

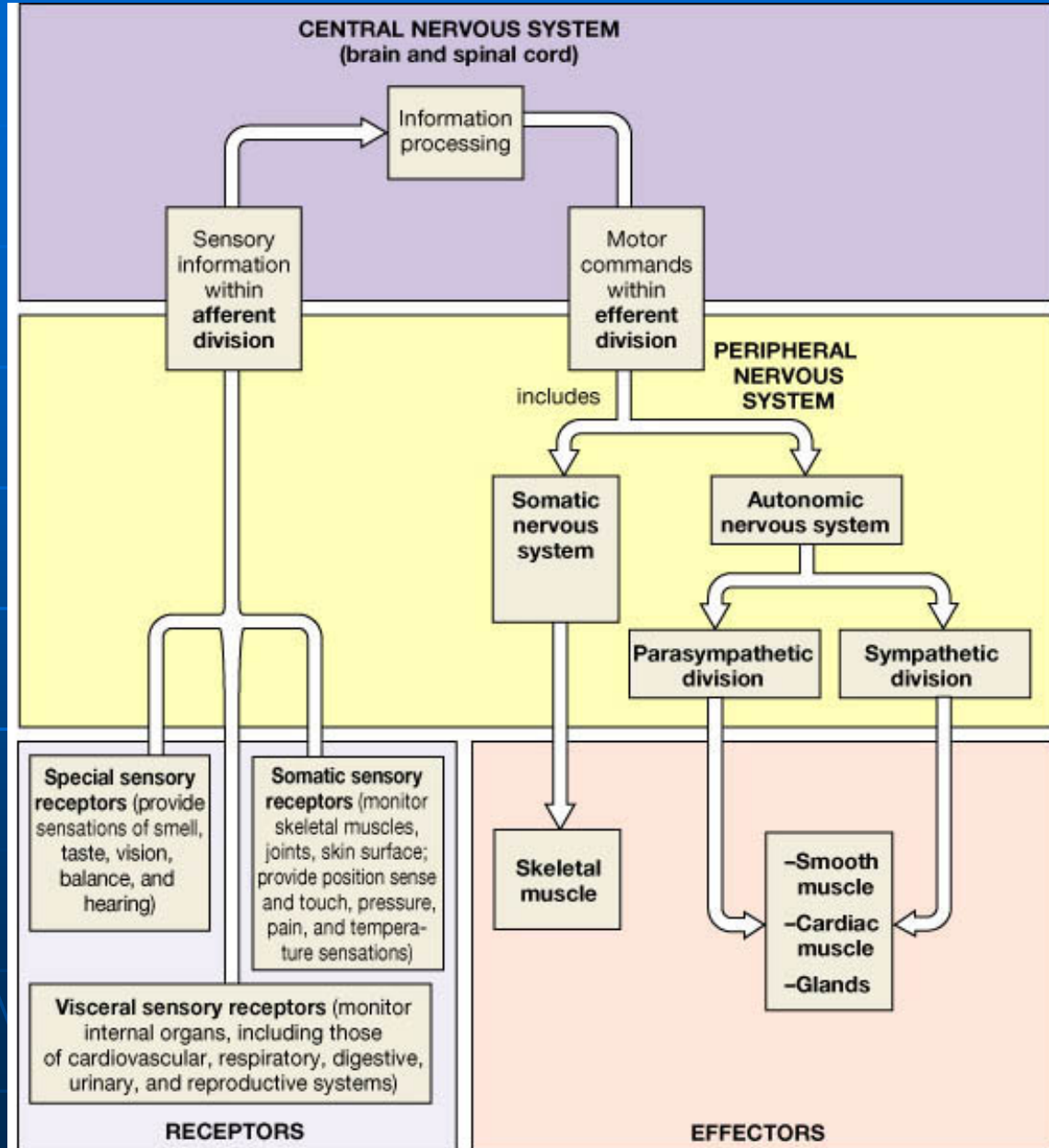
Autonomic Division of NS

Compare and contrast the structures of the sympathetic and the parasympathetic divisions, including functions and neurotransmitters.

Show the levels of integration in the ANS, and compare these with the SNS.

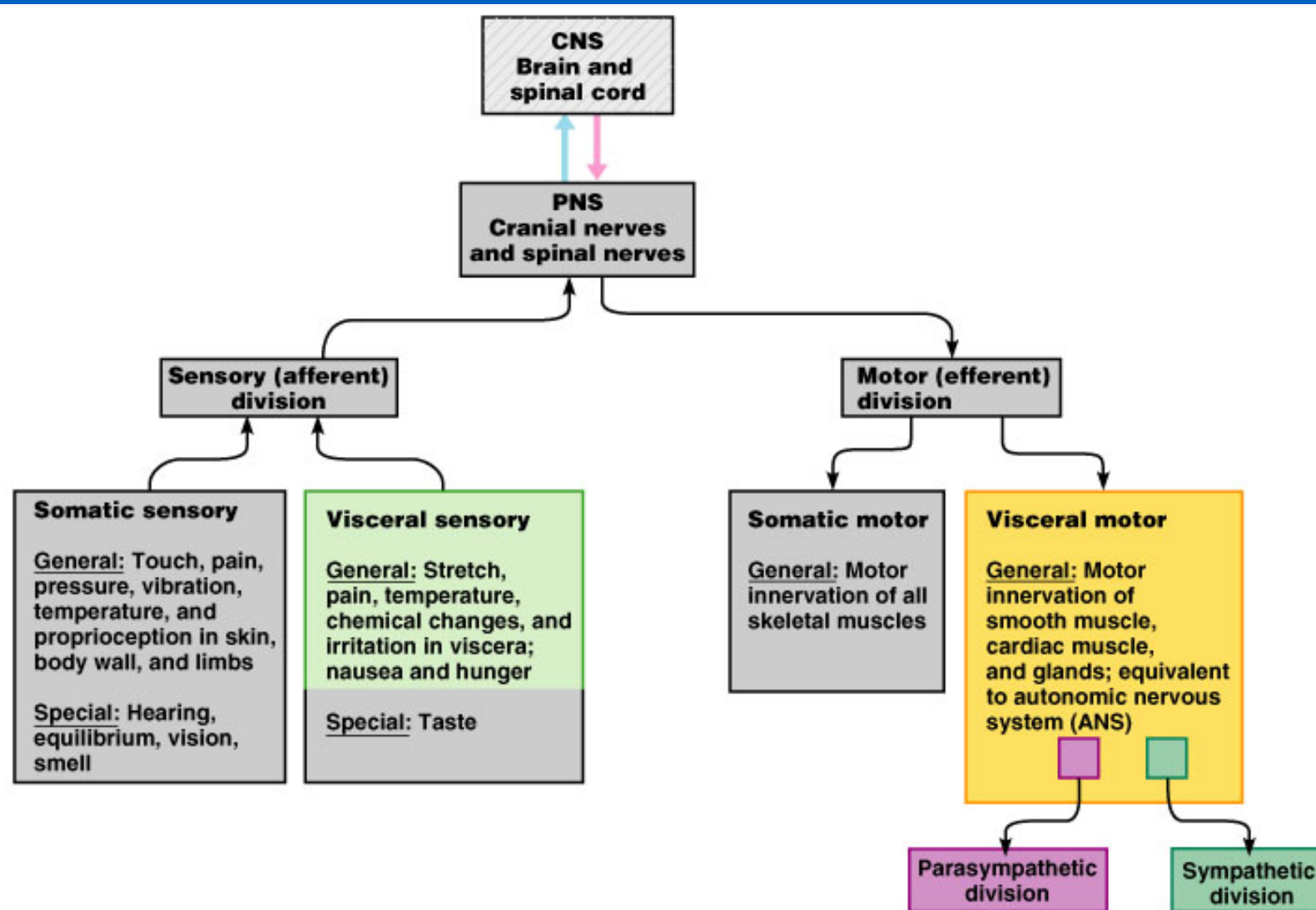


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ANS is
all
efferent!

