Dr. Shimaa Badawy
Lecturer of Biochemistry

Glycine metabolism

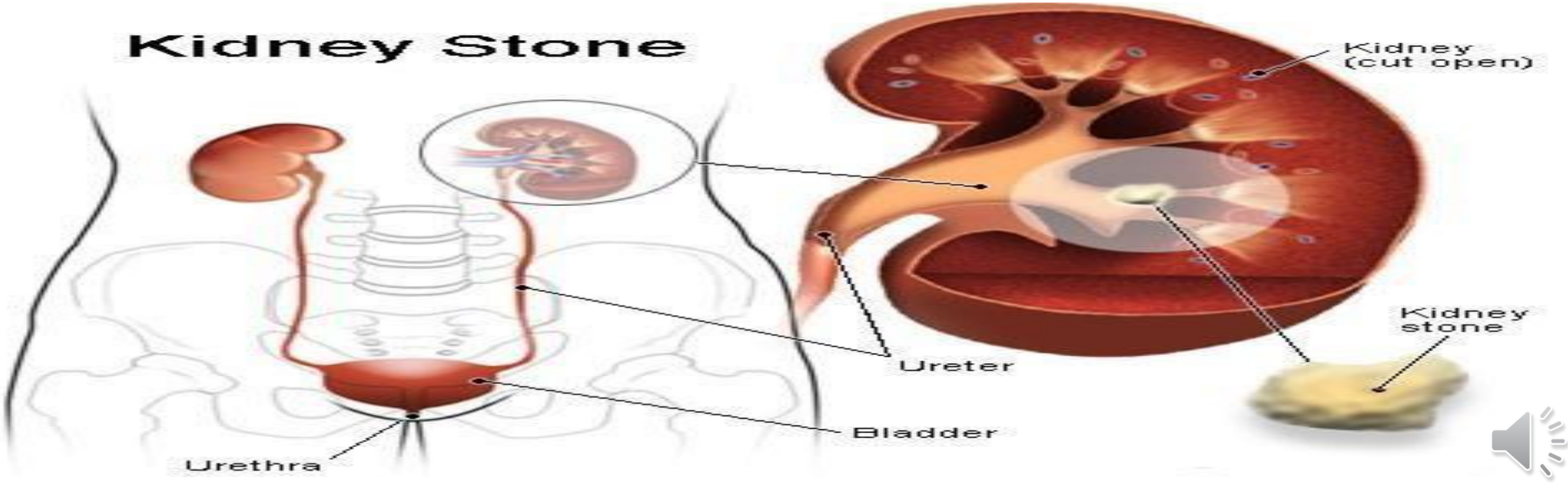
- ✓ Synthesis ,degradation & biomolecules derived from amino acids.
- ✓ Describe Synthesis of glycine amino acid.
- ✓ Enumerate biomolecules derived from glycine amino acid .
- ✓ Discuss biosynthesis and biochemical role of Glutathione, Creatine, choline.

Metabolism of individual amino acids

Glycine metabolism

1-Nature >>>>… 2-Synthesis>>….3- Anabolic fate>>>

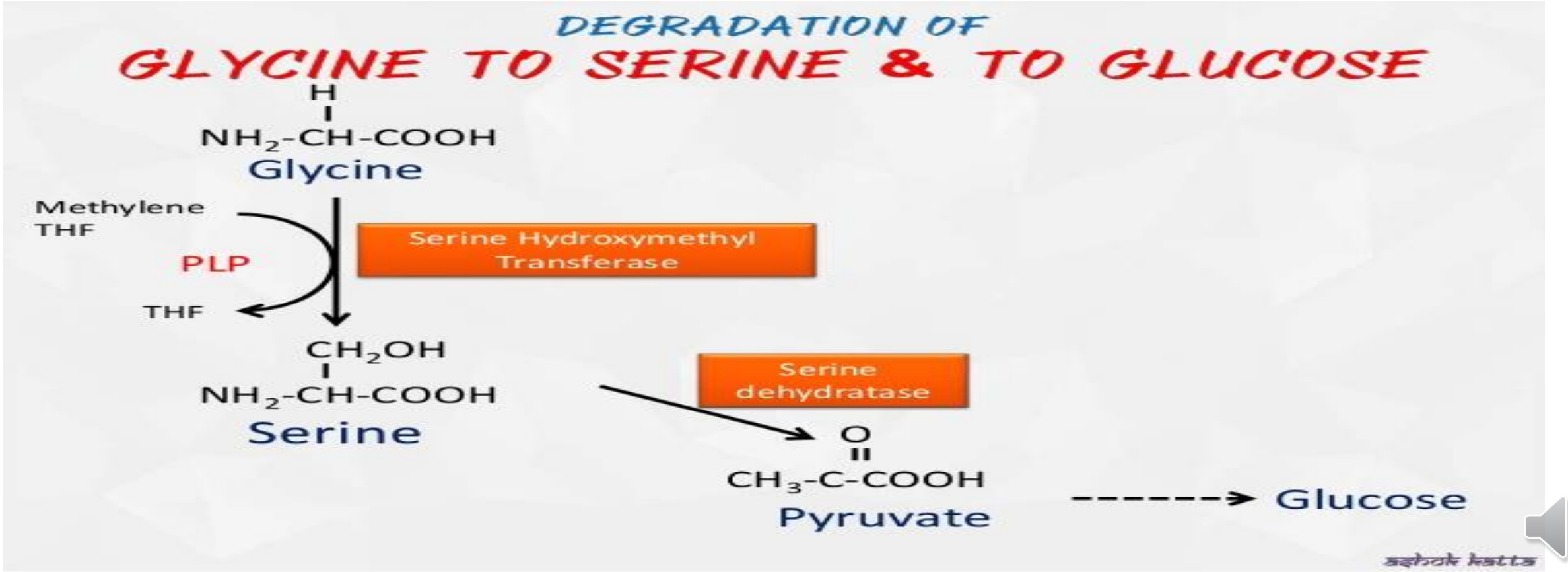
4- Catabolic fates >>> 5- Metabolic defects>>>>>



