Chapter 12: Spinal Cord and Spinal Nerves

I. Spinal Cord
   A. General Structure
      1. The spinal cord extends from the _______________ to the _______________
      2. Why is the spinal cord shorter than the vertebral column? ________________
         ______________________________________________________________
      3. The spinal cord gives rise to _______________________________________
         a. Spinal nerves exit the vertebral column through ___________________
      4. The spinal cord has a _________ diameter at its superior end
      5. Axons supplying the upper limbs enter and exit the cord at _______________
      6. Axons supplying the lower limbs enter and exit the cord at _______________
      7. What is the conus medullaris? ________________________________
      8. The cauda equina is composed of ________________________________

   B. Meninges of the Spinal Cord
      1. The meninges are composed of ________________________________
      2. The dura mater is most ____________________ and __________________
         a. The dura mater is continuous with _______________ of the spinal nerves
      3. Where is the epidural space? ________________________________
      4. What is in the epidural space? ________________________________
         a. Injecting anesthetics into this space is called ________________
      5. Describe the arachnoid mater: ________________________________
      6. Where is the subdural space? ________________________________
      7. What is in the subdural space? ________________________________
      8. The pia mater is ________________________________
      9. What is the filum terminale? ________________________________
     10. Where is the subarachnoid space? ________________________________
     11. What is in the subarachnoid space? ________________________________
     12. The spinal cord is held in place by ________________________________
         a. These attachments are called ________________________________
C. Cross Section of the Spinal Cord

1. The peripheral white matter consists of ______________________________

2. The central gray matter consists of _________________________________

3. List the two deep clefts partially separating the two halves of the spinal cord:
   a. ______________________________
   b. ______________________________

4. The white matter is divided into 3 columns or funiculi called:
   a. ______________________________
   b. ______________________________
   c. ______________________________

5. Each white column is subdivided into ________________________________
   a. Axons within a single nerve tract carry ____________________________

6. The central gray matter is organized into three horns called:
   a. ______________________________
   b. ______________________________
   c. ______________________________

7. What connects the two halves of the spinal cord? ____________________

8. Where is the central canal? _______________________________________

9. The ventral root is formed by ______________________________________

10. The dorsal root is formed by ______________________________________

11. The dorsal and ventral root join together to form _____________________

12. Where is the dorsal root ganglion? _________________________________

13. Organization of Neurons in the Spinal Cord and Spinal Nerves

   a. Sensory Neurons
      1. Where are the cell bodies of sensory neurons? _________________
      2. Which root contains axons of sensory neurons? _________________
      3. Sensory neurons enter what part of the gray matter? ______________

   b. Motor Neurons
      1. Where are the cell bodies of somatic motor neurons? ______________
2. Where are the cell bodies of autonomic motor neurons?

3. Axons from the motor neurons form the ____________________

c. Spinal nerves contain both _______________ & ________________

II. Reflexes

A. Reflex Arc

1. A reflex arc is the basic ________________________________

2. List the five basic components of a reflex arc:
   a. ______________________________
   b. ______________________________
   c. ______________________________
   d. ______________________________
   e. ______________________________

3. A reflex is an automatic ________________________________

4. Functionally reflexes are generally ____________________

B. Stretch Reflex

1. A reflex in which muscles __________ in response to ________________

2. What is the sensory receptor? ______________________________
   a. The cells are contractile only _______________________________
   b. The contractile ends are innervated by ___________________________
   c. The noncontractile centers are innervated by ______________________

3. When a muscle is stretched:
   a. Also stretches ______________________________
   b. Stretch stimulates ________________________________
   c. Sensory neurons stimulate ________________________________
   d. Alpha motor neurons ________________________________
   e. Resulting in ____________________ of the ____________________

4. The stretch reflex is important in maintaining ____________________
C. Golgi Tendon Reflex
1. This reflex prevents _____________________________________________
2. What are Golgi tendon organs? _________________________________
   a. They are located near ________________________________________
3. Golgi tendon organs have a high threshold and are sensitive only to 
   ________________________________
4. When a great amount of tension is applied to the tendon:
   a. Sensory neurons of the ______________________________
   b. The sensory neurons stimulate ______________________________
   c. Which inhibit ______________________________
   d. Causes muscle to ____________________

D. Withdrawal Reflex
1. Functionally the withdrawal reflex ______________________________
2. Stimulation of pain receptors:
   a. Action potentials conducted by ____________________
   b. Through ____________________ to ____________________
   c. Synapse with ______________________________
   d. Which in turn synapse with ______________________________
   e. Alpha motor neurons usually stimulate _______________________
   f. Contraction removes ______________________________
   g. Collateral branches of sensory neurons _______________________
      1. This provides ______________________________

3. Reciprocal Innervation
a. Collateral axons of sensory neurons:
   1. That carry ______________________________
   2. Synapse with ______________________________
   3. In the ______________________________
   4. Which synapse with & inhibit ______________________________
      of ______________________________
4. Crossed Extensor Reflex
   a. When neurons stimulate withdrawal of a limb:
      1. Collateral axons extend ______________________________
      2. To the ______________________________
      3. Synapse with ______________________________
      4. That innervate ______________________________
   b. When a ____________________ reflex is initiated in one lower limb
      the crossed extensor reflex causes ______________________________

