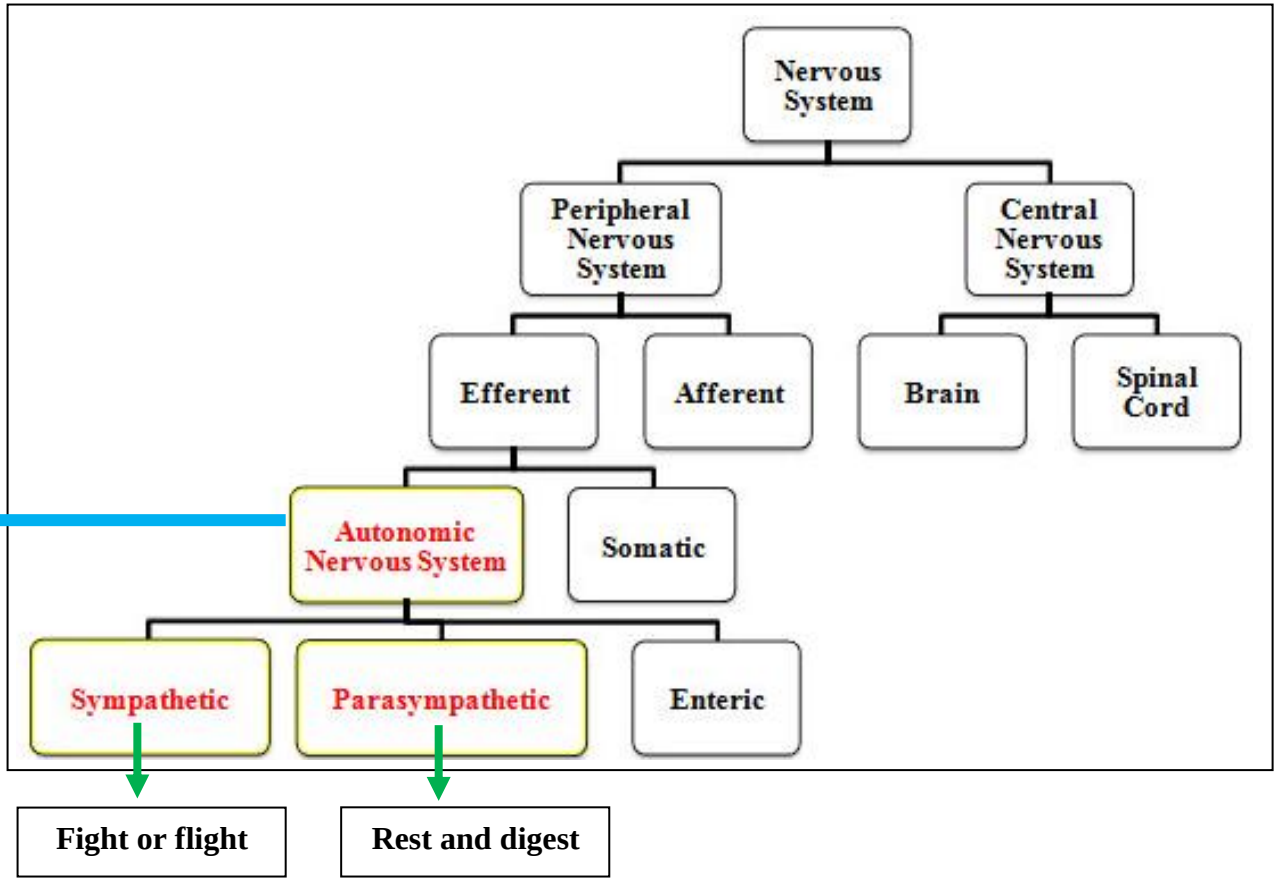
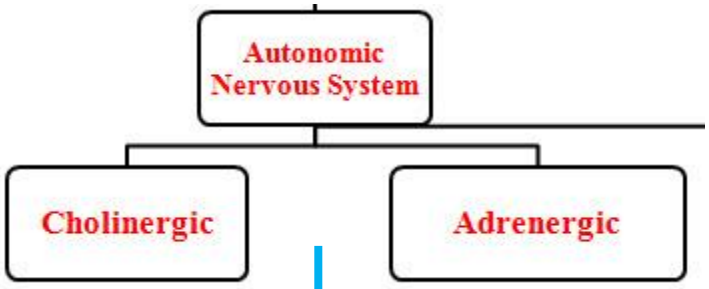
ANS Pharmacology summary :

