BHARATHIDASAN UNIVERSITY

Program: M.Sc., Biomedical Science

Course Title : Neurobiology

Peripheral Nervous System

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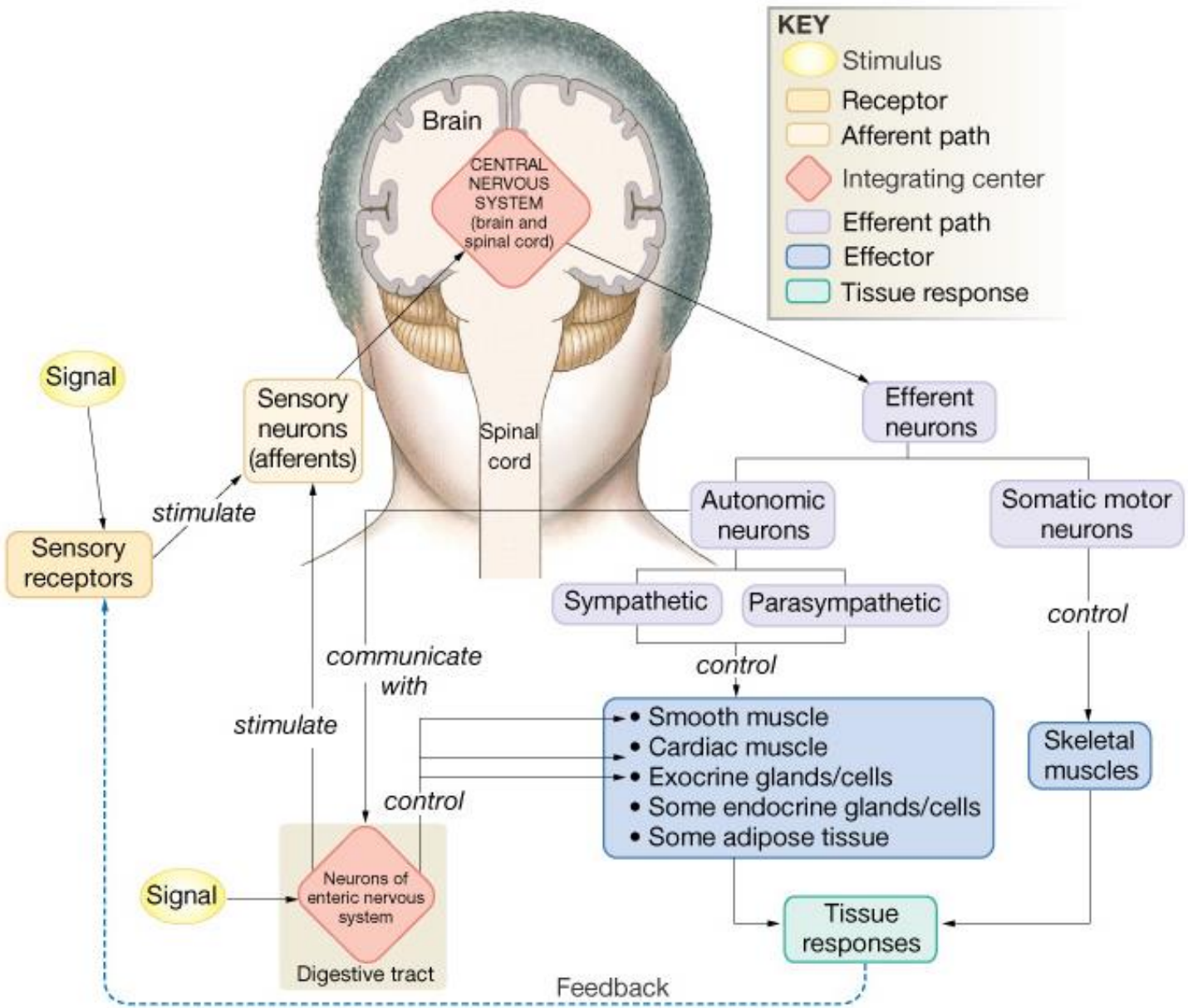
The Peripheral Nervous System

