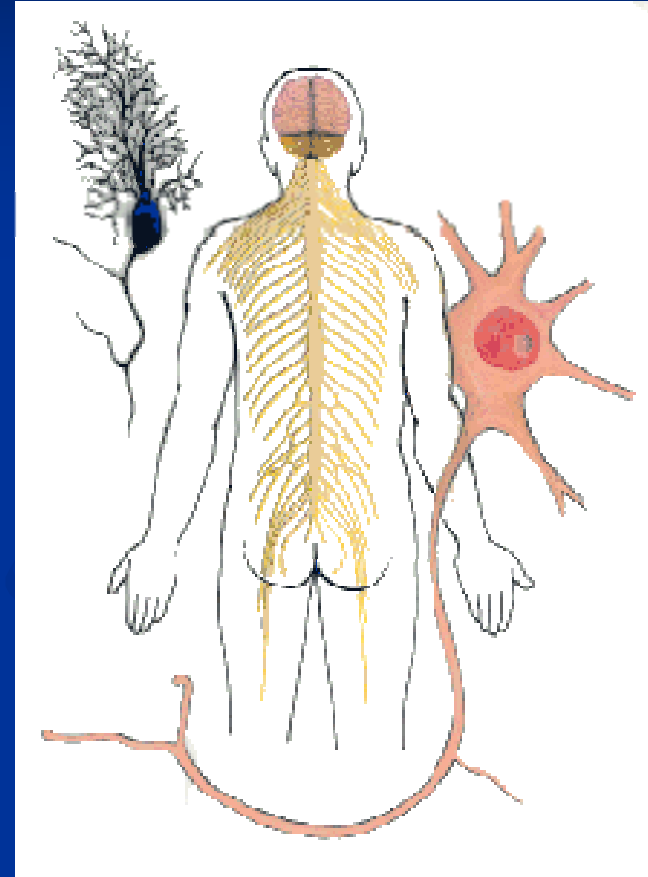


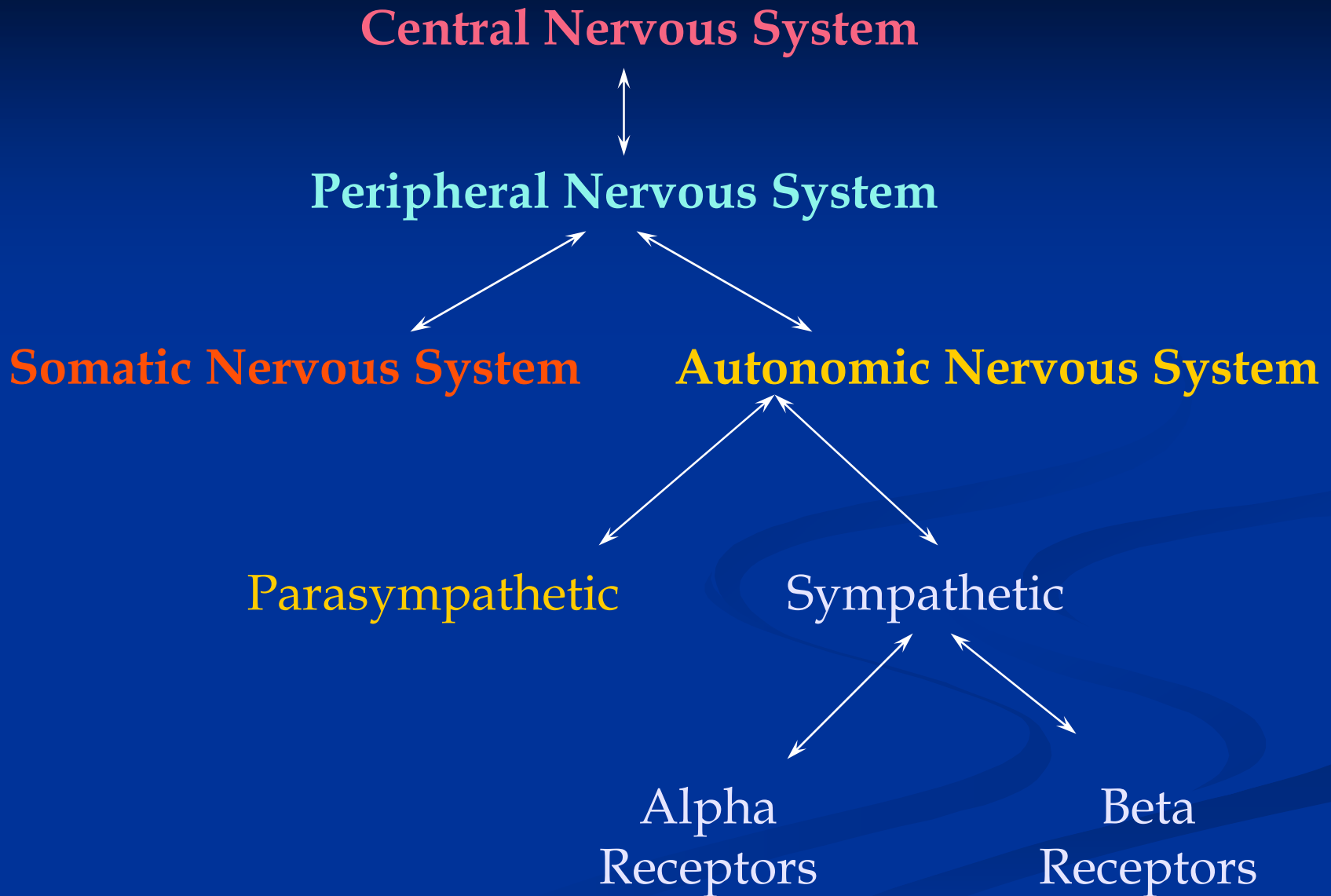
Autonomic Nervous System

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Nervous System

- **Central Nervous System**
 - brain & spinal cord
- **Peripheral Nervous System**
 - Cranial and peripheral nerves
 - Somatic nervous system
 - voluntary movement
 - Autonomic





Autonomic Nervous System

- **Responsible for control of involuntary or visceral bodily functions**
 - cardiovascular
 - respiratory
 - digestive
 - urinary
 - reproductive functions
 - Key role in the bodies response to stress