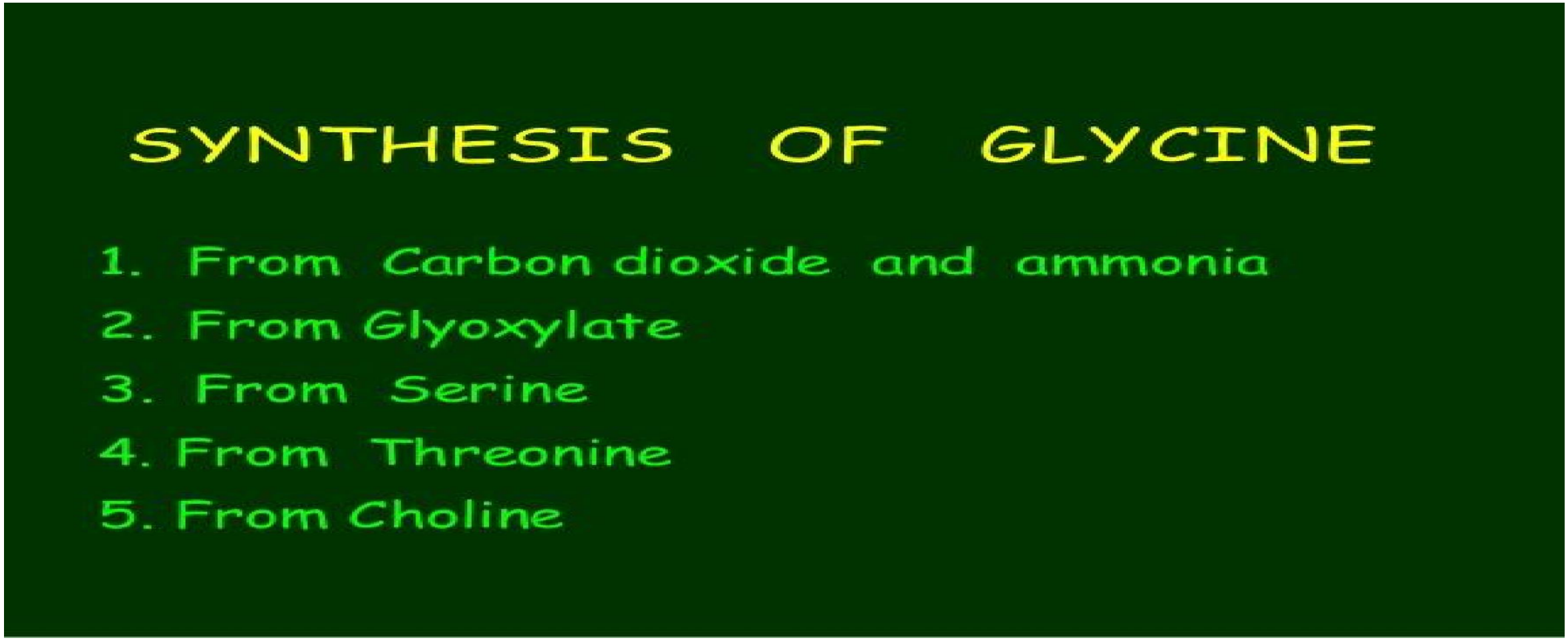
Glycine metabolism

Nature

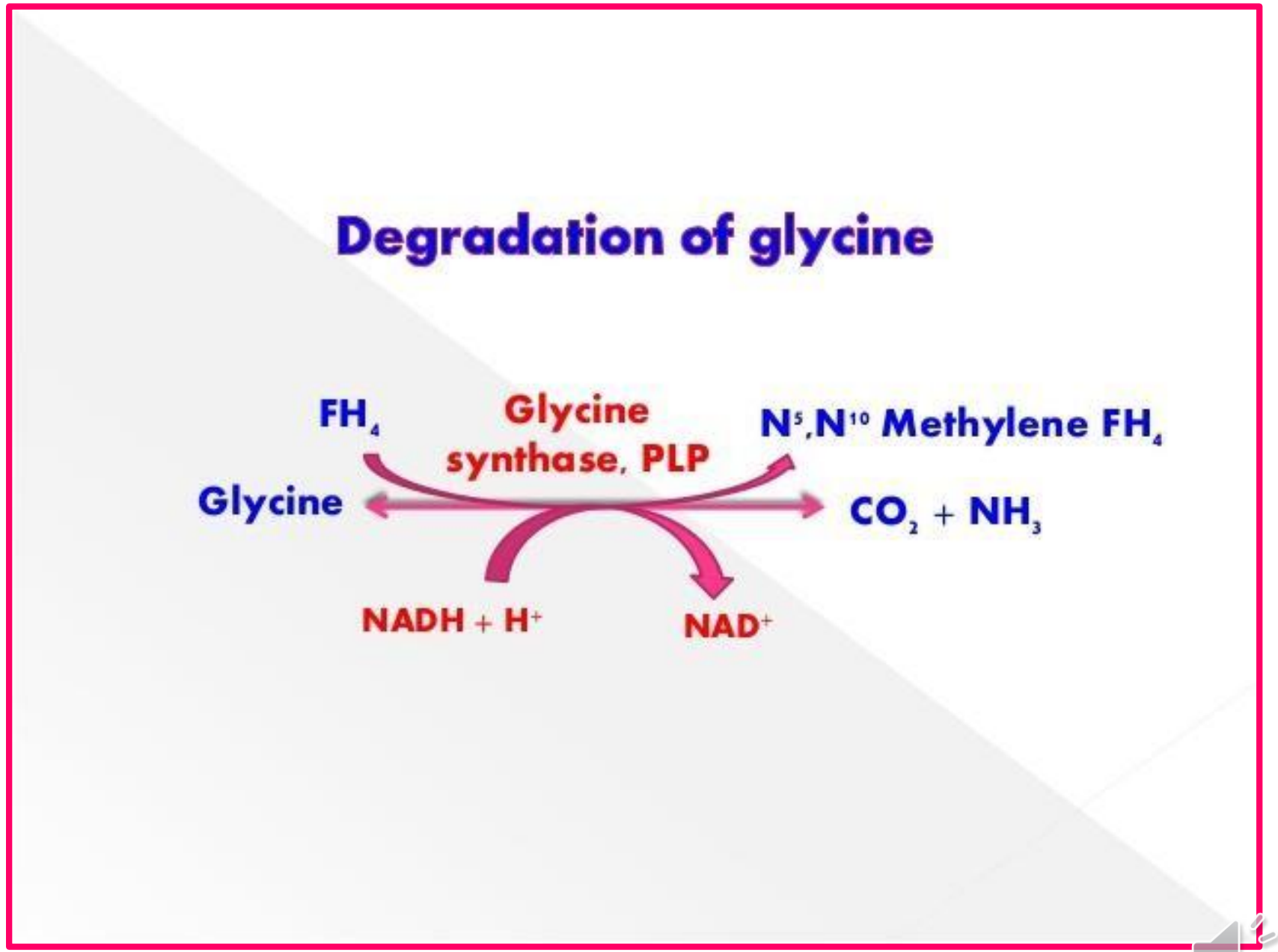
-Non essential amino acids - Glucogenic amino acids