Peripheral Nervous System



The Peripheral Nervous System

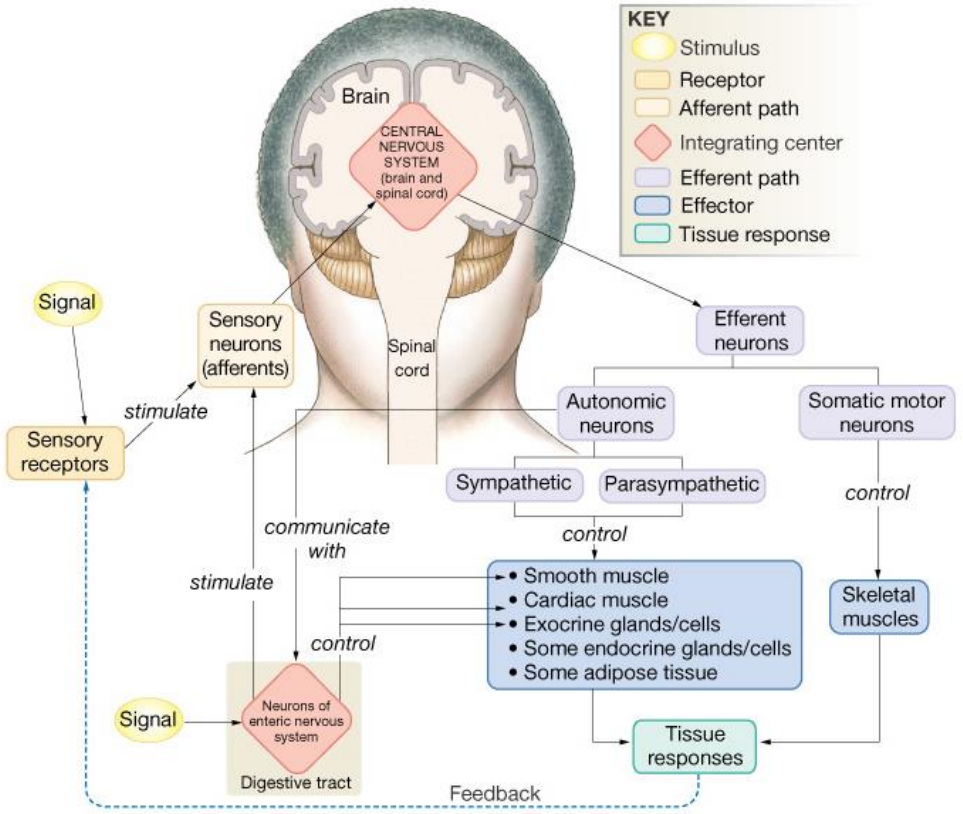
- Nervous structures outside the brain and spinal cord
- Nerves allow the CNS to receive information and take action
- *Functional components of the PNS*
  - Sensory inputs and motor outputs categorized as somatic or visceral
  - Sensory inputs also classified as *general* or *special*

Sensory Input and Motor Output

- Sensory (afferent) signals picked up by sensor receptors, carried by nerve fibers of PNS to the CNS
- Motor (efferent) signals are carried away from the CNS, innervate muscles and glands
- Divided according to region they serve
  - Somatic body region
  - Visceral body region
- Results in four main subdivisions
  - Somatic sensory
  - Visceral sensory
  - Somatic motor
  - Visceral motor

