

# Chapter-6 | P. Chemistry

## Drugs Acting on Autonomic Nervous System

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### In Syllabus:

Study of the following category of medicinal compounds with respect to classification, chemical name (IUPAC Name), chemical structure (compounds marked with\*) uses, stability and storage conditions, different types of formulations and their popular brand names:

### Drugs Acting on Autonomic Nervous System

#### Sympathomimetic Agents (Adrenergic Agonists)

Direct Acting Agents :

- Nor-epinephrine, \*
- Phenylephrine,
- Terbutaline,
- Naphazoline, \*
- Epinephrine,
- Dopamine, \*
- Salbutamol,
- Tetrahydrozoline

Indirect Acting Agents :

- Hydroxyamphetamine,
- Pseudoephedrine

#### Sympathomimetic Agents (Adrenergic Agonists)

Mixed Acting Agents :

- Ephedrine,
- Metaraminol



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## Adrenergic Antagonists (Sympatholytic Agents)

Alpha Adrenergic Blockers :

- Tolazoline,
- Phentolamine,
- Phenoxybenzamine,
- Prazosin.

## Adrenergic Antagonists (Sympatholytic Agents)

Beta Adrenergic Blockers :

- Propranolol, \*
- Atenolol, \*
- Carvedilol

## Cholinergic Drugs And Related Agents

( PARASYMPATHOMIMETRIC )

Direct Acting Agents

- Acetylcholine, \*
- Carbachol,
- Pilocarpine.

Cholinesterase Inhibitors (Indirect Acting Agents)

- Neostigmine, \*
- Edrophonium chloride,
- Tacrine hydrochloride,
- Echothiophate iodide.

## Cholinergic Blocking Agents (Cholinergic Antagonists)

- Atropine sulphate, \*
- Ipratropium bromide.

Synthetic Cholinergic Blocking Agents

- Tropicamide,
- Cyclopentolate hydrochloride,
- Clidinium bromide, and
- Dicyclomine hydrochloride. \*



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## Drugs Acting on Autonomic Nervous System:

- Drugs acting on the autonomic nervous system (ANS) are a class of medications that affect the involuntary control of certain bodily functions, such as heart rate, blood pressure, and digestion.
- These drugs can either inhibit or enhance the functions of the parasympathetic and sympathetic nervous systems.

## SYMPATHOMIMETIC AGENTS (ADRENERGIC AGONISTS)

### Direct Acting Agents :

- Nor-epinephrine, \*
- Phenylephrine,
- Terbutaline,
- Naphazoline, \*
- Epinephrine,
- Dopamine, \*
- Salbutamol,
- Tetrahydrozoline

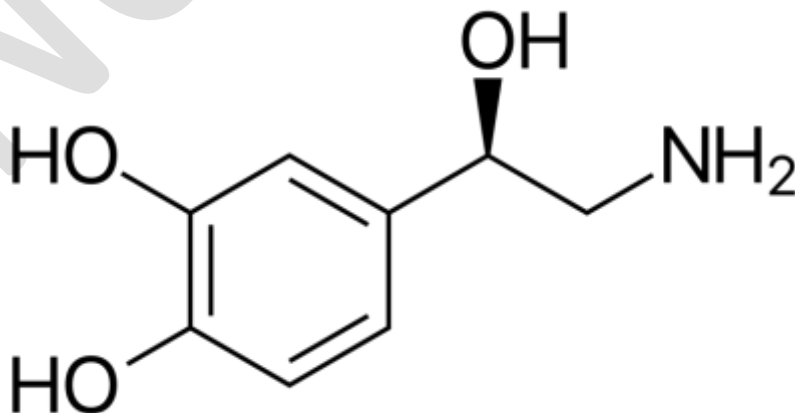
### Nor-epinephrine, \*

- Norepinephrine, also known as noradrenaline, is both a neurotransmitter and a hormone. It plays an important role in your body's "fight-or-flight" response.

### Chemical Name:

4-[(1R)-2-amino-1-hydroxyethyl]benzene-1,2-diol

### Chemical Structure:



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## Uses:

- As a medication, norepinephrine is used to increase and maintain blood pressure in limited, short-term serious health situations.

## Stability and storage conditions:

- Solutions of norepinephrine should be stored in PVC bags at 4°C for 61 days with protection from light

## Types of formulations:

- Intravenous solution
- Injectable solution

## Popular brand names:

- Levarterenol,
- Levophed,
- Norepin

## Phenylephrine,

- Phenylephrine is used to relieve nasal discomfort caused by colds, allergies, and hay fever.

## Chemical Name:

- (R)-3-[-1-hydroxy-2-(methylamino)ethyl]phenol

## Uses:

- It is also used to relieve sinus congestion and pressure.
- Phenylephrine will relieve symptoms but will not treat the cause of the symptoms or speed recovery.

## Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Types of formulations:

- Nasal Drop
- Solution,
- Tablets,
- Granules

## Popular brand names:



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- Nostril
- Pretz-D
- Rhinall
- Tur-Bi-Cal

## **Terbutaline,**

Terbutaline is in a class of medications called beta agonists. It works by relaxing and opening the airways, making it easier to breathe.

