

Advanced Neuroscience Principles

Neuroscience · Answer Key · 25 Questions

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

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

2. During synaptic transmission, which protein complex is primarily responsible for the fusion of neurotransmitter-containing vesicles with the presynaptic membrane?

- A) SNARE complex**
- B) Clathrin
- C) Dynein
- D) Kinesin

3. What is the primary function of the nodes of Ranvier in saltatory conduction?

- A) To produce neurotransmitters
- B) To regenerate the action potential**
- C) To inhibit ion flow
- D) To synthesize myelin

4. Which glial cell type is primarily responsible for the formation of the blood-brain barrier?

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

5. In long-term potentiation (LTP), which receptor type acts as a coincidence detector due to its magnesium ion block?

- A) AMPA receptor
- B) GABA-A receptor
- C) NMDA receptor**
- D) Kainate receptor

6. What is the primary inhibitory neurotransmitter in the adult human central nervous system?

A) Glutamate

B) GABA

C) Acetylcholine

D) Dopamine

7. Which region of the brain is the primary integration center for the regulation of the autonomic nervous system and endocrine output?

A) Thalamus

B) Hippocampus

C) Hypothalamus

D) Amygdala

8. What defines the absolute refractory period of a neuron?

A) The closure of potassium channels

B) The inactivation of voltage-gated sodium channels

C) The hyperpolarization of the membrane

D) The depletion of ATP

9. Which neurotransmitter is synthesized from the amino acid tryptophan?

A) Serotonin

B) Dopamine

C) Norepinephrine

D) Glutamate

10. The primary somatosensory cortex is located in which specific lobe of the human brain?

A) Frontal lobe

B) Occipital lobe

C) Parietal lobe

D) Temporal lobe

11. Which component of the cytoskeleton is most abundant in neuronal axons and is vital for axonal transport?

A) Actin filaments

B) Microtubules

C) Intermediate filaments

D) Spectrin

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

- A) Myelination of axons
- B) Immune defense and debris clearance**
- C) Regulation of extracellular potassium
- D) Synaptic scaffolding

13. Where are the cell bodies of the lower motor neurons that innervate skeletal muscle located?

- A) Dorsal root ganglia
- B) Ventral horn of the spinal cord**
- C) Motor cortex
- D) Thalamus

14. Which cranial nerve is primarily responsible for parasympathetic innervation of the viscera?

- A) Trigeminal nerve
- B) Facial nerve
- C) Vagus nerve**
- D) Glossopharyngeal nerve

15. The Broca's area, responsible for speech production, is typically located in which hemisphere and lobe?

- A) Left frontal lobe**
- B) Right frontal lobe
- C) Left temporal lobe
- D) Right parietal lobe

16. Which ion has an equilibrium potential approximately equal to the resting membrane potential of a typical neuron?

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

17. Which neurotransmitter is released by preganglionic neurons in both the sympathetic and parasympathetic divisions of the autonomic nervous system?

- A) Norepinephrine
- B) Epinephrine
- C) Acetylcholine**
- D) Dopamine

18. What is the role of the enzyme acetylcholinesterase in the synaptic cleft?

- A) Synthesizing acetylcholine
- B) Degrading acetylcholine into choline and acetate**
- C) Binding to postsynaptic receptors
- D) Reuptaking acetylcholine into the presynaptic neuron

19. Which structure connects the two hemispheres of the human brain and allows for interhemispheric communication?

- A) Internal capsule
- B) Corpus callosum**
- C) Fornix
- D) Cerebellar peduncle

20. In the visual system, which cells are responsible for lateral inhibition in the retina?

- A) Ganglion cells
- B) Bipolar cells
- C) Horizontal cells**
- D) Photoreceptors

21. Which part of the neuron is primarily specialized for receiving incoming signals?

- A) Axon hillock
- B) Dendrite**
- C) Axon terminal
- D) Myelin sheath

22. The 'all-or-none' principle in neurophysiology refers to the threshold behavior of which phenomenon?

- A) Synaptic potential
- B) Action potential**
- C) Graded potential
- D) Membrane permeability

23. Which amino acid is the primary precursor for the synthesis of catecholamines like dopamine and norepinephrine?

- A) Tyrosine**
- B) Tryptophan
- C) Glycine
- D) Alanine

24. What is the term for the specific voltage at which a neuron fires an action potential?

- A) Resting potential
- B) Equilibrium potential
- C) Threshold potential**
- D) Hyperpolarization

25. Which meningeal layer is the innermost, closest to the surface of the brain?

- A) Dura mater
- B) Arachnoid mater
- C) Pia mater**
- D) Subdural space