Autonomic Nervous System

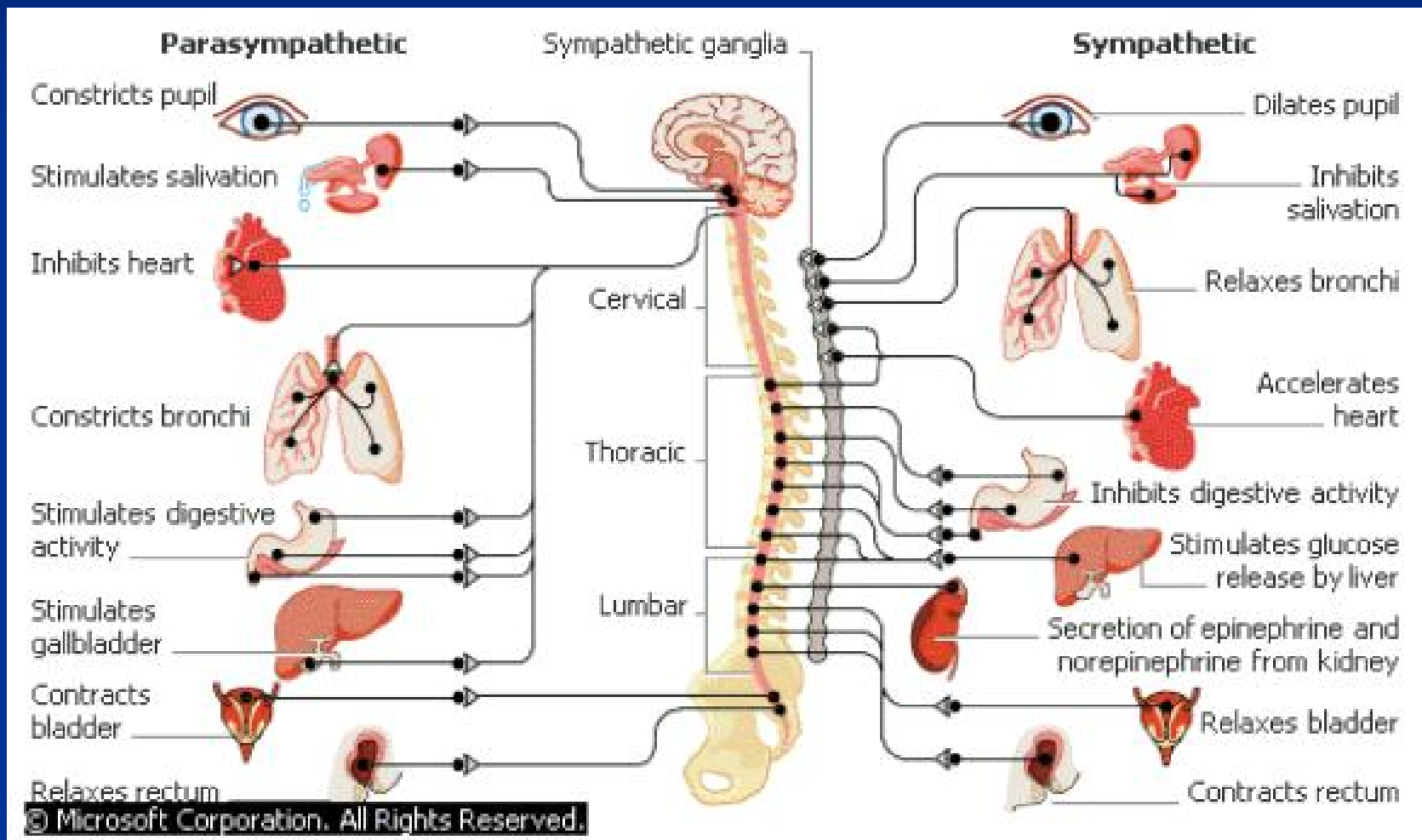
■ Sympathetic nervous system

- allow body to function under stress
- fight or flight

■ Parasympathetic nervous system

- controls vegetative functions
 - feed or breed or rest and repose
 - constant opposition to sympathetic system

Autonomic Nervous System



Major components

■ Neuron

- Sensory - Afferent
- Motoneurons - Efferent

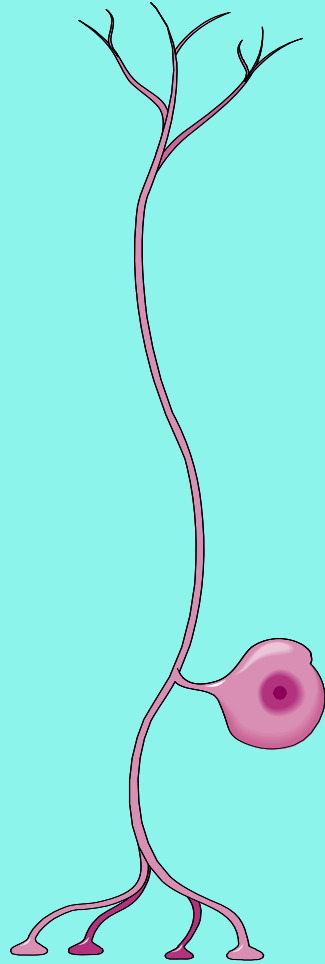
■ Neurotransmitter

- chemical substance which travels across a synaptic junction to act on a target cell.

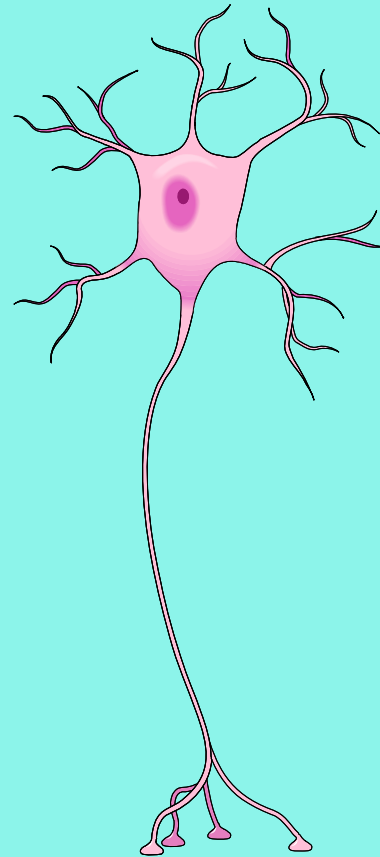
■ Effector Organs

- specific tissues stimulated by the autonomic nervous system

Neuron



Sensory



Motoneuron

Neurotransmitters

■ **Autonomic Nervous system**

- activated by reflex centers located in the brain and spinal cord

■ **Reflex arc**

- complete circuit of nerves involved in an involuntary movement
- From the stimuli to the effector organ

