

AUTONOMIC NERVOUS SYSTEM

Dr Ayesha Jamil

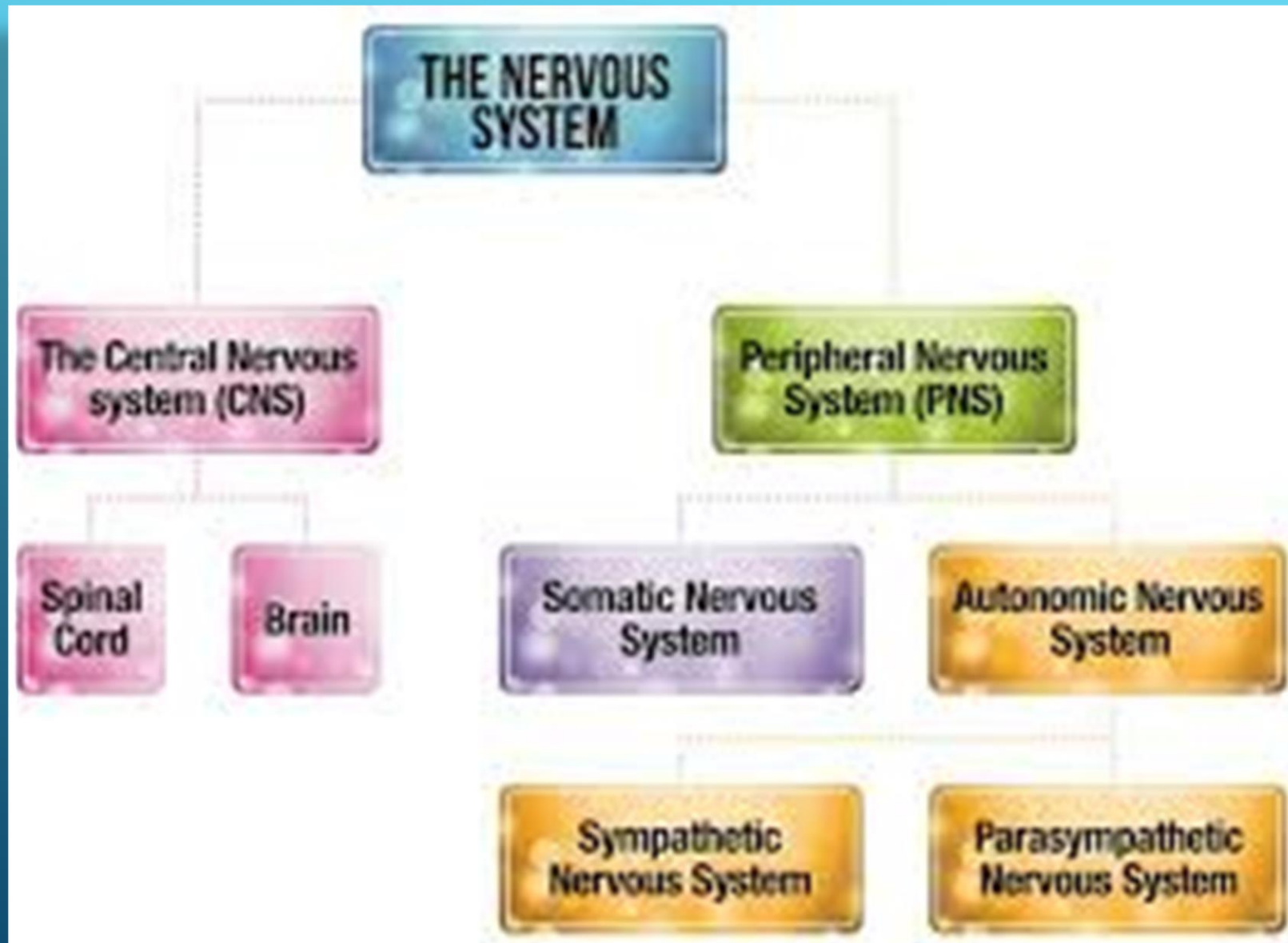
A series of several parallel white lines of varying lengths and positions, all slanted diagonally from the bottom-left towards the top-right, located in the right half of the slide.

