

Review of the ANS

I. Organization of the Nervous System

- the nervous system consists of three major structures: the brain, spinal cord, and the peripheral nerves
- neurons are the basic functional and structural units of the nervous system

A. Neurons

- neurons are cells that transmit electrochemical messages (impulses) to one another and to cells outside the nervous system (heart, glands, muscles, organs, etc.)
- a neuron consists of: cell body, dendrites, and axon
- there are 3 kinds of neurons:
 - (1) sensory neurons: detect stimuli from within and outside the body
 - (2) interneurons: transmit impulses from one part of the nervous system to another
 - (3) motor neurons: transmit impulses from the nervous system to an effector (muscle, gland, organ, etc.)

B. Synapse

- the junction between two neurons → the connection between the axon of one neuron and the dendrites of another neuron
- before an impulse can be propagated from one neuron to the next it must cross a narrow space called the synaptic cleft
- the crossing-over process is accomplished by neurotransmitters (chemical substances which inhibit or stimulate neurons)
- examples of neurotransmitters in the nervous system:
 1. Acetylcholine (ACh)
 2. Norepinephrine (NE)
 3. Dopamine (DA)
 4. Serotonin
 5. GABA
- NE and ACh have antagonistic effects on the ANS
- psychoactive drugs have their major effects at the synapse

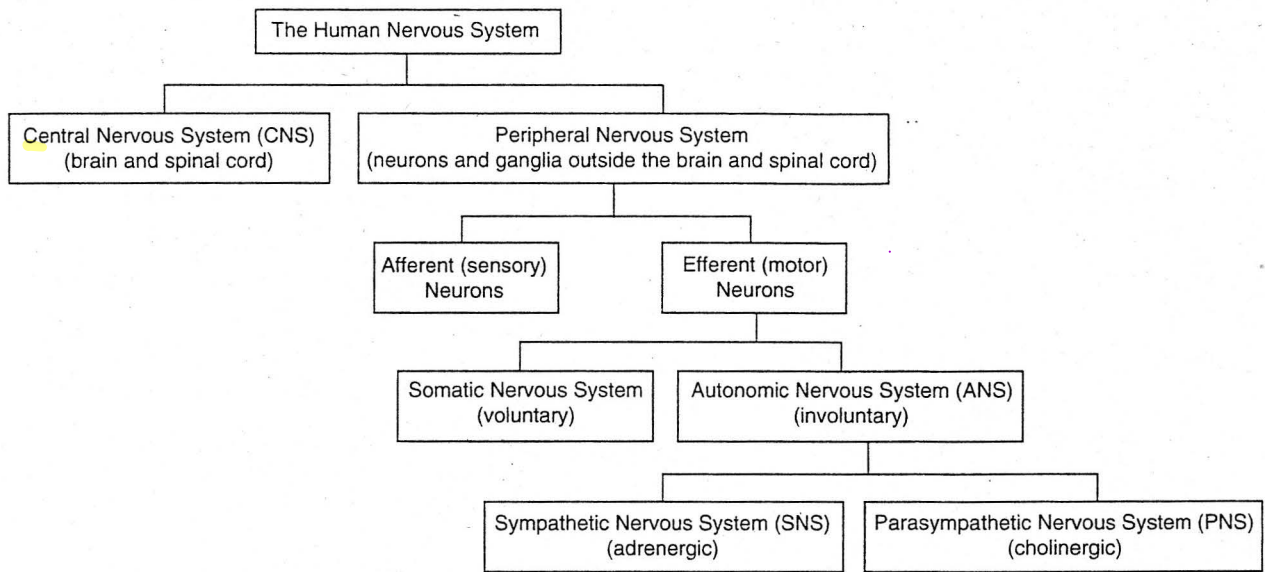


Figure 17-1 Divisions of the human nervous system.

