1. What do you suppose your visual perception would be like without any eye movements to achieve foveation? Usually you do not see the blood vessels in your retina. Why not?

The image would disappear from the visual perception in a few seconds.

The shadow of blood vessels always projects on the same position of retina. From the phenomenon described upon, we cannot see the blood vessels in our retina.

2. What are the four kinds of stereotyped eye movements? Are they voluntary or involuntary?

Saccades: can be elicited voluntary, but mostly involuntary.

smooth pursuit movements: voluntary.

vergence movements: voluntary

vestibulo-ocular movements: involuntary

3. The superior colliculus and frontal eye fields complement each other in the control of saccades. Name one aspect of the control of saccades that is primarily a task for the superior colliculus, and one for the frontal eye fields.

Superior colliculus: the ability to make short-latency, reflect-like eye movements called expressed saccade.

Frontal eye fields: the ability to make saccade that are not directed by an external target.

4. Diagram the muscle stretch reflex. Explain how the antagonist muscle is inhibited via reciprocal innervation. What is the stretch reflex good for in everyday life?

Sensory neuron inhibits antagonist muscle by inhibit alpha motor neuron via local circuit. Stretch reflex is crucial for maintain muscle’s length, which is important in holding goods at a certain position.

5. What are central pattern generators in the spinal cord, and what would life be like without them?

Central pattern generators (CPGs) are neuron networks in spinal cord which can produce rhythm output without sensory feedback.

Without them, it would cause the deficit of the abilities of breath, locomotion and swallowing etc.

6. The major subcortical sources of upper motor neurons are the vestibular nuclei, superior colliculus, red nucleus, and reticular formation. For each region, (a) briefly describe its role in motor control; (b) indicate whether it is part of the midbrain, pons, and/or medulla; and (c) name the pathway that projects from each of these regions to the spinal cord.

1. Vestibular nuclei:

Role: control the movement of eyes.

Part: medulla

Pathway: vestibulospinal tracts

2. Superior colliculus:

Role: transformation of stimuli input to movement output. Mainly orient animals and their eyes to the objects in outside world.

Part: midbrain.

Pathway: colliculospinal or tectospinal tract.

3. Red nucleus:

Role: mainly control the gait.

Part: midbrain

Pathway: rubrospinal tracts

4. Reticular formation:

Role: mainly maintain tone, balance, and posture.

Part: all of above

Pathway: reticulospinal tracts

7. The primary motor cortex “controls movements, not individual muscles.” What does this mean, and what evidence supports it?

Mean: It means that specific site in primary motor cortex controls certain movement which involves multiple muscles to finish an action.

Evidence: Individual pyramid tract axons from primary motor cortex terminate to spinal cord neurons which innervate multiple muscles. This fact indicates that single pyramid neuron dominates multiple muscles to finish particular movement.

8. Give an example of feedforward and feedback in postural control.

Feedforward: Motor center anticipates the postural instability and command to do postural adjustment

Feedback: Sensory input from the instability trigger the postural adjustment.

9. How is it that the motor cortex can direct precise movements even though single neurons are broadly tuned?

Population vector, the sum of the preferred directions of a population of neurons, weighted by the respective spike counts, gives the motor cortex the ability to direct precise movements.

10. How can you find how many muscles a motor cortex neuron innervates?

Stimulate a certain motor cortex neuron and determine the number contracted muscles.