Neurotransmitters

■ Norepinephrine

- Post-ganglionic Neurotransmitter for the sympathetic Nervous system

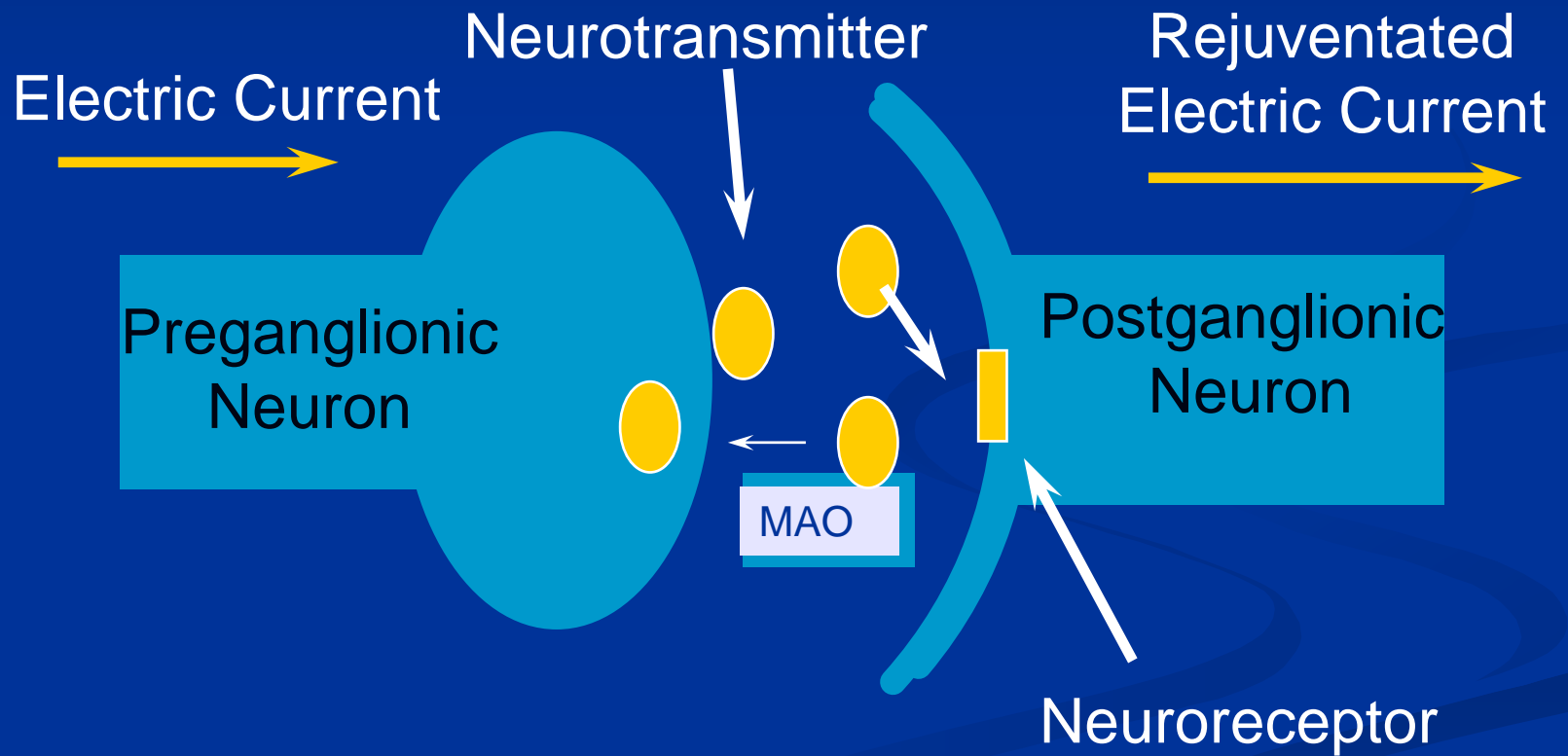
■ Acetylcholine

- pre-ganglionic Neurotransmitter for both systems
- Post-ganglionic neurotransmitter for the parasympathetic nervous system

