



Cholinergic agonists and antagonists

جامعة ساوة

كلية التقنيات الصحية والطبية

قسم تقنيات التخدير

المرحلة الثانية

Nervous system:

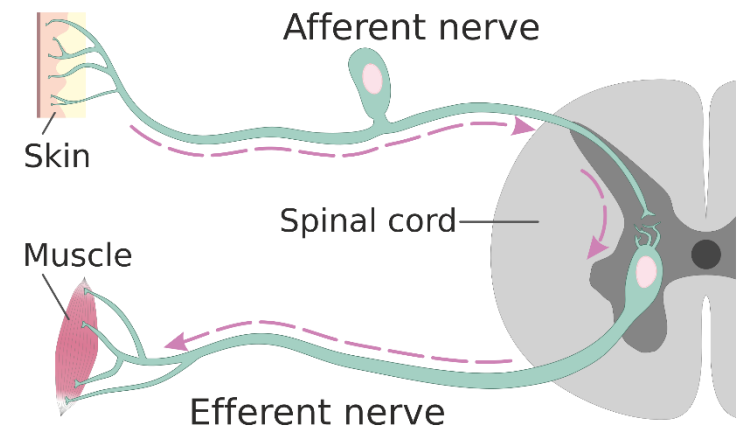
- The nervous system subdivided into two anatomical division:

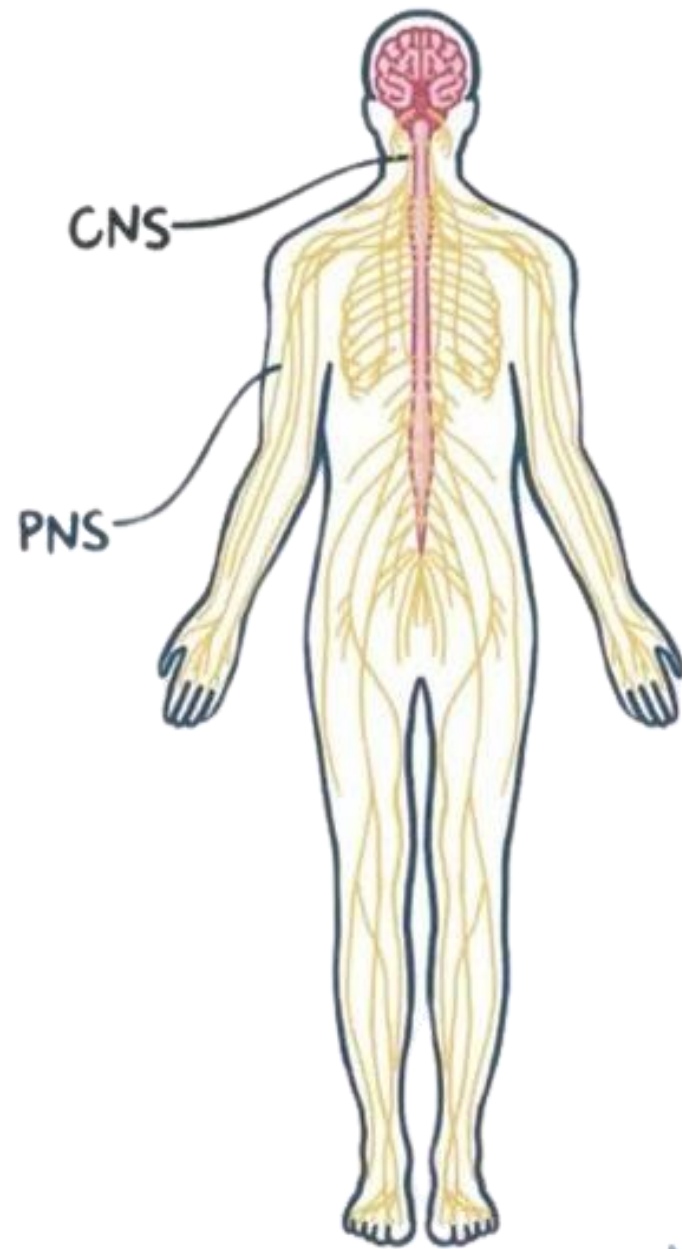
1- **central nervous system(CNS)**: which is composed of the brain and spinal cord.

