## Unit-3

# Pharmacology of Peripheral nervous system

10 × 1 = 10
5 × 2 = 10
2 × 1 = 2
} → 22 Must know

2 × 1 = 2 } → 2 Desirable to know

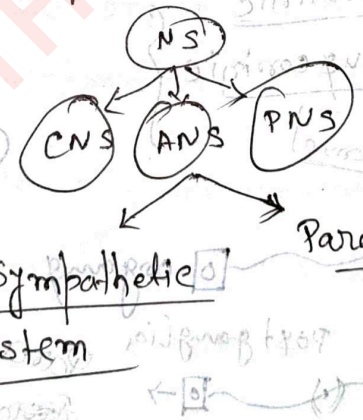
24 Marks

## ⊛ organization & functions of ANS :-

→ ⊙ Nervous comes from brain and spinal cord and different organs.

⊙ They Release different neurotransmeter and control the function of organ.

⊙ The study of Release of neurotransmeter and their on different organs is called Autonomic Nervous System.



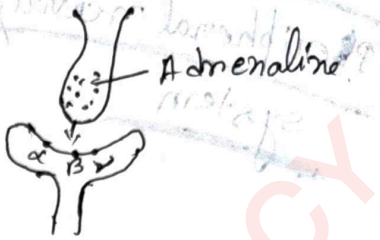

## ⊛ Sympathetic Nervous System :-

⊙ In this type of ANS the ganglion function is present away to the organ.

⊙ In this system Pre-ganglionic fibre is short and Post ganglion fibre is long.

⊙ They Release Adrenaline transmiter is inhibitory in nature. Adrenaline Bind with three types Recepton.

(i) Alpha (α)
(b) ~~Beta~~ Bita (β)
(c) Gama (γ)



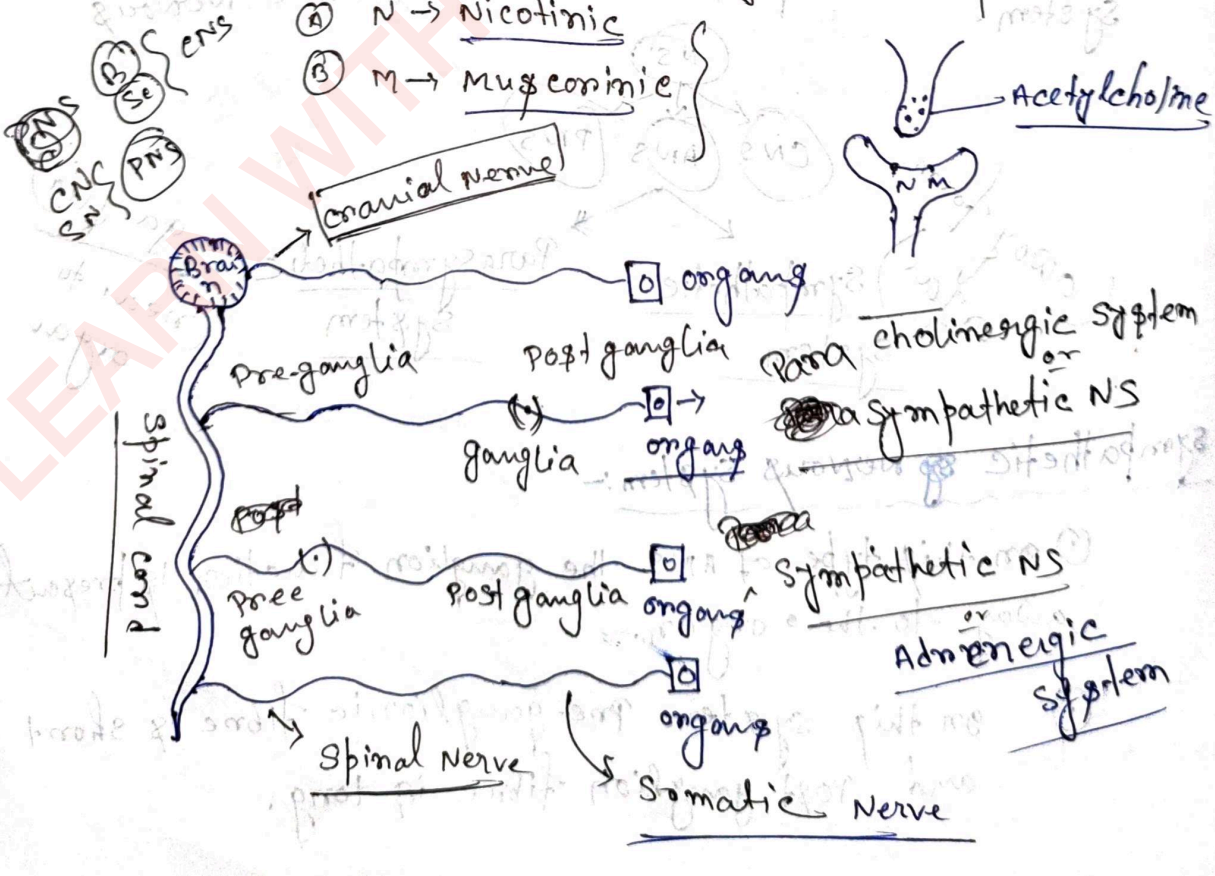

(*) Parasympathetic Nervous system :-

⊙ On this type of ANS the ganglionic function is Present ~~to other~~ near to the organ. in this system Preganglionic fibre is long and Post ganglionic fibre is Small.

⊙ They Release Acetylchlotaine neurotransmeter which is ~~inhibition~~ excitory in nature.

⊙ Acetylcholine bind with two type of Receptor

(A) N → Nicotinic
(B) M → Muscorinic



(*) Different between sympathetic & Parasymthetic Nervous System:-

| Properties | Sympathetic | Parasympathetic |
|---|---|---|
| (a) Ganglia | Away form organ | Near to organ |
| (b) Preganglionic Fibre | Short | long |
| (c) Postganglionic | long | short |
| (d) Neurotransmitter | Adrenaline | Acetylcholine |
| (e) Also known as | Adrenergic | cholinergic |

— o —

## (12) Neuro Hormonal transmission -

→ Process of transfer of signal form brain or The spinal cord to the organ by neurotransmeter is called Neurohormonal Transmission.

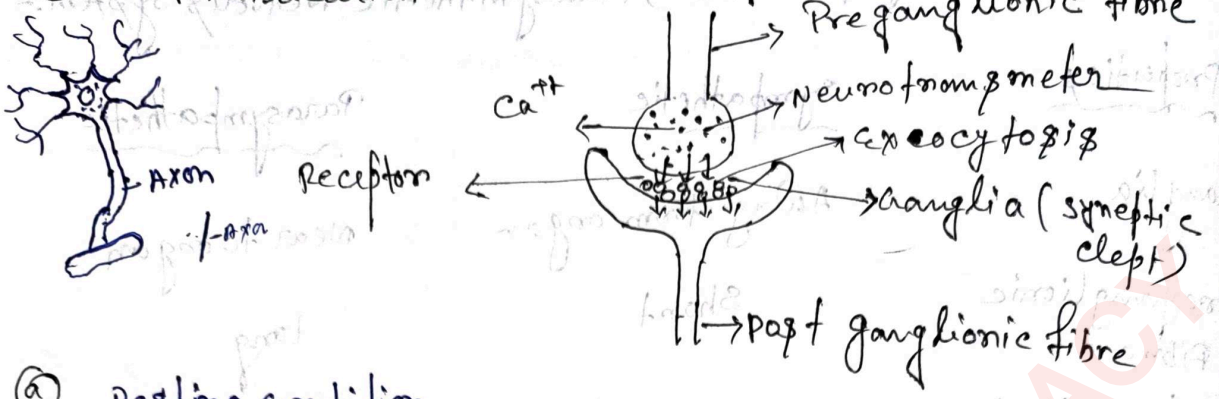
→ In preganglionic fibre neurotransmitter are filled At resting condition when stimulus is obtain than $Ca^{++}$ gas inside & exocytosis starts.

