University of Fallujah
College of Medicine

Protein metabolism

Lecture : 6&7

Stage : 2nd Stage

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Department: Chemistry and Biochemistry

Date: 30/ 3/ 2026

الرؤية والرسالة والاهداف لكلية طب الفلوجة

الرؤية :

تحقيق الريادة في التعليم الطبي وأن نكون شريكاً فعالاً في الإرتقاء بالمستوى الأكاديمي والصحي على مستوى القطر.

الرسالة :

تعليم وتدريب الطلبة في بيئة تعليمية هادفة لتهيئة الخريجين لممارسة طبية متميزة وآمنة مع ترسيخ القيم الانسانية والعلمية والمبادئ الاجتماعية ومعايير الجودة.

تخريج اطباء قادرين على الاستجابة للاحتياجات والتحديات الصحية وتوجيه البحث العلمي لحل المشكلات الصحية في المجتمع.

تجنيد وتطوير هيئة تدريسية بمواصفات عالية لتصبح الأفضل في مجال التعليم والبحوث العلمية

الاهداف :

تخريج أطباء لديهم المعرفة والإرادة والمهارة التي تمكنهم من ممارسة الطب بشكل آمن مع تجسيد القيم الإنسانية والأخلاقية.

التحسين المستمر للعملية التعليمية وتطوير مهارات الهيئة التدريسية وفق معايير الجودة بواسطة التعليم والتدريب الطبي المستمر من خلال الورش والمؤتمرات العلمية.

تعزيز علاقات التعاون مع المؤسسات العلمية والطبية داخل وخارج العراق لتطوير المستوى الأكاديمي للهيئة التدريسية ولتعليم الممارسة الطبية الآمنة للطلبة الخريجين.

السعي في أن تكون الكلية مركزاً بحثياً علمياً رائداً في البحوث الصحية التطبيقية مع الاستغلال الأمثل لنتائج تلك البحوث في خدمة المجتمع وبالتعاون مع مختلف الجهات المستفيدة.

المساهمة في تحسين صحة المجتمع من خلال دعم وتطوير نظام الرعاية الصحية عبر علاقات تكامل وتعاون فعال.

Learn objectives:

