
بسم الله الرحمن الرحيم


Lupus erythematosus


PS

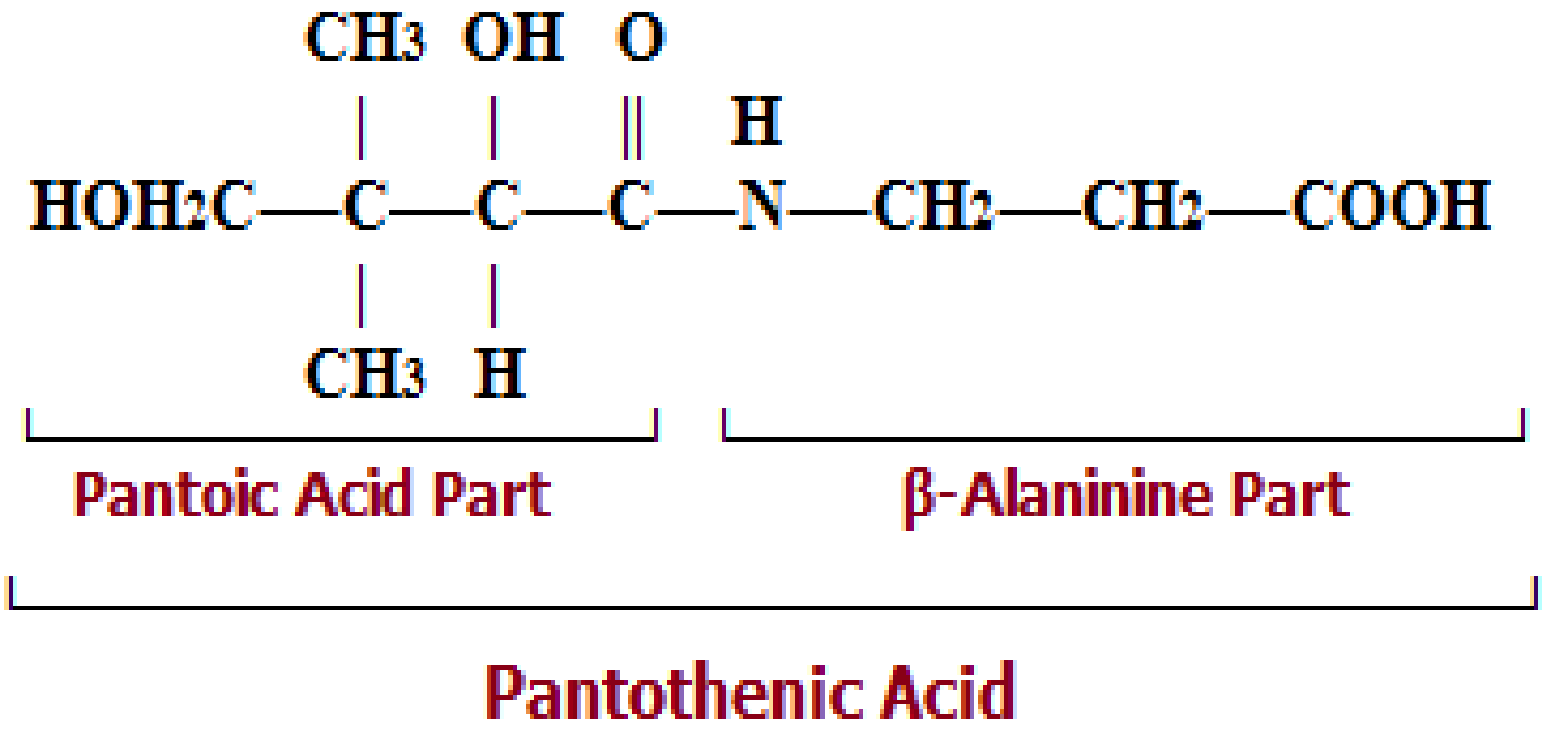
Objectives

- Chemical structure of vitamin B_5
- Sources & daily requirements vitamin B_5
- Absorption & transport
- Formation of Co enzyme A
- Biochemical functions of vitamin B_5
- Deficiency manifestation of vitamin B_5
- Uses of vitamin B_5

Vitamin B_5

(Pantothenic acid)

- **It is a peptide substance composed of Pantoic acid and β-Alanine(held together by peptide linkages).**
- **It can be present as the Calcium salt or the Alcohol "Pantothenol".**



Natural Sources

- Animal Sources:
  - Liver, kidney and Heart.
  - Milk and Milk Products (Cheese, Yogurt and Butter).
- Plant Sources:
  - Cereals
- Honey and Mushrooms.
- Yeasts.

GROUP OF FOODS RICH IN VITAMIN B_5

Required Daily Amount

- Adults 6-10mg/day.
- Less than 4 years 5 mg
- Infants 3 mg

- Requirement increase in stress, burns ,severe injury ,taking antibiotic ,pregnancy, lactation.

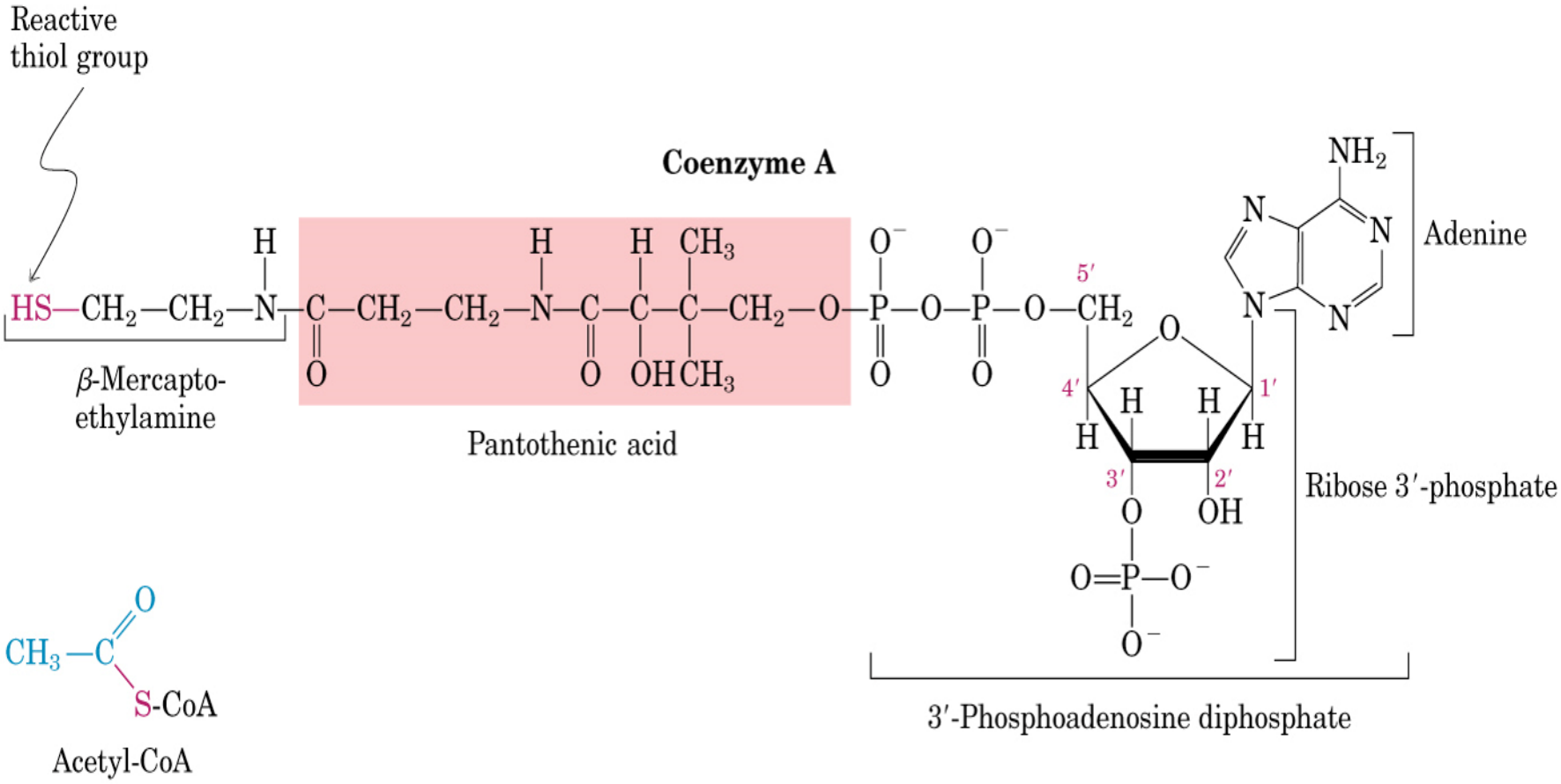
Absorption& transport

- It is present in food either in free or in co enzyme form.
- Coenzyme form is hydrolyzed by intestinal pyrophosphatases.
- Free form is absorbed from upper part of smell intestine.
- Enters portal circulation & transported to various tissues.

