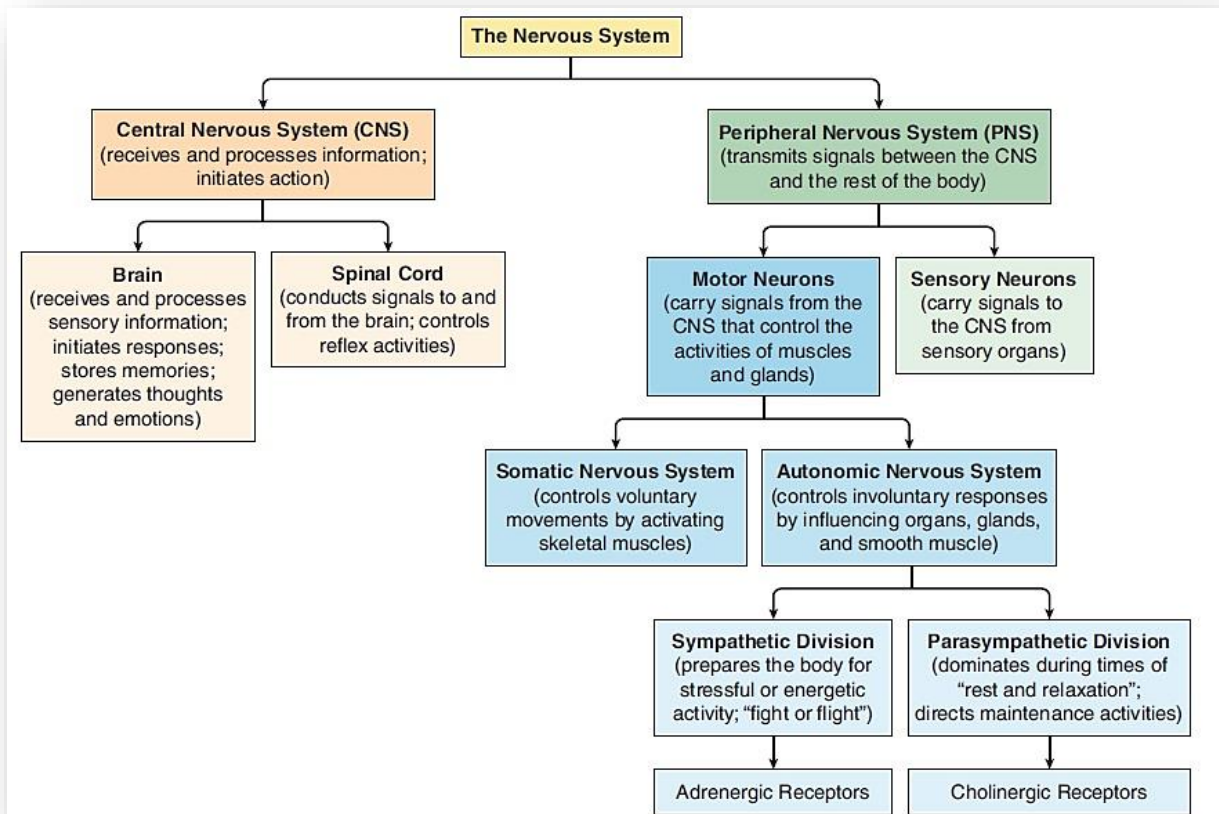


## Autonomic Pharmacology

The ANS is particularly important to pharmacology because a large number of medications affect autonomic nerves. Some of these drug actions produce desirable, therapeutic effects, whereas others produce adverse effects.