Enlist Major Neurotransmitters Of Autonomic Nervous System

Enlist Major Types of Cholinergic Receptors

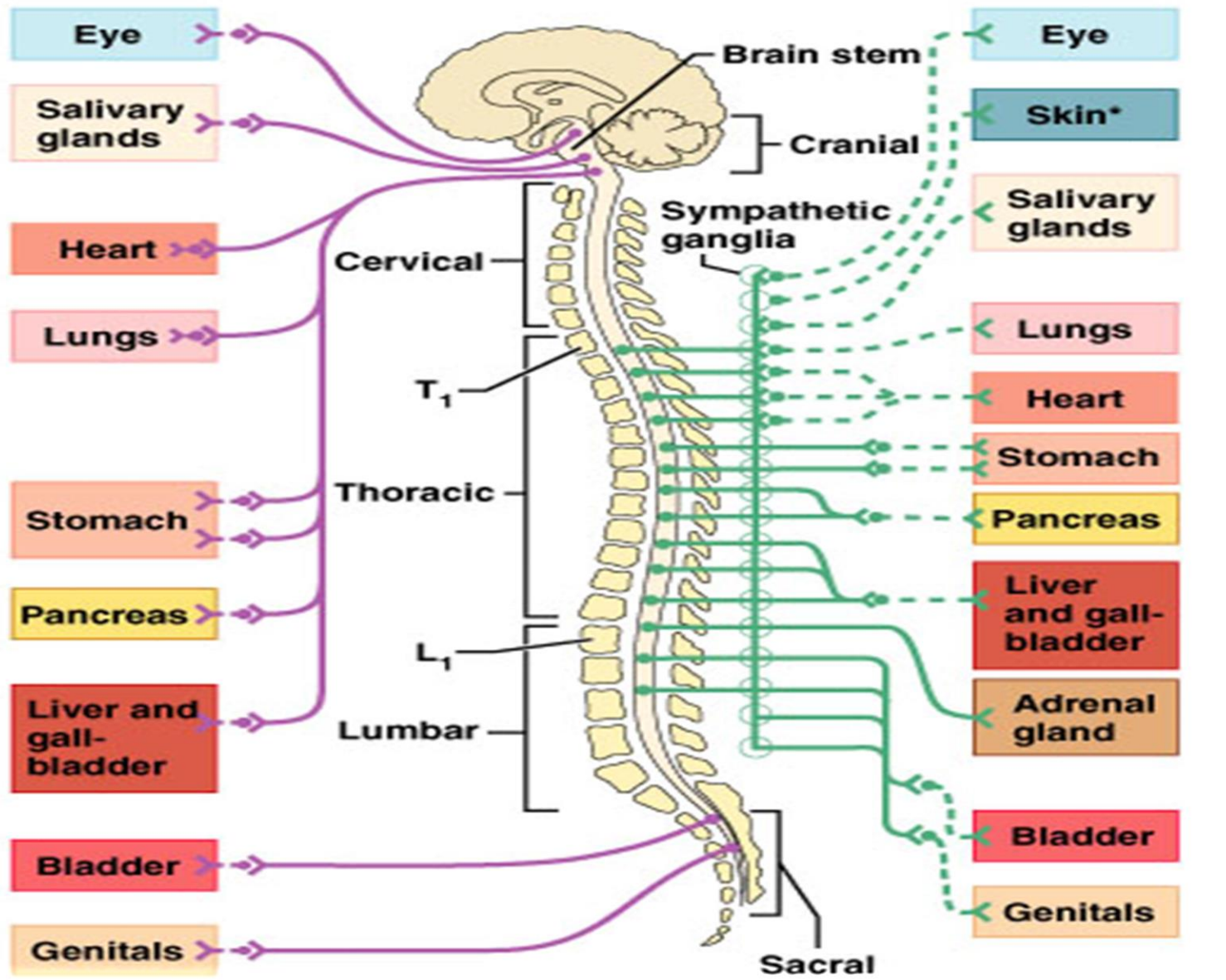
Describe Organ system Distribution Of Autonomic Receptors





Parasympathetic

Sympathetic



The autonomic nervous system.