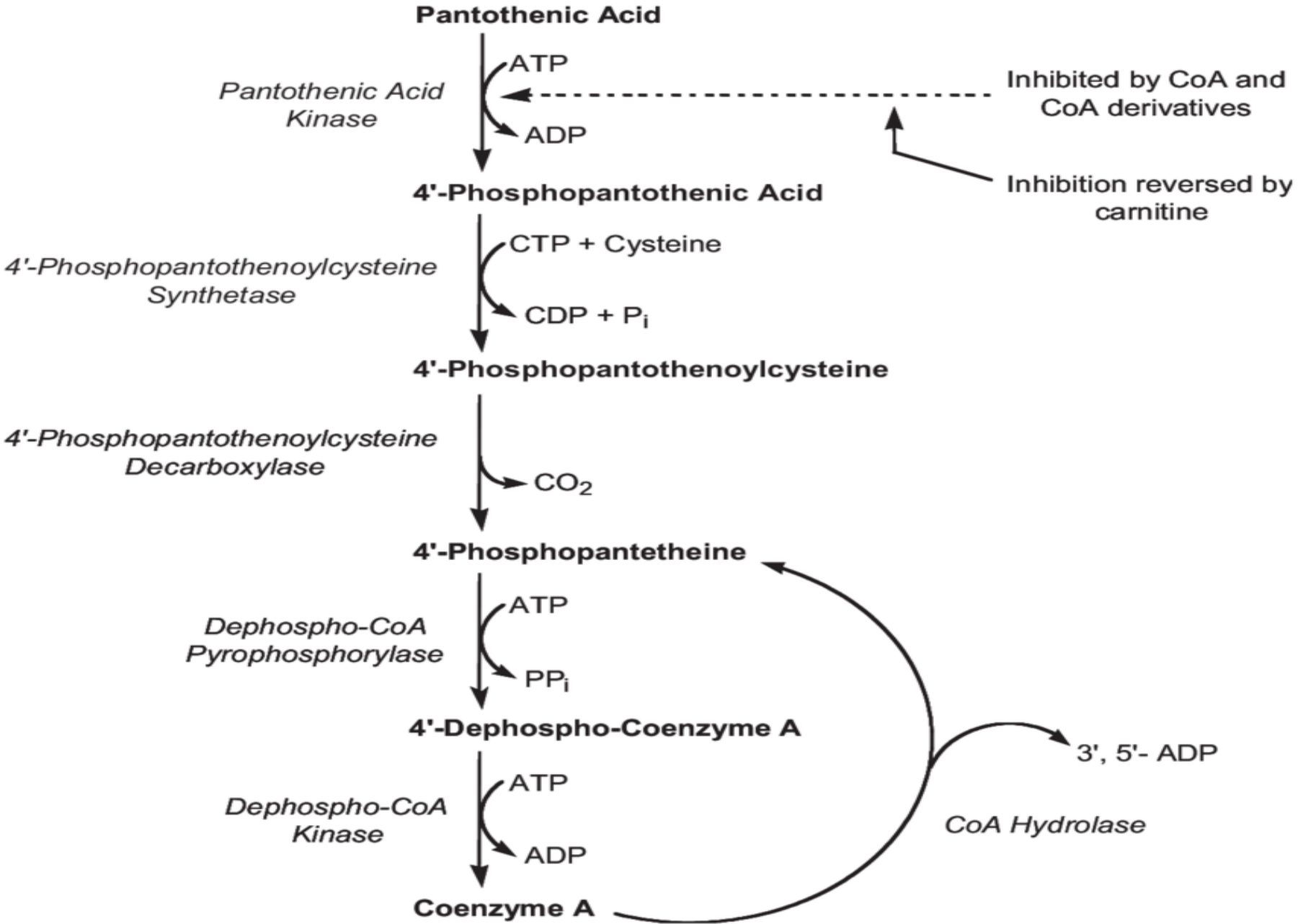
Structure of Co enzyme A

•Pentothenic acid is joined at one hand to adenosine 3- phosphate by pyrophosphate bridge, on the other hand to beta mercaptoethenol amine by peptide linkages.

Thiol group of beta mercaptoethenolmine is reactive site.

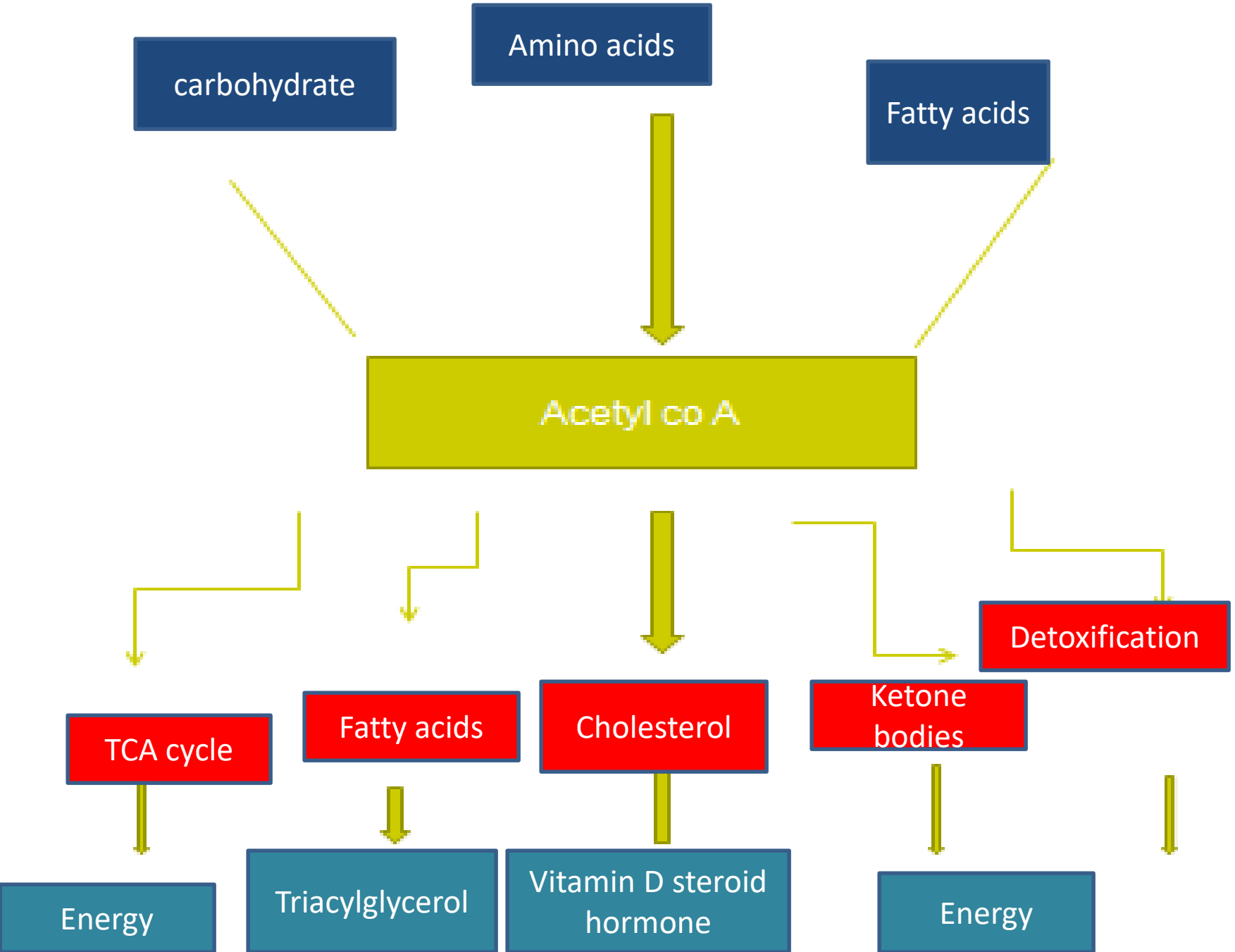


Formation of Co enzyme A



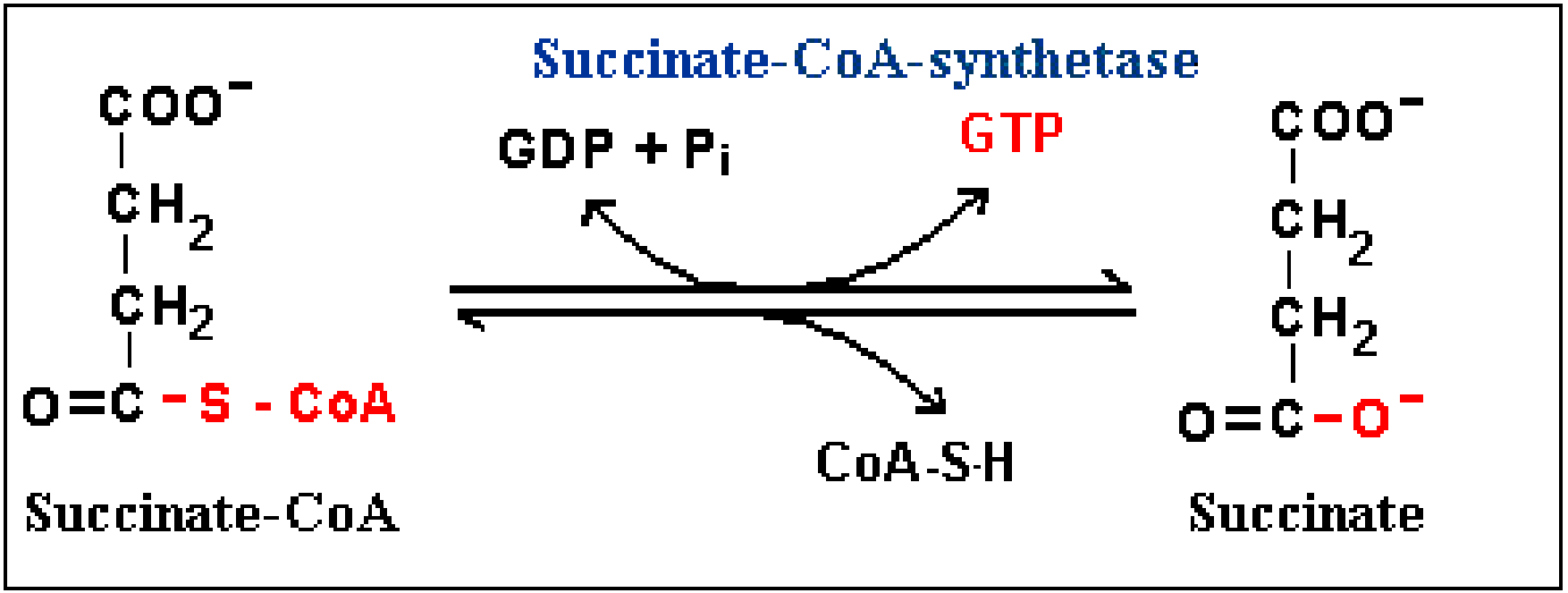
Role of Vitamin B_5

- **It is a part of Co-enzyme A that assists the following reactions:**
- Combine with acetate and form acetyl CoA (active acetate).
  - **Formation of Sterols (Cholesterol and 7-Dehydrocholesterol).**
  - **Formation of Fatty acids.**
  - **Formation of ketone bodies.**
  - **Formation of Keto acids such as Pyruvic acid.**
  - **Acetylcholine formation.**
  - **Combine with oxaloacetate to form citrate which initiate TCA.**


carbohydrate
Amino acids
Fatty acids
Acetyl co A
Detoxification
TCA cycle
Fatty acids
Cholesterol
Ketone bodies
Energy
Triacylglycerol
Vitamin D steroid hormone
Energy

- Formation of succinyl coA is

oxidative decarboxylation of alpha ketogluterate in TCA produce :active succinate:



- Succinyl CoA is involved in ,
- Heme synthesis
- Degradation of ketone bodies
- Role in lipid metabolism, oxidation + synthesis of fatty acid(component of fatty acid synthase complex).
- Formation of adreno cortical hormone from active acetate and cholesterol.