### The Functional Divisions of the Nervous System

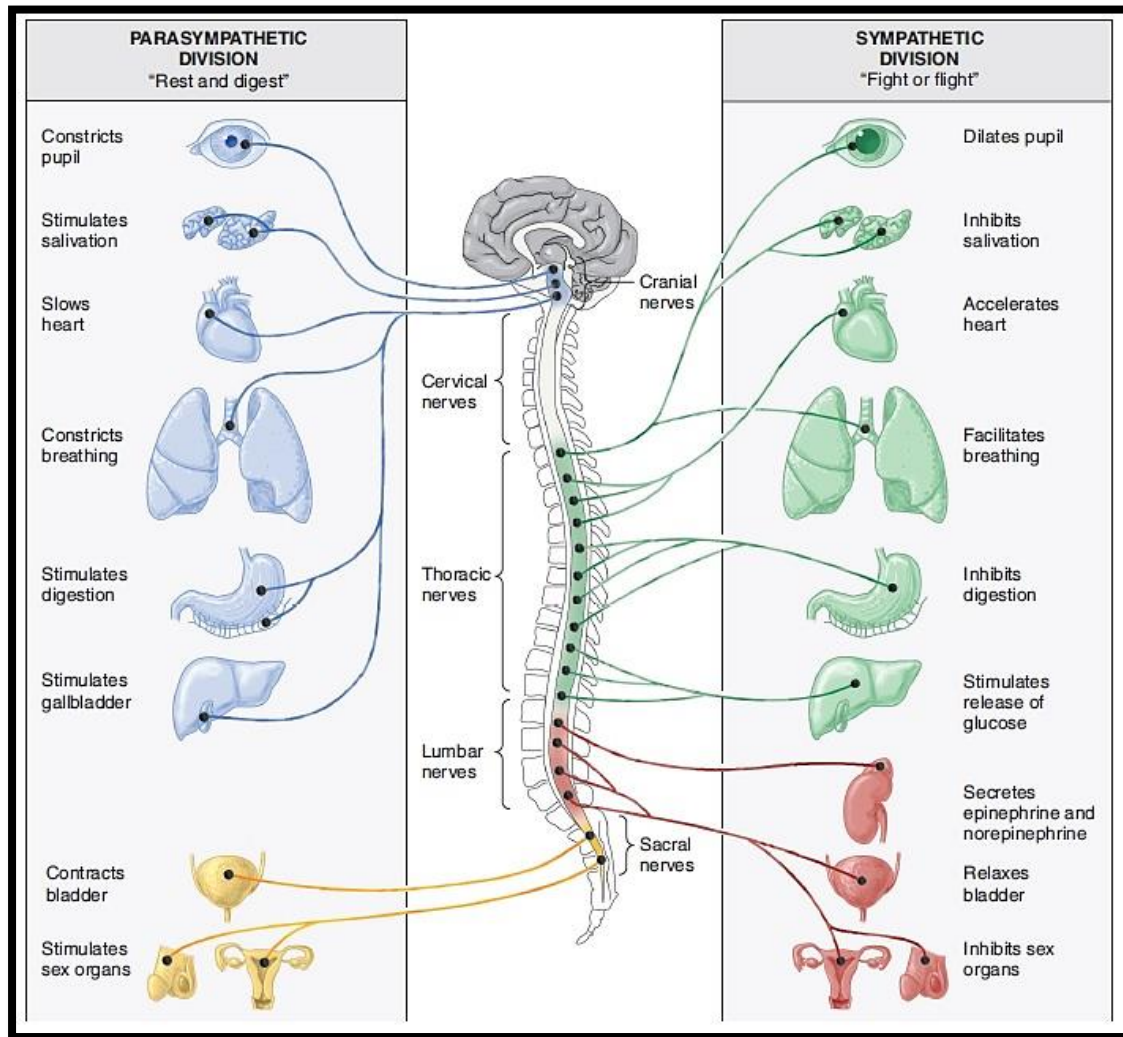


### Divisions Of The Autonomic Nervous System (ANS):

The ANS Has Two Divisions:

1. **Sympathetic (Fight-Or Flight Response)** Activated Under Condition of Stress.
2. **Parasympathetic Nervous Systems (Rest-And-Digest Response)** Activated Under Non Stressful Conditions.

\*\* With A Few Exceptions, Organs and Glands Receive Nerves from Both Branches of the Autonomic Nervous System (Sympathetic and Parasympathetic).