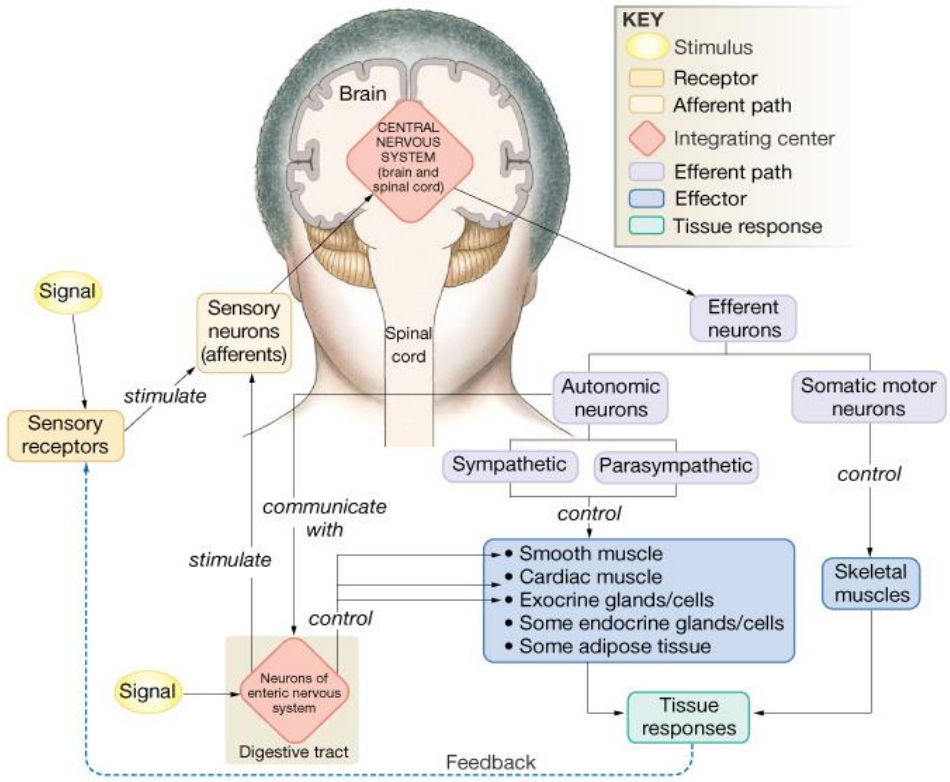
PNS Afferent Division

- Afferent (sensory) division – transmits impulses from receptors to the CNS.
  - Somatic afferent fibers – carry impulses from skin, skeletal muscles, and joints
  - Visceral afferent fibers – transmit impulses from visceral organs