→ After exocytosis neurotransmeter are came in Synaptic cleft and bind With the Recepton of Post ganglionic fibre And signal is Pass.

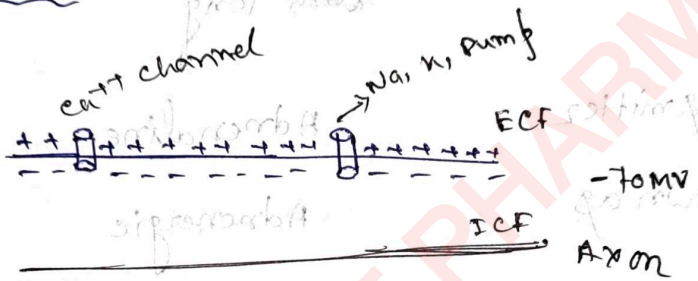
∴ The Process of Neuro hormonal transmission is complete into three Steps —

(a) Resting condition (b) depolarization

(c) Repolarization

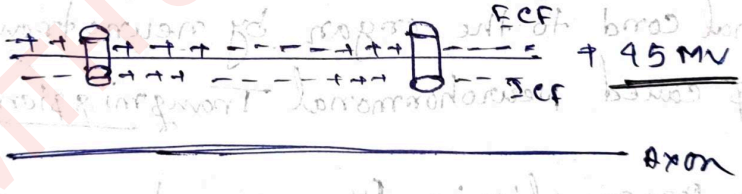



(a) Resting condition:




→ No stimular are obtain in this case.

(b) Depolarization :-




→ when stimular is obtain the $Na^{++}$ and $K^{+}$ comes in ICF from ECF & the negative $Ca^{++}$ & $K^{++}$ form ICF to ECF

→ Due to movement of ions A possitive electrode Potential of +45 MV is develop and signal is Pass on transfer.

(c) Repolarization :-

→ After the transfer of the signal & Responce ions again comes in there initial

stage & transfer signal is stop.


## classification of Neurotransmitters

→ on the basis of action neurotransmeters is of two type

(a) exciatory
(b) Inhibitory

(a) Exciatory :-

→ which increase the actions of Body

Thought & learning
Fight or flight

(a) Acetylcholine
(b) Adrenyline
(c) non-Adrenyline
(d) ~~Dopamine~~
(e) Histamine
(f) Glutamine

→ Increase heart rate & Blood flow

(b) Inhibitory :-

(a) which decrease the Responce

eg:- GABA
Serotonin
Endorphin

→ mood (contributes to well beings & happiness)

(*) Parasympathomimetics or cholinergic drug :-

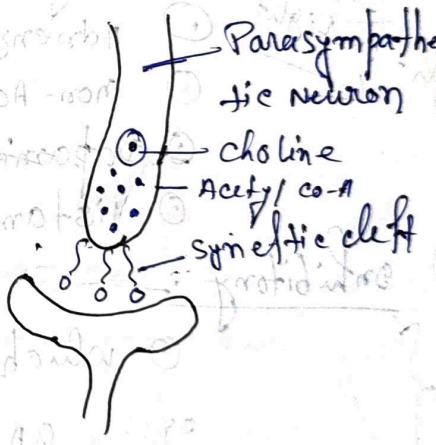
→ In certain cases when the Release of Ach in body is less as per their demand then we used the certain drugs which have the same action like Ach. they are called cholinergic Agonist or cholinergic drugs.

□ They have different function in our body- in intestine, on blood pressure, vasoconstruction, in Asthama, In Menstruation.

(*) Synthesis, Stroage & Release of Ach :-

→ Basically cholinergic neurotransmeter Ach is synthesis inside the Parasympathetic neuron.

⊙ On side the Parasympathetic neurons choline compound is present which is synthesises in to cytoplasm & inside the mitochondria of the cell Acetyl coenzyme is form.

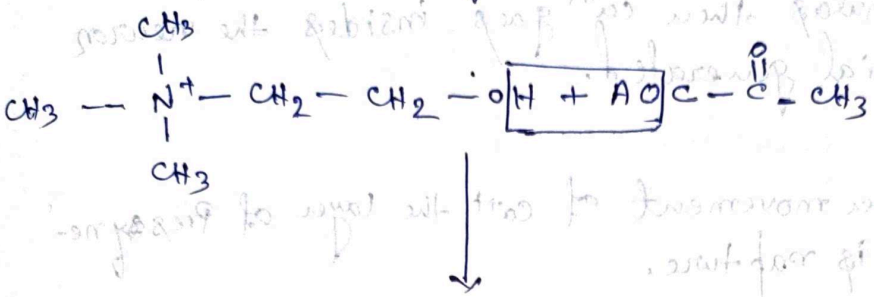


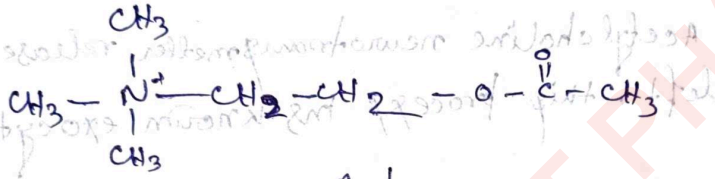

① when Acetyl co-A & choline is Reacted with in the Presence of Acetylcholine-transferase enzyme then they After dehydration they form Acetylcoholine.

choline + Acetyl co-A

↓ Acetyl transferase

Acetylcholine





Ach

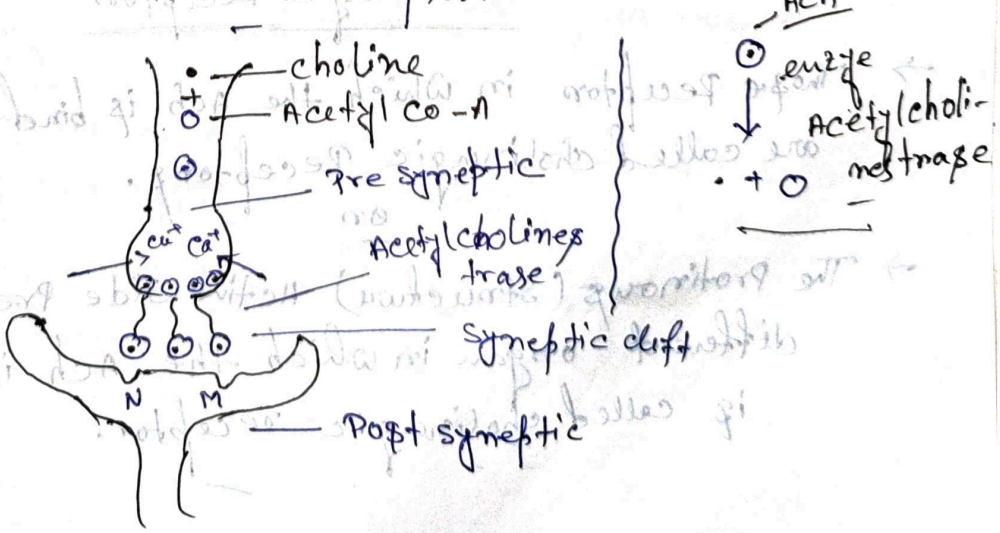
## ⊛ Storage

⊙ About 500 to 1000 molecule of Ach neurotransmetter is store in one Parasympathetic neuron.

⊙ They are always store in the nerve ending of the Parasympathetic Neuron.

⊙ After excitep they release into syneptic cleft and bind with the Particular Receptor.

Release



① Stimulas
② exocytosis
③ Receptor

① Stimulas :- When Parasympathetic neurons gets the stimulas then $Ca^{++}$ gaps insides the neuron and Potential generated.