1) Introduction :

- ANS Receptors :





1- Muscarinic

- M1 : Neurons and Parietal cells
- M2 : Heart
- M3 : Bladder, Exocrine glands, Smooth muscles

1- Nicototinc

Neuromuscular Junction (blocked by : Tubocurare)
Ganglia , (blocked by : Hexamethonium)
Adrenal Medulla

1- Alpha

A1 : * Found in : blood vessels, kidney, liver, pregnant uterus, male sexual organs, intestinal smooth muscle. * Causes vasoconstriction, decreased rennin secretion , uterine contraction
A2 : - Inhibits release of norepinephrine. affects vascular smooth muscle, inhibits insulin secretion, platelet aggregation (BP reduce)

2- Beta

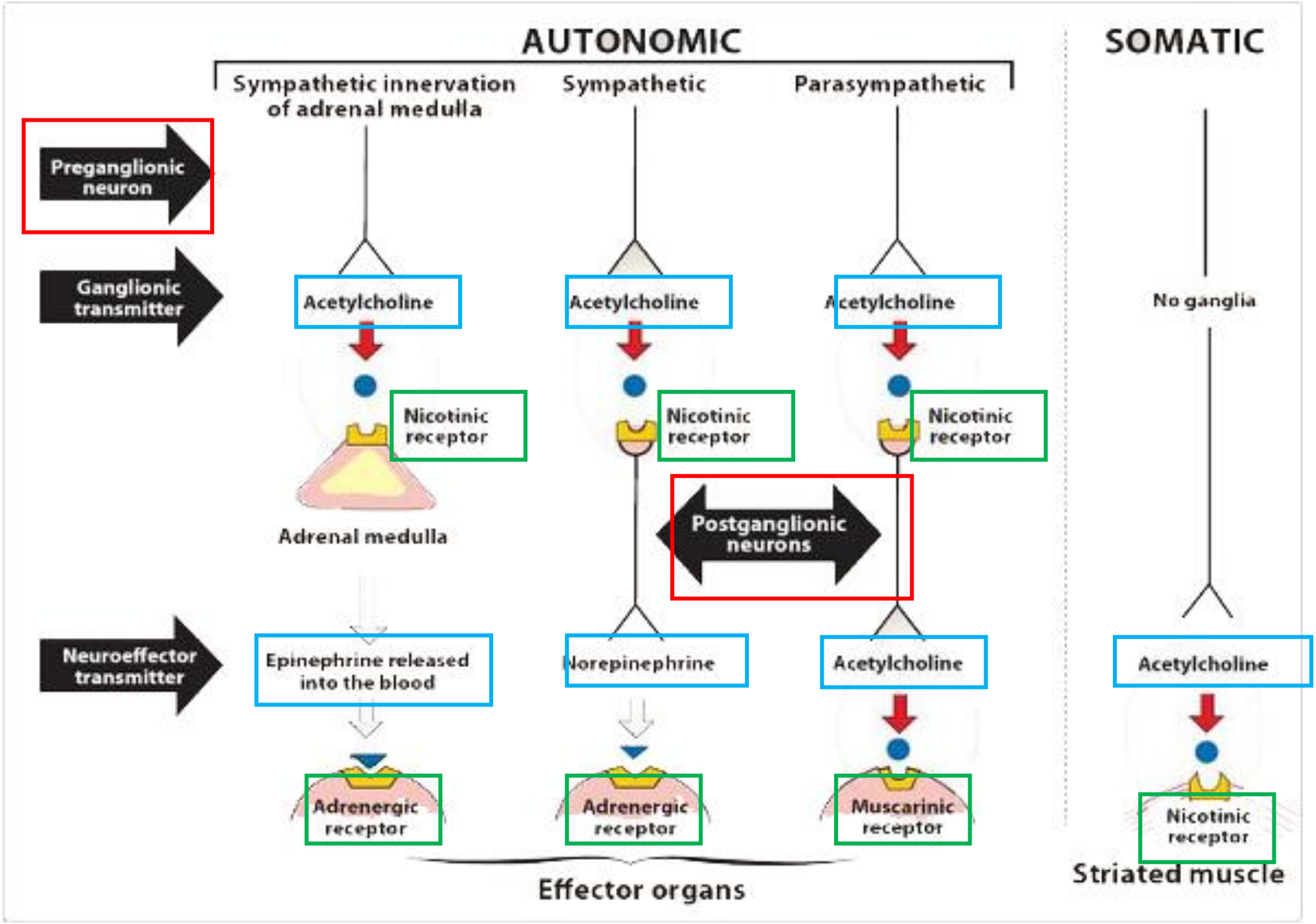
B1 : heart and kidneys (increased heart rate)