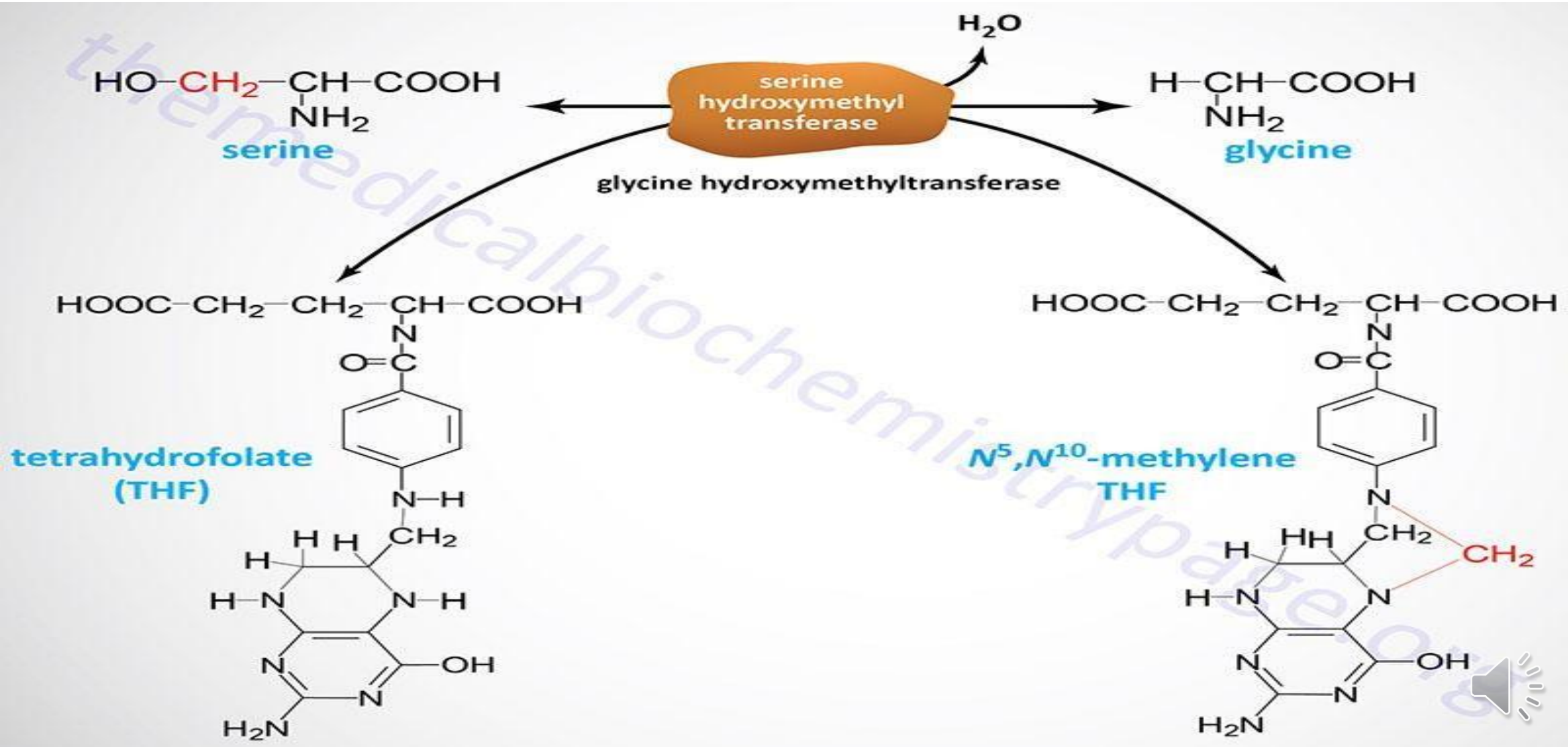
Synthesis of Glycine



1-Denovo synthesis>>>
Degradation of Glycine

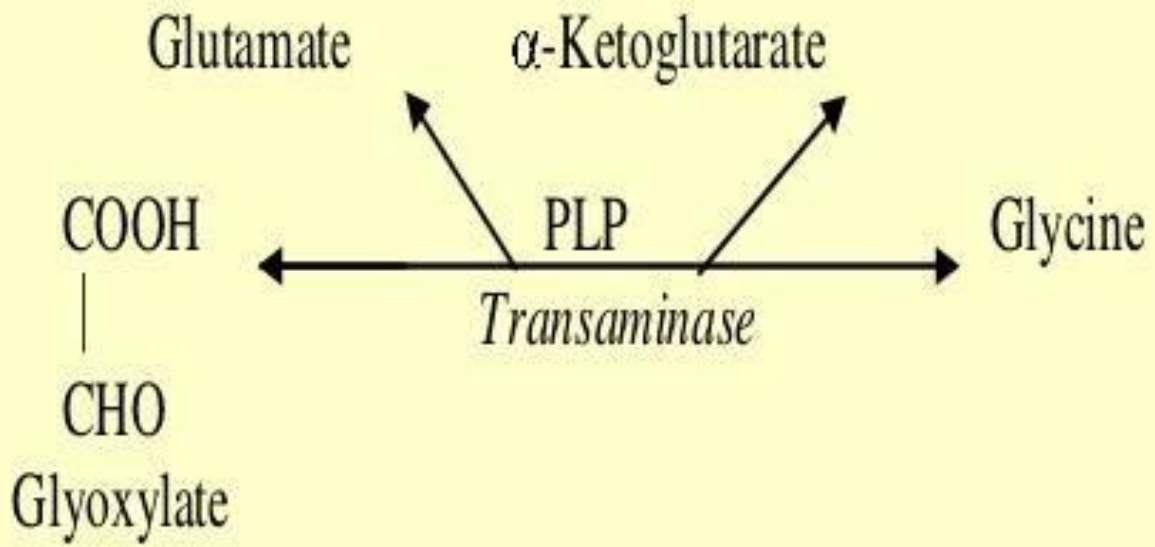


2-Synthesis of Glycine from - Serine Reversible reaction



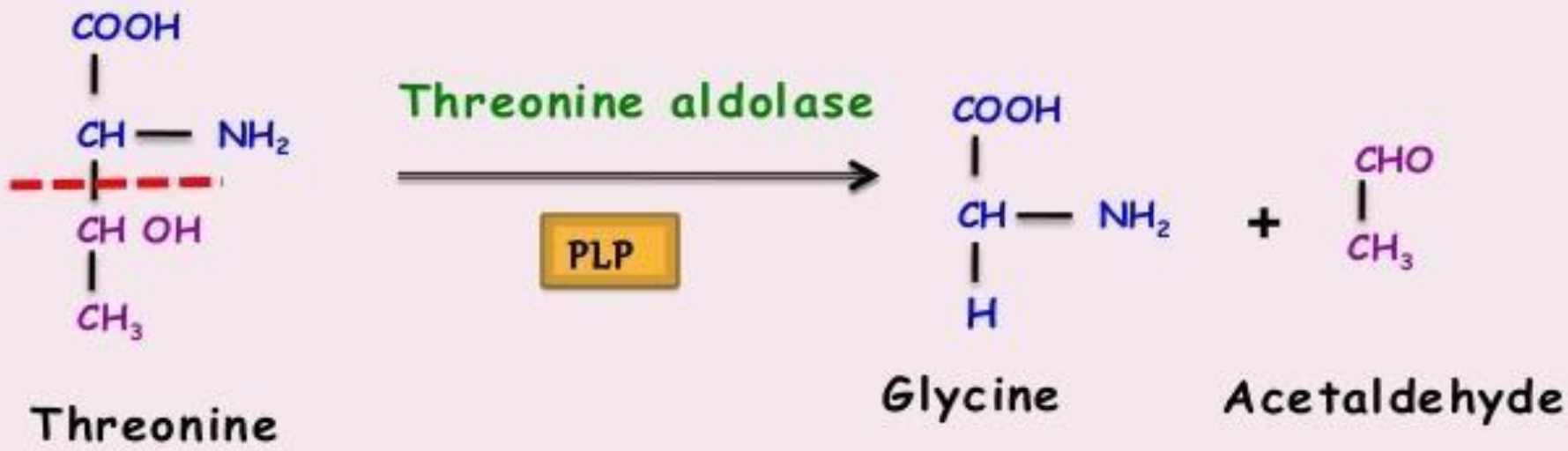
3-Synthesis of Glycine from Glyoxalate

3. Synthesis of Glycine from Glyoxalate:

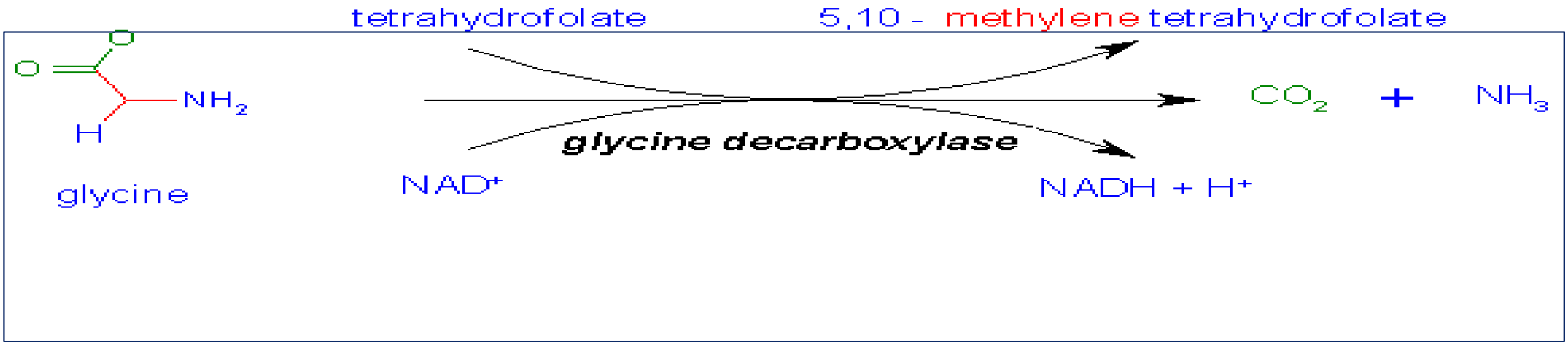


4-Synthesis of Glycine from Threonine

Synthesis of Glycine from Threonine



5-Degradation of Glycine to Ammonia &CO2



Catabolic fate of glycine:

