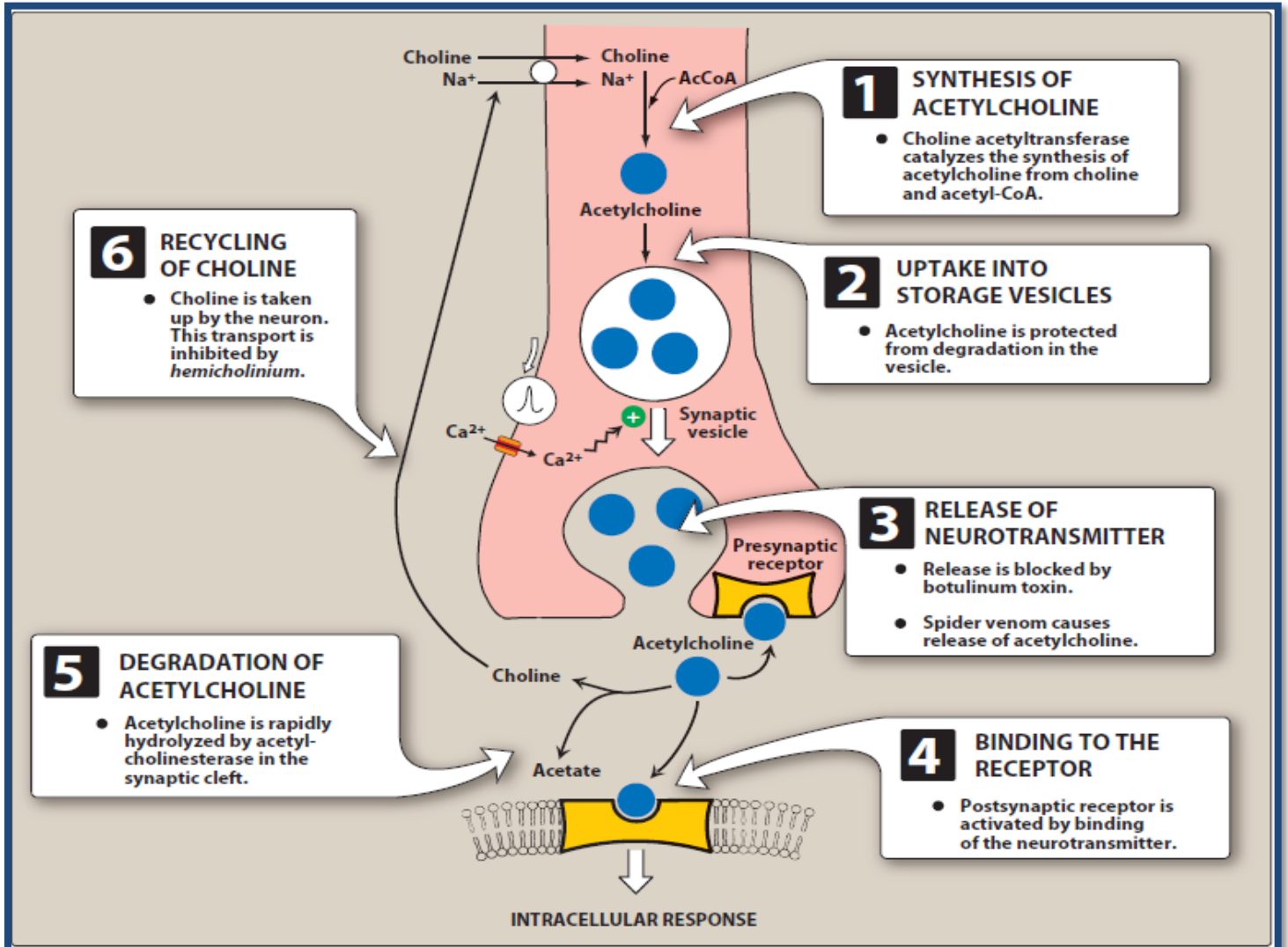


Autonomic nervous system

Autonomic nervous system		
	sympathetic	Parasympathetic
Anatomy		
Origin	From 1 st thoracic to 3 rd lumbar segments	Cranial: (III, VII, IX & X) Sacral: (S2,3, 4)
Ganglia	Close to spinal cord	Near or embedded in organs
preganglionic	Short	long
Postganglionic	long	Short
Innervation	Most organs receive dual nerve supply except	
	Sympathetic only: <ul style="list-style-type: none"> • Dilator pupillae muscle • Erector pili muscle • Sweat glands. • Adrenal medulla. • Ventricle. • Blood vessels. 	Parasympathetic only: <ul style="list-style-type: none"> • Constrictor pupillae muscle
Physiology		
tone	blood vessels & sweat glands.	All organs except blood vessels & sweat gland
Action	They are antagonistic except for atrial Conduction and salivation (both ↑)	
Cardiovascular		
Heart	↑ all cardiac properties	↓ all cardiac properties
Blood vessels	-VC of skin & mucous membrane blood vessels. - VD of coronary & skeletal blood vessels.	Not innervated
blood pressure	Increased	Decreased
Eye	Active mydriasis [++DPM]	- Miosis [++CPM] - Accommodation for near vision - ↓↓ IOP
bronchi	Bronchodilatation	Bronchoconstriction
GIT	Relax wall & contract sphincters	Contract wall & Relax sphincters
Urinary tract		
Genital	Ejaculation in male Relaxation of uterus in female	Erection in male
Salivary gland	Thick & viscid	Watery
Sweat gland	Increase	No effect
Neurotransmitters		
Ganglia	Ach	
Postganglionic	Norepinephrine (NE) except in sweat glands Ach is released	Ach

Parasympathetic nervous system

Chemical transmitter is Acetyl Choline (A.Ch.)



Synthesis:

1. Active uptake of choline by nerve endings "1st carrier mechanism" (blocked by hemicholinium).
2. In cytoplasm: choline + acetyl Co. A \rightarrow A.Ch. under control of Choline acetyl transferase (CAT) enzyme. (blocked by triethylcholine).
3. A.Ch. transported into vesicles "2nd carrier mechanism" (blocked by vesamicol).
4. A.Ch. is stored with ATP, CAT & polypeptide in vesicles
5. Depolarization wave of parasympathetic neuron opens Ca²⁺ Channels \rightarrow exocytosis of vesicles & release of A.Ch.

A.Ch. release is stimulated by spider venom & blocked by Botulinum toxins

Fate: A.Ch. is metabolized by cholinesterase into choline & Acetic acid

Autonomic nervous system

Types of cholinesterase		
	True cholinesterase	Pseudo-cholinesterase
Sites	Cholinergic structures, RBCs and CNS	Liver and plasma
Specificity	Ach, Methacholine	Nonspecific - destroys Ach, Procaine and succinylcholine.
Regeneration	In 3 months	In 3 weeks.

Cholinergic receptors						
	Nicotinic receptors		Muscarinic receptors			
MOA	coupled to Na ⁺ channels		G-protein-coupled receptors			
	Nn (neural)	Nm(muscle)	M1 (Gq)	M2(Gi)	M3(Gq)	M4(Gi) M5(Gq)
Site	-Autonomic ganglia. -Adrenal medulla.	NM junction	Ganglia	• presynaptic • Heart mainly atria	•Smooth muscles •secretory glands	
	CNS					
Activated by	Ach					
	Nicotine , lobeline					
Blocked by	Atropine					
Selective blocker	Ganglion blockers	NMBs	pirenzepine	Gallamine	Hexa Hydro Sila Difenidol	
	(Gq) → Activation of phospholipase C → formation of IP3 and DAG [M1,3,5]. (Gi) → Inhibition of adenylyl cyclase → decrease in cAMP, activation of potassium channels or inhibition of calcium channels [M2,4].					

