

ANS Study Guide

Autonomic Nervous System (ANS)

Nervous System Divisions

- **Central Nervous System (CNS):** Brain and spinal cord
- **Peripheral Nervous System (PNS):** Nerves outside the CNS
 - **Somatic Nervous System:** Voluntary control (skeletal muscles)
 - **Autonomic Nervous System (ANS):** Involuntary control (smooth muscle, glands)

ANS

- **Function:** Acts on smooth muscle and glands to control and regulate the heart, lungs, GI tract, bladder, eyes, and glands.
- **Two Main Divisions:**
 - **Sympathetic Nervous System (SNS):** "Fight or Flight"
 - **Parasympathetic Nervous System (PNS):** "Rest and Digest"

	Sympathetic Nervous System (SNS)	Parasympathetic Nervous System (PNS)
Nickname	"Fight or Flight"	"Rest and Digest"
Primary Neurotransmitter	Norepinephrine (NE)	Acetylcholine (ACh)
Heart	↑ Heart Rate, ↑ Contractility	↓ Heart Rate
Lungs	Bronchodilation (airways open)	Bronchoconstriction (airways narrow)
Eyes	Pupil Dilation (Mydriasis)	Pupil Constriction (Miosis)
GI Tract	↓ Motility, ↓ Secretions	↑ Motility, ↑ Secretions
Bladder	Relaxes bladder, contracts sphincter	Contracts bladder, relaxes sphincter
Salivary Glands	↓ Salivation	↑ Salivation

ANS Neurotransmitters and Receptors

Adrenergic Receptors (Sympathetic)



- **Neurotransmitter:** Norepinephrine (NE) & Epinephrine (Epi)
- **Receptor Types:**
 - **Alpha-1 ($\alpha 1$):** Vasoconstriction (↑ BP), pupil dilation, bladder sphincter contraction

- **Alpha-2 (α_2):** Inhibits NE release (acts as a brake on the SNS), causing vasodilation and \downarrow BP

Heart and Kidney

Beta-1 (β_1): Located in the **heart** ("you have 1 heart"). Increases heart rate, contractility, and renin secretion.

Beta-2 (β_2): Located in the **lungs** ("you have 2 lungs"). Causes bronchodilation, uterine relaxation, and increased blood glucose.

Lungs, Uterus, Pancreas

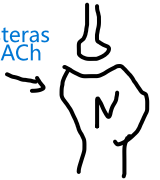
If chicken is nervous, it doesn't lay the egg.

Cholinergic Receptors (Parasympathetic)

- **Neurotransmitter:** Acetylcholine (ACh)
- **Receptor Types:**
 - **Muscarinic (M):** Found on target organs. Effects include \downarrow HR, \uparrow GI motility, \uparrow secretions, pupil constriction.
 - **Nicotinic (N):** Found in **ganglia and skeletal muscle.**

Autonomic Muscle Think Musca = Mucosas

Acetylcholinesterase Enzyme eats ACh



Myasthenia gravis

Battery! People look like they have low battery they can do to many things cause their muscle stop moving.



Quick Reference for Receptor Actions

- **α_1 :** Arteries constrict (\uparrow BP, pupils dilate, sphincters tighten)
- **α_2 :** Anti-sympathetic (\downarrow NE release, \downarrow BP)
- **β_1 :** 1 Heart (\uparrow HR, \uparrow contractility, \uparrow conduction)
- **β_2 :** 2 Lungs (bronchodilation, uterus relaxes, glucose release)

Adrenergic Agonists (Sympathomimetics)

These drugs mimic the effects of the Sympathetic Nervous System.

Epinephrine (Adrenaline)

Used in Emergencies!!!

- **Class:** Nonselective Adrenergic Agonist (stimulates α_1 , β_1 , and β_2)
- **Actions:**
 - **α_1 :** Increases blood pressure (vasoconstriction)
 - **β_1 :** Increases heart rate and contractility
 - **β_2 :** Promotes bronchodilation
- **Uses:**
 - **Anaphylaxis / Anaphylactic Shock** (drug of choice)
 - Cardiac arrest, cardiogenic shock
 - **Severe bronchospasms**
- **Side Effects:** Cardiac dysrhythmias, hypertension, tachycardia, tremors, pulmonary edema.