② Exocytosis :-

→ After movement of $Ca^{++}$ the layer of Presynaptic cleft is rapture.

→ And the Acetylcholine neurotransmetter release into the synaptic cleft, this process ing known exocytosis.

③ Receptor :-

→ Some of the ~~Particular~~ Neurotransmetter Molecule bind with the Particular Nicotinic & Muscarinic Receptor and gives the cholinergic responce.

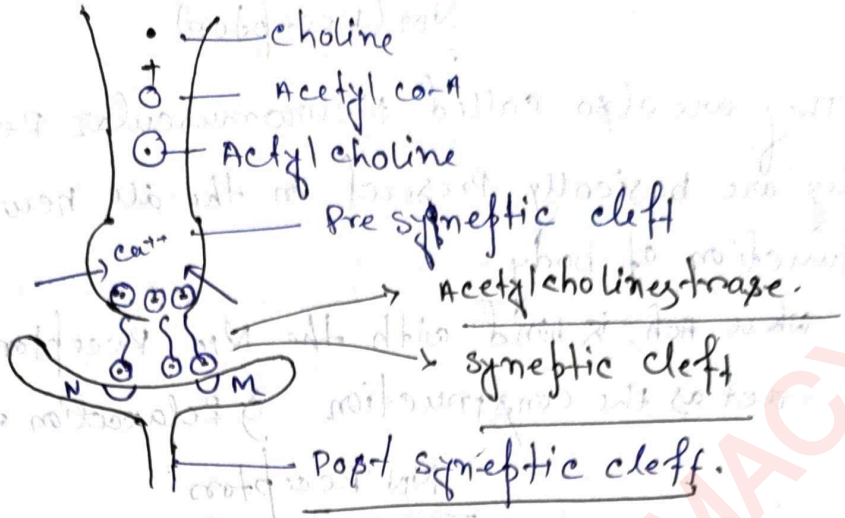
★ → In the synaptic cleft enzyme Acetylcholinesterase is present which dissociate Acetylcholine molecule into acetic acid & choline so they can't bind with the Receptor & their effect is less.

## cholinergic Receptor

→ Those Receptor in which the Ach is bind ~~with~~ they are called cholinergic Receptors.

or

→ The Protinous (structure) Active side present on the different organ in which the Ach is bind this is called cholinergic receptor.




→ cholinergic Receptor are two types—

1. Nicotinic Receptor (N)
2. Muscarinic Receptor (M)

Nicotinic Receptor

→ When the Ach is bind with this Receptor then they Produce like similar effect like Nicotine so this Receptor is called Nicotinic Receptor.

- The nature of Nicotinic Receptor is ion channel Receptor they are made up of glycoprotein & they have five Subunit.
- Nicotinic Receptor have very less time duration they opens only for 0.1 to 10 milisecond but they have Rapid Action.
  - on the basis of nature and Action nicotinic Receptor is two types. nictonic
    - (a) $N_N$ ( Neuro ~~Muscular junction~~ )
    - (b) $N_M$ ( Neuronal ganglia)

## $N_M$ (Receptor).

→ They are also called Neuromuscular Receptor.

→ They are basically Present in the all neuromuscular junction of body.

→ When Ach is bind with the $N_M$ Receptor then they act as the construction & Relaxation of muscle.

## $N_N$ Receptor

→ They are called Neuronal Nicotinic Receptor

→ They are bassically Present on Autonomic neuronal ganglia.

→ And when the Acetylcholine is bind with the $N_N$ Receptor they control the Release of Neurotransmetter.

## Muscarinic Receptor

→ When any Person eat Muscaranus fusicarae Mushroom or fungus, they have similar Responce like Ach bind With this Receptor so this Receptor is called muscarinic Receptor.

→ The nature of muscarinic Receptor is G-PCR. They have Seven Protein helix Structure.

→ Muscarinic Receptor is of five type —

① $M_1$
② $M_2$
③ $M_3$
④ $M_4$
⑤ $M_5$

**$M_1$ Receptor:-**

→ $M_1$ Receptor is present in the nerve cells, nerve ending, ganglia, & exocrine gland.

→ They control the movement of eye, Movement of Release of saliva secreation, tears secreation, GIT secreation.

**$M_2$ Receptor:-**

$M_2$ Receptor is a cardiac Receptor they are present on the cardiac muscle of heart & they increase the force of construction.

**$M_3$ Receptor:-**

→ They are the glandular receptor & they bind with endrocrine or exocrine of the body & they increase the secreation of exocrine & endocrine gland.

**$M_4$ Receptor:-**

→ They are Antagonist in nature: when Ach is bind in this Receptor then they reverse the Action of Ach.

**$M_5$ Receptor:-**

→ They are found in Substania nigra.

⊙ when $M_5$ Receptor bind with Substania nigra they control the secreation of Dopamine.

## Classification of cholinergic drug :-

Direct acting

- Acetylcholine
- Bethanechol
- Pilocarpine
- Methacholine

Trick

Aaj Betha Mitha

Pi Lo

## Indirect Acting cholinergic drug :-

(*) Reversible

(a) Water Soluable :-

- Neostigmine
- Edrophonium
- Pyridostigmine

Trick

No Payara Andar Phone Konke AAW.

(b) Lipid Soluble :-

- Physostigmine
- Donepezil
- Tacrine
- Galantamine

Trick

Fasi Dang do iske gale main

## Irreversible :-

- Organophosphorus compound
- Echothiophate
- Malathion
- Parathion
- Tabun

Trick

→ Agar isko Mala Prasad do Tab Nehi Jayega

# Pharmalogical Action of Acetylcholine

→ on the basis of Action Pharmacological Action of Ach is divided into two category—

① Muscarinic Action
② Nicotinic Action

## Muscarinic Action

### ① Action on eye :- (IOP)

→ The cholinergic drug when bind with eye then it constrict the pupil & is cause Myosis.

→ And it also causes the discharge of fluid form Aqueous & vitrous chamber & it is very useful and it is used for the treatment the glucoma treatment.

Intraocular Pressure ↓

### Action on Glands

→ when Ach drugs are bind with the exocrine gland then they increase their secreation because they are excitatory in nature.

① form eye the secreation of tears are increase, in the mouth the secreation saliva in increase & form the sweat gland secreation of sweat is increase.

### Action on Smooth muscle

→ on smooth muscle basically their reception are present and when acetyl choline drug is bind with the smooth muscle, the cause exicatory action & constriction in

Smooth muscle. So the diameter of bronchi is decrease this is called asthama.

## Action on heart

→ On the heart $M_2$ Receptor are present and when the cholinergic drugs bind with the $M_2$ Receptor it cause inhibitary action.

- The force of ~~contraction~~ conduction & Rythims of heart is decrease.
- The Rate of pumping is also decrease.

## Action on blood vessels

→ On the blood vessel cholinergic drug shows inhibitory action.

- Because they Release EDRF → Endothelial Release Factor. & $NO_2$ are Release the blood vessels dilate.
- And when the blood vessels dialate then the blood pressure sudden decrease.

## Action of GIT

→ Ach also on GIT excitatory Action.

→ It increase the Gastric Acid secreation & Pereptalic movement in the intestine.

## Action on CNS

## Nicotinic Action

→ cholinergic drug can't cross the blood brain Barrier, so they don't show any Responce in brain.

