

# PHARMACOLOGY



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# ANS REVIEW LECTURE NOTES

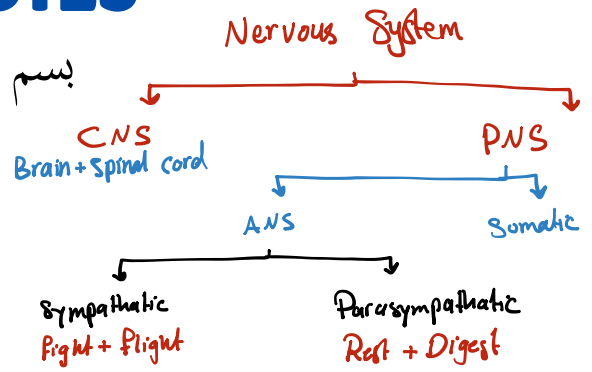
بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Remember

ANS: Involuntary Movement

Agonist: makes physiology

Antagonist: opposes physiology



• **Neurotransmitters:** Neurotransmitters are the chemical mediators released by the neurons to transmit the signals through the synapse. التشابك N and N and organ

• **Sympathomimetic:** a drug that activates sympathetic nervous system

• **Parasympathomimetic:** a drug that activates parasympathetic nervous system

• **Sympatholytic:** a drug that decreases or blocks sympathetic response

• **Parasympatholytic:** a drug that decreases or blocks parasympathetic response

- Adrenaline = epinephrine  
- Nor Adrenaline = Nor epinephrine } endogenous neurotransmitters

## Sympathetic NS

-fight or flight

-neurotransmitters: Adrenaline/Noradrenaline (the same as epinephrine/norepinephrine) cause increased dilation and heart contraction. On the other hand, they have inhibitory effects on GI, secretions, intestines.

-alpha, beta receptors → Adrenergic Receptors

In context of asthma, beta agonists are a recommended medication.

In context of hypertension (atherosclerosis), beta blockers are a recommended medication.

But using beta blockers in individuals with both asthma and hypertension is not recommended as that will cause more bronchoconstriction.

↑ Heart Rate  
↑ Glycogenesis  
↑ Gluconeogenesis  
↑ Broncho dilation ??  
Because muscles need more O<sub>2</sub> and produce more CO<sub>2</sub>