<http://pharmacology-notes-free.blogspot.com/>

Autonomic Nervous System

Regulates unconscious body functions to maintain homeostasis

Sympathetic

Structures

Nerve Fibers:
(Preganglionic) that arise from thoracic and lumbar regions of the spinal cord join a prevertebral ganglion, then from here nerve fibers exit (postganglionic) and connect to the vital organs

Functions

- Dilation of pupils of the eyes and bronchioles of lungs
- Increases heart rate, blood glucose concentration, blood to skeletal muscles
- Slows peristaltic action
- Decreases glandular secretions, blood to digestive organs
- Relaxes muscles of gallbladder and urinary bladder

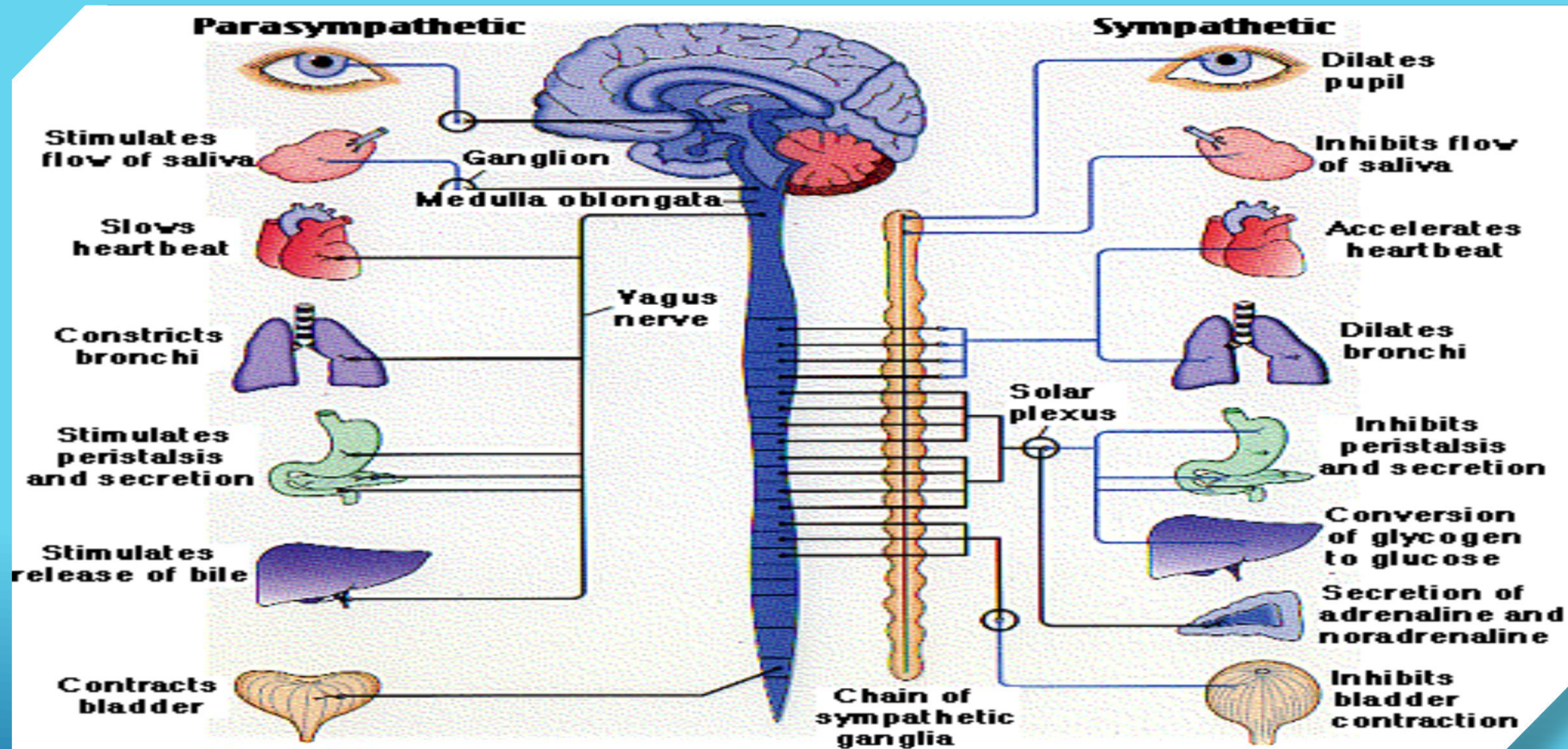
Parasympathetic

Structures

Nerve Fibers:
(Preganglionic) that arise from brainstem and sacral region of the spinal cord to join the nerve fibers (postganglionic) in the muscles and glands

Functions

- Constricts pupils of the eyes and bronchioles of lungs
- Decreases heart rate, blood glucose concentration, blood to skeletal muscles
- Increases peristaltic action, glandular secretions, blood to digestive organs
- Contracts muscles of gallbladder and urinary bladder



TYPES OF NEUROTRANSMITTERS

Classification based on Action



NEUROTRANSMITTERS

- Two Main Types Are Autonomic Neurotransmitters**
- All The Preganglionic Neurotransmitters Are The Same**
- Two Types Of Post Ganglionic Neurotransmitters**