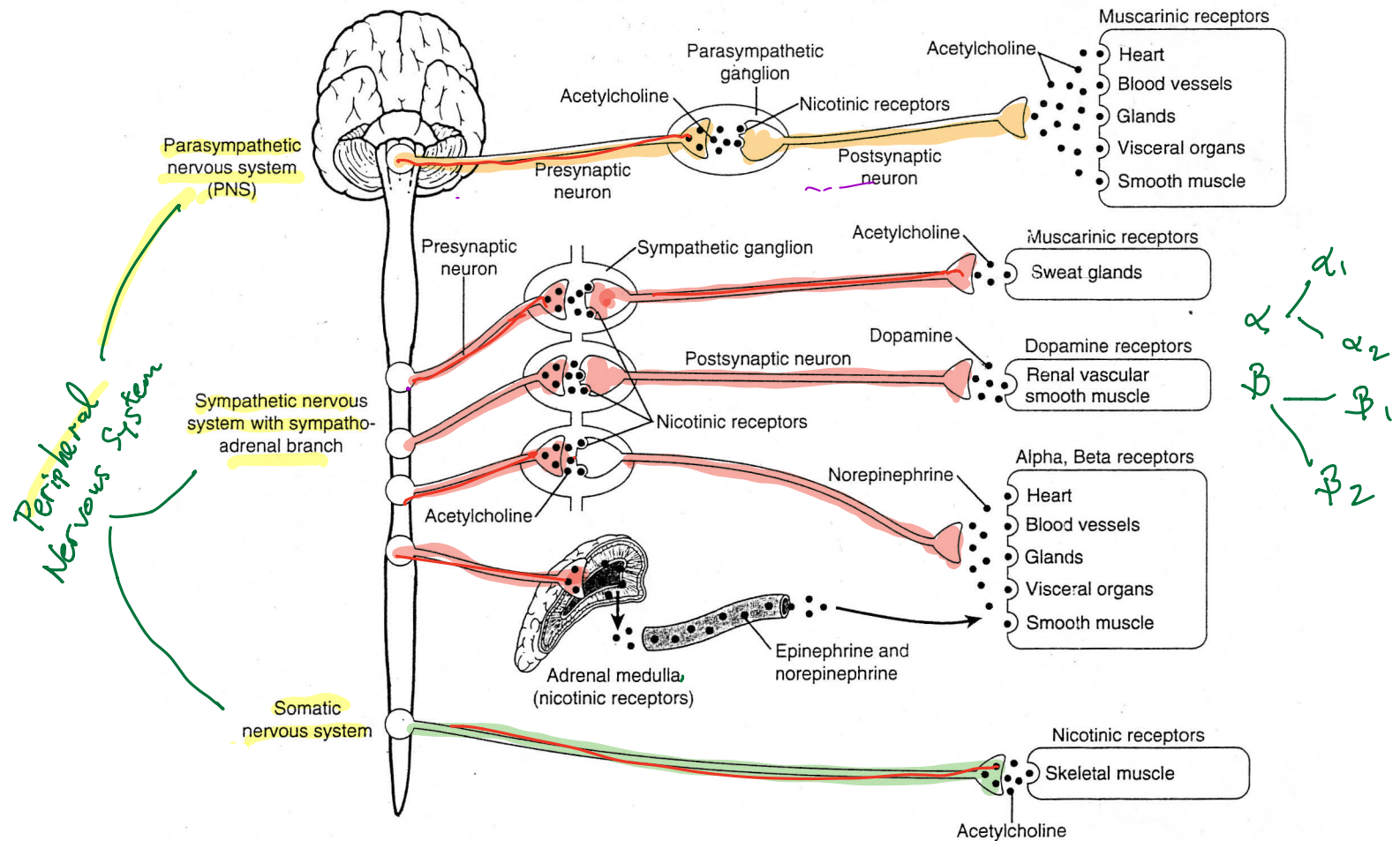
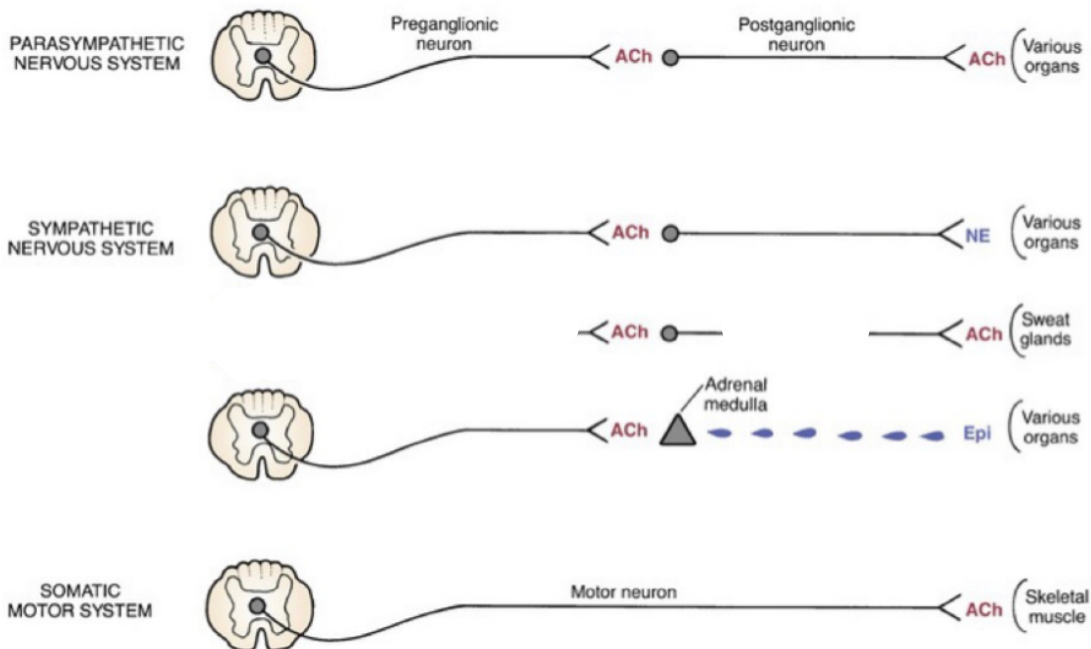