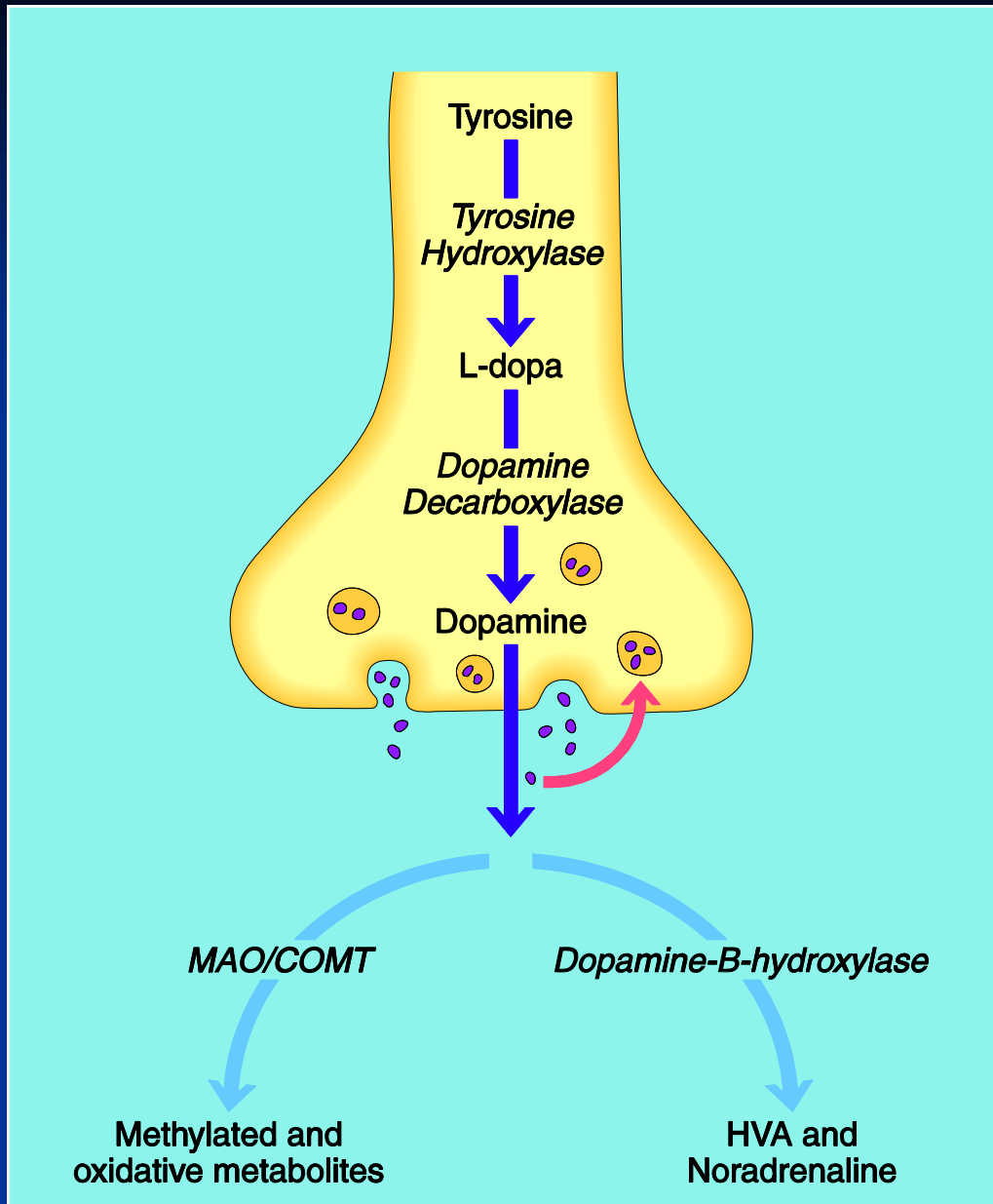
Synapse

- **Junction of Pre and Post synaptic neurons**
 - Neurotransmitter produced in presynaptic membrane
 - Moves across synaptic space
 - binds with receptor on postsynaptic membrane
 - causes impulse potential

Synapse



Dopamine Cycle



Neurologic Conduction

■ Initiation

- Sensory bodies initiate impulse
 - depolarization
 - Afferent impulse

■ Conduction

- impulse is conducted along neuron to Synaptic Junction
- Neurotransmitter is released

Neurologic Conduction

■ Synaptic Activity

- neurotransmitter is release
 - crosses synaptic cleft
 - Stimulates receptors on next neuron
 - Immediately, neurotransmitter is inactivated by enzyme (cholinesterase)
 - Action Potential is initiated along 2nd neuron
- ## ■ impulse travels down efferent neuron to Effector Gland or muscle

Sympathetic

- Thoracolumbar
- Conduction takes place along very short neurons, effecting directly on gland or muscle

Parasympathetic

- Vagus Nerve
- Main regulator of Automatic functions
- Neuron pathways are much longer, making this a slower system

