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## Peripheral Nervous System

### I. Introduction to the Peripheral Nervous System

☞ *Concept:* The peripheral nervous system consists of all of the nervous tissue outside the central nervous system, including sensory receptors, nerves and their associated ganglia, and nerve plexuses. It provides a communication pathway for impulses traveling between the CNS and the rest of the body.

#### A. True–False Questions

- \_\_\_ 1. Sensory receptors within the sensory organs, nerves, ganglia, and plexuses are all part of the peripheral nervous system (PNS).
- \_\_\_ 2. Sensory nerves consist of nerve fibers that conduct impulses toward the central nervous system (CNS).
- \_\_\_ 3. Motor nerves consist of nerve fibers that conduct impulses toward the CNS.
- \_\_\_ 4. In a mixed nerve, each fiber conducts impulses to and from the CNS.

### II. Cranial Nerves

☞ *Concept:* Twelve pairs of cranial nerves emerge from the inferior surface of the brain and pass through the foramina of the skull to innervate structures in the head, neck, and visceral organs of the trunk.

#### A. Multiple Choice Questions

- \_\_\_ 1. The nuclei of all but two of the cranial nerves are located in
  - (a) the hypothalamus and medulla oblongata.
  - (b) the midbrain and brain stem.
  - (c) the cerebrum and cerebellum.
  - (d) the cerebellum and medulla oblongata.
  - (e) the cerebrum and midbrain.
- \_\_\_ 2. Which nerve-muscle interaction is apparent as one's eyes cross when attempting to view an object near the nose?
  - (a) optic nerve–medial rectus eye muscle
  - (b) oculomotor nerve–medial rectus eye muscle
  - (c) optic nerve–medial ocular muscle
  - (d) oculomotor nerve–medial ocular muscle
- \_\_\_ 3. The cranial nerves that innervate the extrinsic ocular (eye) muscles include
  - (a) the oculomotor, abducens, and trochlear nerves.
  - (b) the abducens, facial, and trigeminal nerves.
  - (c) the trochlear, oculomotor, and facial nerves.
  - (d) the oculomotor, facial, and trigeminal nerves.

- \_\_\_\_\_ 4. The three nerves, or divisions, of the trigeminal ganglion include
- (a) the ocular, palatine, and lingual nerves.
  - (b) the ophthalmic, maxillary, and mandibular nerves.
  - (c) the ophthalmic, palatine, and lingual nerves.
  - (d) the frontal, maxillary, and mandibular nerves.
- \_\_\_\_\_ 5. The cranial nerve that does *not* pass through the superior orbital fissure of the skull is
- (a) the oculomotor nerve.
  - (b) the trochlear nerve.
  - (c) the facial nerve.
  - (d) the abducens nerve.
  - (e) the trigeminal (ophthalmic) nerve.
- \_\_\_\_\_ 6. The cranial nerves that are sensory only include
- (a) the optic, vestibulocochlear, and vagus nerves.
  - (b) the olfactory, optic, and facial nerves.
  - (c) the olfactory, optic, and vestibulocochlear nerves.
  - (d) the optic, facial, and vestibulocochlear nerves.
- \_\_\_\_\_ 7. The cranial nerves that innervate the tongue include
- (a) the trigeminal, facial, glossopharyngeal, and hypoglossal nerves.
  - (b) the facial, glossopharyngeal, vagus, accessory, and hypoglossal nerves.
  - (c) the facial, glossopharyngeal, accessory, and hypoglossal nerves.
  - (d) the trigeminal, facial, glossopharyngeal, vagus, and hypoglossal nerves.
- \_\_\_\_\_ 8. The cranial nerve that arises from both the brain and the spinal cord is
- (a) the hypoglossal nerve.
  - (b) the accessory nerve.
  - (c) the vagus nerve.
  - (d) the glossopharyngeal nerve.
  - (e) the abducens nerve.
- \_\_\_\_\_ 9. The inability to shake your head “no” when offered a bowl of raw squid at a Japanese restaurant may result from damage to
- (a) the accessory nerve.
  - (b) the trigeminal nerve.
  - (c) the facial nerve.
  - (d) the hypoglossal nerve.
  - (e) the vagus nerve.
- \_\_\_\_\_ 10. The cranial nerve that does *not* pass through the jugular foramen is
- (a) the accessory nerve.
  - (b) the vagus nerve.
  - (c) the glossopharyngeal nerve.
  - (d) the hypoglossal nerve.

## **B. True–False Questions**

- \_\_\_\_\_ 1. The olfactory nerves are actually quite numerous rather than just paired.
- \_\_\_\_\_ 2. All of the sensory fibers of one optic nerve cross to the other side at the optic chiasma.
- \_\_\_\_\_ 3. The terminal location of the visual tract is within the visual cortex of the occipital lobes.
- \_\_\_\_\_ 4. A persistent constriction of the pupil of the eye may be indicative of trauma to the oculomotor nerve.
- \_\_\_\_\_ 5. The muscles of mastication are innervated with motor fibers by the maxillary nerve of the trigeminal ganglion.
- \_\_\_\_\_ 6. Lateral eye movement is caused by the contraction of the lateral rectus ocular muscle as it is being stimulated by an impulse through the oculomotor nerve.

