Unit-3

Organisation & function of ANS (Autonomic Nervous System)

Nervous comes from brain and spinal cord and bind with different organs.

They release different neurotransmeter and control the function of organ.

They study of release of neurotransmitter and there function on different organs is called Autonomic Nervous system.

ANS is of two type:-

(1) Sympathetic System.

(2) parasympathetic System.

(i) Sympathetic Nervous System:-

→ In this types of ANA the ganglionic junction is present Away to the organ.

→ In this system preganglionic fibre is short And past ganglionic fibre is long.

→ They release Adrenaline transmitter is inhibitory in nature Adrenaline bind with three types Receptor.

(i) Alfa - (α)

(ii) (Bita) - (β)

(iii) Gama - γ

Parasympathetic Nervier fibre.

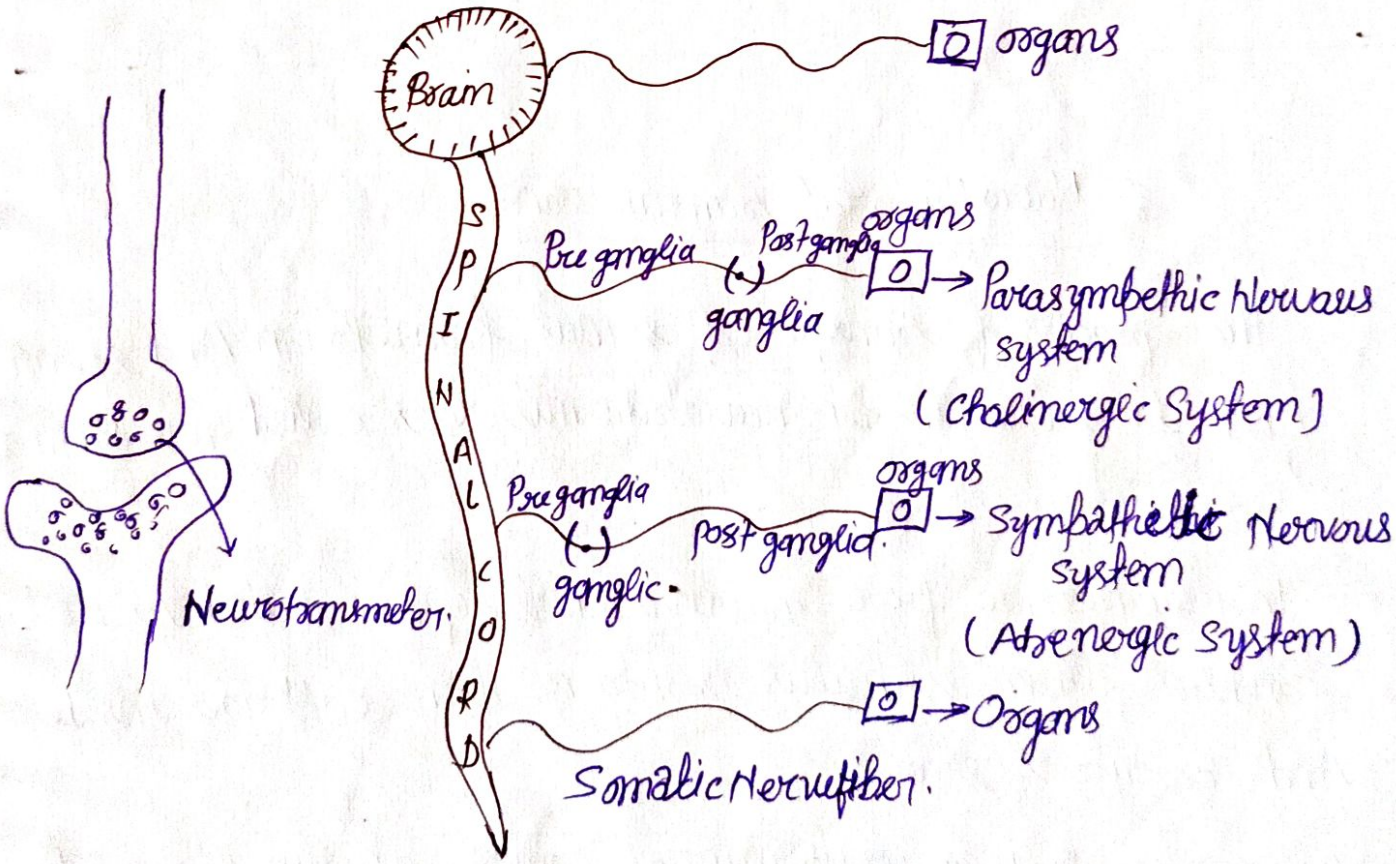
In this type of ANS the ganglionic junction is present near to the organ in this system preganglionic fibre is long And post ganglionic fibre is small.

→ They release Acytilecholine neurotransmitter which is excitatary in nature.

→ Acylilcholine bind with to type of receptor.

(1) N - Nicotinic.

(2) M - Muscorinic



Neurotransmeter
- Parasympathetic → Acetylcholine
- Sympathetic → Adrenaline.

← Difference between Parasympethetic And Sympathetic Nervous System →

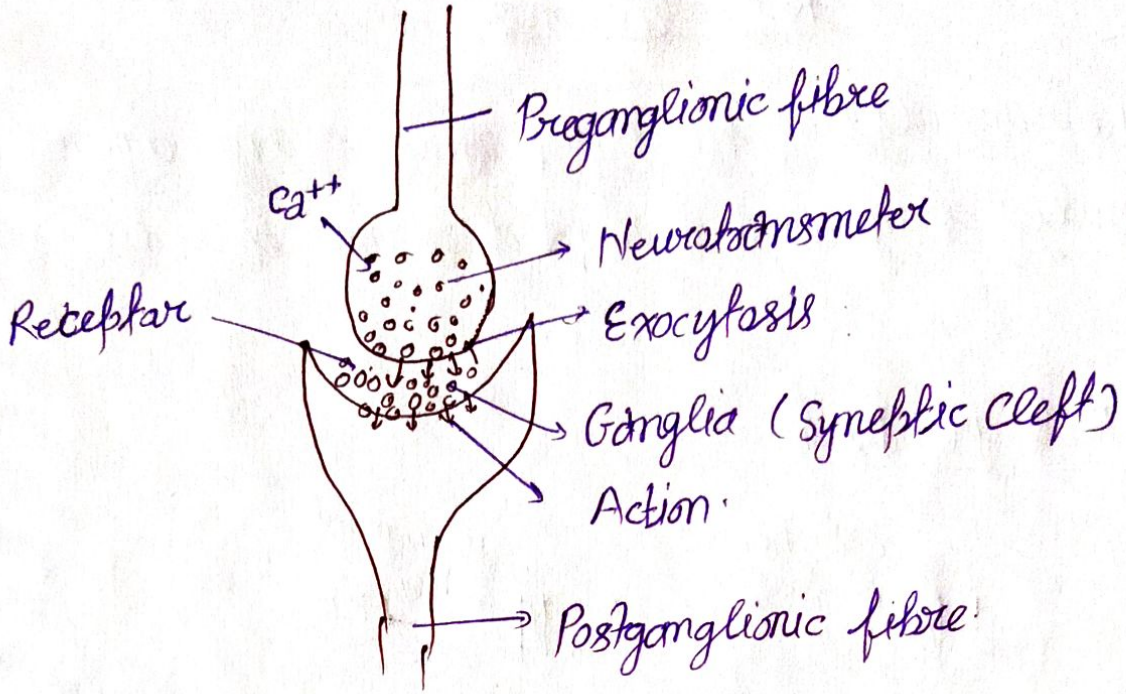
Properties	Parasympethetic	Sympathetic
Ganglia	Near to organ	Away from organ.
Preganglionic Nerve fiber	long	Short
Postganglionic Nerve fiber	Short	long
Neurotransmitter	Acetylcholine	Adrenaline
Also known as	Cholinergic	Adrenergic.

÷ Neuro Humoral Transmission ÷

The process of transfer of signal from brain And spinal card to the organ by neurotransmitter is called neurohumoral Transmission.

→ In preganglionic fibre neurotransmitter are filled. At resting condition when stimulus is obtain than Ca^{++} goes inside And Exocytosis starts.

→ After exocytosis neurotransmeter comes in synaptic cleft And bind with the receptor of post ganglionic fibre And signal is pass



The process of Neuro humoral transmission is complete into three steps.

(1) Resting condition.
(2) Depolarisation.
(3) Repolarisation.

(1) Resting condition :-

At resting condition the positive ca^{++} collected At ECF and negative Ca^{--} ICF so the A negative potashrm of -70 mv is Generated which is called resting Generate potential.

(2) Depolarisation :-

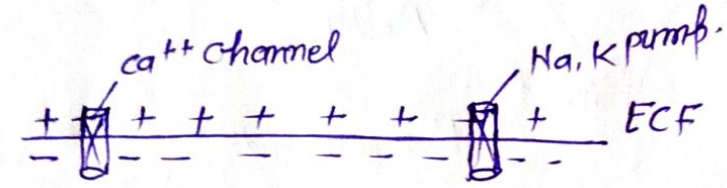
When stimulus is obtain then ca^{++} And K^{++} comes in ICF from ECF And the negative ca^{++} and K^{++} goes from ICF to ECF

→ Due to movement of ions A positive electrode potential of +45MV is develop and signal is pass or transfer.

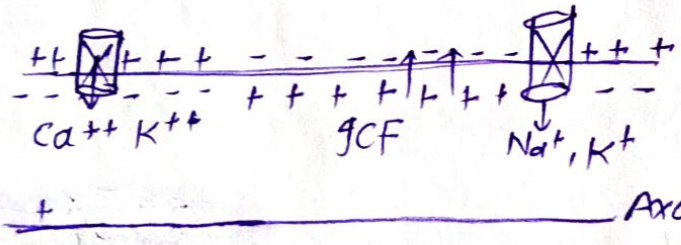
(3) Repolarisation :-

After the transfer of the signal and resfonce ions again comes in There initial stage and transfer of signal is stop.

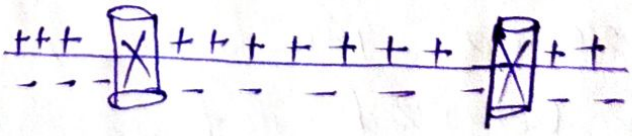
(i) Resting Condition :-



(ii) Depolarisation :-



(iii) Repolarisation :-



÷ Classification of Neurotransmitters ÷

→ On the basis of actions neurotransmitters is of two type-

(i) Excitatary.
(ii) Inhibitary.

(i) Excitatary

→ Which increase the actions of body.

Ex ÷ Acetylcholine, Adrenyline, Nor Adrenyline, Dopamine
Histamine, Glutamine.

(ii) Inhibitary ÷

→ Which decrease the resfonce.

Ex:- GABA, Serotonin, Endorphin.