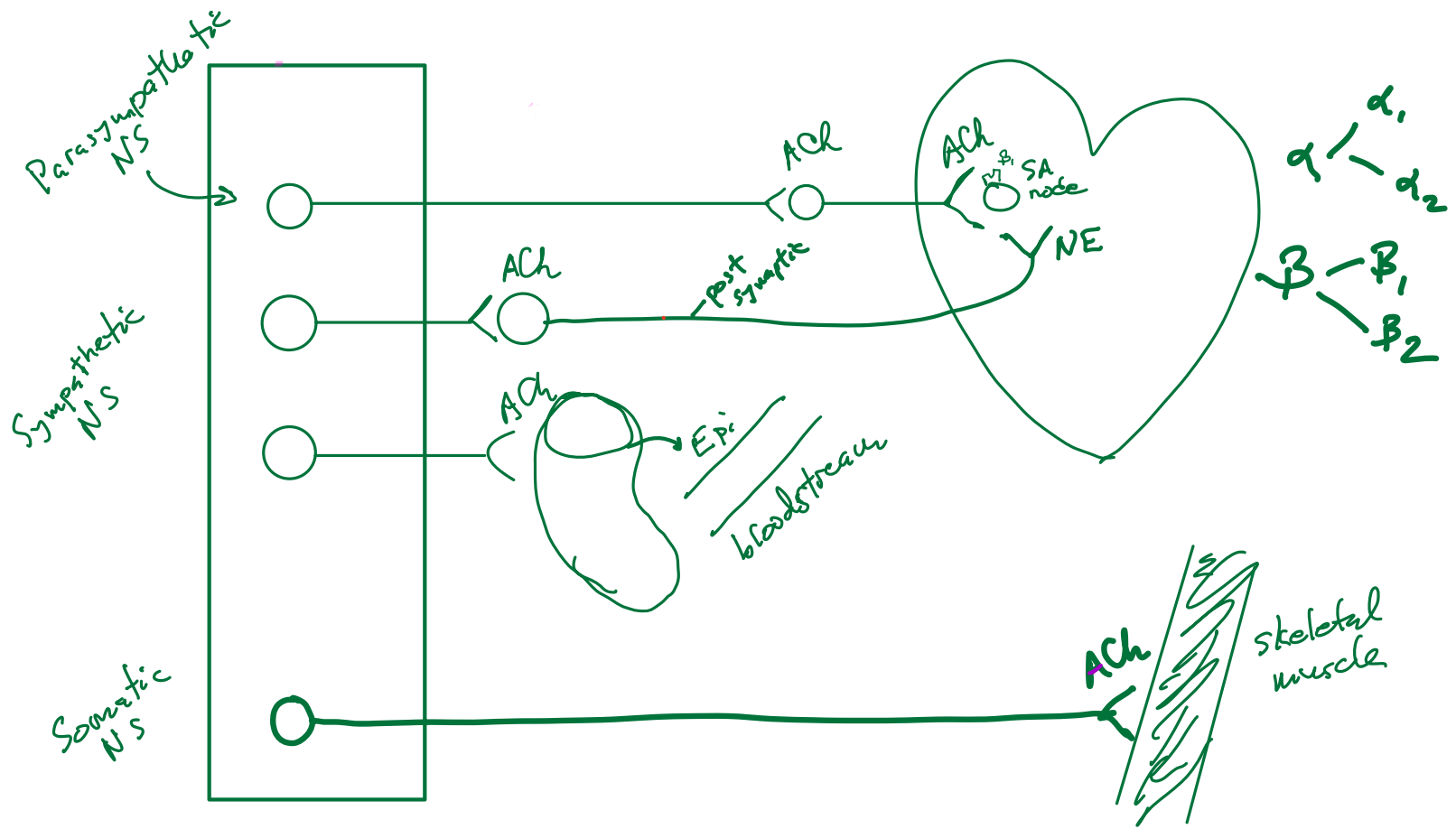
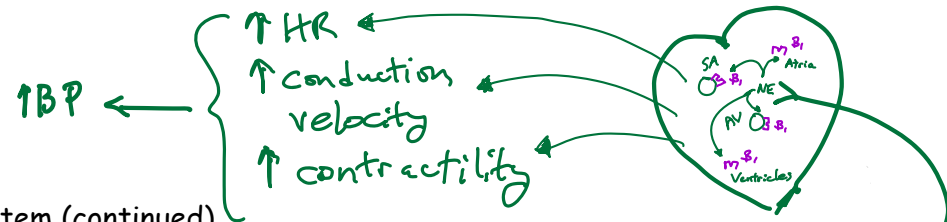


