The Nervous System

Lesson 6.1: Overview of the Nervous System
Lesson 6.2: Transmission of Nerve Impulses
Lesson 6.3: Functional Anatomy of the Central Nervous System
Lesson 6.4: Functional Anatomy of the Peripheral Nervous System
Lesson 6.5: Injuries and Disorders of the Nervous System
Lesson 6.1

Overview of the Nervous System
Nervous System Overview

• organization of the nervous system
  – two major divisions
  – the efferent nerves

• nervous tissues
  – neuroglia
  – neurons
Organization of the Nervous System

• two major divisions
  – central nervous system (CNS)
  – peripheral nervous system (PNS)
    • sensory receptors
    • afferent (sensory) nerves
    • efferent (motor) nerves
Two Major Divisions

Central Nervous System (CNS)  
(brain and spinal cord)

Peripheral Nervous System (PNS)  
(parts of the nervous system other than brain and spinal cord)

Sensory (afferent)  
Motor (efferent)

Sensory Receptors

Autonomic Nervous System  
(to cardiac and smooth muscles and glands)

Somatic Nervous System  
(to skeletal muscles)

Parasympathetic Nervous System  
(routine involuntary functions)

Sympathetic Nervous System  
(high alert)
The Efferent Nerves

- somatic nervous system
  - voluntary
- autonomic nervous system
  - involuntary
  - sympathetic
  - parasympathetic
Nervous Tissues

• neuroglia
  – also known as *glial cells*
  – support the neurons
  – protect the neurons

• neurons
  – transmit nerve impulses
Neuroglia

- central nervous system
  - astrocytes
  - microglia
  - ependymal
  - oligodendrocytes
Neuroglia

- peripheral nervous system
  - Schwann cells
  - satellite cells
Neurons

- dendrites
  - send information to cell body
- cell bodies
- axons
  - send information away from cell body
Neuron Types by Function

- sensory neurons
  - send impulses toward CNS
- motor neurons
  - send impulses away from CNS
- interneurons
  - bridges between neurons
Neuron Structures

- **bipolar**
  - one axon and one dendrite

- **unipolar**
  - one axon

- **multipolar**
  - one axon and many dendrites

A. Bipolar neuron
B. Unipolar neuron
C. Multipolar neuron
Match these words with 1–4 below: sympathetic nervous system, myelin, synapse, axon.

1. high alert
2. transmits impulses away from cell body
3. fatty insulating material
4. gap between neurons
Lesson 6.2
Transmission of Nerve Impulses
Transmission of Nerve Impulses

- action potentials
  - change in cell membrane charge
- impulse transmission
  - charge change travels along axon
- reflexes
  - involuntary response to stimulus
Action Potentials

- polarized
- depolarized
- repolarized
- refractory period
Impulse Transmission

- saltatory conduction
- transmission at synapses
  - gap junctions
  - neurotransmitter
  - excitatory effect
  - inhibitory effect
Impulse Transmission

- saltatory conduction
- transmission at synapses
  - gap junctions
  - neurotransmitter
  - excitatory effect
  - inhibitory effect
Reflexes

- somatic
  - stimulate skeletal muscles
- autonomic
  - stimulate involuntary muscles
Fill in the blanks with: reflexes, saltatory conduction, neurotransmitter, or action potential.

1. A(n) _______________ is an all or none response.

2. _______________ occurs only in myelinated axons.

3. _______________ are rapid, involuntary responses.

4. The axon terminal has tiny vesicles filled with _______________.
Lesson 6.3

Functional Anatomy of the Central Nervous System
The Brain

- cerebrum
- diencephalon
- brain stem
- cerebellum
- meninges
- blood-brain barrier
Cerebrum

• cerebral cortex
  – gyrus
  – sulcus
  – fissure
• lobes
  – frontal
  – parietal
  – occipital
  – temporal
• primary motor cortex
• primary somatic sensory cortex
Cerebrum

A. Exterior view of the brain

Left cerebral hemisphere
Right cerebral hemisphere
Longitudinal fissure
Lateral sulcus
Cerebrum

B. Lobes of the brain
Cerebrum

Motor

Sensory
Diencephalon

- thalamus
- hypothalamus
- epithalamus
Brain Stem

- midbrain
- pons
- medulla oblongata
The Brain

- cerebellum
- blood-brain barrier
The Brain

- cerebellum
- blood-brain barrier

- meninges
  - dura mater
  - arachnoid mater
  - pia mater
Spinal Cord
Review and Assessment