**Chemical Name:** (RS)-5-[2-(tert-Butylamino)-1-hydroxyethyl]benzene-1,3-diol

### **Uses:**

- Terbutaline is used to prevent and treat wheezing, shortness of breath, and chest tightness caused by asthma, chronic bronchitis, and emphysema.

### **Stability and storage conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### **Types of formulations:**

- Powder,
- Solution

### **Popular brand names:**

- Brethaire,
- Brethine



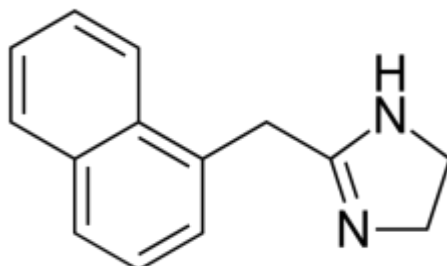
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## Naphazoline, \*

**Chemical Name:** 2-(naphthalen-1-ylmethyl)-4,5-dihydro-1H-imidazole

**Chemical Structure:**



**Uses:**

- Naphazoline is used to relieve redness due to minor eye irritations, such as those caused by colds, dust, wind, smog, pollen, swimming, or wearing contact lenses.

**Stability and storage conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

**Types of formulations:**

- Nasal Drops
- Ophthalmic gel forming solution,
- Ophthalmic solution

**Popular brand names:**

- Naphcon-A

## Epinephrine,

**Chemical Name:** 4-[(1R)-1-hydroxy-2-(methylamino)ethyl]benzene-1,2-diol

**Uses:**

- Epinephrine injection is used along with emergency medical treatment to treat life-threatening allergic reactions caused by insect bites or stings, foods, medications, latex, and other causes

**Stability and storage conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

**Types of formulations:**



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- Injection solution

## Popular brand names:

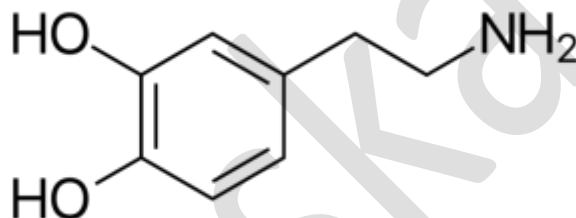
- EpiPen,
- AdrenaClick

## Dopamine, \*

- Dopamine is a type of neurotransmitter and hormone. It plays a role in many important body functions, including movement, memory and pleasurable reward and motivation.
- High or low levels of dopamine are associated with several mental health and neurological diseases.

**Chemical Name:** 4-(2-aminoethyl)benzene-1,2-diol

## Chemical Structure:



## Uses:

- Dopamine is a peripheral vasostimulant used to treat low blood pressure, low heart rate, and cardiac arrest.
- Dopamine (Intropin) is used to treat shock and low blood pressure caused by heart attack, trauma, infections or surgery.

## Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Types of formulations:

- Injectable solution

## Popular brand names:

- Intropin

## Salbutamol,

- It works by relaxing the muscles of the airways into the lungs, which makes it easier to breathe. Salbutamol comes in an inhaler (puffer).

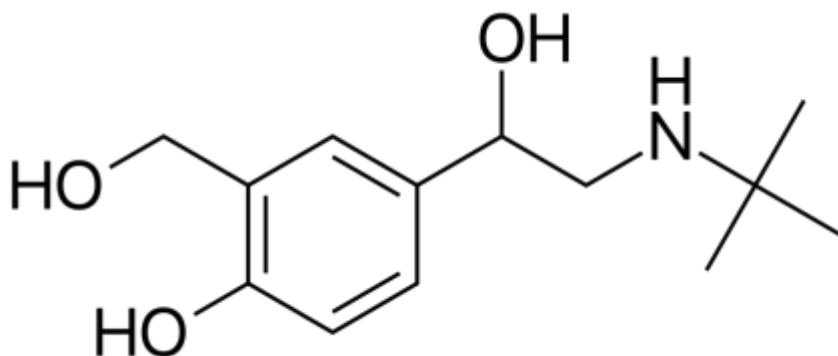


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**Chemical Name:** (RS)-4-[2-(tert-Butylamino)-1-hydroxyethyl]-2-(hydroxymethyl)phenol

**Chemical Structure:**



**Uses:**

- Salbutamol is used to relieve symptoms of asthma and chronic obstructive pulmonary disease (COPD) such as coughing, wheezing and feeling breathless.

**Stability and storage conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

**Types of formulations:**

- Aerosol,
- Solution,
- Tablets
- inhaler

**Popular brand names:**

- Ventolin,
- Airomir,
- Asmalal,
- Easyhaler,
- Pulvinal,
- Salamol,
- Easi-Breathe,
- Salbulin, etc.

**Tetrahydrozoline:**

- Tetryzoline, also known as tetrahydrozoline, is a derivative of imidazoline with central and peripheral alpha ( $\alpha$ )-adrenergic properties.
- Tetryzoline is a drug used in some over-the-counter eye drops and nasal sprays.