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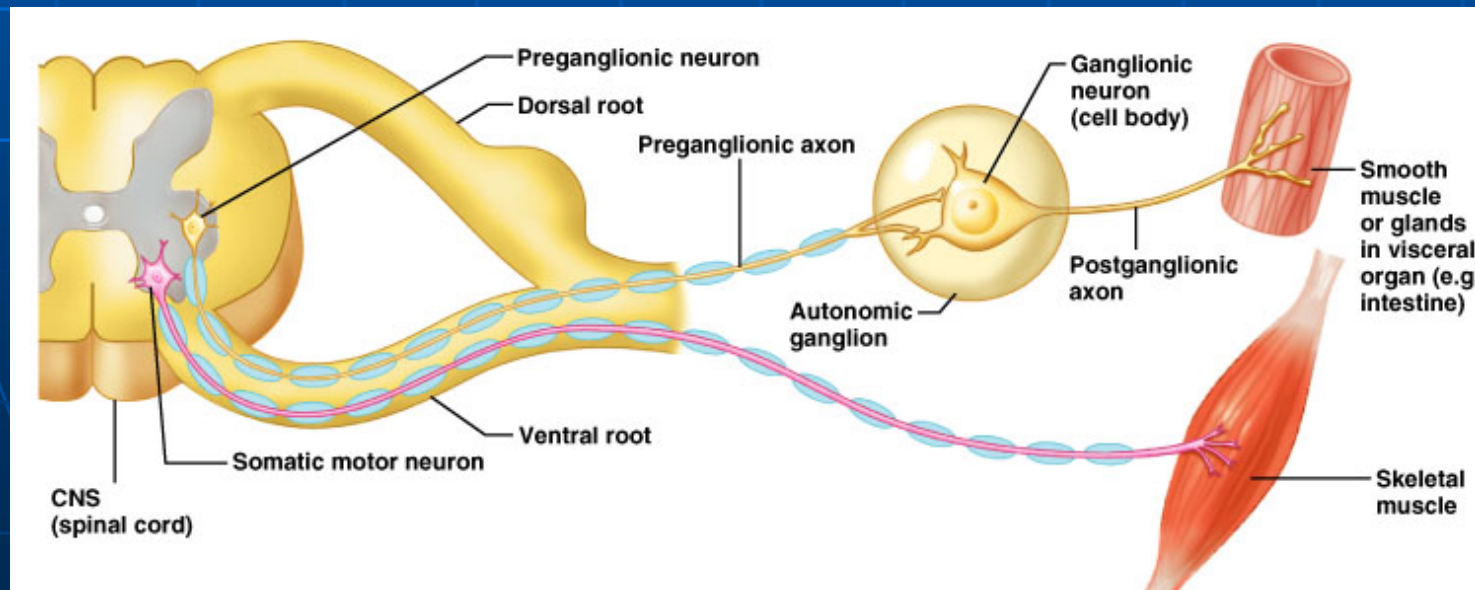


Overview of ANS

Pathway for **Visceral Motor Output**

The somatic NS uses one effector nerve but the ANS output always involves two neurons between spinal cord (CNS) and effector.

Fig 15.2



Overview of ANS

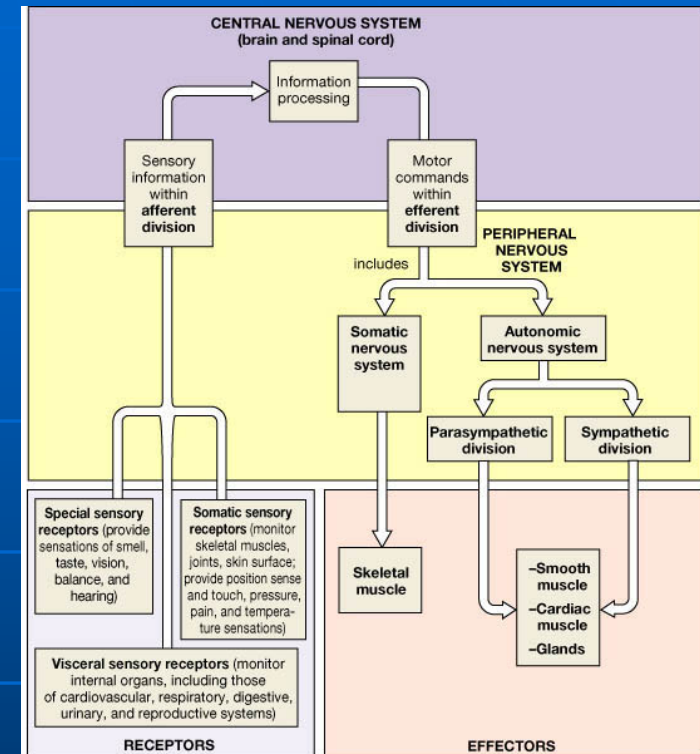
ANS has two divisions with both structural AND functional differences:

1. Parasympathetic – Rest and Repose

1. Craniosacral output
2. Digestion, "housekeeping"
3. **Postganglionic axons release Ach (Cholinergic)**

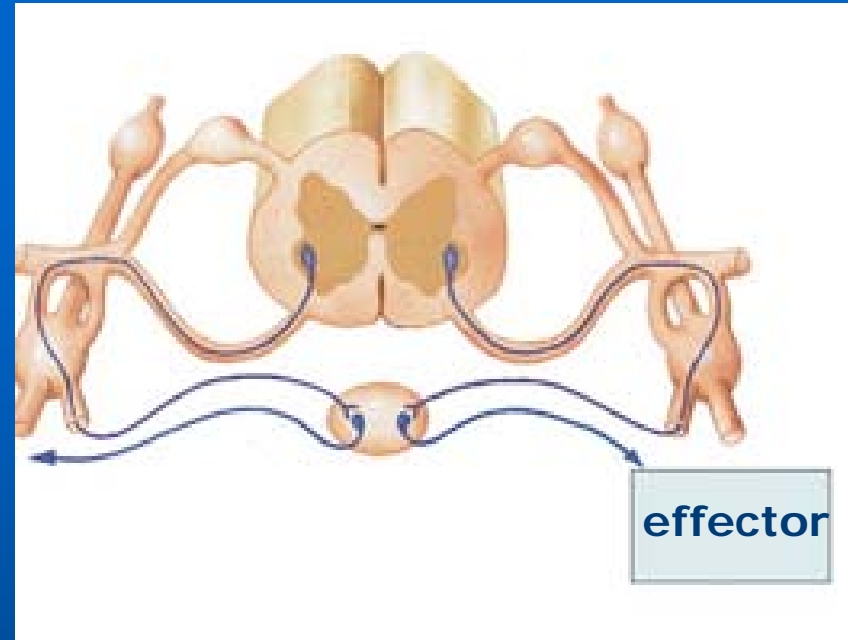
2. Sympathetic- Fight or Flight

1. Thoracolumbar output
2. Heart Rate, Respiration
3. Vasoconstriction
4. **Postganglionic axons release NE (Adrenergic)**



ANS: Some Nomenclature

Naming of neurons:

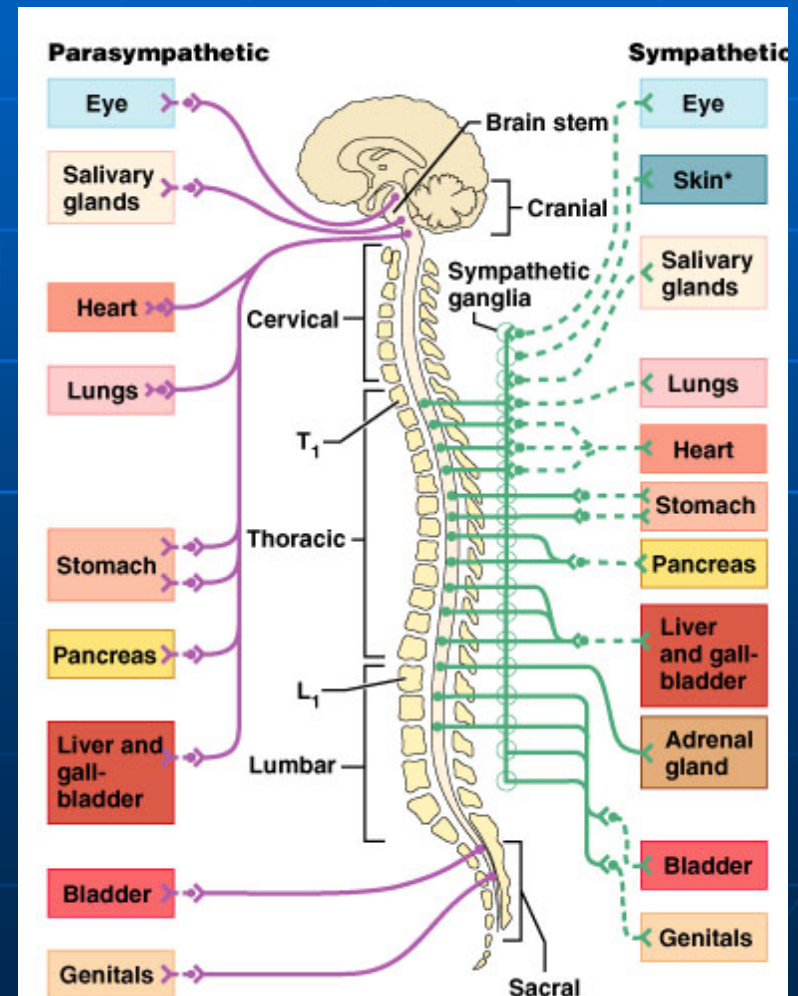


Neuron #1: preganglionic (presynaptic)	➔	Neuron #2: ganglionic (postsynaptic)	➔	effector
Preganglionic fiber (=axon): Lighely myelinated		Postganglionic fiber Unmyelinated		