Figure 17-2 Organization of the autonomic and somatic nervous systems.



stimulating presynaptic α_2 receptors in the medulla oblongata (clonidine) results in



Central Nervous System (continued)

II. Division of the Nervous System

A. Central Nervous System (CNS)

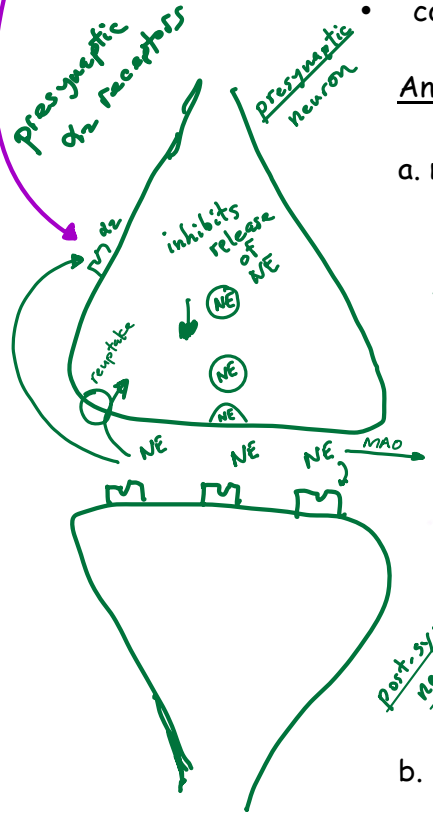
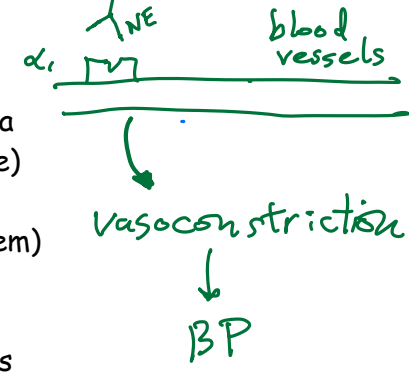
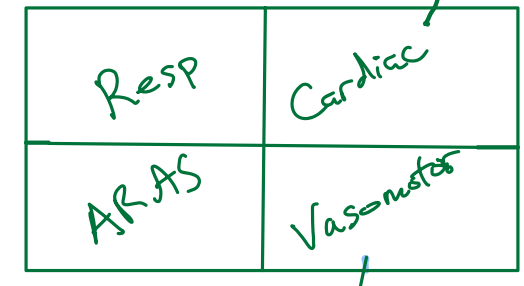
- consists of the brain and spinal cord

