

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Cholinergic Drugs; **(Parasympathomimetic Drugs)**

By

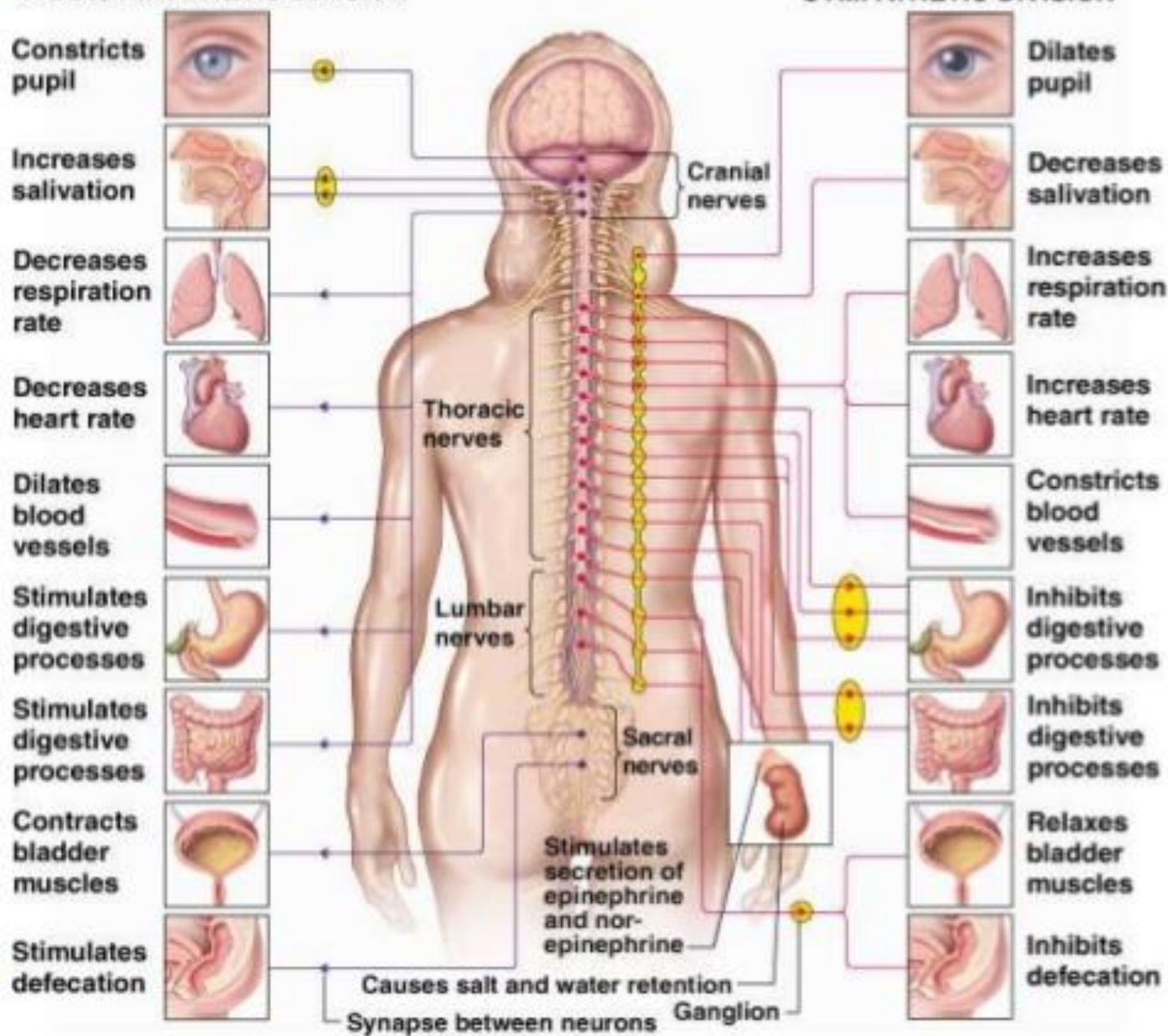
Dr. Muhammad Sarwar

Classification of Autonomic Drugs;

