

Synthesis and Significance of 5-HT, Melatonin

Serotonin / 5-hydroxytryptamine (5HT)

- 5HT is a neurotransmitter, synthesized from tryptophan

Functions:

1. Serotonin is a powerful vasoconstrictor and results in smooth muscle contraction in bronchioles and arterioles.
2. It is involved in the regulation of cerebral activity (excitation).
3. Serotonin controls the behavioural patterns, sleep, blood pressure and body temperature.
4. Serotonin evokes the release of peptide hormones from gastro intestinal tract.
5. It is also necessary for the motility of GIT (peristalsis)

Melatonin

- Melatonin is a hormone, mostly synthesized by the pineal gland.
- The synthesis and secretion of melatonin from pineal gland is controlled by light.

Functions:

1. Melatonin is involved in circadian rhythms or diurnal variations (24 hr cyclic process) of the body. It plays a significant role in sleep and wake process.
2. It inhibits the production of melanocyte stimulating hormone (MSH) and adrenocorticotrophic hormone (ACTH).
3. It has some inhibitory effect on ovarian functions.

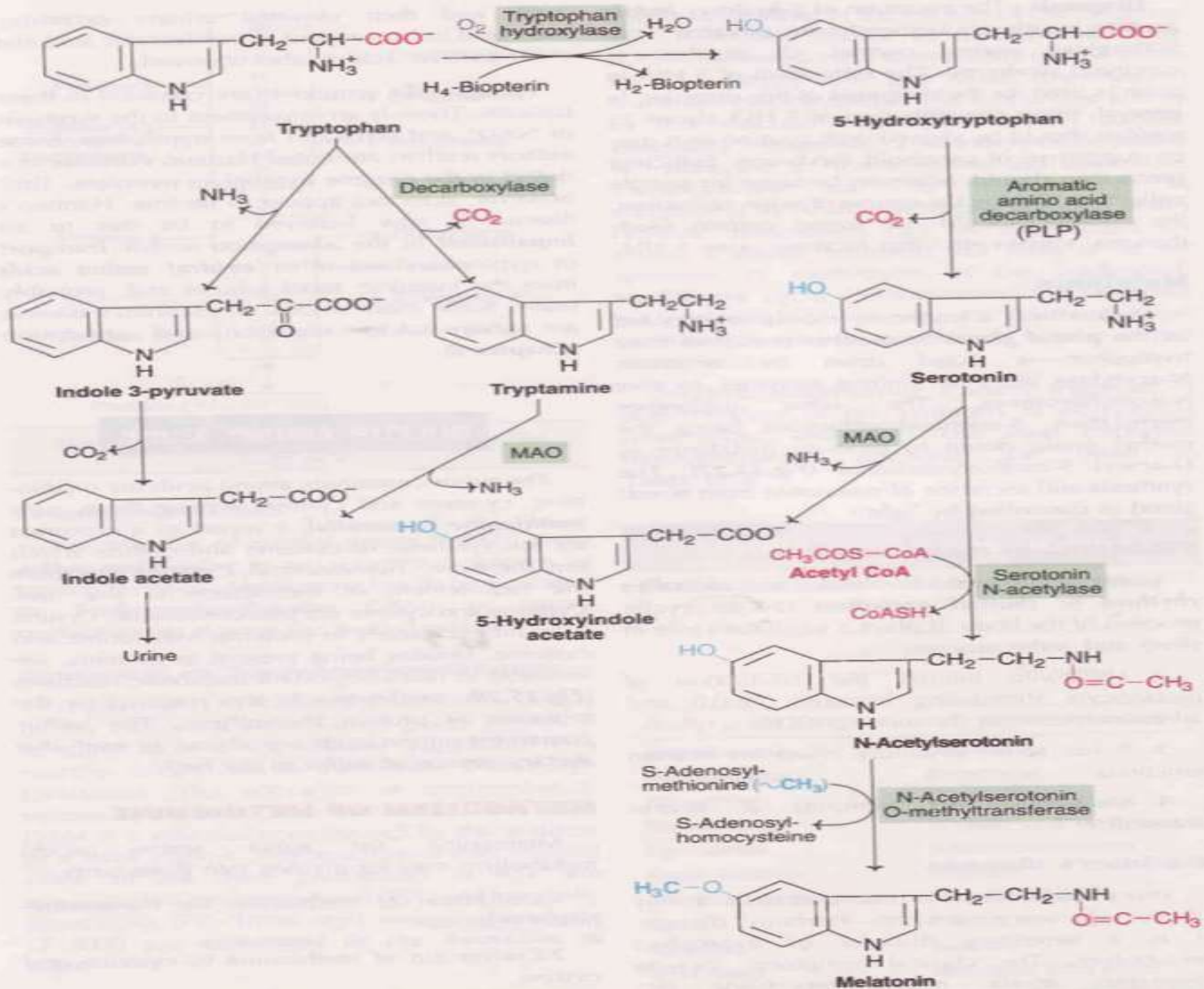
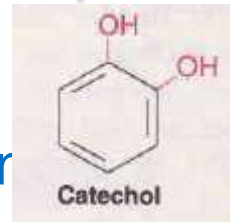


Fig. 15.27 : Metabolism of tryptophan-serotonin and melatonin synthesis (PLP-Pyridoxal phosphate; MAO-Monoamine oxidase).

Synthesis of Catecholamines (Dopamine, Noradrenaline , Adrenaline)

- Catechol refers to the dihydroxylated phenyl ring
- Amine derivatives of catechol are called **catecholamines**
- Tyrosine is the precursor for the synthesis of catecholamines , namely **dopamine, norepinephrine (noradrenaline) and epinephrine (adrenaline)**.
- The conversion of tyrosine to catecholamines occurs in **adrenal medulla and central nervous system**.



Functions of catecholamines :

- Norepinephrine and epinephrine regulate carbohydrate and lipid metabolisms.
- They stimulate the degradation of triacylglycerol and glycogen.
- They cause an increase in the blood pressure.
- Dopamine and norepinephrine serve as neurotransmitters in the brain and autonomous nervous system.

Synthesis of catecholamines:

- Tyrosine is **hydroxylated** to 3,4-dihydroxyphenylalanine (DOPA) by **tyrosine hydroxylase**.
- This reaction requires tetrahydro bipterin as coenzyme.
- DOPA undergoes PLP-dependent **decarboxylation** to give dopamine which, in turn, is hydroxylated to produce norepinephrine.
- **Methylation** of norepinephrine by S-adenosyl methionine gives epinephrine.
- The difference between epinephrine and norepinephrine is only a methyl group (norepinephrine has no methyl group).