÷ Parasympathomimetics (Cholinergic dougs) ÷

÷ Cholinergic Neurotransmeters ÷

Those chemical massanger which are release from the parasympathetic nerve indigs they are called cholinergic neurotransmeters.

- Because they release acytilcholine so it is called cholinergic.

÷ Cholinergic drugs ÷

→ In certain cases when the release of acetylcholine in body is less as per their demond then we have to used the certain drugs which have the same action like acetylcholine they are called cholinergic agonist or cholinergic drugs.

→ They have different function in our body like - In Intestine, In blood pressure, In blood pressure constriction, In vasso-constriction. In Asthma. In Menstruation, In Uterine constriction. they are different role of cholinergic drugs.

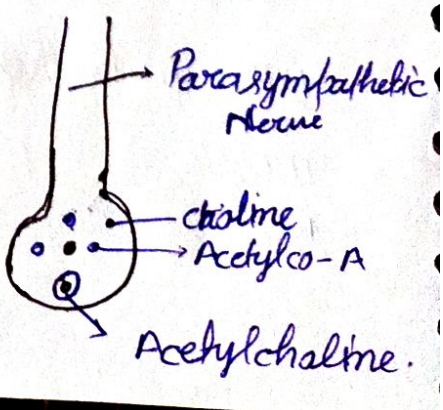
÷ Synthesis storage and Release of Acetylcholine ÷

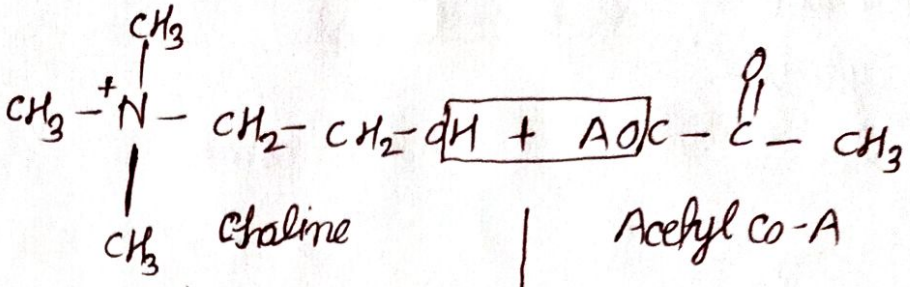
Basically cholinergic neurotransmeter Acetylcholine is synthesies ~~from~~ inside the parasympathetic neuron.

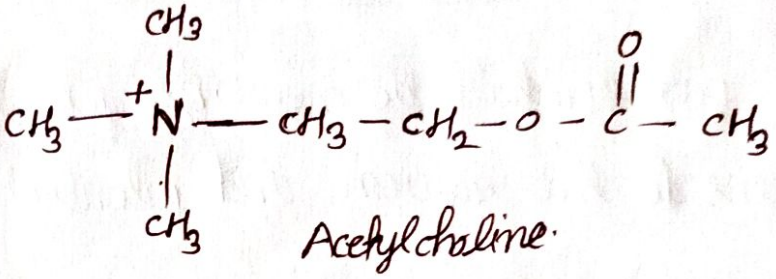
→ Inside the parasympathetic neurons choline compaund is present which is synthesies into cytoplasm and in the mitochondria of the cell acetil co-Enzyme A is foom.

→ When Acetil co-A and choline is reacted with in the presence of Acetylcholine transferase enzyme then after dehydration they form acetylcholine.

Choline + Acetyl co-A
↓ Acetylcholine Transferase
Acetylcholine.







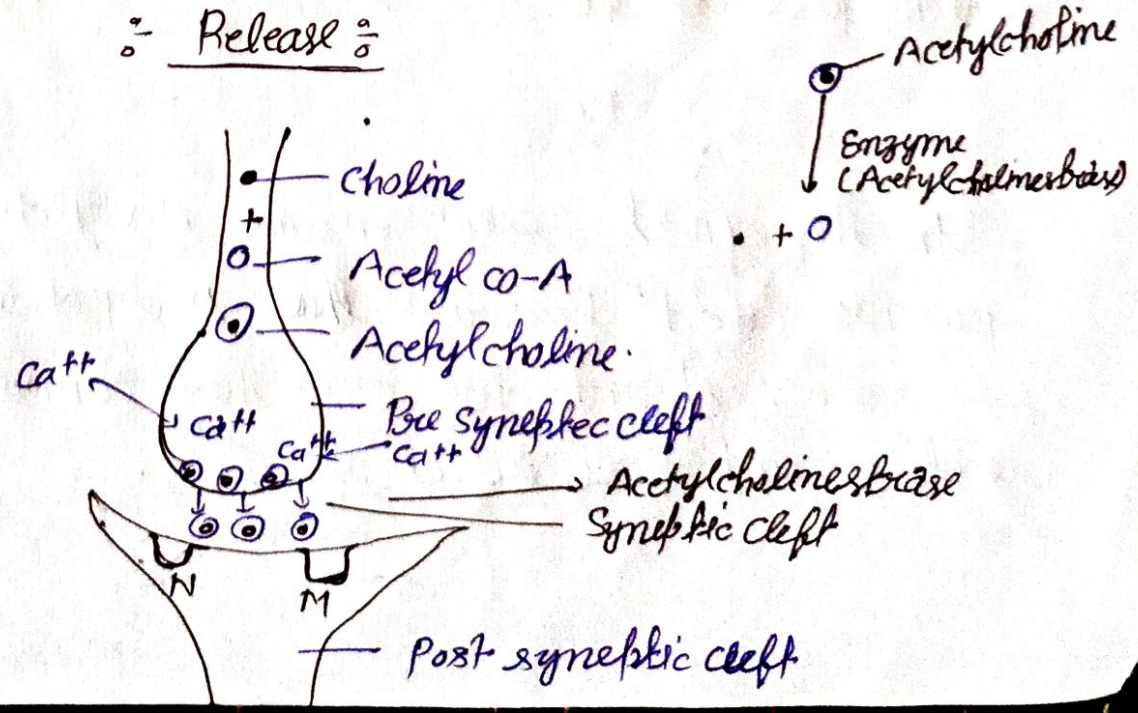
÷ Storage ÷

- About 500 to 1000 molicule of Acetylcholine neurotransmeter is store in one parasympathetic neuron.

⇒ They are always store in the nerve indign of the parasympathetic neuron.

⇒ After exocitosis they release into synaptic cleft and bind with the particular receptor.

÷ Release ÷



(1) Stimulus.
(2) Exocytosis.
(3) Receptor

(1) Stimulus :-

When the parasympathetic neurons gets the stimulus then Ca^{++} goes inside the neuron and potential is generated.

(2) Exocytosis :-

After the movement of Ca^{++} the layer of presynaptic cleft is rapture.
- And the acetylcholine neurotransmeter release into the synaptic cleft. this process is known exocytosis.

(3) Receptor :-

Some of the neurotransmeter molecule bind with the particular Nicotinic and Muscorinic receptor and gives the cholinergic resfonce.

(4)

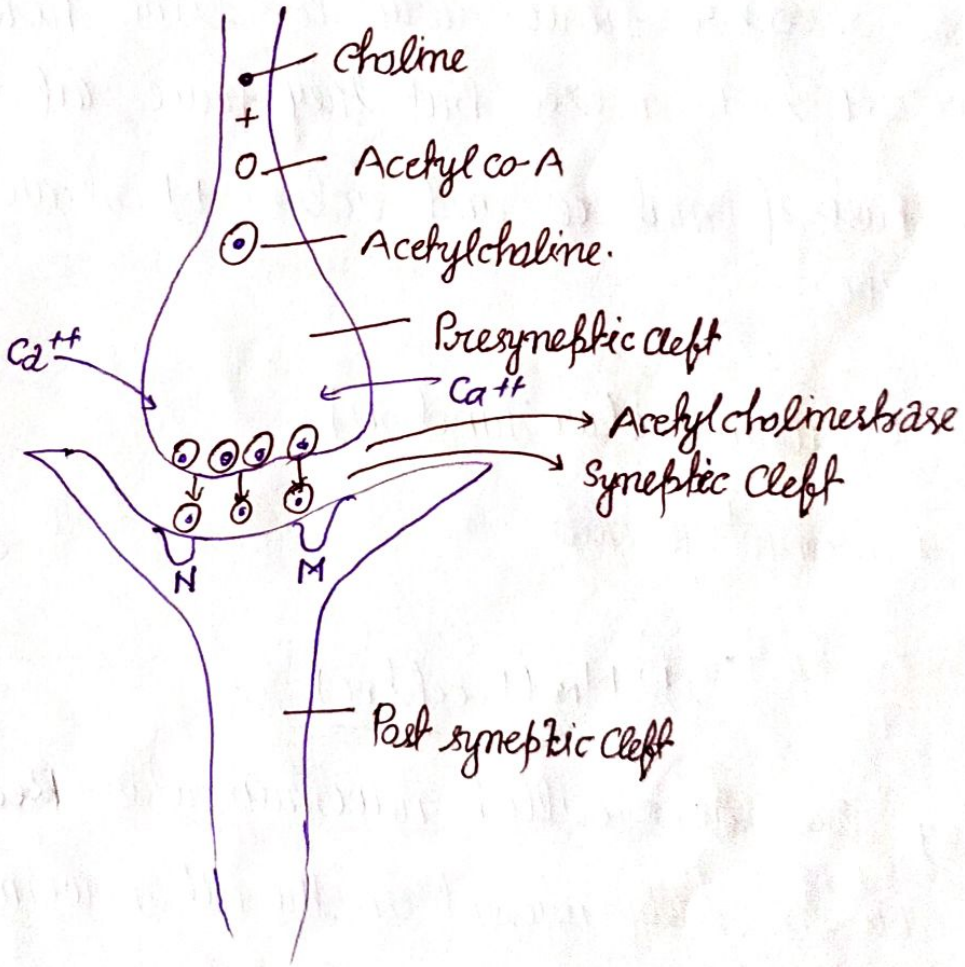
In the synaptic cleft enzyme Acetylcholinestrase is present which dissociate the Acetylcholine molicule into acetic Acid and choline so they cannot bind with the receptor and their effect is loss.

÷ Cholinergic Receptors ÷

Those receptor in which the acetylcholine is bind they are called cholinergic receptors.

or

Those proteinous (structure) Active side present on the different organ in which the acetylcholine is bind this is called cholinergic receptor.



Cholinergic receptor are two types -

(1) Nicotinic Receptor.

(2) Muscarinic Receptor.

(1) Nicotinic Receptor:

- When the acetylcholine is bind with this receptor then they produce the similer 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 and they have five submit.

⇒ Nicotinic receptor have very less time duration they opens only for 0.1 to 10 milisec but they have rapid action.

⇒ On the basis of nature and action Nicotinic receptor is of two type.

(1) N_M → (Neuromuscular Junction)

(2) N_N → Neuronal ganglia.