-Identify the principle of protein digestion and absorption disorders

-Know the Biomedical Significance of amino acid catabolism

Catabolism of Phenylalanine and Tyrosine with disorders

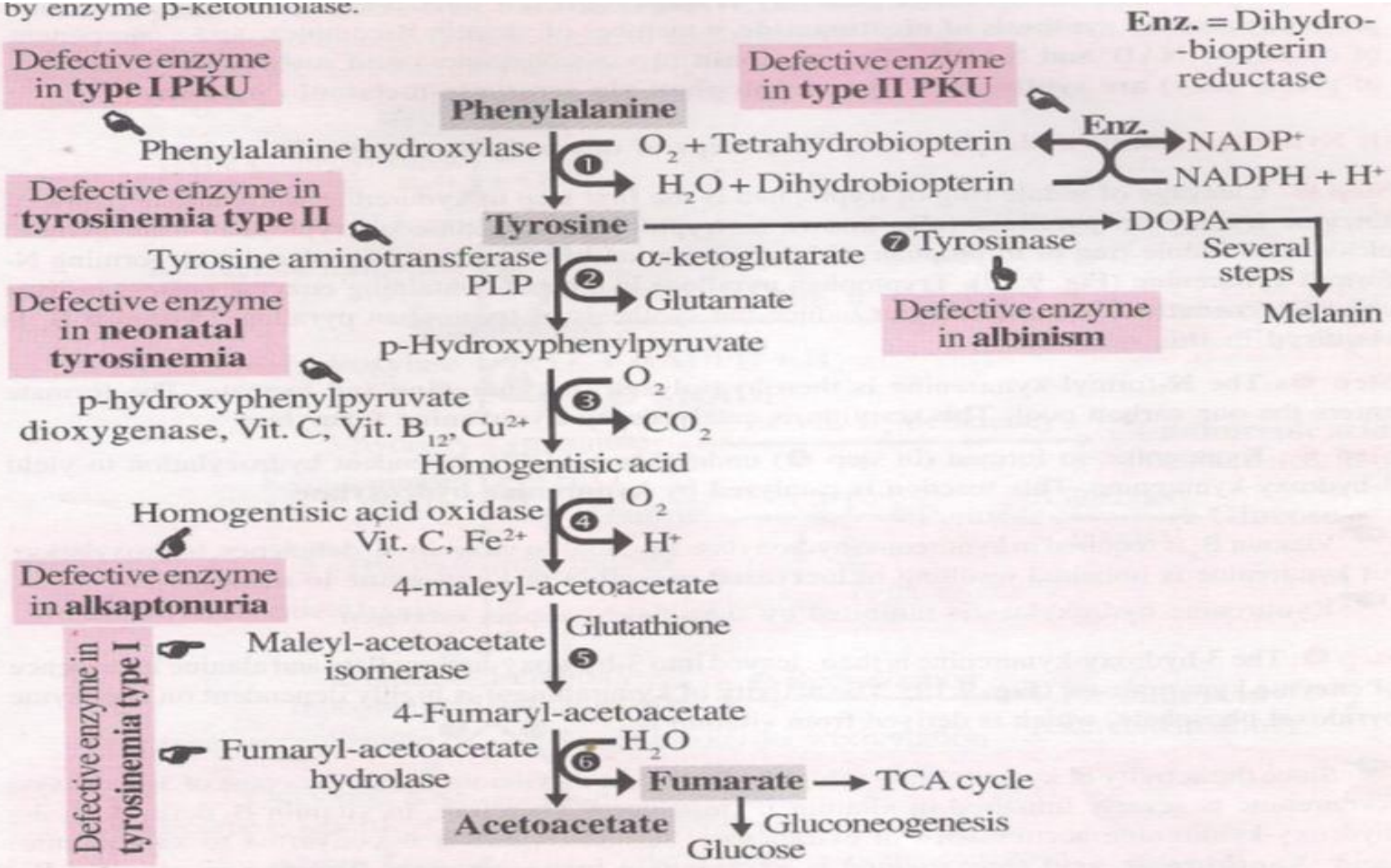

Fig. 9.18: Catabolism of phenylalanine and tyrosine. Inherited deficiencies of enzyme in PKU, albinism, alkaptonuria and tyrosinemias are shown.

Catabolism of cysteine with disorders

Cysteine is catabolized to **pyruvate** via 3 pathways

1-Conversion of cysteine to pyruvate via cysteine-sulfinate

cysteine dioxygenase 1 step &desulfinase 3 step

The cysteine-sulfinate is also metabolized to taurine, which plays important role in brain development and conjugates with bile acids.

2-desulfuration of cysteine to pyruvate by desulfahydrase: 4 step

3-Conversion of cysteine to pyruvate via 3-mercapto-pyruvate by transsulfurase 5,6 step

