

Autonomic Nervous System

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Central Nervous System
(CNS)

Peripheral Nervous System
(PNS)

Brain and Spinal Cord

Afferent
Neurons

Efferent
Neurons

Sensory
Input

Autonomic
Neurons

Somatic Motor
Neurons

Sympathetic

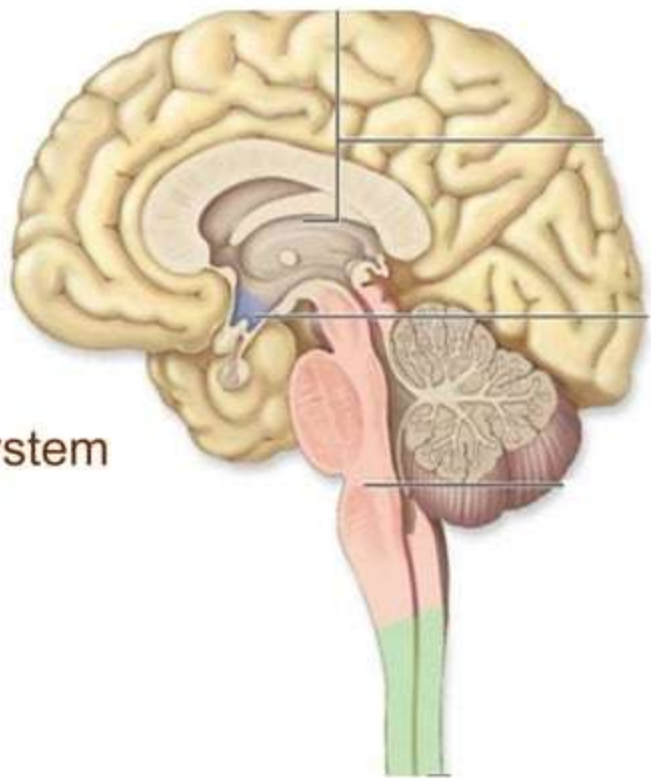
Parasympathetic

