Chapter 35 The Nervous System
I. The Nervous System

A. The Nervous System
   1. Functions
      a. Controls and coordinates functions throughout the body and responds to internal and external stimuli

B. Neurons
   1. Cells that transmit electrical signals in the Nervous System
C. Types of neurons:
1. sensory- carry impulses from the sense organs to the spinal cord and brain.
2. motor- carry impulses from the brain and spinal cord to muscles and glands.
3. interneurons- connect sensory and motor neurons and carry impulses between them.

D. Structure of neurons:
1. cell body
2. nucleus
3. **dendrites** - carries impulses toward the cell body.
4. **axon** - carries impulses away from the cell body.
5. **myelin sheath** - covers part of some axons.
6. **synapse** – at the end of the axon

E. **Nerve Impulse** - an electrical impulse conducted along a nerve fiber.

1. **resting potential** - the electrical charge across the cell membrane of a neuron in its resting state.
Resting Potential

Cell Membrane

Outside of Cell

Inside of Cell

Sodium-potassium pump

ATP
2. action potential- the reversal of charges, from negative to positive- a nerve impulse

3. threshold- the minimum level of stimulus that is required to activate a neuron
   a. All or none

4. The synapse- the location at which a neuron can transfer an impulse to another cell. (The gap between neurons)
   a. Neurotransmitter- a chemical used by the neuron to transmit an impulse across the synapse to another cell.
A At rest

B At the leading edge of the impulse, the sodium gates open. The membrane becomes more permeable to Na\(^+\) ions and an action potential occurs.

C As the action potential passes, potassium gates open allowing K\(^+\) ions to flow out, restoring negative potential inside the axon.

D The action potential continues to move along the axon.
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**D** The action potential continues to move along the axon.
Action Potential
Synaptic Transmission
4. The thalamus - receives impulses from the senses and sends them to the cerebrum.
5. The hypothalamus - connects the nervous and endocrine systems.
II. Divisions of the Nervous System - The nervous system has two major divisions the central nervous system and the peripheral nervous system.

A. The central nervous system - is made up of the brain and the spinal cord.

1. Functions:
   a. sends messages
   b. processes information
   c. analyzes information
2. The brain- is the place to which impulses flow and from which impulses originate. The brain contains approximately 100 billion neurons, many of which are interneurons.

a. Regions of the brain
   i. The cerebrum- controls voluntary actions.
   ii. The cerebellum- coordinates involuntary actions.
   iii. The brain stem- controls basic body functions.
F. The spinal cord connects the brain with the rest of the body. Some reflexes are processed in the spinal cord.
   a. Reflex is a quick automatic response to stimulus.
B. The peripheral nervous system - transmits impulses from sense organs to the central nervous system and back to muscles or glands.

1. The sensory division - sends impulses from the sensory neurons to the central nervous system.

2. The motor division - sends impulses from the central nervous system to muscles and glands.
   a. somatic - control voluntary actions.
   b. autonomic - regulates activities that are automatic.
The Nervous System

- Central nervous system
- Peripheral nervous system
  - Motor nerves
  - Sensory nerves
- Somatic nervous system
- Autonomic nervous system
  - Sympathetic nervous system
  - Parasympathetic nervous system
The Spinal Cord

- Gray matter
- Central canal
- White matter
- Spinal nerve
- Meninges
III. The Senses

A. Sensory receptors - are neurons that react to stimuli in the environment. These receptors send impulses to the central nervous system.

1. 5 types of sensory receptors:
   a. pain receptors - respond to pain.
   b. thermoreceptors - respond to temperature.
   c. mechanoreceptors - respond to pressure.
   d. chemoreceptors - respond to chemicals.
   e. photoreceptors - respond to light.
Auditory canal
Tympanum
Round window
Eustachian tube
Bone
Cochlea
Cochlear nerve
Semicircular canals
Oval window
Hammer
Anvil
Stirrup
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The Senses of Smell and Taste

- Cerebral cortex
- Nasal cavity
- Taste bud
- Olfactory (smell) bulb
- Olfactory nerve
- Smell receptor
- Taste pore
- Taste receptor
- Sensory nerve fibers
- Thalamus
- Sensory area
IV. Vision

A. The sensory organ responsible for vision is the eye.

1. Pupil- is a small opening at the front of the eye.

2. retina- contains photoreceptors
   a. rods- sensitive to light, but don’t distinguish different colors
   b. cones- less sensitive to light, but do respond to light of different colors.
V. Drugs and the Nervous System

A. Drug - any substance, other than food, that changes the structure or function of the body. Several types of drugs affect the nervous system.

1. Stimulants - increase heart rate, blood pressure and breathing rate.

2. Depressants - decrease heart and breathing rates, lower blood pressure, relax muscles and relieve tension.

3. Opiates - act like natural brain chemicals (endorphins).
<table>
<thead>
<tr>
<th>Drug Type</th>
<th>Medical Use</th>
<th>Examples</th>
<th>Effects on the body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulants</td>
<td>Used to increase alertness, relieve fatigue</td>
<td>Amphetamines</td>
<td>Increase heart and respiratory rates; elevate blood pressure; dilate pupils; decrease appetite</td>
</tr>
<tr>
<td>Depressants</td>
<td>Used to relieve anxiety, irritability, tension</td>
<td>Barbiturates, Tranquilizers</td>
<td>Slow down the actions of the central nervous system; small amounts cause calmness and relaxation; larger amounts cause slurred speech and impaired judgement</td>
</tr>
<tr>
<td>Opiates</td>
<td>Used to relieve pain</td>
<td>Morphine, Codeine</td>
<td>Act as a depressant; cause drowsiness, restlessness, nausea</td>
</tr>
</tbody>
</table>
4. Marijuana- can cause memory and concentration problems.
5. Alcohol- is a depressant that slows down the rate at which the central nervous system functions.

VI. Drug abuse- is the intentional misuse of any drug for non-medical purposes.
A. Addition- is an uncontrollable dependence on a drug.