B2 : affects lungs, liver, blood vessel vasodilation, decreased motility and tone … (bronchodilation)

	Sympathetic	Parasympathetic
Arises from	Thoracolumbar	Craniosacral
Type of discharge	Generalized	Discrete
Prepares body for	Fight or Flight	Rest and Digest
Preganglionic fibers	Short	Long
Ganglia	Close to midline	Close to or within effector organ
Postganglionic fibers	Long	Short
Neurotransmitter	Norepinephrine (mainly)	Acetylcholine

- Exceptions :only symp (adrenal medulla / sweet gland / pilomotor muscle)
(only pregan.) (Only ACH)

Fibers **Receptors** **Neurotransmitters**



ANS drugs :

- produce their effect either by : mimicking (Agonist) or altering the function of the system (antagonist)
- Always keep this RULE in ur mind : most drugs work in receptors , so we can classify them according to the receptors :D

- General Effects of Cholinergic Drugs :

1) CVS : Bradycardia / BP↑
2) GIT : salivation↓ / motility and secretion↑ / Relaxation of sphincters
3) Eye : Miosis / Fixed Accommodation
4) Urinary : urination
5) RS : Bronchospasm / secretion
6) sweating↑
7) production of tears↑
8) CNS effect : tremors / convulsions
9) Muscles : Twitching and contraction / Paralysis (at high doses)

Cholinergic drugs : produce effects that mimic the effects of the endogenous Acetylcholine (also called cholinomimetic or parasympathomimetic)

Classification of **Cholinergic Drugs**

1) Agonist

Act on muscarinnc receptors

DIRECT ACTING

- Acetylcholine
- Bethanechol
- Carbachol
- Cevimeline
- Pilocarpine

Choline Esters Alkaloids

Inhibit Acetylcholinesterase

INDIRECT ACTING (reversible)

- Ambenomium
- Demecarium
- Donezepil
- Edrophonium
- Galantamine
- Neostigmine
- Physostigmine
- Pyridostigmine
- Rivastigmine
- Tacrine

INDIRECT ACTING (irreversible)

- Echothiophate

REACTIVATION OF ACETYL-CHOLINE ESTERASE

- Pralidoxime

KEY : ABC .. pile is alkel ! … edro news at Ph by radio … echo pray

2) Antagonist

KEY : atropine .. ipratropium .. scop (IFMSA !)
= at trip with scop
*** success tu bo victory**