Enteric Nervous
System



ANS

1. Autonomous
2. Subconscious
3. Mostly motor system



General Organization

1. Afferent

Subconscious sensory signal from visceral organs

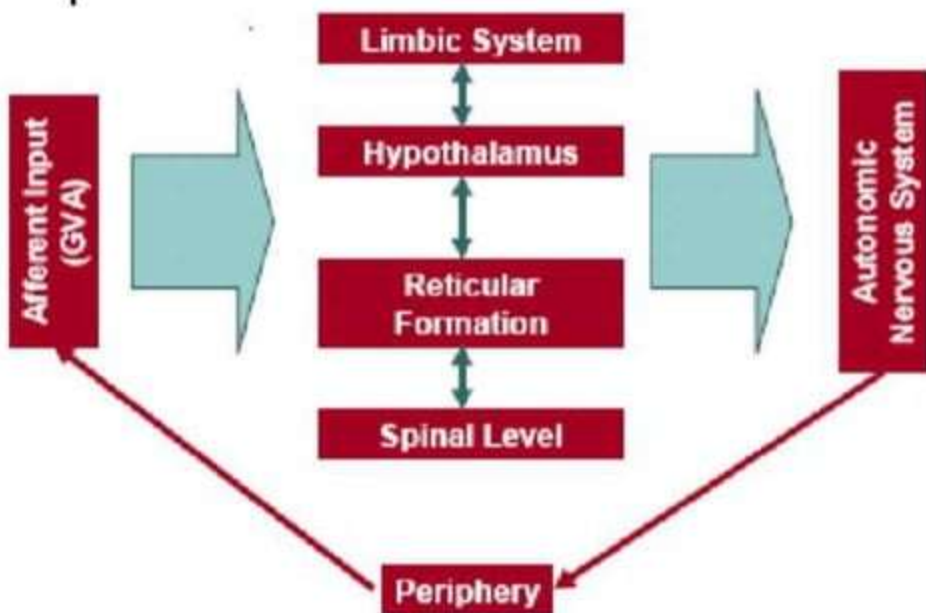
2. Activation centers

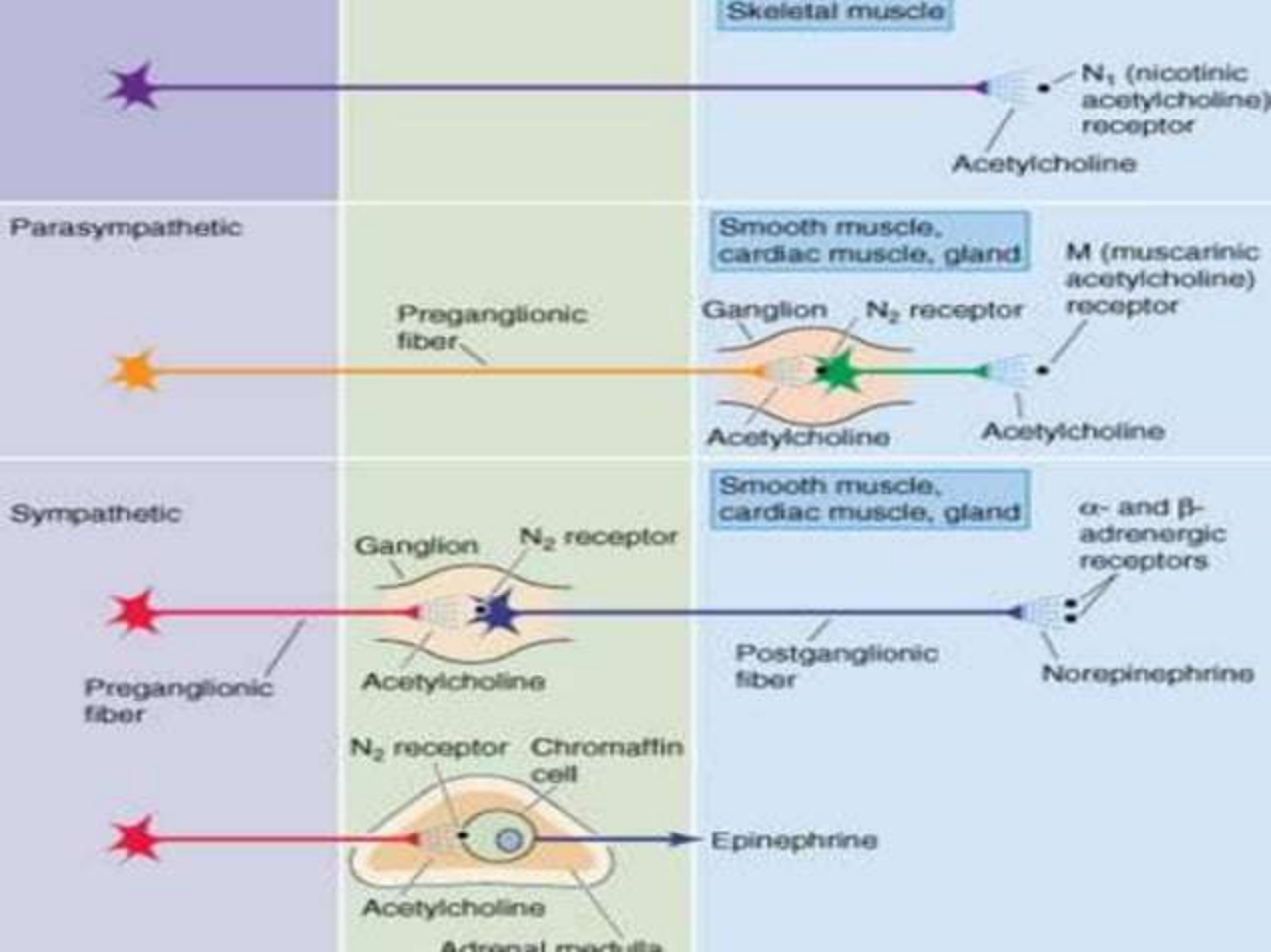
Spinal cord, brain stem, hypothalamus, limbic system.

