Adrenergic system

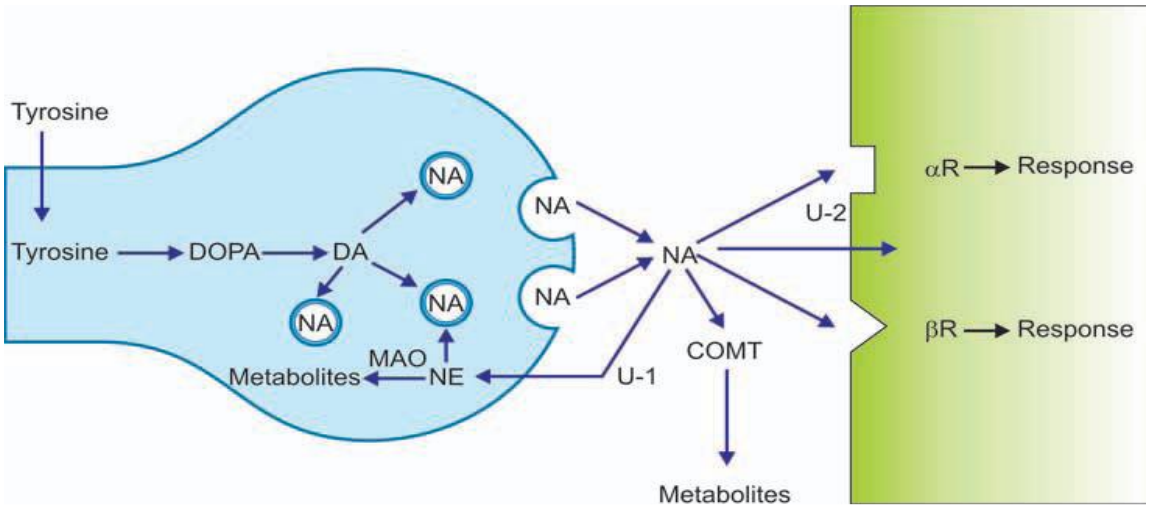
The prime function of the adrenergic or sympathetic nervous system is to help the human being to adjust to stress and prepare the body for fight or flight reactions. When exposed to stress, the heart rate and stroke volume increase with the resultant increase in cardiac output. The blood is shifted from the skin, gut, kidney and glands to the heart, skeletal muscles, brain and lungs, as these organs need more blood during stress. Pupils and bronchi are dilated and sweating is increased. Blood glucose increases by glycogenolysis.

Neurotransmitters of the sympathetic system are noradrenaline (NA, norepinephrine) and dopamine (DA). Adrenaline (epinephrine) is the major hormone secreted by the adrenal medulla

The sympathetic postganglionic nerve fibres that synthesize, store and release NA are called *adrenergic*. Noradrenaline is stored in small vesicles in the adrenergic nerve terminals

Adrenergic receptors classified into 2 types—α and β.
α – α1, α2
β-- β1, β2, β3

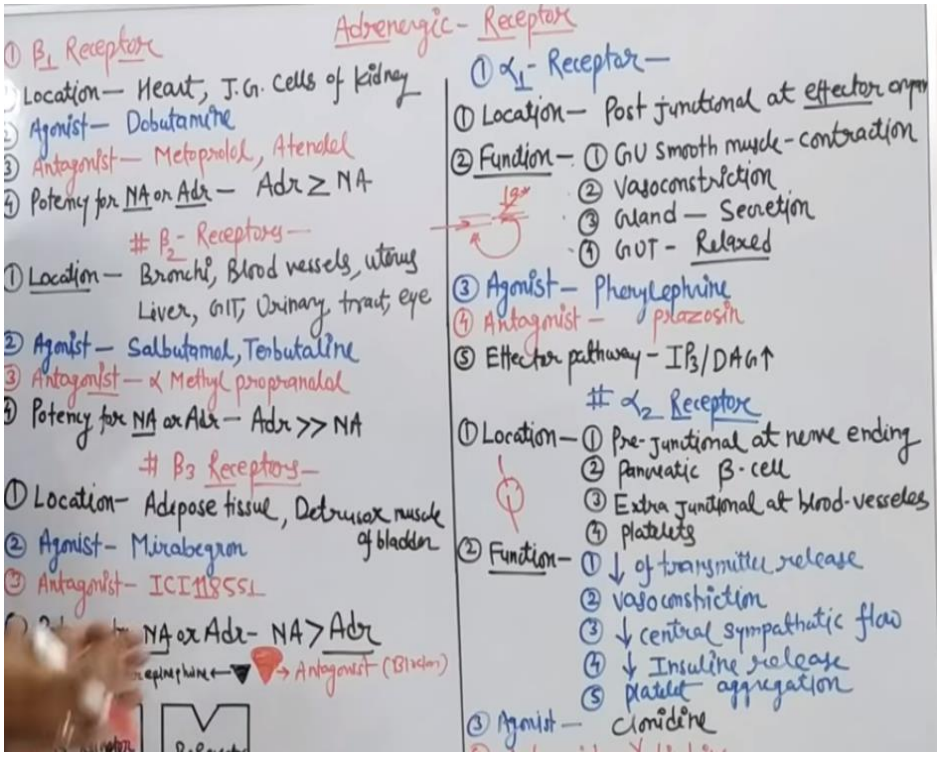
The stimulation of α receptors mainly produces excitatory effects (exception-GIT); β stimulation causes mainly inhibitory effects (exception- heart).