True or False?
1. The gyri divide the brain into 4 regions.
2. The hypothalamus regulates blood pressure.
3. The meninges has 3 layers.
4. The cerebellum coordinates balance.
5. The pons is also called the interbrain.
Chapter 6: The Nervous System

Lesson 6.4

Functional Anatomy of the Peripheral Nervous System
Functional Anatomy of the Peripheral Nervous System

- nerve structure
- cranial nerves
- spinal nerves and nerve plexuses
- autonomic nervous system
Nerve Structure

- **endoneurium**
  - covers axons
- **perineurium**
  - bundles fascicles
- **epineurium**
  - wraps nerves
## Cranial Nerves

<table>
<thead>
<tr>
<th>Nerve</th>
<th>#</th>
<th>System</th>
<th>Function</th>
</tr>
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<tbody>
<tr>
<td>Olfactory</td>
<td>I</td>
<td>sensory</td>
<td>smell</td>
</tr>
<tr>
<td>Optic</td>
<td>II</td>
<td>sensory</td>
<td>sight</td>
</tr>
<tr>
<td>Oculomotor</td>
<td>III</td>
<td>both</td>
<td>eye movements</td>
</tr>
<tr>
<td>Trochlear</td>
<td>IV</td>
<td>both</td>
<td>eye movements</td>
</tr>
<tr>
<td>Trigeminal</td>
<td>V</td>
<td>both</td>
<td>facial sensation, jaw motion</td>
</tr>
<tr>
<td>Abducens</td>
<td>VI</td>
<td>both</td>
<td>eye movements</td>
</tr>
<tr>
<td>Facial</td>
<td>VII</td>
<td>both</td>
<td>facial movements, taste</td>
</tr>
<tr>
<td>Vestibulocochlear</td>
<td>VIII</td>
<td>sensory</td>
<td>hearing, balance</td>
</tr>
<tr>
<td>Glossopharyngeal</td>
<td>IX</td>
<td>both</td>
<td>throat muscle movements, taste</td>
</tr>
<tr>
<td>Vagus</td>
<td>X</td>
<td>both</td>
<td>autonomic control of heart, lungs, digestion, taste, communication between brain and organs</td>
</tr>
<tr>
<td>Accessory</td>
<td>XI</td>
<td>mostly motor</td>
<td>trapezius movements, sternocleidomastoid movements</td>
</tr>
<tr>
<td>Hypoglossal</td>
<td>XII</td>
<td>both</td>
<td>tongue muscle movements, tongue sensation</td>
</tr>
</tbody>
</table>
Cranial Nerves
Spinal Nerves and Nerve Plexuses

- 31 pairs
- dorsal root
- ventral root
- dorsal ramus
- ventral ramus
- plexuses
Autonomic Nervous System

- preganglionic and postganglionic neurons
- sympathetic nerves
  – fight-or-flight action
- parasympathetic nerves
  – resting or digesting action
Autonomic Nervous System
Review and Assessment

Match these words with 1–4 below: efferent, ganglion, optic, perineurium.

1. wraps fascicles
2. motor
3. a cranial nerve
4. enlarged junction
Lesson 6.5

Injuries and Disorders of the Nervous System
Injuries to the Brain and Spinal Cord

- traumatic brain injury
- cerebral palsy
- spinal cord injury
Traumatic Brain Injury

• violent impact to head
  – mild
  – moderate
  – severe
Cerebral Palsy

• damage to brain
  – before birth
  – during birth
  – during infancy

• motor function impairment
Spinal Cord Injuries

- C1–C3: usually fatal
- C1–C4: quadriplegia
- C5–C7: paralysis of lower extremities
- T1–L5: paraplegia
Common Diseases and Disorders of the CNS

- meningitis
- multiple sclerosis
- epilepsy
- Parkinson’s disease
- dementia and Alzheimer’s disease
Review and Assessment

Match these words with 1–4 below: quadriplegia, multiple sclerosis, dementia, cerebral palsy.

1. inflammation destroys myelin sheath
2. loss of memory and thinking
3. loss of function below the neck
4. may begin before birth