
بسم الله الرحمن الرحيم

Sympathomimetics (adrenergic drugs)

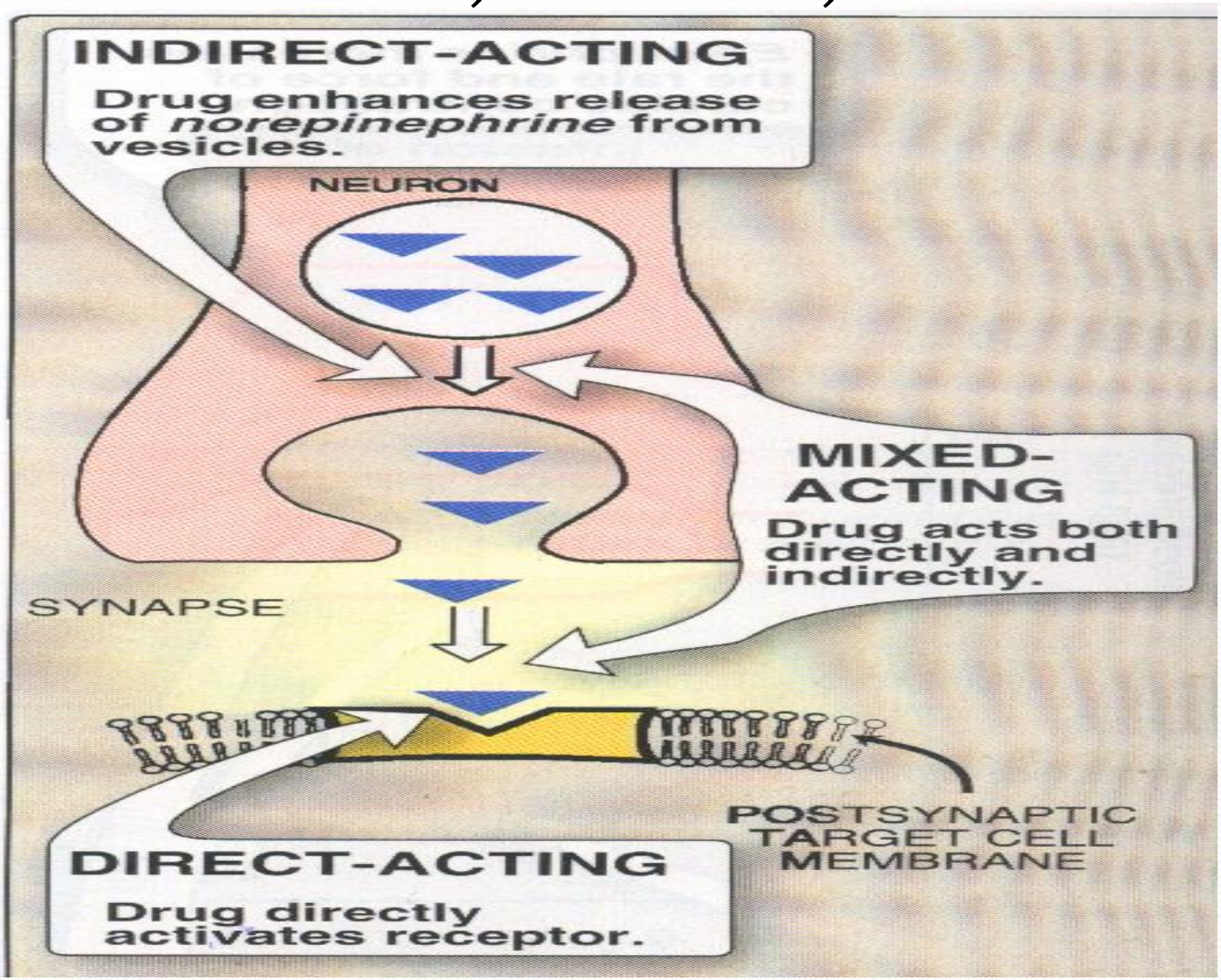
These drugs activate the **adrenoceptors** to mimic the effects of endogenous catecholamines such as epinephrine & norepinephrine.