Autonomic nervous system

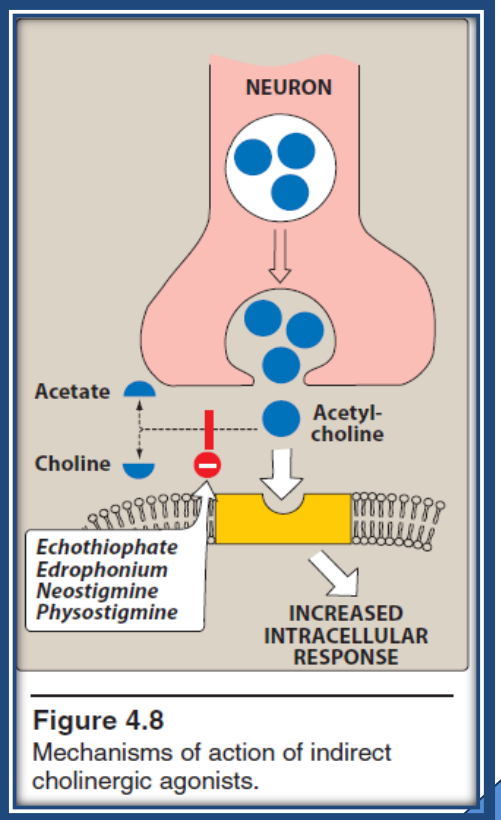
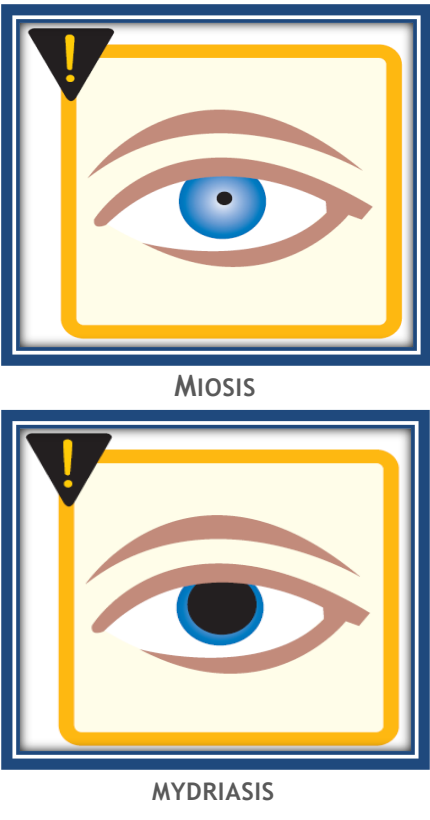
