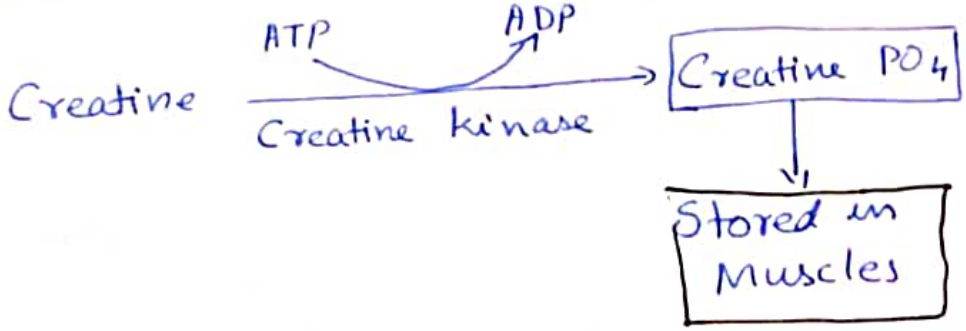
Creatine is Methyl Guanidoacetate

Formation



Function of creatine

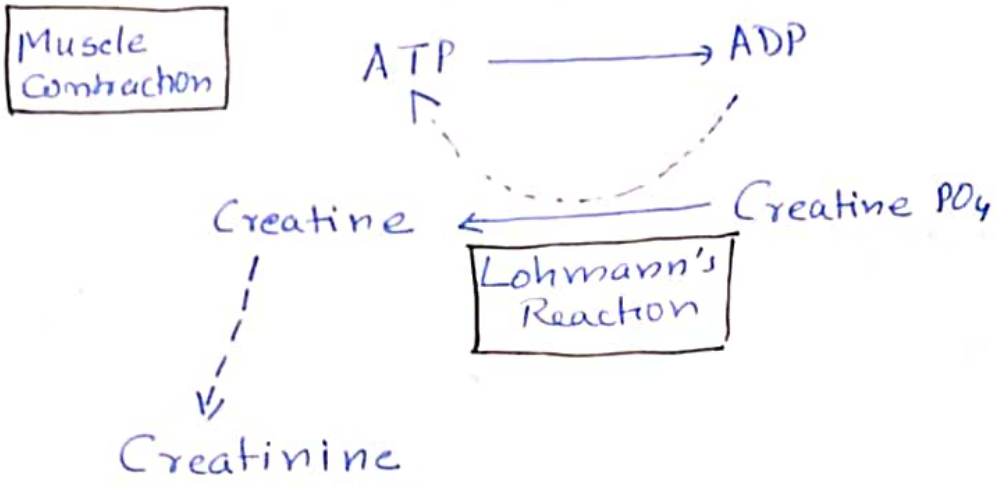
Creatine is converted to Creatine PO_4



Creatine PO_4 is stored in muscles. When muscle contraction occurs, ATP in muscle is depleted. PO_4 present in creatine PO_4 is used to replenish ATP. This reaction is called

Lohmann's reaction

24



Creatine can be converted to its anhydride creatinine by a non enzymatic reaction

Creatinine is excreted through urine

Clinical importance

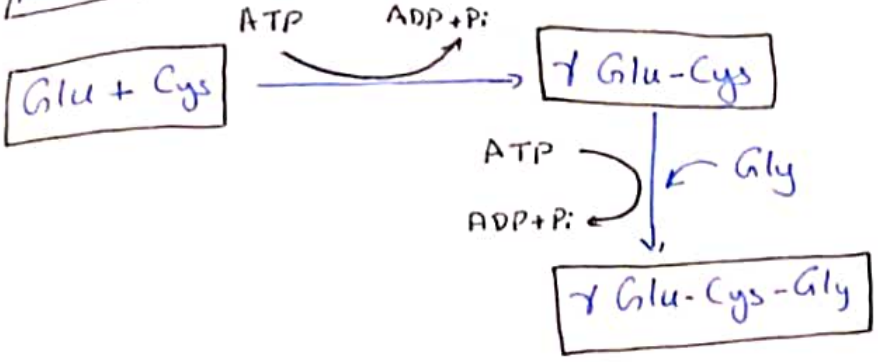
① Serum Creatinine :
Normal level 0.7 - 1.4 mg/dl
↑ed in renal failure

② Serum Creatine
Normal level 0.2 - 0.4 mg/dl
↑ed in muscle damage, muscle dystrophy etc

Glutathione

It is γ Gamma Glutamyl Cysteinyl Glycine. (γ Glu-Cys-Gly).

Formation



Glutathione is abbreviated as G-SH as it has a free -SH group of Cysteine. This can donate H for reductive reactions

This is denoted as $2\ G\text{-}SH \rightarrow GS\text{-}SG + H_2$

Functions of glutathione

(1) Coenzyme role in reductive reactions

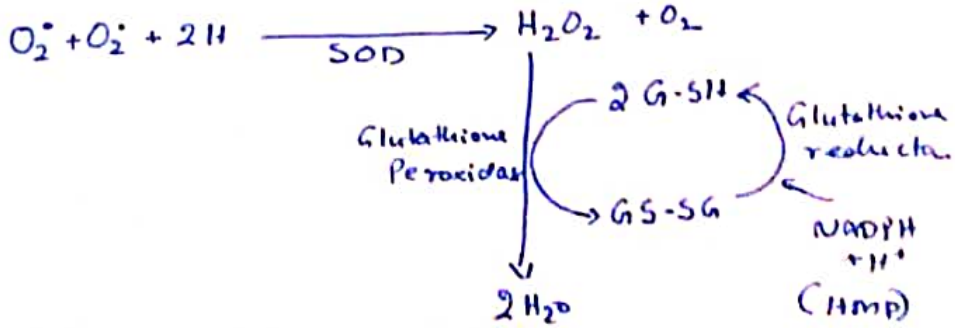
Free SH group donate H in reductive reactions.

This is important in

(a) Reduction of Met Hb

(b) Protecting integrity of RBC membrane

(c) Free radical scavenging



(d) Activation of enzymes having SH group at active site

(2) Amino acid transport-

Glutathione is involved in the absorption of amino acids. This pathway is called Meister Cycle

(3) Conjugating agent

Glutathione ~~is~~ conjugates drugs, heavy metals, organophosphorus compounds etc

Conjugation is catalyzed by Glutathione-S-Transferase