ANTIMUSCARINIC AGENTS

- Atropine
- Cyclopentolate
- Ipratropium
- Scopolamine
- Tropicamide

GANGLIONIC BLOCKERS

- Mecamylamine
- Nicotine

NEUROMUSCULAR BLOCKERS

Depolarizing (agonist)

- Succinylcholine

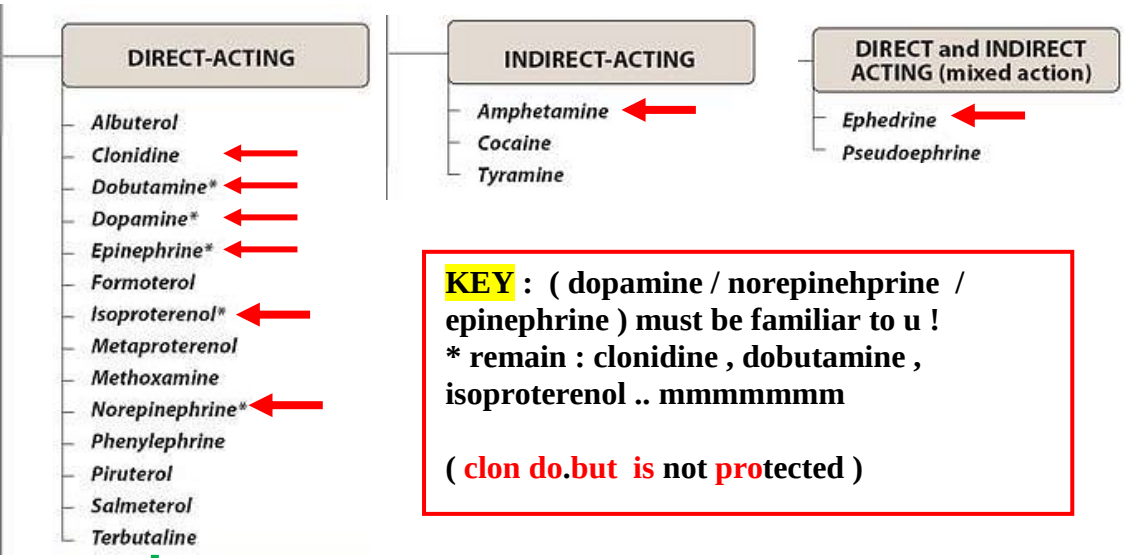
Non-depolarizing (competitive antagonist)

- Tubocurarine
- Vecuronium
- Atracurium
- Cisatracurium
- Doxacurium
- Metocurine
- Mivacurium
- Pancuronium
- Rocuronium

** **Contraindications** for adrenergic agonist :
- Cardiac dysrhythmias, angina pectoris (B1)
- Hypertension
- Hyperthyroidism
- Cerebrovascular disease
- Distal areas with a single blood supply such as fingers, toes, nose and ears
- Renal impairment use caution

Adrenergic drugs : produce effects that mimic the effects of the endogenous Acetylcholine (also called cholinomimetic or parasympathomimetic)

1- Adrenergic Agonists



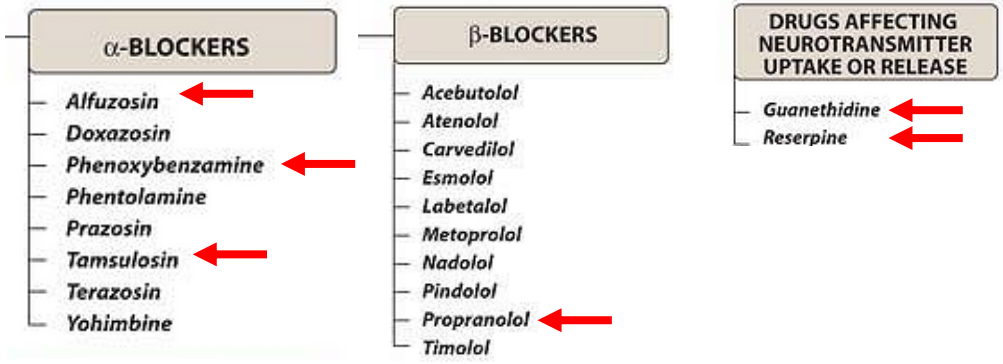
KEY : (dopamine / norepinehprine / epinephrine) must be familiar to u !
* remain : clonidine , dobutamine , isoproterenol .. mmmmmmm

