

## Chapter Twenty-five: Communication and Control

### Teacher Notes

#### Lesson One: The Nervous System

- Two Systems Within a System
  - the nervous system acts as the body's central command post
    - two functions
      - gathers and interprets information
      - nervous system responds to that information as needed
  - Central Nervous System (CNS)-the brain and the spinal cord.
  - Peripheral Nervous System (PNS)-all of the parts of the nervous system except for the brain and the spinal cord.
- The Peripheral System
  - Neuron-a nerve cell that is specialized to receive and conduct electrical impulses.
    - electrical impulses sent through neurons are called impulses
  - Neuron Structure
    - has a large region in its center called the cell body
      - has a nucleus and organelles
    - have dendrites that are usually short, branched extensions of the cell
      - dendrites receive information from other cells
      - a neuron may have many dendrites allowing it to receive impulses from thousands of other cells
    - have axons that carry impulses away from body cells
      - elongated extensions of the neuron
      - can be very short or quite long
      - the tip of each axon is called an axon terminal
  - Information Collection
    - sensory neurons-gather information about what is happening in and around your body
      - have specialized nerve endings called receptors
      - detect changes inside and outside the body
  - Delivering Orders
    - motor neurons-send impulses from the brain and spinal cord to other systems
      - muscles contract when they get information from motor neurons
- Nerves-a collection of nerve fibers (axons) through which impulses travel between the central nervous system and other parts of the body.
  - are located everywhere in body
  - most nerves have both sensory and motor neurons
  - axons transmit information from the spinal cord to muscle fibers
- Somatic and Autonomic Nervous Systems
  - Somatic Nervous System
    - neurons that stimulate skeletal muscles
      - most are controlled consciously
      - control voluntary movements
  - Autonomic Nervous System

- nerves that do not need you to control
- controls body functions that you don't think about like digestion and heart rate
- main job is to keep body functions in balance
- has two divisions
  - sympathetic nervous system
  - parasympathetic nervous system
  - these two work to maintain homeostasis
- The Central Nervous System
  - receives information from the sensory neurons; it then responds by sending messages to the body through motor neurons in the PNS
  - The Control Center
    - Brain-the mass of nerve tissue that is the main control center of the nervous system
      - the largest organ in the nervous system
      - involuntary processes happen without control
        - most of the functions of the brain
      - voluntary processes are processes you control
        - some of the brain functions; example-moving your arm
      - brain has three main parts-cerebrum, cerebellum, and medulla
    - The Cerebrum
      - largest part of brain where you think and most memories are stored
      - controls voluntary movements
      - allows you to sense touch, light, sound, odors, taste, pain, heat, and cold
      - has two halves called hemispheres
        - left hemisphere directs right side of body
        - right hemisphere directs left side of body
        - most brain activities use both hemispheres
    - The Cerebellum
      - second largest part of brain that lies beneath the back of the cerebrum
      - processes sensory information from body
    - The Medulla
      - part of brain that connects to your receptors in your blood vessels
      - is about 3 cm long and you can't live without it
      - controls involuntary processes like blood pressure, body temp., heart rate
      - constantly receives sensory impulses from receptors in your blood vessels
  - The Spinal Cord
    - about as big around as your thumb and is made of neurons and bundles of axons that pass impulses to and from the brain
    - is protected by vertebra
    - nerve fibers allow your brain to communicate with your peripheral nervous system
    - Spinal Cord Injury
      - may block all information to and from the brain
      - information coming from below the injury may not get to the brain
      - commands from the injured area can't get input from the brain

## Lesson Two: Responding to the Environment

- Sense of Touch
  - what you feel when sensory receptors in the skin are stimulated
  - body has different kinds of receptors that respond to specific sensations
  - Integumentary System-the organ system that forms a protective covering on the outside of the body.
    - includes hair, skin, and nails
- Responding to Sensory Messages
  - Reflex-an involuntary and almost immediate movement in response to a stimulus
  - Feedback Mechanisms-a cycle of events in which information from one step controls or affects a previous step.
- Sense of Sight
  - sense that allows you to see the size, shape, motion, and color of objects around you
    - cornea-protects the eye but allows light to enter
    - pupil-located on the front of the eye allowing light to enter
    - lens-light travels through to the retina
    - retina-a layer of light-sensitive cells
      - packed with photoreceptors
        - photoreceptors-special neuron that changes light into electrical impulses
      - rods-are sensitive to dim light and used in night vision
      - cones-are color vision
- Reacting to Light
  - iris-controls the contraction of the pupil and gives the eye its color
    - bright light it contracts (gets smaller)
    - dim light it opens (gets bigger)
- Focusing the Light
  - light travels in a straight line until it passes through the cornea and the lens
    - lens-oval shaped piece of clear, curved material behind the iris
      - shape changes to focus light to the retina
    - nearsighted-light is focused in front of the retina
    - farsighted-light focused just behind the retina
- Sense of Hearing
  - three parts of the ear
    - outer ear
    - middle ear-
    - inner ear
  - cochlea-a coiled tube that is found in the inner ear and that is essential to hearing.
- Sense of Taste
  - sense that allows you to detect chemicals and distinguish flavors
  - tongue is covered with tiny bumps called papillae
    - most papillae contain taste buds or clusters of taste cells
      - taste cells react to four basic tastes-sweetness, sourness, saltiness, and bitterness

-Sense of Smell

- olfactory cells-a nerve cell that responds to chemical molecules in the air
- molecules dissolve in the moist lining of the nasal cavity and trigger an impulse
- olfactory cells send those impulses to the brain which interprets the impulses as odors

**Lesson Three: The Endocrine System**

-Hormones as Chemical Messengers

- Endocrine System-a collection of glands and groups of cells that secrete hormones that regulate growth, development, and homeostasis.
- Gland-a group of cells that make special chemicals for the body.
- Hormone-a substance that is made in one cell or tissue and that causes a change in another cell or tissue in a different part of the body.

-More Endocrine Glands

- Pituitary Gland-secretes hormones that affect other glands and organs
- Parathyroid Glands-regulate calcium levels in the blood
- Adrenal Glands-help the body respond to danger
- Pancreas-regulates blood-glucose levels
- Ovaries-produce hormones needed for reproduction
- Thyroid Gland-increases the rate at which you use energy
- Thymus Gland-regulates the immune system, which helps fight disease
- Testes-produce hormones needed for reproduction

-Controlling the Endocrine Glands

- control feedback mechanisms

-Hormone Imbalance

- can make too much or not enough of a hormone
  - examples are diabetes and a child who doesn't produce enough growth hormone