Action on Muscle :-

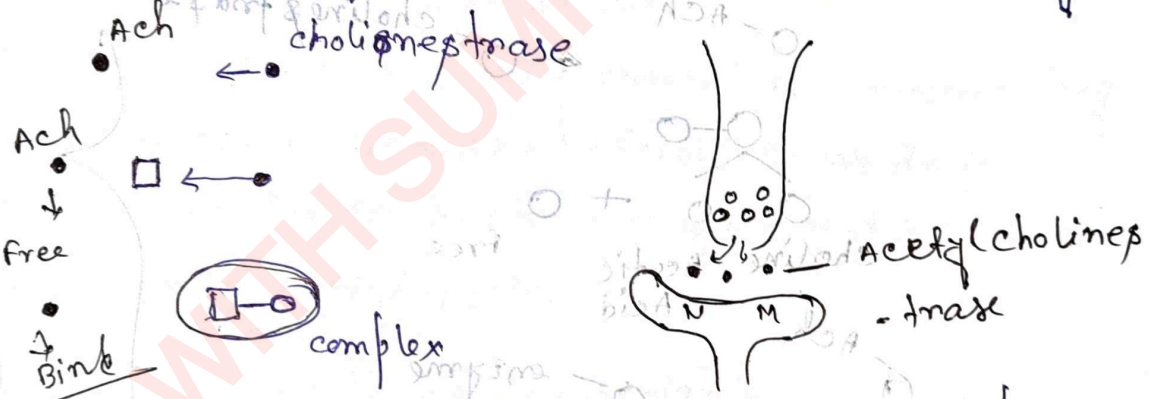
→ NM Reception is bind with the Ach then the muscle construction is increase.

Action of Autonomic Ganglia :-

① The Release of transmetter is increase.

Anticholinesterase Drugs

→ Those drugs which inhibit the action of enzyme Acetyl-cholinestrase they are called anticholinestrase drug.



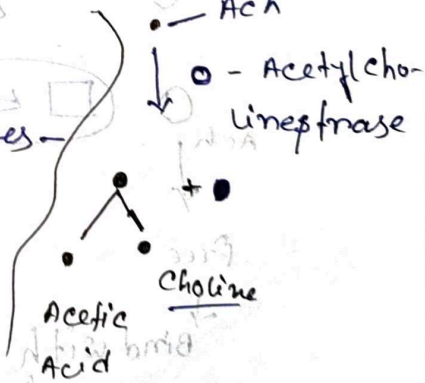

→ on the basis their complex formation Anticholinestrase drug are two types -

(i) Reversible → Prosthesis group

(ii) Irreversible → Acid Transfer

↓

cholinestrase Reactivation




Neostigmine

~~Phyt~~ Physostigmine

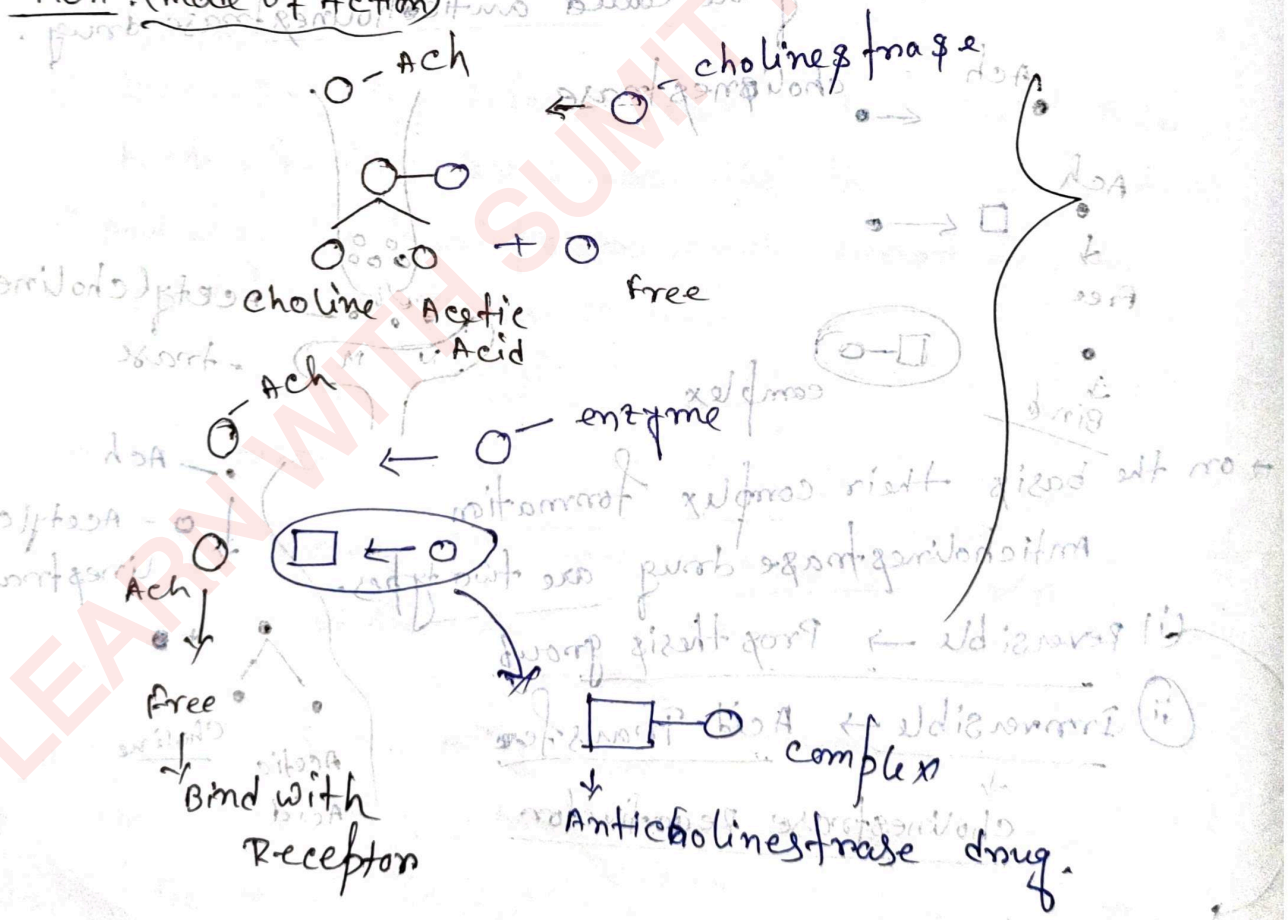
## ⑧ Reversible Anticholinesterase.

### (A) Physostigmin

**Nature:-** The Physostigmin drug is obtain from the alkaloid Physostigma Venenosom.

- First time Physostigmin drug is used for the glucoma treatment.
- It is Present in crystal form, they are colourless, odourless.
- But after exposure of air they convert into the Pink colour.

**MOA (Mode of Action)**



Pharmacokinetics:-

- Basically Physostigmin is short acting time duration
- onset Action Within 5 mine.
- The duration of Action from 45 to 60 min
- They secreated through urine.
- They can cross the blood brain Barrier & they can also act on the brain.

Side effect:

- Rash
- Headache
- Drowsiness
- vomeling

## Neostigmin

- Neostigmin is a quardenary ammonium compound drug.
- They are basically reversible anticholinestrase drug.
- They Bind with the cholinestrase enzyme and increase the level of Acetylcholine.

Mode of Action:- Same as Physostigmin.

Pharmacokinetics:-

- Their duration of Action 20 to 30 mine.
- It is taken orally through mouth.

Side effect:-

Same as Physotigmin.

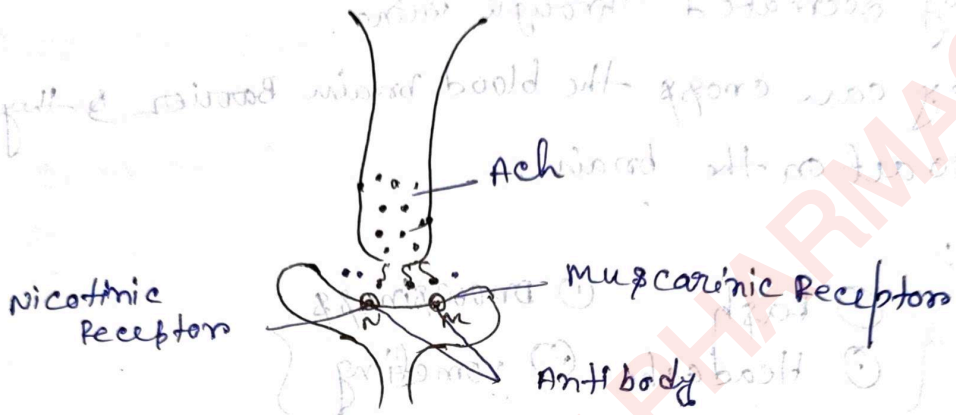
Uses :-

- For Glucoma
- Mysthenia gravis

## ⊛ Pharmalogical Action :-

① "Same as cholinergic drug"

### Mysthenia Gravis




→ Myesthenia gravis @ is a type of Auto immuon disease because they block the constraction & Relaxation Property in our body.