(clon do.but is not protected)

Indications
- Emergency drugs in treatment of acute cardiovascular, respiratory and allergic disorders (anaphylaxis)
- For vasoconstrictive and hemostatic purposes (local anesthetics, shock)

Inhibition of uterine contractions
- Phenylephrine may be used to treat nasal congestion

1- Adrenergic Antagonists
(sympatholytic drugs)

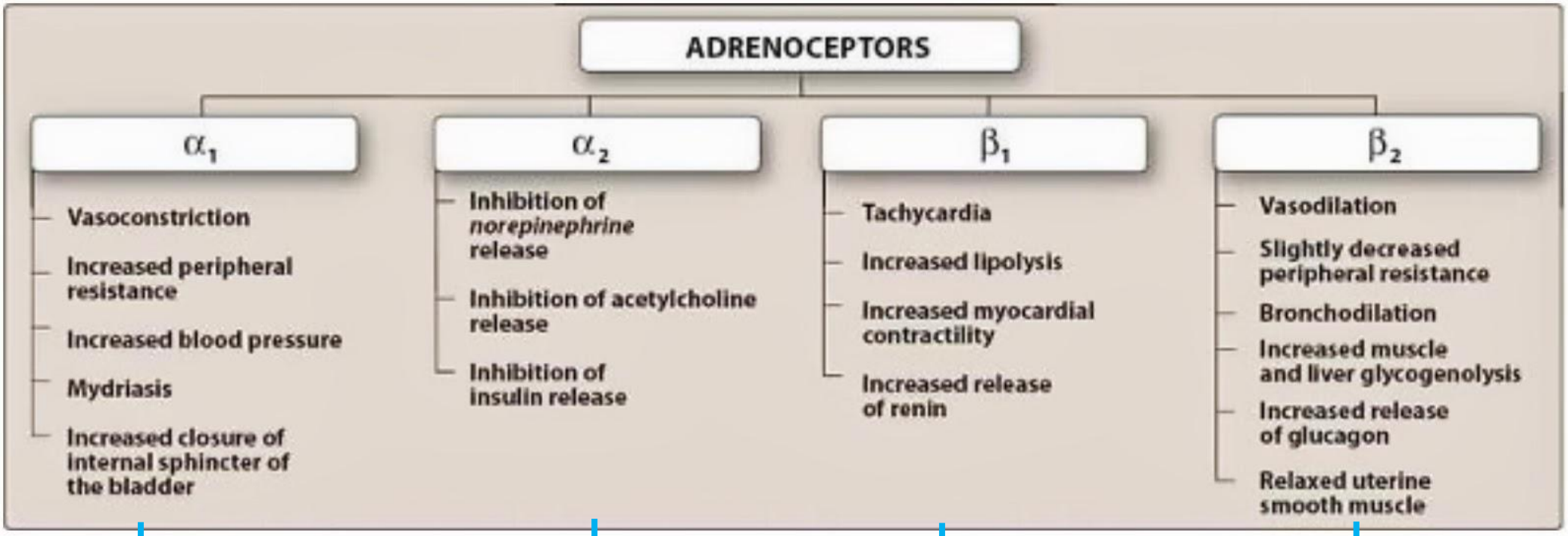


-osin , ine

- olol

KEY : (PNT Es MAA Pin CaLabe)

* Act on skin, mucosa, intestines, lungs and kidneys to prevent vasoconstriction
* Effects:
- dilation of arterioles and veins
- decreased blood pressure
- pupillary constriction
- increased motility of GI tract



- Blood vessels, kidney, liver, pregnant uterus, male sexual organs, intestinal smooth muscle.
- Causes vasoconstriction

- α2 agonists are used in hypertension to reduce the blood pressure. (clonidne)
- α1 agonist this will result in hypertension.