- \_\_\_ 7. All of the muscles of facial expression and those of mastication are innervated by the facial nerves.
- \_\_\_ 8. The vestibulocochlear nerve is purely sensory and responds to auditory sensations through the cochlear nerve and to sensations of equilibrium through the vestibular nerve.
- \_\_\_ 9. Hunger pangs, gastrointestinal distension, intestinal discomfort, and sensations of laryngeal movements are sensations that must pass through the vagus nerves in order to be perceived.
- \_\_\_ 10. The vagus is the only cranial nerve that innervates structures in body regions other than the head.

### III. Spinal Nerves

☞ *Concept:* Each of the 31 pairs of spinal nerves is formed by the union of a posterior and an anterior spinal root that emerges from the spinal cord through an intervertebral foramen to innervate a body dermatome.

#### A. True-False Questions

- \_\_\_ 1. There are 31 pairs of spinal nerves, all of which are composed of both motor and sensory fibers.
- \_\_\_ 2. Although there are seven cervical vertebrae, there are eight cervical spinal nerves.
- \_\_\_ 3. Herpes zoster is a viral infection of the spinal ganglia.
- \_\_\_ 4. An anterior ramus of a spinal nerve innervates muscles and skin on the lateral and anterior side of the trunk.
- \_\_\_ 5. All spinal nerves have a gray ramus.

### IV. Nerve Plexuses

☞ *Concept:* Except in the thoracic nerves T2 through T12, the anterior rami of the spinal nerves combine and then split again as networks of nerves referred to as nerve plexuses. There are four plexuses of spinal nerves: the cervical, the brachial, the lumbar, and the sacral. Nerves emerging from the plexuses are named according to the structures they innervate or the general course they take.

#### A. Multiple Choice Questions

- \_\_\_ 1. Which of the following statements applies to the cervical plexus?
  - (a) It is positioned deep on the front of the neck.
  - (b) It is formed by the anterior rami of the first four cervical nerves and part of C5.
  - (c) It branches to innervate the muscles of the lower back.
  - (d) All of the above apply.
- \_\_\_ 2. Which of the following is *not* a plexus of the spinal nerves?
  - (a) cervical plexus
  - (b) brachial plexus
  - (c) thoracic plexus
  - (d) lumbar plexus
  - (e) sacral plexus
- \_\_\_ 3. Structurally, the brachial plexus is divided into
  - (a) roots, trunks, divisions, and cords.
  - (b) trunks, shoots, divisions, and cords.
  - (c) roots, stems, divisions, and cords.
  - (d) roots, branches, trunks, and cords.

- \_\_\_ 4. In the brachial plexus, the roots of C5 and C6 converge to become  
 (a) the superior trunk. (c) the inferior trunk.  
 (b) the middle trunk. (d) the lateral trunk.
- \_\_\_ 5. Each of the three trunks of the brachial plexus divides into  
 (a) a superior and an inferior division.  
 (b) an anterior and a posterior division.  
 (c) a superficial and deep division.  
 (d) a medial and lateral division.
- \_\_\_ 6. Which statement is *not* true concerning the lumbar plexus?  
 (a) It is formed by the anterior rami of spinal nerves L1–L4 and some fibers from T12.  
 (b) It consists only of roots and divisions rather than roots, trunks, divisions, and cords.  
 (c) It gives rise to the femoral, obturator, and sciatic nerves.  
 (d) It is frequently described, along with the sacral plexus, as the lumbosacral plexus.
- \_\_\_ 7. A body structure or body region that is *not* innervated by nerves arising from the sacral plexus is  
 (a) the pelvis. (d) the abdominal wall.  
 (b) the foot. (e) the perineum.  
 (c) the lower back.
- \_\_\_ 8. Which of the following combinations relating plexus to nerve derivation is *incorrect*?  
 (a) brachial and the radial  
 (b) sacral and the sciatic  
 (c) lumbar and the median  
 (d) cervical and the phrenic  
 (e) brachial and the musculocutaneous

## B. True–False Questions

- \_\_\_ 1. All of the spinal nerves are involved in plexuses except the thoracic nerves T2–T12.
- \_\_\_ 2. The spinal plexuses are formed as the anterior rami of the spinal nerves combine and then split again as a network of nerves.
- \_\_\_ 3. The phrenic nerves, which innervate the diaphragm, arise from the brachial plexuses.
- \_\_\_ 4. The brachial plexus is so named because it is formed in the superior portion of the brachial region, lateral to the axilla.
- \_\_\_ 5. The sciatic nerve enters the thigh through the inguinal ligament and femoral triangle.