Anatomy of the Brain

a. medulla oblongata

- respiratory center (controls breathing)
 - opiates and barbiturates depress this area
- vasomotor center (controls blood pressure)
- cardiac center (controls heart rate)
- ARAS (ascending reticular activating system)

- controls sleeping & waking
- filters incoming sensory impulses
- alcohol, ether, barbiturates → depress ARAS
- amphetamines → stimulate ARAS
- psychedelic drugs → intensely stimulate ARAS → hallucinations



b. Cerebellum

- reflex center coordinating and integrating skeletal muscle movements
- alcohol → depresses cerebellum → loss of muscle coordination → staggering

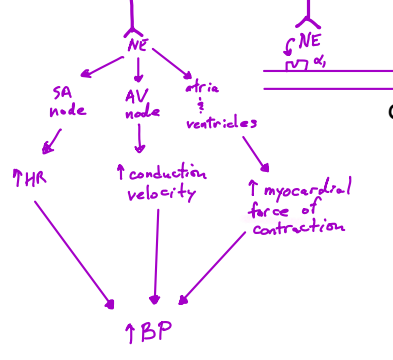
c. Thalamus

- central relay station of the brain

d. Hypothalamus

- maintains homeostasis by linking the nervous system with the endocrine system

In the presence of hypotension, baroreceptors in the aortic arch and carotid sinus will send sensory impulses to the cardiac and vasomotor centers in the medulla oblongata to increase sympathetic outflow to the heart and blood vessels



Central Nervous System (continued)

e. Limbic System

- functions in the regulation of emotions: fear, anger, pleasure, sorrow, etc.
- Valium and Librium depress limbic system -> calming effect -> relief of anxiety

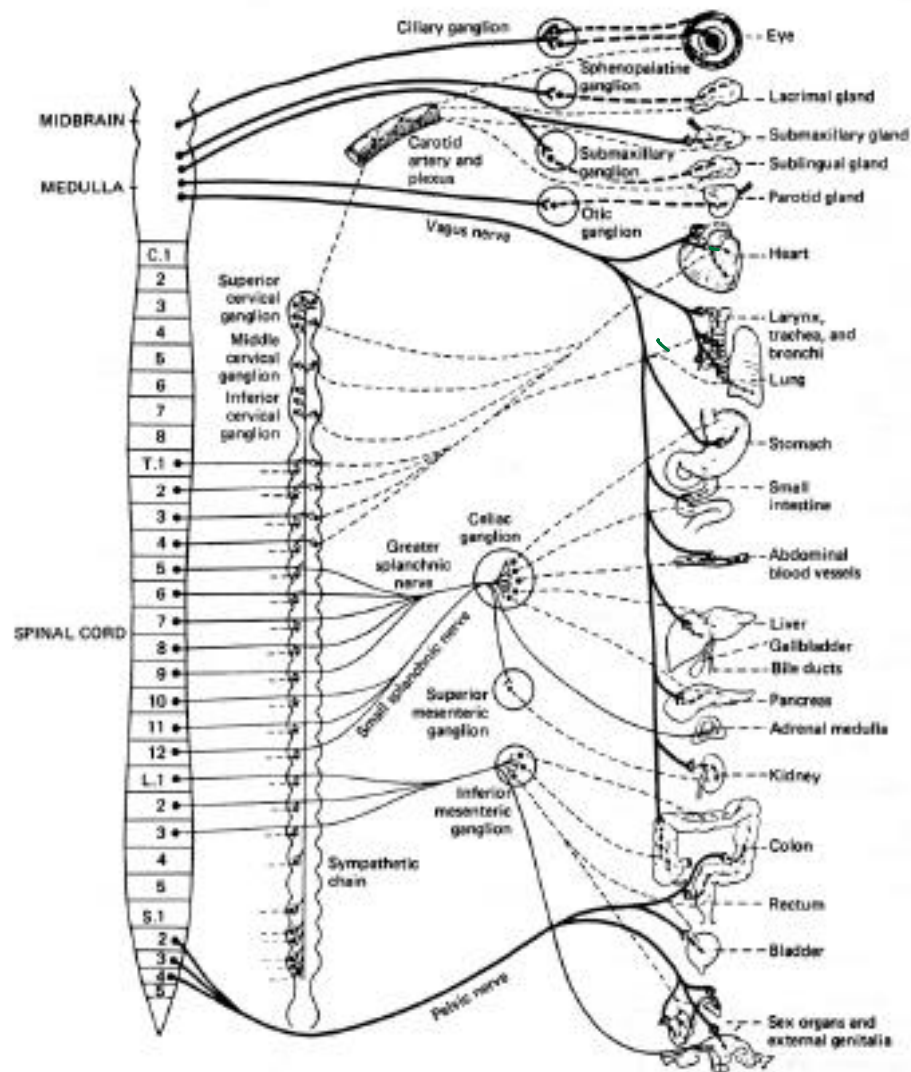
f. Cerebellum (cerebral cortex)