EXCITATORY

Acetylcholine

Aspartate

Dopamine

Histamine

Norepinephrine

Epinephrine

Glutamate

Serotonin

INHIBITORY

GABA

Glycine

ANS

Cholinergic

ANS

Adrenergic

TYPES OF CHOLINERGIC RECEPTORS

TWO MAIN TYPES OF RECEPTORS

Nicotinic

Muscrinic

N_m

N_n

M1

M2

M3

M4

M5

**TYPES OF
CHOLINERGIC
RECEPTORS**

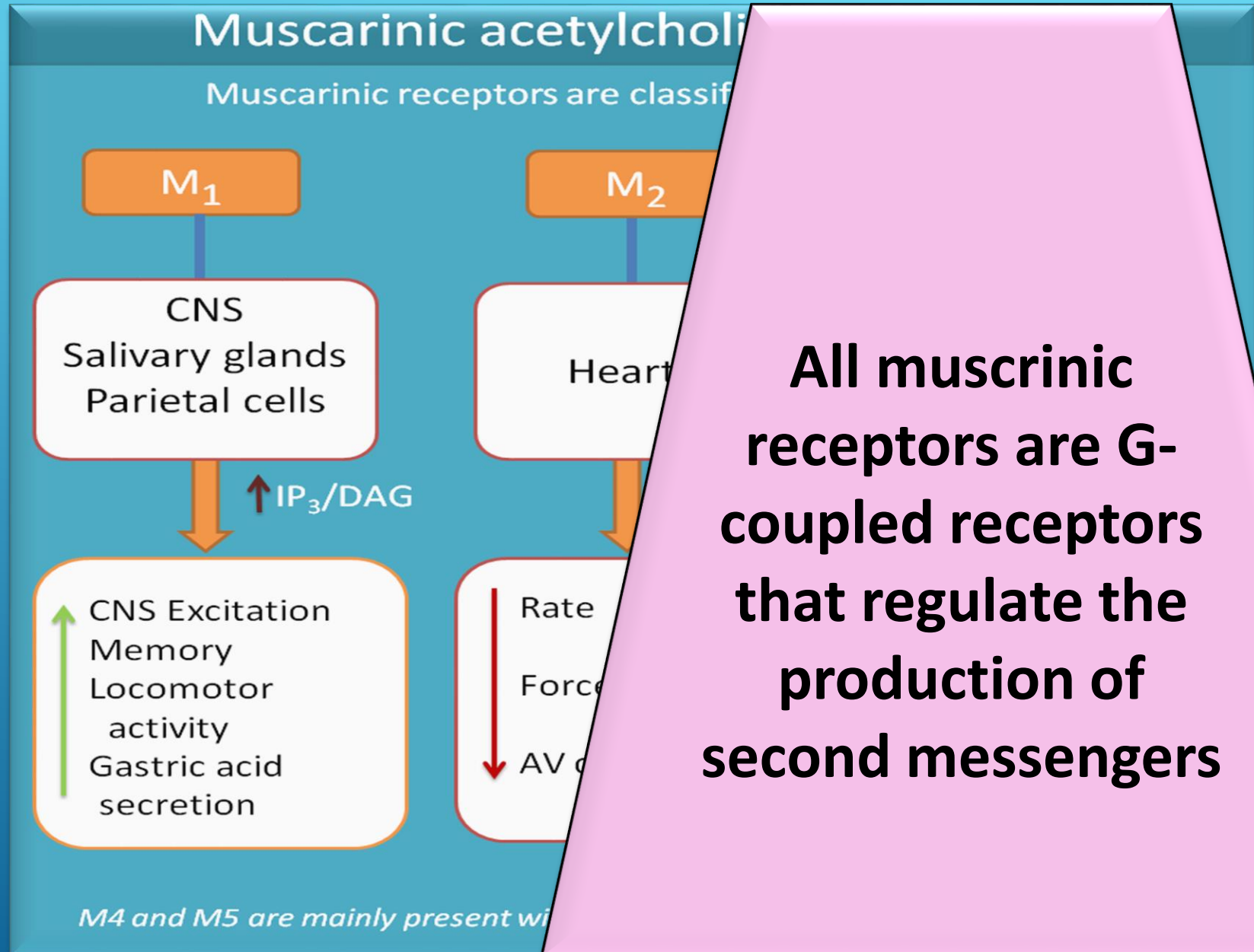
Nicotinic

All The Nicotinic Receptors Are Ion Channels

M1, M2,
M3,M4,M5.