1-Production of co2and NH3

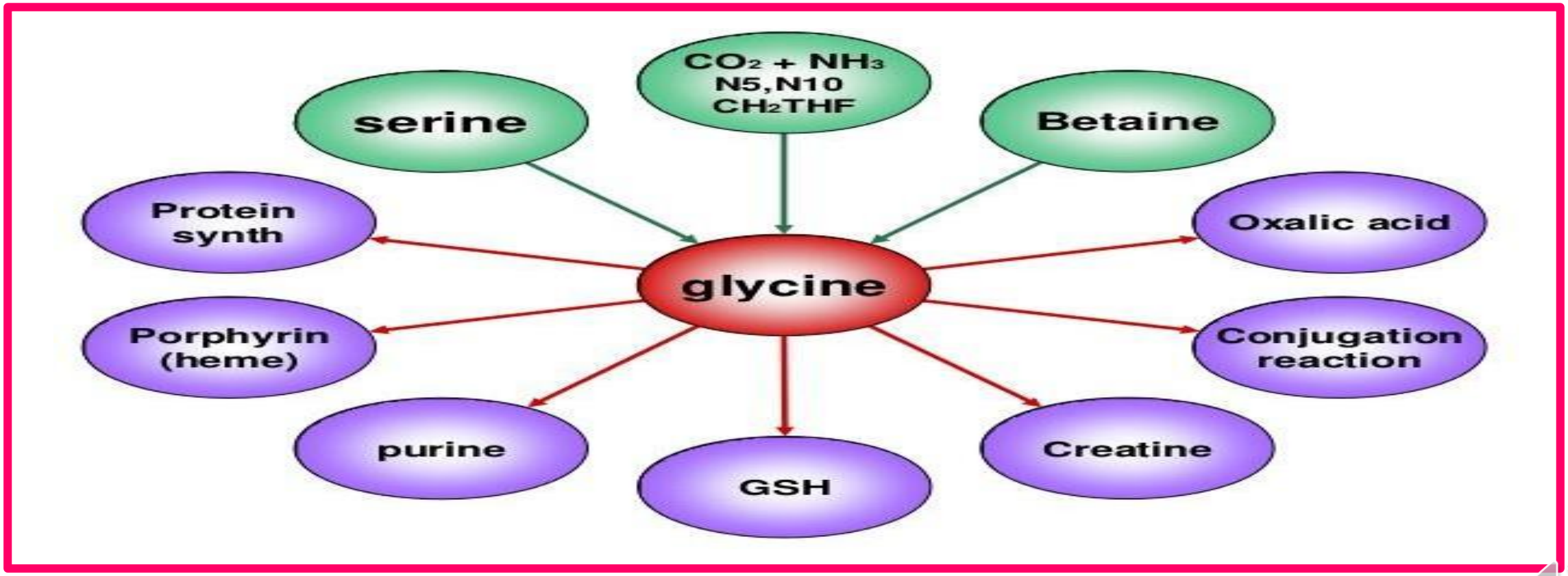
2-Glyoxylic acid

3-pyruvate

4-detoxication reaction by conjugation

Role of Glycine biosynthesis of molecules

Anabolic Fate



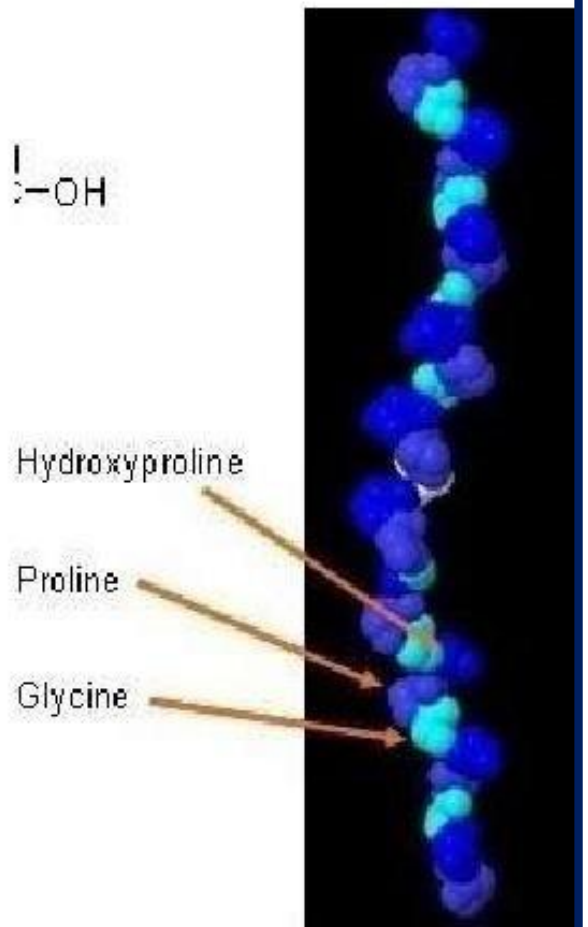
Functions of Glycine: Collagen synthesis