1. Parasympathetic Division

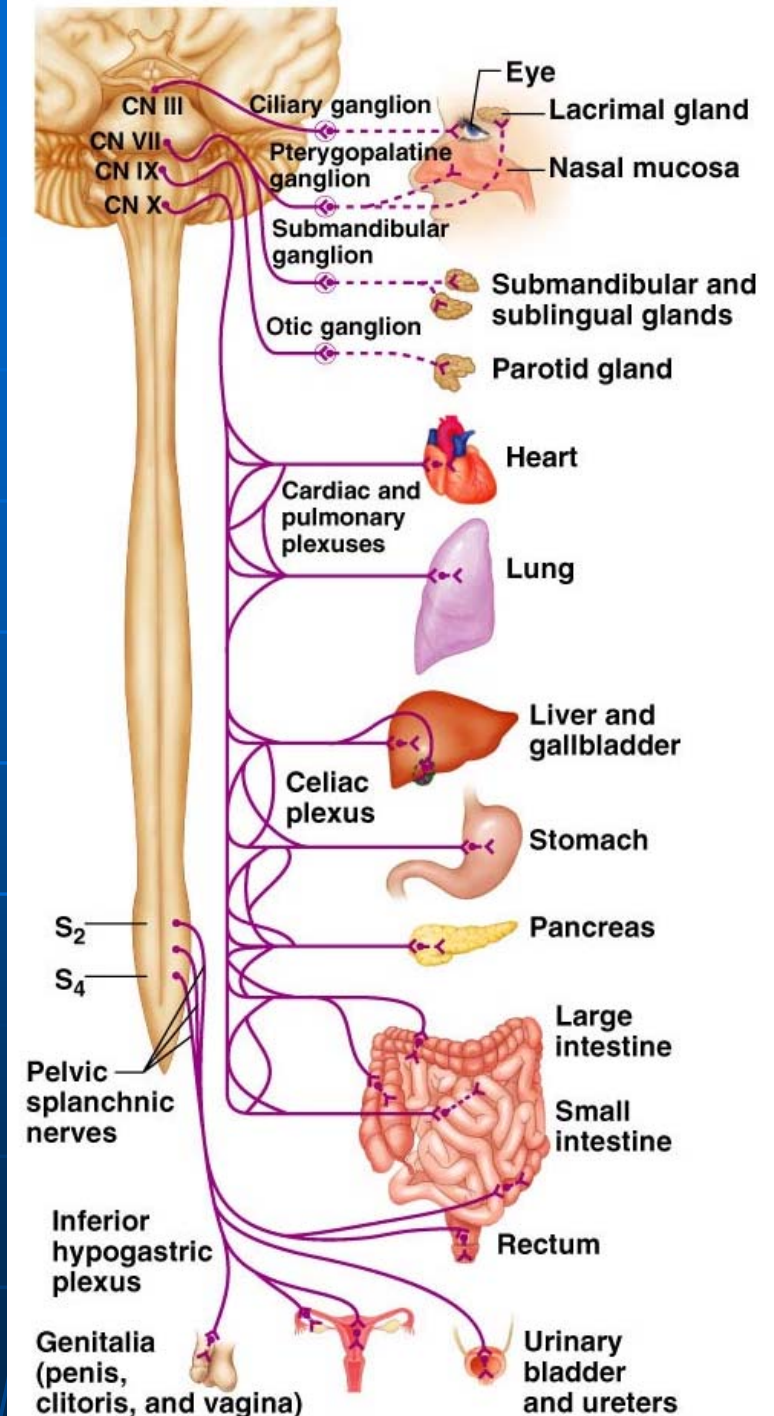
- **AKA Craniosacral** division
- Preganglionic neurons (cell bodies) located in brain stem & sacral segments of spinal cord.
- Cranial Nerves III, VII, IX, **X**
 - Pupils (III), Lacrimal and Salivary Glands (VII), Viscera (X)
- Sacral segments S₂₋₄
 - Bladder, Genitals

Fig 15.3



Parasympathetic Division, cont'd

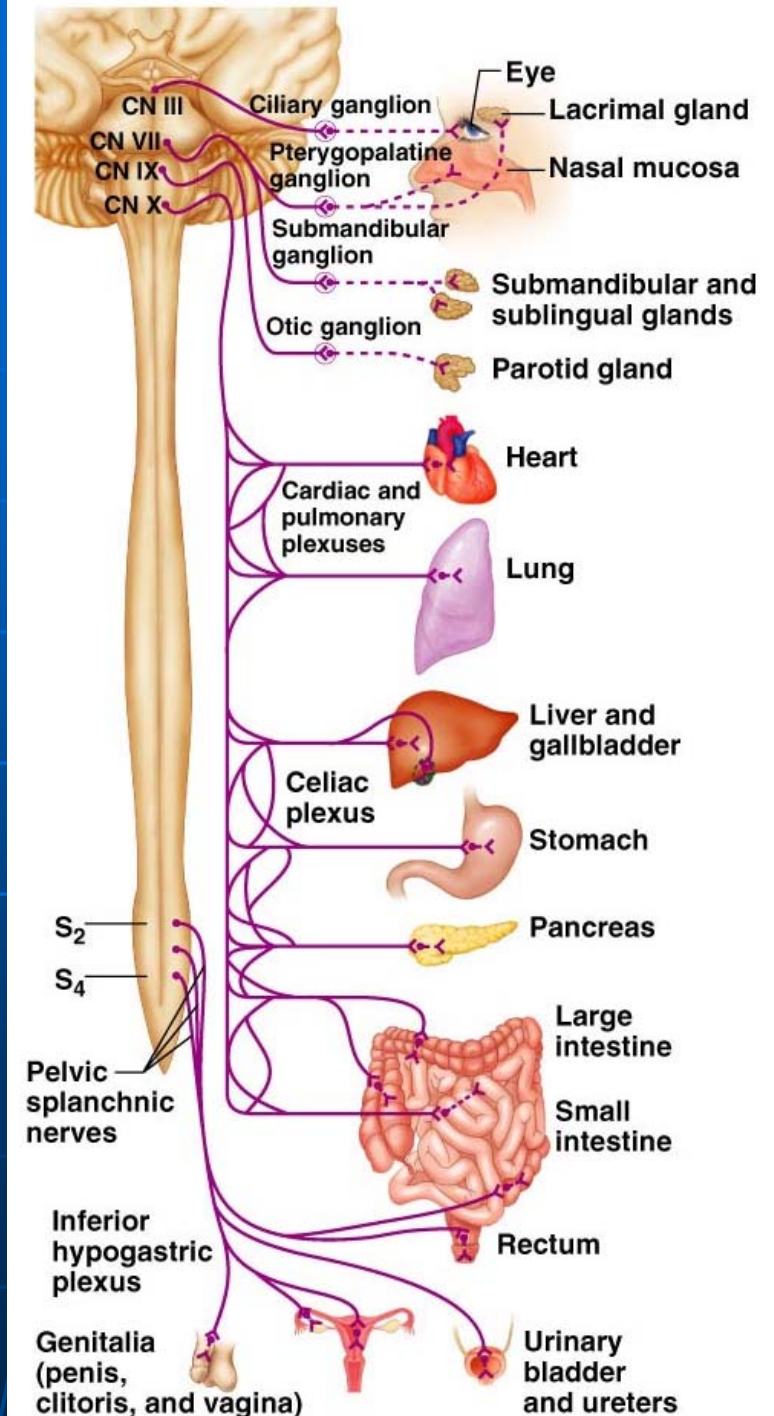
- Ganglionic neurons (cell bodies) in ganglia near target organs: **Intramural ganglia**
- Effects of parasympathetic division: R & R
- Synapses:
 - All use ACh