TYPES OF CHOLINERGIC RECEPTORS



RECEPTORS

**CELLULAR
RESPONSE**

**FUNCTIONAL
RESPONSE**

M1, M3, M5

IP3
DAG



**Increase in learning
and memory**

**Excitatory
Receptors**

**increase in
glandular secretions**

**Increase in smooth
muscle contraction**



M2, M4.

**Cellular
Response**

**Functional
Response.**

**Inhibitory
Receptors**

**cAMP↓
Opening of K
channels**

Hyperpolarization

Depresses S.A Node

Depresses A.V node

**Decrease atrial and
ventricular
contraction**

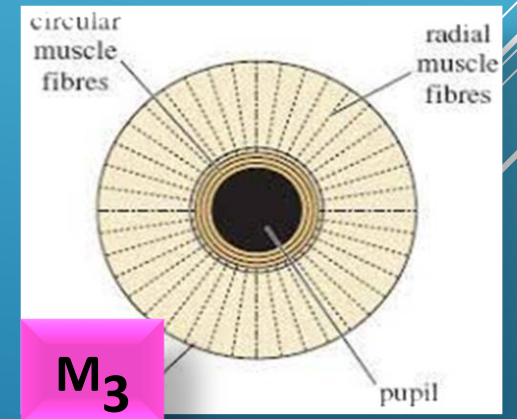
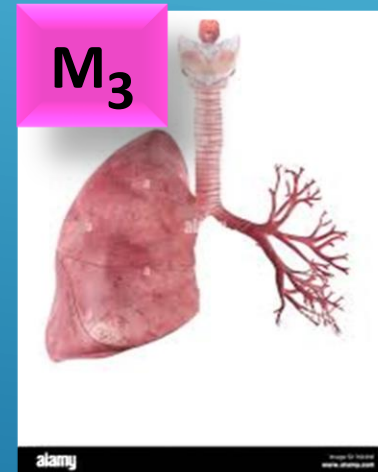
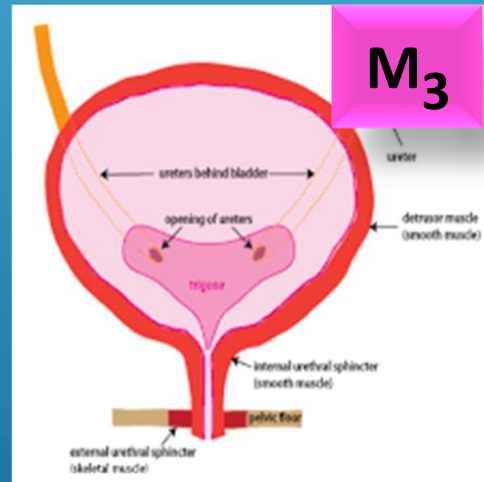
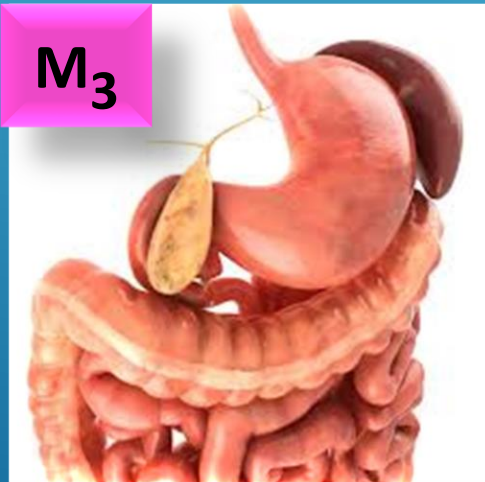
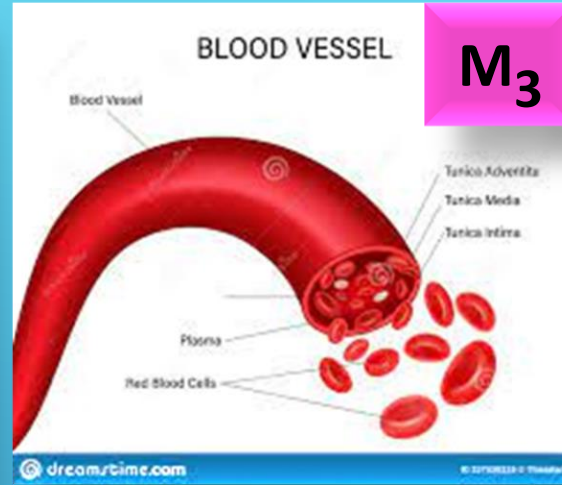
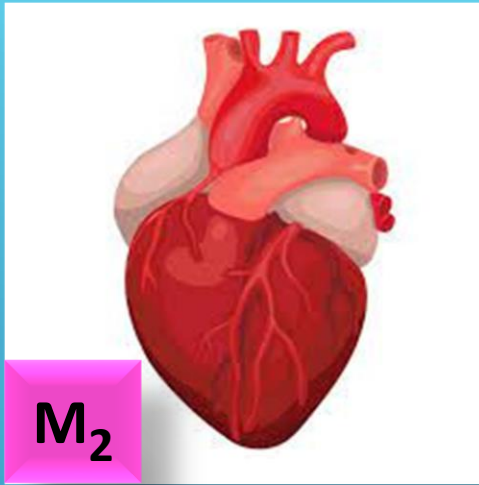
▶ **Muscarinic**

