

CNS

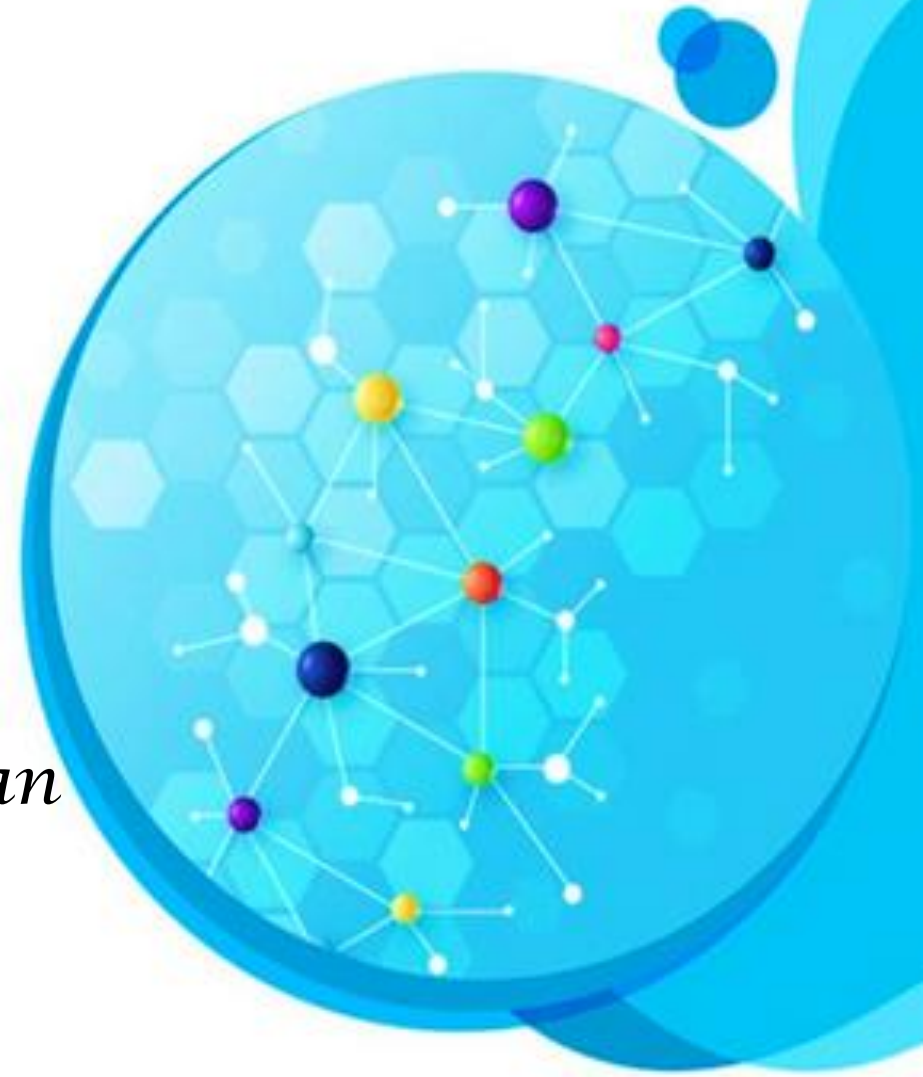
Medical Biochemistry

*Biochemistry of
neurotransmitters*

Asst. Prof. Mohammed Hasan Eleyan

Faculty of Medicine

Al-Azhar University-Gaza





Tyrosine-Derived Neurotransmitters

Catecholamines: Dopamine, norepinephrine, and epinephrine

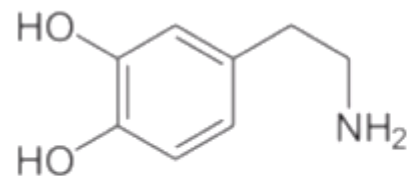
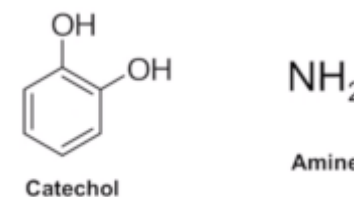


