Question 1: Are the dorsal root ganglia in the central or peripheral nervous system?

Answer: The somatic sensory neurons collect information from the skin, muscles, and joints, and enter the spinal cord through the dorsal roots to synapse on dorsal root and ventral root neurons. The cell bodies of these neurons lie outside the spinal cord in clusters called dorsal root ganglia. The dorsal root ganglia are in the peripheral nervous system because they are situated outside the spinal cord. Furthermore, they are derived from the neural crest cells during embryologic development, as are all parts of the peripheral nervous system. Neurons of the central nervous system are derived from the neural tube.

Question 2: Is the myelin sheath of optic nerve axons provided by Schwann cells or oligodendroglia? Why?

Answer: The retina and optic nerve are part of the central nervous system, as they are derived from the neural tube. We know that oligodendroglia provide myelin for the central nervous system and Schwann cells provide myelin for the peripheral nervous system. Therefore, oliogodendroglial cells must provide the myelin for the optic nerve.

Question 3: Imagine that you are a neurosurgeon, about to remove a tumor lodged deep inside the brain. The top of the skull has been removed. What now lies between you and the brain? Which layer(s) must be cut before you reach the CSF?

Answer: Three layers lie between the surgeon and the brain: first the tough, white, avascular dura, then the spider-like arachnoid, and finally the pial membrane. The dura mater forms a tough, inelastic bag that surrounds the brain and the spinal cord and must be retracted to get a good view of the brain. The arachnoid membrane lies just under the dura, separated from the pia mater by a space filled with salty clear liquid called cerebrospinal fluid (CSF).

Question 4: What is the fate of tissue derived from the embryonic neural tube? Neural crest?

Answer: The entire central nervous system (CNS) develops from the walls of the neural tube, which is initially only a thin sheet of ectoderm that deepens to form a neural groove with folds that fuse to form the neural tube. On either side of the neural tube are pockets of neuronal precursors called neural crest cells. The entire PNS develops from these neural crest cells.

Question 5: Name the three main parts of the hindbrain. Which of these is also part of the brain stem?

Answer: The three main parts of the hindbrain are the cerebellum, the pons, and the medulla oblongata. The cerebellum and pons develop from the rostral half of the hindbrain and the medulla develops from the caudal half.

Question 6: Where is CSF produced? What path does it take before it is absorbed into the bloodstream? Name the parts of the CNS it will pass through in its voyage from brain to blood.

Answer: The choroid plexus in the lateral ventricles of the cerebral hemispheres produces CSF. CSF flows from the paired lateral ventricles through a series of unpaired ventricles in the thalamus, midbrain, and brain stem as well as the spinal canal. CSF also surrounds the outside of the brain. CSF exits the ventricular system via the subarachnoid space through small apertures near the base of the cerebellum. In the subarachnoid space, CSF is absorbed into the blood by the blood vessels called arachnoid villi.

Question 7: What are three features that characterize the structure of cerebral cortex?

Answer: Cerebral cortex in the brain of all vertebrate animals has three features. First, the cell bodies of cortical neurons are always arranged in layers or sheets that lie parallel to the surface of the brain. Second, the layer of neurons closest to the surface or the most superficial cell layer is separated from the pia mater by a zone that lacks neurons. This zone is called the molecular layer or *layer I*. Third, at least one cell layer contains pyramidal cells that emit large dendrites called *apical dendrites* extending up toward layer I where they form multiple branches. This characteristic cytoarchitecture distinguishes cerebral cortex from the nuclei of the basal telencephalon and the thalamus.