

1/ Name 5 main substructures of the brain

2/ What is the typical value of the resting potential of a neuron? Describe briefly the mechanism which generates the resting membrane potential.

3/ Name the 2 ionotropic receptors which are localized on the postsynaptic side of most glutamatergic synapses. Which of the 2 receptors activates faster?

4/ What is a motor unit?

1/ Briefly describe the mechanism which creates the gradient of Na^+ and K^+ ions btw the inside and the outside of the cell. What are the resulting approximate intracellular and extracellular concentrations of these 2 ions?

2/ Which neurotransmitter mediates transmission at the nerve-muscle synapse and what happens to it after it is released from the motor axons?

3/ G-protein coupled receptors (GPCR) can be subdivided into three important classes (Gs, Gi, Gq). Identify the correct statement:

GPCR coupled to Gi:

- activate the enzyme phospholipase C
- inhibit the enzyme Adenylate Cyclase
- inhibit the enzyme phospholipase C

4/ Explain the process of primary sensory transduction in a touch receptor cell; that is, how the primary mechanical stimulus is transduced into a membrane potential response of the cell. Where are the touch receptor cells located, and in which compartment of those cells does this process take place?

5/ In which auditory brainstem nucleus do the axons of auditory nerve fibers end, and form synapses?

- medial nucleus of the trapezoid body
- thalamus
- cochlear nucleus
- inferior colliculus

1/ Explain the principal signaling steps during transmitter release at an excitatory synapse, starting with the action potential in the presynaptic neuron, and ending with the excitatory postsynaptic potential in the postsynaptic cell.

2/ Identify two examples of ligand-gated ion-channels permeable to Na⁺ and K⁺ ions

- GABA-receptor
- glutamate receptor of the AMPA subtype
- Voltage-gated Na⁺ channel
- nicotinic acetylcholine-receptor (AChR)
- muscarinic acetylcholine-receptor
- metabotropic glutamate receptor

3/ Explain the primary sensory transduction of auditory signals in inner hair cells (IHCs). The flow of which ion, through what type of ion channel, depolarizes the IHC?

1/ How is the action potential generated, and propagated along the axon? Describe the role of two important voltage-gated currents in this process. Make a drawing that shows the action potential, and when during the action potential each current flows (*with their correct directions*)

1/ Make a drawing which shows the basic connections between photoreceptors, bipolar cells and retinal ganglion cells in the retina.

Explain how the information flows to an “ON-center retinal ganglion cell” and to an “OFF-center retinal ganglion cell”.

Which cell type fires action potentials and which does not?

Which neuron type in the output neuron of the retina?

2/ What is a motor unit?

Test exam 2015-2016

1/ What is the receptive field of a sensory neuron?

Briefly describe the organization of the receptive field of an ON-retinal ganglion cell.

Test exam 2018-2019

1/ Please identify the two correct statements:

- Color vision is enabled by rods that are located in the fovea of the retina
- Color vision is enabled by cones that located in the periphery of the retina
- In humans there are two opsins, long (L)- and short (S)-wave opsins expressed in cone photoreceptors
- In humans there are three opsins, long (L), medium (M) and short (S) wave opsins expressed in cone photoreceptors
- In humans there are three opsins, long (L), medium (M) and short (S) wave opsins expressed in rod photoreceptors
- Color vision is enabled by cones that are located in the fovea of the retina

Test exam 2019-2020

1/ Name the principal layers of the neocortex. Which is the layer that receives input from the thalamus and from which layer occurs an important output?

VISION:

- 1) What is accommodation
- 2) What is the effect of color blindness
- 3) Describe the green-red opponent system
- 4) Describe the organization of the receptive field of neurons in the primary visual cortex. Which hypothesis can be made to explain this shape

MOVEMENT CONTROL BY THE SPINAL CORD

- 1) What is the distribution of motor neurons in the ventral horn of the spinal cord
- 2) What is the difference and the role of alpha and gamma neurons
- 3) Explain the flexion crossed extension reflex

MOVEMENT CONTROL BY CORTEX AND BASAL GANGLIA:

- 1) What are the 2 main descending motor systems to the spinal cord**

- 2) What happens if you stimulate electrically specific sites in M1**

- 3) What is the preferred direction of a neuron in M1 and what is a population vector**

- 4) What are the possible causes of Parkinson's disease**

- 5) What are the main applications of BMIs**

LEARNING AND MEMORY:

- 1) What are the difference association cortices and their purposes
- 2) How can you test the working memory of monkeys
- 3) What are the two major mechanism that could contribute to the persistent firing of neurons in the prefrontal cortex during the delay period
- 4) What are the 4 distinct operations that involve explicit memories
- 5) Describe the case of patient H.M. What did we learn thanks to him