(1) N_M (Receptor)

→ They are also called neuromuscular Receptor

⇒ The are basically present in the all neuromuscular junction of body.

⇒ When acetylcholine is bind with the N_M receptor then they act as the contraction and relaxation of muscle

N_N Receptor

→ They are also called neuronal Nicotinic receptor.

⇒ They are bassicaly present on autonomic neuronal ganglia

→ And when the Acetylcholine is bind with the N_N receptor they control the release of Neurotransmeter.

(2) Muscarinic Receptor:

→ When any person eat muscarianus fusicarae Mushroom or fungus. they have similer responce like Acetylcholine bind with this receptor so this receptor is called muscarinic receptor.

→ The nature of muscarinic receptor is GPCR. 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. Autonomic ganglia and exocrine gland.

→ The control the movement of eye, Movement of release of salina secreation, tears secreation, GIT secreation.

M_2-Receptor:

M_2-Receptor is a cardiac receptor they are present on the cardiac muscle of heart and they increase the fource of contraction

÷ M_3 - Receptor ÷

→ They are the glandular receptor and they bind in the endocrine and exocrine of the body and they increase the secreation of exocrine and endocrine gland.

÷ M_4 - Receptor ÷

They are Antagonist in nature. When acetylcholine is bind in this receptor then they reverse the action of acetylcholine.

÷ M_5 - Receptor ÷

They are found in "substantia Nigra"

÷ Classification of Chalinergic drug ÷

÷ Direct Acting Chalmergic Drugs ÷

- Acetylcholine.
- Bethanechal
- Pilocarpine.
- Methacholine.

"असी वेंगे मीठा पी लो"

← Indirect Acting Chalinergic Drug ÷

Reversible.

→ Water soluble:- Neostigmine
Edrophonium
- Pyridostigmine

नो प्यरि अन्दर फोन करके आओ

→ Lipid Soluble:- Physostigmine
Donepezil
Tacrine, Gallantamine

फांसी टांग दो इसके गले में

:- Irreversible :-

Organophosphorus Compounds
Echothiophate
Malathion
parathion
Tabun

अगर इसको माला प्रसाद दो तब नहीं जाएगा

÷ Pharmacological Action of Acetylcholine ÷

→ On the basis of action pharmacological action of Acetylcholine is devided into two category.

(1) Muscarinic Action.
(2) Nicotinic Action.

(1) Muscarinic Action ÷

÷ Action on eye ÷

→ The cholinergic drug when bind with the eye then it constict the pupil and it causes myosis.
→ And it also causes the discharge of fluid from Aqueous vitrous chamber so intraocular pressure of eye is decrease. and it is very benifesial and it is used for the glucoma treatment.

÷ Action on glands ÷

When acetylcholine drugs are bind with the exocrine gland then they increase their secreation because they are excitatory in nature -
→ From eye the secreation of tears are increases, in the mouth the secreation of saliva is increases and from the sweat gland the secreation of sweat is increases.

(3) Action on smoth muscle:-

On smooth muscle basically three receptor are present. and when acetylcholine drug is bind with the smooth muscle. the cause excitatory action and constriction in smooth muscle. so the diameter of boonchi is decrease this is called Asthma.

(4) Action on heart:-

On the beard M_2 receptor are present and when the cholinergic drugs bind with the M_2 receptor it cause inhibitory action:

- The force are conduction and rythims of heart is decrease
- The Rate of pumping is also decrease.

(5) Action on blood vessel:-

In the blood vessel cholinergic drug shows inhibitory action.

- Because they release the EDRF - Endothelial Release factor and nitric oxide sothe blood vessel dilate.
- And when the blood vessel dilate then the blood pressure is sudden decrease

(6) Action of GIT:-

- Acetylcholine acts on GIT Excitatory Action.
- It increase the Gastric Acid secreation and peristaltic movement. in the Intestine.

(2) Nicotinic Action:-

(1) Action on CNS:-

Cholinergic drug cannot cross the blood brain barrier so they do not show any response in brain.

(3) Action on Autonomic Ganglia:-

(4) Action on Muscle:-

- N_M receptor is present.
- When acetylcholine is bind with the N_M receptor then there muscle constraction is increase.

÷ Anticholinesterase drug ÷

- Those drugs which inhibit the action of enzyme Acetylcholinestrase. They are called anticholinestrase drug.

On the basis of their complex formation Anticholinestrase drug are two types.

(1) Reversible → Prosthesis group.

(2) Irreversible →

÷ Reversible ÷

- It is also known as prosthesis group.
- Reversible are acts as short acting time.
- The example of prosthesis groups are -

(1) Neostigmin

(2) Physostigmine

Irreversible

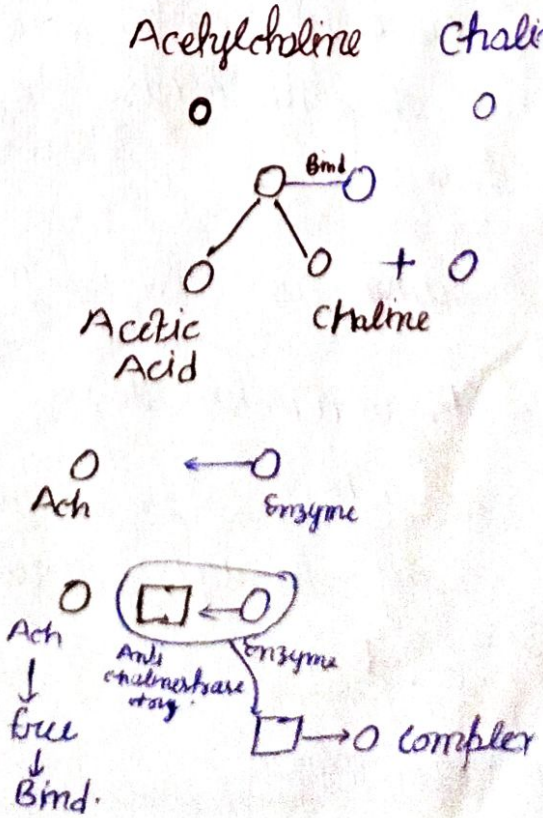
- Irreversible is also known as Acid transfer group or cholinesterase reactivator group.
- Example of these group is - Argenphasphate.

(1) Reversible Anticholinesterase :

(i) Physostigmin :

- **Nature :** The physostigmin drug is obtain from the alkalaid Physostigma Venerasom
- First time Physostigmin drug is used for the Glucoma treatment.
- It is present in the crystalline form they are the colorless, Odorless, crystals.
- But after the exposure of air they convert into the pink color.

Mode of Action :



∴ Pharmacokinetics ∴

- Basically physostigmin is short acting lime drug.
- There duration of action on set of of action within 5min.
- There duration of action from 45 to 60 min
- They secreated through urine.
- They can cross the blood brain barrier and they can also act on the brain.

∴ Side effect ∴

- Rash
- Headache
- drowsiness.
- Hausia
- Vometing
- Blood vision.

∴ Neostigmin ∴

- Neostigmin is a quardenary ammonium compaund drug.
- They are basically reversible anticalinesterase drug
- They bind with the cholinesterase enzyme and increase the lavel of Acetylcholine.

Mode of Action: Same as physostigmine.

∴ Pharmacokinetics ∴

- There duration of action 20 to 30 minute.
- It is taken orally through mouth.

∴ Sideeffect ∴

Same as physostigmine.

Use:
- For Glucoma.
- For Mysthenia Gravis.

Pharmacological Action:

"Same as cholinergic drug"

"Drugs used in Mysthenia Gravis:"

"Mysthenia Gravis:"

- Mysthenia Gravis is a type of auto immune disease
- Because it block the contraction and relaxation property of muscle in our body.
- It is a auto immune desease because our immune system itself kill our nicotinic and muscarinic receptor by forming the antibody.
- In mysthenia Gravis there is a decrease communication b/w neurons & muscle.
- And the main symptom of this disease muscle weakness.

Etiology (cause):

It is an autoimmune disease and our immune system makes an antibody against the Nicotinic and muscarinic receptor.

- And these antibodies when bind with the receptor then they block the receptor so acetycholine they can't bind with the receptor (Nicotinic & muscarinic)

So there is a lack of communication of muscle contraction and muscles becomes weaks.

- After forming Antibodies these antibody destroy and kills the receptor so the number of Nicotinic and muscarinic receptor in our body becomes less in that case Acetylcholine can't bind with the drug and our body becomes muscluary weak.

÷ Symptoms ÷

- Eye and eyelid movement disturb.
- Swallowing and speech problem.
- Respiratory faliure.
- Gravis.

÷ Diagnostic ÷

- For the determination of mysthenia Gravis. symptom in any patient we can perform two types of test.

(1) Provocative test. → D-Tubacuranine (Drug (IV)

(2) Ameiloractive test → Endophonium (Drug IV)

÷ Treatment ÷

(1) Anticholinestrase → Pyridastigmin.

(2) Immunosupressant → Those drug which supress the auto immune resfonce of body. they are called Immunosupressant

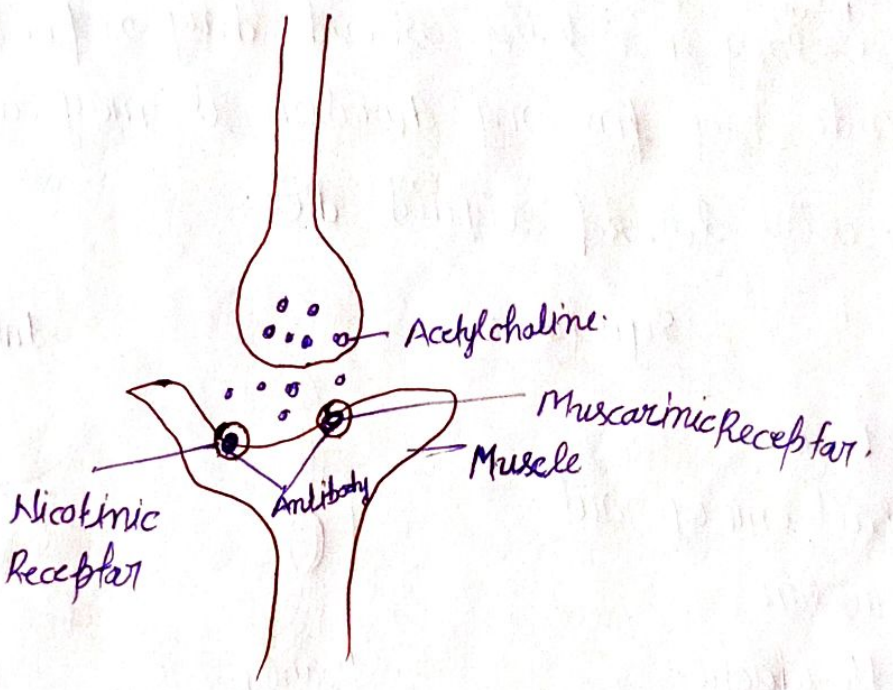
- Cyclosporin.
- Cyclophasphamide
- Azithoprine.