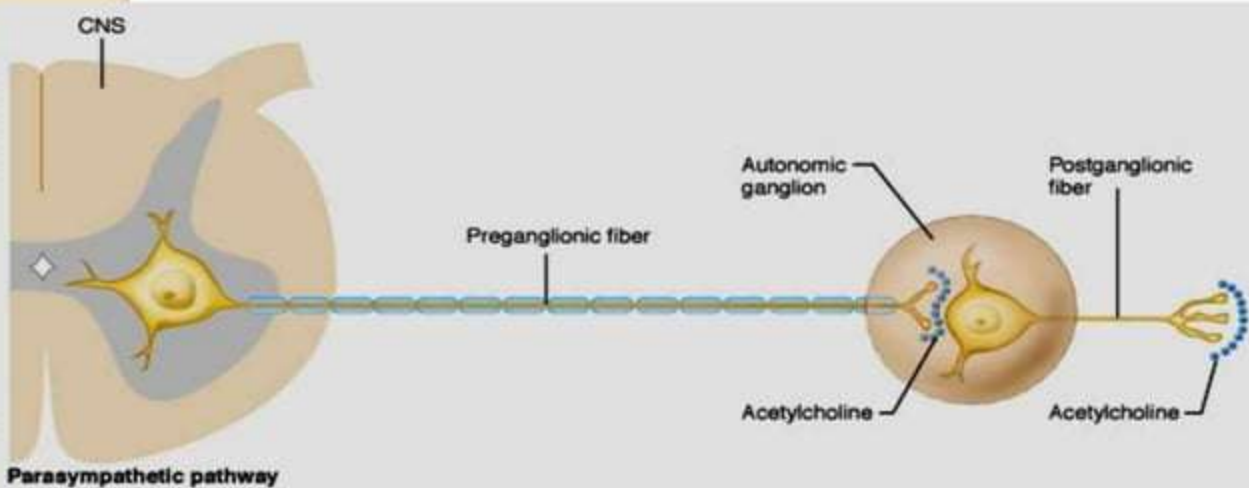
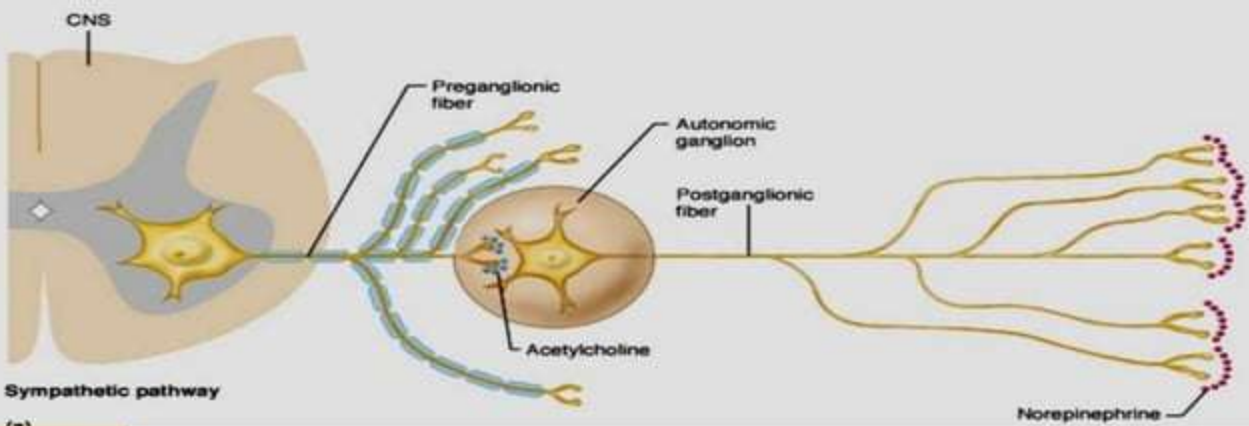
3. Efferent autonomic signals