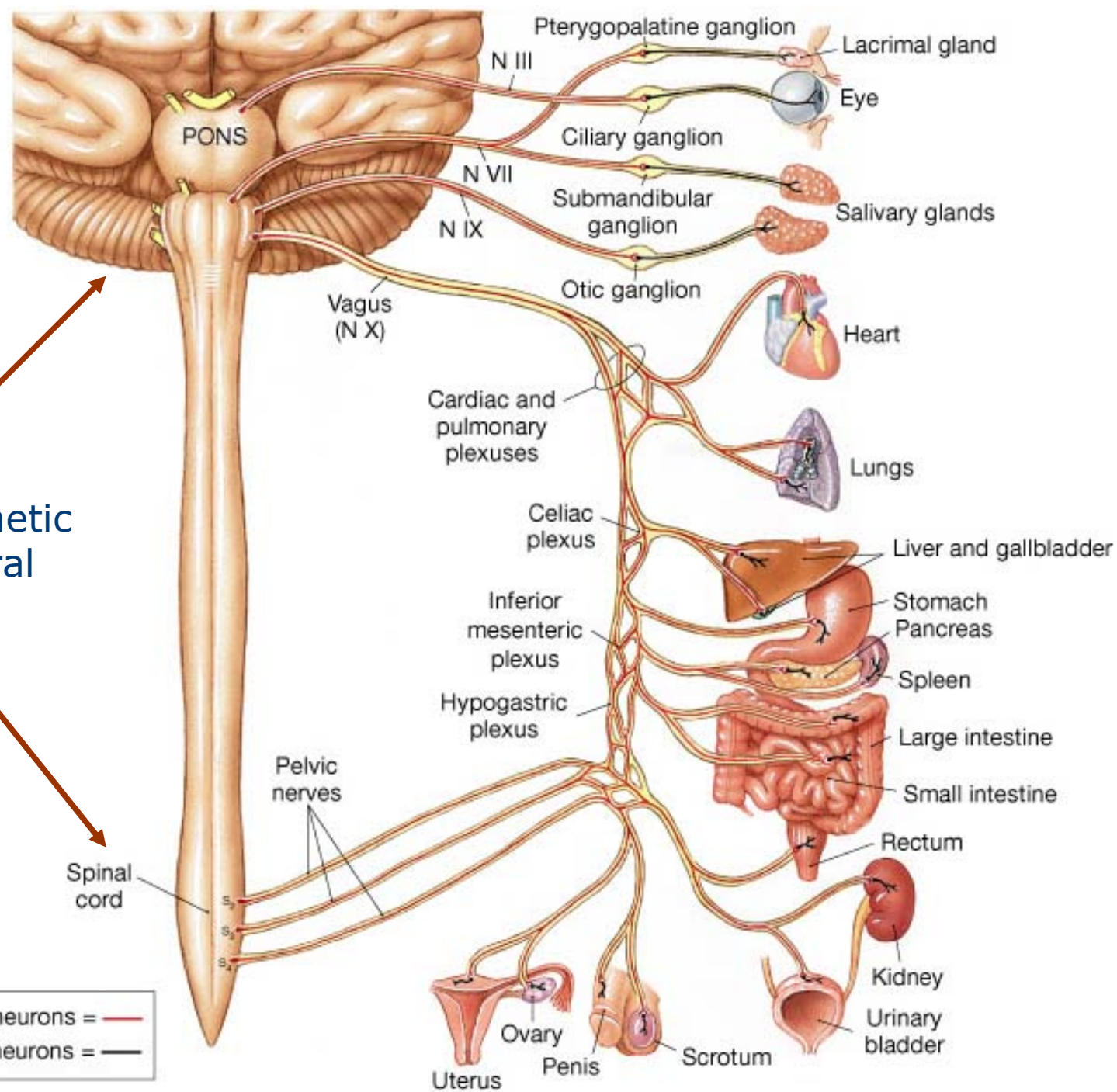
Parasympathetic Division, cont'd

Some functions:

- Constriction of Pupils (opposite sympathetic)
- Secretion of Digestive Glands
 - Insulin, etc.
- Visceral Smooth Muscles
- Defecation and Urination
- Constriction of Respiratory System
- Decrease Heart Rate
- Sexual Arousal



Parasympathetic = Craniosacral



Parasympathetic Division, Summary

- A. Rest and repose
- B. Neurons #1 are long, thinly myelinated, come from the brain stem (N III, VII, IX, X) or sacral spinal cord (S_{2-4}), run with the spinal or pelvic nerves and produce ACh.
- C. Neurons #2 are short, **nonmyelinated**, produce ACh, and may be either excitatory or inhibitory to muscarinic receptors.
- D. Mostly control of internal physiology

2. Sympathetic Division

AKA Thoracolumbar division

Preganglionic neurons (cell bodies) located between T1 & L2 of spinal cord

Ganglionic neurons (cell bodies) in ganglia near vertebral column, AKA "Chain Ganglia."

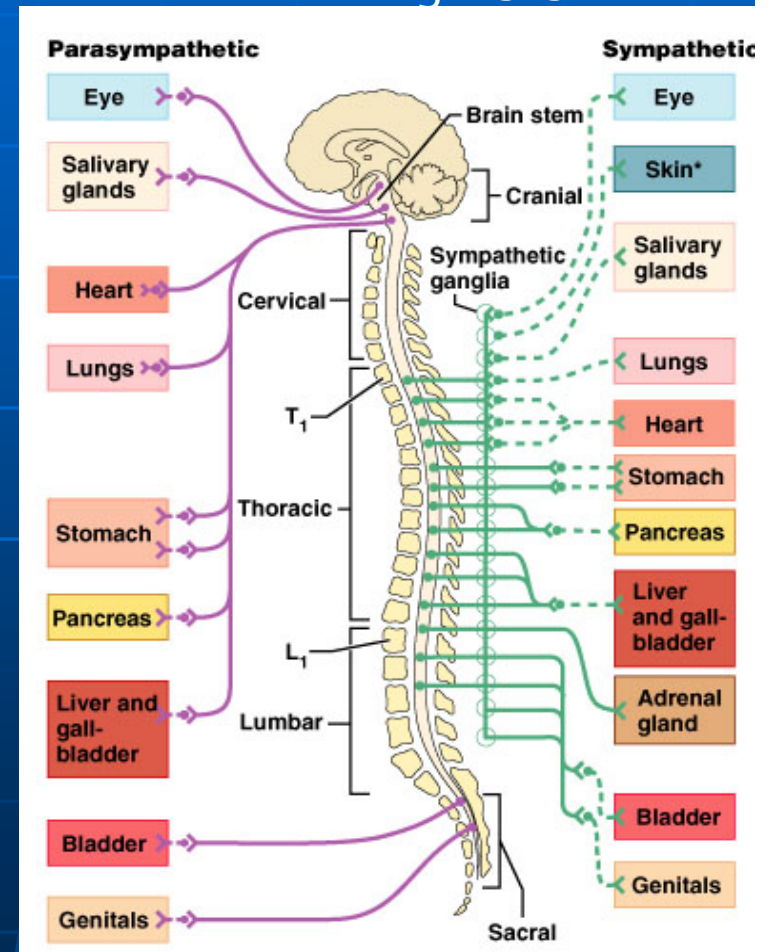
Paravertebral ganglia = sympathetic chain ganglia