(3) Cortico steraid.

(4) Surgery → During the mysthenia Gravice problem

due to over acting response of thymus gland. there size of thymus gland is increase. so by the surgery we cut the thymus gland.

(5) Plasma Exchange :-



:- Drug Used in Glaucoma :-

:- Glaucoma :-

→ Glaucoma is a neuro degenerative desorder due to imbalance the Intra ocular pressure.

→ When the imbalance of liquid b/w Aquous and vitrous fluid then the ocular pressure is increase in that case optics nerve may be damage and vision becomes blood or fatally loss.

:- Types of Glaucoma :-

(1) Open angle Glaucoma.

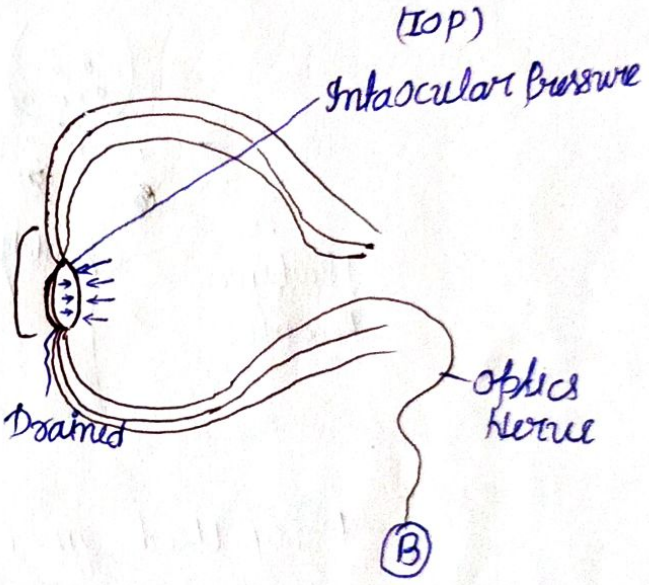
(2) Closed Angle Glaucoma

÷ 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 and in Average other country after the age of 60.
- After a taking long time taken steroids drug or for the exposure of steroids drug for long duration it may cause Glaucoma.
- By excessive takes of liquid diet.

÷ Symptoms ÷

- Eye pain.
- Eye ball emerge out.
- Blood vision
- Severe Headache.
- Blindness.



÷ Diagnosis ÷

- By the Super vision of physician he can examine the Glaucoma.

÷ Treatment ÷

(i) α - Adrenergic Agonist → Aprochlorimidine, Brominidine.

(ii) β - blocker → Betaxalal, Timolol.

(iii) Cholinergic Agonist → Carbocal, Pilocarpin.

(iv) Prostaglandin Analogue → Latanoprost, Travoprost.

(v) Carbonic Anhydrase Inhibitor → Acetazolamide, Dorzolamide

÷ Parasympatholytics / Anticholinergic drugs ÷

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

or

Those drugs or chemical agent which block the cholinergic receptor and gives the opposite effect of cholinergic drug they are called anticholinergic drug.

÷ Classification ÷

(1) Natural Alkaloids ÷
- Atropine
- Hyoscine (Scopolamine)

रोहित आरी और हसिया ले के खेला है।

(2) Semisynthetic derivatives ÷
- Homatropine
- Ipratropium bromide
- Tiatropium bromide
- Hyoscine butyl bromide Methonitrate

आरी के आगे हम इपर्याई लगाओ और हसिया की बट बनाओ तो मीठी रोटी पाओ

(3) Synthetic Compounds

(a) Mydriatics.
(b) Cyclopentolate
(c) Tropicamide.

'साइकिल' चलाता हो 'टोपी' पहन के

(b) Antisecretory - Antispasmodies ÷
- Propantheline
- Pirenzepine
- Valethamate
- Clidinium
- Isopropamide
- Glycopyrrolate
- Piperzalate Methyl bromide
- Dicyclomine

पेपर परने वाले चिल्लाये रोहित सबसे बेस्ट है। इस पर गानी दो या पाइप से मारो दो पहिया से अपि गेस्ट है।

(c) Vasicoselective ÷
- Oxybutynin
- Flavoxate
- Tolterodine

वो Beauty Parlor के सामने फल लगाता था टाल मैन

(d) Antiparkinsonian ÷
- Trihexyphenidyl (Benzhexal)
- Procyclidine
- Biperiden

वेहेन भाई पूरे साइकिल चोर (थे)

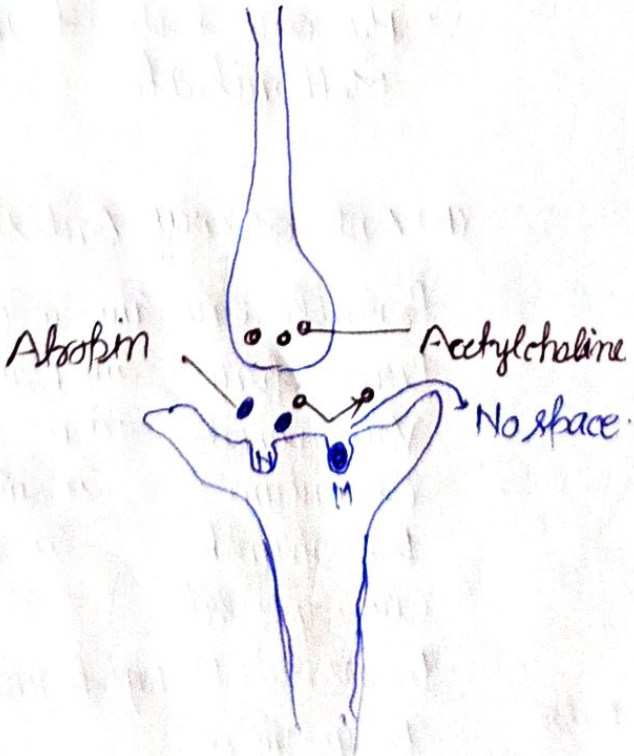
∴ Atropin ∴

→ Atropin is a natural alkaloid which is obtained from the atropa beladona plant or Dhatura Extramonia Plant.

- It is a type of natural anticholinergic drug.

∴ Mode of Action ∴

- Atropin is a basically antagonist of cholinergic drugs so they block the 'M' receptors.
- Atropin do not inhibit the release of Acetylcholine drug but they inhibit the binding of Acetylcholine in the muscarinic receptor.
- Because when atropin is bind with the muscarinic receptor then they block the action of Acetylcholine drug.



Pharmacological Action of Atropin:-

Action in CNS:-

→ Atropin can cross the blood brain barrier so the affects on the central nervous system.

→ On small dose they do not so any resfonce on CNS but on large dose they can cause respiratory depression.

:- Action on Eye:-

→ When atropin is bind on the receptor of eye then it cause miadriaces effect.

:- Action on Boonchi or Smooth muscle:-

→ When the atropin bind with the smath muscle of boonchi then it dilate the boonchi then the respiratary passes becomes large. (for treatment of Asthma)

:- Action of Cardiovascular System:-

→ When Atropin block the muscarinic receptor of heart then it increase the heard rate, force of contraction and the rate of ryithem and increase the conduction from SA Node.

:- Action on blood vessel:-

- When it bind with the blood vessel then is constrict the blood vessel and blood pressure is increase.

∴ Action on GIT ∴

→ When atropin bind with the gastro intestinal track then it decrease the gastric Acid secreation so it is used in the treatment of peptic ulcer.

∴ Action on Uterus ∴

→ Uterus constriction.

∴ Action on Saliva ∴

→ Salivation is decrease.

Action on Lacrimal Gland ∴

- Decrease the rate of discharge of fluid.

∴ Action on body temp ∴

Sweatining is decrease and body temp become increase

∴ Pharmacokinetics of Atropin ∴

→ It is taken orally and its bioavailability is 85 to 90%
→ Its dose is 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.

∴ Therapeutic Use ∴

→ For biology antispasmodic.
→ It is used in the preanaesthetic Medication.
→ In organo phasphorus poisoning.
→ Used In peptic ulcer.
→ It is used in ophthalmic product as a Mydriages effect.
→ It is used in Antiparkinsonism disease.

∴ Side effects ∴

(i) Xerostomia ∴ "Dryness of Mouth"
(ii) Constipation.
(iii) Blood vision.
(iv) Phatofphobia.
(v) Dryness of skin.

∴ Sympathomimetics / Adrenergic drug ∴

∴ Introduction ∴

Those autonomic nervous system from which the neuro-transmeter Adrenaline or Nor Adrenaline, Epinephrine or Nor Epinephrine release and bind with the receptor they are called Sympathomimetics System.

∴ Adrenergic Neurotransmeter ∴

Adrenergic Neurotransmeter → Adrenaline → Epinephrine
Adrenergic Neurotransmeter → Nor Adrenaline → Nor Epinephrine

→ In Adrenergic Neurotransmeter basicaly two types of neurotransmeter are release

(i) Adrenaline

(ii) Nor Adrenaline

→ Adrenaline is also k/a Epinephrine and Nor Adrenaline is also k/a Nor Epinephrine. they are also called emergency neurotransmeter or Emergency hormone

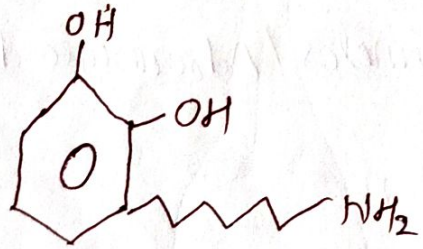
→ They control the different situation like muscle contraction in our body.

∴ Catecholamine ∴

→ Catecholamine is a type of Adrenergic Neurotransmeter

→ In this ring benzene ring is present in this ring two hydroxy group is present in Adjacent position.

- And Amine group is also attach the carbon chain.



Catechol Ring.

Amine Group.

→ Catecholamine Compound never given be oraly.

→ It always taken through injection.