- controls sensory, association, and motor functions
- site of higher mental functions such as memory and reasoning
- coordinates and interprets internal and external stimuli

B. Peripheral Nervous System

- nerves that branch out of the CNS to other parts of the body (effectors)
- the PNS may be subdivided into 2 parts:
 - (a) Somatic Nervous System → innervates skeletal muscles
 - (b) Autonomic Nervous System → innervates organs, glands, smooth muscle
 - the ANS may be subdivided into 2 parts:
 - (1) Sympathetic Nervous System
 - (2) Parasympathetic Nervous System

III. Review of the Autonomic Nervous System (ANS)



A. Sympathetic Nervous System

1. "Fight or Flight" Response
 - mobilizes the body
 - allows the body to function under stress
2. Neurotransmitters
 - epinephrine (Epi)
 - norepinephrine (NE)

3. Synonymous Terms

- adrenergic
- anticholinergic
- catecholamine
- sympathomimetic
- cholinergic blocker
- parasympatholytic

4. Sympathetic Receptors

- a. alpha-1
 - vascular smooth muscle → vasoconstriction
- b. alpha-2
 - presynaptic alpha-2 receptors → regulate NE release
- c. beta-1 (one heart)
 - stimulation causes → increased heart rate (HR), force of myocardial contraction, and increased AV conduction velocity
- d. beta-2 (two lungs)
 - smooth muscle of bronchi → bronchodilation
 - smooth muscle of arterioles → vasodilation

B. Parasympathetic Nervous System

1. "Feed and Breed" Response

- conservation of body resources
- restoration of body resources

2. Neurotransmitter → Acetylcholine (ACh)

3. Synonymous Terms

- cholinergic
- sympatholytic
- adrenergic blocker
- sympathetic blocker
- parasympathomimetic

Parasympathetic Nervous System (cont.)

4. Parasympathetic Receptors

- a. Nicotinic receptors (located in skeletal muscle)
- b. Muscarinic receptors (located in smooth muscle)
 - Bronchi → bronchoconstriction
 - Heart → decrease HR, decrease force of contraction, and decrease conduction velocity
 - GI Tract → increase peristalsis and increase secretions

Functions of the Autonomic Nervous System

Effector Organ	Parasympathetic Effect (Cholinergic)	Sympathetic Effect (Norepinephrine)	
		Receptor	Response
Eye (ciliary muscle)	contraction (for near vision)	beta	relaxation (for far vision)
Heart			
SA Node	decrease HR	beta-1	increase HR
Atria	Decrease contractility	beta-1	increase contractility
AV Node	Decrease conduction velocity	beta-1	increase conduction velocity
Ventricles	decrease in contractility	beta-1	increase in contractility
Arterioles	.....	alpha-1	vasoconstriction
	.....	beta-2	vasodilation
Veins (systemic)	.....	alpha-1	venoconstriction
	.....	beta-2	venodilation
Lung (bronchial)	bronchoconstriction	beta-2	bronchodilation
Salivary Glands	(+) secretions	alpha / beta-2	(-) secretions
Stomach	increase motility	alpha / beta-2	decrease motility
	(+) secretions	.....	(-) secretions
Intestine	increase motility	alpha / beta-2	decrease motility
	(+) secretions	.....	(-) secretions
Gallbladder & Ducts	contraction	.....	relaxation
Urinary Bladder			
Detrusor	contraction	beta	relaxation
Trigone and Sphincter	relaxation	alpha	contraction
Male Sex Organs	erection	alpha	ejaculation
Liver	.....	beta-2	glycogenolysis
Adipose Tissue	.....	beta	lipolysis
Juxtaglomerular (JG) Cells	.....	beta	renin secretion

LUNGS

LIVER