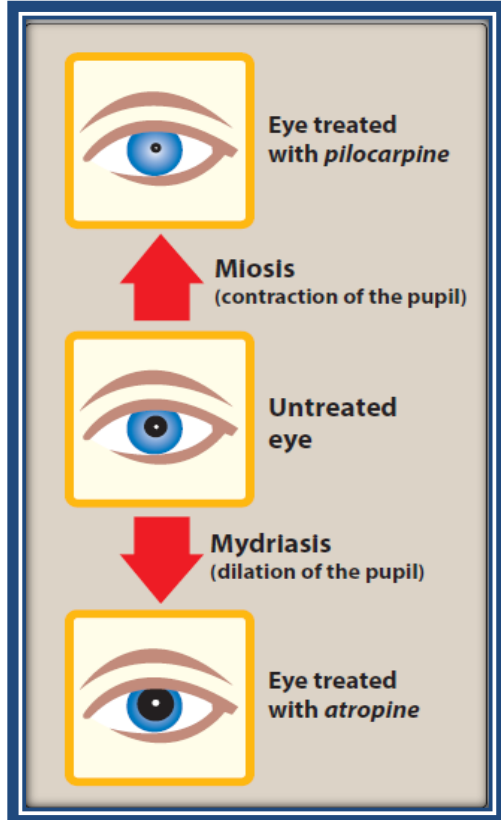
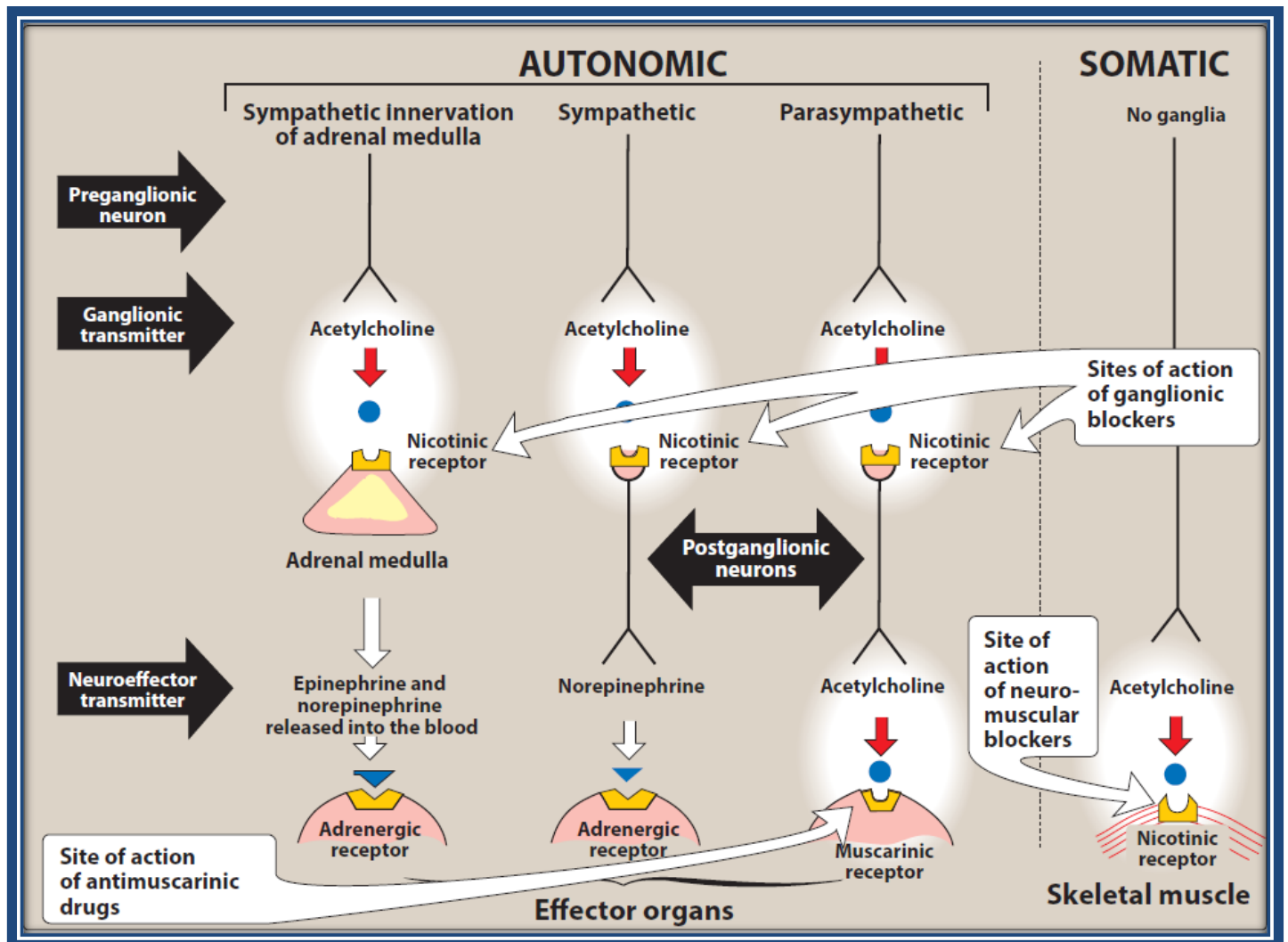


Figure 4.8
Mechanisms of action of indirect cholinergic agonists.