Deficiency

- Rare to occur. When occur it leads to Paresthesias (is a sensation of tingling, pricking, or numbness of a person's skin).

- Myelin degeneration of peripheral nerves & degenerative changes in posterior root ganglion is responsible for nervous manifestation

Deficiency manifestation

- Burning foot syndrome, burning sensation in hands and feet and numbness coupled with poor coordination.
- Essential for acetylcholine synthesis which is required for muscle contraction, so its deficiency causes muscle cramps, numbness and tingling sensation of muscles.
- Irritability, fatigue, tiredness and apathy.

Uses:

- Treat and prevent deficiency state.
- Supplements in cases of inadequate diet.
- It is prescribed for:
  - Diabetic neuropathy.
  - Arthritis.
  - In hair dyes.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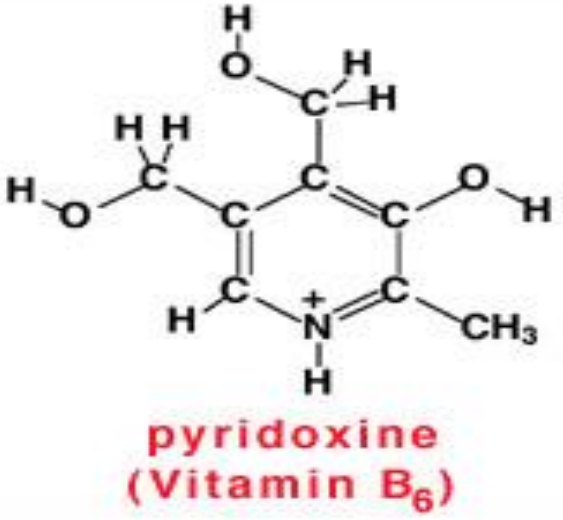
PYRIDOXINE
(VITAMIN B6)

Objectives

- Chemical structure of vitamin B_6
- Sources & daily requirements vitamin B_6
- Formation of active form
- Biochemical functions of vitamin B_6
- Deficiency manifestation & causes of vitamin B_6
- Diagnosis of deficiency
- Uses of vitamin B_6

Vitamin B6

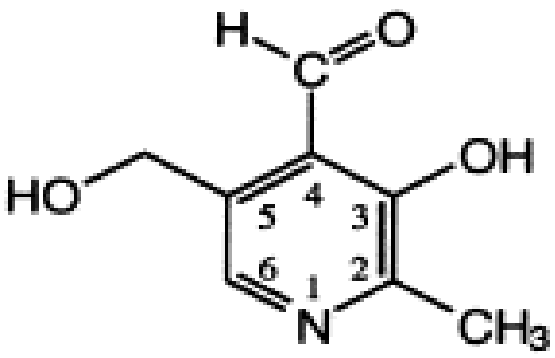


- Vitamin B6 are pyridine derivatives.
- Exist in following forms
- Pyridoxine----- primary alcohol
- Pyridoxal--------- an aldehyde form
- Pyridoxamine-------an amine form
- Pyridoxine can be converted to pyridoxal and pyridoxamine

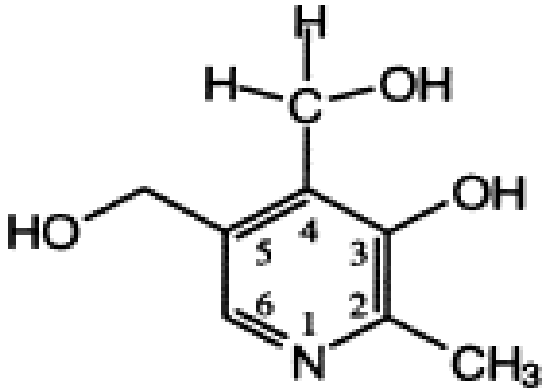
Vitamin B_6

Pyridoxine

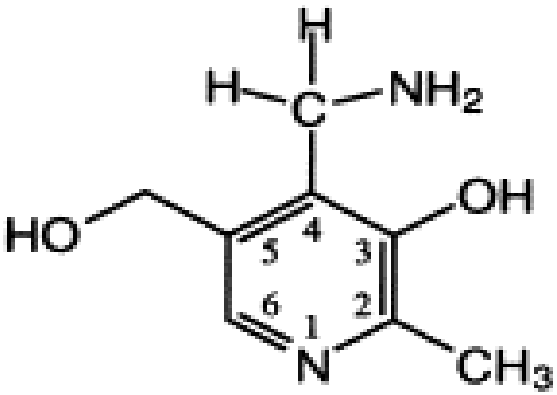
Pyridoxal



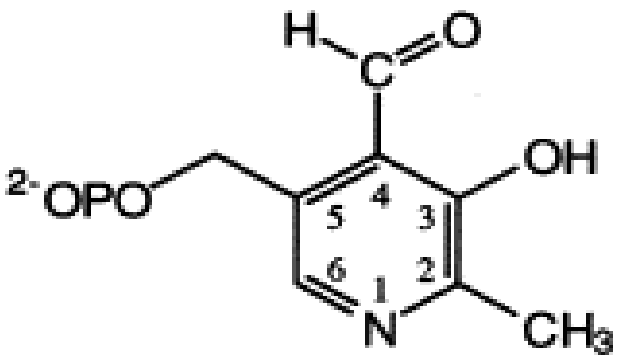
Pyridoxine



Pyridoxamine

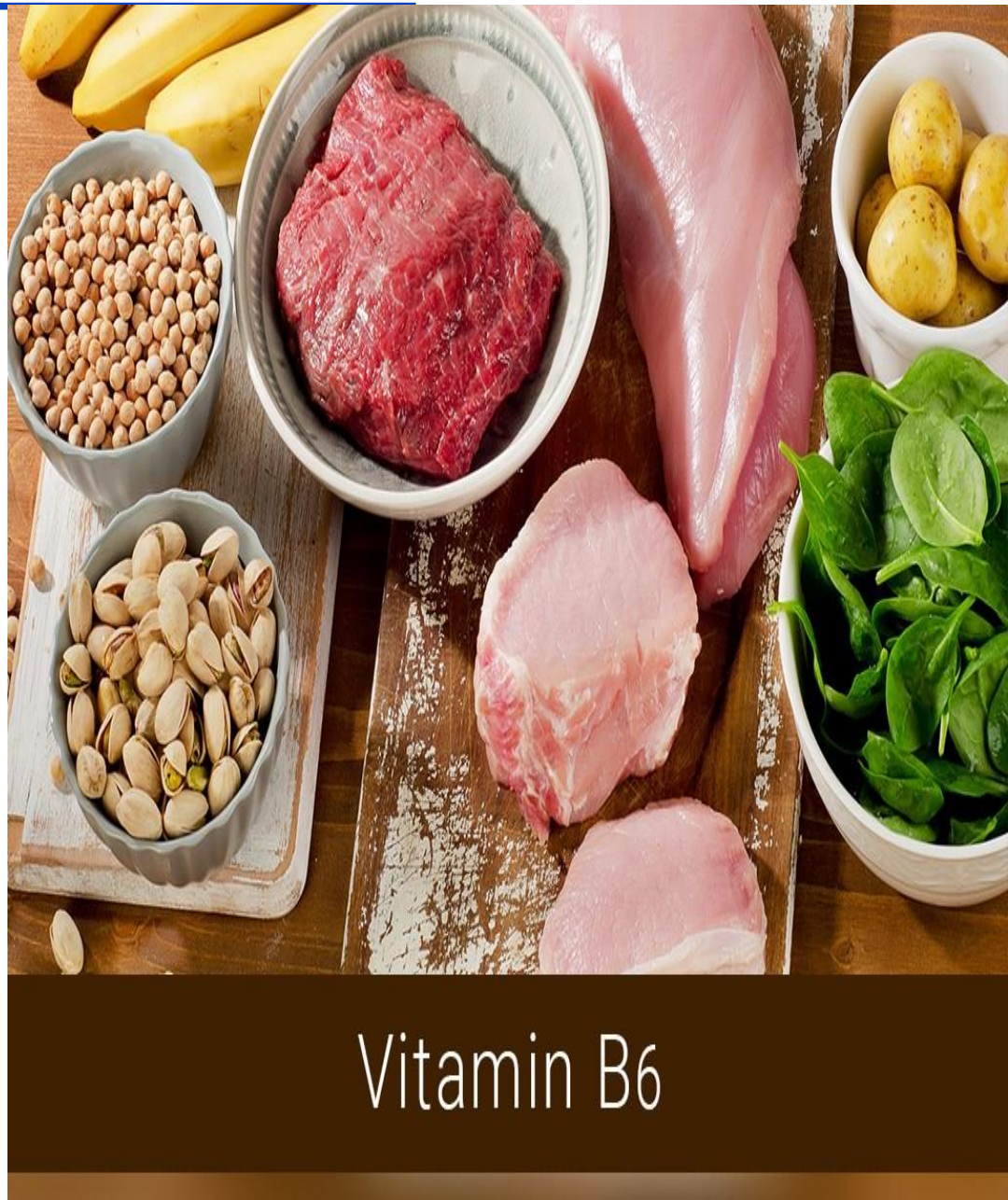


Pyridoxal 5'-Phosphate



Natural Sources

- **Vitamin B_6 is found in: Cereals, Beans, Meat, Liver, Fish, Yeast, Nuts and some fruits as Banana and Potatoes.**
- **It is also produced by bacterial flora in the colon.**
- **RDA :1.5 - 2.5mg/day.**



Absorption & transport

Pyridoxamine is mostly present in plants.