## V. Reflex Arc and Reflexes

☞ *Concept:* The conduction pathway of a reflex arc consists of a receptor, a sensory neuron, a motor neuron and its innervation in the PNS, and an association neuron in the CNS. The reflex arc provides the mechanism for a rapid, automatic response to a potentially threatening stimulus.

### A. Multiple Choice Questions

- \_\_\_ 1. All of the following are components of a reflex arc *except*  
 (a) an effector. (d) a receptor.  
 (b) the sympathetic trunk. (e) a sensory neuron.  
 (c) a motor neuron.

- \_\_\_\_\_ 2. A reflex that results in the contraction of skeletal muscles is classified as  
 (a) somatic. (c) visceral.  
 (b) parietal. (d) autonomic.
- \_\_\_\_\_ 3. Which of the following describes a stretch reflex?  
 (a) polysynaptic and contralateral  
 (b) monosynaptic and intersegmental  
 (c) monosynaptic and ipsilateral  
 (d) polysynaptic and crossed extensor
- \_\_\_\_\_ 4. The patellar (knee-jerk) reflex involves spinal segments  
 (a) T12 through L2. (d) L2, L3, and L4.  
 (b) S1 and S2. (e) L4 through S2.  
 (c) L1 and L2.

### **B. True–False Questions**

- \_\_\_\_\_ 1. Visceral reflexes never involve skeletal muscles.
- \_\_\_\_\_ 2. The center, or interneuron, of a reflex arc is always within the CNS.
- \_\_\_\_\_ 3. Trauma to the posterior horn of the spinal cord would likely interfere with sensory impulse transmission to the damaged segment.
- \_\_\_\_\_ 4. Both a crossed extensor reflex and reciprocal inhibition are important in maintaining balance while a reflex is in progress.
- \_\_\_\_\_ 5. Babinski’s reflex rather than the plantar reflex in an adult may indicate problems of the corticospinal tracts.

## **VI. Developmental Exposition of the Peripheral Nervous System**

### **A. Completion Questions**

1. An area of the skin innervated by specific cutaneous neurons is called a \_\_\_\_\_.
2. Most of the scalp and face is innervated by sensory neurons from the \_\_\_\_\_ nerve.
3. With the exception of the \_\_\_\_\_, \_\_\_\_\_, all of the spinal nerves are associated with specific dermatomes.

## **VII. Chapter Review**

### **A. Completion Questions**

1. \_\_\_\_\_ nerves are composed of both motor and sensory fibers, and therefore convey impulses in both directions.
2. There are \_\_\_\_\_ pairs of cranial nerves and \_\_\_\_\_ pairs of spinal nerves.
3. The olfactory nerves are composed of bipolar neurons that function as \_\_\_\_\_ in that they respond to volatile chemical particles breathed into the nasal cavity.

4. The two optic nerves unite on the floor of the diencephalon to form the \_\_\_\_\_  
\_\_\_\_\_.
5. Four of the six extrinsic eye muscles are innervated by the \_\_\_\_\_ nerve.
6. The uppermost division of the trigeminal ganglion is called the \_\_\_\_\_ nerve.
7. The trigeminal nerve contains the \_\_\_\_\_ ganglion and the facial nerve contains the  
\_\_\_\_\_ ganglion.
8. Two nerve branches form the eighth cranial nerve: the \_\_\_\_\_ nerve from the vestibular organs  
and the \_\_\_\_\_ nerve from the spiral organ (organ of Corti).
9. Visceral innervation that is vital to survival is provided by the \_\_\_\_\_ nerve.
10. With the exception of the first cervical nerve, the spinal nerves leave the spinal cord and the vertebral canal through  
\_\_\_\_\_ foramina.
11. The cell bodies of sensory neurons are located in enlargements called \_\_\_\_\_  
\_\_\_\_\_.
12. The disease \_\_\_\_\_, also known as shingles, is a viral infection of  
the spinal ganglia.
13. Nerves from the \_\_\_\_\_ plexus innervate the diaphragm; nerves from the  
\_\_\_\_\_ plexus innervate the muscles of the upper extremity.
14. A herniated intervertebral disc in the lumbar region may cause a condition called \_\_\_\_\_ as a  
result of compression of the spinal roots of the sacral plexus. This condition is characterized by pain extending  
down the posterior side of the thigh.
15. Reflexes that cause smooth or cardiac muscles to contract or glands to secrete are \_\_\_\_\_.

## B. Matching Questions

Match the cranial nerve with the foramen it passes through.

- |                          |                                      |
|--------------------------|--------------------------------------|
| ___ 1. hypoglossal       | (a) cribriform plate of ethmoid bone |
| ___ 2. trochlear         | (b) jugular foramen                  |
| ___ 3. olfactory         | (c) superior orbital fissure         |
| ___ 4. facial            | (d) internal acoustic meatus         |
| ___ 5. glossopharyngeal  | (e) stylomastoid foramen             |
| ___ 6. vestibulocochlear | (f) optic canal                      |
| ___ 7. optic             | (g) hypoglossal canal                |