Prevertebral ganglia = collateral ganglia

Special case: adrenal medulla is a modified ganglion

Effects of Sympathetic Division? F or F

Fig 15.3



Sympathetic Efferent Pathways: Examples

Fig 15.11

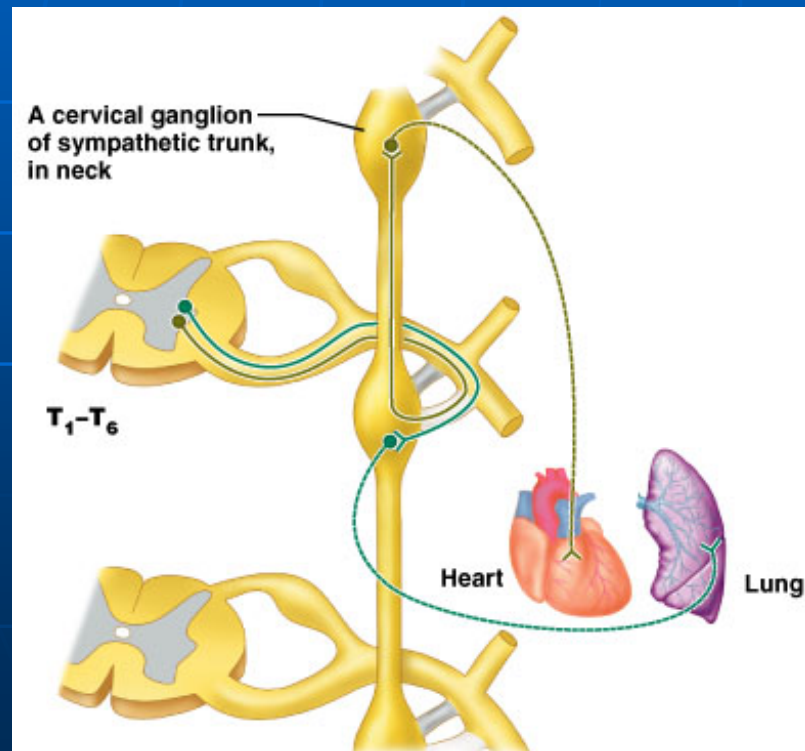
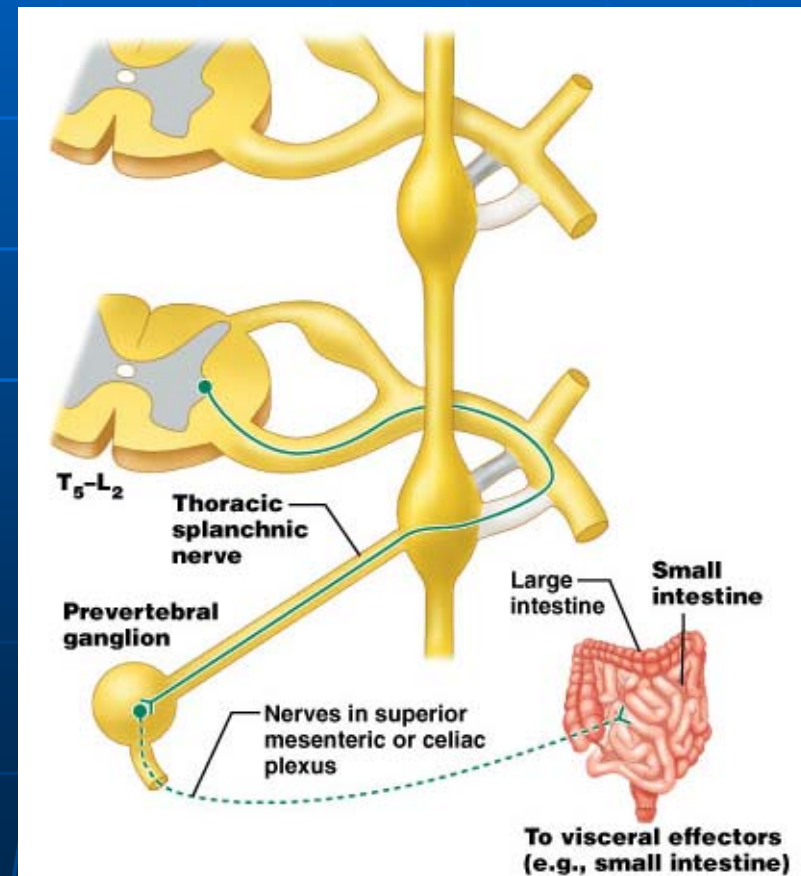