Sympathetic agonists
Adrenoceptor agonists
Adrenoceptor activating drugs

By
DR. M. Sarwar

Classification according to **mode of action;**

- **Direct, indirect, mixed acting.**



a) Direct Acting Agonists; (Adrenergic Receptor agonists);

- **Adrenaline,**
- **Nor adrenaline,**
- **Dopamine,**
- **Dobutamine,**
- **Phenylephrine,**
- **Methoxamine,**
- **Xylometazoline,**
- **Oxymetazoline,**
- **Orciprenaline,**
- **Isoprenaline,**
- **Salbutamol,**
- **Terbutaline,**
- **Rimiterol,**
- **Pirbuterol,**
- **Fenoterol,**
- **Ritodrine,**
- **Procaterol.**

b) Indirect-Acting Sympathomimetics;

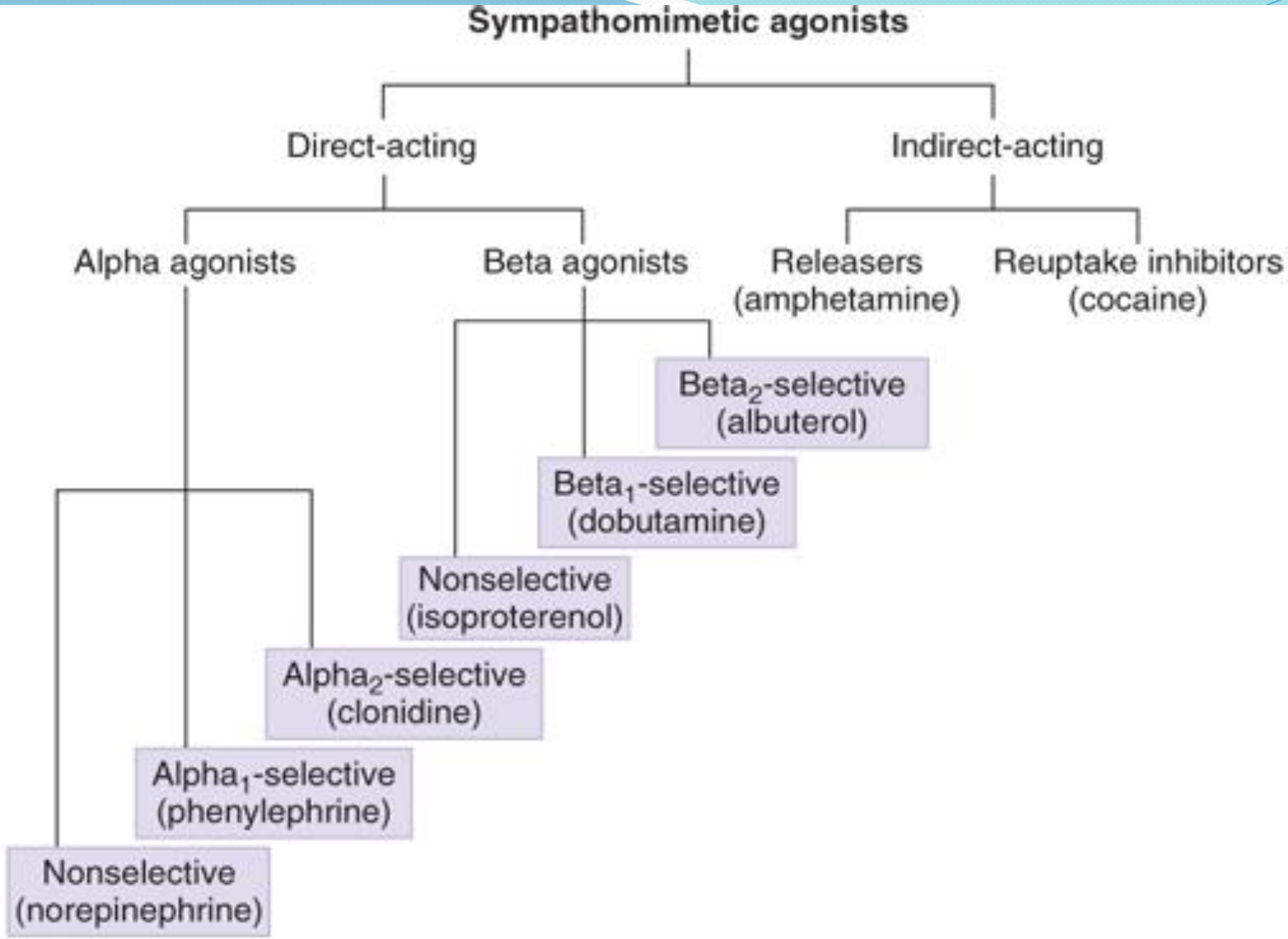
These drugs causes **release of NA from stores at nerve endings.**

- **Amphetamine**,
- Dexamphetamine,
- Methylamphetamine,
- Hydroxyamphetamine,
- **Tyramine.**

c) Mixed-Acting Agonists;

Acting both directly and indirectly.