Sympathetic and Parasympathetic

Autonomic Nervous System







1. Antagonistic effects

SNS

PNS

1 Blood Vessels

Vasoconstriction

1.Vasodilatation

- **2. Dilates pupil**

2.Constricts

-

3.Defecation

↓motility of colon

↑motility of colon

2. Dual but different effect –AGONIST

Salivary gland

SNS → increase salivary mucous cell secretion

PNS → increase salivary serous cell secretion

3. Without Dual Innervation

- only sympathetic- adrenal medulla,
 - arrector pili muscles,
 - sweat glands and
 - many blood vessels

Autonomic Nervous System

Adrenergic

(Sympathomimetic)

1. Increases heart rate
2. Bronchodilates
3. Dilates Pupils
4. Decreases GI tract
5. Decreases lacrimation
6. Decreases urination
7. "Fight or Flight"

Cholinergic

(Parasympathomimetic)

1. Decreases heart rate
2. Bronchoconstricts
3. Constricts Pupils
4. Increases GI tract
5. Increases lacrimation
6. Increases urination
7. "Rest and Digest"

Effects of the two branches of the ANS

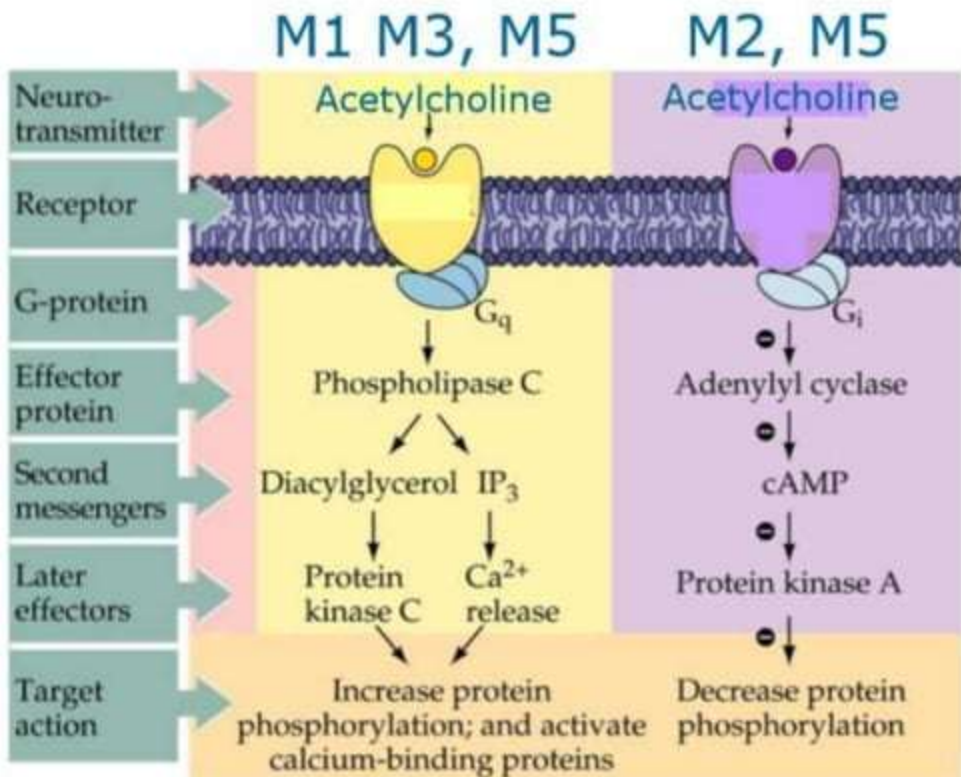
Organ	Sympathetic Effect	Parasympathetic Effect
Pupil	dilation	constriction
Lens	Far focus (lower curvature)	Near focus (increased curvature)
Salivary Gland secretion	High in viscosity	serous
Heart	Increased rate and pressure	Lower rate and pressure
Lungs	Dilation of respiratory passages	Constriction of respiratory passages
Gastrointestinal	Decreased motility	Increased motility
Kidneys	Decreased filtration rate	Increased filtration rate
Male genitalia	Ejaculation	Erection
Vascular smooth muscle	Variable depending on the neurotransmitter	Relaxation
Sweat glands	Increased activity	No innervation
Arteries to skeletal muscle	dilation	No innervation
Veins	Variable depending on the neurotransmitter	No innervation