MOHAMMED ELEYAN

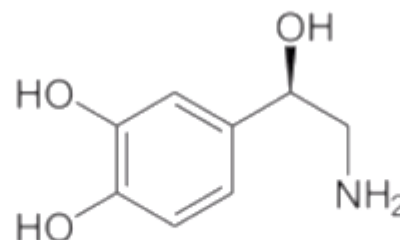


Catecholamines

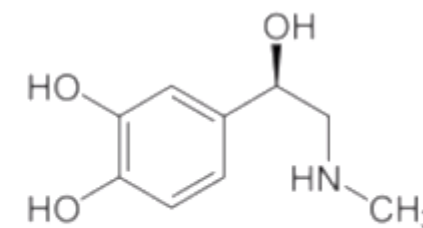
- Catecholamines are a class of neurotransmitters and hormones derived from the amino acid **tyrosine**.
- They share a common structure consisting of:
 - **Catechol group**: A benzene ring with **two hydroxyl (-OH) groups**.
 - **Amine group (-NH₂)**: A nitrogen-containing functional group.
- This combination gives rise to the name **Catecholamine (Catechol + Amine)**.



Dopamine



Norepinephrine



Epinephrine

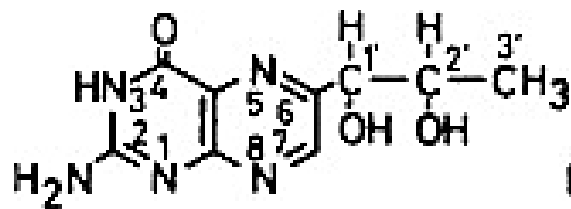