- **Ephedrine,**
- Pseudoephedrine,
- Metaraminol.

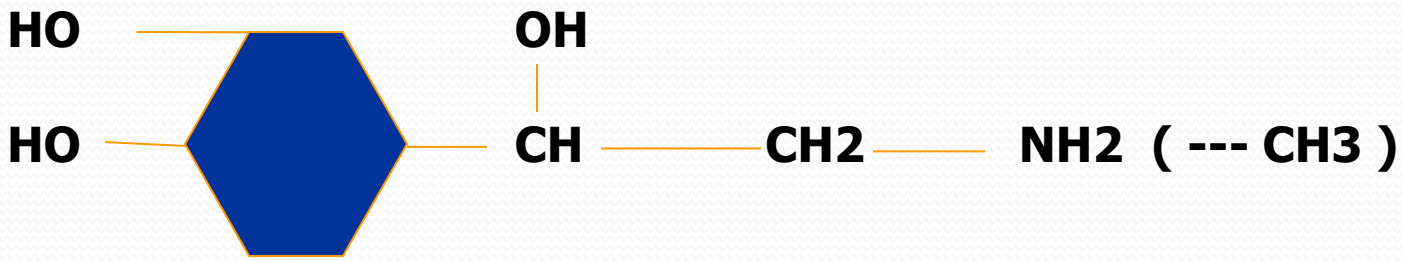

Sympathomimetic agonists
Direct-acting
Indirect-acting
Alpha agonists
Beta agonists
Releasers (amphetamine)
Reuptake inhibitors (cocaine)
Beta2-selective (albuterol)
Beta1-selective (dobutamine)
Nonselective (isoproterenol)
Alpha2-selective (clonidine)
Alpha1-selective (phenylephrine)
Nonselective (norepinephrine)

Classification according to chemical structure;

- **Phenylethylamine ---** the parent compound from which sympathomimetic drugs are derived.
- This compound consists of a **benzene ring** with an **ethylamine side chain**.

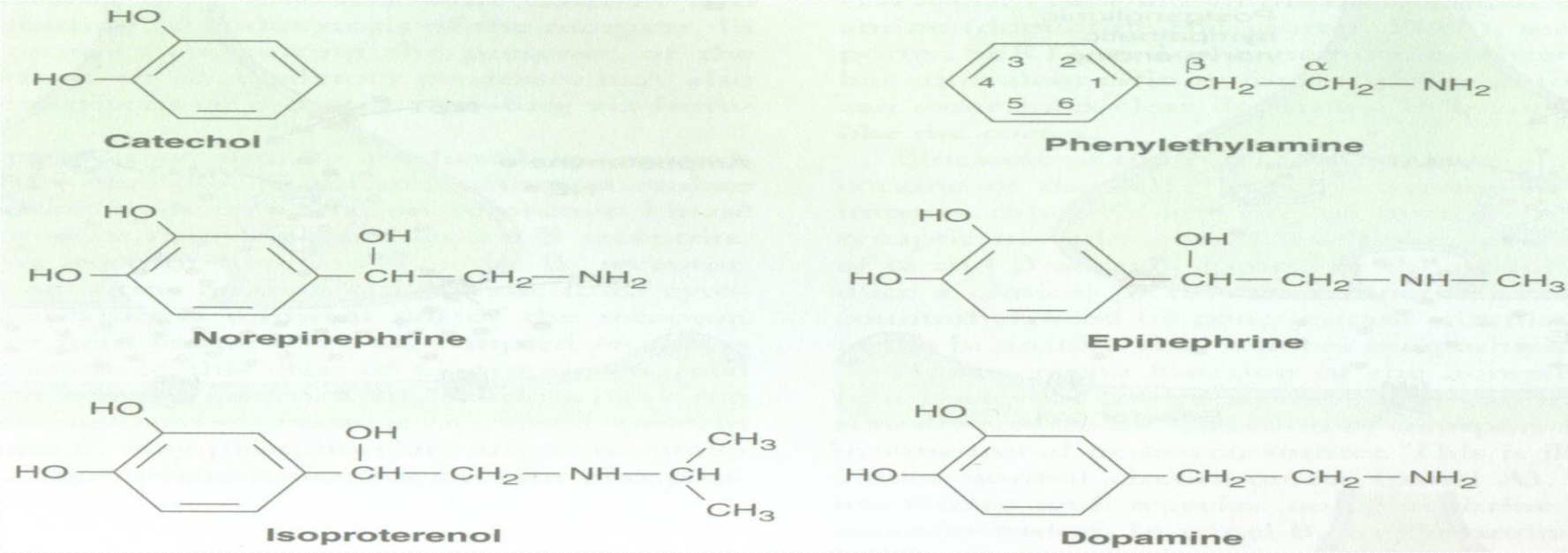
- The presence of **–OH groups at the 3 and 4 positions** of the benzene ring yields sympathomimetic drugs collectively known as **catecholamines**.
- **Absence of OH group may ↓ potency as in Phenylephrine but ↑es lipid solubility as in Ephedrine or amphetamine.**