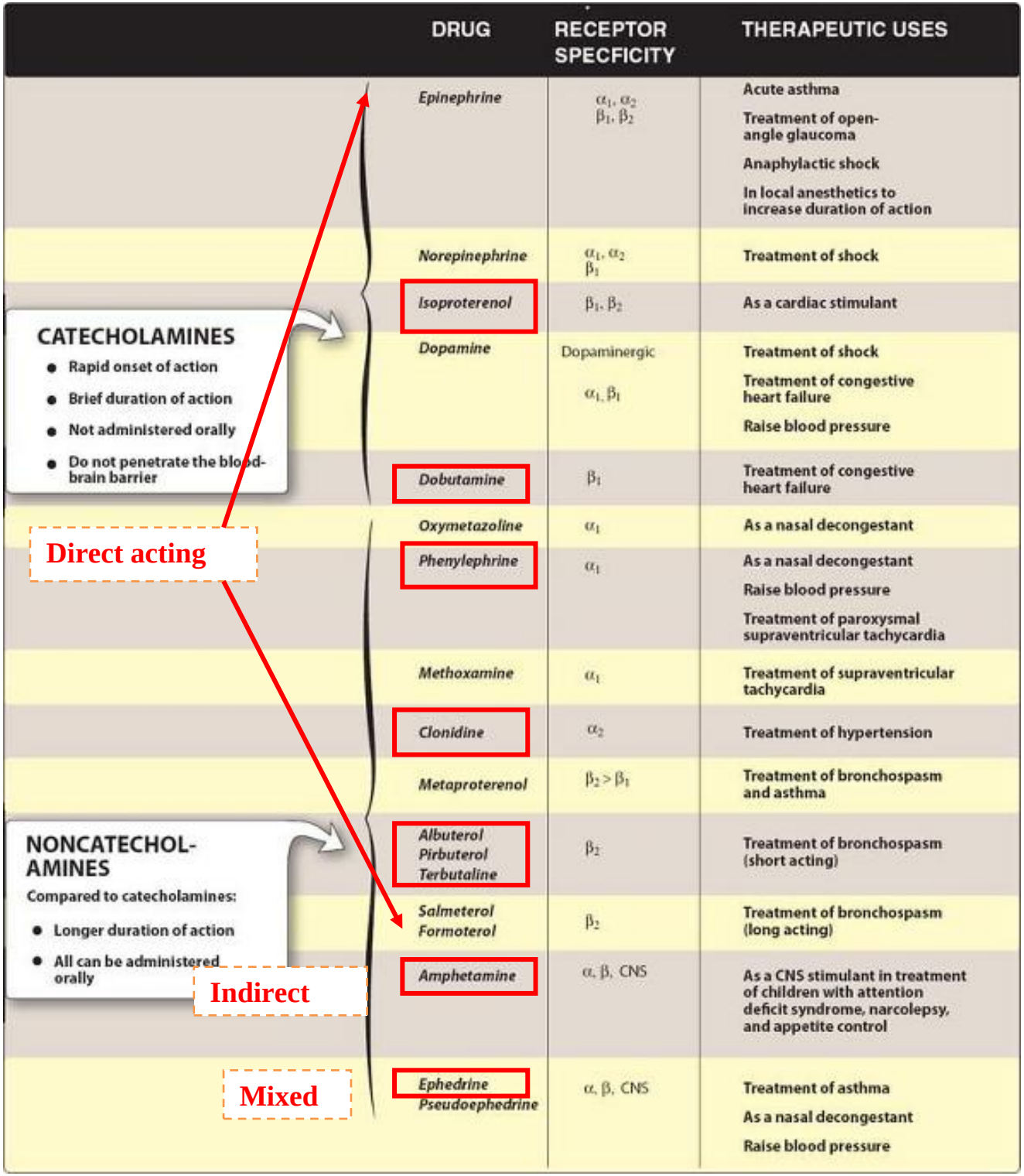
- Affects heart and kidneys
- stimulating of β1 will result in tachycardia