Biosynthesis of Catecholamines

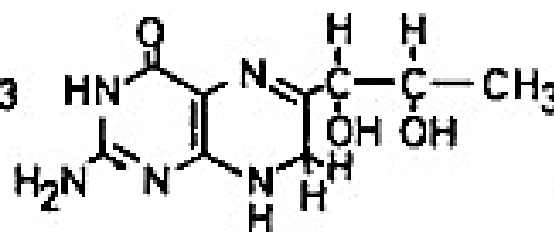


MOHAMMED ELEYN

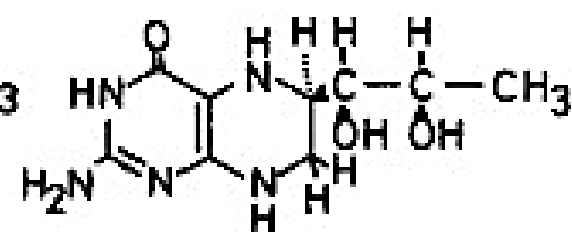




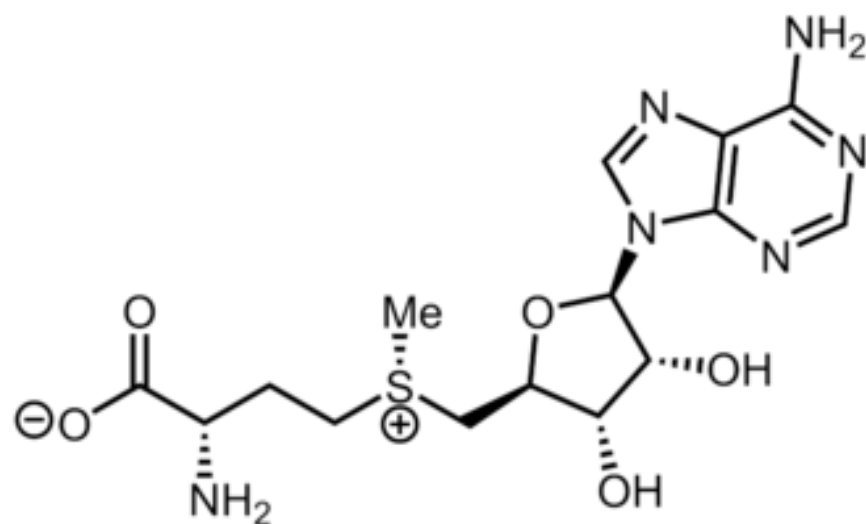
biopterin



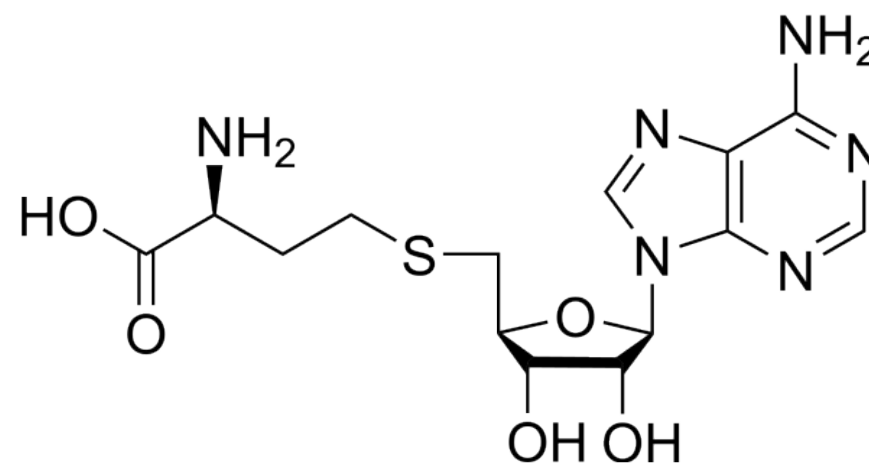
7,8-dihydrobiopterin



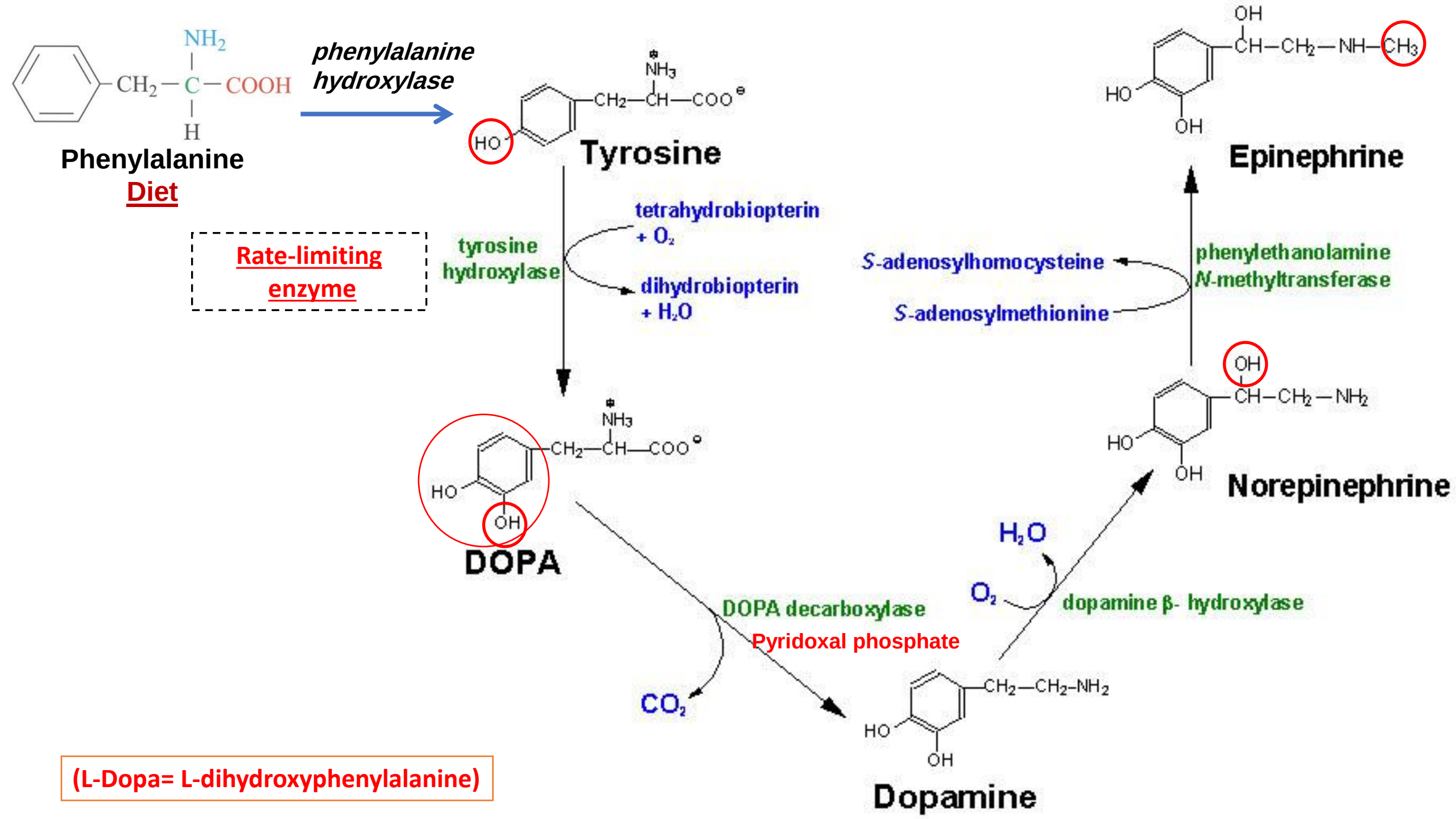
5,6,7,8-tetrahydrobiopterin



S-Adenosyl methionine



S-Adenosylhomocysteine





Catabolism of Catecholamines



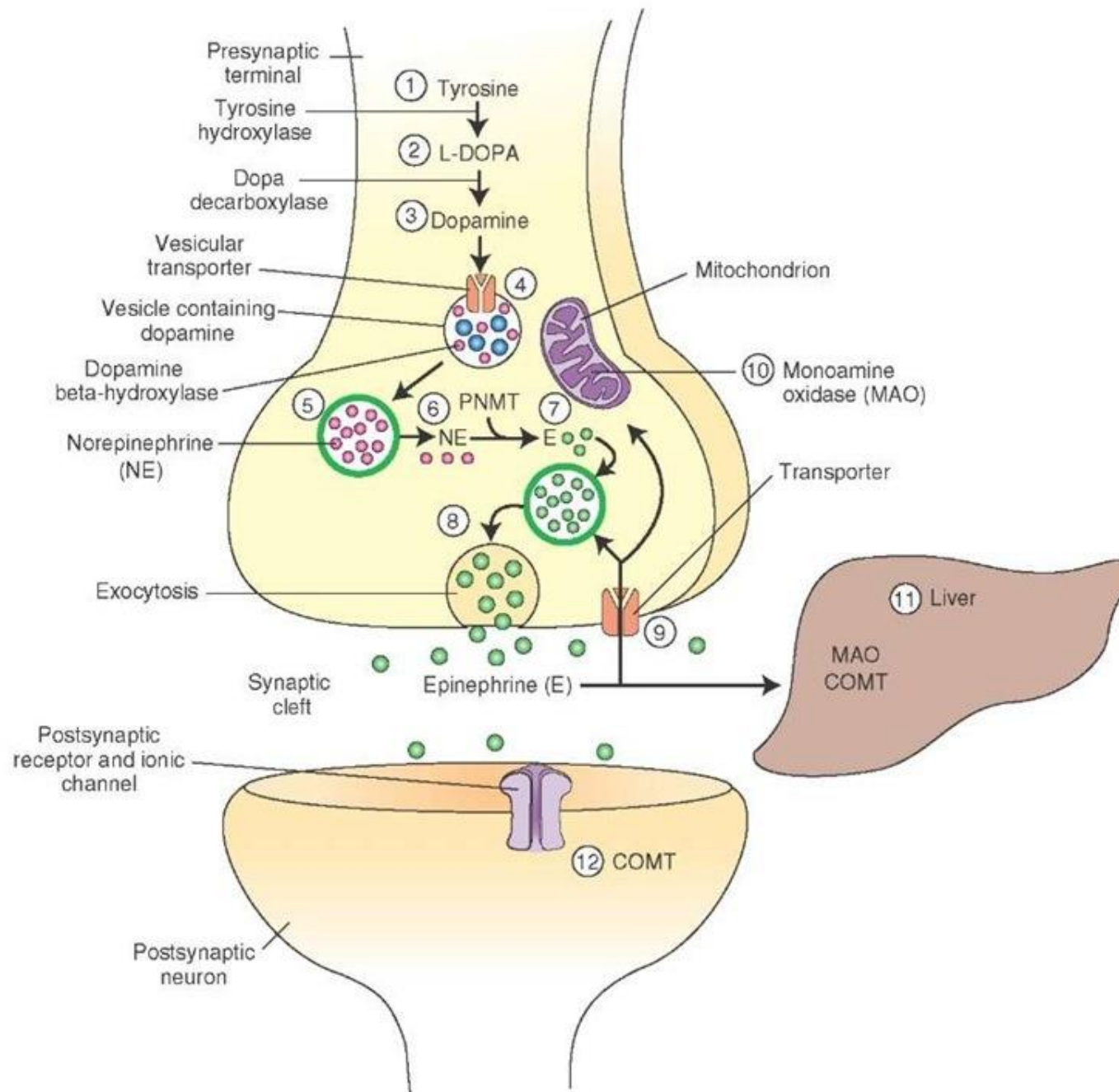
MOHAMMED ELEYAN





Two Possible Pathways for Catecholamine Catabolism

- Catecholamines (dopamine, norepinephrine, and epinephrine) are broken down by two major enzymes:
 1. Monoamine Oxidase (MAO) – present in mitochondria
 2. Catechol-O-Methyltransferase (COMT) – present in cytoplasm and synaptic cleft
- These enzymes degrade catecholamines into inactive metabolites, which are excreted in the urine.
- Catecholamines can be metabolized through two parallel pathways, each initiated by either MAO or COMT.

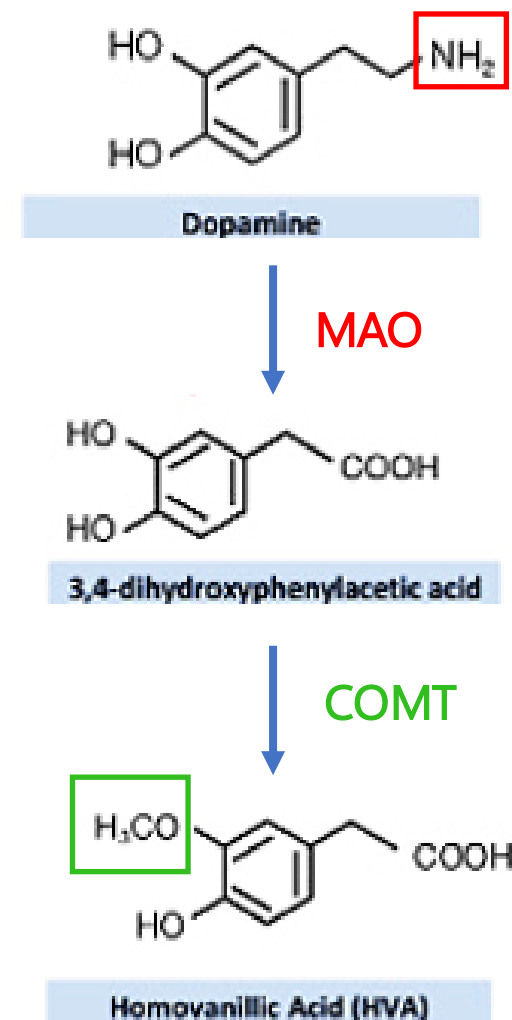


Two Possible Pathways for Catecholamine Catabolism

- ◆ This is the dominant pathway in neurons and the liver.

(Oxidative Deamination → O-Methylation):