2- **peripheral nervous system(PNS)**: which include neurons located outside the brain and spinal cord, PNS subdivided into

Efferent division, the neurons of which carry signals from the brain and spinal cord to the peripheral tissue (organs)

Afferent division, the neurons of which bring information from the periphery to the CNS(opposite to efferent).





NERVOUS SYSTEM

CENTRAL NERVOUS
SYSTEM (CNS)
(BRAIN & SPINAL CORD)

PERIPHERAL NERVOUS
SYSTEM (PNS)
(CONNECTS CNS TO MUSCLES & ORGANS)

AUTONOMIC
NERVOUS SYSTEM
(CONTROLS INTERNAL ORGANS)

SOMATIC NERVOUS
SYSTEM
(CONTROLS SKELETAL
MUSCLES)

SYMPATHETIC
NERVOUS SYSTEM

PARASYMPATHETIC
NERVOUS SYSTEM

- The efferent portion of PNS divided into somatic and autonomic system.
- ✓ **Somatic neurons** are involved in the voluntary control functions of skeletal muscle.
- ✓ **Autonomic neurons**: involuntary movement of smooth muscle, cardiac muscle and exocrine glands.

Autonomic nervous system is divided into the **sympathetic and parasympathetic** nervous system.

Differences between sympathetic and parasympathetic:

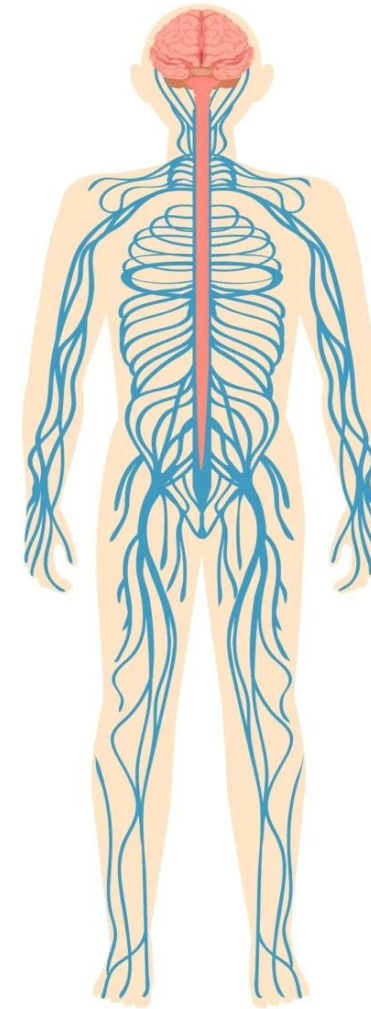
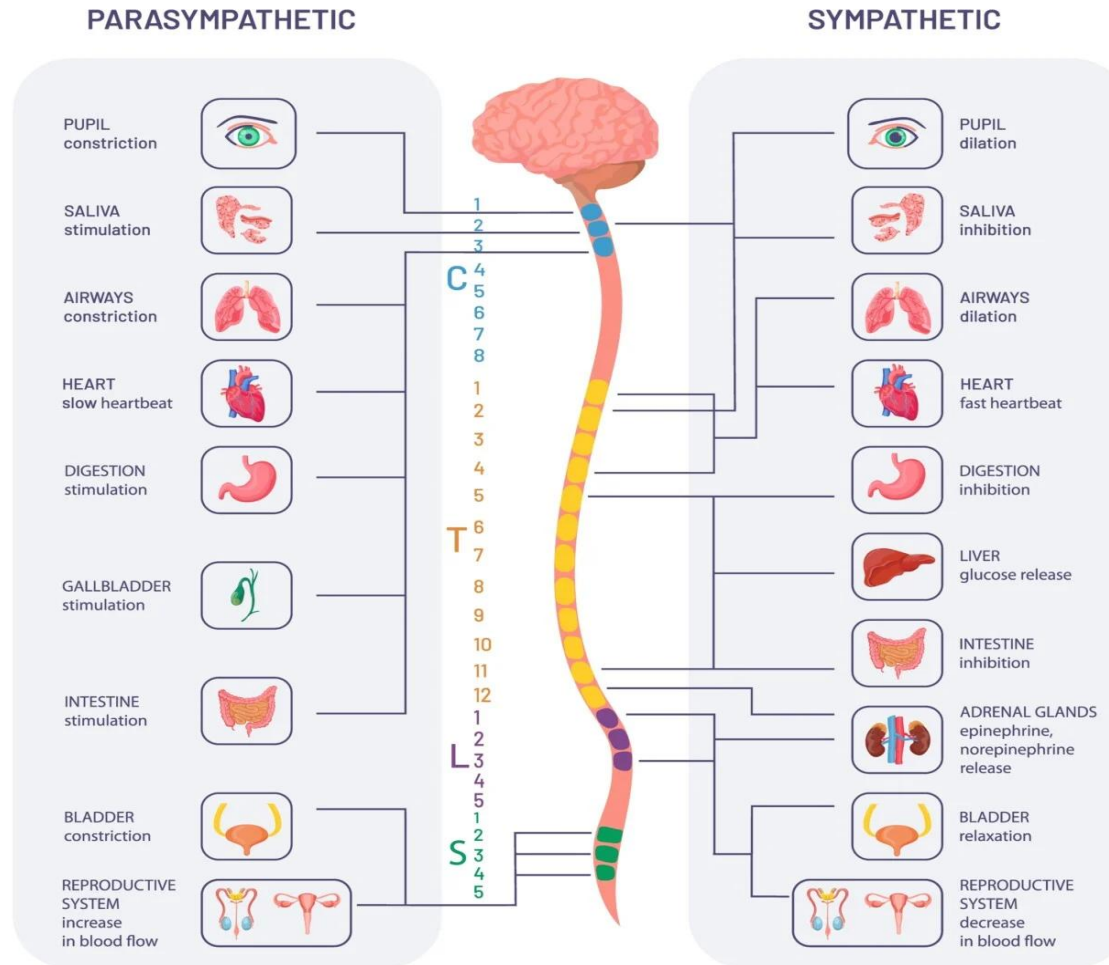
- **Sympathetic :**