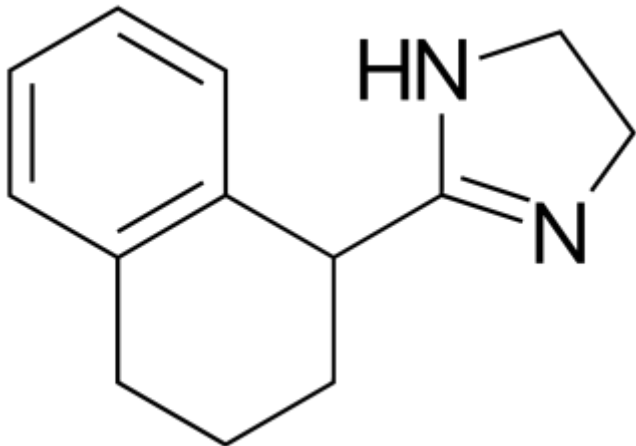


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**Chemical Name:** (RS)-2-(1,2,3,4-tetrahydronaphthalen-1-yl)-4,5-dihydro-1H-imidazole

**Chemical Structure:**



**Uses:**

Ophthalmic tetrahydrozoline is used to relieve minor eye irritation and redness caused by colds, pollen, and swimming.

**Stability and storage conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

**Types of formulations:**

- Eye Drops

**Popular brand names:**

- Visine



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## Indirect Acting Agents :

- Hydroxyamphetamine,
- Pseudoephedrine

## Hydroxyamphetamine:

- 4-Hydroxyamphetamine, also known as hydroxyamfetamine, is a drug that stimulates the sympathetic nervous system.
- It is used medically in eye drops to dilate the pupil, so that the back of the eye can be examined.

**Chemical Name:** Hydroxyamphetamine hydrobromide

### Uses:

- It also reduces your body's ability to adjust your eye for near vision. These drops are used when you have your eyes examined by the eye doctor.

### Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Types of formulations:

- Eye Drops

### Popular Brand Name:

- Paremyd

## Pseudoephedrine:

- Pseudoephedrine is a sympathomimetic drug of the phenethylamine and amphetamine chemical classes.
- It may be used as a nasal/sinus decongestant, as a stimulant, or as a wakefulness-promoting agent in higher doses.

**Chemical Name:** (S,S)-2-methylamino-1-phenylpropan-1-ol

### Uses:

- Pseudoephedrine is used to relieve nasal congestion caused by colds, allergies, and hay fever.
- It is also used to temporarily relieve sinus congestion and pressure.

### Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.



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## Type of formulation:

- Tablet
- Capsule
- Aerosol
- Inhaler

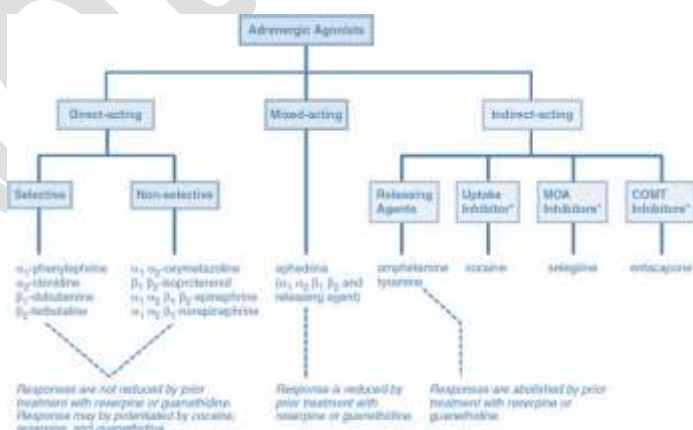
## Popular Brand Name:

- Sudafed,
- Galpseud,
- Boots Decongestant

## SYMPATHOMIMETIC AGENTS (ADRENERGIC AGONISTS):

- Adrenergic agonist is a drug that binds to and activates adrenergic receptors. Adrenergic receptors are proteins found on the surface of cells throughout the body. When activated, these receptors send signals to the cells, causing them to change their activity.
- There are two main types of adrenergic receptors: alpha receptors and beta receptors. Alpha receptors are further divided into alpha-1 and alpha-2 receptors, while beta receptors are further divided into beta-1, beta-2, and beta-3 receptors.

## Classification of Adrenergic Agonists:



## Mixed Acting Agents :

- Ephedrine,
- Metaraminol



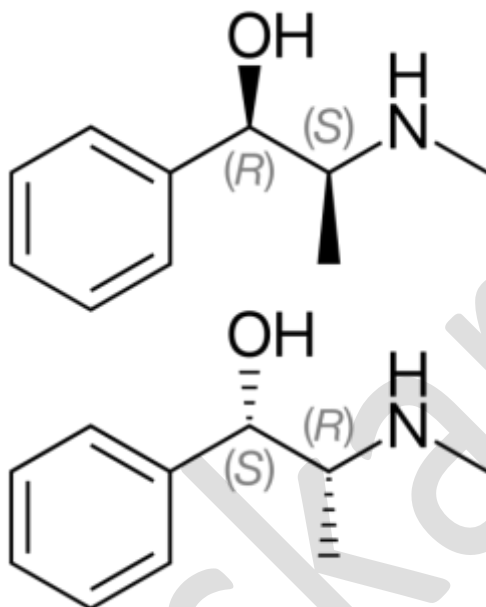
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## Ephedrine:

**Chemical Name:** benzenemethanol  $\alpha$  - [1 - (methylamino) ethyl] - sulfate (2:1) (salt).

### Chemical Structure:



### Uses:

- Ephedrine is a medication used to manage and treat clinically significant hypotension. It is in the sympathomimetic class of drugs.
- Ephedrine is a central nervous system stimulant that is often used to prevent low blood pressure during anesthesia.
- It has also been used for asthma, narcolepsy, and obesity but is not the preferred treatment.
- It is of unclear benefit in nasal congestion.

### Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Type of formulation:

- Tablet
- Capsule

### Brand Name:

- Akovaz
- Corphedra
- Emerphed



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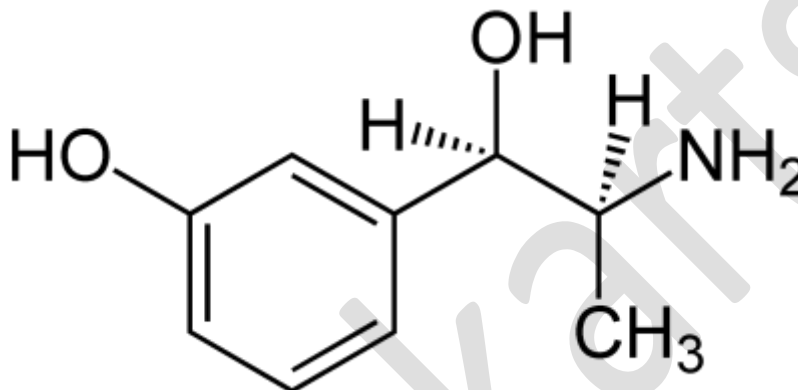
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## Metaraminol:

- Metaraminol is a sympathomimetic agent with direct and indirect effects on adrenergic receptors. It has both alpha and beta-adrenergic activity, the former being predominant.
- Metaraminol increases the force of myocardial contractions as well as having a peripheral vasoconstrictor action.

**Chemical Name:** (1R,2S)-3-[-2-amino-1-hydroxy-propyl]phenol

## Chemical Structure:



## Uses:

- Metaraminol is indicated for prevention and treatment of the acute hypotensive state occurring with spinal anesthesia.

## Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Injection

## Brand Name:

- Aramine,
- Metaramin,
- Pressonex



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## Adrenergic antagonists (sympatholytic agents):

- Adrenergic antagonists are also referred to as sympatholytics because they lyse, or block, the effects of the sympathetic nervous system.
- They react with specific adrenergic receptor sites without activating them, thus preventing the typical manifestations of SNS activation.

## Alpha Adrenergic Blockers :

- Tolazoline,
- Phentolamine,
- Phenoxybenzamine,
- Prazosin.

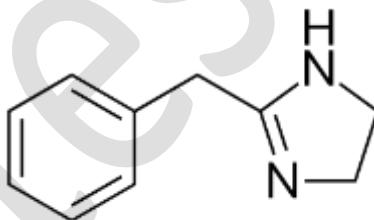
## Tolazoline:

- Tolazoline is a non-selective competitive  $\alpha$ -adrenergic receptor antagonist. It is a vasodilator that is used to treat spasms of peripheral blood vessels.

## Chemical Name:

2-Benzyl-4,5-dihydro-1H-imidazole

## Chemical Structure:



## Uses:

- Tolazoline is a vasodilator used to treat pulmonary artery anomalies.

## Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Syrup
- Tablet

## Brand Name:

- Priscoline



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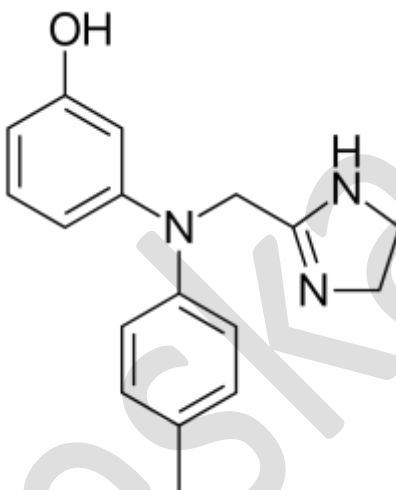
## Phentolamine:

- Phentolamine is a long-acting, adrenergic, alpha-receptor blocking agent which can produce and maintain "chemical sympathectomy" by oral administration.
- It increases blood flow to the skin, mucosa and abdominal viscera, and lowers both supine and erect blood pressures.

## Chemical Name:

3-[(4,5-Dihydro-1H-imidazol-2-ylmethyl)(4-methylphenyl)amino]phenol

## Chemical Structure:



## Uses:

- Phentolamine is indicated for the control of episodes of hypertension and sweating that occur with a disease called pheochromocytoma.

## Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Powder for injection,
- Injection Solution

## Brand Name:

- Regitine,
- OraVerse



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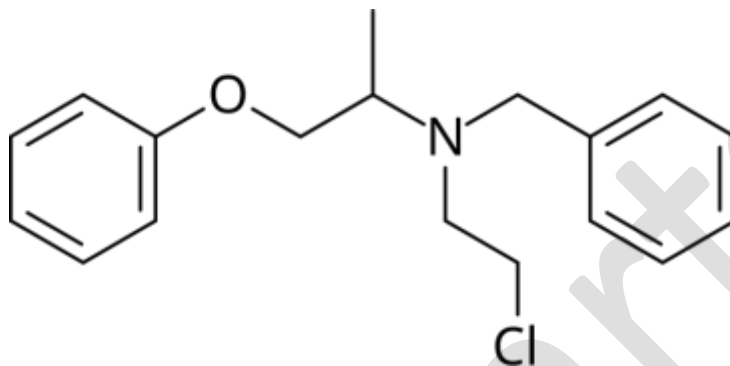
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## Phenoxybenzamine:

- It is in the nonselective, irreversible antagonist of the alpha-adrenergic receptors class of drugs.

**Chemical Name:** N-(2-chloroethyl)-N-(1-methyl-2-phenoxyethyl) benzylamine (12.2. 5)

## Chemical Structure:



## Uses:

- Phenoxybenzamine is a medication used in the management and treatment of paroxysmal hypertension and sweating resulting from pheochromocytoma.

## Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Capsule
- Tablet

## Brand Name:

- Dibenzyline





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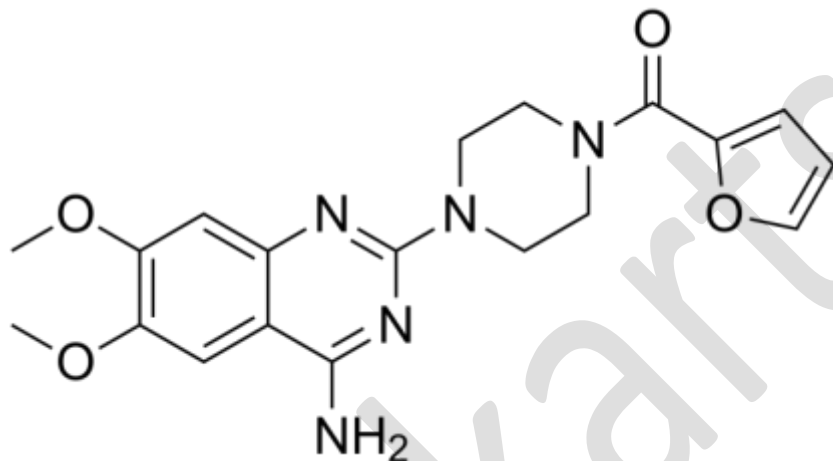
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## Prazosin:

- It is a quinazoline derivative that acts as a competitive alpha1-antagonist.

**Chemical Name:** [4-(4-Amino-6,7-dimethoxy-2-quinazoliny)-1-piperazinyl](2-furyl)methanone

## Chemical Structure:



## Uses:

- Prazosin is used alone or in combination with other medications to treat high blood pressure.

## Stability and Storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Capsules

## Brand Name:

- Minipress



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## Adrenergic Antagonists (Sympatholytic Agents)

Beta Adrenergic Blockers :

- Propranolol, \*
- Ateolol, \*
- Carvedilol

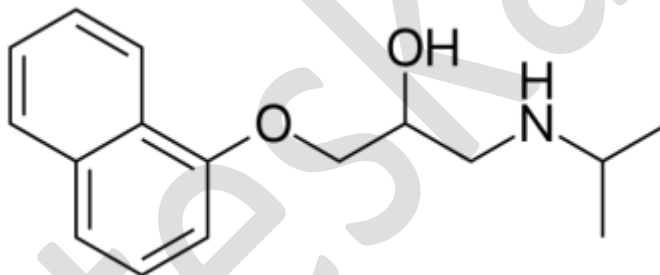
### Propranolol:

- Propranolol is a type of medicine called a beta blocker. Like other beta blockers, propranolol works by changing the way your body responds to some nerve impulses, including in the heart.
- It slows down your heart rate and makes it easier for your heart to pump blood around your body.

### Chemical Name:

6-Chloro-3,4-dihydro-2H-1,2,4-benzothiadiazine-7-sulfonamide 1,1-dioxide.

### Chemical Structure:



### Uses:

- It's used to treat heart problems, help with anxiety and prevent migraines.
- It is also used for High blood pressures.