Addition of **alkyl** substituent on amino group leads to ↑ **in β-activity.**



Nor epinephrine **(Epinephrine)**

β_2 selective agonists – a large substituent group.



- **Catecholamines;**
  - **Natural(endogenous);**
    - Epinephrine (adrenaline)
    - Nor epinephrine(nor adrenaline)
    - Dopamine.
  - **Synthetic;**
    - Dobutamine
    - Isoproterenol(isoprenaline)
- **Non-catecholamines;**
  - Ephedrine,
  - Amphetamine,
  - Hydroxyamphetamine,
  - Orciprenaline,
  - Methoxamine.
  - Oxymetazoline,
  - Albuterol (Salbutamol),
  - Terbutaline,
  - Formeterol,
  - Ritodrine.
  - Pseudoephedrine,
  - Dexamphetamine,
  - Methylamphetamine,
  - Metaraminol,
  - Phenylepherine,
  - Xylometazoline,
  - Pirbuterol,
  - Procaterol,
  - Fenoterol,

Catecholamines;

- **Catechol** structure.
- Rapidly metabolized by **COMT, MAO.**

- **Inactive** by **oral route.**
- **Rapid onset** of action.
- **Brief duration** of action.
- **Do not enter** the **CNS** in significant amount.
- **Reuptake** into **nerve terminal** also occur (NE,E& dopamine) when given as drugs.

Isoproterenol (a synthetic catecholamine) is not readily taken up into nerve endings.

Noncatecholamines;

- **Non Catechol** structure.
- Resistant to COMT.

Amphetamines & tyramine are **resistance to MAO.**

- **All** can be administered **orally.**
- **Slow onset** of action.
- Effects lasts much **longer.**
- **Enter** the **CNS.**

- **Not readily taken up** into nerve endings.

PHARMACOLOGICAL EFFECTS of ADRENOCEPTOR AGONISTS:

Cardiovascular system(CVS);

➢ β1 receptor agonists; (Dobutamine)

- **Heart** (β1--- cardiac muscles, SA node, AV node)

