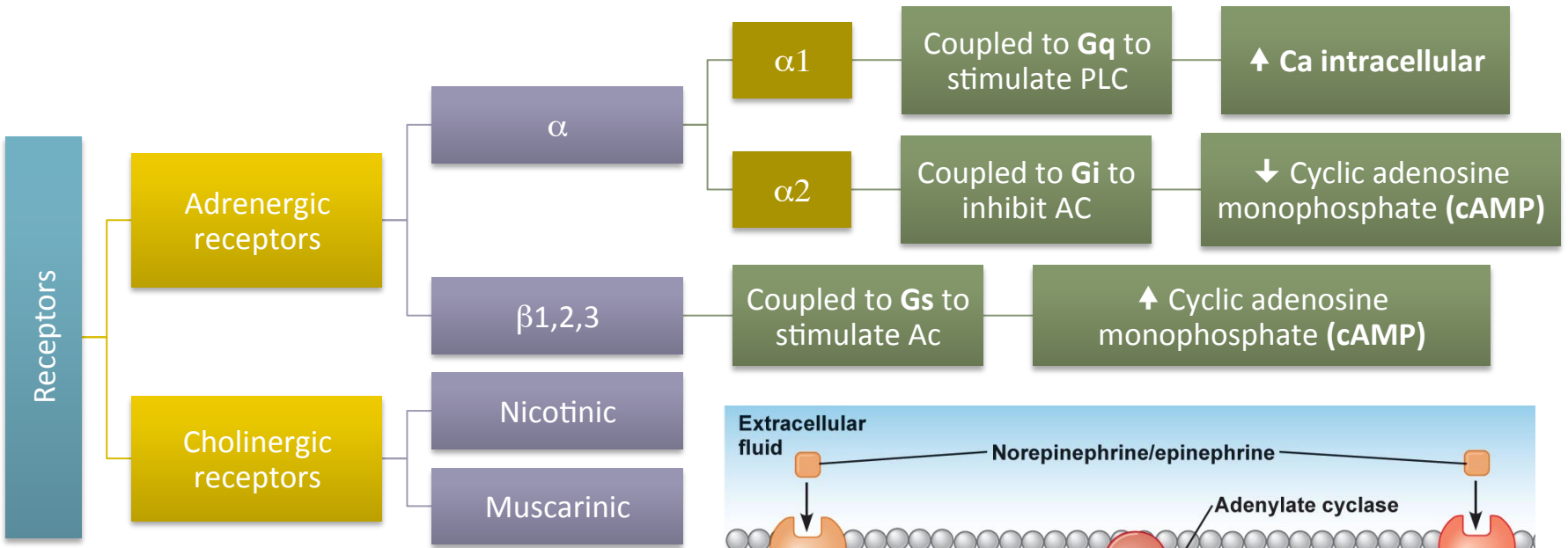




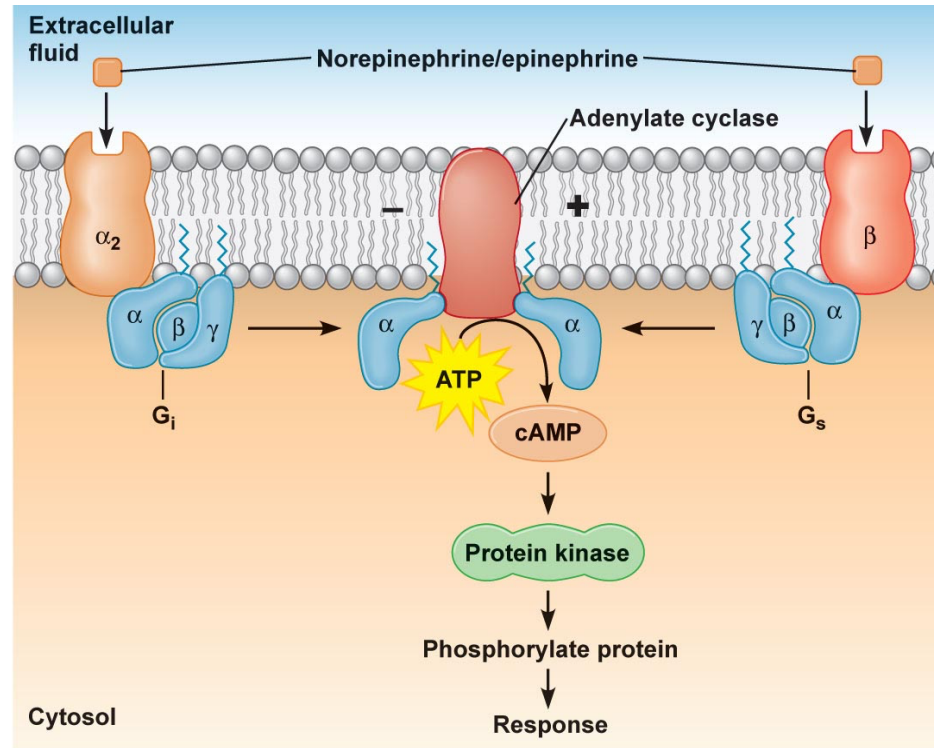
# Physiology of Sympathetic Nervous System