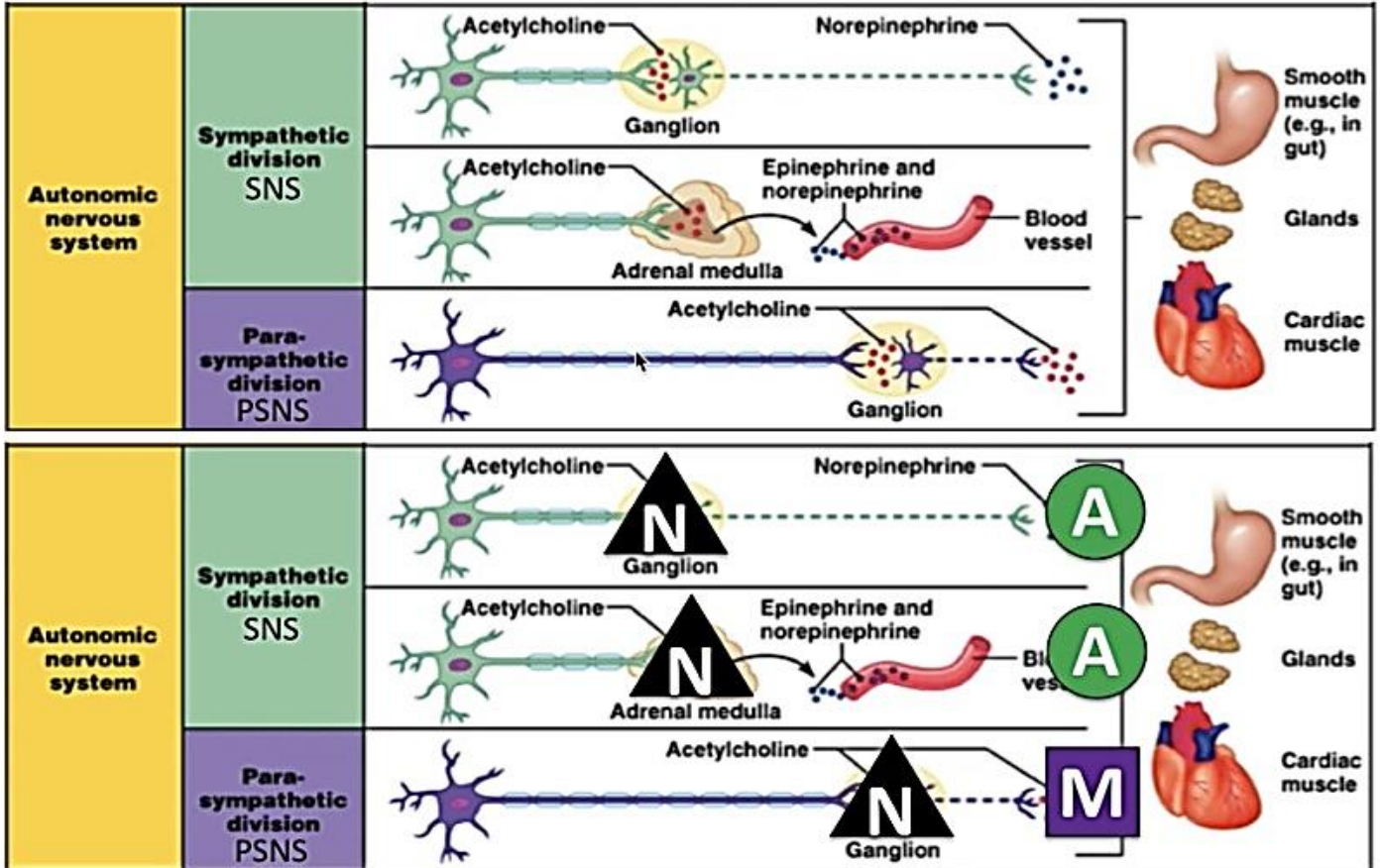
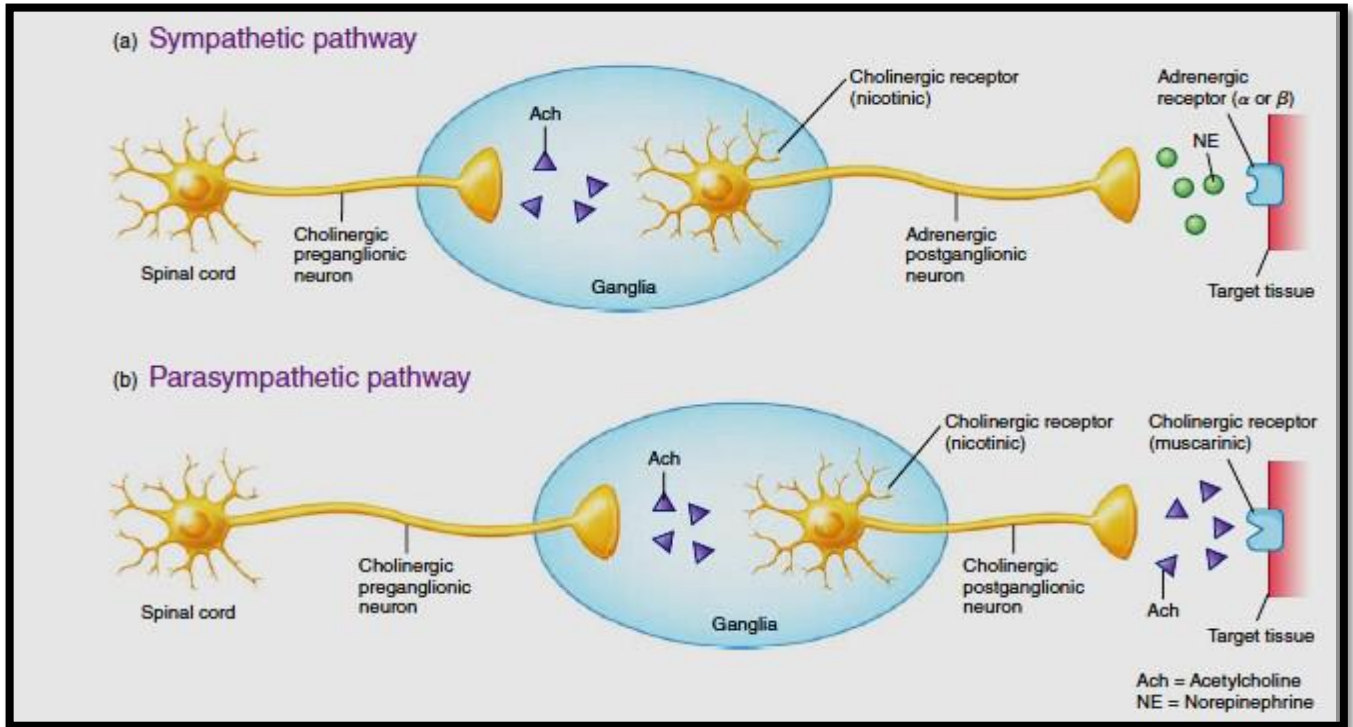
**(Effects of The Sympathetic and Parasympathetic NS On Different Organs)**