- Affects lungs, liver, blood vessel vasodilatation, decreased motility and tone, present in the bronchi ,there stimulation results in dilation (relaxation). .. (given to pregnant)

Agonist : will produce the same effect !

Antagonist (blockers) : will produce the reverse effect ! or will just block the effect

1- Adrenergic Agonists



DRUG	RECEPTOR SPECFICITY	THERAPEUTIC USES
Epinephrine	α_1, α_2 β_1, β_2	Acute asthma Treatment of open-angle glaucoma Anaphylactic shock In local anesthetics to increase duration of action
Norepinephrine	α_1, α_2 β_1	Treatment of shock
Isoproterenol	β_1, β_2	As a cardiac stimulant
Dopamine	Dopaminergic α_1, β_1	Treatment of shock Treatment of congestive heart failure Raise blood pressure
Dobutamine	β_1	Treatment of congestive heart failure
Oxymetazoline	α_1	As a nasal decongestant
Phenylephrine	α_1	As a nasal decongestant Raise blood pressure Treatment of paroxysmal supraventricular tachycardia
Methoxamine	α_1	Treatment of supraventricular tachycardia
Clonidine	α_2	Treatment of hypertension
Metaproterenol	$\beta_2 > \beta_1$	Treatment of bronchospasm and asthma
Albuterol *Pirbuterol* *Terbutaline*	β_2	Treatment of bronchospasm (short acting)
Salmeterol *Formoterol*	β_2	Treatment of bronchospasm (long acting)
Amphetamine	α, β, CNS	As a CNS stimulant in treatment of children with attention deficit syndrome, narcolepsy, and appetite control
Ephedrine *Pseudoephedrine*	α, β, CNS	Treatment of asthma As a nasal decongestant Raise blood pressure

2- Adrenergic Antagonist (beta blockers)

Contraindications
Heart block
Heart failure
Diabetes (caution)
B2 in pregnant
B2 in Asthma patients

Effects of beta blocking drugs →
Decreased heart rate
Decreased force of contraction
Decreased CO
Slow cardiac conduction
Decreased automaticity of ectopic pacemakers
Decreased renin secretion from kidneys
Decreased production of aqueous humor in eye

prototype →

DRUG	RECEPTOR SPECFICITY	THERAPEUTIC USES
Propranolol	β_1, β_2 **Non-cardioselective**	Hypertension Glaucoma Migraine Hyperthyroidism Angina pectoris Myocardial infarction
Nadolol *Timolol*	β_1, β_2	Glaucoma Hypertension
Acebutolol[1] *Atenolol* *Esmolol* *Metoprolol*	β_1 **cardioselective**	Hypertension
Pindolol[1]	β_1, β_2	Hypertension
Carvedilol *Labetalol*	$\alpha_1, \beta_1, \beta_2$	Hypertension Congestive heart failure