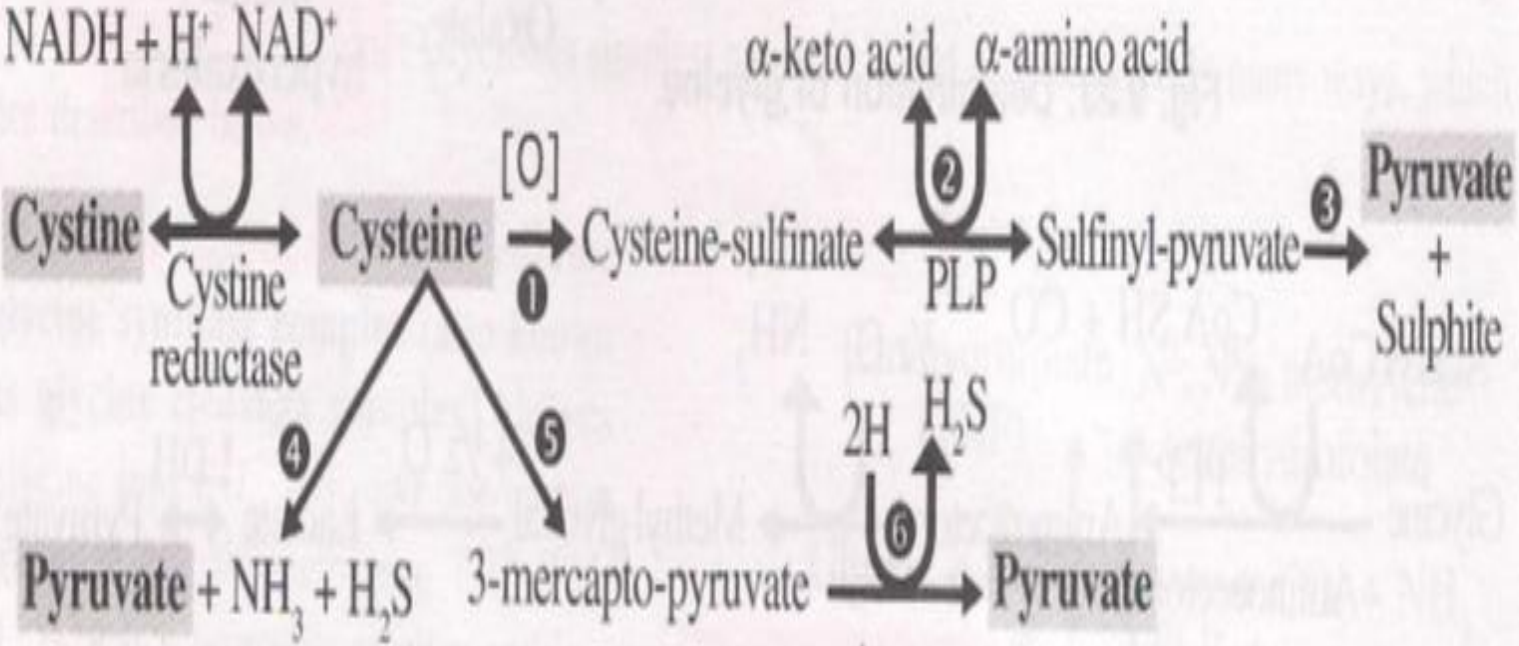

Fig. 9.26: Catabolic pathways of cysteine.

-Cystinuria (cystine-lysinuria) results from defect in renal tubular reabsorption of cystine and basic amino acids (lysine and arginine).

Catabolism of methionine:

The catabolism of methionine can be described in following three steps

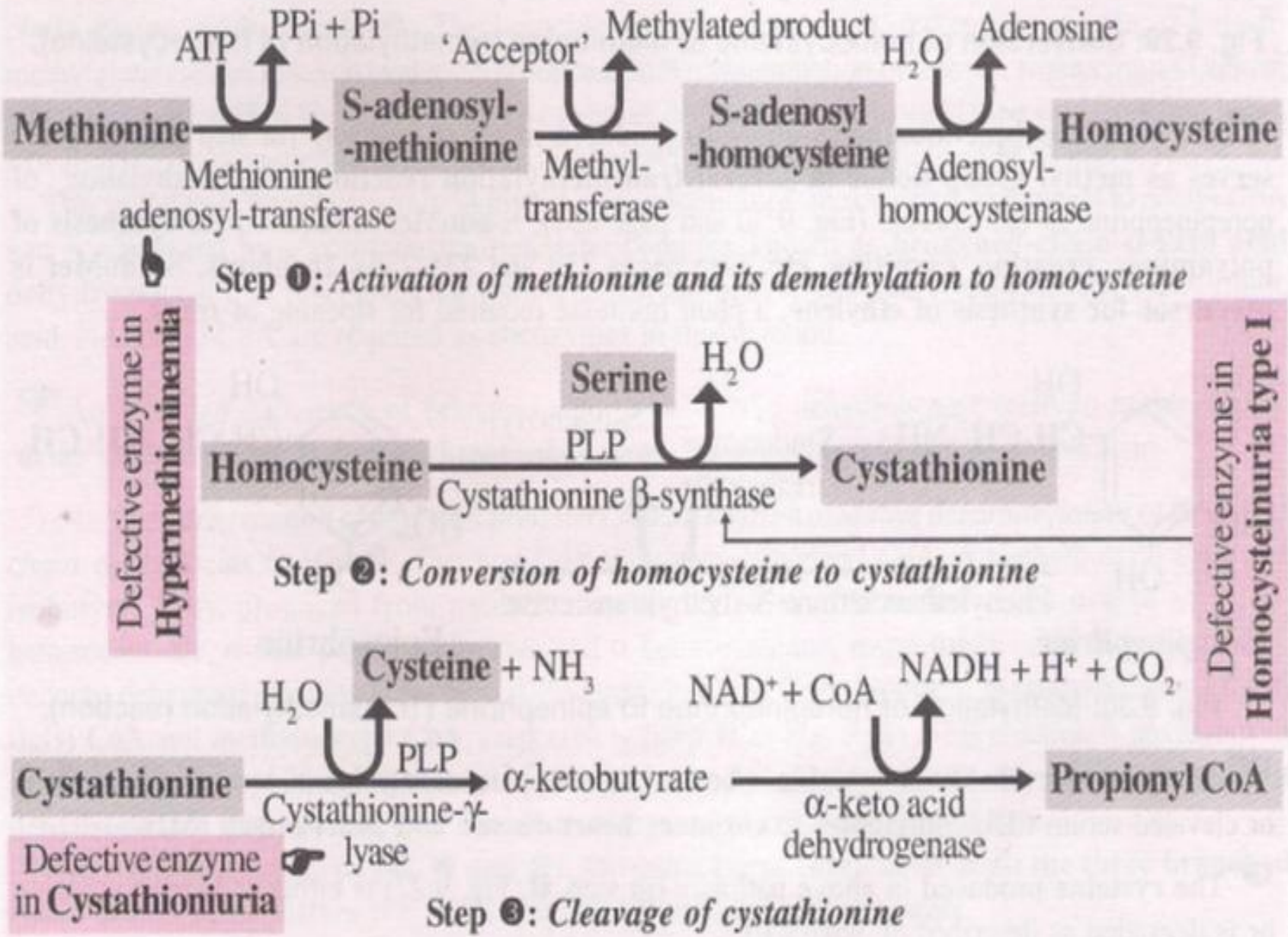

Fig. 9.27: Methionine catabolism.

Biomedical Significance of Methionine Metabolism

-degraded through succinyl CoA to CO, and water in TCA cycle

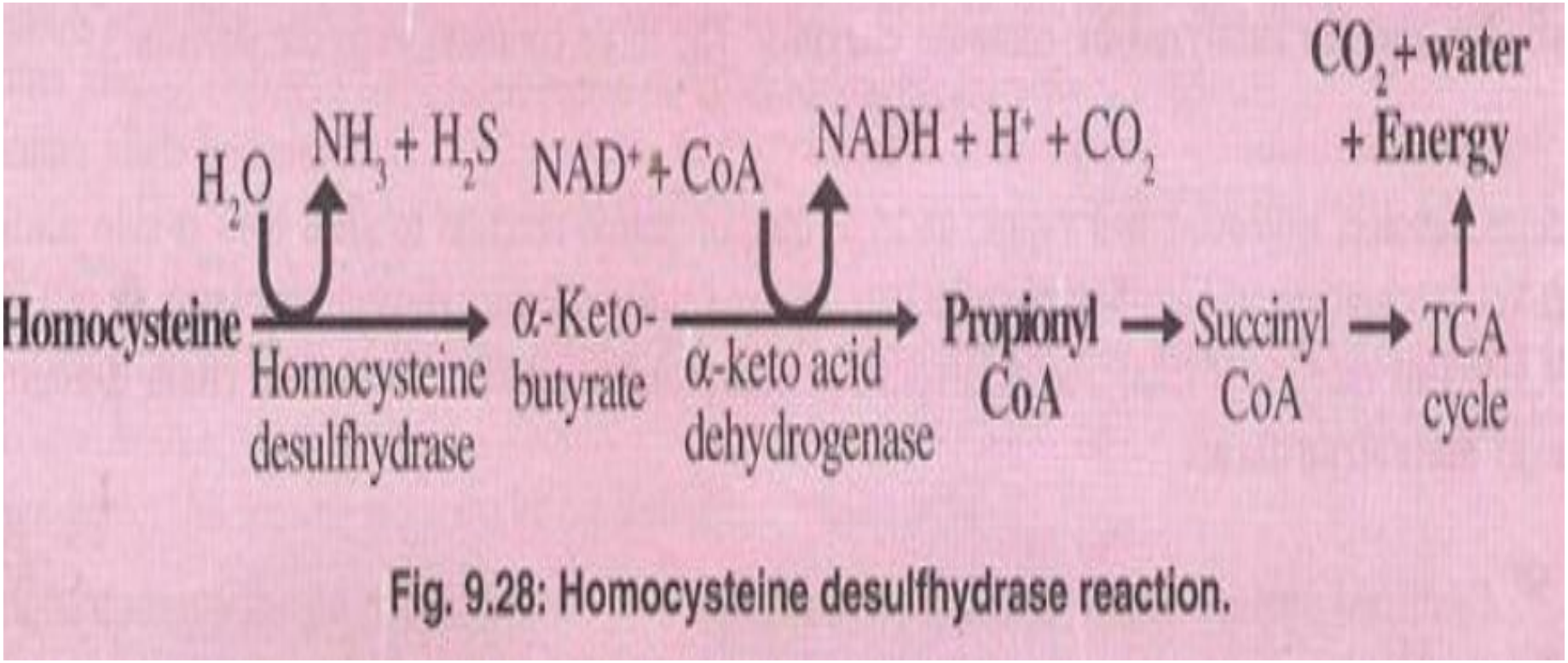

Fig. 9.28: Homocysteine desulfhydrase reaction.