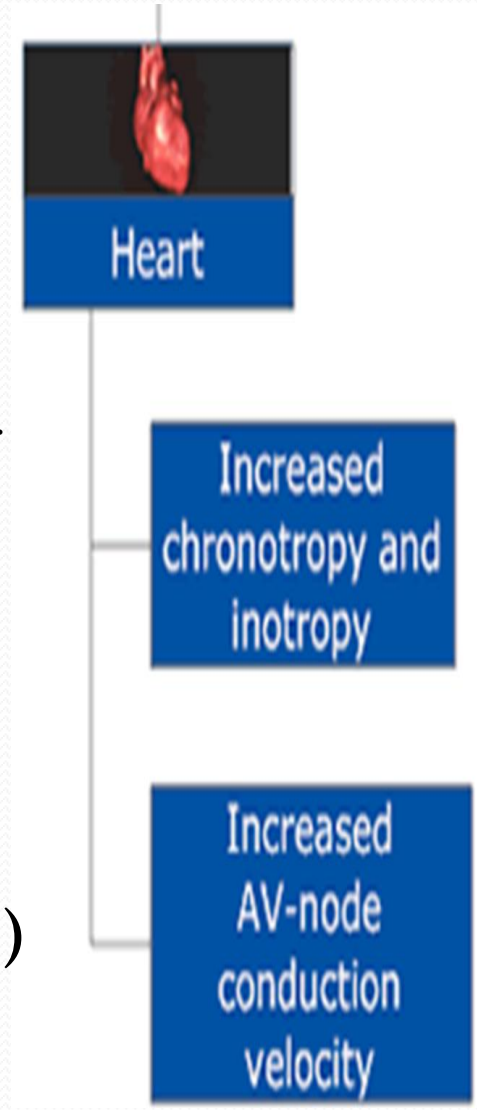
  (Kidney (β1): renin release,

  Posterior pituitary (β1): ADH secretion,

  Salivary glands (β1); Viscous, amylase rich secretion).

  Ciliary Epithelium (β1 & β2); ↑ Secretion.

  - ↑ rate + Ve Chronotropic effect.
  - ↑ force + Ve Inotropic effect.
  - ↑ conduction velocity through the AV node with a ↓ in the refractory period.



➢ β2 receptor agonists; (Salbutamol, $\beta_2 >>> \beta_1$)

- Relaxation of vascular smooth muscle that may invoke a reflex ↑ in heart rate.

➢ α_1 Receptor Agonists; (Phenylephrine, Xylometazoline)

(α_1 Receptors ----- Most vascular muscles, Pupillary dilator muscle, Prostate).

- **Constrict** smooth muscle of resistance **blood Vessels** (splanchnic and skin) causing **↑ peripheral resistance** and **venous return.**
- In normotensive patients (less effect than those with hypotension) the **↑ BP** may invoke a **reflex baroreceptor vagal discharge** and a **slowing of the heart**, with or without an accompanying change in cardiac output.

➢α2 Receptor Agonists; (Clonidine, Methyldopa)

(α2 Receptors--- CNS, Presynaptic terminals, Some Blood vessels, Pancreatic β cells)

- Reduce BP by a prejunctional action on neurons in the CNS to **inhibit sympathetic outflow.**

Eye;

(α_1-- Radial muscle of the iris.)

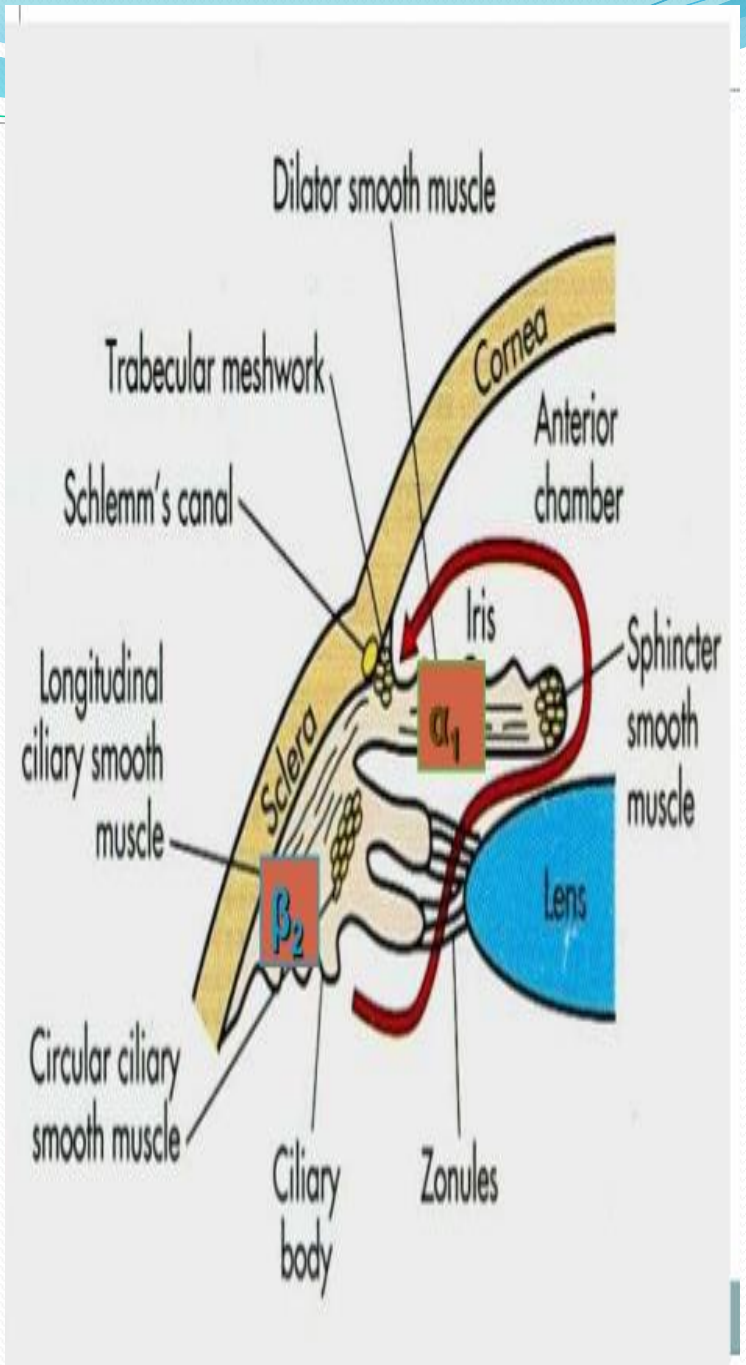
(β_2, β_1--- Ciliary epithelium.)