- .1**Collagen –rich in Glycine -30%**

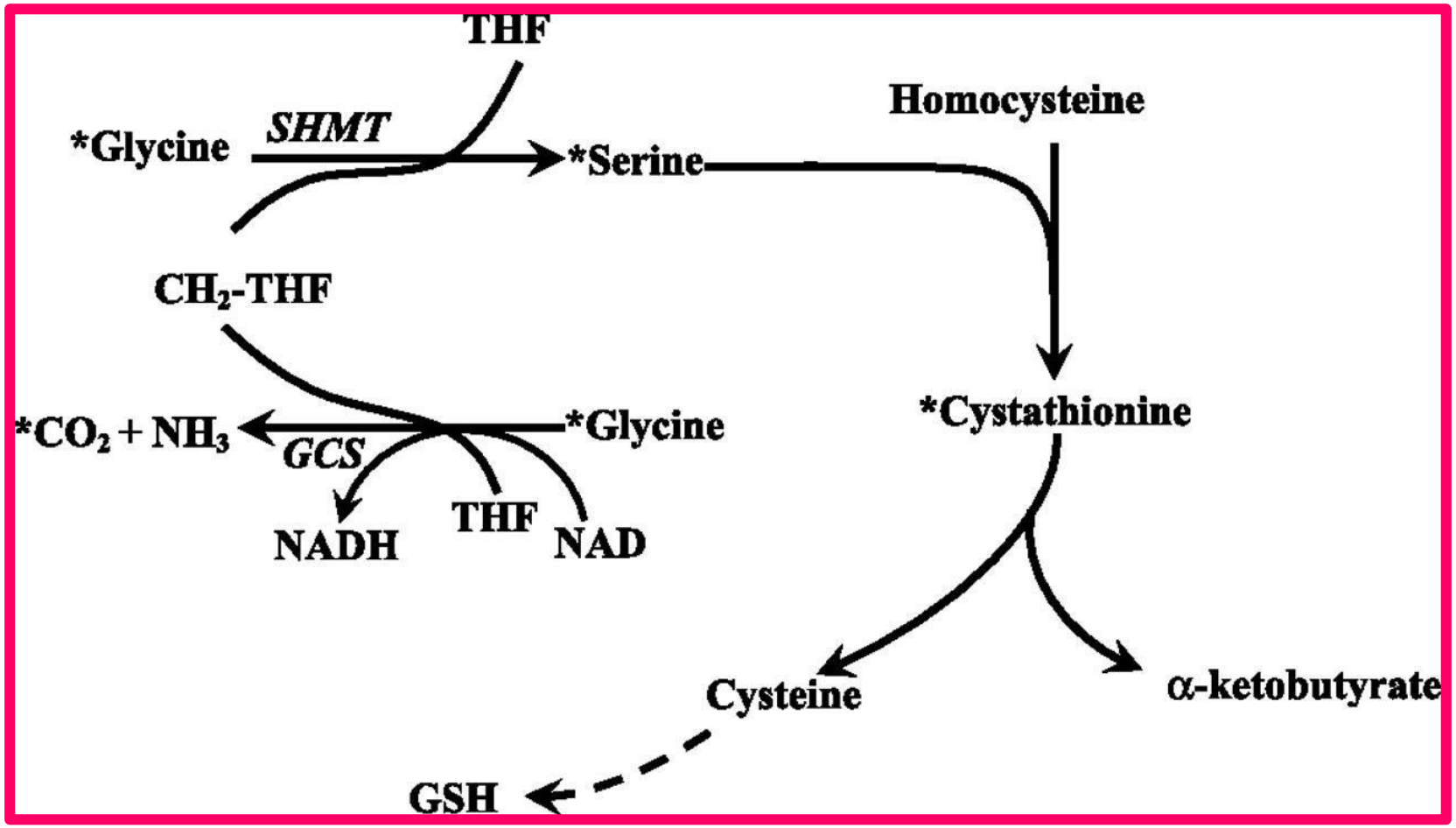
--(--GLY---X---Y--GLY---X---Y--)--

X≡ PROLINE

Y≡ Hydroxy Proline
Hydroxy Lysine

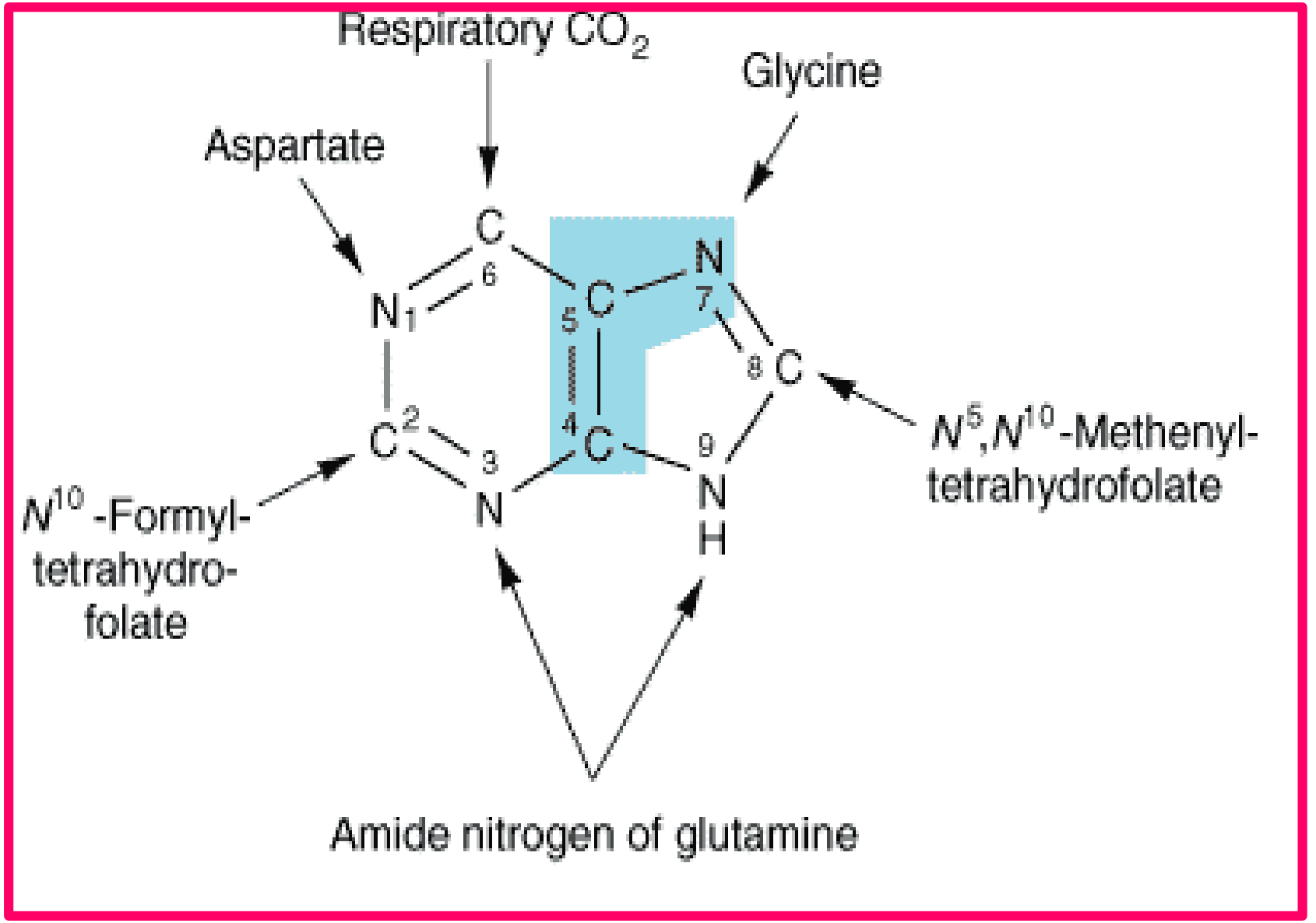


Role of Glycine in synthesis of Cysteine



Functions of Glycine :Formation of purine ring

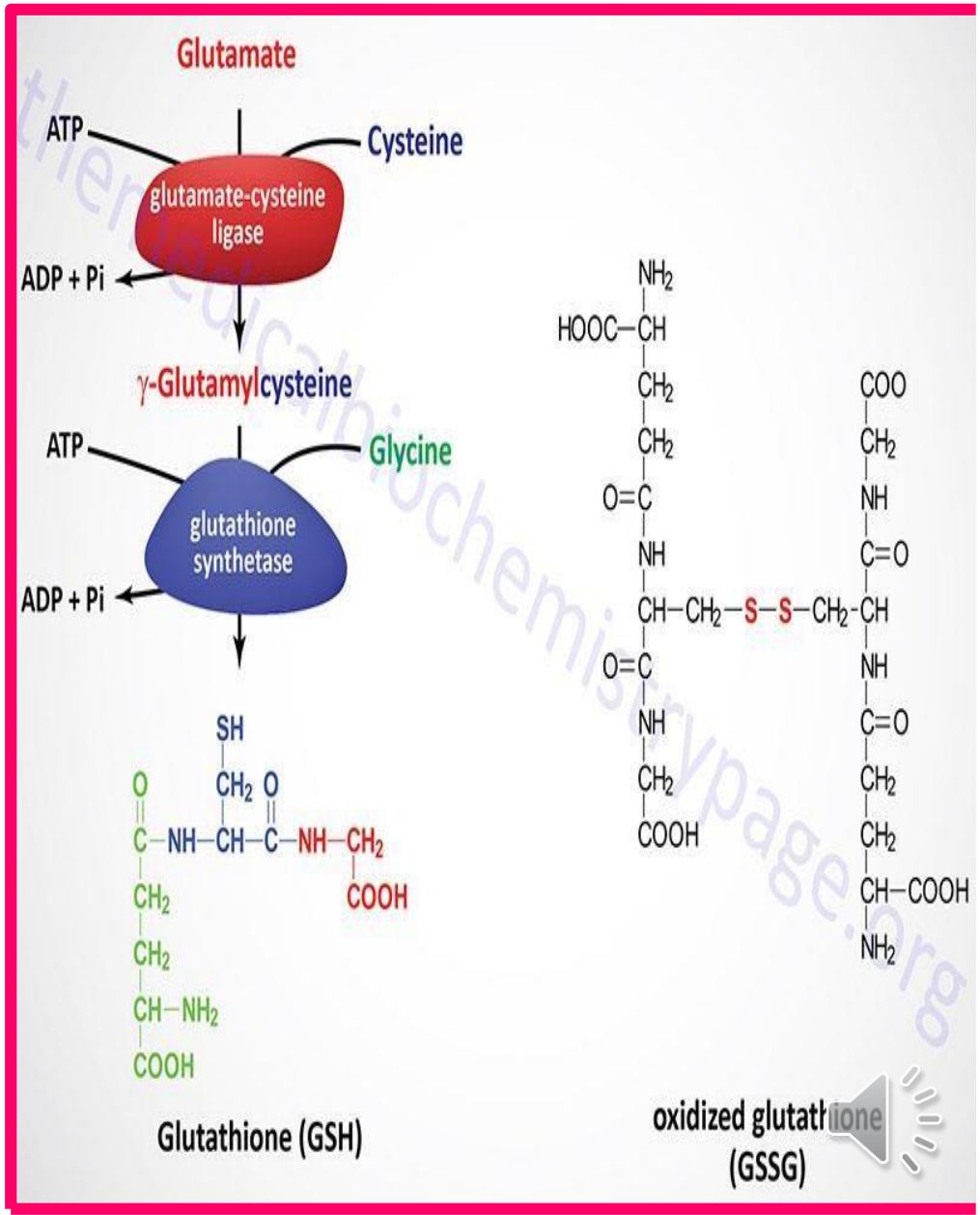
❑.2**Formation of purine ring : N7**



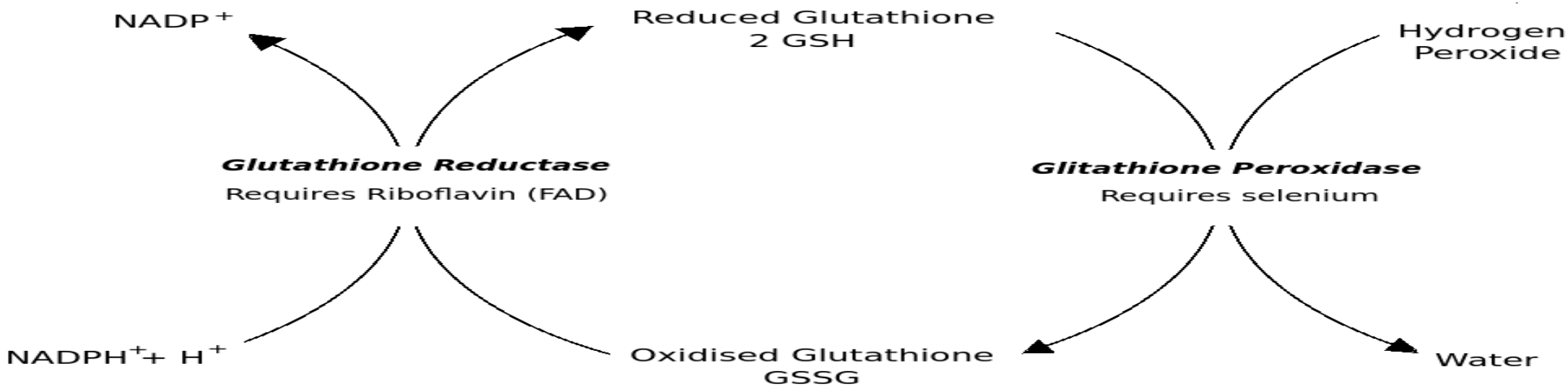
Functions of Glycine -3.Synthesis of Glutathione

- Reduced glutathione has the following functions:

- ✓ Amino acid transport across the cell membrane (including absorption).
- ✓ It is a coenzyme for maleylacetoacetate isomerase enzyme, see tyrosine. It is also a coenzyme in S-adenosylmethionine and heme synthesis, and for formaldehyde dehydrogenase, glycogen synthase and glyoxylase.
- ✓ Synthesis of leukotrienes (see prostaglandins).
- ✓ Detoxication by conjugation (see metabolism of xenobiotics).
- ✓ It functions as hydrogen donor in oxidation reduction reactions that include:
- ✓ It protects hemoglobin against oxidation by hydrogen peroxide.
- ✓ Keeps the integrity of the cell membrane against damage by oxidants, e.g., H_2O_2. Thus, it prevents lipid peroxidation of the membrane lipids of RBCs and thence its hemolysis by various oxidants because it is the most liable among cells, sees Favism.



- ✓ It maintains the SH group(s) at the active site of several enzymes that is essential for their activity, e.g., glyceraldehyde dehydrogenase.
- ✓ It inactivates insulin in the liver by reductive cleaving of the 2 disulfide linkages of insulin into separate polypeptide chains catalyzed by insulin-glutathione transhydrogenase.
- ✓ -It protects the â-cells of pancreas from the degenerative action of alloxan or dehydroascorbic acid. This protective action is due to antioxidant properties of glutathione, which reduces alloxan to inactive substance and reduces dehydroascorbic acid to ascorbic acid.