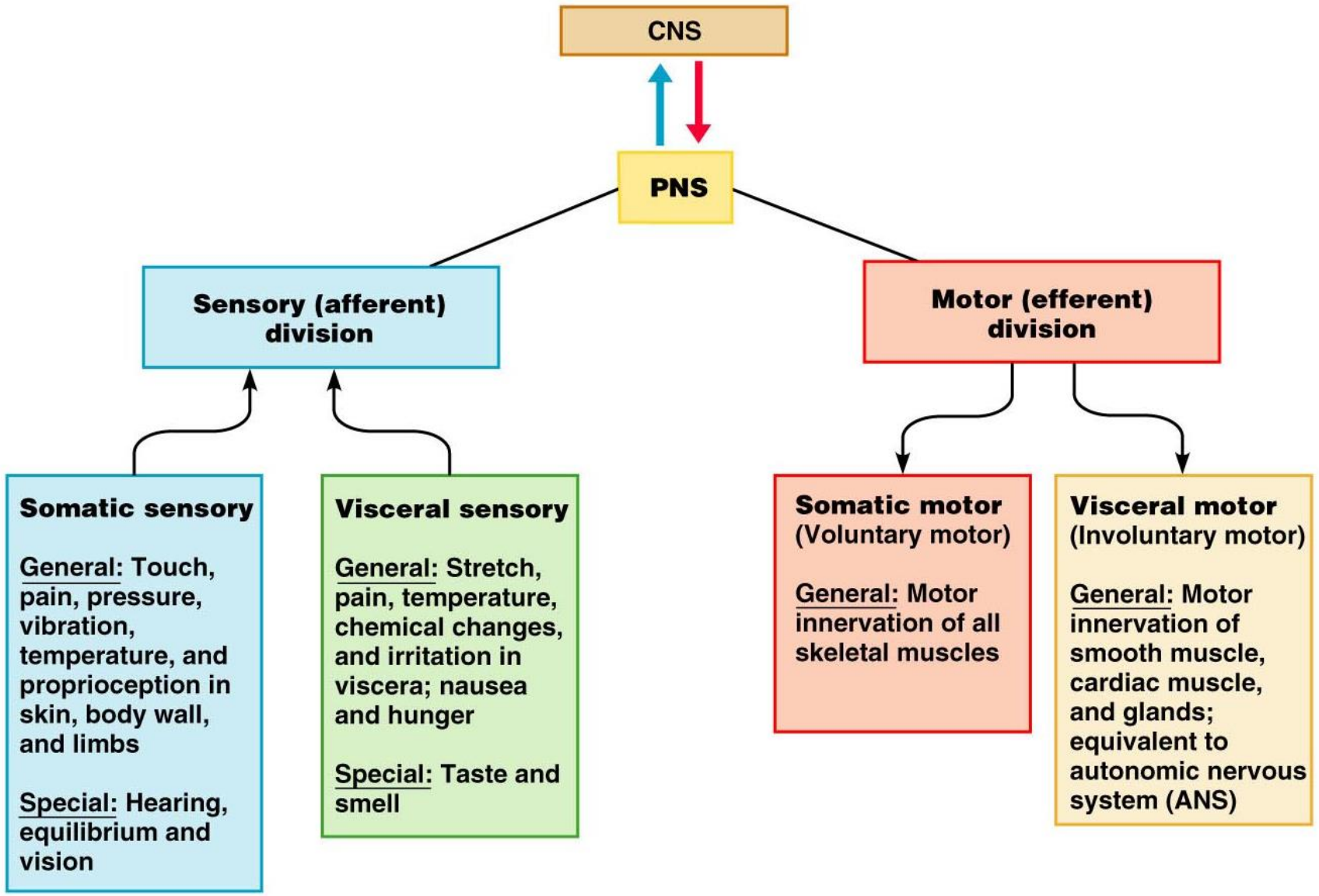


PNS Efferent Division

- Motor (efferent) division – transmits impulses from the CNS to effector organs. Two subdivisions:
  - Somatic nervous system – provides conscious control of skeletal muscles
  - Autonomic nervous system – regulates smooth muscle, cardiac muscle, and glands