SHOCK: an acute medical condition associated with a fall in blood pressure, caused by such events as loss of blood, severe burns, bacterial infection, allergic reaction, or sudden emotional stress, and marked by cold, pallid skin, irregular breathing, rapid pulse, and dilated pupils:

Shock = Oxygen doesn't get to the the hole body because of cardiovascular prc

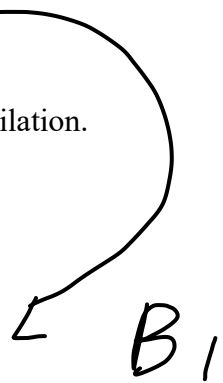
Wherever the receptors are

- **Caution:** Use with caution in patients with cardiac dysrhythmias, hypertension, hyperthyroidism, diabetes, and narrow-angle glaucoma. Interacts with **beta-blockers** and **digoxin.**



→ Albuterol (Proventil) = Asthma

- **Class:** Selective Beta-2 Adrenergic Agonist
- **Action:** Stimulates β_2 receptors in the lungs to cause bronchodilation.
- **Uses:**
 - Acute asthma attacks ("rescue inhaler")
 - **Bronchospasm prevention** (e.g., exercise-induced)
 - **COPD, bronchitis**
- **Side Effects:** Tachycardia, palpitations, tremors, restlessness.
 - β_1 spillover
- **Nursing Considerations:** Monitor HR and BP. **Overuse can lead to paradoxical bronchospasm** (worsening of breathing).



Central-Acting Alpha-2 Agonists

- **Mechanism:** Stimulate α_2 receptors in the CNS, which reduces sympathetic outflow from the brain, leading to vasodilation and decreased BP.

Drug	Primary Use	Pregnancy Safety	Key Points
Clonidine (Catapres)	Hypertension, ADHD, opioid withdrawal	Usually avoided	Available as a patch. Abrupt cessation can cause rebound hypertension.
Methyldopa (Aldomet)	Hypertension, especially during pregnancy	Preferred; considered safe	Longer acting than clonidine.



Adrenergic Blockers (Sympatholytics)

These drugs block the effects of the Sympathetic Nervous System.

Type/Class	Mechanism	Examples	Primary Use
Alpha Blockers	Block α_1 receptors → vasodilation	<u>Prazosin, Doxazosin</u>	Hypertension, <u>BPH</u> (relaxes prostate/bladder neck)
Beta Blockers	Block β receptors	Metoprolol, Atenolol, Propranolol	Hypertension, angina, heart failure, arrhythmias
Mixed Alpha/Beta Blockers	Block both α_1 and β receptors	Carvedilol, Labetalol	Heart failure, hypertension

Alpha Blockers (Alpha-1 Antagonists)

- **Examples:** Prazosin (Minipress), Doxazosin (Cardura)
- **Action:** Block α_1 receptors, causing vasodilation (\downarrow BP) and relaxation of smooth muscle in the prostate and bladder neck.
- **Uses:** Hypertension, Benign Prostatic Hyperplasia (BPH).
- **Side Effects:** Orthostatic hypotension, dizziness, palpitations, sexual dysfunction.

Prostate = Pipe sphincter, so since, so we use A1 blocker for BPH

Beta Blockers (Beta Antagonists)



Summary

Beta blockers are to cure heart, just remember that some are nonselectives and can affect lungs

- **Action:** Decrease heart rate, contractility, and blood pressure.
- **Two Types:**
 - **Selective (Cardioselective):** Block only β_1 receptors (*safer for patients with lung issues*).
 - **Examples:** Atenolol (Tenormin), Metoprolol (Lopressor)
 - **Nonselective:** Block both β_1 and β_2 receptors.
 - **Examples:** Propranolol (Inderal)
 - **Contraindication:** **COPD** and asthma, as blocking β_2 causes bronchoconstriction.
- **Side Effects:** Bradycardia, hypotension, fatigue, impotence/decreased libido, bronchospasm (with nonselective beta-blockers).
- **Beta-blockers can mask the symptoms of hypoglycemia.**

Hypoglycemia sign -> Tachycardia. Beta blocker can mask this symptom.