(Needed for studying SNS PHARMACOLOGY)

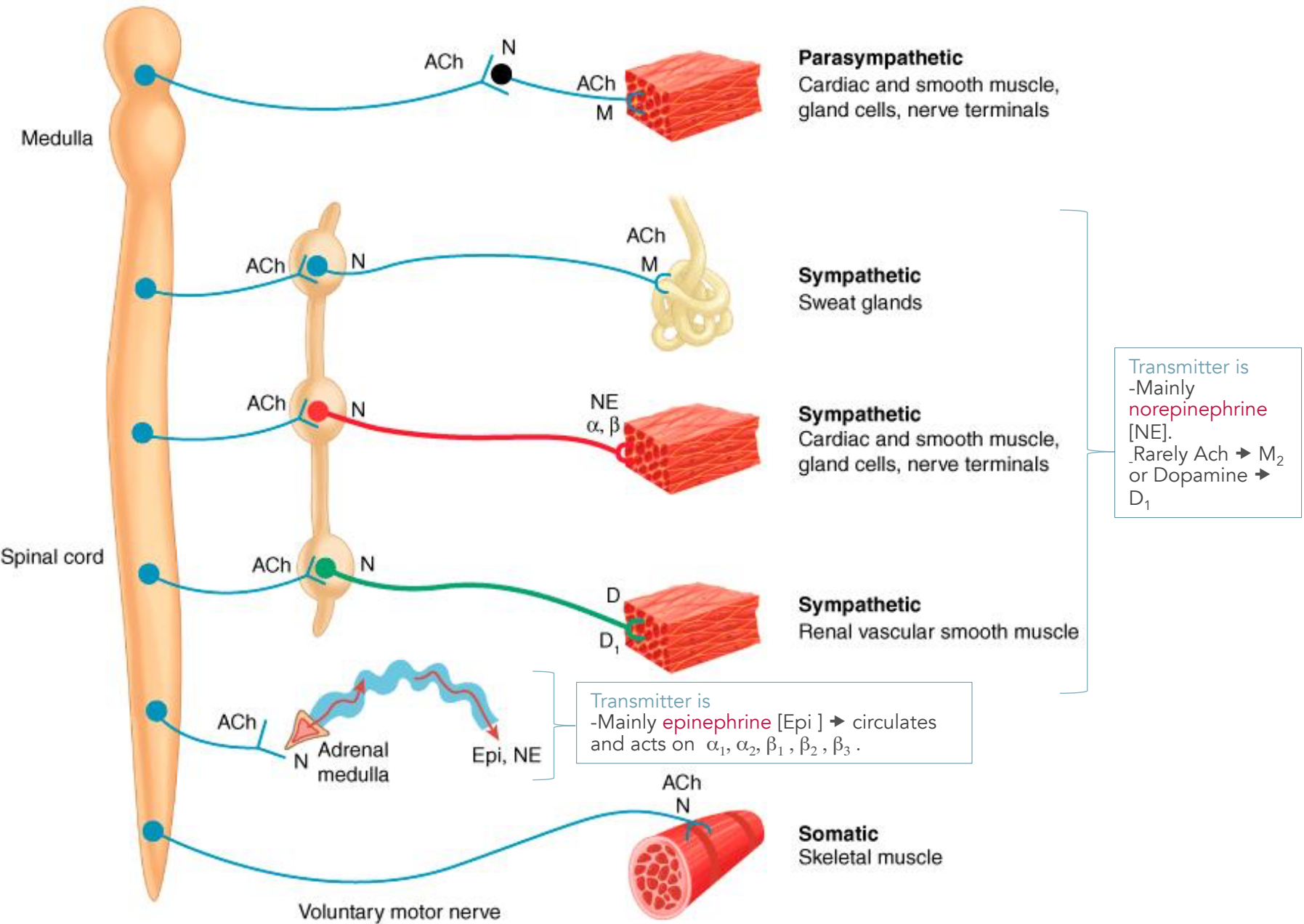


PREDOMINANT TONES OF MAJOR ORGAN SYSTEMS

Sympathetic	Parasympathetic
Arterioles / Arteries Veins Sweat glands	Heart Iris Ciliary muscle GI tract (ENS) Smooth muscle Bladder Salivary glands Lacrimal glands



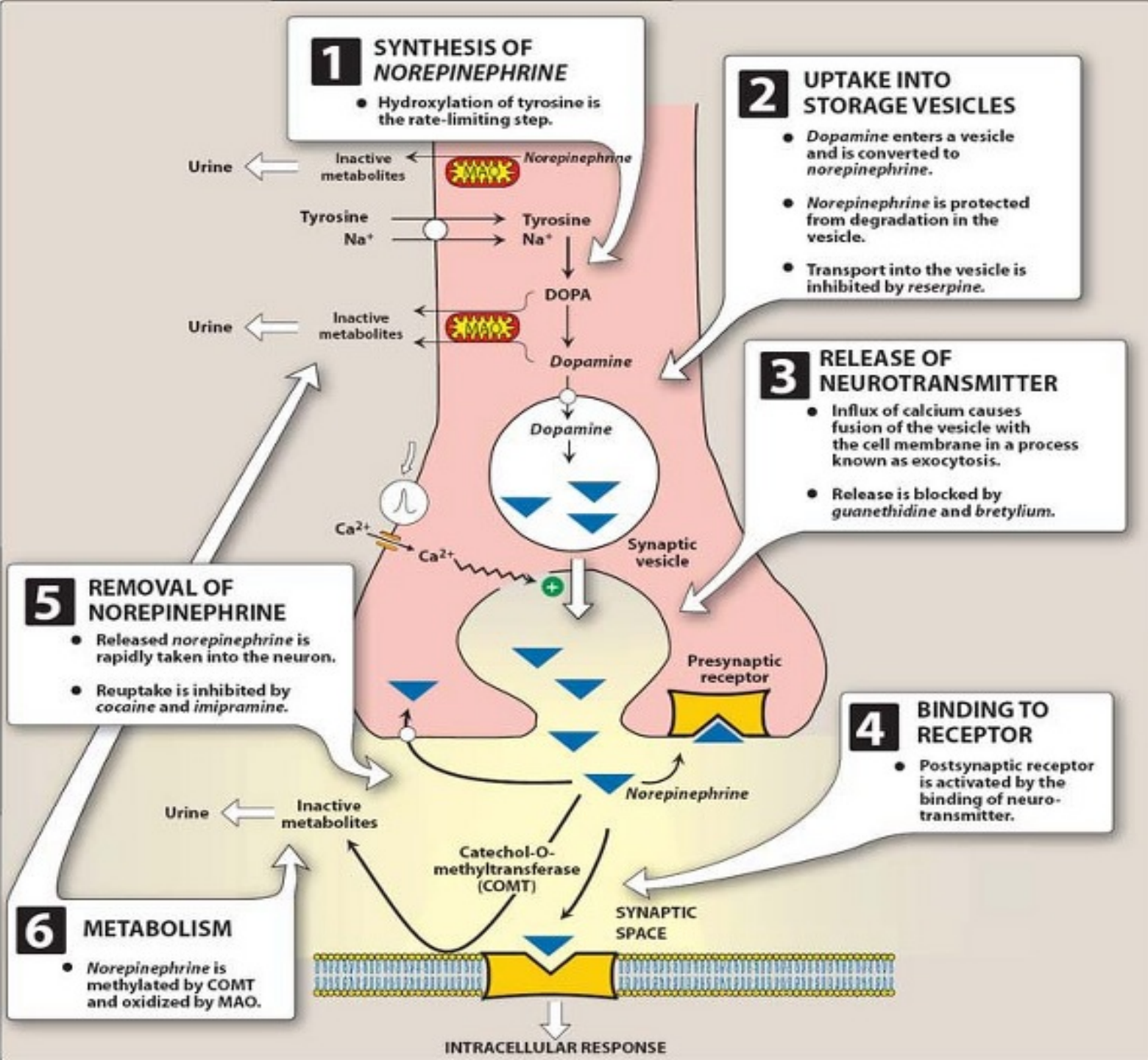
- $\alpha_1$  :  $Ca^{++}$  binds with protein that activates MLCK which phosphorylates smooth muscles in the blood vessels (allow interaction between myosin & actin)  $\rightarrow$  Vasoconstriction in all vessels in body except Heart & Skeletal Muscle.
- $\alpha_2$  : No cAMP  $\rightarrow$  No phosphorylation of Glycogen phosphorylase  $\rightarrow$  decrease breakdown of glycogen (Stops GI).
- $\beta$  : cAMP can't phosphorylate Myosin  $\rightarrow$  Muscle relaxation  $\rightarrow$  vasodilation of Heart & skeletal muscles vessels.



