PHARMACOLOGY 433

King Saud University
College of Medicine
1st Year, 3rd block

Prerequisite Physiology of the Sympathetic Nervous System

Respiratory Block

Main Differences between the Sympathetic and Parasympathetic Nervous System

	Sympathetic (Fight or flight)	Parasympathetic (Rest and digest)
Nerve origin	Lumbar and thoracic segments of spinal cords (T1-L2) "Thoracolumbar outflow"	Cranial nerves (III, VII, IX, X) and sacral (S2-S4) "Craniosacral outflow"
Nerves	Short preganglionic	Long preganglionic
Neurotransmitter	*Epinephrine *Norepinephrine *Dopamine "D1 is located on the renal vasculatures" "released directly from the medulla of the adrenal gland"	Acetylcholine (Ach)
Site of ganglia	Sympathetic chain ganglia or collateral ganglia near vertebrae (Far from the target organ)	In or close to visceral target (terminal ganglia)
Predominant tones of major organ systems	Arterioles/arteries, Veins, Sweat glands..	Heart, Iris, Ciliary muscles, GI tract, Smooth muscles, Bladder, Salivary glands, Lacrimal glands..

Norepinephrine

Synthesis	Precursor is Tyrosine → DOPA → Dopamine (get released) → Norepinephrine "at nerve endings, but in adrenal medulla some of it becomes Epinephrine"
Storage	In synaptic vesicles
Releasing	By an action potential stimulus that will make it perform its action; Ca ion enters → the vesicles move → exocytosis → releasing norepinephrine.
Action	On receptors found on target organs (most), or on receptors on terminal ending of the nerves.
Reuptake	By NET (norepinephrine transport) at the terminal endings
Degradation	*By MAO (mono-amine oxidase enzymes) : at terminal endings *By COMT (catecol –O-methyl transferase) : in target organs

How good does each one of these neurotransmitters act on each Adrenoceptors ?

Adrenoceptors

	α_1	α_2	β_1	β_2	β_3
Epinephrine	Less	Weak	Good	Good	Good
Norepinephrine	Good	Good	Lesser	No acting	Weak
Dopamine	Good	Weak	Good	No acting	No acting

*Dopamine also acts on the receptor D1

*Epinephrine acts on all the receptors

*Epinephrine acts good on all the β receptors.

*Norepinephrine acts good on all the α receptors

*All of the receptors are postsynaptic except for α_2 which is presynaptic.

*α_2 and β_2 have autoregulatory functions.

Properties of the Heart:

*Force of contraction : Inotropic

*Rate of contraction : Cronotropic

*Conduction of the impulse to the heart : Dromotropic

*Initiation of impulse : lusitropic

"Done by β1 receptor"

Major Functions of the Adrenoceptors

	Organ	Action
α1	*Most of blood vessels (skin and peripheral) *GIT and Bladder *Eye	*Vasoconstriction *Contraction of the sphincter *Mydriasis
α2	*Pancreas *Platelets *Membrane of adrenergic axon terminals	*Inhibits insulin secretion. *Stimulates blood clotting *Inhibit NE release from adrenergic terminals
β1	*Heart *Kidneys *Adipose tissue	*Stimulates the heart "the properties that were mentioned before" *Stimulates releasing of Renin
β2	*Lungs *GIT *Blood vessels *Skeletal and cardiac vascular muscles *Non-vascular smooth muscles	*Bronchodilatation. *decrease motility *Coronary arteries dilatation *vasodilatation of smooth muscles' vessels.
β3	Adipose tissue	Lipolysis by Adipose cell

α1 are coupled to Gq to stimulate Phospholipase C (PLC) → increase Ca intracellular. (contraction)

α2 are coupled to Gi to inhibit adenylyl cyclase (AC) → decrease cAMP

β are coupled to Gs to stimulate adenylyl cyclase (AC) → increase cAMP

This Lecture was given by Prof. Omnia to group C, in order to understand the next lecture (Adrenergic Agonist) properly.
It's not included in the mid-block exam nor in the Respiratory Block syllabus.

We hope this is clear to you,
Good luck !

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