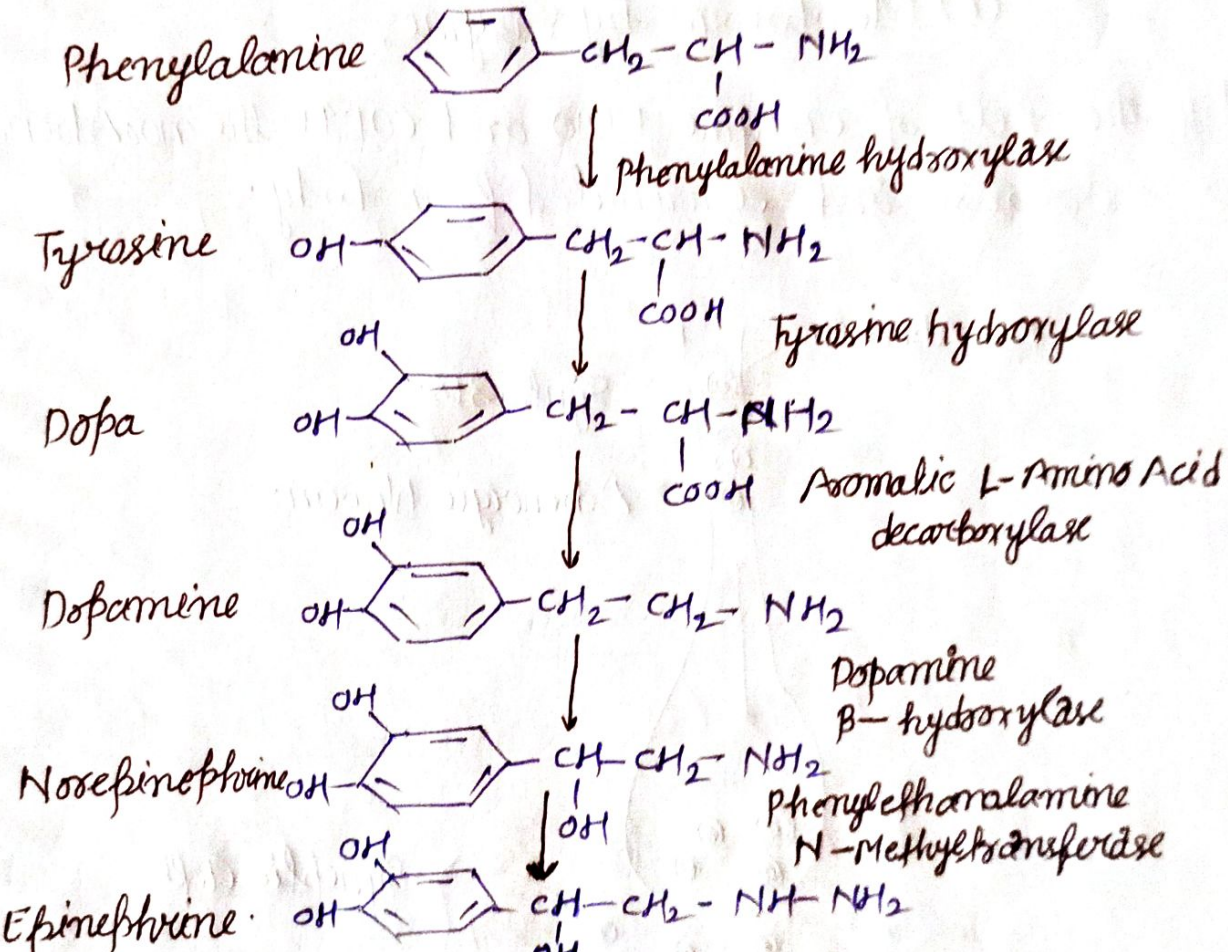
→ The duration of action of Catecholamine is long.

→ Catecholamine Compaunds are never do not crass the BBB so they do not given for the brain problem.

- Catecholamine compounds are highly specialy for oxidation because hydroxyl group.
- So they are always given combination with antioxidant like sodium sulphide.

÷ Synthesis, Storage and Release of Catecholamine ÷

(1) Synthesis of Nor Adrenaline or Nor Epinephrine



(2) Uptake in storage vessicle ÷

- After the formation of Adrenaline it is inclosed inside the vessicle for their long term security.

(3) Release of Neurotransmeter ÷

- By the exocytosis process the neurotransmeter are release from the neurons and comes inside the synaptic cleft.

4. Binding to the receptor.

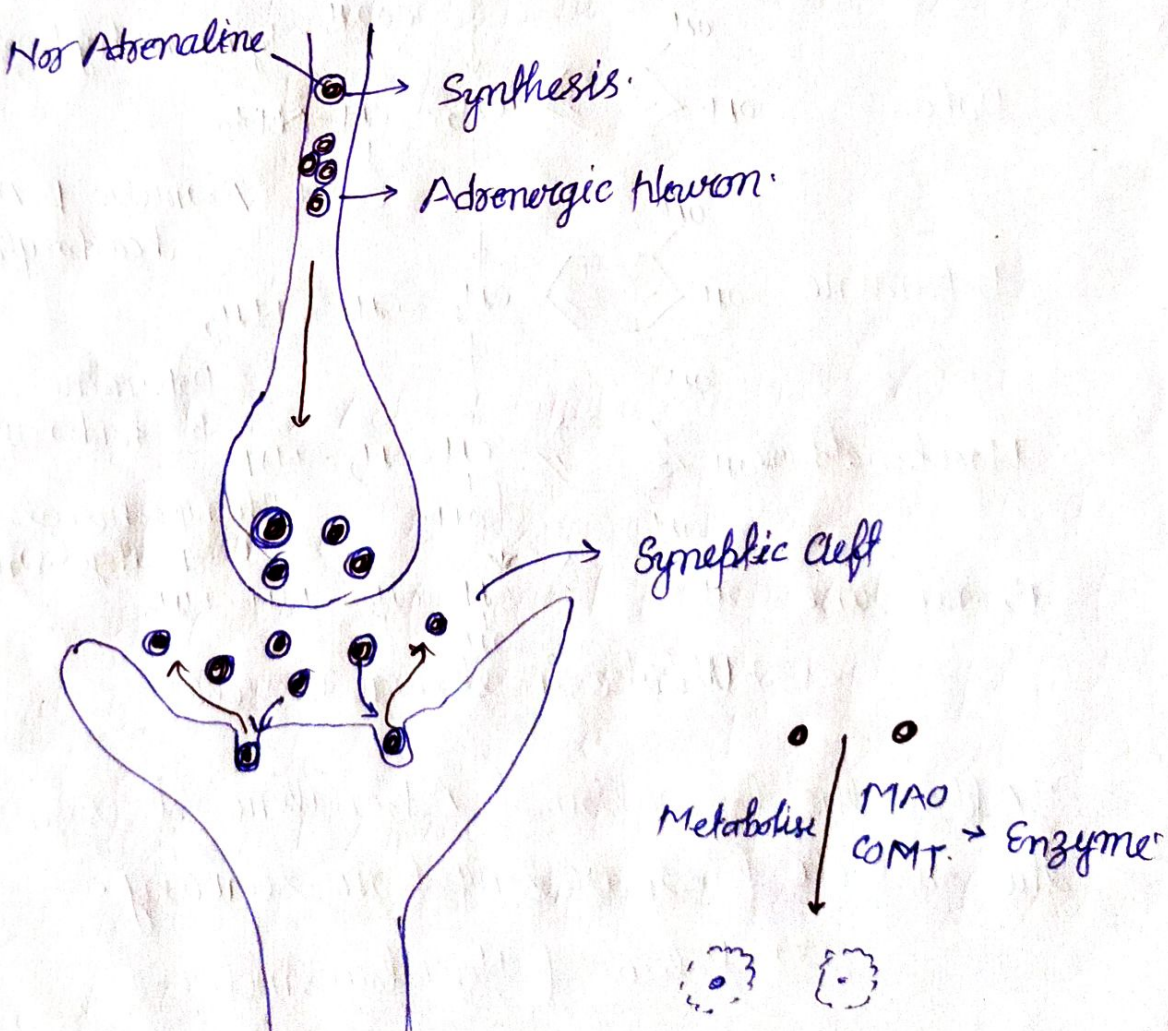
→ Now these neurotransmeter norAdrenaline bind with their alpha and Beta (α, β) receptors on the organs.

(5) Removal of Nor Epinephrine:

→ After the pharmacological action the nor Epinephrine remove the receptor and goes into the synaptic cleft.

(1) Metabolism by Enzyme:

- By the help of enzyme MAO and COMT the norAdrenaline is metabolise and eliminated from body.



Adrenergic Receptor

→ Adrenaline binds with the receptor they are called Adrenergic receptor it is of two types -

(i) α - Alpha
- α_1 - Excitatory
- α_2 - Inhibitory

(ii) β - Beta
- β_1 → Ex.
- β_2 - In.
- β_3 - Ex.

:- α - Receptor

It is of two type :-

(1) α_1 → Smooth muscle of Iris, Blood vessels, Liver, Bladder, Uterus → It is Excitatory in nature.

(2) α_2 → Blood Vessels ⇒ It is Inhibitory in nature.

β - Receptor

It is of ~~three~~ types :-

(1) β_1 - Mycardium Muscle (Heart) → It is Excitatory in Nature

(2) β_2 - Bronchi, Vascular Smooth muscle, Uterus, GIT → it is Inhibitory in nature.

(3) β_3 - Fat Cell in liver → It is Excitatory in nature.

Classification of Sympathomimetic Agent:

(1) Direct Acting.
(2) Indirect Acting.
(3) Mixed Acting.

Sympathomimetic Agent:

Direct Acting
- Nor Ephinephrine.
- Ephinephrine.
- Phenylephrine.
- Dopamine.
- Methyldopa.
- Salbutamal.

Indirect Acting
- Hydroxyamphetamine
- Pseudoephedrine
- Propylhexedrine

Mixed Acting
- Ephedrine
- Meta Araminal.

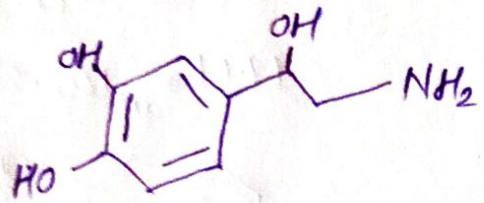
Direct Acting Sympathominetic Agent:

→ They act through complexation with ~~resfonce~~ specific receptors they are represented by nor Adrenaline for the Activation of beta receptor phenolic hydroxy function in meta at the catechal nucleus and at the side chain Hydroxide in beta and Amine especially the phenolic hydroxyl seems to be relatively more critical for Activation of beta receptor.