Pyridoxal and pyridoxamine are found in animal food.

Readily absorbed in jejunum & ileum of small intestine.

Widely distributed in various tissues.

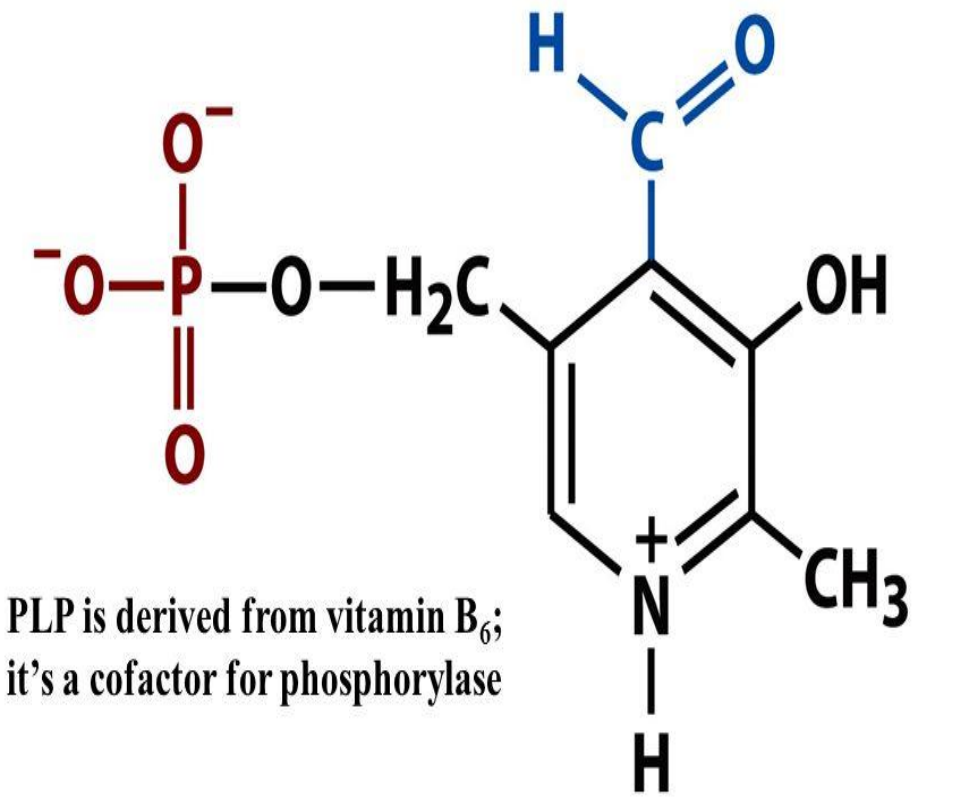
Excreted in urine as 4-pyridoxic acid.

Biologically active form

Active form is pyridoxal phosphate.

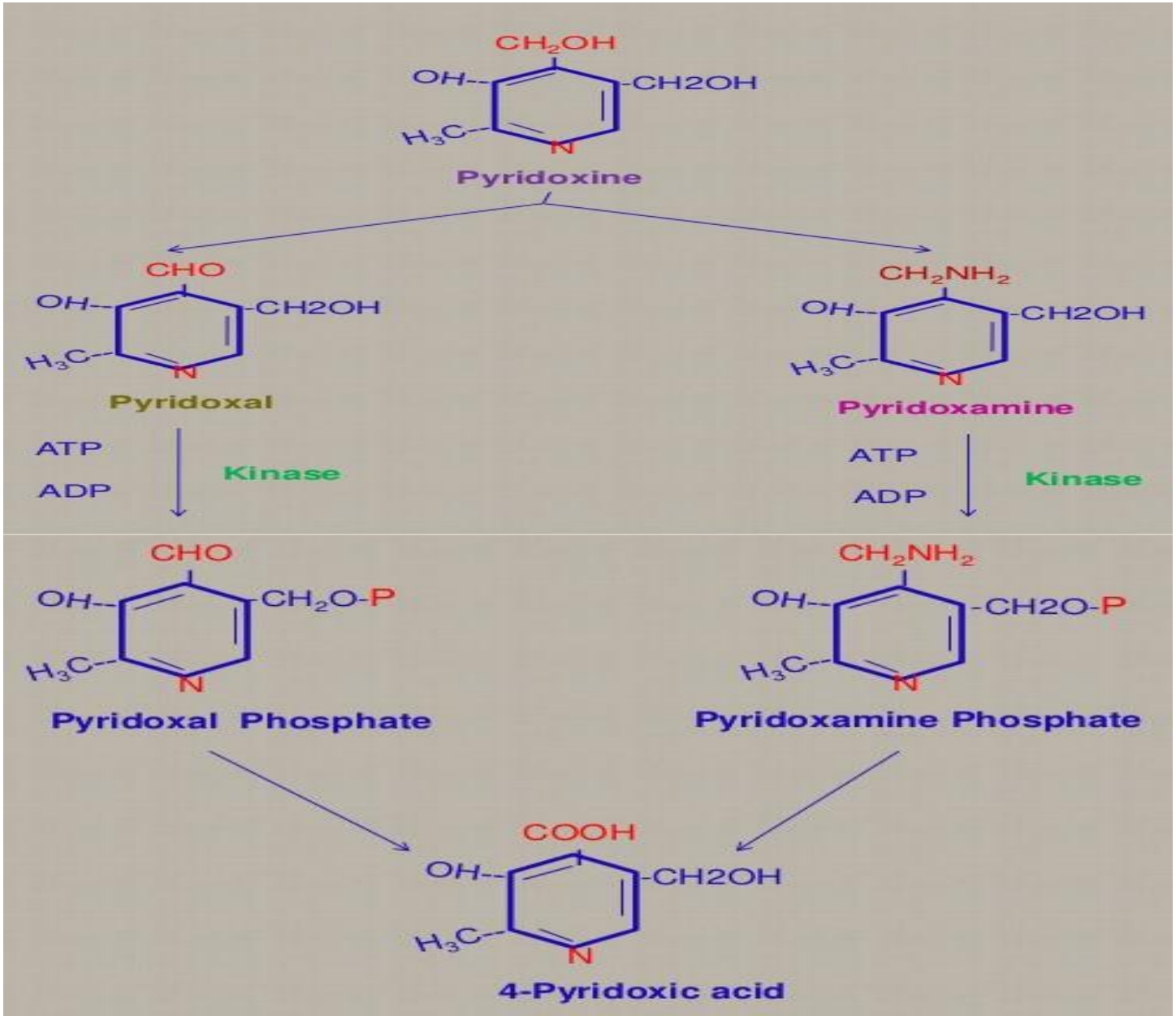
phosphorylation involves hydroxy methyl group at position 5 in pyridine ring.

Phosphorylation take place in liver, brain.



Pyridoxal-5′-phosphate (PLP)

Formation of pyridoxal phosphate



Role of Vitamin B_6

- **Vitamin B_6 is needed for more than 100 enzymes involved in protein metabolism.**
- **It is also essential for red blood cell metabolism and hemoglobin formation.**
- **The nervous and immune systems need vitamin B_6 to function efficiently.**
- **It is also needed for the conversion of Tryptophan (an amino acid) to Niacin (Vitamin B_3).**
- **Vitamin B_6 also helps maintain blood glucose within a normal range. When caloric intake is low vitamin B_6 help to convert stored carbohydrate or other nutrients to glucose to maintain normal blood sugar levels.**

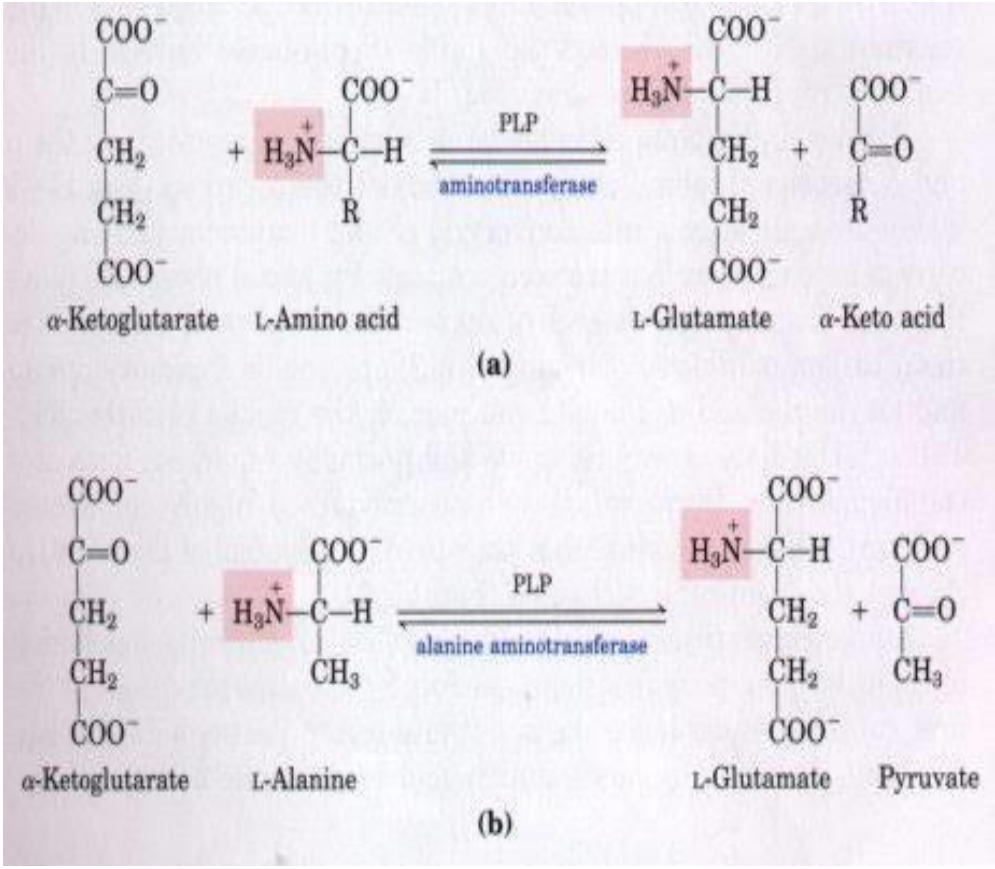
Biochemical functions

Participate in

- Transamination
- De carboxylation
- De amination
- Trans sulfation
- Condensation