- is the nervous system responsible for your “fight or flight” responses in times of emergencies. It controls the body’s responses to stress, injuries, or perceived threats.
- In sympathetic case release of neurotransmitter (epinephrine and norepinephrine) target specific organs such as :
- increase heart rate, increase blood pressure.
- Increase respiratory rate.
- Increase pupil dilation.
- Decrease digestion
- Decrease urine production (urinary bladder relaxation).

- **Parasympathetic :**

- is the nervous system responsible for your “rest and digest” responses in times of non-emergencies. It controls the body’s responses at rest and helps your body regulate its normal daily organ functions.
- In parasympathetic case the preganglionic neuron release acetylcholine as neurotransmitter.
- Decrease heart rate.
- Decrease respiratory rate.
- Pupil dilation.
- Increase digestion (GIT motility)
- Bladder contraction.

NERVOUS SYSTEM



Autonomic Nervous System

Sympathetic - "Fight or Flight"



Parasympathetic - "Rest and Digest"



Autonomic nervous system:

- 1- Cholinergic system (parasympathetic)
- 2- Adrenergic system (sympathetic)

Cholinergic system: responsible for secretion of acetylcholine (Ach), acetylcholine is neurotransmitter within (the parasympathetic nervous system) that plays role in:

- memory, learning, attention and involuntary muscle movement, medical conditions associated with low acetylcholine levels include Alzheimer's disease.

- Acetylcholine act on two main receptors:

1- Muscarinic receptor or M receptor have three types:

- M1 receptor : C.N.S stimulation and increase stomach HCL secretion.
- M2 receptor : heart inhibition.
- M3 receptor : smooth muscle stimulation, bronchi, intestinal and urinary bladder stimulation, salivary and sweat gland stimulation.

2- Nicotinic or N receptor

- Nn receptor: stimulation of autonomic ganglion in (C.N.S).
- Nm receptor: stimulation of skeletal muscle contraction.

Cholinergic drugs

- Cholinergic drugs stimulate the activation of the parasympathetic nervous system by activating receptors for acetylcholine release.
- These drugs inhibit cholinesterase enzyme that rapidly destroy (Ach) so prevent the destruction of acetylcholine.
- Cholinergic drugs are agonist of acetylcholine.
- Cholinergic drugs are two types:
 - 1-direct acting
 - 2- indirect acting.