III. Spinal Cord Pathways
   A. Ascending Tracts
      1. Sensory neurons of a reflex arc send action potentials along __________
         ______________________________
      a. This causes perception ______________________________
   B. Descending Tracts
      1. Carry action potentials to ______________________________
      2. The neurotransmitters released either ____________________ or __________
         ____________________ motor neurons in the anterior gray horn

IV. Structure of Spinal Nerves
   A. Peripheral nerves consist of:
      1. ______________________________
      2. ______________________________
      3. ______________________________
   B. Each axon and its Schwann cell is surrounded by a ____________________
      called the ____________________
   C. What is the perineurium? ______________________________
      1. It surrounds ____________________ to form ____________________
   D. The third layer of dense connective tissue is called ____________________
      1. This layer binds the ____________________ to form a ____________________
V. Spinal Nerves

A. General

1. The first pair of spinal nerves exits the vertebral column between the ________________ and the ______________________________

2. All other pairs of spinal nerves exit the vertebral column through ________________ between ______________________________

3. Each spinal nerve is designated by a _____________ & a _____________
   a. The letter designates ______________________________
   b. In each region the number 1 spinal nerve would be most ______________

4. What is a dermatome? ___________________________________________
   ______________________________________________________________

5. Each spinal nerve has a _____________ and a _____________ ramus

6. Communicating rami are found in the ______________________________ regions
   a. These carry axons associated with __________________

7. The dorsal rami innervate ________________________________________
   a. They also innervate ________________________________________

8. The ventral rami in the thoracic region form ______________________
   a. These nerves innervate ________________________________________

9. The ventral rami of the other spinal nerves form ____________________

10. What does plexus mean? _______________________________________  

11. What forms a plexus in the spinal cord? __________________________

12. Nerves that arise from plexuses contain axons from ________________
    __________________________________________

B. Cervical Plexus

1. A relatively small plexus originating from spinal nerves ________________

2. Nerves derived from the cervical plexus innervate:
   a. Superficial ______________________________
      1. Including ______________________________
   b. Skin ______________________________
   c. Posterior ______________________________

3. An important derivative of the cervical plexus is the ________________
a. The nerve originates from spinal nerves ____________________
b. The nerve innervates the _________________________________
c. If the nerve were severed a person would have trouble _______________

C. Brachial Plexus
1. A plexus originating from spinal nerves ____________________
a. There is also a connection from spinal nerve __________
2. Axillary Nerve
   a. Which muscles does it innervate?
      1. ______________________________
      2. ______________________________
   b. It also provides sensory innervation to:
      1. ______________________________
      2. ______________________________
3. Radial Nerve
   a. Which muscles does it innervate?
      1. ______________________________
      2. ______________________________
      3. ______________________________
   b. Its cutaneous sensory innervation is to:
      1. ______________________________
      2. ______________________________
4. Musculocutaneous Nerve
   a. Which muscles does it innervate? ______________________________
   b. Provides cutaneous sensory innervation to ______________________
5. Ulnar Nerve
   a. Which muscles does it innervate?
      1. ______________________________
      2. ______________________________
   b. The sensory distribution is to _________________________________
6. Median Nerve  
   a. Which muscles does it innervate?  
      1. ______________________________  
      2. ______________________________  
   b. The cutaneous sensory innervation is to ______________________________  

7. Other Nerves of the Brachial Plexus  
   a. Supply most of the muscles acting on ______________________________  
   b. Supply the cutaneous innervation of ______________________________  

D. Lumbar and Sacral Plexuses  
1. Lumbar plexus originates from spinal nerves ____________________  
2. Sacral plexus originates from spinal nerves ____________________  
3. The term "lumbosacral plexus" refers to ______________________________  
4. Obturator Nerve  
   a. Supplies the muscles that ______________________________  
   b. Its cutaneous sensory distribution is to ______________________________  

5. Femoral Nerve  
   a. Which muscles does it innervate?  
      1. ______________________________  
      2. ______________________________  
      3. ______________________________  
   b. Its cutaneous sensory innervation is:  
      1. ______________________________  
      2. ______________________________  

6. Tibial and Common Fibular Nerves  
   a. They are jointly referred to as the ______________________________  
      1. It is by far the ______________________________ in the body  
   b. Tibial Nerve  
      1. Which muscles does it innervate?  
         a. Posterior ______________________________  
         b. Plantar ____________________ & skin _____________________
2. It supplies cutaneous innervation:
   a. ______________________________
   b. ______________________________

c. Common Fibular Nerve
   1. Which muscles does it innervate? ______________________________
   2. The cutaneous distribution is to the:
      a. ______________________________
      b. ______________________________

7. Other Lumbosacral Plexus Nerves
   a. List the muscles innervated by other nerves arising from the plexus:
      1. ______________________________
      2. ______________________________
      3. ______________________________
   b. List the skin areas innervated by other nerves arising from the plexus:
      1. ______________________________
      2. ______________________________
      3. ______________________________
      4. ______________________________
   c. Which nerve plays an important role in sexual stimulation and response?
      ______________________________

E. Coccygeal Plexus
   1. A very small plexus formed by spinal nerves __________ & __________
   2. Supplies motor innervation to muscles ______________________________
   3. Supplies sensory cutaneous innervation to skin __________________________