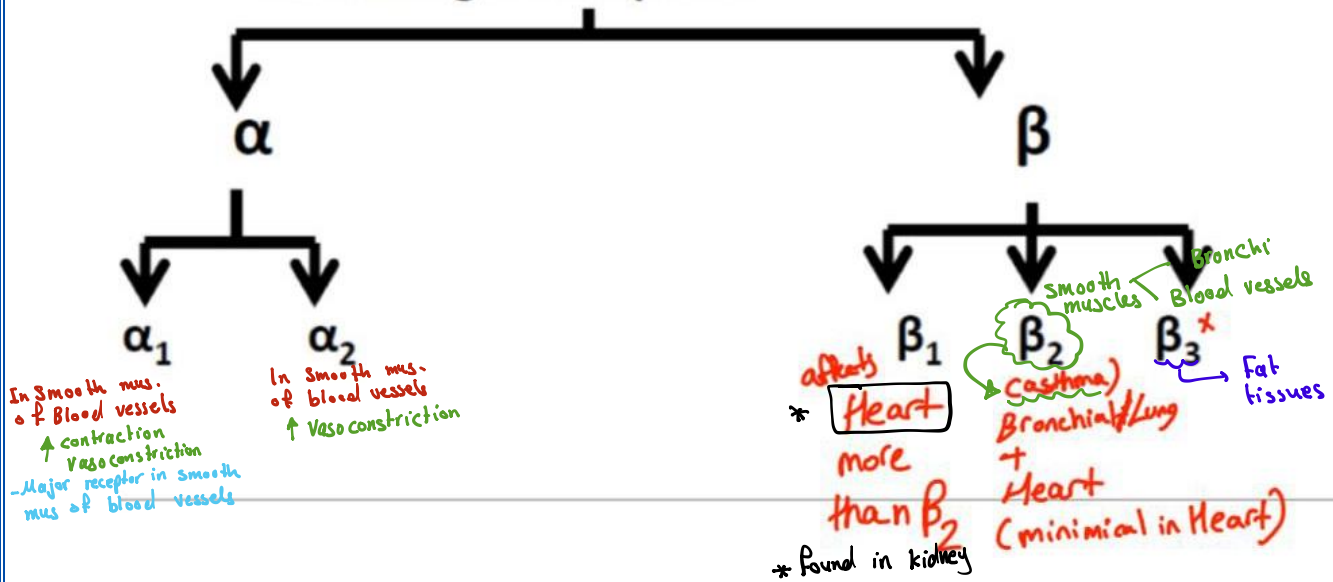
↑ Mydriasis in eyes  
توسيع العين

[متى وقت هضم ولا إخراج] ← بعمله تثبيط

\* In hypertension  
\*  $\beta_1$  receptor ??  
↑ Heart Rate  
↑ Contractility  
↑ More blood produces by heart  
\* Hypertension is determined by:  
1) The amount of blood in vessels [↑ Blood ∴ ↑ Hypertension]  
2) Diameter of B.V.

\* In asthma  
→ Use  $\beta_2$  agonist ??  
(Spray)  
In smooth mus., there are  $\beta_2$  receptors. spray activates  $\beta_2$  receptors so happen relaxation of them so airways dilay.  
\*  $\beta_1$  Blocker → does reverse  $\beta_2$   
↓ Heart ∴ ↓ Contra. ∴ ↓ Blood ∴ ↓ Hypert.  
↓ Rate  
Vaso const. ∴ ↑ Hypert.  
↑ Vaso dilation ∴ ↓ Hypert.

# Adrenergic Receptors



Adr:	↑α <sub>1</sub> + ↑α <sub>2</sub> + ↑β <sub>1</sub> + ↑β <sub>2</sub>	adrenaline
NA:	↑α <sub>1</sub> + ↑α <sub>2</sub> + ↑β <sub>1</sub> but no β <sub>2</sub> action	Nor adrenaline
Iso:	↑β <sub>1</sub> + ↑β <sub>2</sub> but no α action	Semi synthetic

## Adr/Iso: bronchodilators

- Beta agonists end with **ol** eg: albuterol
- Beta blockers end with **lol** eg: atenolol
- alpha blockers end with **sin** eg: prazosin
- Adr increases heart rate by increasing the automaticity of SA node, cardiac contraction increases.
- Cardioselective beta1 blockers: affect the heart only

\* Angina الذبحة الصدرية

## Contraindication

لأنه الكوليسترول مترسب بجران العشاء الرسوي ومغله جند كبير منه ، عند ما ينزل للرضه مجهود  
 لو كان إنسان طبيعى مش مريض القلب يستهلك O<sub>2</sub> :: الفم يوصل O<sub>2</sub> إلى القلب  
 Patient with angina → خلايا القلب تستهلك O<sub>2</sub> :: الفم يستهلك O<sub>2</sub> ولكنه إيصال الدم ↓  
 ↑ Heart Rate & ↑ Contractivity  
 ← بالتالي حب المنظمه ::

↓↓↓ O<sub>2</sub> supply + ↑↑↑ O<sub>2</sub> consumption ::

- ADR is contraindicated in hypertensive, hyperthyroid, and angina patients

إذ نستخدم β Blockers

!!! Adrenaline تخيل أعطي Adrenaline حيتب إقنعيني . ← الذبحة الصدرية

Adrenaline → ↑ Heart Rate → ↑ Contra. → ↑ O<sub>2</sub> consumption

ADR

Ischemia ← lead to ↓↓ O<sub>2</sub> supply وهو لا أرضى عنهم

- It should not be given to patients receiving β blockers (a marked rise in BP can occur)

Because taking β blockers for long time, increases the receptors in the heart (upregulation), so if you then take ADR, it will bind to huge number of receptors in heart and stimulates heart in a very high level which is bad news.