Types of Sensory and Motor Information



Sensory

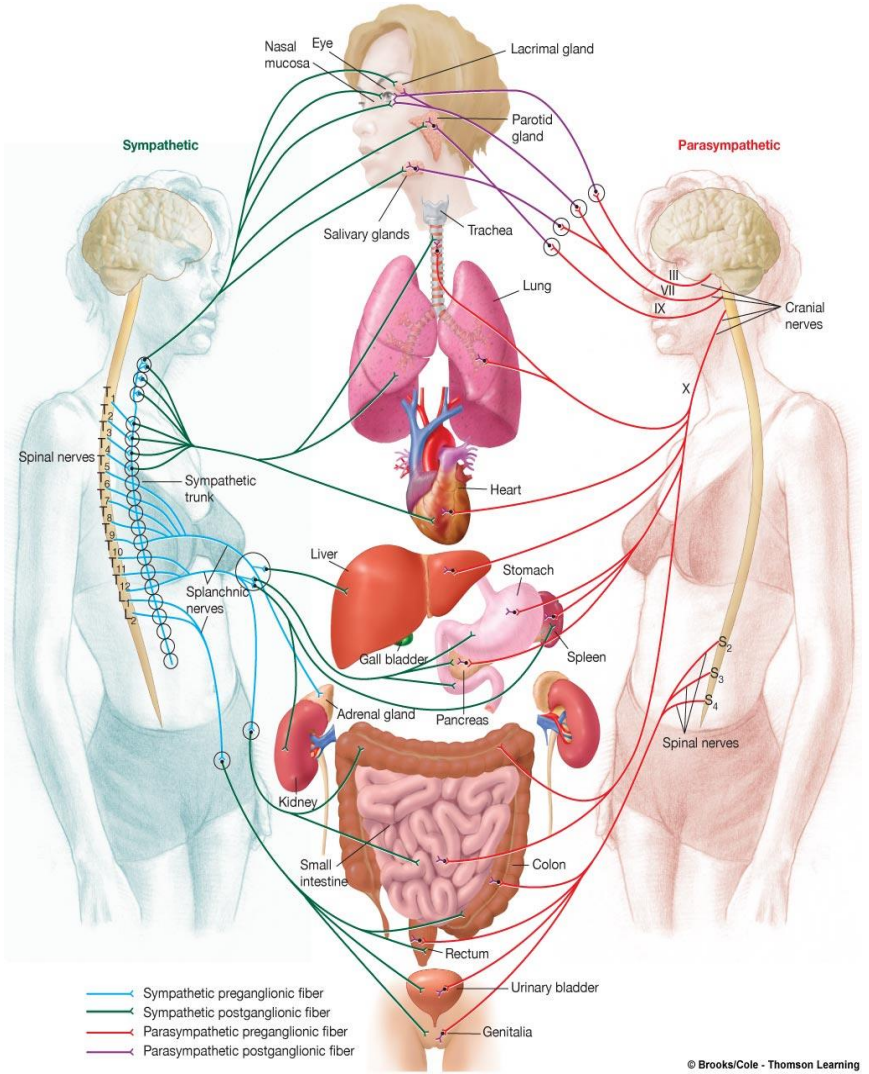
- General somatic senses – include touch, pain, vibration, pressure, temperature
- Proprioceptive senses – detect stretch in tendons and muscle provide information on body position, orientation and movement of body in space
- Special Senses - hearing, balance, vision, olfaction (smell), gustation (taste)

Motor

- General somatic motor
  - Signals contraction of skeletal muscles
  - Under our voluntary control
- Visceral motor
  - Makes up autonomic nervous system (ANS)
  - Regulates the contraction of smooth and cardiac muscle, controls function of visceral organs
  - ANS has two divisions
    - **Parasympathetic**
    - **Sympathetic**