-resynthesis of methionine

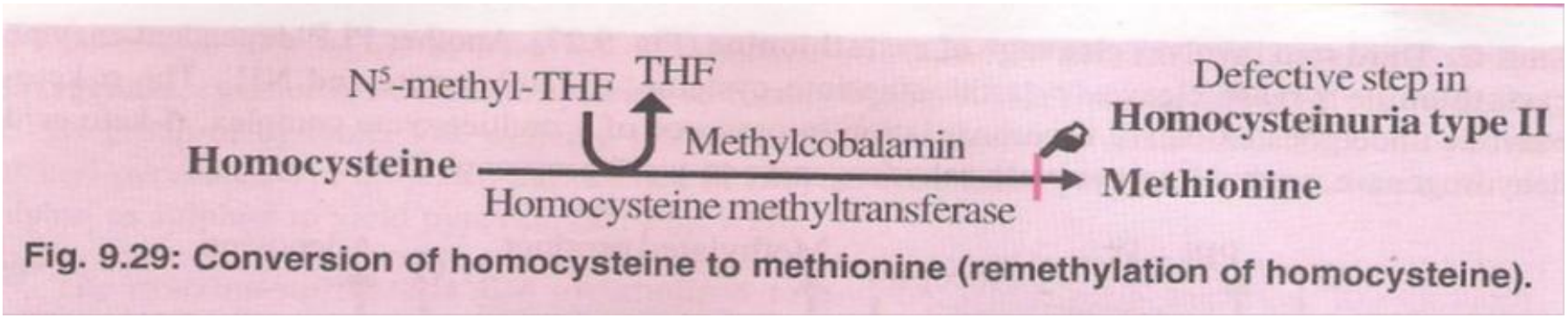

Fig. 9.29: Conversion of homocysteine to methionine (remethylation of homocysteine).

*S-adenosyl-methionine convert to . methylation of norepinephrine to epinephrine figure 9-27

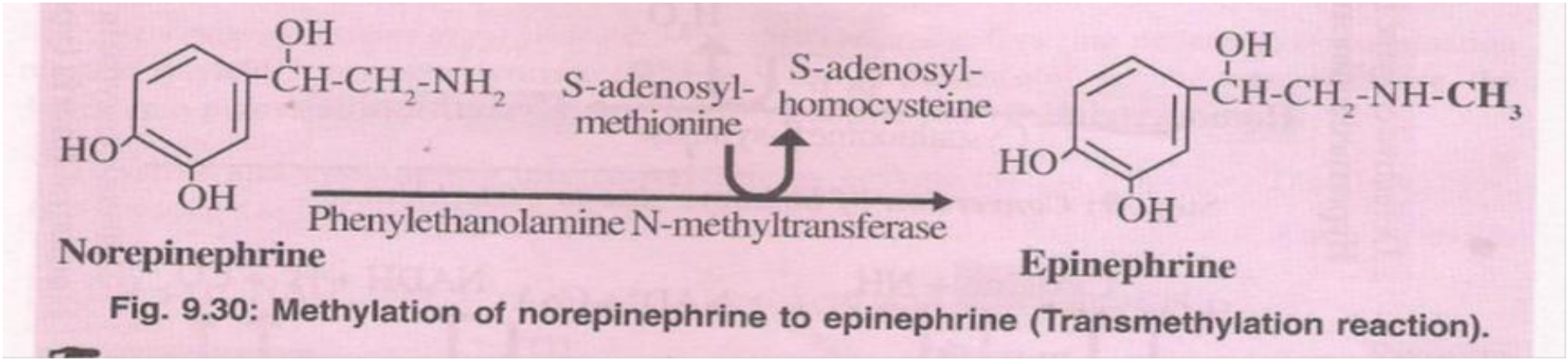

Fig. 9.30: Methylation of norepinephrine to epinephrine (Transmethylation reaction).

-Hyperhomocysteinemia (elevated homocysteine in blood) without hypercholesterolemia, hyper-triglyceridemia or elevated serum LDL contributes to coronary heart disease and heart attack (MI). The cysteine produced in above pathway (Fig. 9.27) is either converted to cystine or catabolized to pyruvate.

Catabolism of **tryptophan** with disorders

The tryptophan is both glucogenic and ketogenic amino acid.

