

Core Principles of Neuroscience

Neuroscience · Answer Key · 18 Questions

1. Which specific ion is primarily responsible for the repolarization phase of an action potential by flowing out of the neuron?

- A) Sodium (Na^+)
- B) Potassium (K^+)**
- C) Calcium (Ca^{2+})
- D) Chloride (Cl^-)

2. The primary motor cortex is located in which specific gyrus of the frontal lobe?

- A) Superior frontal gyrus
- B) Middle frontal gyrus
- C) Precentral gyrus**
- D) Postcentral gyrus

3. Which glial cells are responsible for the myelination of axons within the central nervous system?

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

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

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

5. The Wernicke's area, essential for language comprehension, is typically located in which lobe of the brain?

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

6. Which structure serves as the primary relay station for sensory information (except olfaction) before it reaches the cerebral cortex?

A) Hypothalamus

B) Thalamus

C) Basal ganglia

D) Amygdala

7. What is the resting membrane potential of a typical mammalian neuron, measured in millivolts?

A) -70 mV

B) -30 mV

C) 0 mV

D) +30 mV

8. The blood-brain barrier is primarily maintained by the end-feet of which type of glial cell?

A) Oligodendrocytes

B) Ependymal cells

C) Astrocytes

D) Microglia

9. Which cranial nerve is responsible for the parasympathetic innervation of the heart, lungs, and digestive tract?

A) Trigeminal nerve

B) Facial nerve

C) Vagus nerve

D) Hypoglossal nerve

10. What is the functional unit of the cerebellum that receives massive excitatory input from mossy fibers and climbing fibers?

A) Basket cell

B) Purkinje cell

C) Granule cell

D) Stellate cell

11. Which neurotransmitter is most significantly depleted in the substantia nigra of patients with Parkinson's disease?

A) Acetylcholine

B) Dopamine

C) Norepinephrine

D) Glutamate

12. What phenomenon describes the strengthening of synapses based on recent patterns of activity, considered the cellular basis for learning?

- A) Long-term depression (LTD)
- B) Long-term potentiation (LTP)**
- C) Synaptic pruning
- D) Neural plasticity

13. The Broca's area is classically associated with which specific cognitive function?

- A) Visual processing
- B) Auditory perception
- C) Speech production**
- D) Executive decision-making

14. What is the term for the gaps in the myelin sheath where voltage-gated sodium channels are concentrated, allowing for saltatory conduction?

- A) Synaptic clefts
- B) Dendritic spines
- C) Nodes of Ranvier**
- D) Axon hillocks

15. Which part of the brain is most critical for the formation of new declarative memories?

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

16. What effect does the activation of GABA-A receptors have on a postsynaptic neuron?

- A) Depolarization
- B) Hyperpolarization**
- C) Action potential firing
- D) Calcium influx

17. Which lobe of the cerebral cortex contains the primary visual cortex (V1)?

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

18. The 'limbic system' is a collection of structures involved in emotional regulation; which structure within it is primarily responsible for processing fear?

A) Cingulate gyrus

B) Amygdala

C) Fornix

D) Septal nuclei