Nor-Epinephrine :-

Chemical formula → $C_8H_{11}NO_3$

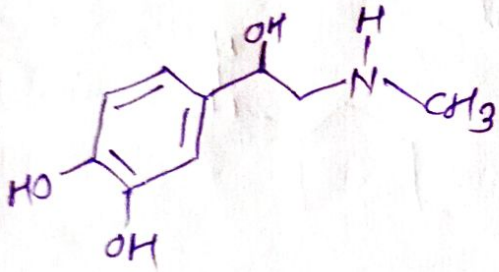
Molecular Mass → 169.18 g/mol



:- Epinephrine :-

C.F → $C_9H_{13}NO_3$

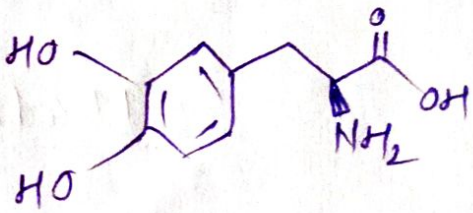
M.M → 183.204 g/mol



Methyldopa

C.F → $C_{10}H_{13}NO_4$

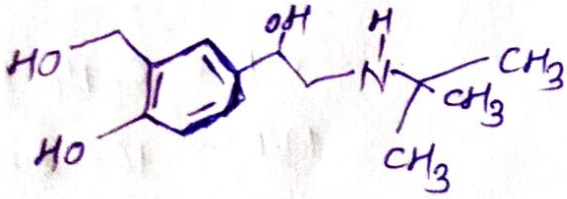
M.M → 211.215 g/mol



Salbutamol

C.F → $C_{13}H_{21}NO_3$

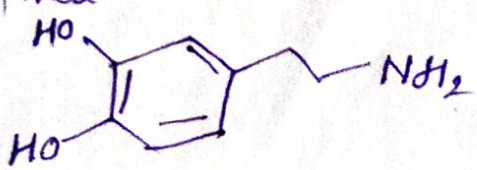
M.M → 239.311 g/mol



:- Dopamine :-

C.F → $C_8H_{11}NO_2$

M.M → 153.18 g/mol

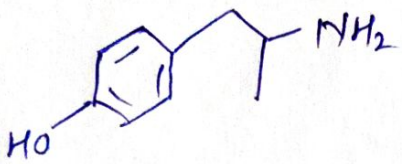


Indirect Acting :-

Hydroxyamphetamine

C·F → $C_9H_{13}NO$

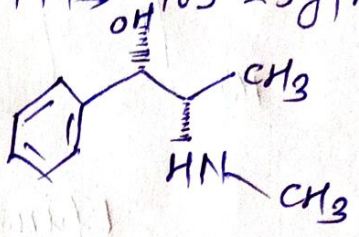
M·M → 151.206 g/mol.



:- Pseudoephedrine :-

C·F → $C_{10}H_{15}NO$

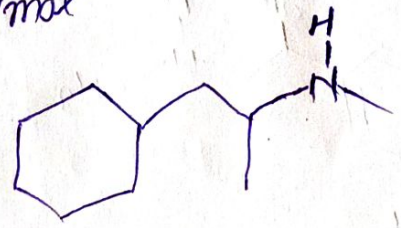
M·M → 165.23 g/mol.



:- Propylhexedrine :-

C·F → $C_{10}H_{21}N$

M·M → 155.29 g/mol

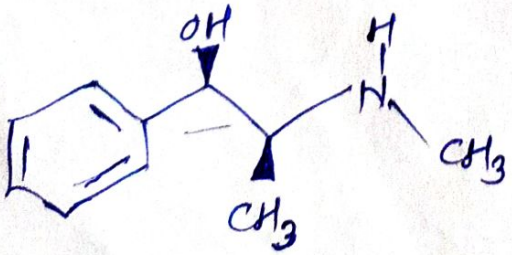


:- Mixed Action :-

Ephedrine

C·F → $C_{10}H_{15}NO$

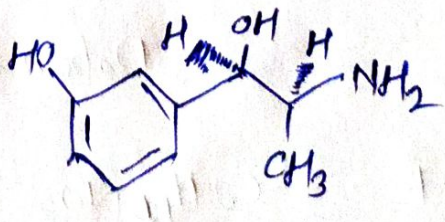
M·M → 165.24 g/mol



Metaraminol.

C·F → $C_9H_{13}NO_3$

M·M → 167.205 g/mol.



Epinephrine / Adrenaline :-

:- Introduction :-

→ Epinephrine, nor epinephrine are the neurotransmeters. And the harmones which is release from the medula part of the Adrenal gland.

→ In 1897 the Scientist Abel & Crowford first discover the Adrenaline or Nor Adrenaline harmones.

→ Epinephrine and nor Epinephrine harmones also called emergency harmones.

:- Pharmacological Action :-

→

(1) :- Action on CNS :-

- When Adrenaline bind with the central nervous system And cross the blood brain barrier. then it is increase the tremor, Restlessness, Palpitation in the brain.

(2) :- Action on Heart :-

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

→ "When, Adrenaline drug bind with the β-receptor of heart then it increase the heart rate."

(3) :- Action on blood vessel :-

- The blood vessel which are present in smooth muscle they shows constriction (Vasoconstriction)

And the blood vessel which are present on skeleton muscle they shows vasodilation.

(4) Action on Blood Pressure :-

→ β- receptors are present on blood vessels. and when Adrenaline drug is bind with the blood vessel then they cause vasconstriction. and increase blood pressure.

(5) Action on respiration :-

→ When adrenaline drug is bind with the respiratory system then it stimulate the respiration and it can also called Apnea. And it cause difficulty in breathing.

(6) Action on Eye :-

→ When Adrenaline is bind with the eye then it dilates our pupil. and causes mydriases.

(7) Action on GIT :-

When Adrenaline drug is bind with our intestine. and GIT then it decrease the peristaltic movement of intestine. and the digestion of food is decrease.

(8) Action on Boonchi

→ When Adrenaline drug also bind with the smath muscle of boonchi then it cause vasodilation. so it is also used in treatment of Asthma.

(9) Action on skeleton Muscle :-

→ In skeleton muscle basically β-receptors are present.
→ When adrenaline bind with the skeleton muscle. then it increased the muscle contraction.

(10) Action on Urinary bladder :-

→ Adrenergic receptor is also present in urinary (system) bladder then it increase the tone of urinary bladder, and it is also called urination.

(11) Action on Metabolism :-

When Adrenaline drug is release then metabolism rate of carbohydrates, fat & Proteins are increase.

:- Pharmacokinetics :-

→ Adrenaline and nor Adrenaline are Generally given in IV, and Subcuteneous route.
→ There on set of Action 3 to 5 minute.
→ There duration of Action is About 20 minute.
→ 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 construction.
→ Used in nasal decongestant.

÷ Side effect ÷

→ Nausia
→ Vomating.
→ Anorexia.
→ Dyspnea
→ Anxiety.
→ Headache.

÷ Non Catecholamine ÷

It is of two type.

(i) Ephedrine.
(ii) Amphetamine.

What are Adrenergic Antagonists.

→ Drugs which antagonize the action of Epinephrine and Nor Epinephrine at the receptor level.
→ The occupy Adrenergic receptors (α and β) but do not produce signal transduction.
→ Can be reversible or irreversible.
→ Classified according to relative affinity for α or β receptors.

÷ α-Adrenergic blockers ÷

- Phenoxybenzamine.
- Phentolamine.
- Prazosin.
- Terazosin.
- Doxazosin.

÷ Phenoxybenzamine & Phentolamine ÷

- Non-Selective α blockers.

÷ Actions ÷

- Block of α_1 receptor →
  - Vasodilation and postural hypotension.
- Block of α_2 receptor ÷
  - Reduced Nor Epinephrine action on α_2 receptors on the varicosity.
  - Increases release of NE from varicosity which can cause tachycardia and increased CO.

÷ Mechanism of Action ÷

- Binds covalently (And therefore irreversibly) to α receptor. and blocks Nor Adrenaline Action.
- Action is reversible in the case of phentolamine

÷ Pharmacokinetics ÷

→ Given orally, IV and SC injection.

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

→ $T_{1/2}$ for Phentolamine = 3 hours.

÷ Clinical use ÷

→ Used in treatment of phaeochromocytoma.

÷ Adverse Effects ÷

→ Postural hypotension.

→ Tachycardia.

→ Dizziness and headache.

→ Sexual disfunction.

Prazosin, Terazosin and doxazosin ÷

→ Selective α_1 Antagonist.

÷ Action ÷

→ Vasodilation and reduction in BP.

→ Increase HR (a reflex β_1 receptor resfponce to the decrease in BP)

→ Decrease bladder sphincter tone.

→ Inhibition of hyperbophy on smoth muscle of bladder neck and prostate capsule.

÷ Mechanism of Action ÷

Block the action of Endogenous and exogenous agonists on the α_1 receptor

- → Decrease peripheral vascular resistance.
- → Relaxes arterial and venous smooth muscle.
- → Causes minimal changes in CO, renal blood flow and GFR.

÷ Pharmacokinetics ÷

Prazosin and Terazosin.

- → Absorbed orally.
- → $T_{1/2}$ = 3-4 hours.
- → Metabolised by liver.
- → Extensive 1st pass metabolism.

÷ Doxazosin ÷

$T_{1/2}$ = 22 hours.

÷ clinical uses ÷

- Severe hypertension.
- Benign prostatic hypertrophy.

÷ Adverse Effects ÷

- → Orthostatic hypotension.
- → Dizziness.
- → Hypersensitivity reactions.
- → Insomnia.
- → Priapism.

÷ β- Adrenergic blockers ÷

- Propranolol
- Timolol
- Nadolol
- Acebutolol
- Atenolol
- Metoprolol
- Esmolol

÷ Non Selective ÷

- Propranolol
- Timolol
- Nadolol

B_1 selective (Cardioselective)

- Acebutolol
- Atenolol
- Metoprolol
- Esmolol

Propranolol

- Non selective β blocker

÷ Action ÷

- CVS
- Decreases CO (-ve inotropic and chronotropic effects)
- Decreased SA and AV Node Activity.
- Peripheral vaso constriction via increased peripheral resistance

- Bronchoconstriction.
- Reduces renin release
- Decreased glycogenolysis and Glucagon secretion.

∴ Mechanism of Action ∴

- Block sympathetic drive.
- Reducing pacemaker activity and increases AV conduction time.
- Reduces the slow inward Ca^{2+} current.

∴ Pharmacokinetics ∴

- Orally Administered.
- Almost completely absorbed.
- Extensive 1st pass metabolism (only 0.25 bioavailability)
- Large volume of distribution.
- Readily crosses blood brain barrier.
- Metabolites excreted in urine.

∴ Therapeutic Uses ∴

- Class II Antiarrhythmic.
- Hypertension.
- Angina pectoris.
- Migraine
- Hyperthyroidism.
- Prevention of death by dysrhythmia following myocardial infarction.
- Paroxymal Astrial fibrillation.

÷ Adverse effects ÷

- Bronchoconstriction.
- Arrhythmias (If stopped Abruptly)
- Sexual Impairment.
- Metabolic disturbances (Fasting hypoglycemia)

CNS- effects:

- Dizziness.
- Lethargy
- Fatigue.
- Weakness
- Visual disturbances.
- Hallucinations.
- Short term memory loss.
- Emotional Lability.
- Vivide dreams
- Depression.

÷ Nadolol & Timolol ÷

- Non Selective beta Antagonists.
- Nadolol has very long duration of action.

÷ Action ÷

- Decreases Intraocular pressure
- More potent than propranolol.

÷ Mechanism of Action ÷

- Reduce production of Aqueous humor in the eye.
- Decrease secretion of Aqueous humor by ciliary body
- Do not cause cycloplegia.

∴ Pharmacokinetics ∴

→ Onset is about 30 minutes when administered intraocularly.

→ Duration of action = 12 to 24 hours.