→ It is a auto immuno disease. our immuno system itself kill our Nicotinic & Muscarinic receptors by forming antibody

→ In mysthenia Gravis there is a decrease communication b/w Neurons & Muscle.

→ And the main symptoms of this disease muscle weakness.

② Etiology :- It is an auto immuno disease and our immuno system makes an antibody against the nicotinic & Muscarinic Receptor.

And these antibody when bind with the Nicotinic & Muscarinic Receptor then they block the Receptor & Ach can't bind with the Receptor (N & M)

⊙ So that case a lock of communication of muscles becomes weaks.

⊙ After forming Antibodies these antibody destroy & kill the Receptor so Ach can't bind with the Receptor & our body becomes muscleny weak.

⊙ On that case no of (N & M) receptor are less.

## Symptoms

- ⊙ eye & eyelid movement destory
- ⊙ Swallowing & Spech problem (bronchil)
- ⊙ Respiratory faliure
- ⊙ Gravies.

## Digagnostic

⊙ For the determination of Mypthenia gravis sytom in any patient we can perform two types of test -

- ⊙ Provocative test → D-Tuba curanine (Drug Iv)
- ⊙ Ameliorative test → Endrophonium (Drug Iv)

## Treatment

(i) Anticholinestrase :- Pyridostigmin. / Physostigmin

(ii) Immuno Supressant :- Those drugs which supress the immuno Responce body they are called immunosupressant.

- cyclosporin
- cyclophasphamate
- Azithoprine

} 

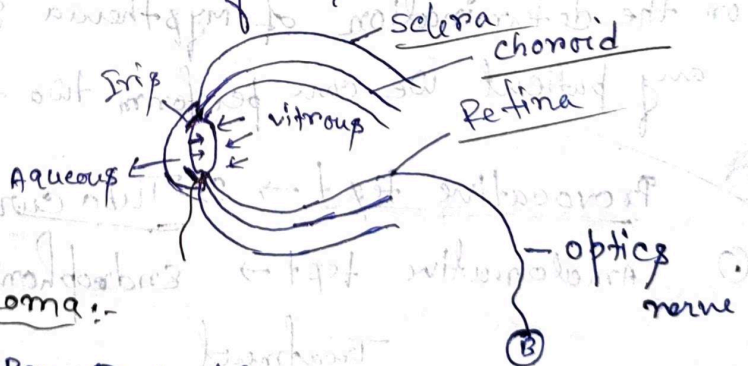
- cartico steroid.

(2) Surgery :- During the myasthenia Gravies problem due to overactive responce of thymus gland is increase so by the surgery we cut the thymus gland.

## Glucoma / Glaucoma

→ Basicaly Glaucoma is a ~~Genetics factor~~ neuro-degenerative disorder due to imblance the intra ocular pressure (IOP).

→ when the imbalance of liquid b/w Aqueous & vitrous chamber fluid then the ocular pressure is increase in that case optics nerve may be damage & vission becomes blower & totally loss.




(3) Types of Glaucoma :-

- Open Angel Glaucoma
- closed Angel Glaucoma

} 

(4) Risk factor :-

- Basically Glaucoma is a genetics factor
- Age is another risk factor of Glaucoma

in African and indian country there are after age of 40 & in Avarage other country the Age of 60.

① After a taking long time steroids drug or for the exposure of steroids drug for long duration it may cause glaucoma.

② By excessive takes liquid diet.

## Symptoms

- ① eye pain
- ② eye ball emerge out.
- ③ Blower vission
- ④ Severe Headache
- ⑤ Blindness

## Diagnosis

→ By the super vision of Physician he can examine the glaucoma.

## Treatment

① α- Adranergic Agonist → Aprochlorinidine, Brominidine.

② β- Blocker → Betaxalal, Timalol.

③ cholinergic Agonist :→ Pilocarpin, carbacol.

④ Prostaglandin Analogue :— Latanoprost, Travoprost. (eye drop)

⑤ carbonic Anhydrase inhibitor — Acetazolamide, Dorzalamide

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## ⊛ Para-sympatholytics / Anti-cholinergic drugs:-

→ The drug which bind with the cholinergic receptor and block the action of cholinergic drug they are called anti cholinergic drug.

### classification

① Natural Alkaloids:-
- Atropine
- Hyosicine (Scopolamine)

Trick
Rohit Atari or Hasai le kar khelte hai.

② semi synthetic derivative:-
- Homotropine
- Ipratropium bromide
- Tiatropium bromide
- Hyoscine butyl bromide
- Methonitrate

Trick
→ Atari ke Age hum if tye lagaw Aur Hasia ko bad banaw to Mithi Rate Paw

③ Synthetic compounds:-
- Mydriatics
- Cyclopentolate
- Tropicamide

Trick
→ cycle chalate ho topi Laga ke

④ Anti Secretory - Antispasmodics:-
- Propantheline
- Pirenzepine
- valethamate
- Clidinum
- Isopropamide
- Glycopyrrolate
- Piperidolate Methyl bromide
- Dicyclomine

⊙ Paper Padh ne bale chilaye Rohit sobcheye best hai is par gali do yea paipe se mar do Paipe se Ayea guest ha.

## Atropin

→ Atropin is a natural alkaloid which is obtained from the Atropa belladonna Plant or Dhatura extromoina Plant. (belladonna)

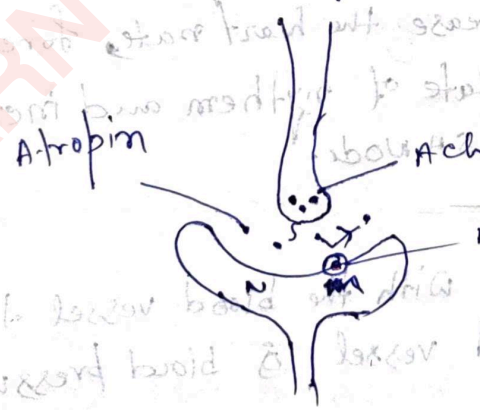
→ It is a type of natural anticholinergic drug.

### MOA (Mode of Action)

→ Atropin is a basically antagonist of cholinergic drug So they block the 'M' Receptor.

→ Atropin don't inhibit the Release of Ach drug but they inhibit the binding of Ach in the Muscarinic Receptor.

→ Because when Atropin is bind with the Muscarinic Receptor then they block the Action of Ach drug.



## Pharmalogical Action of Atropin

① **Acting in CNS :-** Atropin can cross the blood brain barrier (BBB). So they effect on CNS. on small dose they don't show any responce but in larger dose they can cause respiratory depression.

② **Acting on eye :-**

- When Atropin is bind on the Receptor of eye then it cause midriasis effect.

③ **Acting on bronchi & smooth muscle :-**

→ When the Atropin bind with the smooth muscle of bronchi then it dilate bronchi then the respiratory passes becomes large (for treatment of Asthma)

④ **Acting of cardiovascular system :-**

→ When the Atropin block the Muscarinic Receptor of heart then it increase the heart rate, force of contraction and the rate of rythem and increase the conduction from SA Node.

⑤ **Action of blood vessel :-**

→ When it bind with the blood vessel then is constrict the blood vessel & blood pressure is increase.