- **Cholinergic Drugs;**
 - **Parasympathomimetic Drugs.**
 - Muscarinic agonist drugs
 - **Parasympatholytic Drugs;**
 - Antimuscarinic drugs
 - **Ganglion Blocking Agents.**
 - **Neuromuscular blockers.**
- **Adrenergic Drugs;**
 - **Sympathomimetic Drugs;**
 - **Sympatholytic Drugs;**
 - **Adrenergic Blocking Drugs:**

PARASYMPATHETIC DIVISION

SYMPATHETIC DIVISION



Parasympathetic Nervous System

Sympathetic Nervous System

Somatic Motor System



Long

Preganglionic Neuron



Ach
nAChR



Short

Ach
mAChR

Various
Organs



Short

Ach
nAChR

Long

Ach
mAChR

Sweat
Glands



Short

Ach
nAChR

Adrenal
Medulla

Epi

Various
Organs



Motor Neuron

Ach
nAChR

Skeletal
Muscle

Ach = Acetylcholine

NE = Norepinephrine

Epi = Epinephrine

Chemical transmitters employed at specific junctions of the peripheral nervous system.

Ach as neurotransmitters;

- **All autonomic ganglion, (N)**
- **Neuromuscular junction, (N)**
- **Post ganglionic parasympathetic nerves,(M)**
- **Postganglionic Sympathetic Nerves to sweat glands, (M)**
- **Vascular smooth muscles in skeletal muscle has sympathetic cholinergic dilator fibers, (M)**
- **CNS. (M & N)**
 - **Cognitive functions, especially memory,**
 - **Presenile dementia of Alzheimer type --- profound loss of cholinergic neurons.**
 - **Motor activity (excitation),**
 - **tremors, rigidity --- Parkinson's Disease**

Classification of Cholinergic Receptors

Cholinergic receptors

Nicotinic (N)

Muscarinic (M)