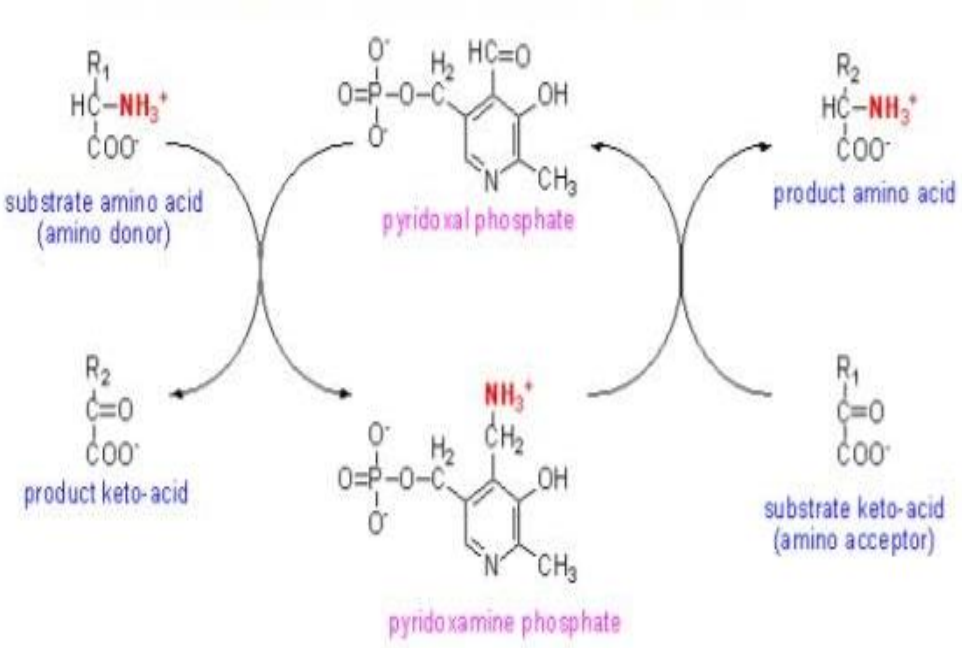
Transamination

- Pyridoxal phosphate is involved by tansaminases converting amino acid to keto acid .
- Keto acid enter citric acid cycle to generate energy.



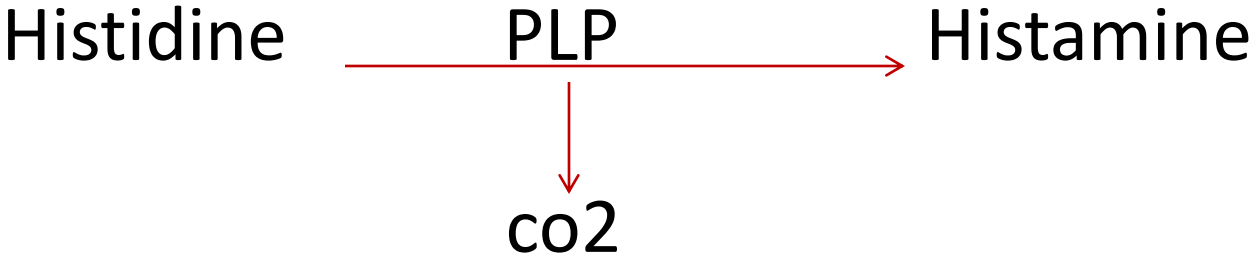
Formation of Schiff base

- PLP interacts with amino acid and form Schiff base.
- The amino group is handed over to form pyridoxamine, keto acid is liberated.



Decarboxylation

- Decarboxylases are dependent on PLP .
- Many biogenic amines with important functions are synthesized.eg,
- Serotonine
- Produce from tryptophan is important in nerve impulse transmission(neurotransmitter).
- Histamine
- Vasodilator, stimulate gastric HCL secretion, involved in allergic and inflammatory conditions

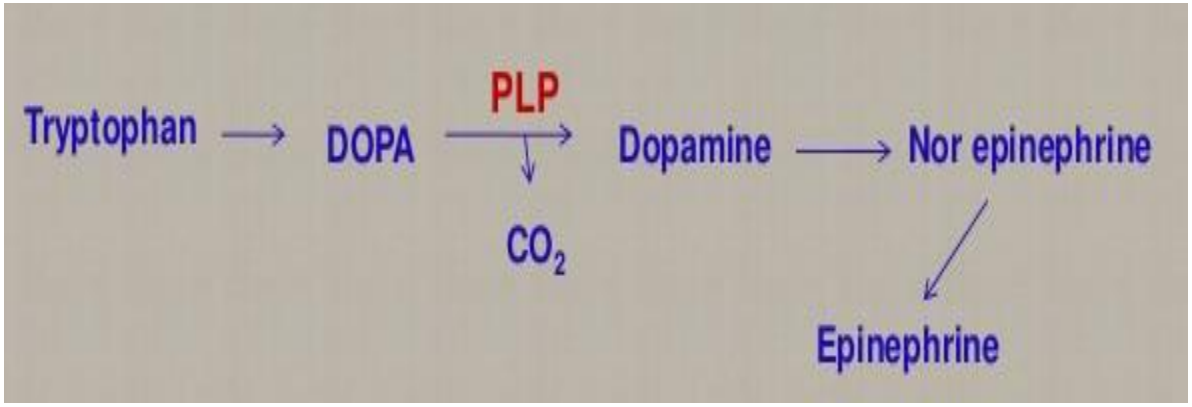


GABA inhibitory neurotransmitter

Glutamate —PLP→ GABA

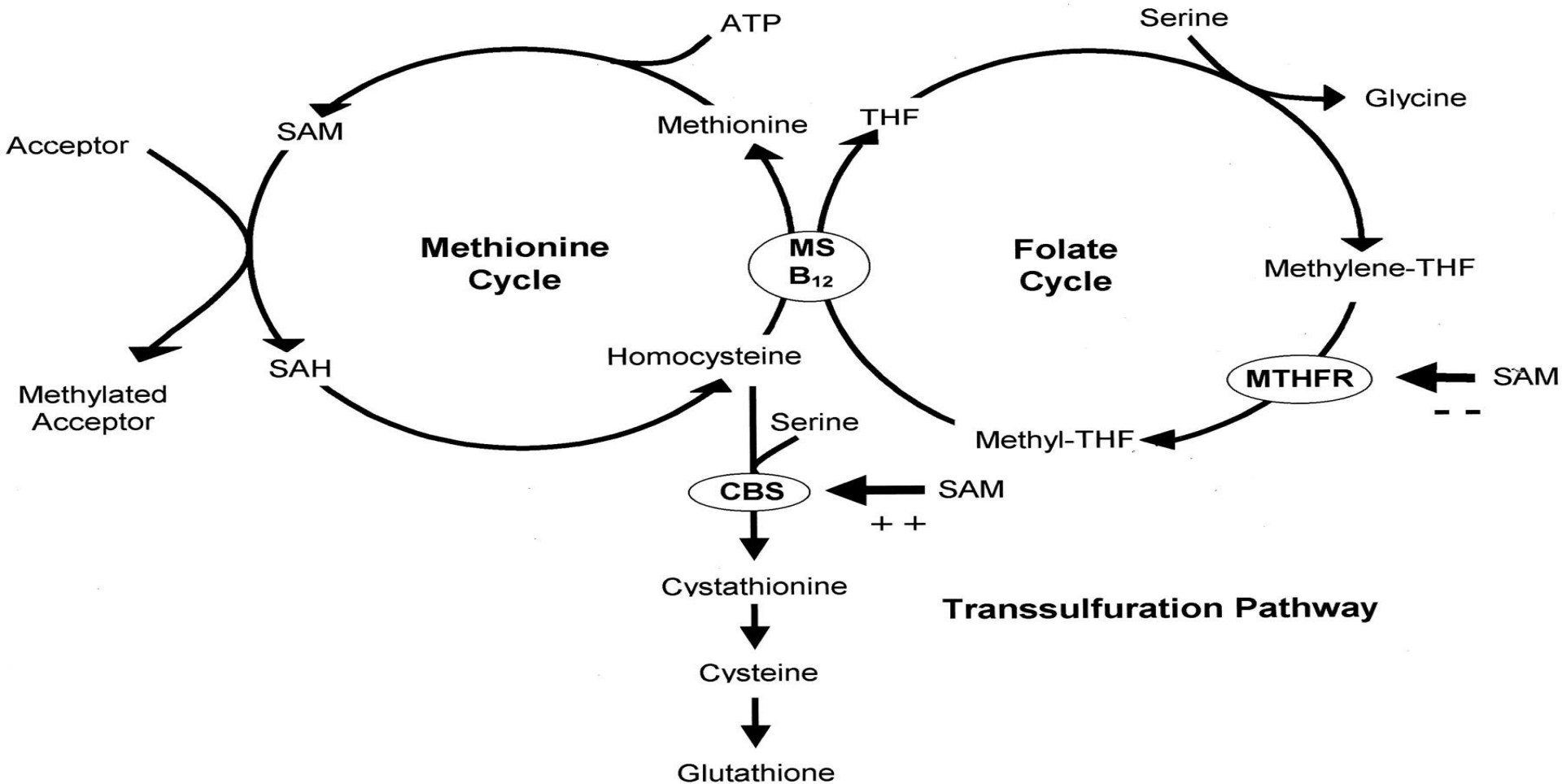
PLP → co2

- Synthesis of catecholamine(involved metabolic and nervous control) from tyrosine require PLP.