Reflex Arc

■ **Craniosacral**

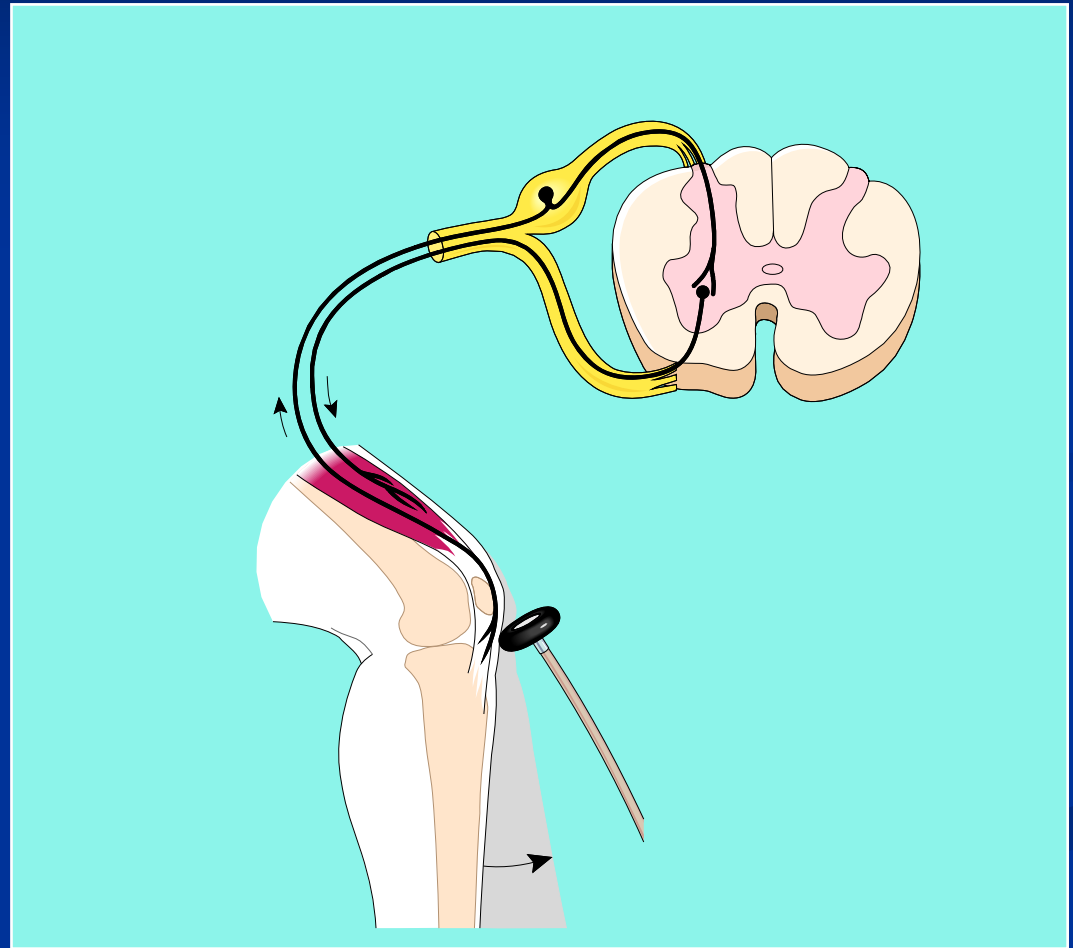
- brain to effector organ
- parasympathetic nervous system

■ **Thoracolumbar**