∴ Clinical Use ∴

→ Chronic Mangement of Glaucom.

← Acebutolol, Atenalol, Bisaprolal, Esmalol, & Metaprolol

→ Selective beta blockers – known as cardioselective.

→ Selectivity is lost at high doses.

∴ Action ∴

→ Decrease BP in hypertension.

→ Increase Exercis tolerance in Angina.

∴ Pharmacokinetics ∴

→ Orally administered.

→ $T_{1/2}$ → Atenalol = 6 hours.

→ Esmalol = 10 hours.

∴ Clinical Use ∴

→ Emergency treatment of supraventricular dysrhythmias (Esmolol)

→ Antihypertensive in abetic patients receiving insulin or oral hypoglycemic agents.

÷ Skeletal Muscle Relaxant ÷

→ Skeletal muscle relaxants are drugs that act peripherally at neuromuscular junction / muscle fibre itself or centrally in the cerebrospinal axis to reduce muscle tone and / or cause paralysis

- A muscle relaxants is a drug that affects skeletal muscle function and decreases the muscle tone.
- It may be used to improve symptoms such as muscle spasms, pain and hyperreflexia.

÷ Peripherally acting muscle relaxants ÷

Neuromuscular blocking agent ÷

→ Nondepolarizing (Competitive blockers)

Long Acting ÷ d-Tubocurarine, Pancuronium, Doxacurium. pipecuronium.

Intermediate Acting ÷ Vecuronium, Atracurium, Cisatracurium Rocuronium, Rapacuronium.

Short Acting ÷ Mivacurium.

→ Depolarizing blockers ÷ Succinylcholine (Sch), Decamethonium

÷ Centrally Acting Muscle relaxants ÷

- Classification ÷

Class	Example
Mephenesin congeners	Mephenesin Carisoprodol Chlorzoxazone Chlormezanone Methocarbamal.
Benzodiazepines	Diazepam & others.
GABA mimetic	Baclofen Thiocolchicoside
Central α_2 Agnist	Tizanidine.

÷ Nondepolarizing Competitive blockers ÷

MOA ÷ The site of action of both competitive & depolarizing blockers is the end plate of skeletal muscle fibre.

Pharmacological Action ÷

Skeletal Muscles ÷ Intravenous injection of nondepolarizing blockers rapidly produces muscle weakness followed by flaccid paralysis.

- Autonomic Ganglia ÷ Produce some degree of ganglionic blockade.

Histamine release ÷ d-TC releases histamine from mast cells. histamine release contributes to the hypotension produced by d-TC. Flushing bronchospasm and increased respiratory secretions are other effects.

Cardiovascular System:- d-Tubocurarine produces significant fall in BP. This is due to -
- Ganglionic blockade.
- Histamine release and
- Reduced venous return.

Gastrointestinal Track:- The ganglion blocking activity of competitive blockers may enhance postoperative paralytic ileus after abdominal operations.

Central Nervous System:- All neuromuscular blockers are quaternary compounds → do not cross blood brain barrier.

:- Non depolarizing blockers - Individual Compounds:-

d-Tubocurarine:- Not clinical used do to its histaminic effects.

Succinylcholine:- Sch is most commonly used muscle relaxant for passing tracheal tube.
- It induces rapid, complete and predictable paralysis with spontaneous recovery in ~ 5 min.
- Occasionally Sch is used by continuous IV infusion for producing controlled muscle relaxation of longer duration
- It should be avoided in younger children unless absolutely necessary, because risk of hyperkalaemia and cardiac arrhythmia is higher.

→ Pancuronium:- It is a synthetic steroidal compound ~5 times more potent and longer acting than d-Tc.
→ Because of longer duration of action needing reversal, its use is now restricted to prolonged operations, especially neurosurgery.

Pipecuronium:- Muscle relaxant with a slow onset and long duration of action, steroidal in nature, recommended for prolonged surgeries.

Nondepolarizing blockers → Individual compounds uses:-

Adjuvants to general Anaesthesia

→ The most important use of neuromuscular blockers is as adjuvants to general Anaesthesia.
→ Choice of the neuromuscular blocker depends on the nature and duration of the procedure; pharmacokinetics of the blocker and cardiovascular stability that it provides.
⇒ Vecuronium & rocuronium are the most frequently selected nondepolarizing blockers.

:- Assisted ventilation:-

Critically ill patients in intensive care units often need ventilatory support.
→ Convulsions and trauma from electroconvulsive therapy can be avoided by the use of muscle relaxants without decreasing the therapeutic benefit.

Assisted ventilation: Critically ill patients in intensive care units often need ventilatory support.

÷ Directly Acting Muscle relaxants:

Dantrolene: Dantrolene acts on the RyR1 (Ryanodine receptor) calcium channels in the sarcoplasmic reticulum of skeletal muscle and prevents Ca^{2+} induced Ca^{++} release through sarcoplasmic reticulum.

- Dantrolene is slowly but Adequately absorbed from the GIT. it penetrates brain and produces some sedation, but has no selective effect on polysynaptic reflexes responsible for spasticity.

Comparative features of centrally and peripherally Acting ÷ muscle relaxants:

Centrally Acting	Peripherally Acting.
- Decrease muscle tone without reducing voluntary power.	- Cause muscle paralysis Volentary movements lost
- Selectively inhibit polysynaptic reflexes in CNS.	Block neuromuscular transmission.
- Causes some CNS Depression.	No effect on CNS.
- Given orally sometimes parenterally.	- Practically Always given IV.
- Used in chronic spastic, conditions acute muscle spasms, tetanus	- Used for short term purpose (surgical operations)

÷ Baclofen ÷

- This analogue of the inhibitory transmitter GABA acts as a selective $GABA_B$ receptor Agonist.
- The primary site of action of baclofen is considered to be in the spinal cord where it depresses both polysynaptic monosynaptic reflexes.
- As such it does produce muscle weakness but it less sedative than diazepam.
- → Baclofen is well absorbed orally and is primarily excreted unchanged in urine with a $t_{1/2}$ of 3-4 hours.

÷ Side effect ÷

Side effect are drowsiness, mental confusion weakness and ataxia, serum transaminases may rise sudden withdrawal after chronic use may cause hallucinations. tachycardia and seizures.

÷ Tizanidine ÷

→ This clonidine congener is a central α_2 Adrenergic Agonist - inhibits release of excitatory amino acids in the spinal interneurones.

It may facilitate the inhibitory transmitter glycine as well.

Use of centrally Acting muscle Relaxants

→ Acute muscle spasms.

→ Torticollis. lumbago, backache, neuralgias.

→ Anxiety and tension.
→ Spastic neurological diseases.
→ Tetanus.
→ Electroconvulsive therapy
→ Orthopedic manipulations.

÷ Local Anaesthetics ÷ (LA)

→ Local Anaesthetics are those dougs which blocks the neuronal conduction at local particular area.
→ And it is helpful for minor surgery.
→ Local Anaesthetics ~~→~~ produce reversible action.
Generally

÷ Classification ÷ of LA)

÷ Injectable Anaesthetic ÷

÷ Low potency, short duration ÷

Procain
Chloroprocaine

पिरकी काना परगा

→ Intermediate potency and duration ÷

Prilocaine
Lidocaine (Lignocaine)

पार्ले जी ला दो

→ High potency, long duration ÷

- Tetracaine (Amethocaine
- Bupivacaine

→ Ropivacaine
- Dibucaine (cinchocaine)

तेरा बाप भी से दिया

∴ Surface Anaesthetic ∴

Soluble Insoluble ∴

Benoxinate
Tetracaine.
Cocaine
Lidocaine

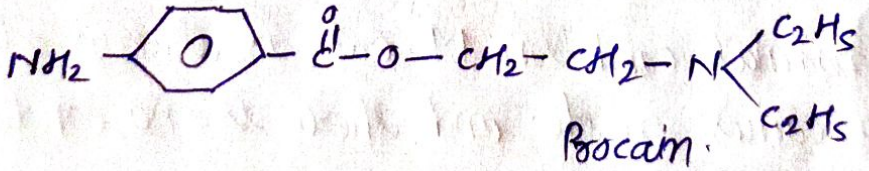
वहनो ट्रेक्टर को ला दो

Insoluble Insoluble ∴

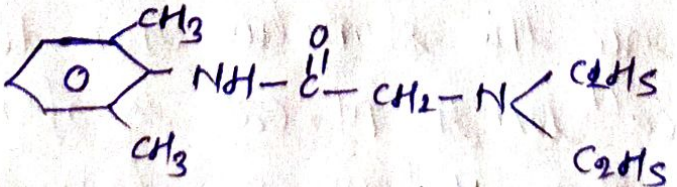
Oxethazain
Benzocaine
Butylaminobenzoate ∴

ओ वहन बोतल दो

∴ Chemistry of local Anaesthetics ∴



Procain



Lidocain

→ All types of local Anaesthetics drugs contain tertiary amine structure. sathey are basic in nature
→ All the local Anaesthetics contains two types of bond