N_N

- Ganglia
- Adrenal medulla

N_M

- Neuro-muscular junction

M1

- Gastric ganglia
- CNS

M2

- Heart
- CNS

M3

- Eye
- GIT
- Bladder
- Bronchus
- Glands
- CNS

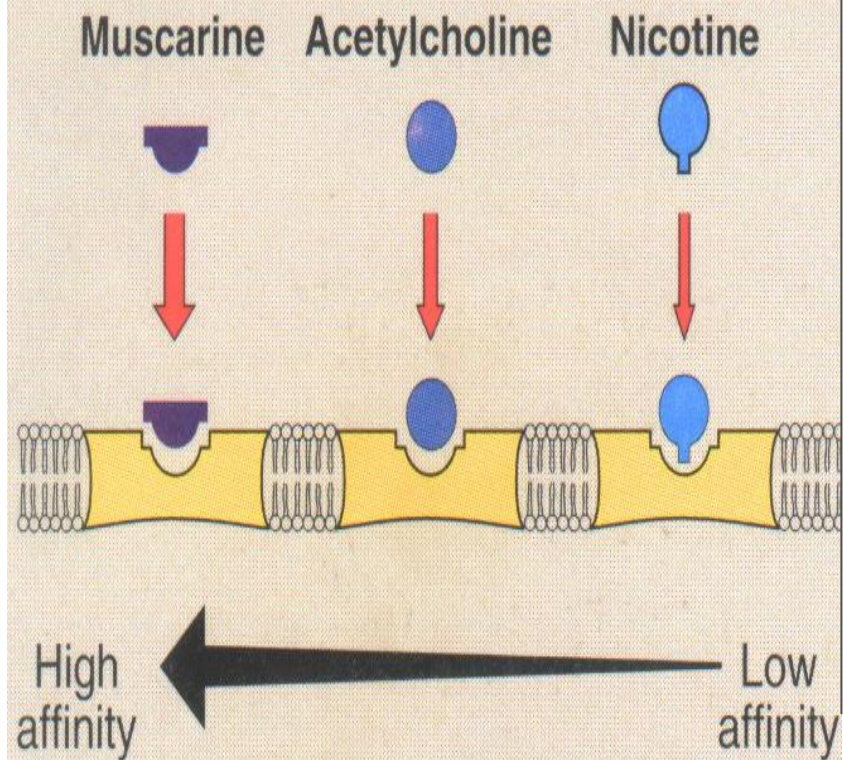