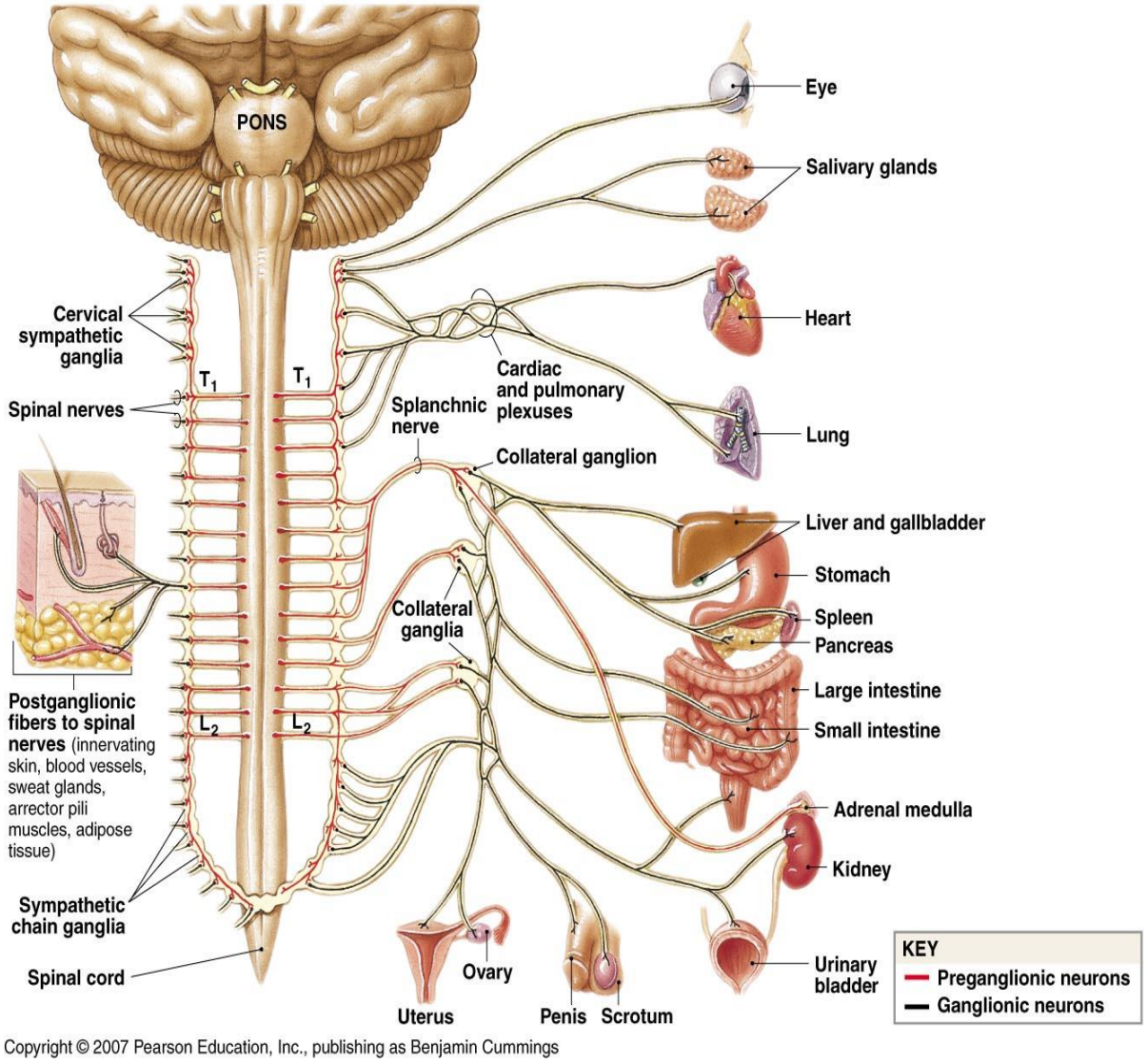
Divisions of the ANS

- Sympathetic - “fight or flight”
  - Catabolic (expend energy)
  - Mass activation prepares for intense activity.
    - Heart rate (HR) increases.
    - Bronchioles dilate.
    - Blood [glucose] increases.
- Parasympathetic - “feed & breed”, “rest & digest”
  - Maintain homeostasis
  - Normally not activated as a whole, stimulation of separate parasympathetic nerves.
  - Relaxing effects:
    - Decreases HR.
    - Dilates visceral blood vessels.
    - Increases digestive activity.
- Dual innervation of many organs — having a brake and an accelerator provides more control



Sympathetic Division Organization

- Preganglionic neurons in segments T_1 to L_2
- Ganglia near the vertebral column
- Sympathetic ganglia
  - Paired sympathetic chain ganglia
  - Unpaired collateral ganglia
- Preganglionic fibers to adrenal medullae
  - *Epinephrine* (adrenalin) into blood stream