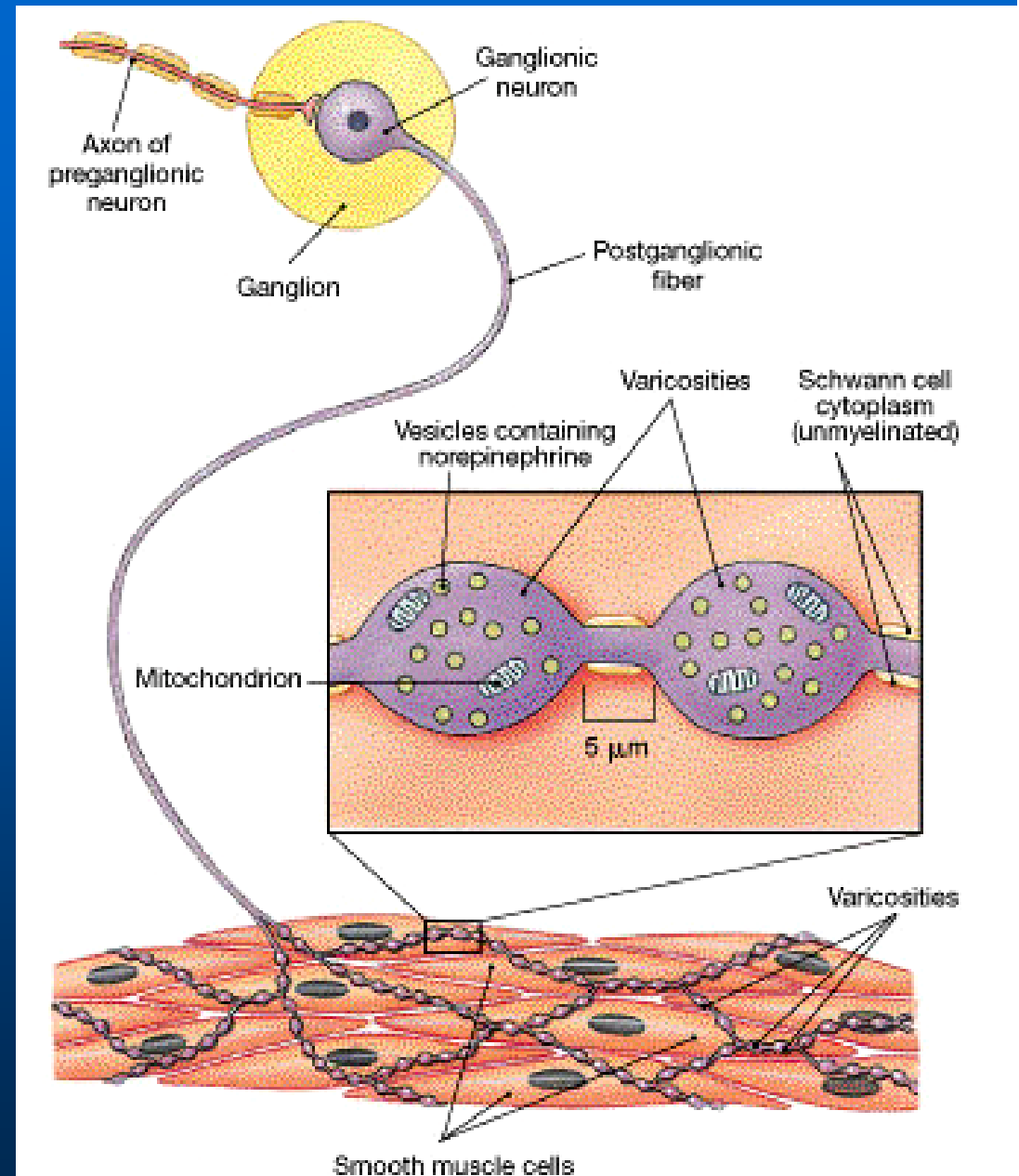
Fig 15.12

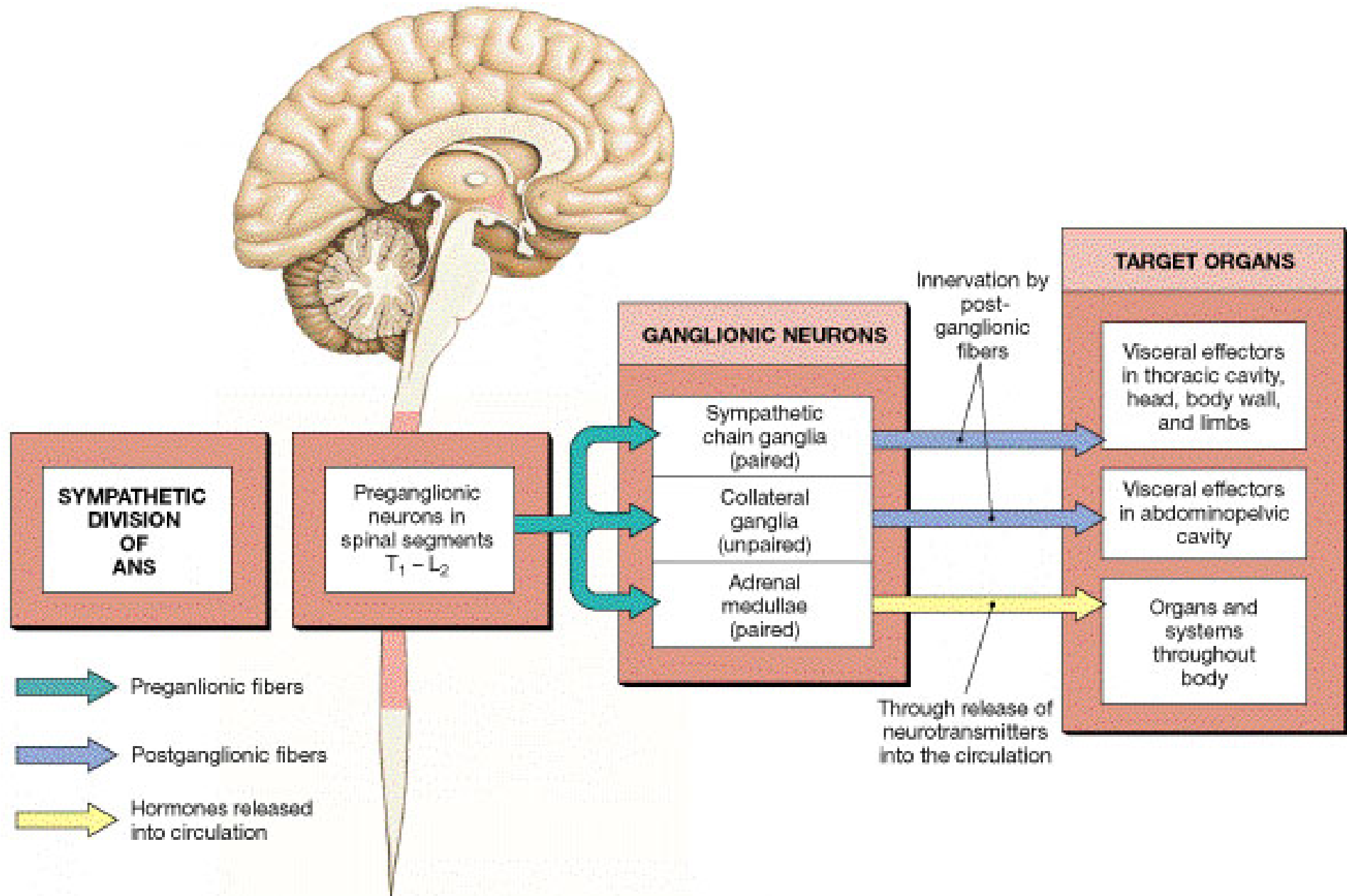


Sympathetic Neuroeffector Junctions

Differ from somatic neuromuscular junctions

Varicosities contain NT





Special Case: Adrenal Medulla

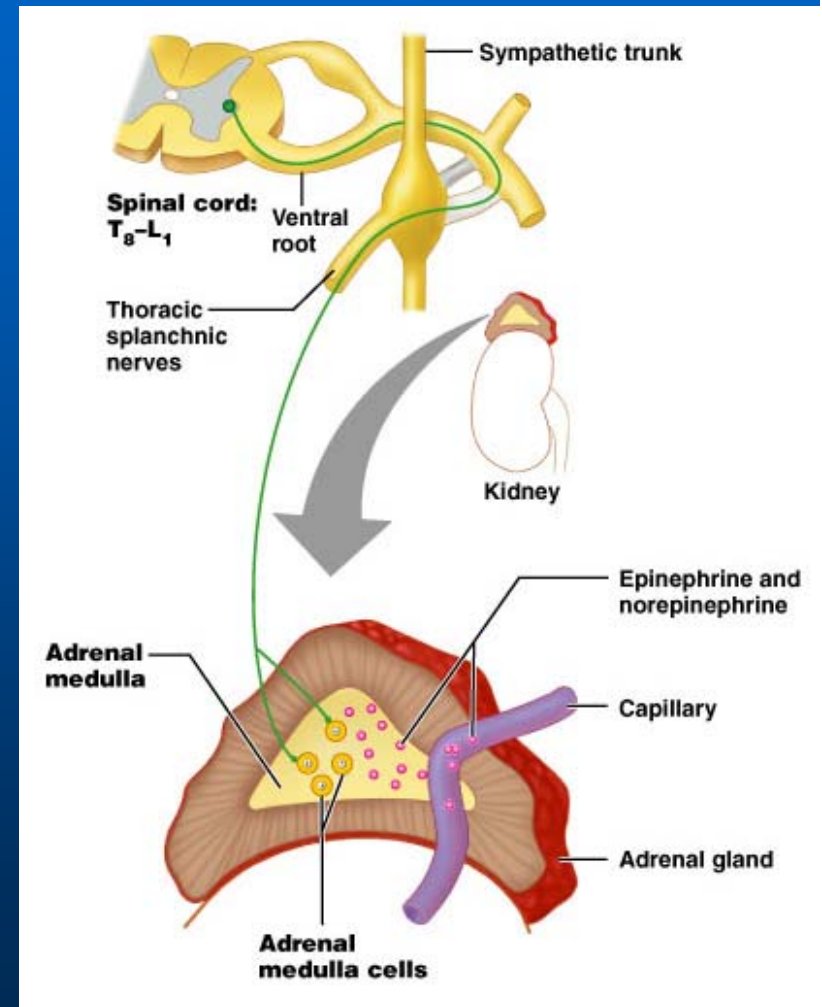
“Modified sympathetic ganglion”

Terminus for neuron #1,
stimulates specialized 2nd order
neurons with very short axons in
adrenal medulla to release NT
into blood stream (= hormones)

Epinephrine (adrenaline) ~ 80%
and norepinephrine
(noradrenaline)

Endocrine effects are longer
lasting than nervous system
effects

Fig. 17-6



Sympathetic Receptors

(not in book)

Alpha (α -)(Smooth muscle in blood vessels)

Beta (β -)(Heart, resp tract, skeletal muscle)

An enormous number of drugs have their effect at these receptors

Summary of Sympathetic Division

- A. Neuron #1 is short, neuron #2 is long
- B. Synapsing occurs in paravertebral chain ganglia or prevertebral collateral ganglia
- C. Neuron #1 releases Ach, usually neuron #2 releases NE ("adrenergic")
- D. Prepares for emergency action, excitatory to many organs, inhibitory to others (digestive for example) "F or F"
- E. Effects are very widespread and somewhat persistent; (not as slow as endocrine system)

Dual Innervation

Each organ receives innervation from sympathetic and parasympathetic fibers

Fibers of both divisions meet & commingle at plexuses (fig 17-9) to innervate organs close to those centers