1. MAO first removes the amine ($-NH_2$) group.
2. Then COMT methylates the hydroxyl ($-OH$) group on the catechol ring (not present in Catecholaminergic Neurons).





Inside Catecholaminergic Neurons (Intraneuronal Metabolism)

The dominant pathway inside neurons follows this order:

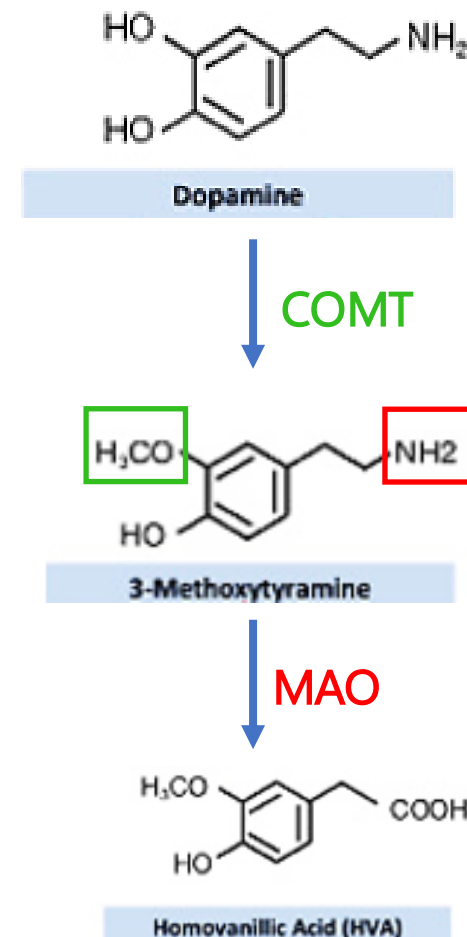
Monoamine Oxidase (MAO) acts first, removing the amine ($-NH_2$) group producing intermediate compound which leaves the neuron via passive diffusion or transporters and then further metabolized by COMT inside glial cells, liver, or peripheral tissues.