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Type of formulation:

- Capsules
- Tablet

### Brand Name:

- Inderal LA,
- Innopran XL,
- Inderal XL



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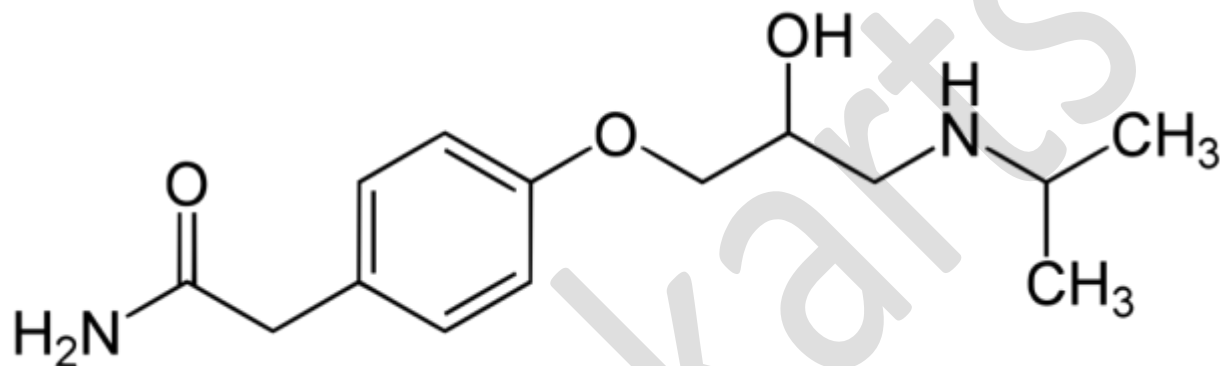
## Ateolol:

- Atenolol is a beta blocker medication primarily used to treat high blood pressure and heart-associated chest pain.
- Atenolol, however, does not seem to improve mortality in those with high blood pressure.

Chemical Name:

[4-[2-hydroxy-3-isopropyl-aminopropoxy]-phenyl-acetamide]

## Chemical Structure:



Uses:

- Atenolol is used alone or in combination with other medications to treat high blood pressure.
- It also is used to prevent angina (chest pain) and improve survival after a heart attack.

## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Capsule
- Tablet

## Brand Name:

- Tenormin



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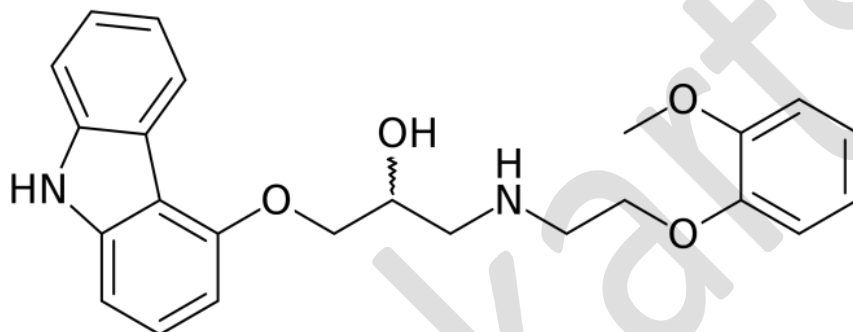
## Carvedilol:

- Carvedilol is a type of medicine called a beta blocker. Carvedilol, sold under the brand name Coreg among others, is a medication used to treat high blood pressure, congestive heart failure, and left ventricular dysfunction in people who are otherwise stable.

## Chemical Name:

((2R,3S)-1-(9H-carbazol-4-yloxy)-3-[[2-(2-methoxyphenoxy)ethyl]amino]propan-2-ol)

## Chemical Structure:



## Uses:

- It's used to treat high blood pressure (hypertension) and helps prevent: heart disease.

## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of formulation:

- Tablet

## Brand Name:

- Coreg



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## Cholinergic drugs and related agents (parasympathomimetic)

### Direct Acting Agents

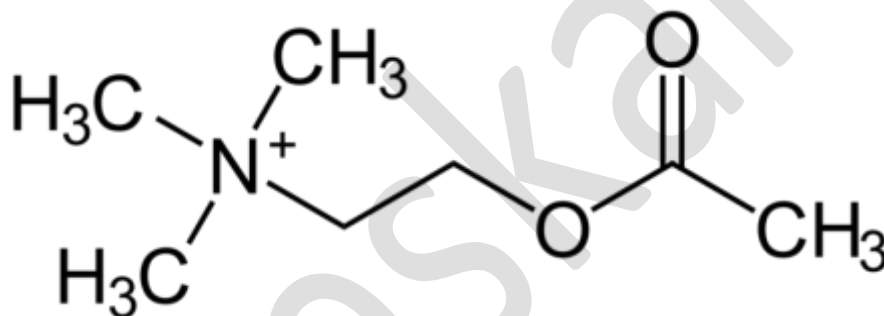
- Acetylcholine, \*
- Carbachol,
- Pilocarpine.

### Acetylcholine:

- Acetylcholine is the neurotransmitter at neuromuscular junctions, at synapses in the ganglia of the visceral motor system, and at a variety of sites within the central nervous system.

**Chemical Name:** 2-Acetoxy-N,N,N-trimethylethanaminium

### Chemical Structure:



### Uses:

- Acetylcholine is the substance the nervous system uses to activate skeletal muscles, a kind of striated muscle.
- Acetylcholine is a neurotransmitter that plays a role in memory, learning, attention, arousal and involuntary muscle movement.