Direct acting cholinergic drugs

- They act by binding directly to cholinergic receptor (muscarinic and nicotinic receptor).
- Do not readily enter the CNS so effects are peripheral.
- Resistance to metabolism by acetylcholinesterase,.
- Effects are long acting.

Bethanechol

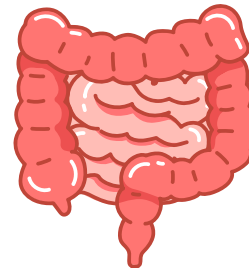
- Not hydrolysis by acetylcholinesterase.
- **Actions**
 - ✓ directly stimulate M receptor causing increased intestinal motility.
 - ✓ Stimulate muscle of the bladder while trigon and sphincters are relaxed causing expulsion of urine.

- **Therapeutic uses:**

1. Treats urinary retention by stimulating bladder emptying



2. Promotes gastrointestinal motility

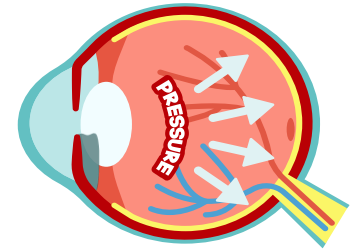


pilocarpine

pilocarpine is Direct-acting cholinergic agonist

- **Therapeutic use:**

1. Used in the treatment of glaucoma to reduce intraocular pressure



2. when applied locally to cornea produce rapid **miosis** during eye surgery



3. Treats xerostomia (dry mouth) in patients with after radiation therapy



Indirect acting cholinergic agonist

- They act through inhibition of acetylcholinesterase enzyme, so increase acetylcholine level in the synapse.
- Accumulation of acetylcholine enhances the activation of the nicotinic and muscarinic receptors.
- Indirect acting drugs are either reversible or irreversible inhibitor to acetylcholinesterase.

Reversible: bind to cholinesterase for period of minutes to hours.

Irreversible: bind to cholinesterase and form permanent covalent bond, the body must make new cholinesterase to break these bond.

Indirect acting cholinergic agonist (irreversible)

Physostigmine

1. Anticholinesterase capable of crossing blood brain barrier, is lipid soluble, used as antidote for over dosage of anticholinergics such as atropine
2. used in treatment of glaucoma, increased intestinal and bladder motility.

Pyridostigmine

Is used for patient with myasthenia gravis.

Neostigmine

- Type of anticholinesterase agent, used after surgery to help reverse the effect of certain types of medicines that have been used to relax the muscles.

Donepezil

- Used in the treatment of mild to moderate Alzheimer's disease.
- Helps to increase or maintain memory and learning capabilities.

Cholinergic agents side effects

- Cardiovascular (bradycardia, hypotension)
- CNS (headache, dizziness, convulsion)
- GIT (abdominal cramps, nausea, vomiting)
- Respiratory (bronchospasm)
- Others(lacrimation, sweating, salivation, miosis)

Indirect acting cholinergic agonist (irreversible)

- **organophosphates** (pesticides) and **sarin** (nerve agent) bind to and irreversibly inhibit acetylcholinesterase (AChE).
- This inhibition leads to an accumulation of acetylcholine (ACh)
- causing symptoms such as (**Lacrimation, Urination ,bradycardia, bronchoconstriction.seizures, and paralysis.**)

- **antimuscarinic drugs.**

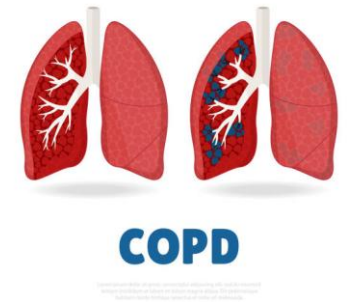
these drugs reduce the activity of the parasympathetic nervous system By inhibiting acetylcholine

- 1. Atropine**

1. Preoperative medication to reduce salivation and secretions
2. Treatment of bradycardia (slow heart rate)
3. Antidote for organophosphate and sarin poisoning

2 . Ipratropium

Bronchodilator for chronic obstructive pulmonary disease (COPD) and asthma



3. Hyoscyamine

Treats gastrointestinal cramping



4 . Oxybutynin

- Treats overactive bladder by reducing urinary urgency and frequency