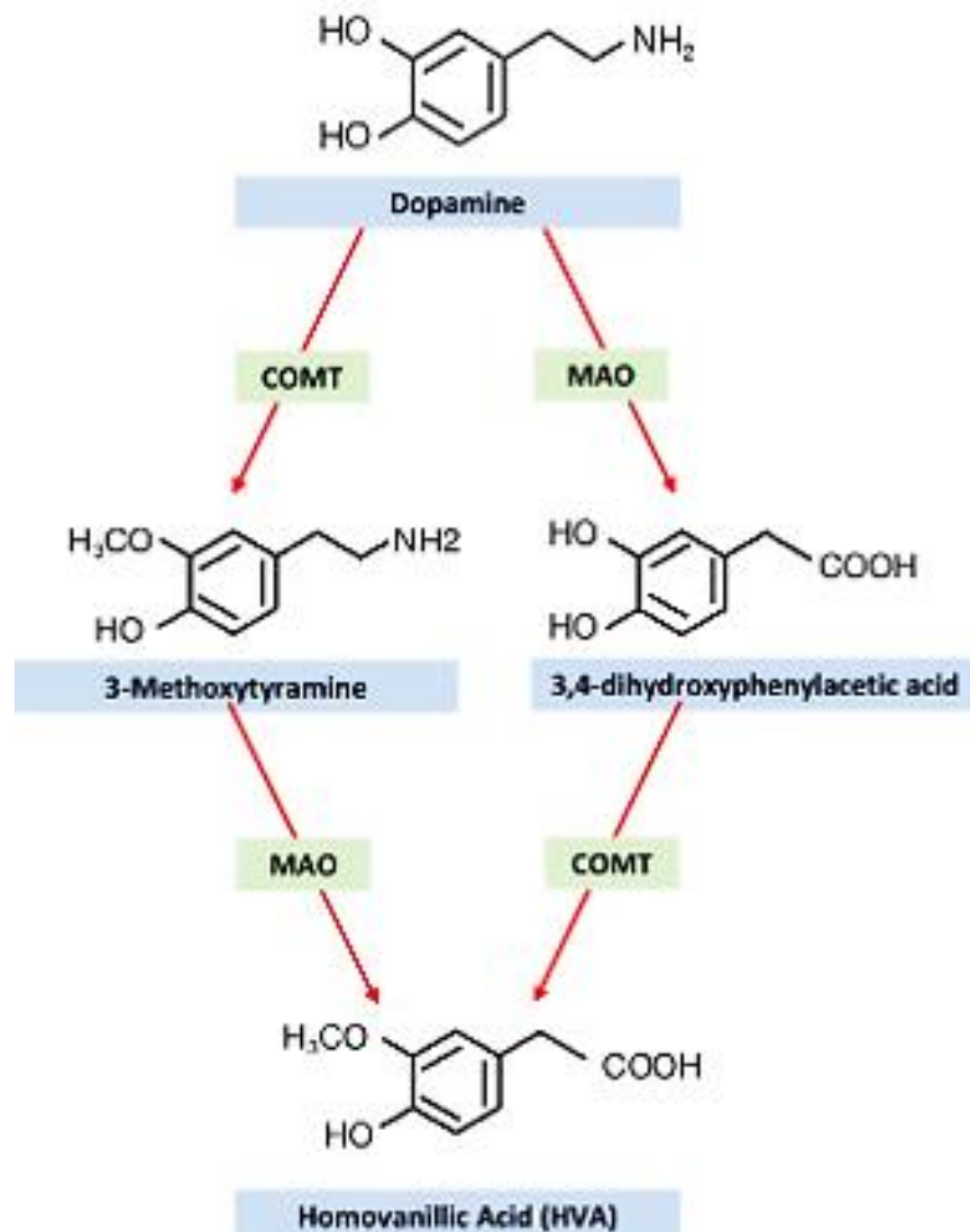
There is no significant Catechol-O-Methyltransferase (COMT) activity inside catecholaminergic neurons

