Chapter 15: The Autonomic Nervous System

Autonomic Nervous System = Visceral Motor Division

- Motor commands sent to viscera (internal organs)
- Divided into sympathetic and parasympathetic divisions
- Regulation of breathing, blood pressure, heart rate, etc.
    - Things outside of conscious control
- Receptors control these functions:
    - Thermoreceptors—Body heat
    - Baroreceptors—Pressure
        - Ex: Elderly people become dizzy when they stand up quickly because their baroreceptors don't work as quickly

Visceral Reflexes

- ANS is responsible for body's visceral reflexes
- Visceral reflex arc: Receptors --> Afferent Neurons --> Interneurons --> Efferent Neurons --> Effectors
- Baroreflex: High blood pressure detected by arterial stretch receptors (baroreceptors)
    - Example of homeostatic negative feedback loop
        - Advantageous because body senses pressure of blood as soon as it comes off of aorta (away from heart)
        - If blood pressure it too high, could damage other organs
            - Kidney normally first to be damaged, liver normally last to be damaged
        - Information sent to brain when blood pressure gets too high, two ways to decrease BP once message gets to brain:
            - Blood vessels may dilate
            - Decrease heart rate

Autonomic Motor Pathways vs. Somatic Motor Pathways

- Somatic—Myelinated fiber from somatic efferent nerve to gland
- Autonomic—Two neurons from CNS to effectors
    - Preganglionic fiber and postganglionic fiber
        - Myelinated preganglionic fiber synapses on ganglion

        - Fiber that leaves ganglion is an unmyelinated postganglionic fiber that will synapse on the target

Functional Organization of Somatic vs. Autonomic

- Conscious (somatic) vs. unconscious (autonomic) control

Divisions of the ANS

- Sympathetic Division: Prepares body for physical activity
    - "Fight or flight"—Prepares you for stressful situations
    - Heart rate, breathing, etc. all increase
    - Digestion decreases
- Parasympathetic Division: Calms body functions
    - "Rest and digest"
    - Heart rate, breathing, etc. normal
    - Body can focus on digestion

Sympathetic Division (Thoracolumbar Division): Short preganglionic and long postganglionic fibers

- Short, branching preganglionic axon coming off of preganglionic neuron
- Preganglionic Neurosomas: Lead to nearby sympathetic chain of ganglia
    - Paravertebral ganglia—right beside vertebrae
    - Only in thoracic and lumbar regions
- White communicating ramus: Preganglionic (myelinated) fiber that is responsible for helping with communication from spinal nerve to ganglia
    - Information coming off of one nerve able to be distributed to other parts of body
    - Chain of ganglia
- Gray communicating ramus: Postganglionic fiber (unmyelinated)
- Nerve communicates with sympathetic chain of ganglia via WCR and leaves ganglia via GCR
    - Very short preganglionic fiber because fiber coming off of spinal cord immediately to chain of ganglia
    - Longer postganglionic fiber to reach target
- When a spinal nerve synapses and sends information to ganglia, 3 possibilities:

        - 1. Send information up or down chain and synapse in another ganglia above/below
        - 2. Nerve may end (synapse with a postganglionic fiber) within ganglia itself
        - 3. Go through a ganglia, but not synapse on ganglia, and synapse at a later ganglion that is not prevertebral (located more distally)
            - Form pelvic splanchnic nerves or splanchnic nerve
            - Splanchnic: Nerves to organs
            - Pelvic Splanchnic: Nerves to organs in pelvic region
- Neural Divergence: Not 1:1 ratio—may have one nerve that synapses on several postganglionic fibers (wide dispersal of information)

Sympathetic Chain Ganglia

The Adrenal Glands

- Each is two glands with different functions:
    - 1. Adrenal Cortex: Outer layer that secretes steroid hormones
    - 2. Adrenal Medulla: Inner core that is essentially a sympathetic ganglion
        - Secretes catecholamines

Parasympathetic Division (Craniosacral Division)

- Nerves from midbrain, medulla oblongata, and pons, and sacral region S2-S4
    - Oculomotor, facial, glossopharyngeal nerves
    - Vagus nerve (thoracic and abdominal pelvic regions)
    - Nerves in S2-S4 region—form pelvic splanchnic nerves
        - Originate in sacral region and innervate some of the lower abdominal organs and all organs in pelvic region (i.e. reproductive, bladder, etc.)

Enteric Nervous System: Nervous system of the digestive system

- Not connected to the CNS—Set of nerves only found in digestive system
- Composed of 100 million neurons found in walls of digestive tract
- Regulates esophagus, stomach, and intestinal motility and secretion of digestive enzymes and acid
- Has own reflex arc that does not involve CNS