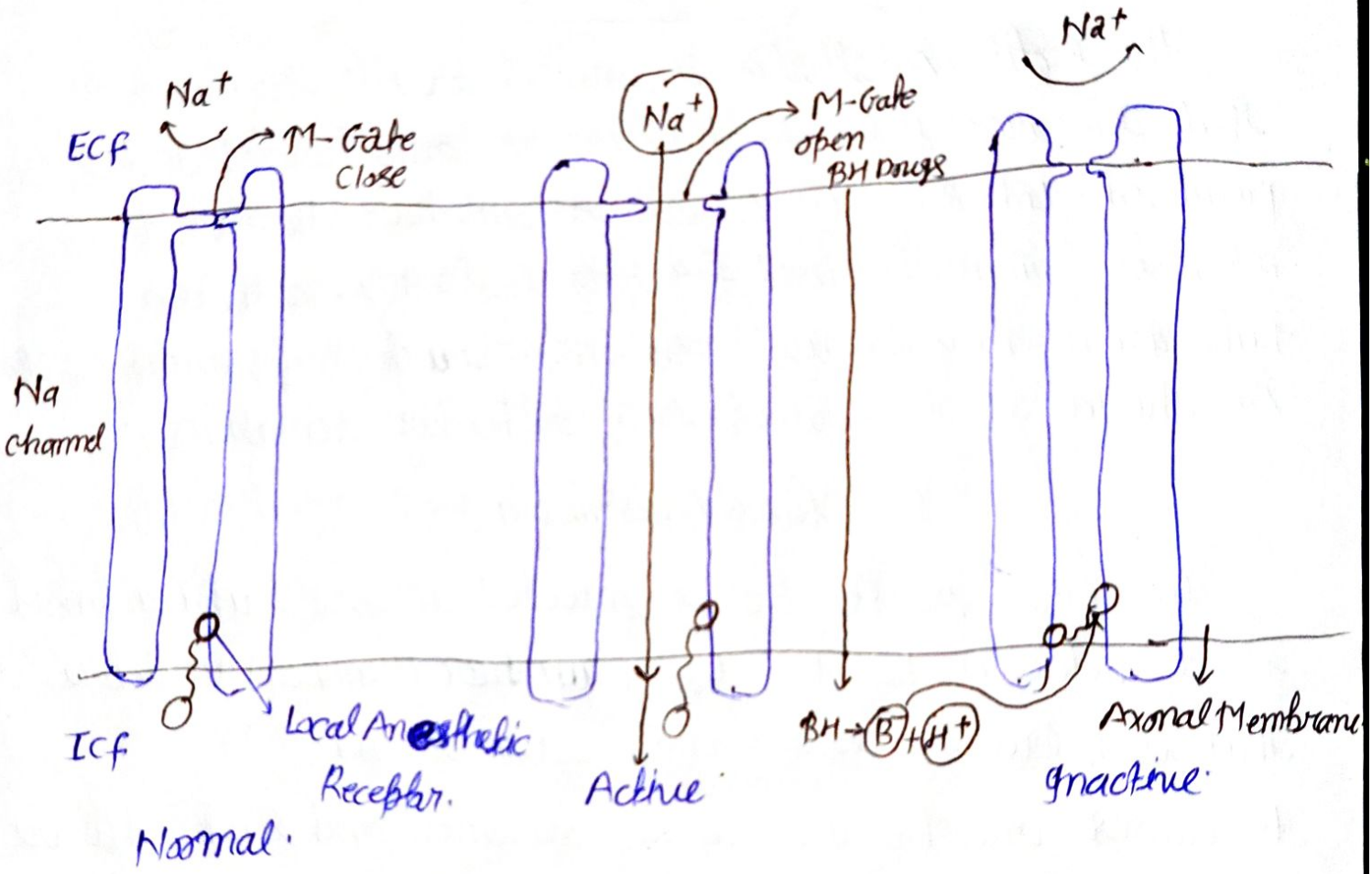
- Ester bond for ex- procain and one is Amide bond for example Lidocain.
- ⇒ Easter bond is easily hydralise so there duration of Action is less.
- And Amide bond is nat easily hydrolize so there duration of Action is long.
- They also contain phenyl grauf which have diff-2 compound.

÷ Mechanism of Action ÷

- ⇒ Basically local Anaesthetics dougs blocks the Axonal membrane in conduction of neuron and the suffply of neuron from brain to organ.
- ⇒ In the axonal membrane basically sodium channel is present in which M-Gate & LA (Local Anaesthetic receptor) is present.
- ⇒ When M- at normal condition M-Gate is always closed no sodiam ion comes inside and there is no conduction of any signal.
- ⇒ When body receive the stimulus then due to transmission of ca^{++} ion the M-Gate is open and when M-Gate is open then Na^{+} ion pass from Ecf to Icf and conduction generated signal goes to the brain.
- ⇒ When LA Dougs is given this is basic drug in nature and they cross the Axonal membrane & in Icf the dissociate into the ionic form.

⇒ This ionic form of LA drugs bind with the LA receptor which is present in sodium channel and the block the receptor or close the channel.

⇒ And no Na^+ ion pass from ECF to ICF. That is why the conduction is completely blocks.



Techniques of Local Anesthetics:-

(i) Surface Anesthesia:-

⇒ It is produced by topical application of surface Anesthesia to mucous membranes.

⇒ The superficial layer is anesthetised. Except for lidocaine/prilocaine are capable to anesthetising the skin intact

(2) ÷ Infiltration Anesthesia ÷

- A dilute solution of local Anesthetic is infiltrated under the skin in the area of surgical operation.
- It blocks sensory nerve endings. Lidocaine 30 to 60 minute, bupivacaine 120 to 180 minute has duration of nerve block.

(3) Conduction block ÷

→ The local Anesthetic is injected around the nerve so that the area distal to injection is anesthetized and paralised. Lidocaine 1-2 %, with intermediate duration of action is commonly used for long lasting Anesthesia bupivacaine may be used. The main purpose of nerve block Anesthesia is to Abolish pain and other sensations.

÷ Spinal Anesthesia ÷

→ The local Anesthetic is injected in the subarachnoid space between L_2-4 or L_3-4 lumber (lumber) vertebra that is below the lower end of spinal cord.

It causes anesthesia to lower abdomen and limbs that are Anesthetized and paralyzed. spinal anesthesia is ed for surgery of lower limbs pelvis, lower abdomen, fracture setting, obstetric. Caesaream operation. Women during the late pregnancy need fewer doses for spinal Anesthesia.

The spinal anesthesia has following advantages over general Anesthesia

→ It is safe

→ It produces Analgesia and muscle relaxants without loss of consciousness.

→ Diabetes, cardiac, renal disease, pulmonary disease do not interfere much and poses less problem in treatment

→ The complications of spinal Anesthetics are Nausea & Vomiting.

→ It occurs after abdominal surgery.

→ It is due to reflexes initiated by traction on Abdominal viscera. It can be controlled with opoid Analgesics

Headache :- It is due to seepage of cerebrospinal fluid. Use small bore needle to minimise this effect.

- Septic meningitis it is due to infection introduced/entered during lumbar puncture.
- Cauda equine Syndrome.

→ Respiratory Paralysis.

→ Hypotension.

→ Spinal Anesthesia is contraindicated in uncooperative or mentally ill patients, infants and children vertebral abnormalities like lumbar lodosis, Kyphosis and a patient with hypotension and hypovolaemia

(5) Epidural Anaesthesia :-

Lidocaine and bupivacaine are popular drugs for epidural anaesthesia.

→ Action of both drugs is prolonged by Addition of Adrenaline.

→ Epidural Anaesthesia is technically difficult than the spinal Anesthesia and large quantity of drug is needed.

→ Epidural Anaesthesia is of three types depending on the site of injection.

(a) Thoracic injection is administered in the mid thoracic region.

→ The epidural space in this region is narrow, smaller volume of needed and a wide segmental band of analgesia involving the middle thoracic dermatomes is produced.

→ Thoracic Anaesthesia is used for pain relief of thoracic & upper abdomen surgery.

(b) Caudal Anaesthesia:- Injection is given in the sacral canal through the sacral hiatus and produces Anaesthesia of pelvic and perianal region.

It is used for vaginal delivery Anorectal and genitourinary operations.

(c) Lumbar Anaesthesia:- Large volume of drug is needed because epidural space is wide. It produces Anaesthesia of lower abdomen, pelvis and hind limb.

Individual compound:-

:- Cocaine :-

Cocaine is an ester of benzoic acid and is found naturally in the leaves of Erythroxylon coca. It is odourless, colorless white crystalline powder. It is slightly volatile in nature and is slightly soluble in water. It has been used medically and recreationally for many hundreds of years. In Addition to its local Anaesthetics action on nerve membranes, it is also

Able to block the re-uptake of norepinephrine at sympathetic neurones, potentiating the effects of catecholamines It is used as a topical Anaesthetic usually for procedures involving the nasal mucosa. It was traditionally combined with ephinephrine and bicarbonate as Moffet's solutions to provide a solution with very intense vasconstrictor properties. Cocaine should not be injected.

= Cocaine is used as cocaine hydrochloride. Cocaine is dangerous for Administrations as a spinal anesthesia. The repeated use of cocaine may lead to drug dependence. Cocaine produces central nervous system stimulation with effect on mood and behaviour. It produces state of well being delayed fatigue and increase power of patience.

∴ Side effect ∴

Cocaine indiosyncrasy headache faintness cocaine eye drops may cause loosening of corneal epithelium and corneal erosion.

∴ poisoning ∴

In acute cocaine poisoning convulsions may be treated with diazepam respiratory depression with artificial respiration.

∴ Brand name ∴

Cophelto, C - Topical Solution.

Procaine

→ Discovered for the first time in 1905, Novocain (the trade name of procaine) is a local anaesthetic of the ester type that is able to induce a loss of sensitivity when injected unlike the oral intake that has been established to exert therapeutic values. The first local synthetic anesthetic that was produced, novocaine was used primarily for oral surgical surgeries in dentistry, however since foregin anesthetics generally have a high potential to cause allergic reactions they eventually becomes obsolete and eventually are replaced by a more effective anesthetic known as lidocaine.

Side effect:

Heartburn, migraines nausea and can induce a serious condition known as systemic lupus erythematosus (SLE)

Brand Name

Novocain, Mericaine.

Chloroprocaine

Chloroprocaine is a local ester anesthetic used in the united states. UU. which now increases again in use in Europe.

→ It has limited cardiotoxicity due to rapid ester hydrolysis. and this is due to a maximum dose of 10mg/kg it is particularly useful for saving the inadequate obstetric epidural block, where large amounts of local amide Anesthetics have Already been used.

This is because it has a rapid onset of action, deposite having a high pKa, which is possible through the use of higher doses due to the lower potential for systemic toxicity. Used in the 1970s and 1980s its intrathecal use diminished. after the discovery of neurotoxicity when used in subarachnoid blocks, probably due to Additives, however, the recent development of chloroprocaine without preservatives has rekindled the interest in its use in this environment

Benzocaine

Benzocaine is a local anesthetic of the Atypical ester and is the ethyl ester of PABA. The ethyl side chain group has no amino component, therefore remains Attached and is poorly soluble in water. Higher concentrations have the potential to cause methemoglobinemia. Its use is largely limited to topical analgesia, as is the treatment of pain associated with oral and cutaneous ulcers.

Lidocaine (Lignocaine)

Introduced in 1947, Lidocaine is a derivative of the tertiary starch of diethylaminoacetic acid. In concentrations from 0.5 to 1 percent, it is able to provide a deep block with a fast start speed due to its low pKa. The protein binding is relatively low so its duration of action is predictably short. It is also used intravenously as a class 1b antiarrhythmic agent. As an indicator of its impressive safety, Intravenous Lignocaine is often used in voluntary

studies to familiarize individuals with the symptoms of local Anesthetic toxicity. Lidocaine is a versatile local anesthetic. It is suitable for local or surface applications as well as for injection use it is injected around a nerve that blocks the guide in three minutes while the procaine lasts about 15 minute the Anesthesia is more intense and lasting.

Pharmacokinetics

Onset of action 4 to 17 minutes duration of Action 3 to 6 hours plasma half life by IV injection is about 13 min by IM injection 90 minute, half life is increased in liver disease.

Indication

Epidural, surgical spinal anesthesia, periferal nerve block insect bites minor burns painful cystitis.

Availability

Injections Cesicaine 30 ml vial.

Side effects

Nausia vomiting blurred vision, constriction of pupils of eye, Anaphylaxis, rash, Edema, tissue necrosis. cardiac arrest, hypotension, fectal bradycardia, tremors shivering, drowsiness, loss of consciousness.

contraindications

Hypersensitivity, healic impairment, ~~pregnancy~~ pregnancy, child below 12 years of age.