Names of plexuses derived from locations or organs involved

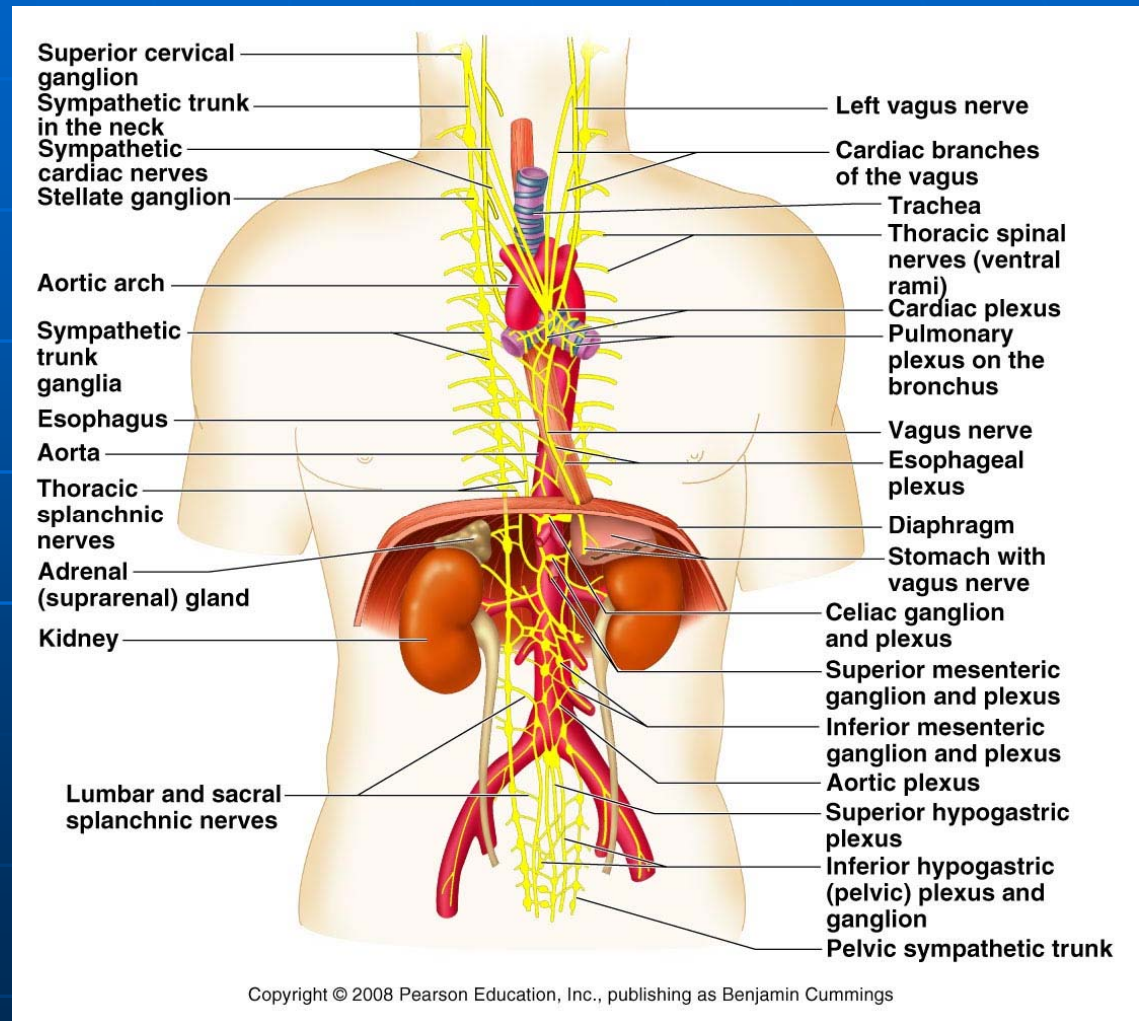
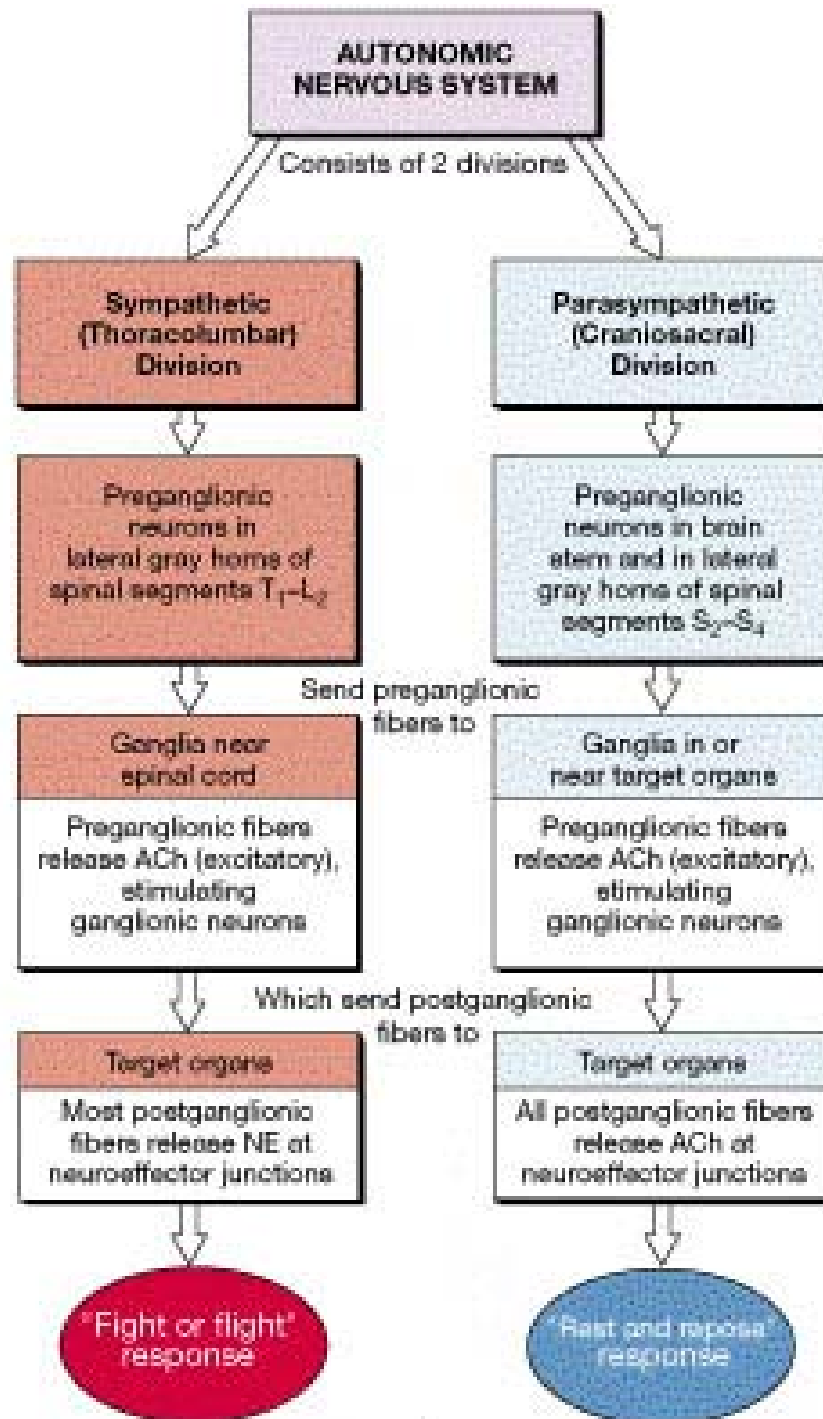
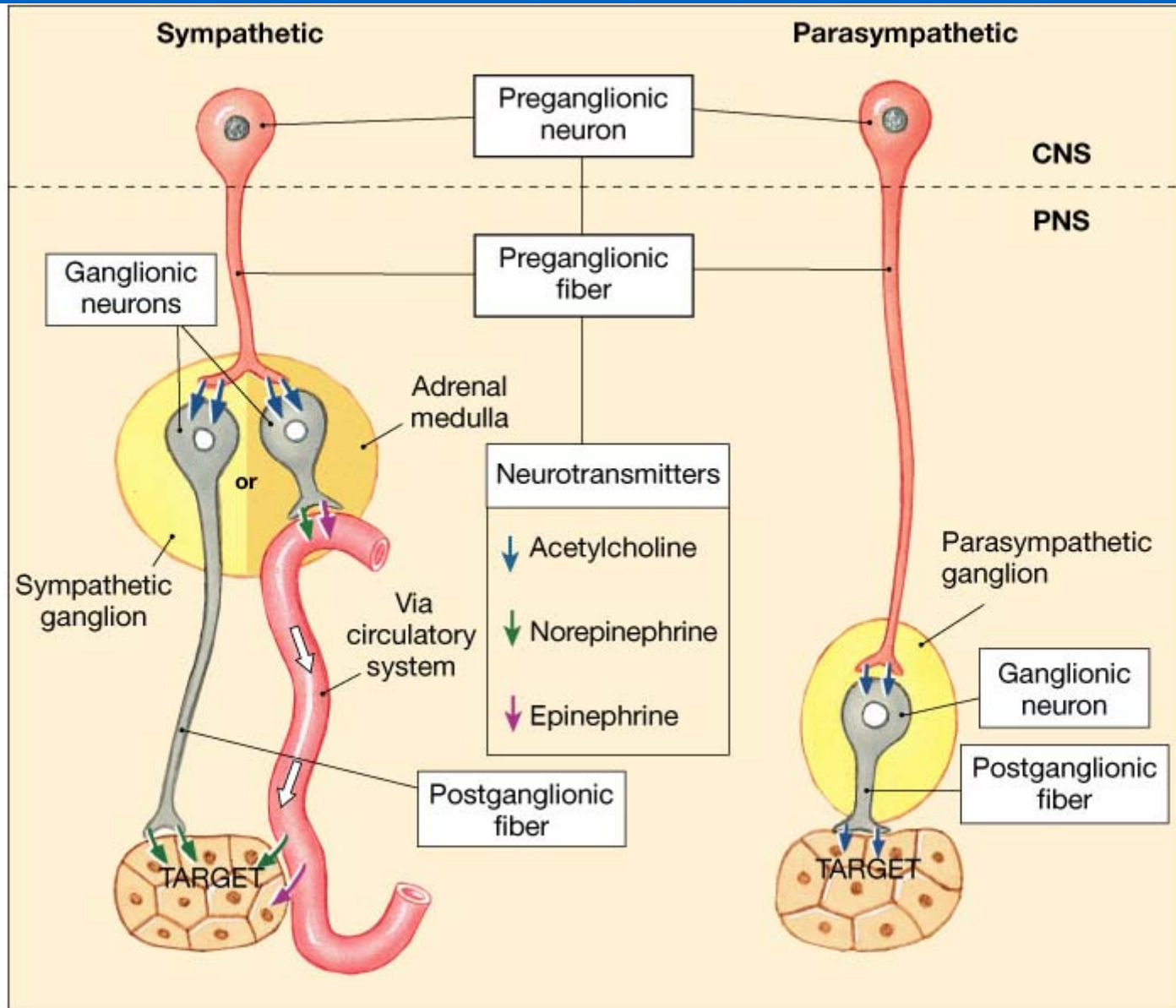