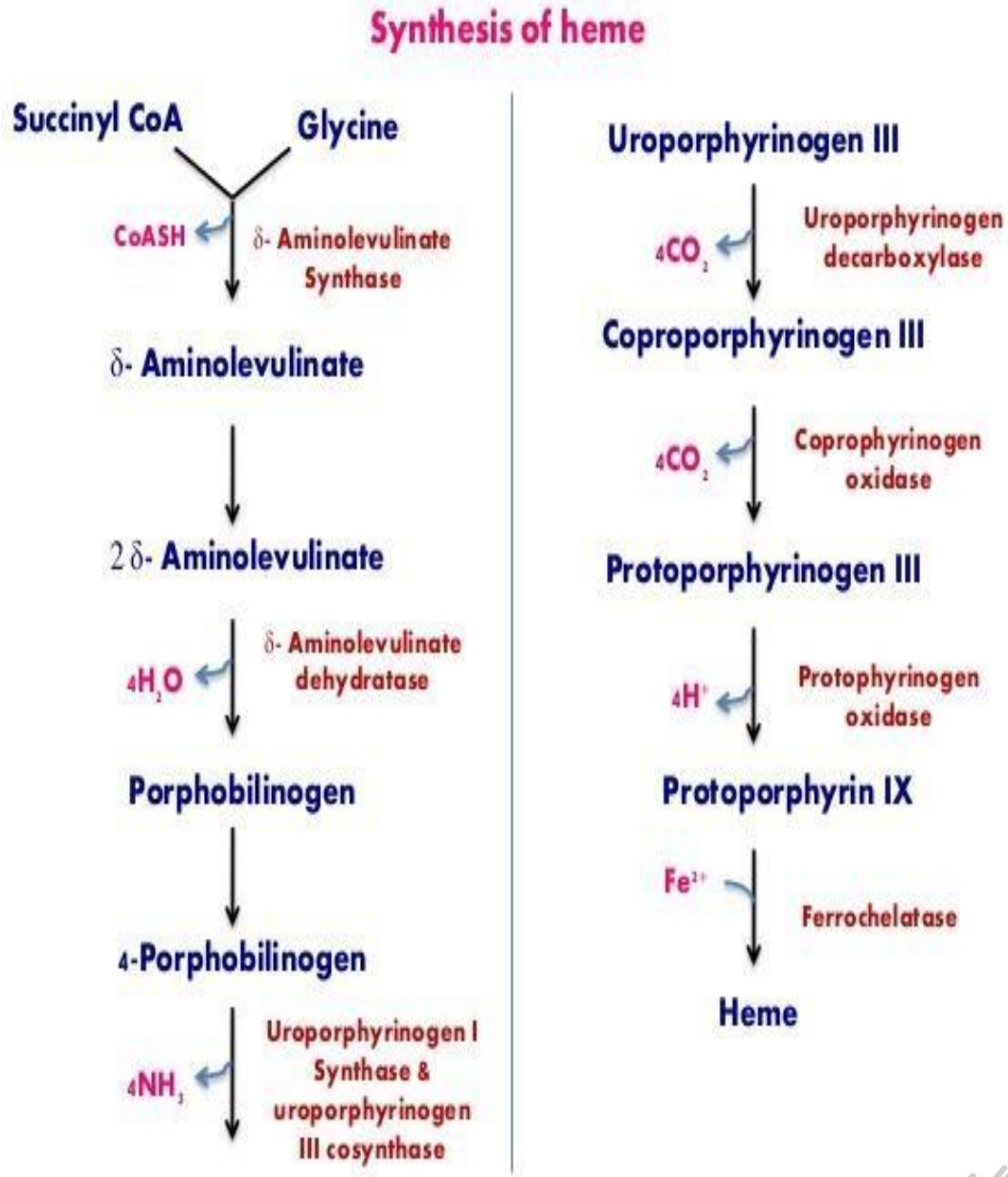


Functions of Glycine in Detoxification by conjugation reaction

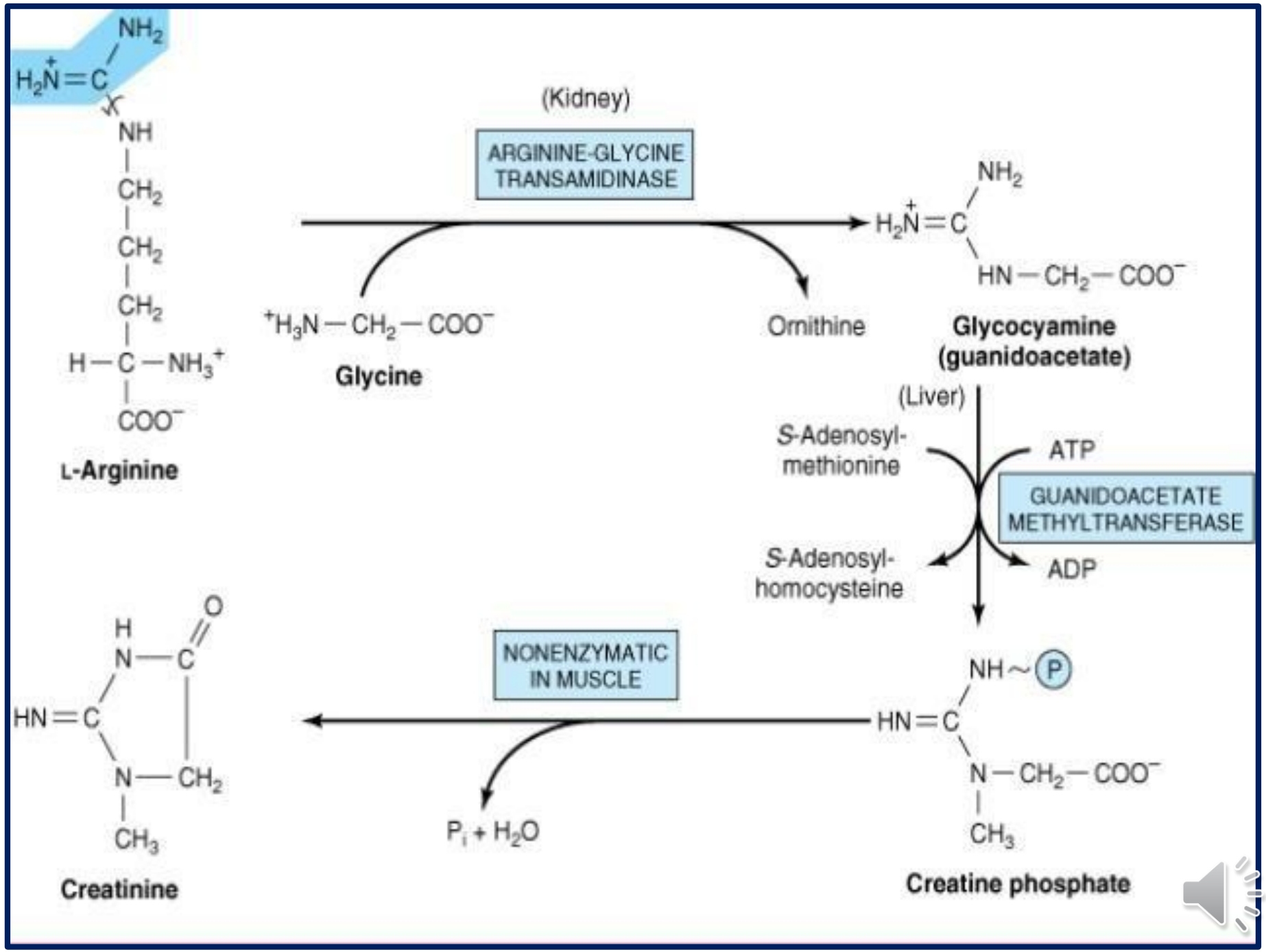
❑ **.4Detoxification by conjugation reaction**

- Bile acids →cholic acid /cheno cholic acid
- **Cholic acid + Glycine→ Glycocholic acid**
- **Chenodeoxy cholic acid+ Glycine →Glyco- cheno deoxy cholic acid**
- **Benzoic acid +Glycine → Hippuric acid**)excreted by kidney(

Synthesis of Heme from Glycine



Arginine ,Glycine & Methionine (SAM(involved in synthesis of Creatine



Creatine & creatinine : clinical significance

	Creatine	Creatinine
Serum	0.6- 0.2mg/ dl	1.0- 0.6 mg/ dl
Urine	50 – 0mg/day	2- 1gm /day

❖ Creatinine estimation

–KFT (CREATININE –ENDOGENOUS ,NOT ABSORBED NOR SECRETED SECRETION,DAILY EXCRETION(

❖ **Creatinine coefficient - mg / kg body weight / day**

Man - 24-26mg / kg body weight / day

Woman - 22 -20 mg / kg body weight / day

Creatnuria : muscular dystrophy /Diabetes Mellitus / Hyperthyroidism/ starvation

Metabolic disorders of Glycine

❖ **Primary hyperoxaluria**

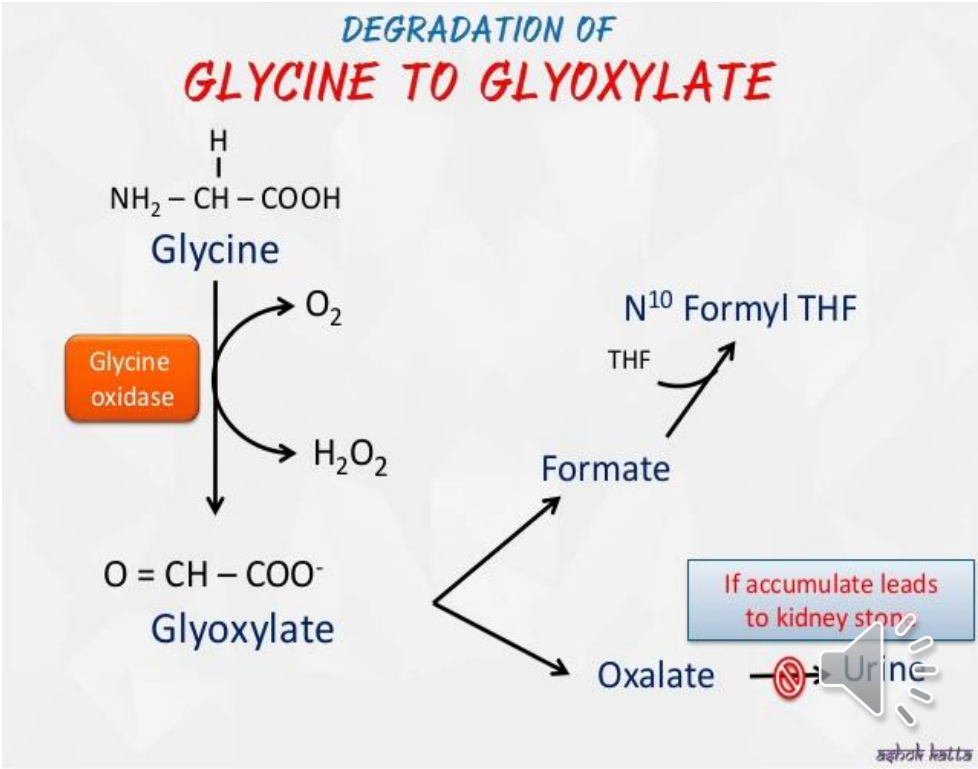
Increased formation of urinary oxlate calculi