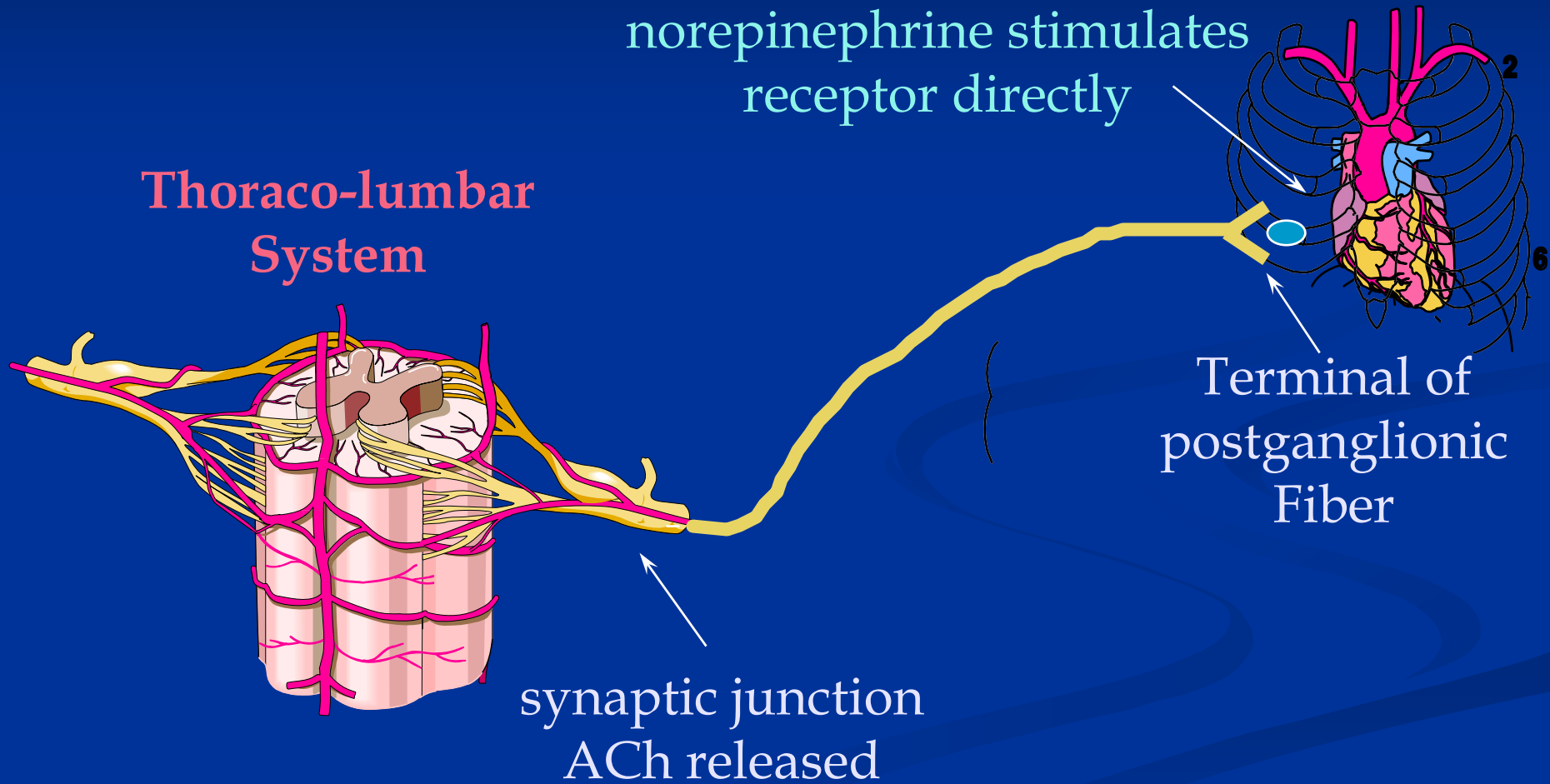
- ganglia are located near the spine
- makes for a quicker response
- Sympathetic nervous system