Alpha agonist: vasoconstriction (both alpha 1 & 2) ↑ Hypertension  
 Beta 2 agonist: vasodilation (skeletal muscle, liver, coronaries) ↑ Smooth mus. Relaxation  
 Beta 2 stimulants for asthma. → Because they make relaxation in smooth mus. of bronchi  
 ↑ Bronchodilation

## General effects of $\alpha$ blockers

↓↓↓ Hypertension by 2 methods  
 Vasodilation  
 Venodilation

Blockade of vasoconstrictor  $\alpha$ 1 also  $\alpha$ 2 receptors ↓ peripheral resistance  
 and causes pooling of blood (Hypovolemia) → ↓ venous return and cardiac output → ↓ BP

$\alpha$  blocker → ↑ venous dilation → less blood return to heart → ↓ venous return → less blood go from heart  
 ↓ cardiac output → ↓ BP. قلب الدم الواصل إلى القلب. يقل الدم الذي ينطلق من القلب

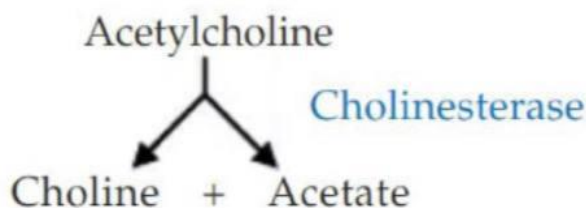
Alpha blockers have no effect on adrenergically induced cardiac stimulation, bronchodilation, or vasodilation because these are predominantly mediated through beta receptors.

تحديدًا من خلال  
 تأثيرهم على  
 $\beta$  receptors

## Parasympathetic NS

- rest and digest
- neurotransmitters: Acetylcholine → cholinergic receptors
- Ach has a key role in stimulating GI, secretions, and saliva production.
- cholinergic receptors: M 1,2,3,4,5 they could be muscarinic or nicotinic (Nn, Nm), (In GI, muscles & ganglia)
- Nicotinic receptors have no direct therapeutic use → Because they are found in symp and para-symp.
- ~~poisonous gases make irreversible bonds to muscarinic receptors.~~

ACh is hydrolyzed by the enzyme cholinesterase, and choline is recycled immediately after release

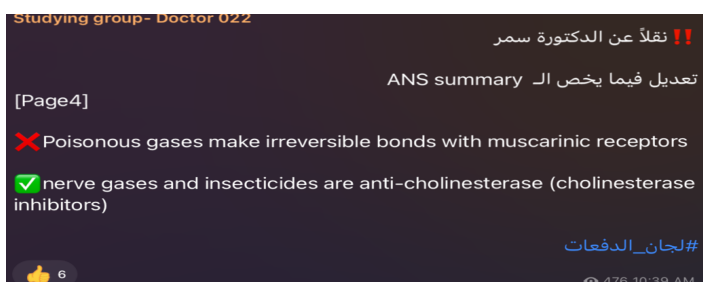


Ach contains ester

\* Parasymp :

- ↓ Heart Rate
- ↓ Contractility
- ↑ Secretions
  - ↑ Serous salivary secretions
  - ↑ Gastric acid secretions
  - ↑ Exocrine secretion

↑ Insuline  
 Broncho constriction



## Cholinoceptors

Two classes of cholinoceptors are muscarinic and nicotinic

### Muscarinic

These receptors are selectively stimulated by muscarine and selectively blocked by atropine

They are located in the heart, blood vessels, eye and glands of the gastrointestinal, respiratory, and urinary tracts, sweat glands, and in the CNS

