Autonomic Nervous System 2

Cholinergic and adrenergic fibers

• Both preganglionic fibers : cholinergic



• Parasympathetic postganglionic fibers : cholinergic

Mechanisms of Transmitters

Secretion at the nerve endings

- Role of Action Potential.
- Role of Ca⁺⁺ & the vesicles

Synthesis of Acetylcholine

- Synthesized in Axoplasm and stored in the vesicles
- **Duration** of action: few seconds
- **Destruction** : by Acetyl cholinesterase



Synthesis of Norepinephrine

Synthesized in Axoplasm & vesicles

- 1) Tyrosine <u>hydroxylation</u> Dopa (+OH)
- 2) Dopa ^{decarboxylation} Dopamine (-COOH)
- 3) Dopamine $\xrightarrow{hydroxylation}$ Norepinephrine (+OH)

Note: in Adrenal medulla :	Norepinephrine	^{methylation} → 80% Epinephrine
		,

Duration of action: few seconds

Destruction :

3.

- 1. Reuptake 50-80 %
- 2. Diffusion into blood
 - Destruction by _____ MAO Mono Amine Oxides (in nerve endings)

Catechol-O-methyl transferase (all tissues)

Note: Epinephrine & Norepinephrine from *Adrenal medulla* : released into blood Duration 1-3 minutes Destruction in Liver by Catechol-O-methyl transferase







Norepinephrine : activates Alpha receptors mainly **Epinephrine :** activates both Alpha & Beta receptors

Adrenergic Receptors and Function

Alpha Receptor	Beta Receptor	
Vasoconstriction	Vasodilatation (β_2)	
Iris dilatation	Cardioacceleration (β_1)	
Intestinal relaxation	Increased myocardial strength (β_1)	
Intestinal sphincter contraction	Intestinal relaxation (β_2)	
	Uterus relaxation (β_2)	
Pilomotor contraction	Bronchodilatation (β_2)	
Bladder sphincter contraction	Calorigenesis (β_2)	
	Glycogenolysis (β_2)	
	Lipolysis (β_1)	
	Bladder wall relaxation (β_{2})	

Effects of Sympathetic and Parasympathetic Stimulation of organs

Effector organ		Sympathetic division	Parasympathetic division	
1.	Eye	Ciliary muscle	Relaxation	Contraction
		Pupil	Dilatation	Constriction
2.	2. Lacrimal glands		Decrease in secretion	Increase in secretion
3.	3. Salivary secretion		Decrease in secretion and vasoconstriction	Increase in secretion and vasodilatation
		Motility	Inhibition	Acceleration
4.	Gastrointestinal tract	Secretion	Decrease	Increase
		Sphincters	Constriction .	Relaxation
5.	5. Gallbladder		Relaxation	Contraction
6.	Urinary bladder	Detrusor muscle	Relaxation	Contraction
		Internal sphincter	Constriction	Relaxation
7.	7. Sweat glands		Increase in secretion	_
8.	8. Heart – rate and force		Increase	Decrease
9.	9. Blood vessels		Constriction of all blood vessels except those in heart and skeletal muscle	Dilatation
10.	Bronchioles		Dilatation	Constriction

Function of Adrenal Medullae



Duration: 1-3 minutes

Comparing Epinephrine & Norepinephrine:

- 2. Epinephrine activates Beta receptors increase cardiac contraction
- 3. Epinephrine increase Metabolism up to 100% above normal increase glycogenolysis in Liver and Muscles → increase Glucose in blood

Value of Adrenal Medullae to the function of Sympathetic system:

Comparison between ANS & Skeletal Nervous System:

ANS : Low frequency stimulation
1 impulse/sec ---- normal effect
10-20 impulse/sec ----- Full effect

Skeletal Nervous System : High frequency stimulation 50-500 impulse/sec

Sympathetic & Parasympathetic Tone

- ANS (always active)
- Basal rates of activity = **Tone**
- Blood vessels : normal sympathetic tone keeps ¹/₂ diameter
- Gastrointestinal Tract: (cutting the vagus nerves) → Atone & Constipation

Effect of Loss of Sympathetic & Parasympathetic Tone after Denervation