M4

- CNS

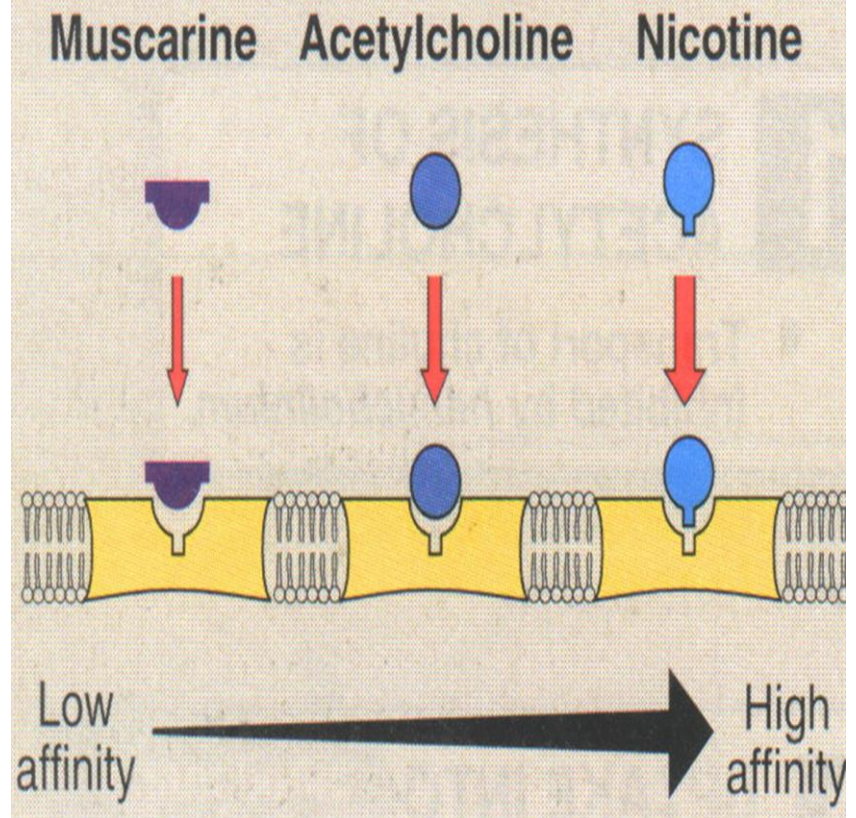
M5

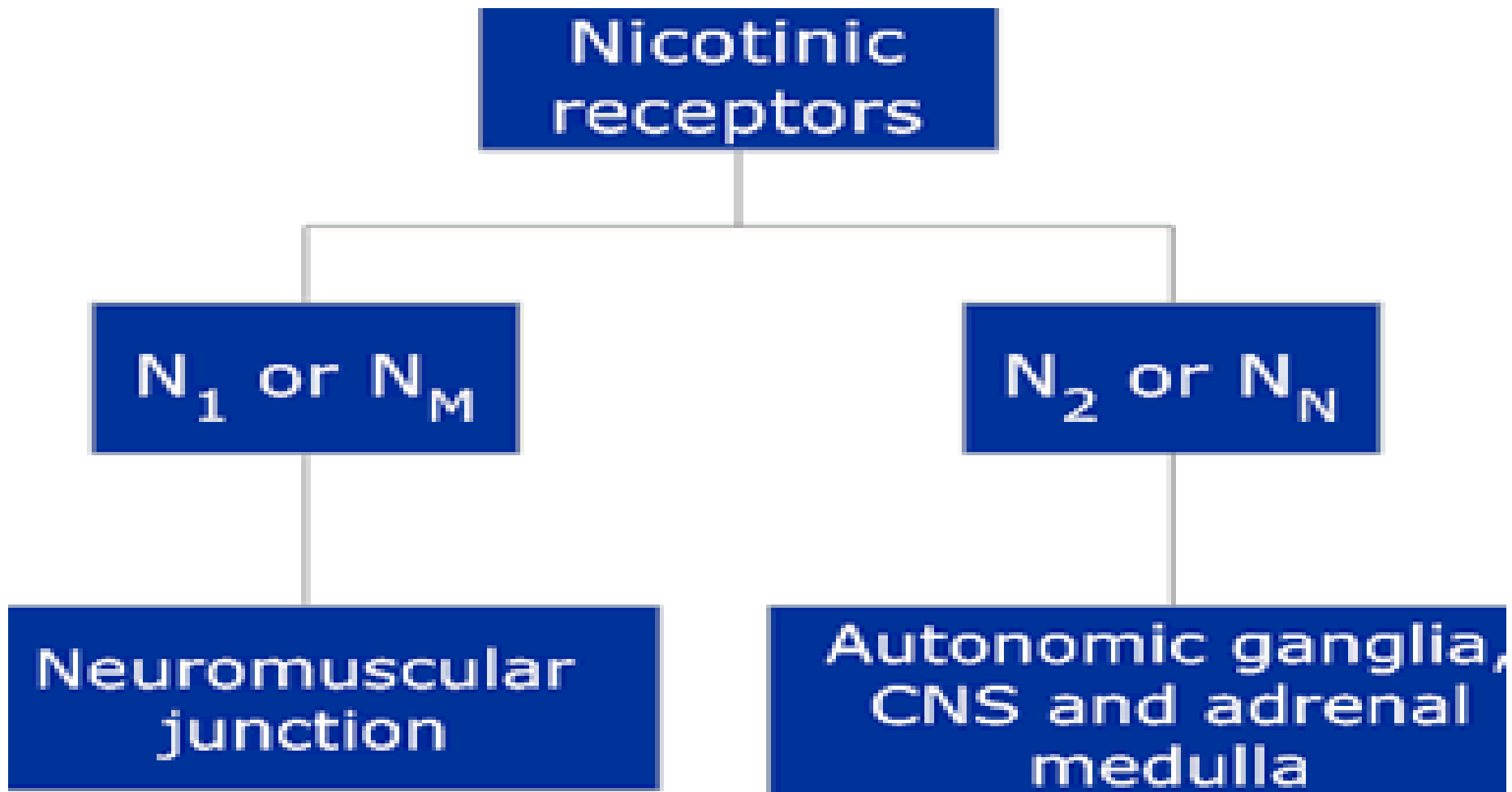
- CNS

A Muscarinic receptors

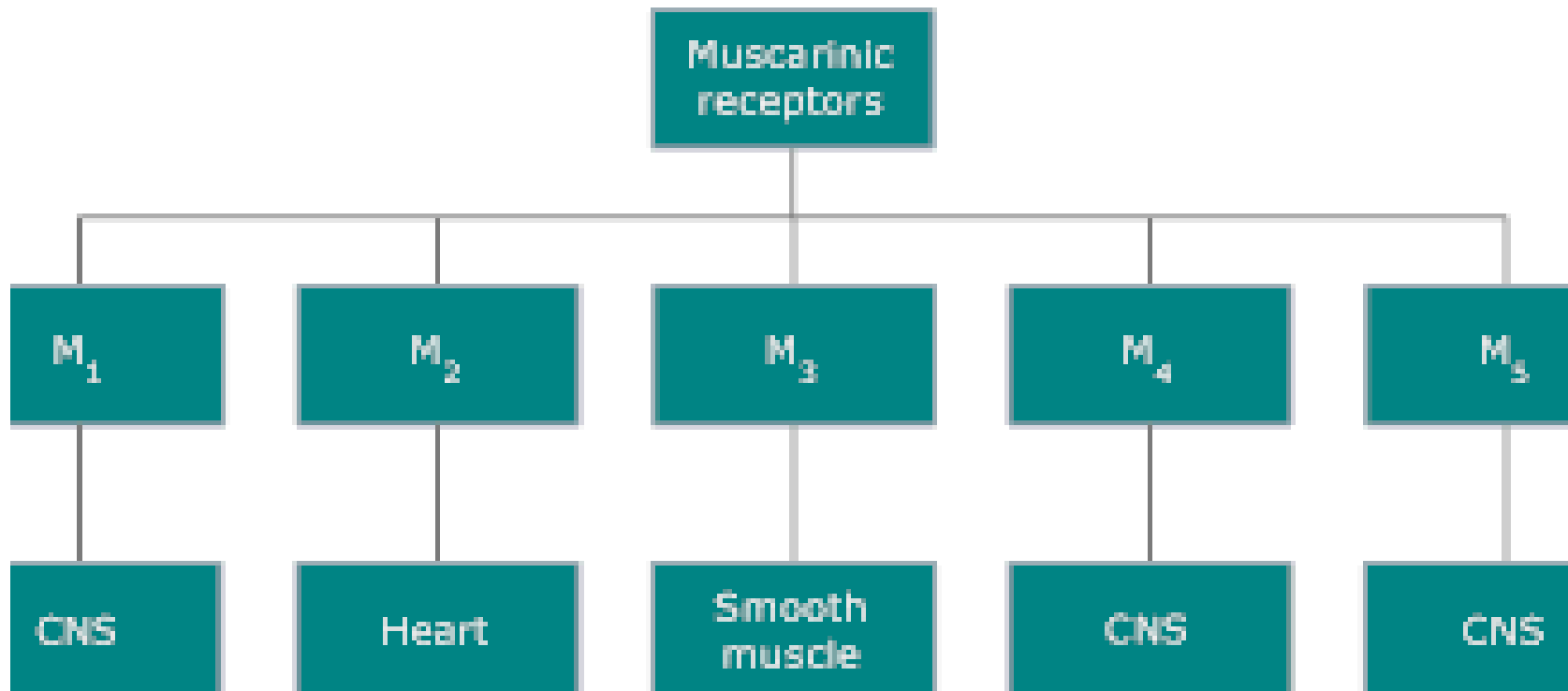


B Nicotinic receptors