There are **2 pathways**

1- Kynurenine-anthranilate pathway

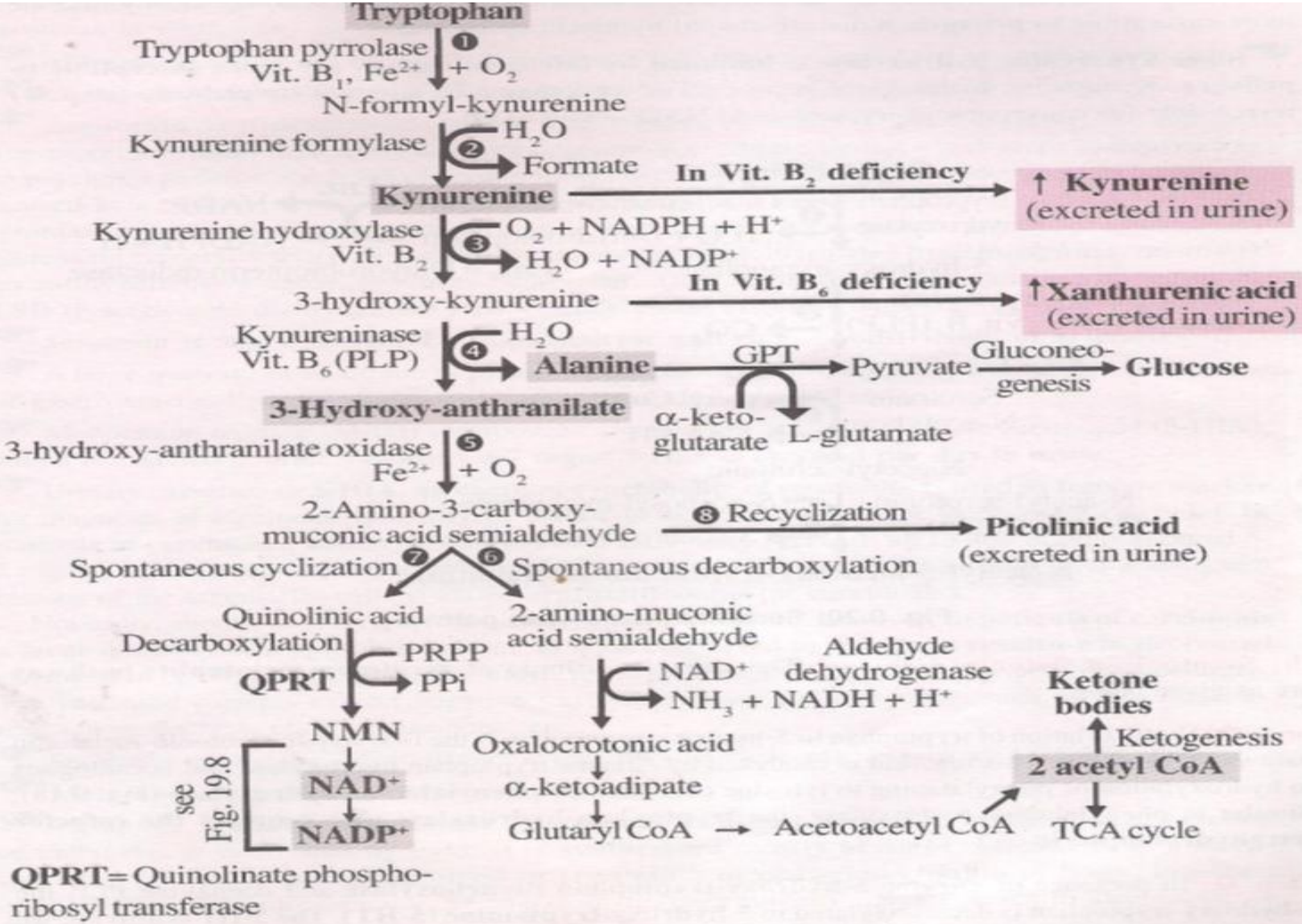

Fig. 9.19: Kynurenine-anthranilate pathway.

Biomedical Significance of Kynurenine-anthranilate Pathway

-Nicotinic acid (niacin) (is the only water soluble vitamin which is synthesized in human body. 60 mg tryptophan is converted to I mg niacin as Nicotinamide Mononucleotide (NMN) in kynurenine-anthranilate pathway