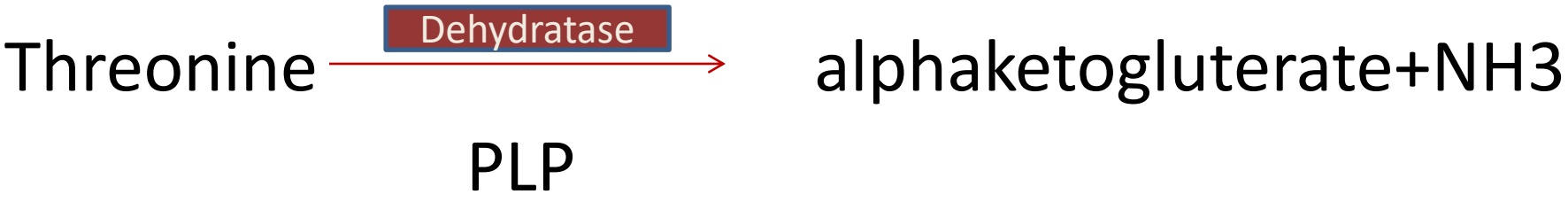
Transulfuration

- Transfer of sulfur from Homocysteine to serine in synthesis of cysteine.



Deamination

- Deamination of hydroxyl group containing amino acids require PLP.

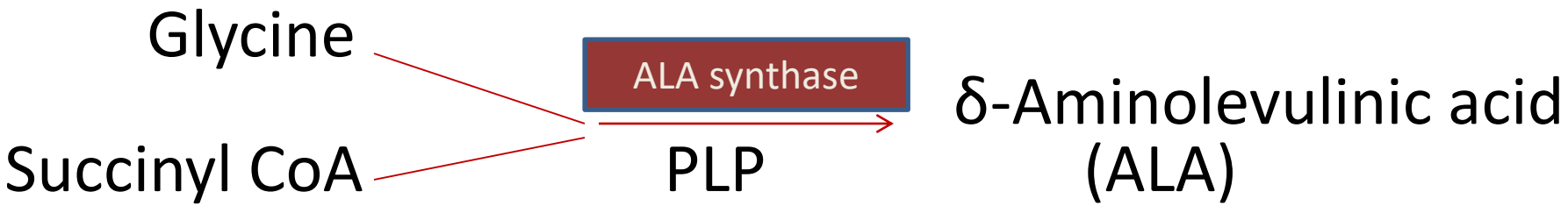


- Activation of serine (involved in synthesis of sphingomyline) depend on PLP.

- Involved in synthesis of CoA from pentothenic acid.
- Needed for absorption of amino acids from intestine.
- PLP is bound with glycogen phosphorylase.
- Synthesis of niacin from tryptophan ,enzyme kynurinase require plp.

Condensation

- Require for synthesis of heme



- Required as co enzyme with condensing enzyme for chain elongation of FA.

Deficiency

Signs of vitamin B_6 deficiency include:

- **Skin: Dermatitis (skin inflammation), Stomatitis (inflammation of the mucous lining of any of the structures in the mouth), Glossitis (is inflammation or infection of the tongue).**
- **Neurological abnormalities: Depression, confusion, peripheral neuropathy, and convulsions.**
- **Vitamin B_6 deficiency also can cause anemia (hypochromic microcytic).**

Causes of deficiency

- Isoniazid is bound with PLP and blocks its action.
- Penicillamine also inactivate PLP.
- Alcohol abuse.
- Contraceptive pills.

Diagnostic tests

- Measurement of level of B_6 in blood.
- Measurement of urinary pyridixic acid
- RBCs transaminases level,e.g ALT.

Uses

- **Treatment and Prevention of deficiency.**
- **For people who are at high risk of deficiency.**
- **Can also prescribed in:**
  - **Acne**
  - **Kidney stones**
  - **Premenstrual syndromes**
  - **Improve some CNS conditions, like parkinson,s disease**
  - **Hyper emesis gravidum.**

BIOTIN (VITAMIN B7-H)

Objectives

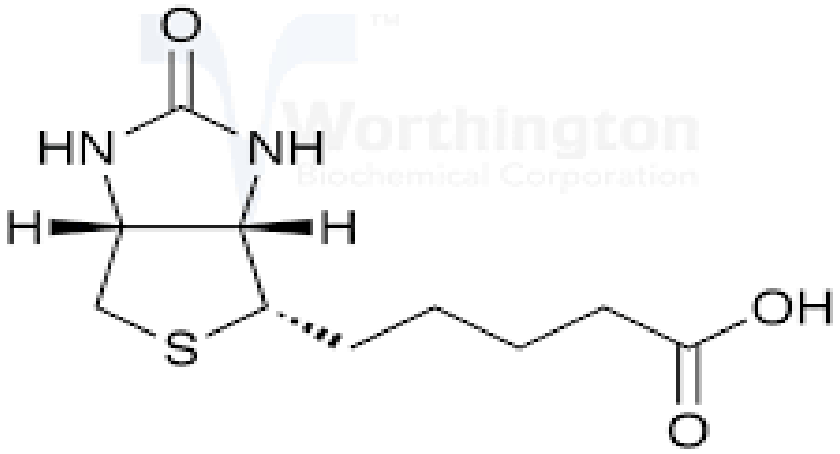
- Chemical structure of Biotin
- Biologically active form of Biotin
- Biosynthesis & metabolism of Biotin
- Sources & requirement of Biotin
- Metabolic functions of Biotin
- Deficiency diseases of Biotin

Vitamin B_7

(Vitamin H, Biotin, Growth Factor, Co-enzyme R)

- Heterocyclic monocarboxylic acid (sulphur containing).colorless, needle like crystals.
- Formed by fusion of imidazole and thiophene ring with a valeric acid side chain.
- Soluble in water
- Heat stable.

Biotin



Biologically active forms

- α biotin (egg yolk).
- β biotin (liver).

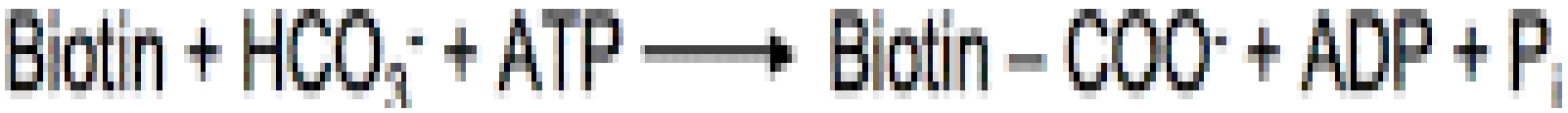
- Occurs in free and bound form in tissues and food.

- Bound forms are
- Biocytin, oxybiotin and desthiobiotin.

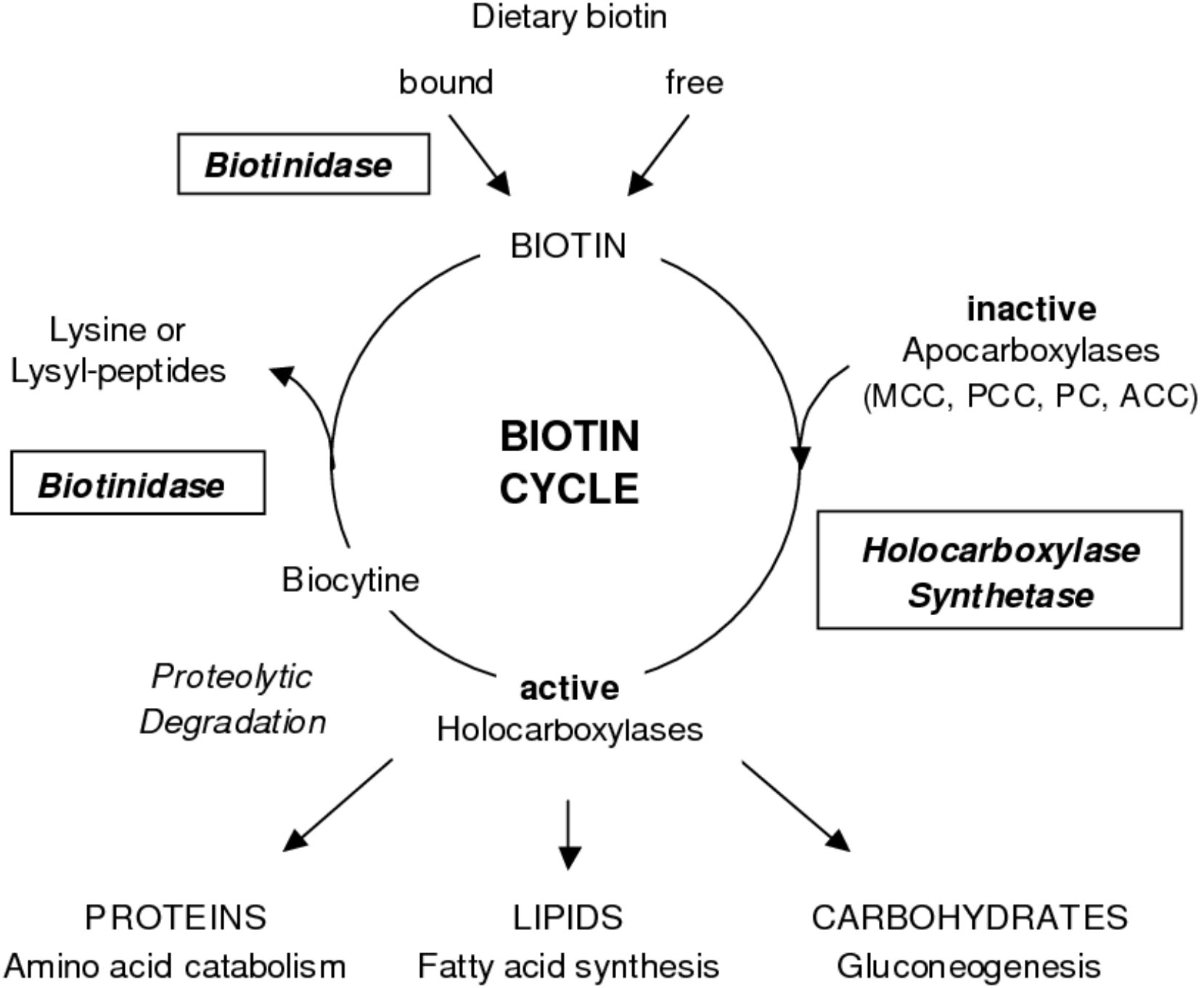
- Desthiobiotin and oxybiotin is found in certain bacteria and yeast.