⑥ **Action on GIT :-**

- When atropin bind with the gasto intestinal track then it decrease the gastric Acid secreation.

so it is used in the treatment of peptic ulcer.

⊙ Action on Uterus :-

→ Uterus contriction

⊙ Action of Saliva :-

→ Salivation is decrease

⊙ Action on Lacrimal Gland :-

→ Decrease the rate of discharge of fluid.

⊙ Action on body temp :-

→ Sweating is decrease and body temperature becomes increase.

## Pharmacokinetic of Atropin

⊙ It is taken orally and it bioavailability it is 90%

⊙ It does taken 0.5 to 1 mg.

⊙ It is distributed with the help of Plasma Protein binding.

⊙ And metabolise in the liver

⊙ Excreated through the urine.

ADME

⊙ Therapeutic use :-

⊙ For biological Antispasmodic

⊙ It is used in the pre anesthetic medic-ation

⑤ used in peptic ulcer.

⑥ It is used in opthalmic Product as a mydriasis effect.

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Side effect :-

① xerostomia :- Dryness of mouth
② constipation
③ Blood vission
④ Dryness of skin

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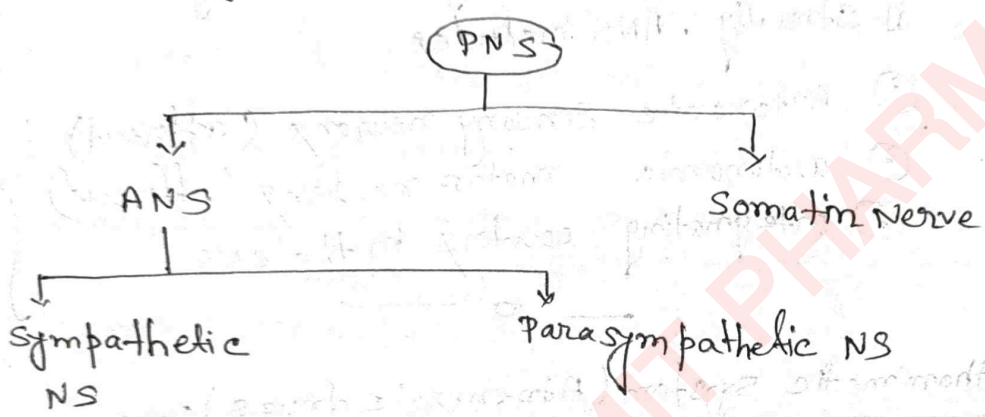
# Sympathomimetics / Adrenergic drug

The Peripheral Nervous system, or PNS, consists of the cranial nerves, Spinal Nerve, ganglia. The Peripheral Nervous System Subdivided into :—




→ The Autonomic nervous system is the Part of Peripheral Nervous System that Act as a control System.

- It Also responsible for control of "involuntary" like cardiovascular, respiratory, urinary, Reproductive functi and also play role in the bodies response to Stress.
- The Autonomic nervous system (ANS) Regulates the Activity of cardic muscle, smooth muscle & glands.

1. Sympathetic Nervous system:—
   - Allow body to function under Stress
   - Fight or Flight
   - [illegible]
   - Primes body for in intense Skeletal Muscle.

Activity.

2. Parasympathetic Nervous System:—

- ⊙ maintenance function
- ⊙ Rest and digest
- ⊙ counterbalance sympathetic function.

□ In general nerve impulses from one division of the ANS stimulate the organ to increase its activity and another Part inhibit the organs activity.

□ Structally, ANS includes

- ⊙ Autonomic sensory neurons (afferent)
- ⊙ autonomic motor neurons (efferent
- ⊙ integrating centers in the CNS

(*) Sympathomimetic System (Adrenergic drugs):—

⇒ Those autonomic Nervous System from which the neurotransmeter, adrenalin or non-adren epinephrine or non-epinephrine release & bin with the Receptor is called Adrenergic Nerv System.

□ ~~Adrenaline Neuro~~

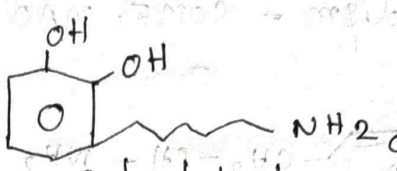
In Adrenergic NS basically two types of Neuro-transmitters are release —

① Adrenaline → epinephrine

② Non-Adrenaline → Non-epinephrin

they control different situation in our body, like, muscle constraction, Relaxation.

① catacholamine :→




catechol ring — amine group

Adrenergic catecholamine

→ catecholamine is type of neurotransmeter in this benzene ring is present, two Hydroxyl group are Present in Adjucent Position & Amine group also attached with the carbon chain.

→ catecholamine is never given in orally, it always given through injection. (compound)

→ The duration of Action of catecholamine is long.

→ catecholamine compounds are never don't cross the blood brain Barrier, So they don't given in Brain Problem.

→ catecholamine campounds are highly specific for oxidation because of Hydroxyl group. So they are always given in the combination of Antioxidant like sodium Sulphide.

□ Synthasis, Storage & Release of catecholamine :—

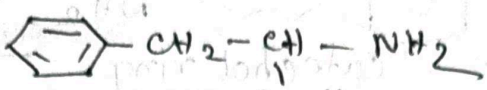
Step. 1. Synthesis of NE / NAD

2. uptake in Storage vessicle.

3. Release of Neurotransmitter

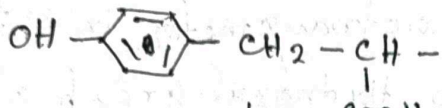
4. Binding to Receptor.
5. Removed of NE
6. Metabolism - COMT, MAO

1. Phenylanaline



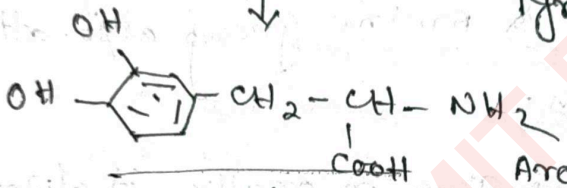
↓ Phenylanaline Hydroxylase.

Tyrosine



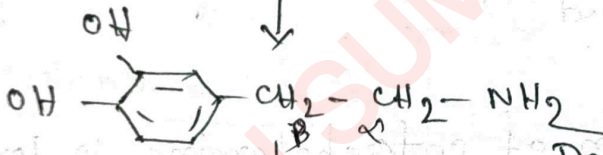
↓ Tyrosine Hydroxilase.

DOPA



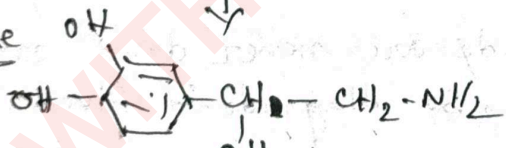
Aromatic L-Amine acid Decarboxylase.

Dopamine

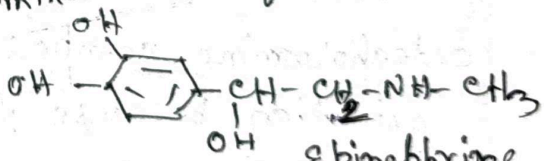


Dopamine β-hydroxylase

Norepinephrine



Phenylethanolamine-n-Methyl transferase



Epinephrine

2. uptake in storge vessicle :-

→ After the formation of Adrenaline it is excle into the vessicle for the long term security.

3. Release of Neurotransmitter :-

→ By the exocytosis process the neurotransmitter are release from the neuron & comes into the synefticlefts.

4. Binding to Receptor :-

→ Now this Neurotransmeter or Nor Adrenaline binding with the α, B · Receptor on the organs.