# ADRENOCEPTORS (ADRs)

Receptor	Organ	Action
$\alpha_1$	Eye	Dilates pupils (mydriasis).
	Blood vessels	Constriction of BV in skin & peripherals (except the heart and skeletal muscle).
	GI	Sphincter : Constriction (retention).
	GU	- Urinary sphincter : Constriction. - Uterus, pregnant : Contraction. - PENIS : Ejaculation.
	Secretory glands	Sweat : Localized secretion.
$\alpha_2$	Secretory glands	- Intestinal : Inhibition. - Salivary glands: ↓ Salivation.
	Metabolism	- Pancreas ( <b>b cells</b> ) : ↓ insulin release. - <b>Adrenergic</b> terminals : inhibits NE release.
$\beta_1$	Heart	- ↑ heart rate (chronotropic). - ↑ Force of contraction (Inotropic). - ↑ Conduction velocity and automaticity (Dromotropic).
	Blood vessels	- ↑ systolic
	Kidney	- ↑ renin release.
$\beta_2$	Eye	Ciliary muscle : Relaxation.
	Lungs	Bronchial muscle : Relaxation (Bronchodilatation).
	Blood vessels	- Relaxation of BV (Vasodilatation) → Coronary & skeletal. - Abundant on blood vessels serving the heart, liver and skeletal muscle.
	GI	↓ motility and tone.
	GU	- Bladder wall : Relaxation. - Uterus, pregnant : relaxation (Tocolysis).
	Metabolism	- Skeletal muscle : Glycogenolysis , ↑ contractility . - Liver : ↑ Glucose.
$\beta_3$	Fat cells	Lipolysis.