Fig. 15.6

ANS Summary

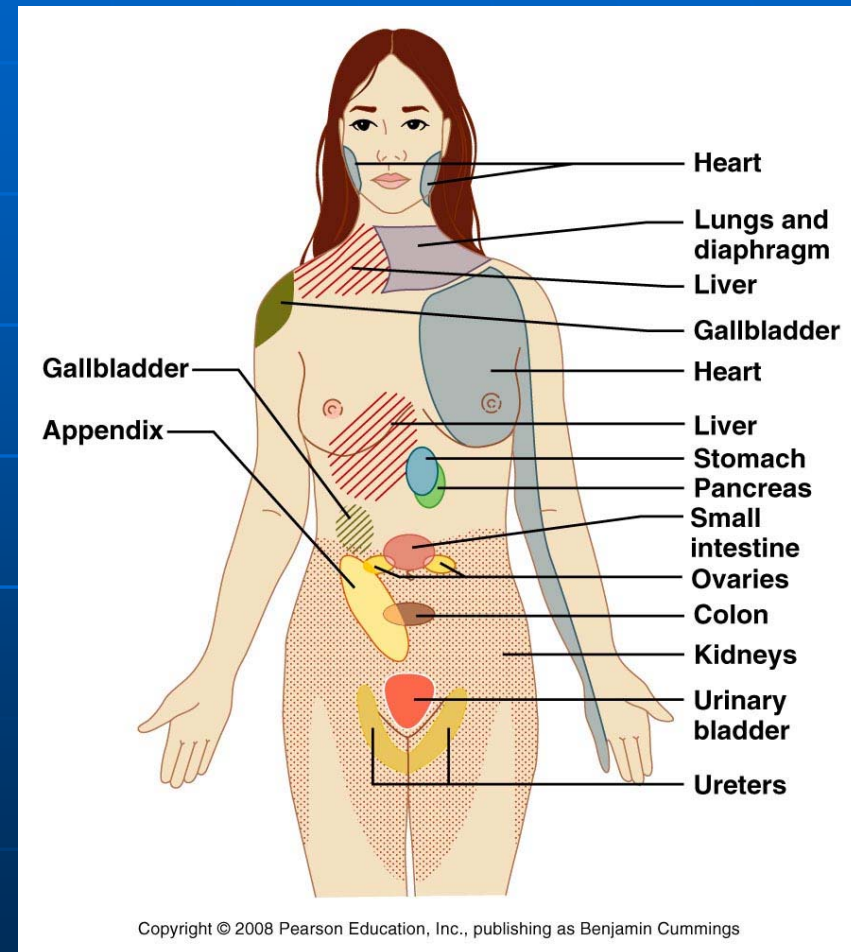
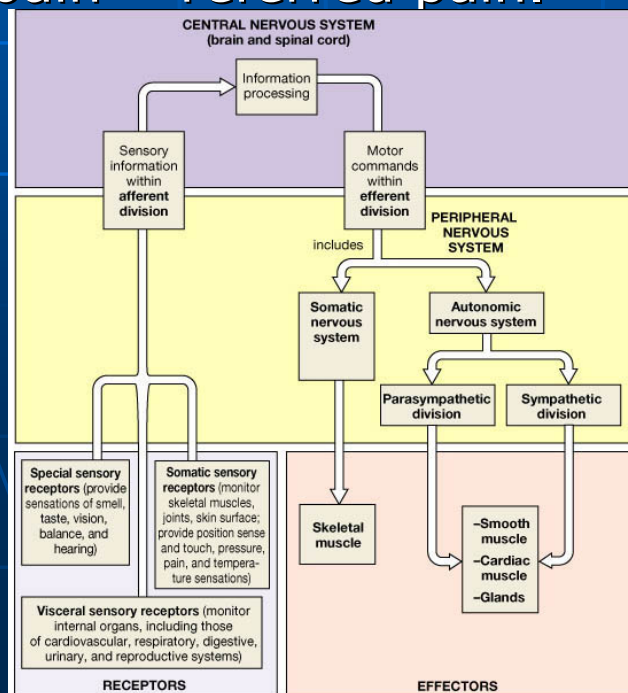


Comparison



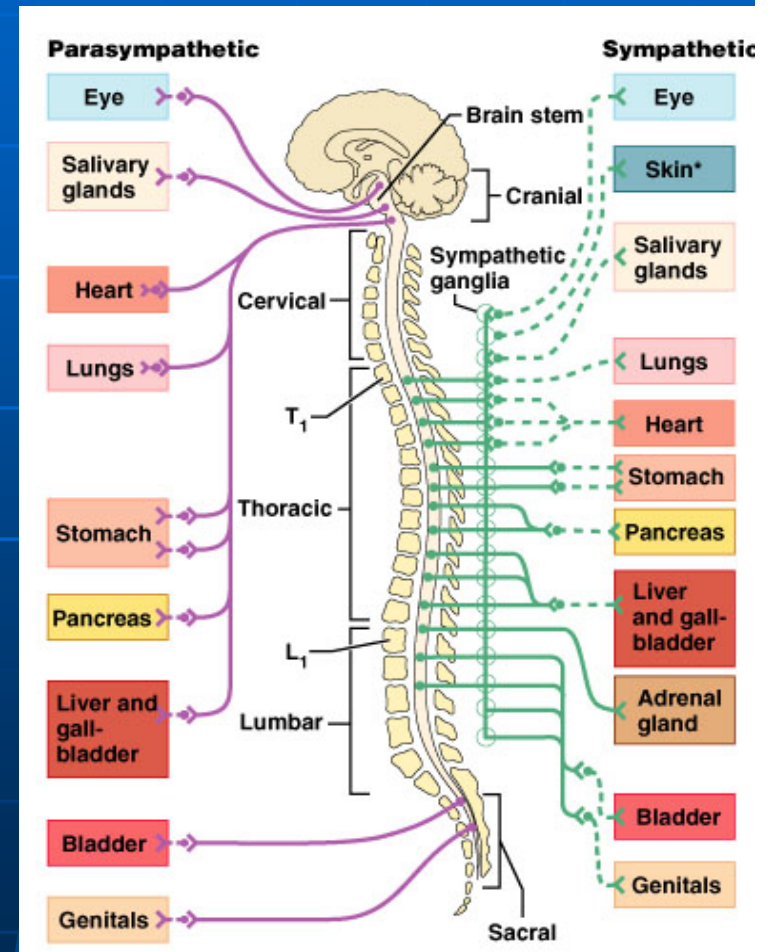
Visceral Sensory

- The interior monitoring
- Much of the input via CN X (Vagus)
- Visceral pain is often perceived as somatic pain—"referred pain."



Horner's Syndrome

- Loss of sympathetic innervation to an eye
- Ptosis
- Miosis
- Anhidrosis
- Causes are varied: tumor, aortic aneurism, trauma



Higher Levels of Control

- Common sense tells us that the ANS isn't only automatic. "Higher centers" exert significant control over the ANS
 - Anger => rapid HR
 - Nervousness => sweat

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