DA–Dopamine, NA-Noradrenaline, U-1-Uptake 1,
U-2–Uptake 2, MAO-Monoamine oxidase, COMT-Catechol-O-methyltransferase

Table 10.1: Characteristics of adrenergic receptors

Receptor type	*Selective agonist*	*Selective antagonist*	*Location*	*Response*
α_1	Phenylephrine Mephenteramine Methoxamine	Prazosin Terozosin	Vascular smooth muscle Gut Genitourinary smooth muscle Liver	Contraction Relaxation Contraction Glycogenolysis
α_2	Clonidine	Yohimbine	Pancreatic β cells Platelets Nerve terminals	↓ Insulin release Aggregation ↓ NE release
β_1	Dobutamine	Metoprolol Atenolol	Heart	↑ Force of contraction, ↑ heart rate, ↓ AV conduction velocity
β_2	Salbutamol	Butoxamine	Smooth muscle–vascular, bronchial, gut and genito-urinary	Relaxation
β_3	—	—	Adipose tissue	Lipolysis



Adrenergic Drugs(Sympathomimetics)

Sympathomimetics are drugs whose actions mimic that of sympathetic stimulation.

sympathomimetics or adrenergic drugs may be classified in various ways depending on the presence/absence of catechol nucleus, mode of action and

therapeutic indications

CLASSIFICATION

I. *Chemical classification—based on the presence/absence of catechol nucleus*

1. *Catecholamines*

Noradrenaline (NA),

Adrenaline,

Dopamine (DA),

Isoprenaline (Synthetic)

2. *Non-catecholamines*
Ephedrine,
Amphetamine

II. *Depending on the mode of action*
1. Directly acting sympathomimetics (by interacting with adrenergic receptors)
Noradrenaline, adrenaline,
dopamine, isoprenaline

2. Indirectly acting sympathomimetics (by releasing NA from nerve terminals)
Amphetamine, tyramine

3.Mixed action amines
(both direct and indirect actions)
Ephedrine, methoxamine

Therapeutic or clinical classification
1. Vasopressors *Noradrenaline,dopamine, methoxamine,metaraminol*

2. Cardiac stimulants
Adrenaline, dopamine, dobutamine, isoprenaline, ephedrine

3. CNS stimulants
Amphetamine, ephedrine

4. Bronchodilators
Adrenaline, isoprenaline, salbutamol, terbutaline,
salmeterol, perbuterol, fenoterol, formoterol

5. Nasal decongestants
Ephedrine, pseudoephedrine, phenylpropanolamine, phenylephrine,
oxymetazoline, xylometazoline

6. Appetite suppressants
(anorectics) *Fenfluramine, dexfenfluramine*

7. Uterine relaxants
Salbutamol, terbutaline, isosxuprine, ritodrine

Uses of Adrenaline

1. *Anaphylactic shock* Adrenaline is the drug of choice (0.3-0.5 ml of 1:1000 solution). It promptly reverses hypotension, laryngeal oedema and bronchospasm and is life saving in presence of anaphylactic shock.
IM route is preferred

2. *Cardiac arrest* Sudden cardiac arrest due to drowning, electrocution, etc. are treated with intracardiac adrenaline
.
3. *Control of haemorrhage* Cotton or gauze soaked in adrenaline–1: 10,000 to 1 : 20,000 concentration is used as a topical haemostatic to control bleeding. Bleeding stops due to vasoconstriction.

4. *With local anaesthetics*
Injected with LA, adrenaline produces vasoconstriction and reduces the rate of absorption of the LA. By this it prolongs the action of the LA.

Acute bronchial asthma Adrenaline produces bronchodilation

Glaucoma Adrenaline decrease IOP and can be used in glaucoma. But it has the disadvantages of being - (1) poorly absorbed, (2) short acting as it is quickly metabolised in the eye.

Contraindications

Adrenaline is contraindicated in patients with angina pectoris, hypertension and in patients on B blockers