Biologically active form

- Biotin is first converted to carboxy-biotin complex by reaction with bicarbonate and ATP.



- Co_2-biotin complex is the source of active Co_2 which is transferred to substrate.

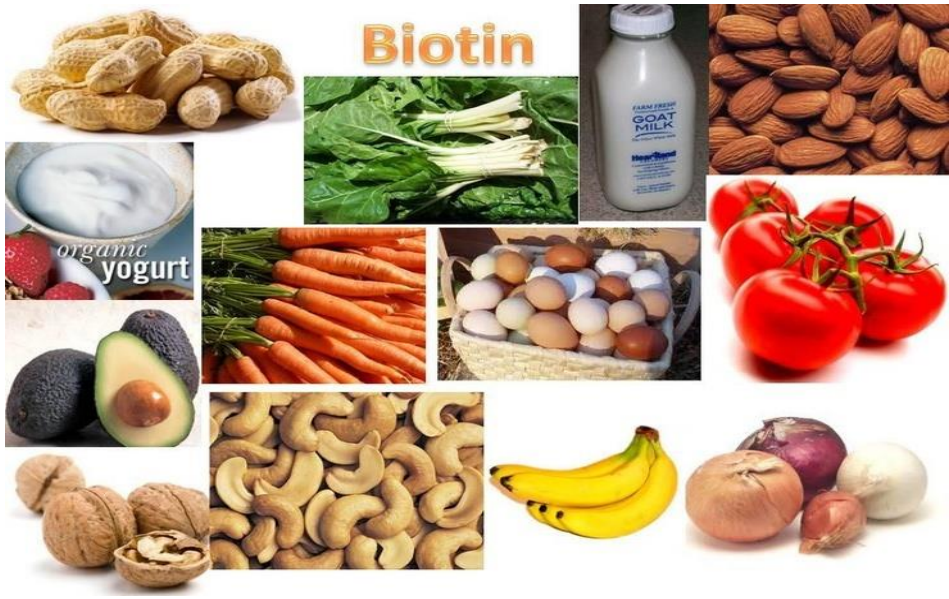

Dietary biotin
bound
free
Biotinidase
BIOTIN
Lysine or
Lysyl-peptides
inactive
Apocarboxylases
(MCC, PCC, PC, ACC)
BIOTIN
CYCLE
Biotinidase
Holocarboxylase
Synthetase
Biocytine
Proteolytic
Degradation
active
Holocarboxylases
PROTEINS
Amino acid catabolism
LIPIDS
Fatty acid synthesis
CARBOHYDRATES
Gluconeogenesis

Biosynthesis and metabolism

- Synthesized in human by intestinal flora.
- Found in leaves and roots of plants.
- Synthesized in yeast and bacteria.
- Absorbed in jejunum and ileum small intestine.
- Excreted mainly in urine and small amount in feces and sweat.

Sources & requirements

- Plants
- Cauliflower, whole wheat, leafy vegetables, tomatoes,carrots.
- Animals
- Egg yolk, cheese, yeast.
- RDA
- 200 --300 µg/day



Biochemical and metabolic functions

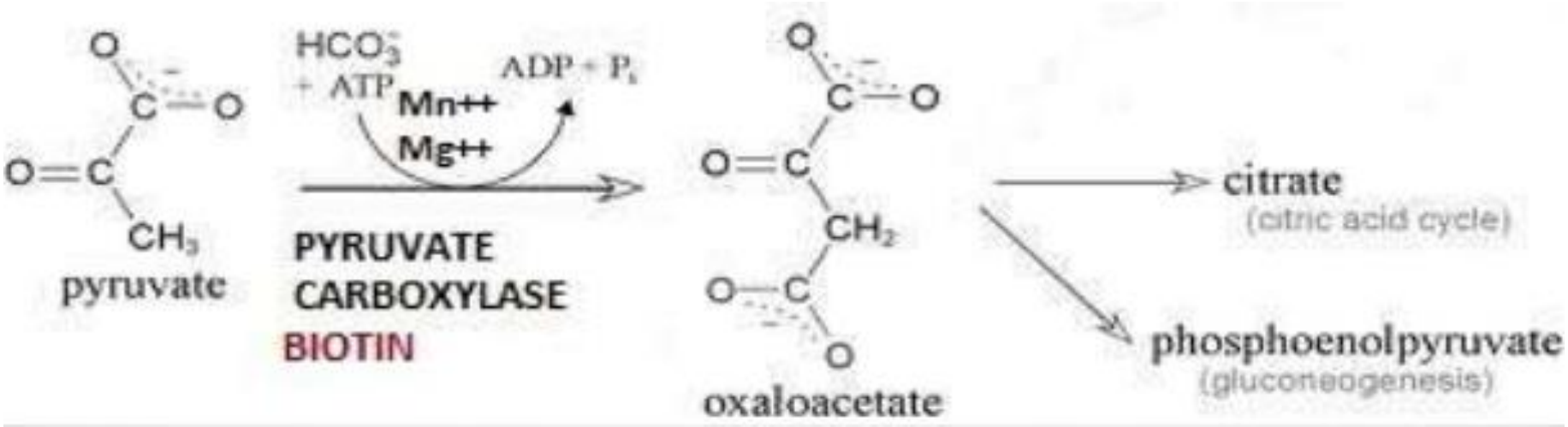
- Metabolize carbohydrates,lipids and proteins.
- Maintains blood sugar level.
- Required for cell division and tissue proliferation.
- Maintains skin,nails and hair growth.
- Prevents baldness and graying hairs.

Examples of carboxylation reactions

1. Conversion of pyruvate to oxaloacetate

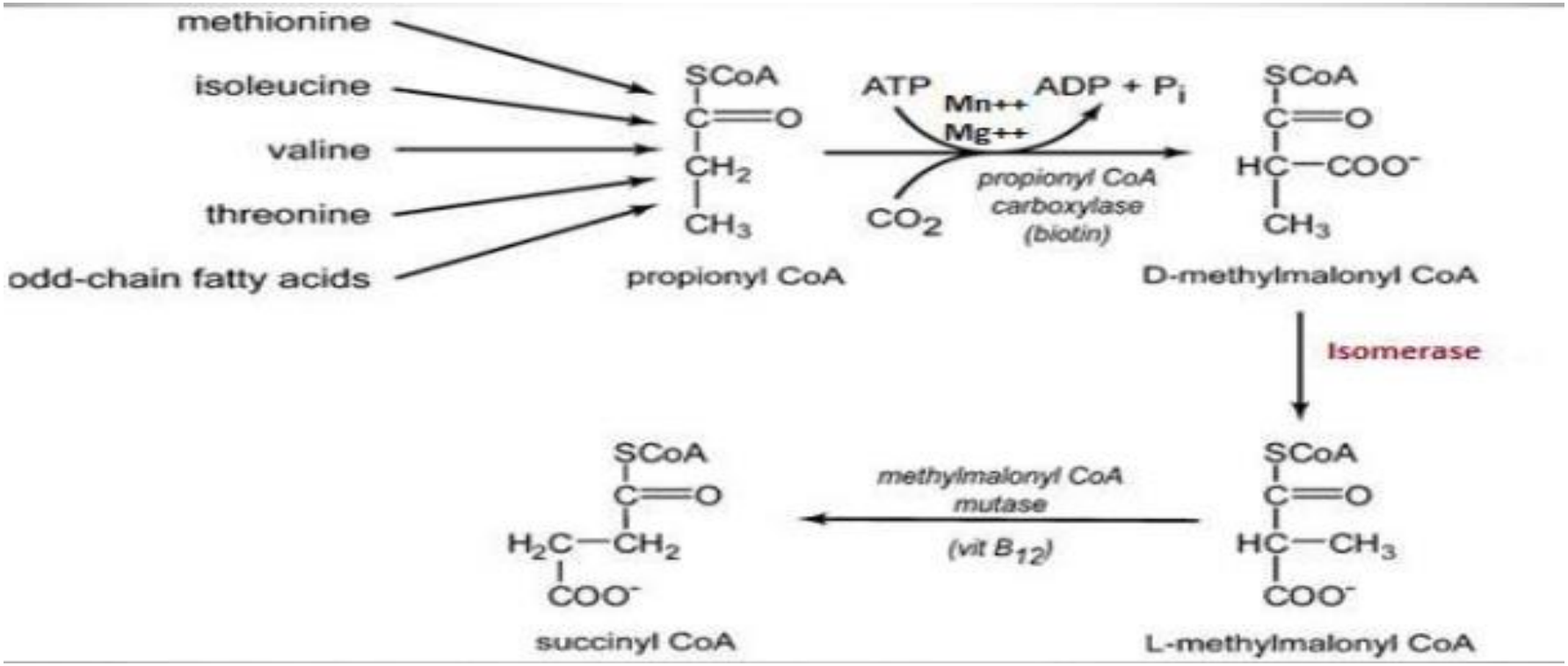
Biological significance

- It is the first reaction of gluconeogenesis.
- OAA can be used for glucose production or for the functioning of TCA cycle depending on the needs of cell.