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Types of Formulations

- Powder for injection,
- Gels,
- Lozenges

### Brand Name:

- Miochol-E,
- Miochol,
- Miochol Plus



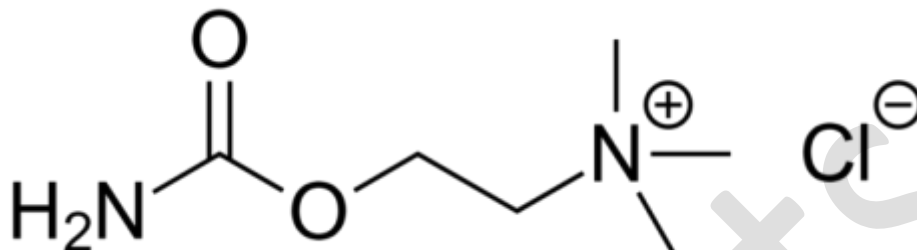
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## Carbachol:

**Chemical Name:** 2-[(Aminocarbonyl)oxy]-N,N,N-trimethylethanaminium chloride

### Chemical Structure:



### Uses:

- Carbachol is primarily used in the treatment of glaucoma, but it is also used during ophthalmic surgery.
- Carbachol eyedrops are used to decrease the pressure in the eye for people with glaucoma.
- It is sometimes used to constrict the pupils during cataract surgery.

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Type of Formulation:

- Tablet,
- Solution

### Brand Name:

- Miostat

## Pilocarpine.

**Chemical Name:** (3S,4R)-3-Ethyl-4-((1-methyl-1H-imidazol-5-yl)methyl)dihydrofuran-2(3H)-one

### Uses:

- Pilocarpine is a medication used to manage and treat xerostomia and glaucoma. It is a muscarinic receptor agonist.

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.



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## Type of Formulation:

- Tablet,
- Ophthalmic Solution

## Brand Name:

- Isopto Carpine
- Salagen

## Cholinesterase Inhibitors (Indirect Acting Agents)

- Cholinesterase inhibitors (ChEIs) are a class of drugs that inhibit the activity of acetylcholinesterase, an enzyme that breaks down the neurotransmitter acetylcholine. This leads to an accumulation of acetylcholine in the synaptic cleft, which enhances cholinergic transmission.
- ChEIs are used to treat a variety of conditions, including Alzheimer's disease, myasthenia gravis, and glaucoma.
- They are also used as antidotes for poisoning by organophosphates and carbamates.
- Indirect acting cholinesterase inhibitors are a type of ChEI that work by increasing the amount of acetylcholine available at the neuromuscular junction.
- This is done by inhibiting the breakdown of acetylcholine by acetylcholinesterase. Indirect acting ChEIs include neostigmine, pyridostigmine, and ambenonium.

## Example:

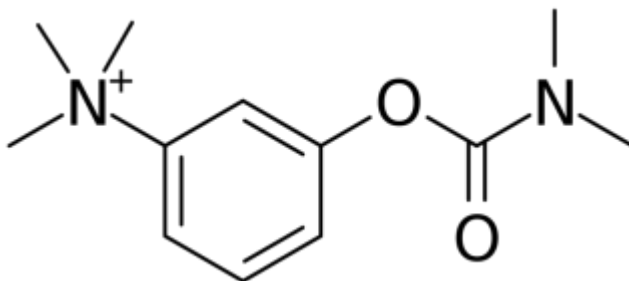
- Neostigmine, \*
- Edrophonium chloride,
- Tacrine hydrochloride,
- Echothiophate iodide.

## Neostigmine, \*

- Neostigmine is water-soluble, an ionized compound that reversibly inhibits the enzyme acetylcholinesterase.

**Chemical Name:** 3-[[Dimethylamino)carbonyl]oxy]-N,N,N-trimethylbenzenaminium

## Chemical Structure:



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## Uses:

- Neostigmine injection is used to treat a muscle disease called myasthenia gravis.
- Neostigmine injection is also used to prevent or treat certain kidney or intestinal problems.
- This medicine is also given after surgery to help reverse the effects of certain types of medicines that have been used to relax the muscles.

## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of Formulation:

- Tablet

## Brand Name:

- Bloxiverz,
- Prostigmin,
- Vagostigmin

## Edrophonium chloride:

### Chemical Name:

- N-ethyl-3-hydroxy-N,N-dimethylbenzenaminium chloride

### Uses:

- They are used to glycoma.
- They are also used in Ophthalmic preparation.
- Edrophonium is a cholinesterase inhibitor used to diagnose and evaluate myasthenia gravis.

## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of Formulation:

- Tablet
- Eye Drops

## Brand Name:

- Tensilon
- Enlon





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## **Tacrine hydrochloride,**

**Chemical Name:** Tacrine hydrochloride (1,2,3,4-Tetrahydroacridin-9-amine)

### **Uses:**

- Tacrine is used to treat the symptoms of mild to moderate Alzheimer's disease.

### **Stability and Storage Conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### **Type of Formulation:**

- Tablet

### **Brand Name:**

- Cognex®

## **Echothiophate iodide.**

**Chemical Name:** 2-(Diethoxyphosphorylsulfanyl)ethyl-N,N,N-trimethylazanium iodide

### **Uses:**

- This medication is used to treat high pressure inside the eye (due to conditions such as certain types of glaucoma) and other eye problems (such as accommodative esotropia).