Nursing Interventions for Adrenergic Blockers

- ✓ **Monitor:** BP and heart rate. **Hold the medication if BP or HR is too low** (e.g., HR < 60 bpm).
- ✓ **Report:** Marked decrease in BP/HR, dizziness, or chest pain.
- ✓ **Assist:** Help patient with ambulation to avoid falls from orthostatic hypotension.
- ✓ **Teach:** Instruct patient to rise slowly and how to take their own pulse.

Cholinergic Agonists (Parasympathomimetics)

Rest and Digest => Salivation, Secretion and Pop, Pee, Eat.

These drugs mimic the effects of the Parasympathetic Nervous System (Rest and Digest).

Cholinergic Agonist Effects ("SLUDGE")

- ✓ S: Salivation
- ✓ L: Lacrimation (tears)
- ✓ U: Urination
- ✓ D: Digestion / Diarrhea
- ✓ G: GI motility/cramping
- **E: Emesis (vomiting)** To much belly stimulation! :)
- **Other effects:** Pupil constriction (miosis), bronchoconstriction, bradycardia.

Direct-Acting Cholinergic Agonists

- **Bethanechol (Urecholine)**
 - **Action:** Stimulates muscarinic receptors to increase bladder tone and urination.
 - **Use:** **Urinary retention** (non-obstructive).
- **Pilocarpine (Pilocar)**
 - **Action:** Constricts pupils (miosis).
 - **Use:** Glaucoma.

Indirect-Acting Cholinergic Agonists (Cholinesterase Inhibitors)

- **Mechanism:** Inhibit the enzyme **acetylcholinesterase**, which normally breaks down acetylcholine. This leads to **more ACh** available at the receptors.
- **Uses:** **Myasthenia Gravis, Alzheimer's disease.**
- **Side Effects:** Bradycardia, bronchospasm, increased salivation and GI motility.

Antidote for Cholinergic Crisis: Atropine

Remember the picture of the guy in the toilet



Anticholinergics (**Parasympatholytics**)

← Antagonist

These drugs block the effects of the Parasympathetic Nervous System. They produce effects similar to the Sympathetic Nervous System.

Anticholinergic Effects ("Can't See, Can't Pee, Can't Spit, Can't Sh*t")

- **Can't See:** Blurred vision, pupil dilation (mydriasis)
- **Can't Pee:** Urinary retention
- **Can't Spit:** Dry mouth
- **Can't Sh*t:** Constipation
- **Other effects:** Tachycardia, decreased sweating.

Anticholinergic Drugs

Drug	Primary Use	Key Points
Atropine	Symptomatic bradycardia , preoperative (to decrease secretions)	Increases heart rate. Antidote for cholinergic crisis.
Benztropine (Cogentin)	Parkinson's disease, drug-induced extrapyramidal symptoms (EPS)	Reduces tremors and muscle rigidity.
Tolterodine (Detrol)	Overactive bladder	Decreases urinary frequency and urgency.
Ipratropium (Atrovent)	Asthma, COPD	Bronchodilator.
Scopolamine	Motion sickness	Available as a transdermal patch.

- **Contraindications: Glaucoma, BPH, myasthenia gravis.**

Cholinergic vs Anticholinergic Toxidrome

	Cholinergic Toxidrome (Too much ACh)	Anticholinergic Toxidrome (Too little ACh)
Mnemonic	SLUDGE-M + Killer B's	"Hot as a hare, Dry as a bone , Red as a beet, Blind as a bat , Mad as a hatter, Full as a flask"
Salivation / Tears	↑ Salivation, ↑ Lacrimation	Dry mouth, dry eyes
Urination / GI	↑ Urination, ↑ Diarrhea, ↑ GI motility	Urinary retention, ↓ GI motility / constipation
Pupils	Constricted (miosis)	Dilated (mydriasis), <u>blurred vision</u>
Skin	Sweating ↑	Dry, flushed skin
Heart Rate	Bradycardia	Tachycardia
<u>Mental Status</u>	Confusion, seizures in severe cases	Agitation, confusion, delirium, hallucinations
Respiratory	Bronchoconstriction, ↑ secretions	Dry respiratory tract, risk of hyperthermia
Other	Hypotension possible	Hyperthermia

When u go to the doctor and he dilates your pupils u then see all blurry. 

Good luck on your exam! Happy studying!