↓

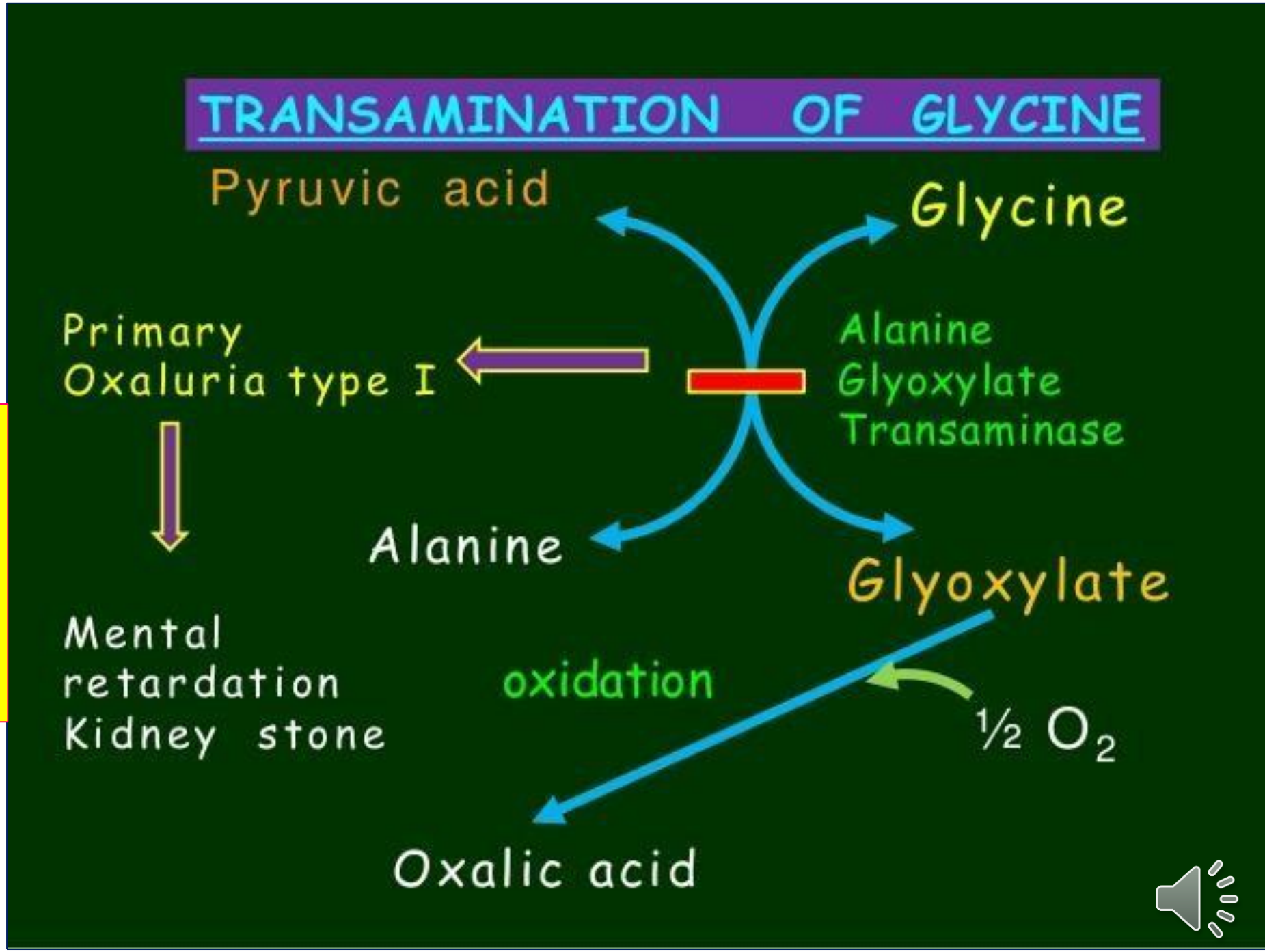
oxalosis)deposition in various tissue)

Generally defective Glycine transaminase

+impairment in Glyoxalate oxidation to Formate



Primary Oxaluria type I leads to renal /kidney stone formation &is responsible for mental retardation