- **M1**
- **M2**
- **M3**

▶ **Nicotinic**

- **Nn (Ganglion, Adrenal medulla)**
- **Nm (NMJ)**

Distribution of cholinergic receptors



| Receptors | Location | Actions |
|--------------|--|---|
| M1 | CNS Autonomic ganglia Gastric glands | <ul style="list-style-type: none"> • Inc learning & memory • Promote glandular secretions |
| M2 | Heart | <ul style="list-style-type: none"> • Depress SA node, AV node & heart muscles activity |
| M3 | Smooth muscles Exocrine glands Endothelial cells | <ul style="list-style-type: none"> • Inc smooth muscle contraction • Inc exocrine gland secretion • Vasodilation by EDRF release |
| Nn Nm | Autonomic ganglia, adrenal medulla Neuromuscular junction | <ul style="list-style-type: none"> • Stimulates both sympathetic and parasympathetic actions • Skeletal Muscle contraction |

Adrenergic Receptors

α β

α

α_1

α_2



pre-synaptic

post-synaptic

β

β_1

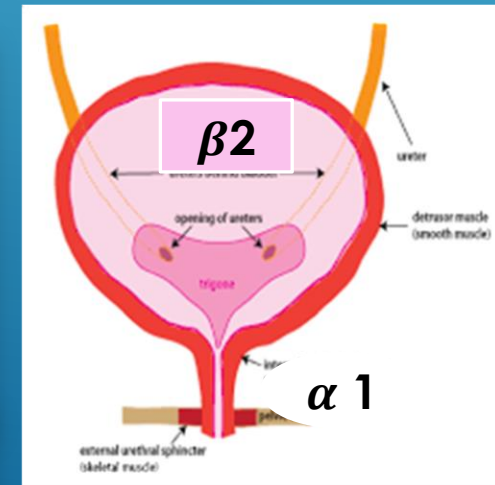
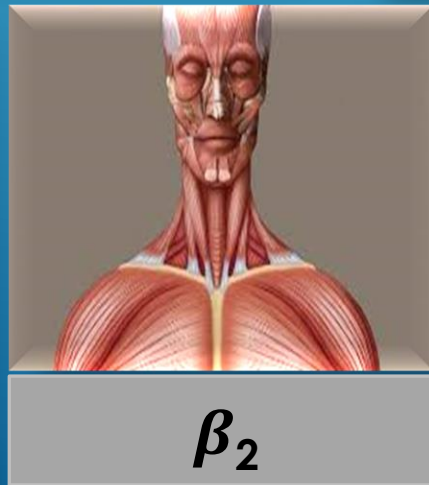
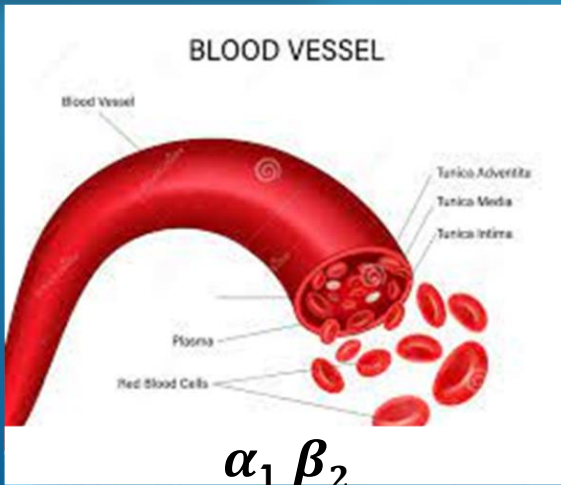
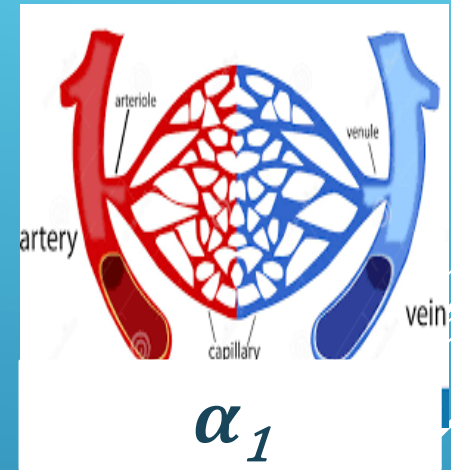
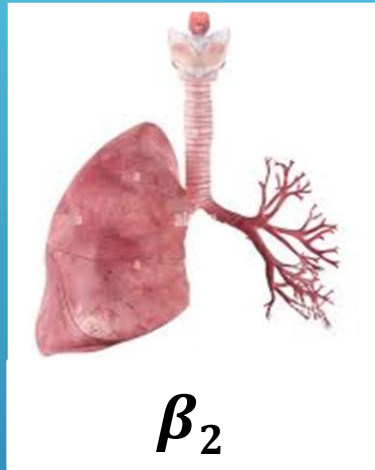
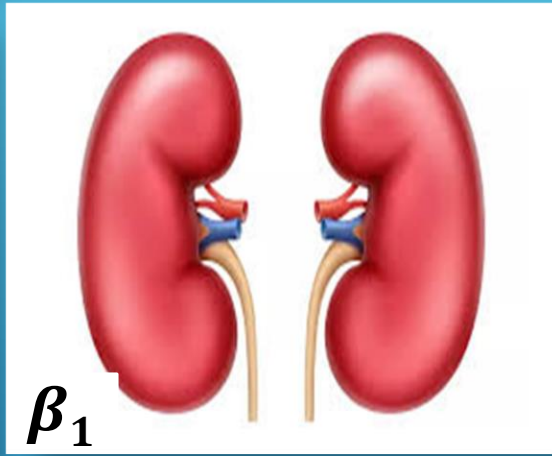
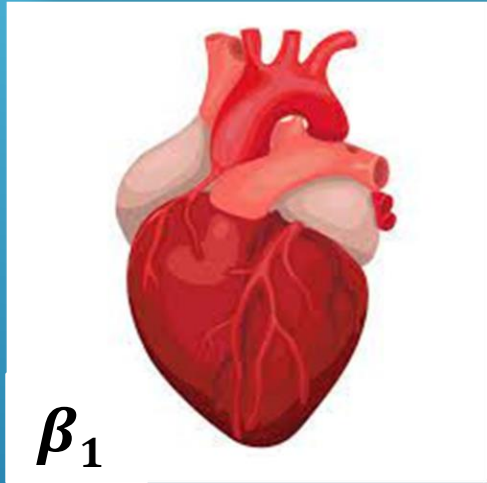
β_2

