Question 1: What did Sherrington call the "final common pathway," and why?

Answer: Sherrington called the lower motor neurons of the spinal cord the "final common pathway" that controls behavior. These motor neurons, also called the somatic motor neurons, directly command muscle contraction. They are the output of the motor system. Inputs to lower motor neurons include the sensory afferents entering the dorsal horn (providing information about muscle length), the upper motor neurons in the motor cortex, and the interneurons within the spinal cord that participate in spinal motor programs. Regardless of the source of the input, the output is the lower motor neurons, the final common path.

Question 2: Define, in one sentence, motor unit. How does it differ from motor neuron pool?

Answer: A motor unit consists of one alpha motor neuron and all the muscle fibers that the alpha motor neuron innervates. This is the elementary component of motor control. A motor neuron pool consists of all the alpha motor neurons that innervate a single muscle.

Question 3: Which is recruited first, a fast motor unit or a slow motor unit? Why?

Answer: Most muscles have a range of motor unit sizes. These motor units are recruited in order of size–the smallest being recruited first and the largest last. This explains why finer control is possible when muscles are under light loads than when they are under greater loads. Small motor units have small alpha motor neurons and large motor units have large alpha motor neurons. Small neurons are more easily excited by signals descending from the brain.

Question 4: When and why does rigor mortis occur?

Answer: The stiffening of muscles after death is a condition known as rigor mortis. Muscle contraction occurs because of the interaction between myosin, the major thick filament

protein, and actin, the major thin filament protein, during excitation contraction coupling. The heads of myosin filaments bind to actin filaments and undergo a conformational change. This causes the thick filament to move with respect to the thin filament, shortening the muscle fiber during muscle contraction. ATP is required to release the myosin heads from the actin filament. When no ATP is available because the tissue is dead, the attachment between the thick and thin filaments becomes permanent.

Question 5: Your doctor taps the tendon beneath your kneecap and your leg extends. What is the neural basis of this reflex? What is it called?

Answer: When your doctor taps the tendon beneath your kneecap, the tendon attached to the quadriceps muscle of your thigh is stretched. When this muscle is stretched, the muscle spindle afferents deliver sensory feedback about the muscle length. This causes the muscle to contract and your leg to extend. This is a monosynaptic reflex arc involving the spindle afferents that enter the dorsal horn and the motor neurons that control the muscle. The knee-jerk reflex tests the intactness of the nerves and muscles in this reflex arc.

Question 6: What is the function of gamma motor neurons?

Answer: Alpha motor neurons innervate extrafusal muscle fibers, causing muscle contraction. On the other hand, gamma motor neurons innervate the intrafusal muscle fiber at the two ends of the muscle spindle. The activation of these fibers causes a contraction of the two poles of the muscle spindle, pulling the noncontractile equatorial region and keeping the Ia axons active. The gamma motor activity keeps the muscle spindle during muscle contraction under control. Otherwise, during muscle contraction, the muscle spindles would become slack and insensitive to muscle length.

Question 7: Lenny, a character in Steinbeck's classic book *Of Mice and Men*, loved rabbits, but when he hugged them, they were crushed to death. Which type of proprioceptive input might Lenny have been lacking?

Answer: Lenny might have been lacking the proprioceptive input of reverse myotactic reflex. The normal function of the reflex arc is to regulate muscle tension within an optimal range. In extreme circumstances, the reflex arc protects the muscle from being overloaded. This type of proprioceptive input is particularly important for the proper execution of fine motor acts, such as the manipulation of fragile objects with hands, which requires a steady, but not too powerful, grip.