Cranial Nerves and Neural Pathways

I. Cranial Nerves - 12 pairs

I - olfactory  
II - optic  
III - oculomotor  
IV - trochlear  
V - trigeminal  
VI - abducens  
VII - facial  
VIII - vestibulocochlear (auditory)  
IX - glossopharyngeal  
X - vagus  
XI - accessory (spinal accessory)  
XII - hypoglossal

A. Functional Groupings of Cranial Nerves

1. special sensory nerves - I, II, VIII  
2. nerves to extrinsic eye muscles - III, IV, VI  
3. nerves to face, jaw and tongue - V, VII, IX  
4. major autonomic cranial nerve - X  
5. nerves to neck and tongue muscles - XI, XII

II. Sensory and Motor Neural Pathways

A. Primary Somatic Sensory Pathway

1. first-order neurons are sensory neurons  
   - dendrites at sensory receptors  
   - axons in spinal nerves  
   - cell bodies in dorsal root ganglion  
   - axons enter posterior (dorsal) gray horn of spinal cord  
   → ascending tracts in spinal cord - posterior white columns  
2. second-order neurons originate in spinal cord or brainstem  
   → thalamus  
3. third-order neurons originate in the thalamus  
   → primary somatosensory area (postcentral gyrus)

B. Direct Somatic Motor Pathway (Pyramidal Pathway)

1. upper motor neurons originate in primary motor area (precentral gyrus)  
   axons in descending tracts of brain and spinal cord:  
   → cerebral white matter  
   → internal capsule  
   → brainstem  
   - midbrain - cerebral peduncles  
   - pons  
   - medulla - pyramids, decussation of pyramids  
   → spinal cord - corticospinal tracts  
2. lower motor neurons are true motor neurons  
   - cell bodies in anterior (ventral) gray horn  
   - axons travel out spinal nerves to skeletal muscles
Study Questions
1. Identify the 12 cranial nerves by name, number, and general function (sensory, motor, or both). Describe at least one specific function for each cranial nerve (and two functions for the trigeminal, facial, and vagus nerves).

2. List the major CNS structures involved in a somatosensory pathway that would function in touch perception in your left hand. Begin with a sensory neuron entering the spinal cord and follow the pathway up to the somatosensory area of the cerebral cortex. Distinguish between the first-order, second-order, and third-order neurons in the pathway.

3. List the major CNS structures involved in the direct somatic motor pathway that would function in voluntary movement of your right hand. Start at an upper motor neuron in the primary motor area of the cerebral cortex and end at a lower motor neuron exiting the spinal cord.