β_3

Adrenergic Receptors

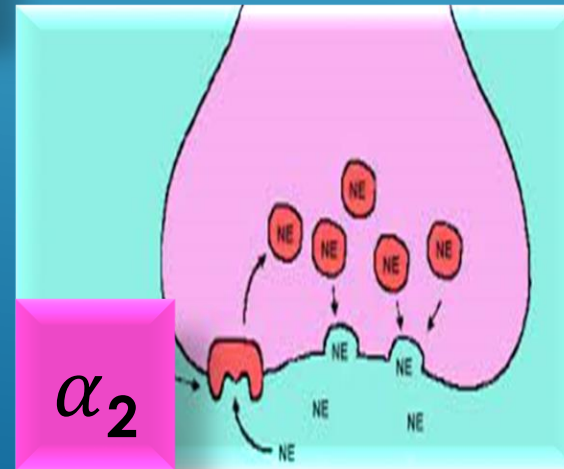
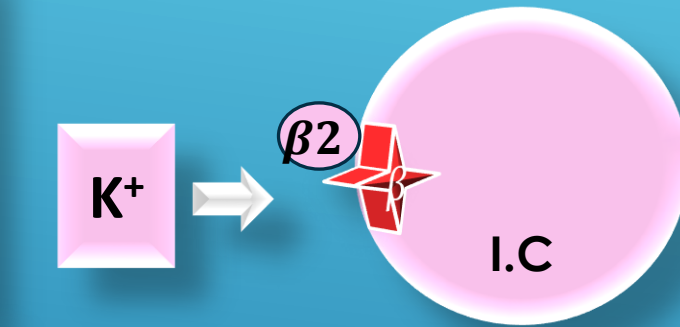
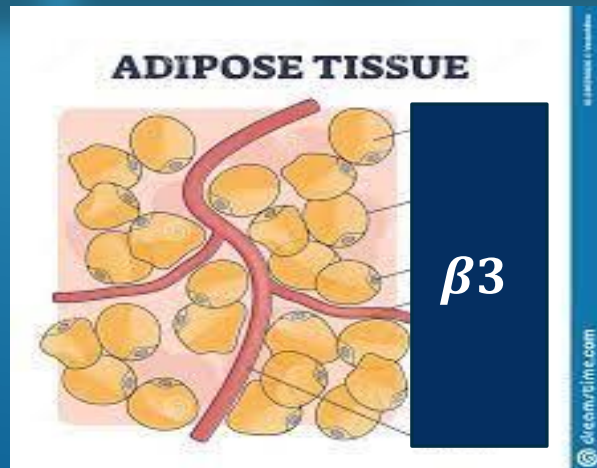
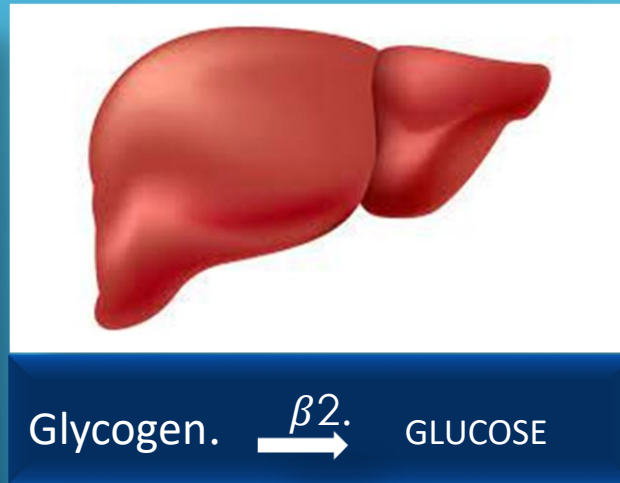
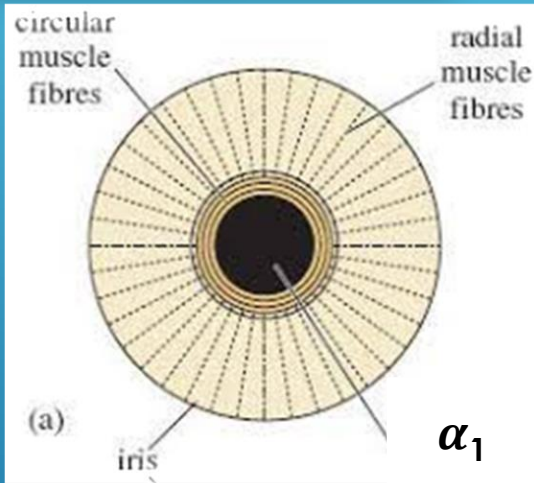
| Receptor | Cellular response |
|------------|-------------------|
| α_1 | ↑ IP3/DAG |
| α_2 | ↑ cAMP |
| α_2 | ↓ cAMP |

Distribution of Adrenergic Receptors



Anal sphincter α_1 -

Distribution of Adrenergic Receptors



| Receptor | Major Effector Tissues | Major Functions |
|--------------------|--|--|
| Alpha ₁ | SM, sphincters | Contraction (constriction), |
| Alpha ₂ | Nerve endings | ↓ Transmitter release |
| Beta ₁ | Cardiac muscle, Kidney | ↑ Heart rate and force, ↑ Renin secretion |
| Beta ₂ | SM including bronchi Liver Skeletal muscle | Relax SM ↑ Gluconeogenesis, glycogenolysis ↑ Glycogenolysis and K ⁺ uptake |
| Beta ₃ | Adipose | ↑ Lipolysis |
| DA ₁ | SM especially renal, mesenteric and cardiac | Relax renal vascular SM (higher doses activates β ₁ and α ₁ receptors) |