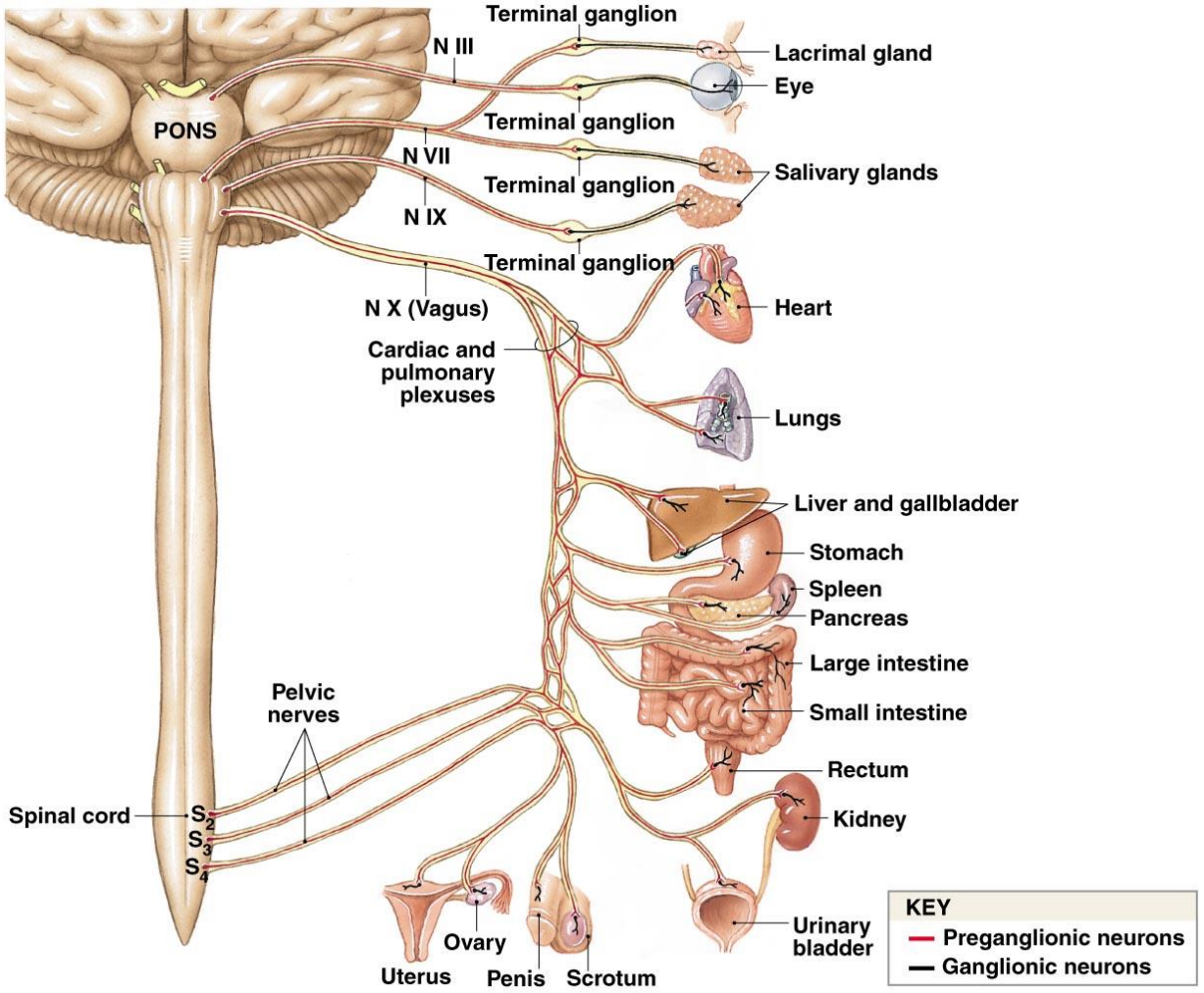


The Autonomic Nervous System

- Effects of Sympathetic Activation
  - Generalized response in crises
  - Increased alertness/energy
  - Increased cardiovascular activity
  - Increased respiratory activity
  - Increased muscle tone

Parasympathetic Division Organization

- Preganglionic neurons in brain stem and sacral spinal segment
- Ganglionic neurons (peripheral ganglia) in or near target organ
- Sacral fibers form *pelvic nerves*