Reflex Arc

- Reflex Arc
 - complete circuit of nerves involved in involuntary movement



Sympathetic Nervous System



Sympathetic Stimulation

- stimulate sweat glands
- constrict peripheral vessels
- increase blood to skeletal muscles
- increase **chronotropic** and **inotropic** effects
- bronchodilation
- stimulation of NRG production
- reduce blood flow to abdomen
- decrease digestive activity
- relax smooth muscle in wall of bladder
- release glucose stores from liver



Adrenal Medulla

- This area of the nervous system is also stimulated by the release of norepinephrine.
 - This releases
 - **noradrenalin & adrenalin**
 - These are released into the body to also react with receptors and **prolong the effects of sympathetic stimulation**

Sympathetic Receptors

- As norepinephrine is released, it travels across the synaptic cleft and interacts with adrenergic receptors
 - Epinephrine will also stimulate these receptors
- Two Types of Sympathetic Receptors
 - **adrenergic**
 - **dopaminergic**

Adrenergic Receptors

■ Alpha 1

- Peripheral Vasoconstriction
- Positive inotropic effect
- Negative chronotropic effect

■ Alpha 2

- Peripheral vasodilation
 - limits release of norepinephrine
- stimulated by excessive amounts of Norepinephrine in synaptic cleft

Adrenergic Receptors

■ Beta 1

- positive **inotropic** effect on heart
 - increased contractility
- positive **chronotropic** effect on heart
 - increased heart rate
- positive **dromotropic** effect on heart
 - automaticity

Adrenergic Receptors

■ Beta 2

- Peripheral vasodilation
- Bronchodilation
- Uterine smooth muscle relaxation
- GI smooth muscle relaxation