-kynurenine hydroxylase is inhibited by estrogen

-Ammonia is produced in small amount in kynurenine-anthranilate pathway

2-Serotonin-melatonin pathway

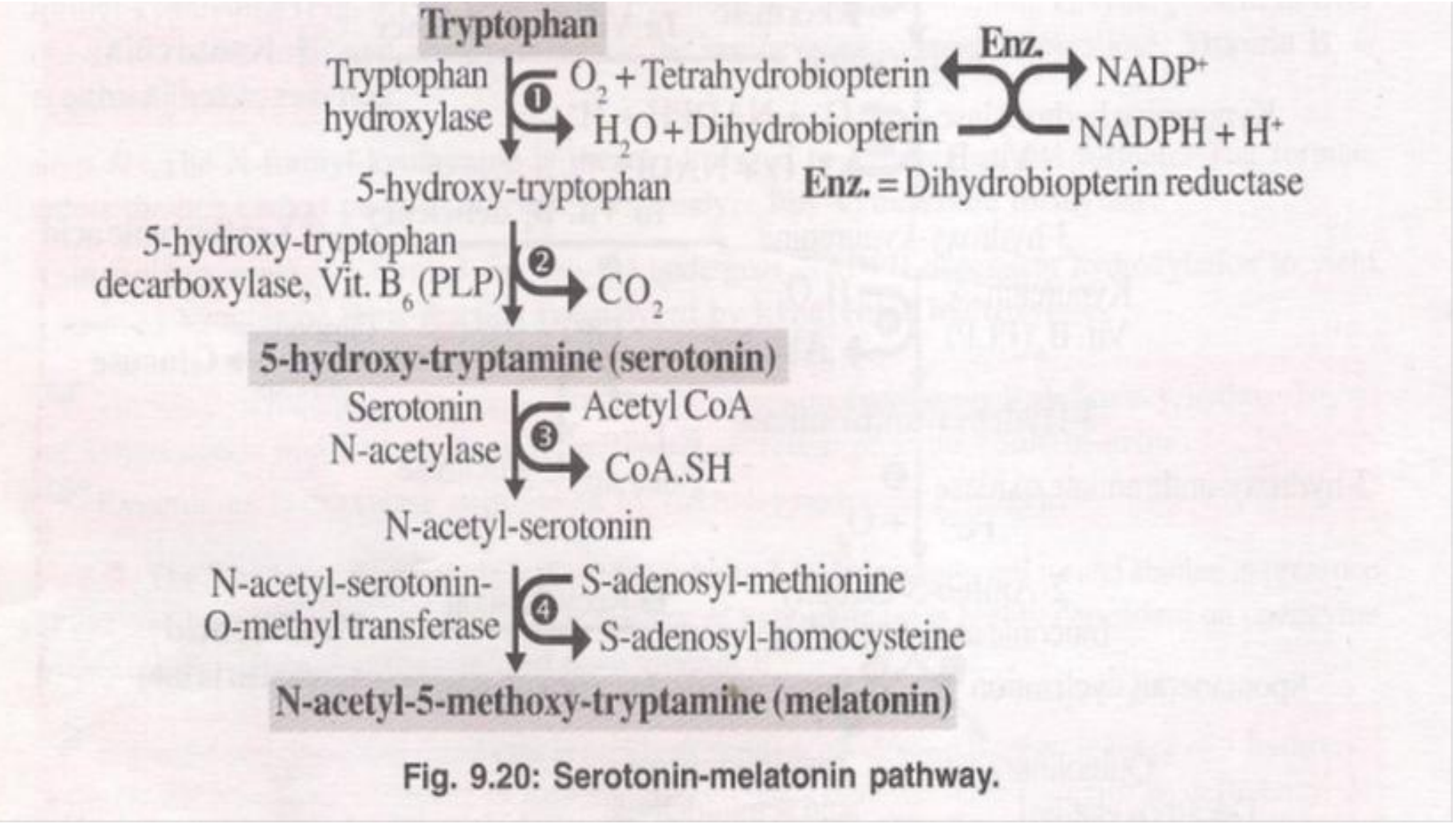

Fig. 9.20: Serotonin-melatonin pathway.

Biomedical Significance of Serotonin and Melatonin

-Serotonin is synthesized from tryptophan in brain, liver, intestine and mast cells.