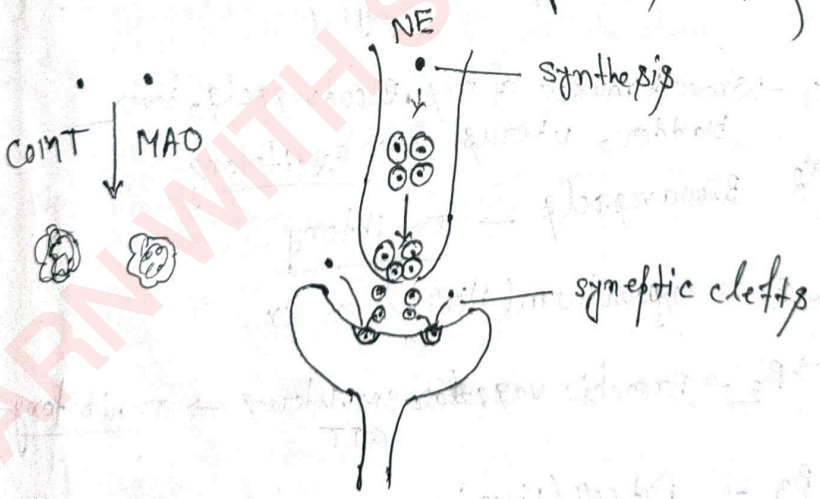
(5) Removed of NE :-

→ After the Pharmalogical Action The nor-epinephri Removed the Receptor & goes into the synaptic clefts

(6) Metabolism :-

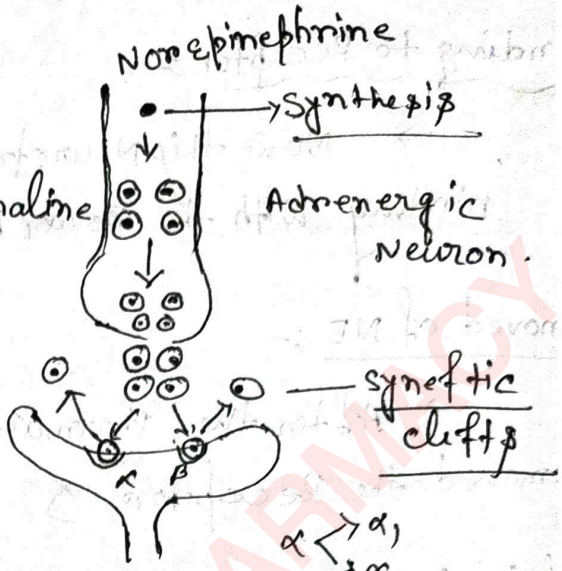
→ By the help of enzyme MAO & COMT The nor Adrenaline is Metabolise & Eliminated from body.

MAO :- Monoamino oxidase
COMT :- catechol-o-Methyl transferase



## Adrenergic Receptor

→ Non Adrenaline or Adrenaline Binds with the Receptor they are called Adrenergic Receptor.




□ Adrenergic drug Basically Bind with α & β receptor. α Receptor is further divided into two one is $\alpha_1$ & another one is $\alpha_2$.

→ Same β Receptor is three types $\beta_1$, $\beta_2$, $\beta_3$

→

- α → $\alpha_1$ → Smooth muscle of iris, Blood vessels, Liver, bladder, uterus → Excitatory
- α → $\alpha_2$ → Blood vessels → Inhibitory
- β → $\beta_1$ → Myocardium (Heart) → Ex
- β → $\beta_2$ → Bronchi, vascular SM, uterus, GIT → Inhibitor
- β → $\beta_3$ → Fat cell (Liver) → Ex

## Classification of Adrenergic drugs (or Sympathomimetic) :-

→ On the basis of Receptor
- α ⟨ α1 Agonist
  α2 Agonist
- β → β1 "
  β2 "
  β3 "

→ On the basis of therapeutic Application

## Therapeutic classification of Adrenergic drug :-

### (1) Pressore Agent :→

- Dopamine
- Mephentermine
- Methoxamine
- Phenylephrine
- Noradrenaline
- Ephedrine

Trick

DoPAHR Main Mitha Pheny Na Piyiea Blood Pressure Baad Jayega.

### (2) Cardic Stimulants :-

- Dobutamine
- Adrenaline
- Isoprenaline

Trick

Do Bottom ke Andar is Prokar Dil Hai Mera.

### (3) Bronchodilators :-

- Isoprenaline
- Salmeterol
- Salbutamol
- Formoterol
- Terabutaline
- ~~Broxaterol~~ Bambuterol

Trick

is Proker Sali Sala ne Formality main tera bamboo daba diya.

(iv) Nasal decongestants :→

- Phenylephrine
- Naphazoline
- Pseudoephidrine
- oxymetazoline
- xylometazoline

Trick

Fin se nafa diya vo ne To bell beech k xylodunga.

(v) CNS Stimulants :→

- Amphetamine
- Methamphetamine
- Dexamphetamine

Trick

Dimak main tha mati
Desk main thaf tofi

(vi) Anorectics :-

- Fenfluramine
- Sibutramine
- Dexfenfluramine

(vii) Uterine relaxant & vasodialators :-

- Ritodrine
- Salbutamol
- Iso x Suprine
- Terbutaline

Trick

Tera beta naatko Saal aiysa vigada hai

# Epinephrine / Adrenaline

→ Epinephrine / nor Adrenaline are the neurotransmeters & the hormones which is release from the medula Pard of the Adrenal gland. This hormones also called emergency hormones.

## Pharmalogical Action

① Action of CNS:—

→ When Adrenaline bind with the CNS & cross the blood ~~Brad~~ brain barrier then it is increase the tremor, Restlessness, Palpitation in the brain.

② Acting on heart:—

→ When Adrenaline drug is bind with the β Receptor, it increase the heart rate, increase the force of contraction and increase the cardiac out put.

③ Acting on blood vessel:—

→ The blood vessel which are present on smooth muscle they shows constriction (vasoconstriction).

→ And the blood vessel which are present ~~on smooth~~ Skeleton muscle they shows vasodialiation.

④ Acting on Blood Pressure:—

→ β- receptors are present in blood vessels & when Adrenaline drug is bind with the blood vessel then they cause vasoconstriction & increase blood Pressure.

(6) Acting on Respiration :-

→ When Adrenaline drug is bind with Respiratory System then it stimulate the Respiration and it can also called Apnea. And it cause dificulty in breathing.

(7) Action on eye :-

→ When Adrenaline in bind with the eye then it dilates our pupil & causes Mydriasis.

(8) Action on GIT :-

→ when the Adrenaline drug is bind with the our intestine & GIT then it decrease the Peristalic movement of intestine & the digestion of food is decrease.

(9) Acting on Bronchi :-

→ When Adrenaline drug also bind with the smooth muscle of bronchi then it cause vaso dilation, so it is also used in treatment of Asthama.

(10) Acting on Skeleton Muscle :-

→ on skeletal muscle basically - β - Receptors are present.
→ When adrenaline bind with the skeleton muscle, then it increapsed the muscle contraction.

(11) Acting on urinary bladder :-

→ Adrenergic receptor is also Present in urinary (System) bladder it increase the urinary bladder and it is also called urination.

Acting on Metabolism :—

→ When Adrenaline drug is release then Metabolism rate of carbohydrates & Proteins are increase.

## Pharmacokinetics

- Adrenaline or non Adrenaline are generally given IV, & Subcutaneous Route.
- There on set of Action 3 to 5 minute.
- There duration of Action is about 20 min.
- They are basically bind with the plasma protein.
- They Metabolise in Liver.
- They excreated through urine.

## Therapeutic use.

- It is used in the Asthma.
- It is used in the Anaphylactic shock.
- Local Anasthetic treatment.
- it is used in the heart constriction.
- used in Nasal decongestant.

## Side effect

- Nausia
- Vomating
- Headache
- Anxity

## Non catacholamine

- Ephedrine
- Amphetamine

# Adrenergic Blocker

An adrenergic anta-gonist is a drug that inhibits the function of Adrenergic Receptors. There are five Adrenergic Receptors, which are divided into two groups.