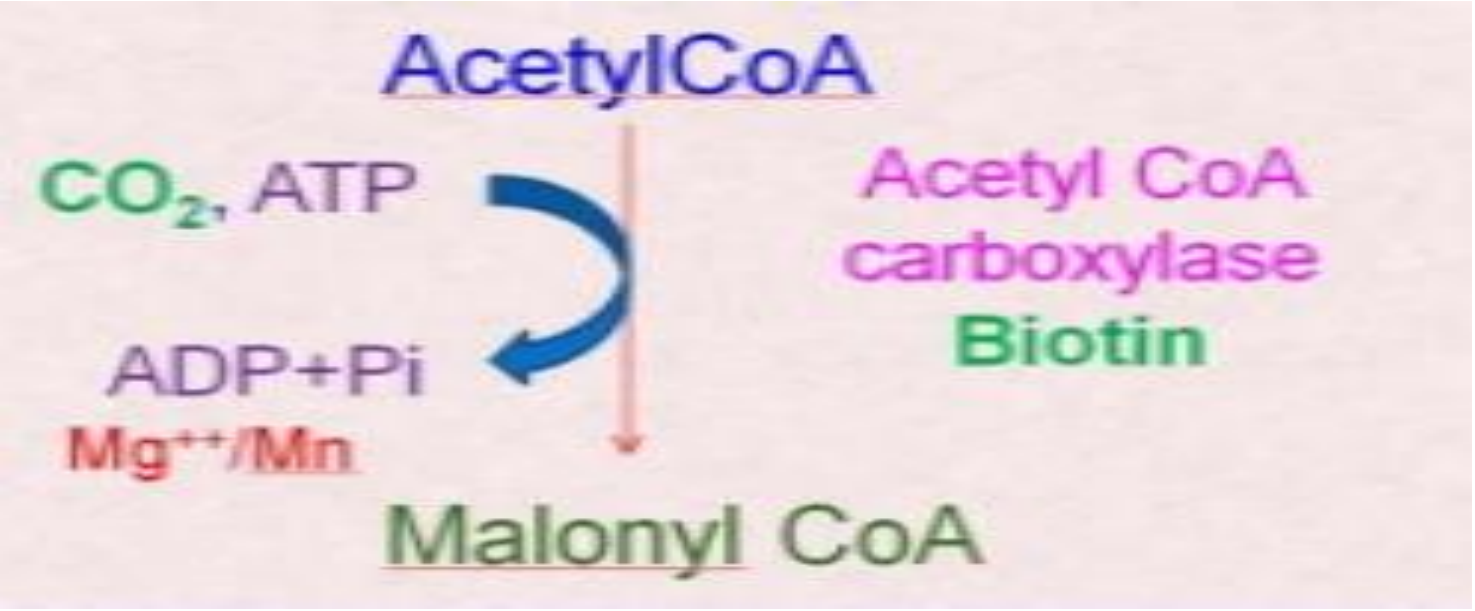
2. Carboxylation of propionyl Co A

- **<u>Biological significance</u>**
- Succinyl Co A enters the TCA cycle for complete oxidation to provide energy.
- Propionyl Co A is glucogenic in nature.



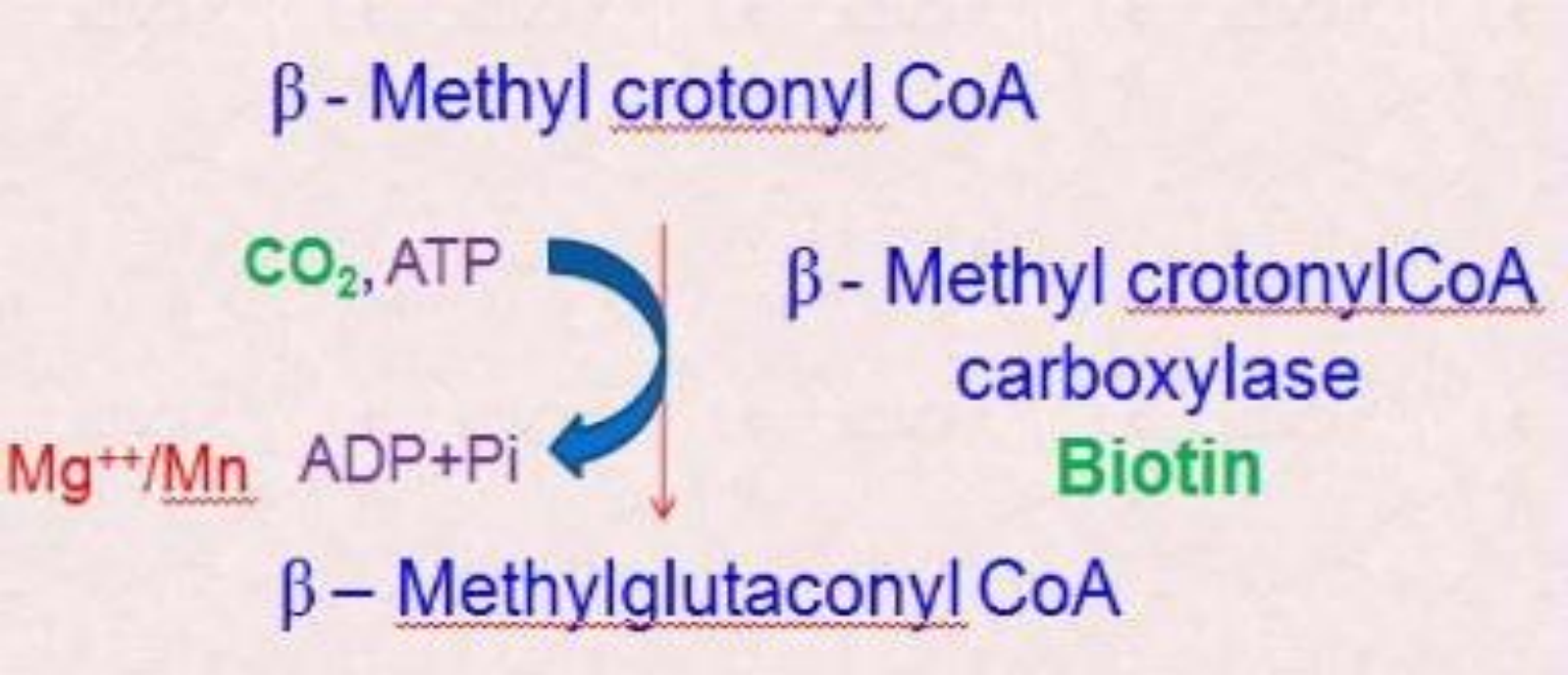
3. Conversion of Acetyl CoA to Malonyl Co A

- **<u>Biological significance</u>**
- First and rate limiting step of fatty acid synthesis.
- In absence of Biotin fatty acid synthesis is enormously affected.



4. Carboxylation of β-methylcrotonyl CoA

- **Biological significance**
- Important reaction of leucin metabolism.
- Biotin deficiency impairs leucin metabolism.



Uses

- Treat and prevent deficiency conditions.
- Supplement in cases of inadequate diet.
- In vitamin B-Complex to improve glucose metabolism.
- In skin disease as Acne and Dermatitis.

Deficiency

Only induced in experimental animals not observed in human:

- Skin lesions
- Brittle nails
- Retarded growth
- Hair loss
- Seborrheic dermatitis
- Neurological defects in children.
- Loss of appetite

Loss of hair

dermatitis

Greying of hair

Treatment

- No permanent cure
- Only symptomatic cure is given.

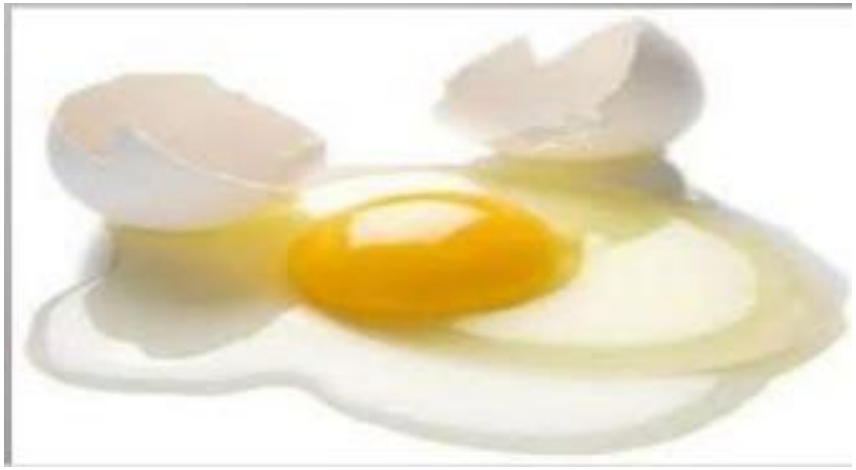
- **Acquired Biotin deficiency**
- Two types
- Leiner's disease
- Egg white injury

Leiner's disease

- Seen in infants while being exclusively breast fed and infants having chronic diarrheas.
- Due to chronic diarrhea Biotin is not absorbed.
- Breast milk has low content of Biotin.
- Such infants present with symptoms of Biotin deficiency in the form of dermatitis and easily peeling of skin.

Egg white injury

- Due to excessive consumption of raw eggs mainly egg white.
- Protein Avedin(anti vitamin) binds with biotin and inactivates it.
- Cooked egg white is found not to be toxic since Avidin is heat labile and boiling of egg inactivates Avidin.
- 1 molecule of Avidin can bind 4 molecules of Biotin.



References

- Chatterjea
- Jaypee
- Satyanaryn


THANK YOU FOR LISTENING 6B
ANY QUESTIONS???
memegen.com