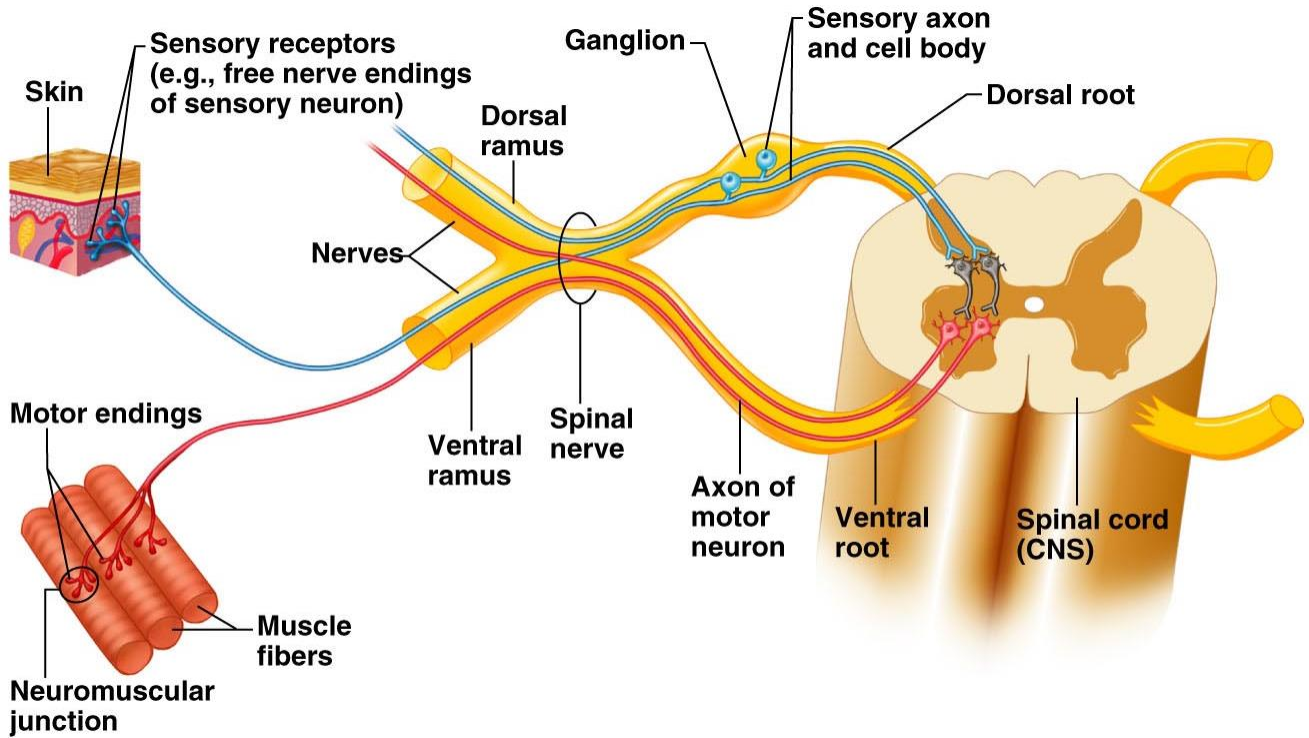


The Autonomic Nervous System

- Effects of Parasympathetic Activation
  - Relaxation
  - Food processing
  - Energy absorption
  - Brief effects at specific sites

Basic Structural Components of the PNS

- **Sensory receptors** – pick up stimuli from inside or outside the body
- **Motor endings** – axon terminals of motor neurons innervate effectors (muscle fibers and glands)
- Nerves and ganglia
  - **Nerves** – bundles of peripheral axons
  - **Ganglia** – clusters of peripheral neuronal cell bodies



Nerves

- **Nerves** – cable like organs in the PNS
- Consists of numerous axons wrapped in connective tissue
  - **Endoneurium** – layer of delicate connective tissue surrounding the axon
  - **Perineurium** – connective tissue wrapping surrounding a nerve fascicle
  - **Nerve fascicles** – groups of axons bound into bundles
  - **Epineurium** – whole nerve is surrounded by tough fibrous sheath
- Axon is surrounded by Schwann cells