⊙ The first group of Receptors are the (Beta) Adrenergic Receptor. There are $\beta_1$, $\beta_2$, $\beta_3$

⊙ The second group contains the alpha($\alpha$) adrenoreceptors. There are only $\alpha_1$ & $\alpha_2$ Receptors.

⊙ Adrenergic Receptors are located near the heart, kidneys, lungs & gastrointestinal tract.

## $\alpha$ Adrenergic Blocking Drugs:-

These drugs are competitive inhibitors of the effects of catecholamines at $\alpha$-adrenergic Receptors. These drugs usually have vasodilation effects on the blood vessels. These drugs further classified as -

a) Non Selective $\alpha$- Adrenergic Antagonist.
   ① Haloalkylamines
   ② Imidazolines (Tolazoline)

b) $\alpha_1$ Selective Antagonist :- Prazosin

c) $\alpha_2$ Selective Antagonist :- Yohimine.

1) β Adrenergic Blocking Drugs :-

| First Generation | Second Generation | Third generation |
|---|---|---|
| ⊙ Propranolol | ⊙ Metoprolol | ⊙ Labetalol |
| ⊙ Timolol | ⊙ Atenolol | ⊙ Carvedilol |
| ⊙ Sotalol | ⊙ Bisoprolol | ⊙ Nebivolol |
| ⊙ Pindolol | ⊙ Esmolol | ⊙ Betaxolol |
| | ⊙ Acebutolol | |

2) Non Selective α adrenergic blocker.

- ⊙ Phentolamine
- ⊙ chlorpromazine
- ⊙ Ergotamine

Trick

→ Phenta or chola Agar Mango to Sob Pi lenge.

3) α1 Selective

- → Prazosin ✓
- → Terazosin ✓
- → Doxazosin ✓
- → Alfuzosin
- → Tamsulosin

Trick

→ Pyara Zosi Tere do Alfaz Sunkar Tamtamiya sultan yudhi ka

4) α2 Selective

→ Yohimbine

## (*) β Adrenergic Blocker :-

- Non Selective ($B_1$, $B_2$, $B_3$)
  - Propranolol ✓
  - Sotalol
  - Timolol
  - Pindolol
  - Labetalol ✓
  - Carvedilol ✓

Trick

Proper Sotenge sigret time se pijenge Red Lev el car Main Bath kar Lal Mere.

(*) Cardio Selective ($B_1$) :-

- Betaxolol
- Meto Prolol
- Atenolol
- Acebutolol
- Celiprolol
- Esmolol
- Bisoprolol

Trick

→ Beta Mitter Antina Ac Siling isko Lal kar do Bigkul khilaunga..

(*) what are the Pharmalogical Action Anti-Adrenerg drug,

→ opposite of Adrenergic drug,

## What are Adrenergic blockers

→ Drugs which Antagonize the Action of Ephinephdrine & NO-Ephidrine at the Receptor level.

→ They occoupy Adrenergic receptors (α & β) but don't Produce signal trausduction.

→ It can be reversible or irreversiable.

→ classified according to relative affinity for α & β Receptors.

### (*) α- Adrenergic blockers or Antagonist:-

① Phenoxy Benzamine
① Phentolamine
① Prazosin
① Terazosin
① Doxazosin

{ Phenoxy Benzamine & Phentolamine }

→ Non Selective α- Antagonist / blockers.

### Action

**Block $\alpha_1$ Receptor:-** vasodilation & Postura hypotension

**Block $\alpha_2$ Receptor:-** ① Reduced Nor EP action on $\alpha_2$-Recept- on on the varicosity.

① increase release of NE from varicosity which can cause tracky cardia & increased CO

## Mode of Action

→ Binds covalently to α Receptor and blocks non Adrenaline Action.

→ Action is irreversible in the case of Phentolamine.

## Pharmacokinetics

→ Given orally, IV & SC injection

→ $T_{1/2}$ for Phentolamine = 3 hours (because of reversible binding to receptor)

→ $T_{1/2}$ for Phenoxybenzamine = 12 hours (Because of irreversible binding to receptor)

## Clinical use

① used in treatment of Phaeochromocytoma.

## Adverse effects

- ⊙ Postural hypotension
- ⊙ Tachycardia
- ⊙ Dizziness & headache
- ⊙ Sexual disfunction

Prazosin, Terazosin, Doxazosin

→ Selective $\alpha_1$ Agonist (Actually block only $\alpha_1$ Receptor)

## Action

① vasodilation & Reduction in BP.

① Increase HR

① Decrease bladder sphincter tone.

## MOA

- Block the Action of endogenous & exogenous Agonist of on the $\alpha_1$ Receptor.
- Decrease Peripheral vascular Resistance.
- Relaxes arterial and venous smooth muscle.
- causes minimal changes in CO.

## Pharmacokinetics

1. Prazosin & Terazosin :—
   - Absorbed orally
   - $T_{1/2}$ = 3 - 4 hours
   - Metabolised by liver.
   - Extensive 1st pass Metabolisms
2. Doxazosin :—
   - $T_{1/2}$ = 22 hours

## clinical use

- severe hypertension

## Adverse effects

- Dizziness
- orthostatic hypotension
- Insomnia
- Priapism.

## β- Adrenergic blocker :-

| Non Selective ($\beta_1, \beta_2, \beta_3$) | $\beta_1$ Selective |
|---|---|
| ⊙ Propranolol | ⊙ Acebutolol |
| ⊙ Timolol | ⊙ Atenolol |
| ⊙ Nadolol | ⊙ Metoprolol |
| | ⊙ Esmolol. |

### Non selective β- Blocker :-

### ⊛ Propranolol :-

#### Action

⊙ It block the β receptor which is present in cardiovascular system (CVS), Therefor it increase the HR, force of contraction

⊛ Decreased SA & AV Nod Activity.

⊙ Peripheral vasoconstriction via increased Peripheral resistance.

⊙ Broncho constriction

⊙ Reduce Renin release

⊙ Decreased glycogenolysis & glucogen secretion.

#### MoA

⊙ Block the $\alpha_1$ Receptor

⊙ Block sympathetic ~~drive~~ nerve.

⊙ Reducing Pacemaker activity & increase Av conduction time

⊙ Reduces the slow inward $Ca^{++}$ current.

## Pharmacokinetics

- orally Administered.
- Almost completely Absorbed.
- Extensive 1st Pass metabolism (only 0.25 bioavailability)
- Large volume of distribution.
- cross BBB
- Metabolites excreted in urine.

## Therapeutic uses

- Hypertension
- Angina pectoris
- Hyperthyroidism
- Migraine

## ADverse effect

- Bronchoconstriction
- Arrhythmias
- Metabolic distributions
- Sexual impairment.

CNS effect
- Dizziness
- Lethargy
- Weakness
- Depression.

## Nadolol & Timolol

→ Non selective beta antagonists
→ Nadolol has very long duration of action

## Action

- Intraocular Pressure decrease
- More potent than Propanolol

## MOA

- Reduces Production of aqueous humor in the eye
- Decrease secreation of aqueous humor by ciliary body
- Do not cause cycloplesia.

## Pharmaco kinetics

- Duration of Action = 12-24 hours
- onset is about 30 minute when administered intraocularly.

## clinical use

- chronic mangement of glucoma.

## Acebutolol, Atenolol, Bisoprolol, Esmolol & Metaprolol

→ Selective Beta blockers - known as cardio Selective.

→ Selectivity is lost at high doses

## Action

- Decrease BP in hypertension
- Increase exercise tolerance in Angina.

## Pharmacokinetics

- orally administered
- $T_{1/2}$ Atenolol — 6 hr

Esmolol → 10 hr

## Clinical use

- It is use as a Antianginal
- It is used as a Antihypertensive