Alarm or Stress response

- Pupillary dilation
- Increase heart rate and strength of contraction
- Increase blood pressure
- Increase blood flow to active muscles
- Increase rates of metabolism
- Increased blood glucose concentration
- Increased muscle strength



Muscarinic receptors



Adrenergic Receptors $\alpha + \beta$

1. α_1 \rightarrow contraction smooth muscle,
2. α_2 \rightarrow \downarrow secretions
3. β_1 , \uparrow Cardiac activity
4. β_2 , Eye, Bronchi, Uterus, Bladder, Arteries, muscles, GIT

NOTE:-

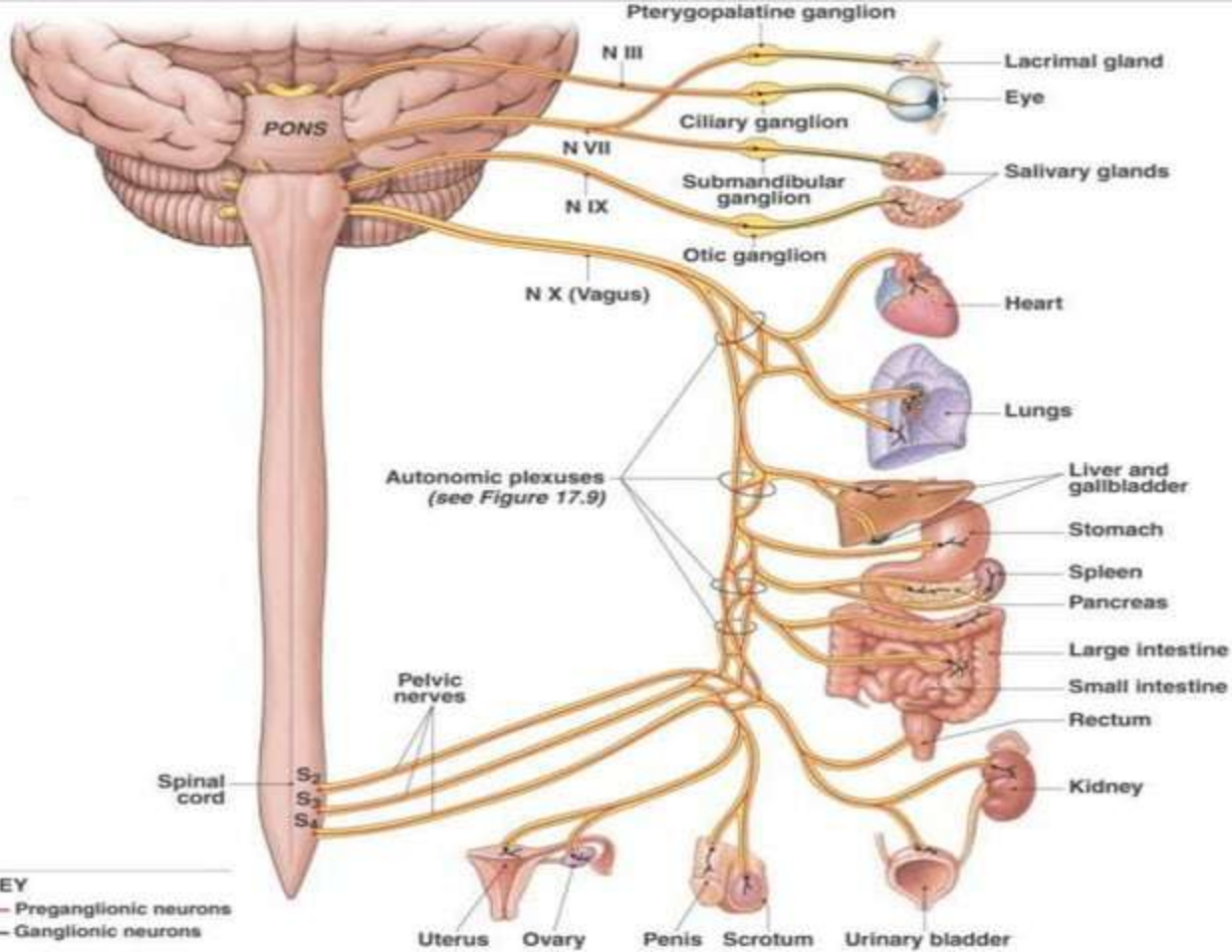
$\alpha_1 + \beta_1$ ARE USUALLY EXCITATORY