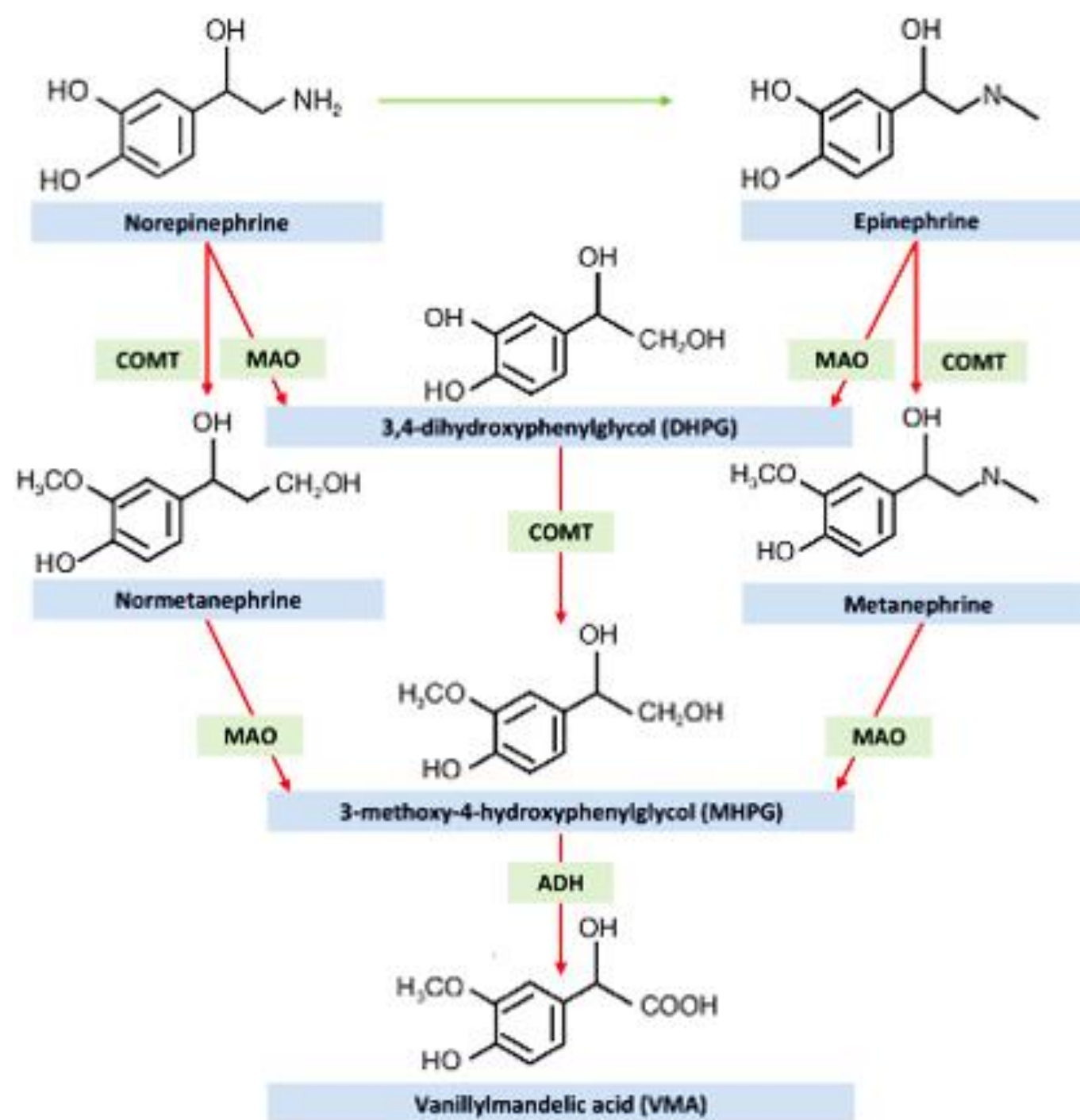
Two Possible Pathways for Catecholamine Catabolism

◆ This pathway is more common in peripheral tissues, especially in the adrenal medulla. (O-Methylation → Oxidative Deamination):

1. COMT first **methyates** the catechol ring.
2. MAO then **oxidatively deaminates** the O-methylated compound.









Thanks Part 3



MOHAMMED ELEYN