➢ α receptor agonists;

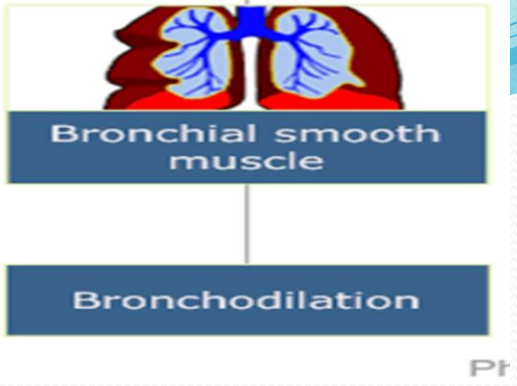
- Contracts the radial muscle of the iris and dilate the pupil. (mydriasis).
  - ❖ ↑ outflow of aqueous humor from the eye.

➢ β receptor antagonists;

- ↓ production of aqueous humor.



Respiratory system;



➢β2 receptor agonists;

- Induce **relaxation** of **bronchial smooth muscle** and decrease airway resistance.

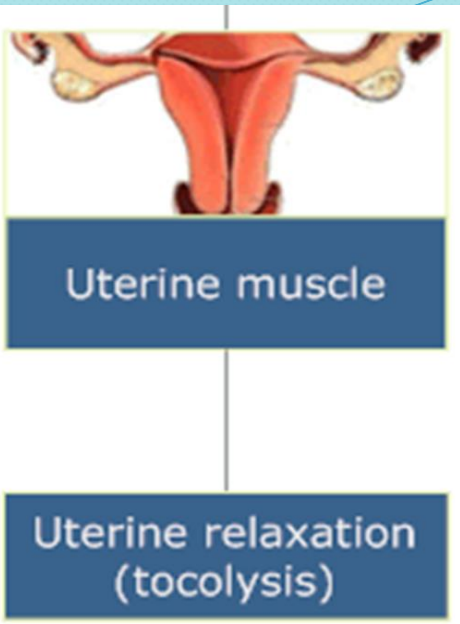
Gastrointestinal tract;

➢α_2-Receptor and β_2- Receptor agonists;

- Relax GIT smooth muscle
  - α_2 receptor agonists **reduce** the **release of ACh.** and other transmitters from intramural nerves by a **prejunctional action.**
  - β_2 receptors are located directly on smooth muscle & cause **relaxation**.

➢α1-Receptor agonists **contract** GIT **sphincters.**

Genitourinary tract effects;



➢ β2 receptor agonists;

- Induce relaxation of **uterine smooth muscle** and the bladder wall.

➢ α_1 receptor agonists;

- **Constrict** the bladder wall and the **urethral sphincter.**

Metabolic and endocrine effects;

- **β_2 receptor agonists;**
  - **Increase liver and skeletal muscle glycogenolysis.**
  - **Increase insulin & glucagon secretion.**
- **β_3 agonists;**
  - **Increase lipolysis in fat cells.**
- **α_2 receptor agonists;**
  - **Decrease insulin secretion.**


Thank You