$\alpha_2 + \beta_2$ ARE USUALLY INHIBITATORY

PARA-SYMPATHETIC DIVISION

- 1, CRANO-SACRAL
2. CHOLENERGIC
3. NERVOUS SYS. OF TOMORROW
4. ANABOLIC SYSTEM
5. NOURISHMENT SYSTEM
6. "D" division:
 1. DIGESTION,
 2. DEFEACATION
 3. DIURESIS

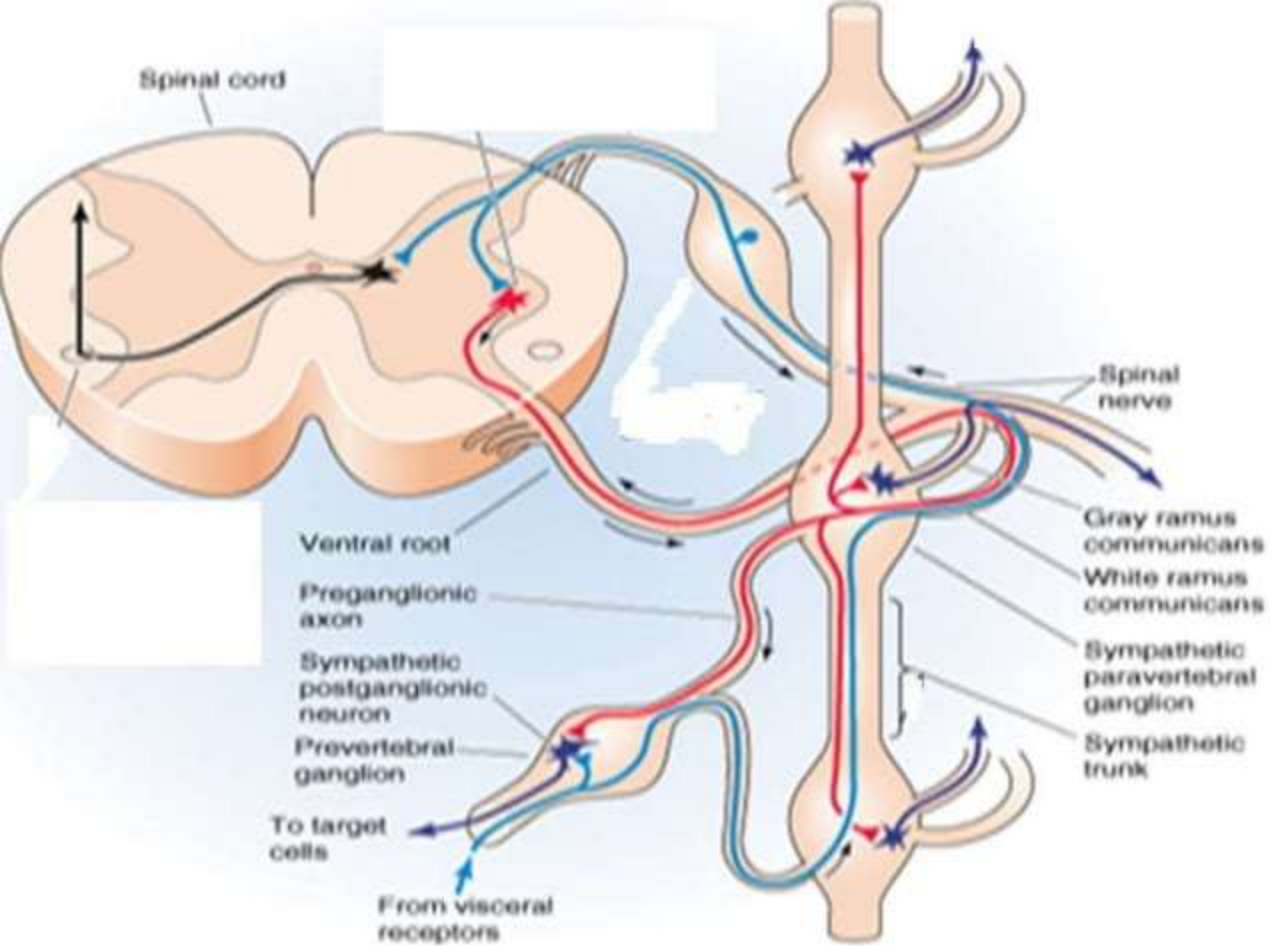




SYMPATHETIC DIVISION

1. THORACO-LUMBAR
2. ADRENERGIC, NON-ADRENERGIC
3. NERVOUS SYSTEM OF TODAY
4. CATABOLIC SYSTEM
5. ENERGY RELEASING SYSTEM
6. "E" division
 1. exercise,
 2. excitement,
 3. emergency,
 4. embarrassment



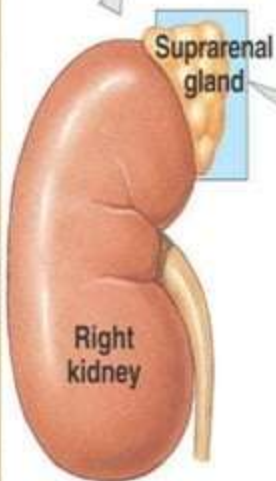


Adrenal gland