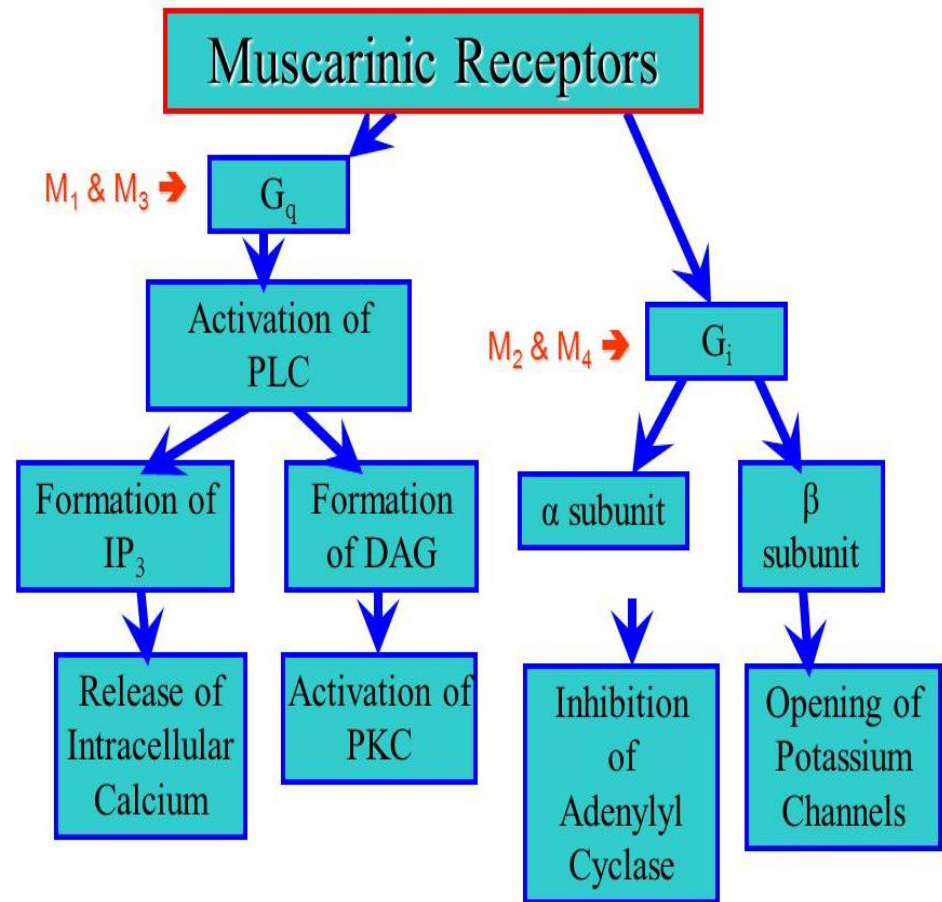
Muscles innervated by somatic motor fibers (**Nm**)



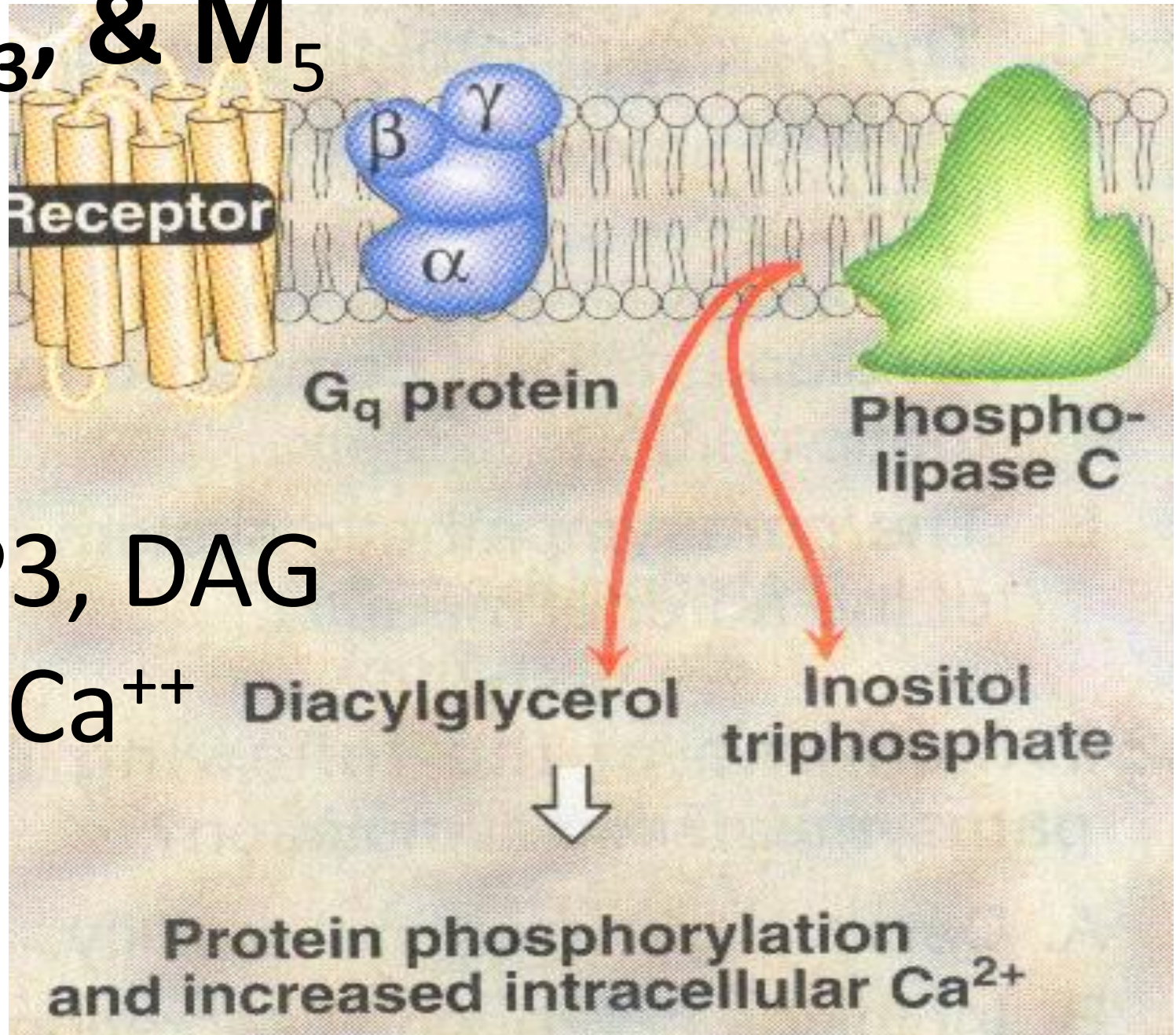
- **All muscarinic (M) Ach receptors are Selectively stimulated by muscarine and blocked by atropine.**
- Drugs with muscarinic actions preferentially stimulate **muscarinic receptors**, but at high concentration they may show some activity at **nicotinic receptors**.

