

Advanced Neuroscience Principles

Neuroscience · Answer Key · 20 Questions

1. Which specific ion channel is primarily responsible for the repolarization phase of an action potential in a neuron?

- A) Voltage-gated sodium channel
- B) Voltage-gated potassium channel**
- C) Ligand-gated chloride channel
- D) Calcium-activated sodium channel

2. What is the primary excitatory neurotransmitter in the adult human central nervous system?

- A) GABA
- B) Dopamine
- C) Glutamate**
- D) Acetylcholine

3. Which structure within the limbic system is most critically involved in the formation of new declarative memories?

- A) Amygdala
- B) Hippocampus**
- C) Hypothalamus
- D) Thalamus

4. During synaptic transmission, which ion enters the presynaptic terminal to trigger the exocytosis of neurotransmitter vesicles?

- A) Potassium
- B) Sodium
- C) Magnesium
- D) Calcium**

5. What is the primary function of the myelin sheath produced by oligodendrocytes in the central nervous system?

- A) To provide structural support to the cell body
- B) To facilitate saltatory conduction of nerve impulses**
- C) To store neurotransmitters for rapid release
- D) To synthesize proteins for synaptic repair

6. Which lobe of the human cerebral cortex is primarily responsible for processing visual information?

- A) Frontal
- B) Parietal
- C) Temporal
- D) Occipital**

7. The 'all-or-none' principle of action potentials refers to which of the following properties?

- A) The intensity of a stimulus dictates the amplitude of the action potential
- B) The axon must fire at a maximum frequency at all times
- C) An action potential occurs fully or not at all once threshold is reached**
- D) All neurons in a circuit must fire simultaneously for a response to occur

8. Which glial cell type is primarily responsible for forming the blood-brain barrier?

- A) Microglia
- B) Astrocytes**
- C) Ependymal cells
- D) Satellite cells

9. What is the term for the gap between two neurons where information is chemically transmitted?

- A) Axon hillock
- B) Synaptic cleft**
- C) Node of Ranvier
- D) Dendritic spine

10. In which region of the brain is the primary motor cortex located?

- A) Precentral gyrus of the frontal lobe**
- B) Postcentral gyrus of the parietal lobe
- C) Superior temporal gyrus
- D) Cingulate gyrus

11. Which neurotransmitter is most directly associated with the reward pathway and the reinforcement of motivated behaviors?

- A) Serotonin
- B) Dopamine**
- C) GABA
- D) Noradrenaline

12. What is the resting membrane potential of a typical mammalian neuron?

- A) -70 mV**
- B) 0 mV
- C) +30 mV
- D) -100 mV

13. Which brain structure acts as the primary relay station for sensory information (except smell) before it reaches the cortex?

- A) Hypothalamus
- B) Thalamus**
- C) Basal ganglia
- D) Cerebellum

14. The phenomenon of Long-Term Potentiation (LTP) is most commonly studied in which synaptic pathway of the hippocampus?

- A) Perforant path
- B) Schaffer collateral pathway**
- C) Mossy fiber pathway
- D) Striatal pathway

15. Which nervous system division is responsible for the 'fight or flight' response?

- A) Parasympathetic nervous system
- B) Enteric nervous system
- C) Sympathetic nervous system**
- D) Somatic nervous system

16. Which protein complex is responsible for the 'docking' and fusion of synaptic vesicles with the presynaptic membrane?

- A) SNARE complex**
- B) Actin filament complex
- C) Myosin motor complex
- D) Tubulin dimer complex

17. What occurs during the absolute refractory period of a neuron?

- A) The neuron can fire again if the stimulus is strong enough
- B) Sodium channels are inactivated and cannot be opened**
- C) Potassium channels are closed to conserve energy
- D) The neuron becomes hypersensitive to sub-threshold stimuli

18. Which ion has a much higher concentration inside the resting neuron compared to the extracellular fluid?

- A) Sodium
- B) Chloride
- C) Potassium**
- D) Calcium

19. The Broca's area is typically located in which hemisphere and is associated with which function?

- A) Right hemisphere; visual processing
- B) Left hemisphere; speech production**
- C) Right hemisphere; spatial awareness
- D) Left hemisphere; sensory perception

20. What is the primary role of microglia in the central nervous system?

- A) Producing cerebrospinal fluid
- B) Conducting electrical impulses
- C) Immune defense and debris clearance**
- D) Myelinating axons