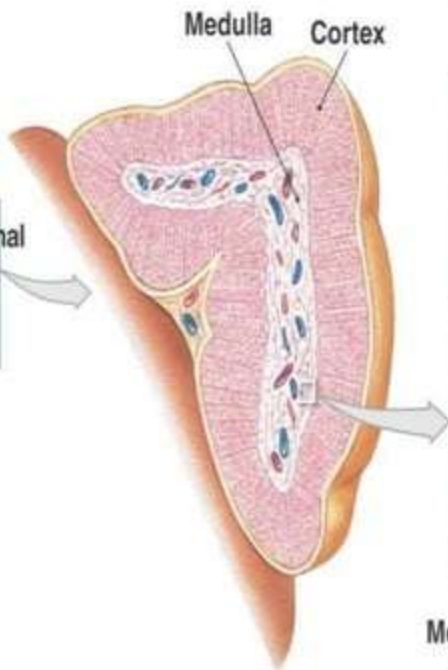
1. Adrenal=a modified sym: gang: pyramid-shaped on top of each kidney
2. Structurally and functionally, they are 2 glands:
 - a) Adrenal cortex (outside) glandular (epithelial)
 - b) Adrenal medulla (inside) is nervous hormonal
3. Embryologically derived from pheochromoblasts differentiate into modified neuronal cells

Pheochromocytes

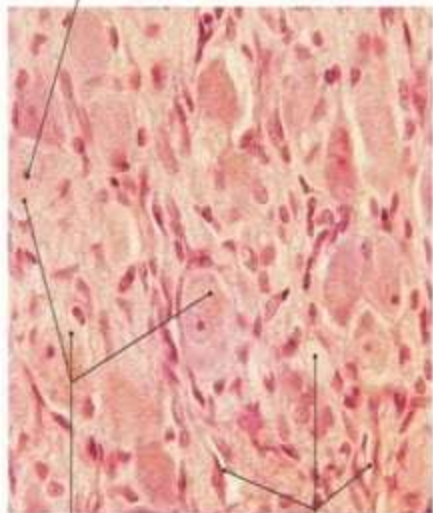
4. Release into blood- 80% -E 20% -NE



(a)



Nucleolus in nucleus



Modified neurons
(sympathetic
ganglion cells)
of suprarenal medulla

Capillaries

(b)