ANS Diseases and Their drugs

Disease	Drug for therapy	Side effects	Notes
Glaucoma **Is a condition characterized by an increase in the Intra-Ocular Pressure (IOP) which may eventually cause damage to the optic nerve**	**Pilocarpine (emergency)** **Carbachol (Synthetic)** **Echothiophate** **Physostigmine** **Propranolol** **nadolol / Timolol**	**Fixation of accommodation, excessive sweating and salivation and CNS effects** **- ↓ cardiac output and heart rate And bronchoconstriction**	**- alkaloid , unchaged** **- Not Hydrolysed by Acetylcholin-esterase** **- Decrease salivation** **- Choline Ester as eye drops (produce miosis)** **- Not Hydrolysed by Acetylcholin-esterase** **- Muscarinic/Nicotinic Receptors** **- charged** **Irreversible Anticholinesterases (used for Chronic Open-Angle Glaucoma) , antidote : Atropine** **(atropine is contraindicated in : Glaucoma ! and prostate enlargement , and urinary retention)**
Eyedrops for rapid miosis before surgery	**Acetylcholine (Endogenous)**		**- Choline Ester** **- Hydrolysed by Acetylcholin-esterase** **- Muscarinic/Nicotinic Receptors** **- charged**
- Postsurgical /Postparum Atony / Non-obstructive urinary retention / Neurogenic Atony / Megacolon **- Atonic bladder** **- intestinal atony**	**Bethanechol (Synthetic)** **- Physotigimine** **- Neostigmine**		**- Choline Ester** **- Not Hydrolysed by Acetylcholin-esterase** **- Muscarinic Receptors** **- charged**
Xerostomia (dry mouth syndrome) and Sjogren Syndrome	**Pilocarpine**		**** Sjogren Syndrome : systemic autoimmune disease in which immune cells attack and destroy the exocrine glands that produce tears and saliva**

Myasthenia Gravis **An autoimmune disease characterized by the progressive weakness of muscles that is caused by antibodies against the nicotinic receptors of the Neuro-muscular junction**	**Edrophonium** **Neostigmine** **Pyridostigimine**		**- Diagnose Myasthenia gravis**
Cholinergic Crisis **A condition in which there's severe cholinergic effects** **Caused by excessive intake of Anticholinesterases**	**Atropine**		**Side effects :** **- loss accommodation** *** Atropine competitively inhibits muscarinic responses to ACh**
Toxicity of Organophosphate Compounds (Nerve Gases)	**Antidote:** **Atropine** **Pralidoxime**		**Toxicity of nerve gases will produce:** **-- Runny nose, chest tightness, constricted pupil** **-- Excessive salivation, urination and defecation** **-- Muscle weakness and paralysis** **-- Coma, convulsions** **-- Death**
Acute Asthma	**Ipratropium** **terbutaline / albuterol**		**B2 agonist**
Prevent motion sickness	**Scopolamine (hycosine)**	**- Amnesia effect** **حالة من النسيان**	**Peripheral effects similar to atropine** **More CNS effects**
Used during surgery to relax muscles	**Turbocurarine**		**Non-depolarizing (competitive antagonist)** **Block ion channels at motor end plate** **- Increases safety of anesthetics** **- Does not cross blood-brain barrier**
endotracheal intubations **electroconvulsive shock therapy**	**Succinylcholine**		**Depolarizing (agonist)** **Activates receptor** **** Problem: can cause apnea (breath stop)**
Block uptake process of choline **inhibit release of ACH**	**Hemicholinium** **Botulinum toxin**		

stimulate release of ACH	**Black widow spider**		
Hypertension	**All the beta blockers ! remember the key ! (PNT Es MAA Pin CaLabe)**	**- arrhythmia , sexual dysfunction ,**	
Migraine **Hypothyroidism** **Angina pectoris** **Myocardial infraction**	**Propranolol**		
Congestive heart failure	**Carvedilol** **labetolol** **dobutamine**		
nasal decongestant	**Phenylephrine**		
BPH (benign prostatic hyperplasia) **تضخم البروستات الحميد**	**Alpha 1 blockers (*Tamsulosin* and *alfuzosin)***		**Inhibit contraction of muscles in prostate and bladder**
pheochromocytoma, (catecholaminesecreting tumor of cells derived from the adrenal medulla.)	***Phenoxybenzamine***	**postural hypotension, nasal stuffiness, nausea, and vomiting**	

Best wishes ^_^

Omar Sawas