Muscarinic receptors and G protein coupled effect;

- M_1 ----- G_q
- M_2 ----- G_i
- M_3 ----- G_q
- M_4 ----- G_i
- M_5 ----- G_q



M₁, M₃, & M₅



G_q – IP3, DAG

↑ Ca⁺⁺

Target		Receptor	Response
Eye	Sphincter	M ₃	Contraction—miosis
	Ciliary muscle	M ₃	Contraction—accommodation for near vision
Heart	SA node	M ₂	↓ Heart rate (HR)—negative chronotropy
	AV node	M ₂	↓ Conduction velocity—negative dromotropy No effects on ventricles, Purkinje system
Lungs	Bronchioles	M ₃	Contraction—bronchospasm
	Glands	M ₃	Secretion
GI tract	Stomach	M ₃	↑ Motility—cramps
	Glands	M ₁	Secretion
	Intestine	M ₃	Contraction—diarrhea, involuntary defecation
Bladder		M ₃	Contraction (detrusor), relaxation (trigone/sphincter), voiding, urinary incontinence
Sphincters		M ₃	Relaxation, except lower esophageal, which contracts
Glands		M ₃	Secretion—sweat (thermoregulatory), salivation, and lacrimation
Blood vessels (endothelium)		M ₃	Dilation (via NO/endothelium-derived relaxing factor)—no innervation, no effects of indirect agonists

Muscarinic receptors

Receptor	Locations	Pharmacological actions
M1 Excitatory	CNS gastric parietal cells	CNS excitation Gastric acid secretion
M2 Inhibitory	Heart	Cardiac inhibition (Bradycardia)
M3 Excitatory	Exocrine glands Smooth muscles Vascular endothelium	<ul style="list-style-type: none">• Secretion of glands• Smooth muscle contraction• Vasodilatation (via nitric oxide)
M4 & M5	CNS	memory, arousal, attention and

Cholinergic Drugs; (Parasympathomimetic Drugs)

- **Directly acting;**

These act by stimulating the nicotinic or muscarinic receptors.