■ Sympathomimetics

- meds that stimulate the sympathetic nervous system

■ Sympatholytics

- inhibit the sympathetic system

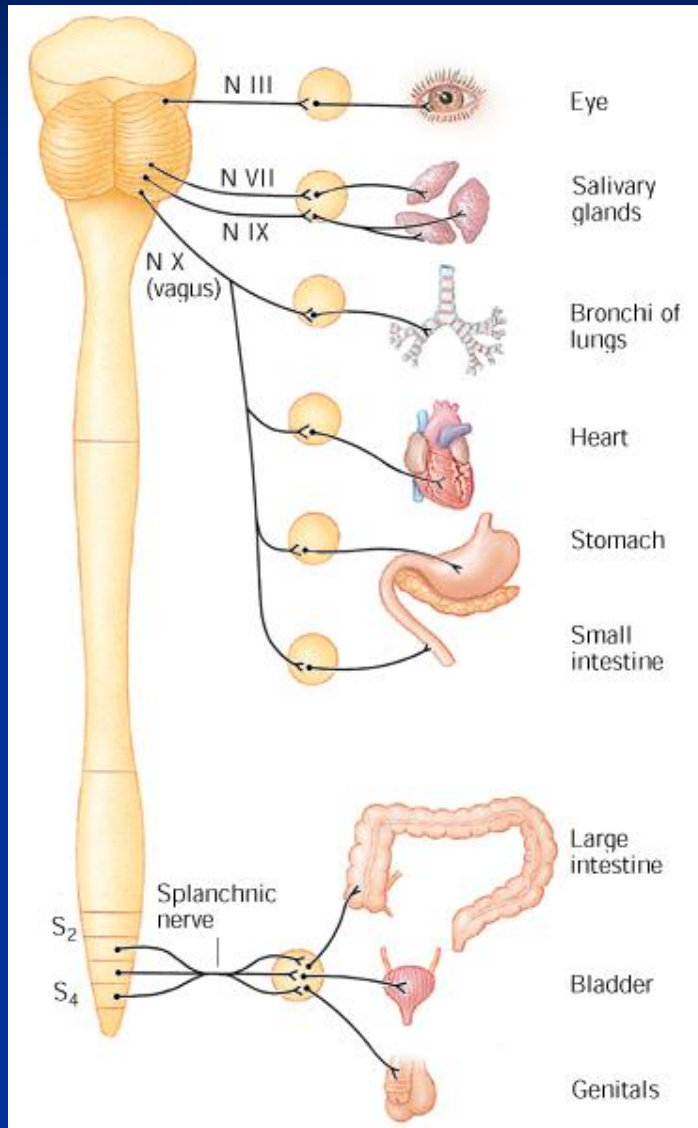
■ Alpha or Beta agonist

- stimulate Alpha sites

■ Alpha or Beta antagonists

- block effects of Beta stimulation

Parasympathetic Nervous System

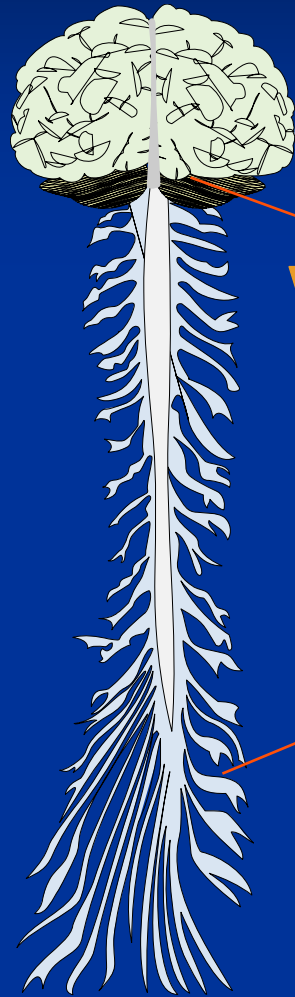


■ Stimulation Results in:

- pupillary constriction
- secretion by digestive glands
- increased smooth muscle activity along GI tract
- bronchoconstriction
- reduced HR & negative Inotropic effects

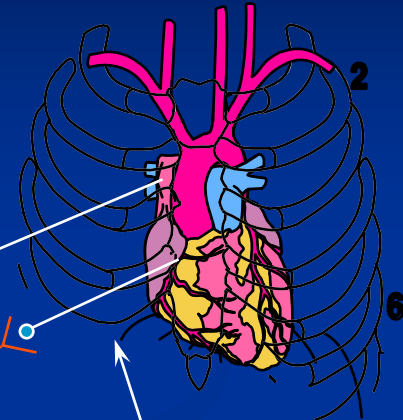
Parasympathetic Nervous System

Craniosacral System



Vagus Nerve

ACh released



Post-ganglionic Fibers

Preganglionic Fibers

■ Parasympathomimetics

- stimulate parasympathetic nervous system

■ Physostigmine

- Anticholinesterase inhibitor

- OD of Atropine, Tricyclic Antidepressants, CO poisoning
- Some research on improving Alzheimer's disease

■ Parasympatholytics

- block action of parasympathetic system

■ Atropine Sulfate

- parasympathetic blocker

Cholinesterase Inhibitors

Cholinesterase breaks down excess Acetylcholine shutting down the parasympathetic System. Exposure to some organophosphates (fertilizers) or biochemical weapons such **Sarin, Soman, Tabun** bind up cholinesterase, preventing the system from shutting down and causing the signs below

- **Salivation**
- **Lacrimation (teary eyes)**
- **Urination**
- **Defecation**
- **Gastric disturbance**
- **Emesis**

Antidote would be a **Parasympathetic Blocking** drug such as **Atropine Sulphate**

Propranolol

- Pure Beta Blocker
- What effects will it have on Heart?
- What are some benefits in AMI?
- What are some potentially hazardous side effects?

Epinephrine

- **Alpha & Beta stimulator**

- **Alpha Effects**

- arterioles in Bronchioles constrict
 - reducing edema
- Peripheral vasoconstriction
 - increased B/P

- **Beta Effects**

- Beta 1 - increases heart rate & CO
- Beta 2 - bronchiole smooth muscle relaxes
 - increases lung capacity