The muscarinic receptors have been divided into 5 subtypes M1, M2, M3, M4, and M5

توسيع العين

Sympathetic: mydriasis (dilation)

Parasympathetic: miosis (contraction)

تضييق العين

## Cholinergic drugs

They act similarly to ACh, either **directly** by interacting with cholinergic receptors (**agonists**) or **indirectly** by increasing the availability of ACh (**anticholinesterases**)

⊖ enzyme

1. Parkinson (high Ach, low dopamine)

It is due to dopamine deficiency. //or imbalance between Ach and dop.

The enzyme that degrades dopamine: monoamino oxidase/catechol-O-methyl transferase... if we give a drug to inhibit these enzymes, dopamine increases, Parkinson level decreases. Also can use Anti-Muscarinic drugs → ↓↓ effect of Ach.

← ما يؤدي إلى تراكم Acetylcholine  
وارتباطه بال Receptor

② Cholinergic antidote is atropine (for example prevents salivation)

3. High doses of Ach will have minimal effects on sym NS.

Use Anti-Muscarinic agents  
like atropine

→ ↓↓ Salivation \* خلصت عند  
كسبب الاضرار \*

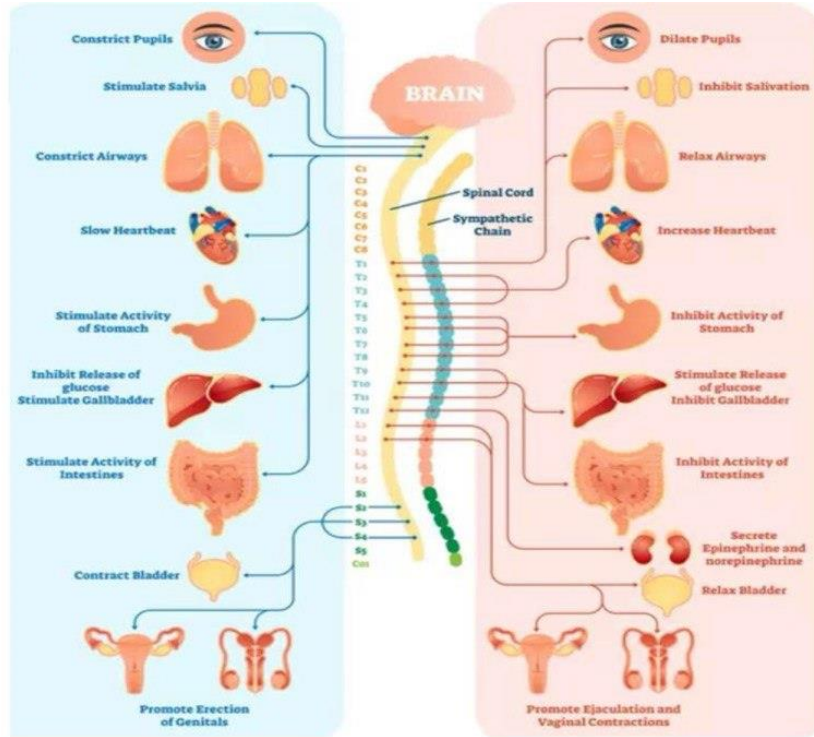
## Muscarinic cholinoceptors

The first 3 have been functionally characterized

M1: has a major role in mediating gastric secretion and relaxation of the lower esophageal sphincter caused by vagal stimulation → In Stomach

M2: Cardiac muscarinic receptors are predominantly M2 and mediate vagal bradycardia → In Heart

M3: Visceral smooth muscle contraction and glandular secretions are elicited through M3 receptors → In Smooth muscle, Bladder



Parasympathetic "Rest and digest"

Sympathetic "Fight or Flight"

اللهم سد رميهم، وثبت أقدامهم، وانصرهم على القوم الظالمين