-Serotonin is a powerful vasoconstrictor

-Monoamine oxidase (MAO) metabolizes serotonin to 5-hydroxy-indole-acetic acid (5-HIA), which is excreted in urine

-Urinary excretion of 5-HIA, an excretory metabolite of serotonin, is used as tumor marker for diagnosis of carcinoid

-serotonin deficiency causes decrease in cerebral activity, which leads to depression

-Melatonin is synthesized from serotonin. Melatonin is a hormone mostly synthesized in pineal body. The synthesis and secretion of melatonin is controlled by light; it is synthesized mostly at night

-Hartnup's disease: Hartnup's disease is an inherited disorder of tryptophan metabolism. This disease was first of all reported in the family of Hartnup, therefore, named Hartnup's disease. The disease results from genetic defect in intestinal absorption and renal reabsorption of tryptophan

Catabolism of branched chain amino acids (leucine, isoleucine and valine)

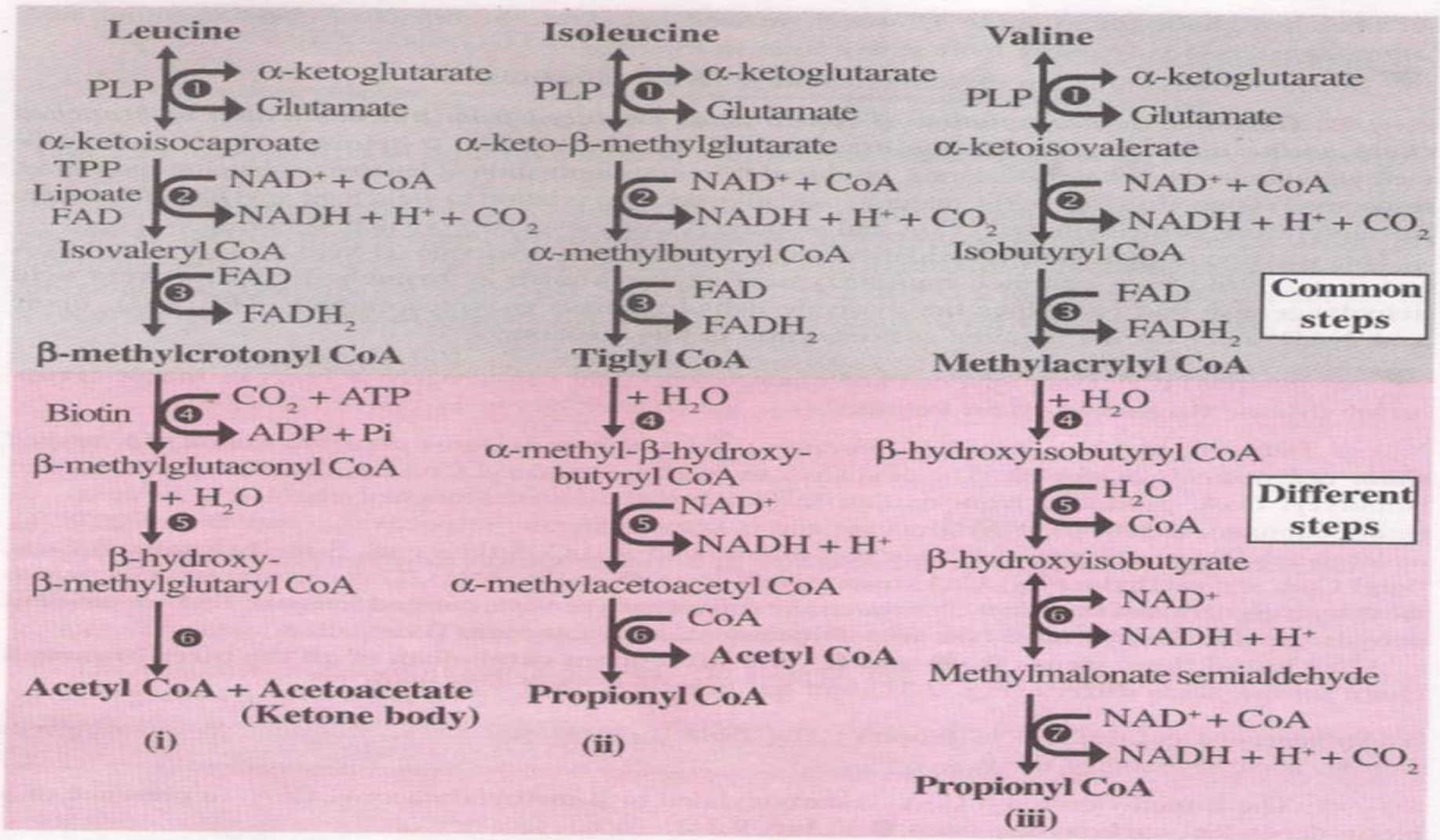

Fig. 9.31: Catabolism of branched chain amino acids— leucine (i), isoleucine (ii) and valine (iii).

Inferited Disorders of Catabolism of Branched Chain Amino Acids

Maple-syrup urine disease (branched chain ketonuria), hypervalinemia and isovaleric acidemia are the inherited disorders of catabolism of branched chain amino
acids