### **Stability and Storage Conditions:**

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### **Type of Formulation:**

- Tablet
- Eye Drops

### **Brand Name:**

- Phospholine Iodide



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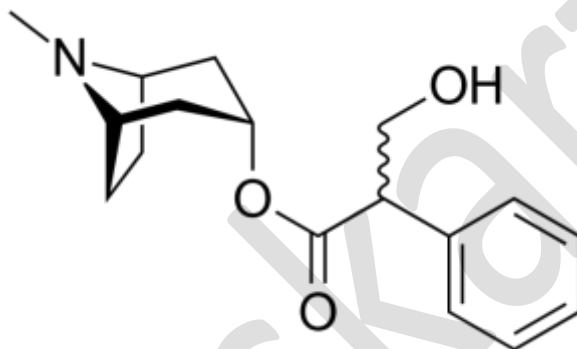
## CHOLINERGIC BLOCKING AGENTS (CHOLINERGIC ANTAGONISTS)

- Atropine sulphate, \*
- Ipratropium bromide.

### Atropine sulphate:

**Chemical Name:** Hyoscyamine Sulfate ((RS)-(8-Methyl-8-azabicyclo[3.2.1]oct-3-yl) 3-hydroxy-2-phenylpropanoate)

### Chemical Structure:



### Uses:

- Atropine sulfate eye drops is used to dilate the pupil before eye exams.
- It is also used to treat an eye condition called amblyopia (lazy eyes) and other eye conditions (eg, cycloplegia).

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Type of Formulation:

- Tablet
- Eye Drops

### Brand Name:

- Isopto Atropine



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## Ipratropium bromide:

**Chemical Name:** [8-methyl-8-(1-methylethyl)-8-azoniabicyclo[3.2.1]oct-3-yl] 3-hydroxy-2-phenylpropanoate

### Uses:

- Ipratropium oral inhalation is used to prevent wheezing, shortness of breath, coughing, and chest tightness in people with chronic obstructive pulmonary disease (COPD).

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

### Type of Formulation:

- Syrup
- Inhaler
- Tablet

### Brand Name:

- Atrovent

## Synthetic Cholinergic Blocking Agents

- Tropicamide,
- Cyclopentolate hydrochloride,
- Clidinium bromide, and
- Dicyclomine hydrochloride. \*

### Tropicamide:

**Chemical Name:** Benzeneacetamide, N-ethyl- $\alpha$ -(hydroxymethyl)-N-(4-pyridinylmethyl)-

### Uses:

- Tropicamide is used to dilate (enlarge) the pupil so that the doctor can see into the back of your eye.
- It is used before eye examinations, such as cycloplegic refraction and examination of the fundus of the eye.
- Tropicamide may also be used before and after eye surgery.

### Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.



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## Type of Formulation:

- Syrup
- Inhaler
- Tablet

## Brand Name:

- Mydriacyl

## Cyclopentolate hydrochloride,

**Chemical Name:** (RS)-2-(dimethylamino)ethyl (1-hydroxycyclopentyl)(phenyl)acetate

## Uses:

- Cyclopentolate is used to dilate (enlarge) the pupil. It is used before eye examinations (such as cycloplegic refraction or ophthalmoscopy).

## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of Formulation:

- Syrup
- Tablet

## Brand Name:

- Cyclogyl
- Cylate
- Mydrilate
- Pentolair

## Clidinium bromide,

**Chemical Name:** 3-[(2-hydroxy-2,2-diphenylacetyl)oxy]-1-methyl-1-azabicyclo[2.2.2]octan-1-ium bromide

## Uses:

- Clidinium bromide is the bromide salt of clidinium. It is used for the symptomatic treatment of peptic ulcer disease and also to help relieve abdominal or stomach spasms or cramps due to colicky abdominal pain, diverticulitis, and irritable bowel syndrome.



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## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of Formulation:

- Syrup
- Tablet

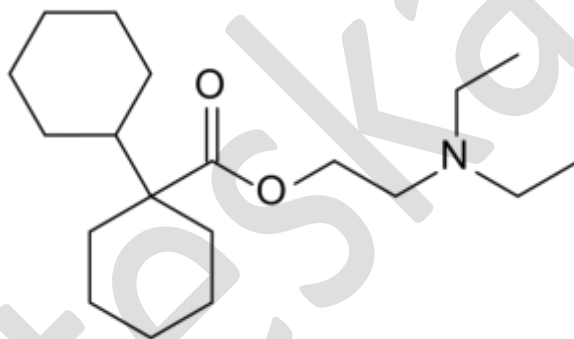
## Brand Name:

- Librax

## Dicyclomine hydrochloride.

**Chemical Name:** 2-(diethylamino)ethyl 1-cyclohexylcyclohexanecarboxylate

## Chemical Structure:



## Uses:

- Dicyclomine is used to treat the symptoms of irritable bowel syndrome.
- It relieves muscle spasms in the gastrointestinal tract by blocking the activity of a certain natural substance in the body.

## Stability and Storage Conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

## Type of Formulation:

- Syrup
- Inhaler
- Tablet

## Brand Name:

- Bentyl