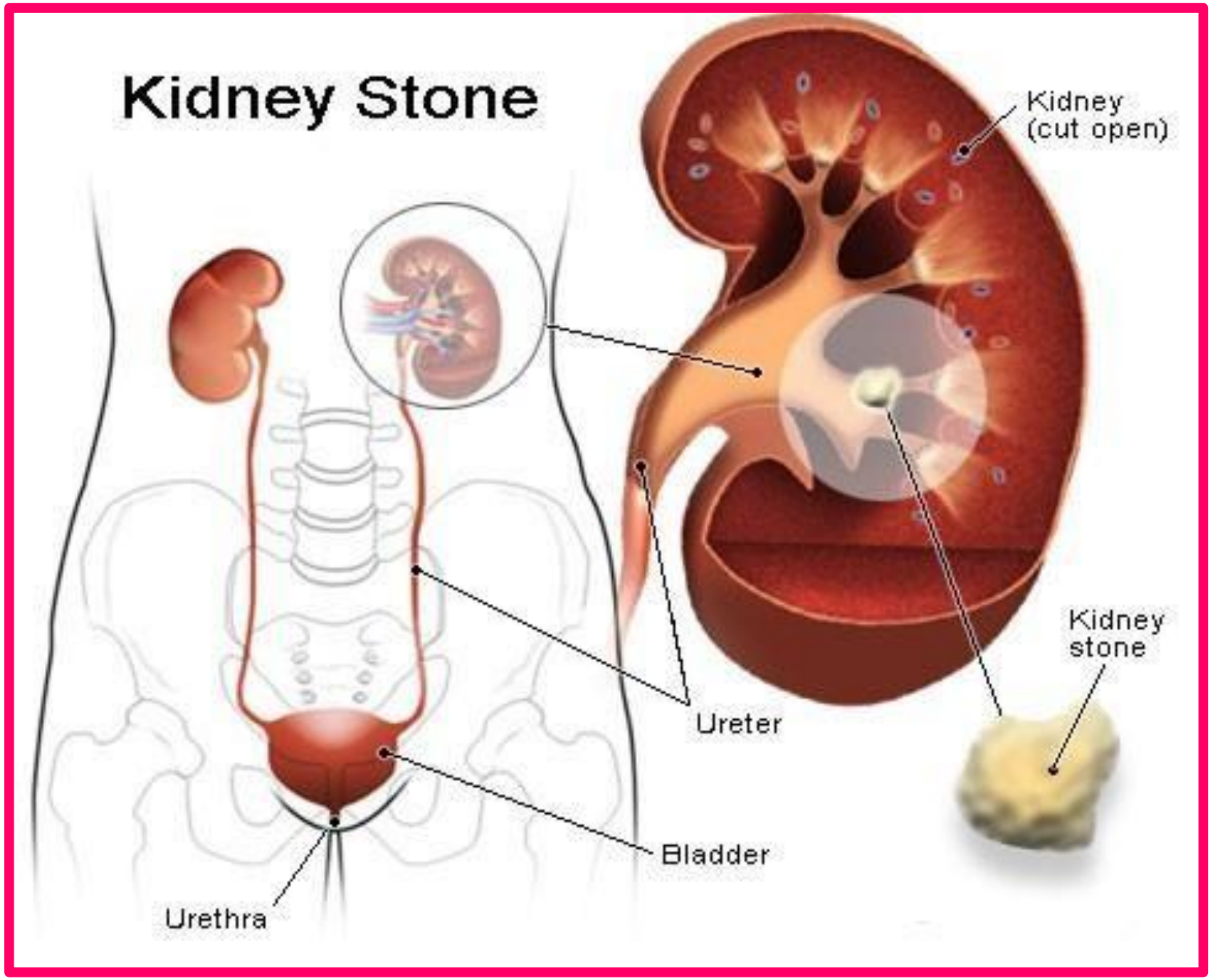


Metabolic disorders of Glycine

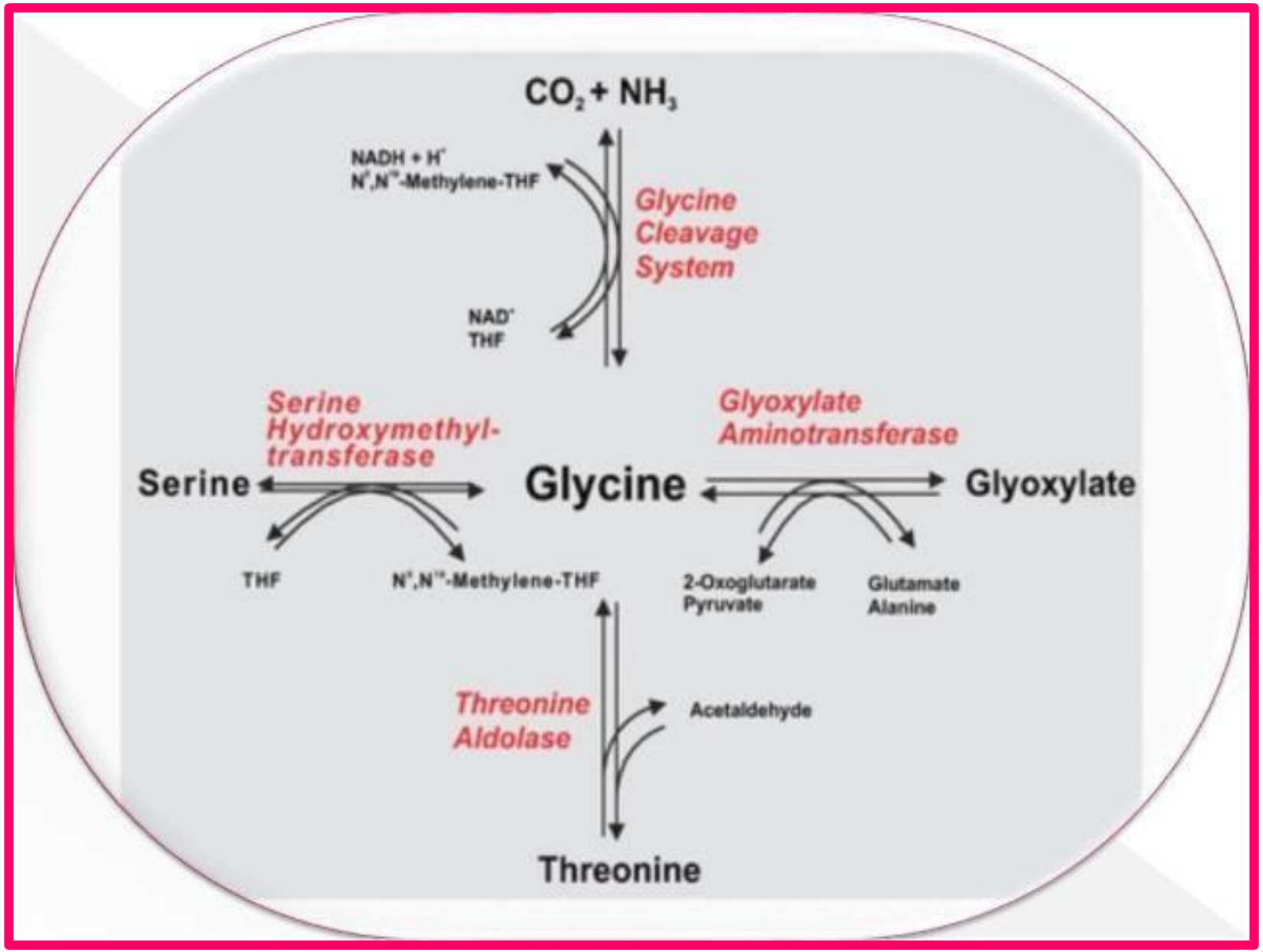
Glycinuria

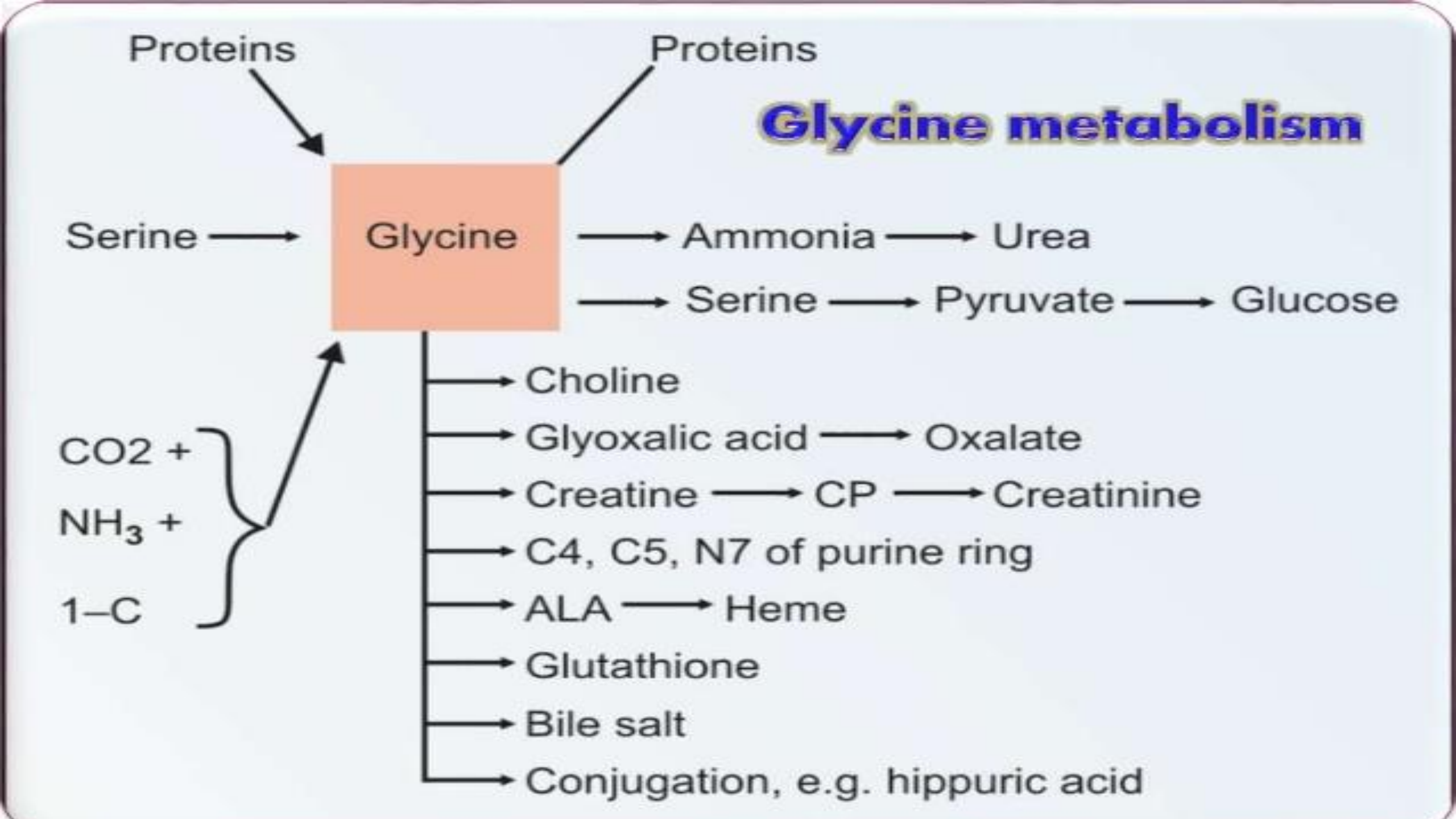
- This is a rare disorder.
- Serum glycine concentration is normal, but very high amount (normal 0.5-1 g/day) is excreted in urine.
- It is due to defective renal reabsorption.
- It is characterized by increased tendency for formation of oxalate renal stones.
- Urinary oxalate level is normal in these patients

Kidney stones(Calcium oxalate)



Summary
Of Metabolic pathways of Glycine




Proteins
Proteins
Glycine metabolism
Serine
Glycine
Ammonia
Urea
Serine
Pyruvate
Glucose
Choline
CO2 +
NH3 +
1–C
Glyoxalic acid
Oxalate
Creatine
CP
Creatinine
C4, C5, N7 of purine ring
ALA
Heme
Glutathione
Bile salt
Conjugation, e.g. hippuric acid

Learning check

Q1:Which out of the following amino acids in not required for creatine synthesis?

a) Methionine
b) Serine
c) Glycine
d) Arginine

Q2: Which out of the following amino acids is not needed for the synthesis of Glutathione?

a) Serine
b) Cysteine
c) Glutamic acid
d) Glycine

Q3:Glycine is required for the synthesis of all of the following except:

a) Creatine
b) Glutathione
c) Heme
d) γ-aminobutyric acid (GABA)