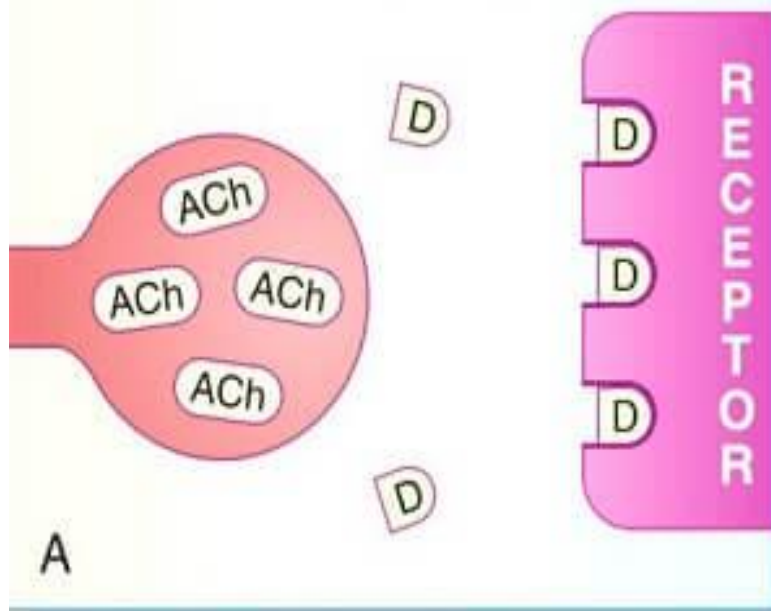
- **Indirectly acting;**

Increase the availability of Ach. to receptors

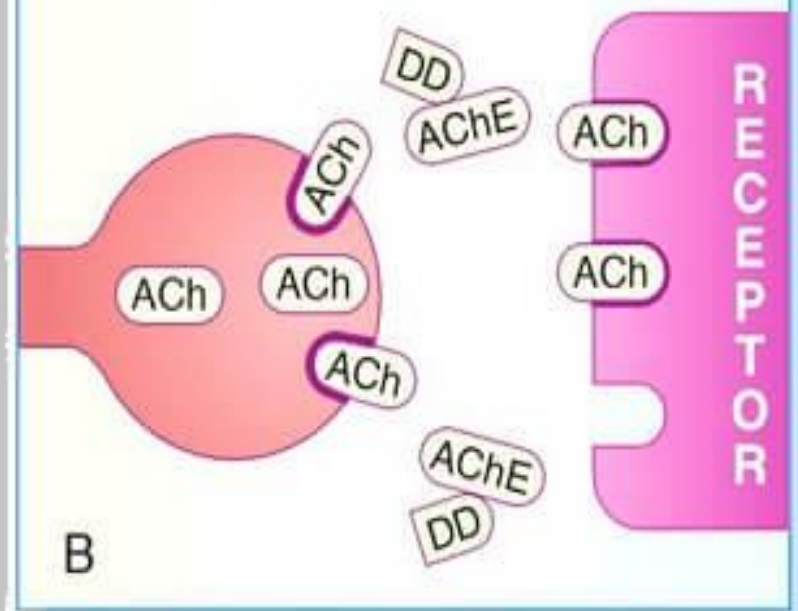
(These act as **cholinesterase inhibitors** or drugs that promote Ach. release)

Direct and indirect parasympathomimetic drugs

Direct-acting parasympathomimetic
(cholinergic drug)



Indirect-acting parasympathomimetic
(cholinesterase drug)



A landscape photograph featuring rolling green hills in the foreground and middle ground. The foreground is dominated by a field of bright yellow wildflowers. The sky is a deep blue, filled with soft, white, wispy clouds. The overall scene is bright and cheerful.

Thank You