**- Receptors of ANS**

1. Cholinergic Receptors
  - A. Nicotinic
  - B. Muscarinic
2. Adrenergic Receptors
  - A. Alpha- Receptors
  - B. Beta-Receptors

**- Neurotransmitters of ANS**

1. Acetylcholine (Activate Cholinergic Receptors).
2. Epinephrine and Norepinephrine (Activate Adrenergic Receptors).



## CHOLINERGIC DRUGS

- A. Cholinergic agonist
- B. Cholinergic antagonist

### A. Cholinergic Agonist (Parasympathomimetic drugs)

Drugs and other chemicals that stimulate cholinergic receptors directly or indirectly. Cholinergic agonists work either **directly or indirectly**.

#### 1. Direct acting

Act by occupy receptor sites for ACh on the membranes of the effector cells of the postganglionic cholinergic nerves, causing increased stimulation of the cholinergic receptor. (The direct-acting cholinergic agonists essentially act by the same mechanism as Ach itself).

**e.g.:** Acetylcholine, Bethanechol, Carbachol, Pilocarpine, Nicotine.

**Mechanism of action (M.O.A):** act at cholinergic receptors to mimic the effects of ACh and parasympathetic stimulation.

These parasympathetic effects include

1. slowed heart rate and decreased myocardial contractility.
2. Vasodilation
3. bronchoconstriction and increased bronchial mucus secretion.
4. increased GI activity and secretions.
5. increased bladder tone.
6. relaxation of GI and bladder sphincters.
7. pupil constriction

#### **Indications:**

Bethanechol: Treatment of non-obstructive postoperative and postpartum urinary retention. (muscarinic).

Carbachol: Induction of miosis to relieve increased intraocular pressure of glaucoma.

Pilocarpine: Treatment of symptoms of dry mouth in patients with Sjögren's syndrome.

**Adverse Reactions:**

(Hypotension, bradycardia, Headache, increase sweating and salivation, vomiting, diarrhea, blurred vision, urinary frequency).

**2. Indirect-acting**

**e.g.:** Pyridostigmine, Edrophonium, Neostigmine, Donepezil

**M.O.A.:**

Indirect-acting drugs inhibit acetylcholinesterase (AChE) (also called cholinesterase), the enzyme in cholinergic synapses that destroys Ach. By blocking the destruction of Ach, the neurotransmitter accumulates and remains in the synaptic cleft for a longer time to produce enhanced rest-and-digest responses.

**Indications:**

- a. **ambenonium , pyridostigmine** >>> Treat "Myasthenia gravis.
- b. **galantamine (Reminyl)** >>> Alzheimer's disease.
- c. **Edrophonium (Tensilon)** >>>> Diagnosis of myasthenia gravis.

**Adverse Reactions:**

(GI upset, nausea, vomiting, diarrhea, dyspnea, insomnia, anorexia, urinary frequency).

**B. Cholinergic Antagonist (Anticholinergics)**

**M.O.A.:** Anticholinergics act by blocking the effects of acetylcholine at muscarinic or nicotinic receptors. (Anticholinergics act by competing with acetylcholine for binding of cholinergic receptors specially (muscarinic receptors).

**Effects of anticholinergics**

1. Eye: **mydriasis** (dilatation of the pupil)
2. Respiratory tract: slight bronchodilation.
3. Gastrointestinal tract: decrease in gastric and intestinal movement
4. Cardiovascular system: increase in pulse rate.
5. Decrease bronchial secretions, salivation, and sweating.

## Indications

1. **Atropine** is used for several medical conditions because of its effective muscarinic receptor blockade. These applications include treatment of muscarinic agonist poisoning, including that caused from overdose of bethanechol, cholinesterase inhibitors, or accidental ingestion of certain types of mushrooms or organophosphate pesticides.
2. **Scopolamine (Buscopan, Transderm-V)** is used for sedation and motion sickness.
3. **Anticholinergics used for Cardiac rhythm abnormalities:** Anticholinergics can be used to accelerate the heart rate in clients experiencing bradycardia.
4. **Pre-anesthesia:** Combined with other agents, anticholinergics can decrease excessive respiratory secretions and reverse the bradycardia caused by anesthetics.
5. **Benzotropine (Cogentin)** is prescribed to reduce the muscular tremor and rigidity associated with Parkinson's disease.
6. **(Atrovent) and tiotropium (Spiriva)**, oral and nasal inhalation which are a relatively new anticholinergics used for clients with COPD.

## Adverse Reactions:

(drowsiness, photophobia, tachycardia, xerostomia, constipation, urinary retention).