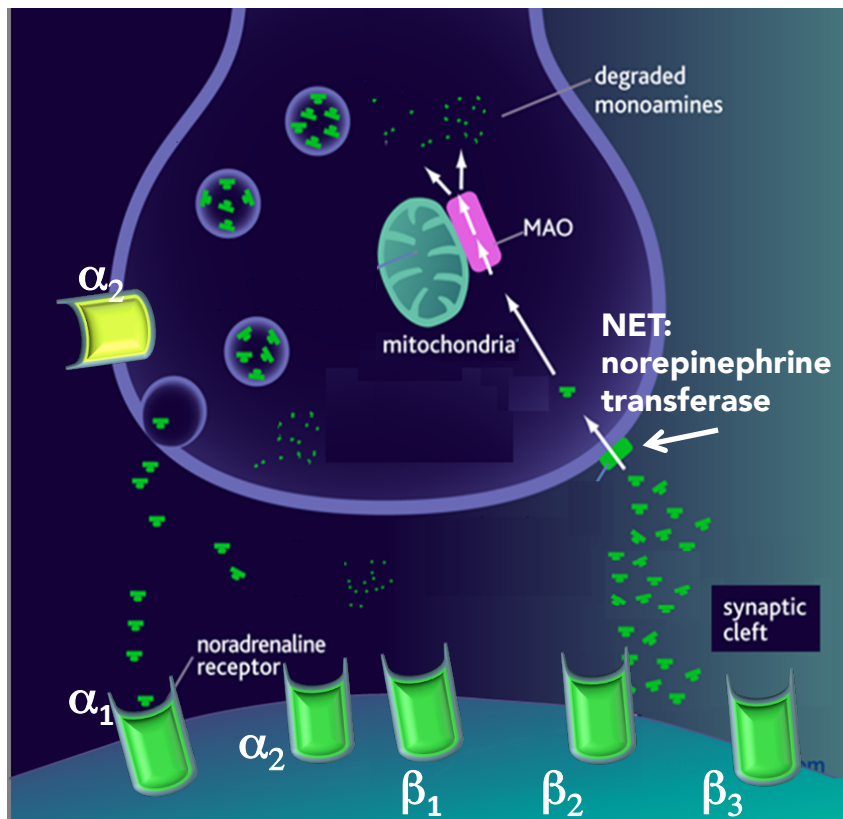
POSTGANGLIONIC SYMPATHETIC NERVE ENDING



## Adrenoceptors [ADRs]

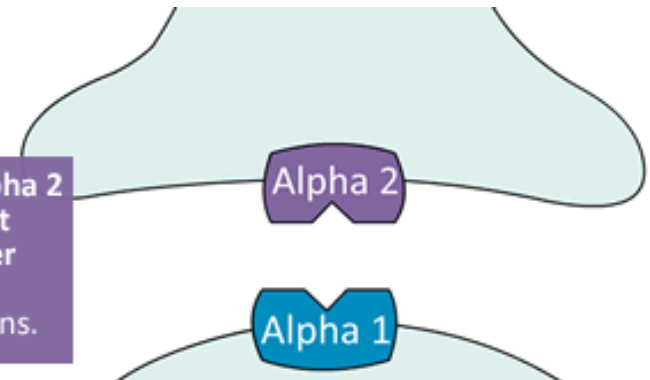
	$\alpha_1$	$\alpha_2$	$\beta_1$	$\beta_2$	$\beta_3$	D1
Dopamine	✓	-	✓	-	-	✓
Norepinephrine	✓	✓	(low effect). ✓	-	(very low effect). ✓	-
epinephrine	(low effect). ✓	(very low effect). ✓	✓	✓	✓	-

- **Epinephrine** works mainly on  $\beta$  receptors and **Norepinephrine** works mainly on  $\alpha$  receptors.



- **Presynaptic** :  $\alpha_2$  receptor.  
(**Autoregulatory Function**)
- **Postsynaptic** :  $\alpha_1$ ,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$  receptors.
- $\beta_2$  : is positive Autoregulatory on  $\alpha_2$ .

When activated, alpha 2 receptors inhibit neurotransmitter release from presynaptic neurons.



Although  $\alpha_2$  receptors are found on both presynaptic neurons and postsynaptic cells, they work mainly as autoreceptors to mediate feedback inhibition of sympathetic transmission.

PHYSIOLOGICAL ACTIONS OF EPINEPHRINE (ADRENALINE)

Receptor	Organ	Action
$\alpha_1$	Eye	- Dilates pupils (mydriasis). - accommodation for far vision and little effect on IOP
	Blood vessels	- Constriction of BV in skin & peripherals (except the heart and skeletal muscle). - Blood Pressure: $\uparrow$ diastolic (high dose)
	GI	Sphincter : Constriction (retention).
	GU	- Urinary sphincter : Constriction. - Uterus, pregnant : Contraction.
$\alpha_2$	Metabolism	- Pancreas (b cells) : $\downarrow$ insulin release.
$\beta_1$	Heart	- $\uparrow$ heart rate (chronotropic). - $\uparrow$ Force of contraction (Inotropic). - $\uparrow$ Conduction velocity and automaticity (Dromotropic). - $\uparrow$ excitability (Lusiotropic)
	Blood vessels	- Blood Pressure: $\uparrow$ systolic.
$\beta_2$	Lungs	Bronchial muscle : Relaxation (Bronchodilatation).
	Blood vessels	- Relaxation of BV (Vasodilatation) $\rightarrow$ Coronary & skeletal. - Blood Pressure: $\downarrow$ diastolic (Low Dose)
	GI	$\downarrow$ motility and tone.
	GU	- Bladder wall : Relaxation. - Uterus, pregnant : relaxation (Tocolysis).
	Metabolism	- Skeletal muscle : glycolysis. - Liver : $\uparrow$ Glucose (Glycogenolysis.).
$\beta_3$	Fat cells	Lipolysis.

CNS  $\rightarrow$  little, headache, tremors & restlessness

# Good luck!

## Done by Pharmacology team 434

Mada Al batli  
Moneera Al Draihem  
Maha Al-Rabiah



For any correction, suggestion or any useful information do not  
hesitate to contact us: [Pharmacology434@gmail.com](mailto:Pharmacology434@gmail.com)