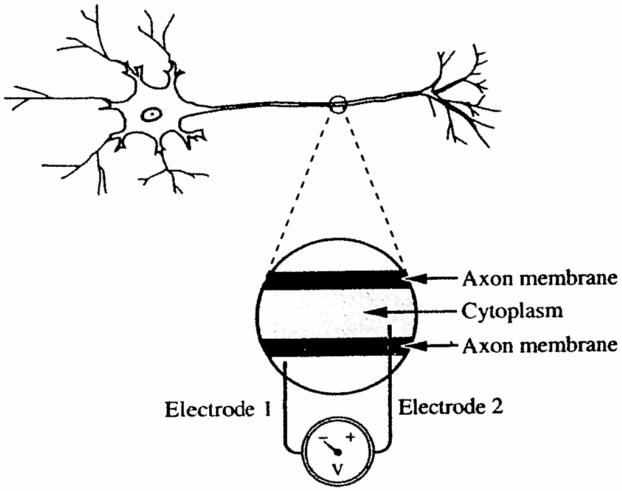
NERVOUS SYSTEM REVIEW QUESTIONS

Use the following information to answer the next three questions.

Measuring the Membrane Potential of a Spinal Neuron

A microelectrode can be inserted into the axon of a neuron in order to measure the differences in charge between the outside and inside of the cell. A specialized, sensitive voltmeter is used to measure this difference. Electrode 1 is placed on the outside of the cell membrane and Electrode 2 is placed on the inside of the cell membrane.



1. The neuron in an experiment was taken from a spinal cord. The propagation of an action potential in the neuron was slower than the 24 m/s that is typical with sensory neurons. Why?

A. Myelination was absent in this spinal neuron.
B. Axon length is much longer in sensory neurons.
C. The Nodes of Ranvier were absent in sensory neurons.
D. The neurotransmitters were blocked in this spinal neuron.

2. The voltmeter showed a negative reading and the sodium ion concentration remained constant outside the axon. How could this be explained?

A. The threshold for the neuron was not reached.
B. The sodium pump had exhausted ATP reserves.
C. The action potential was established and sustained.
D. The dendrites were stimulated by the release of acetylcholine.

3. In a resting neuron, the outside of the cell membrane is

A. positive, and the sodium ion concentration is greater in the fluid outside the axon than in the cytoplasm
B. negative, and the sodium ion concentration is greater in the fluid outside the axon than in the cytoplasm
C. positive, and the sodium ion concentration is greater in the cytoplasm than in the fluid outside the axon
D. negative, and the sodium ion concentration is greater in the cytoplasm than in the fluid outside the axon

4. Certain compounds known as opiates (opium, morphine, and codeine) are addictive drugs. Scientists have found that opiates work by binding to specific sites in the brain that interpret perceptions of pleasure and pain.

A likely explanation of how receptors in the human brain are stimulated by opiates is that opiates

A. bind to neurotransmitters
B. act in the same way as cholinesterase
C. increase the strength of action potentials
D. have molecular shapes similar to a neurotransmitter

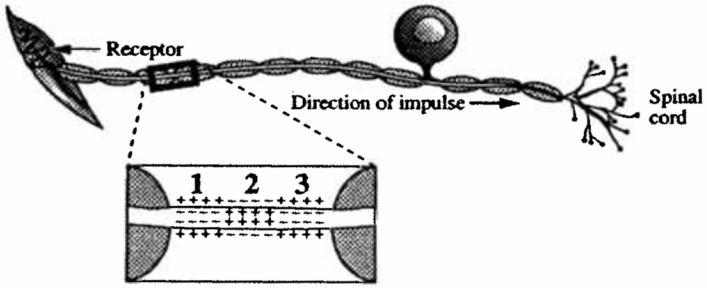
5. A mutation is the cause of fatal familial insomnia and Creutzfeldt/Jakob disease. One symptom of fatal familial insomnia is a drastically reduced heart rate. Individuals with Creutzfeldt/Jakob disease experience personality changes. Both diseases result from lesions or damage in the brain caused by the accumulation of abnormal clumps of prion proteins. Prion proteins are found in the brain tissue of humans. The mutation occurs in a gene coding for a prion protein. One nucleotide in DNA triplet 178 (CTG) is changed, resulting in a new triplet (TTG).

Which row correctly identifies the most likely location of lesions in each disease?

Row	Location of lesions in fatal familial insomnia	Location of lesions in Creutzfeldt/Jakob disease
A.	cerebellum	hypothalamus
B.	medulla oblongata	hypothalamus
C.	cerebellum	cerebrum
D.	medulla oblongata	cerebrum

Use the following information to answer the next two questions.

A Neuron



6. This neuron transmits an impulse from a receptor to the central nervous system; therefore, it is

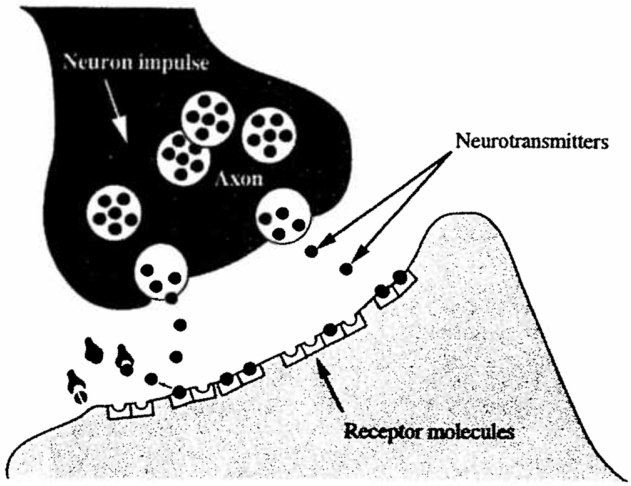
A. a motor neuron
B. a sensory neuron
C. an autonomic neuron
D. an association neuron

Numerical Response

7. In the diagrammed neuron, which numbers represent segments of the axon that are, respectively, polarized, repolarized, and depolarized, during normal neural impulse conduction?
Answer: _____ _____ _____
polarized repolarized depolarized
(Record your three-digit answer.)

Use the following information to answer the next two questions.

A Synapse



1 Attachment of neurotransmitters to receptor molecules
2 Diffusion of neurotransmitters across the synapse
3 Destruction of the neurotransmitter by an enzyme
4 Exocytosis of the neurotransmitter

Numerical Response

8. Identify the sequence of events that would occur when a signal crosses the synapse.
Answer: _____
(Record your four-digit answer.)

9. Serotonin is a neurotransmitter found in the brain. Some studies show that too little serotonin may cause depression and lead to a tendency to behave impulsively.

-- from *The Edmonton Journal*

Excitatory neurotransmitters like serotonin

A. hyperpolarize a postsynaptic neural membrane
B. block the postsynaptic membrane's receptor sites
C. increase the permeability of postsynaptic membranes to sodium
D. decrease the permeability of postsynaptic membranes to sodium

Inside the Human Ear

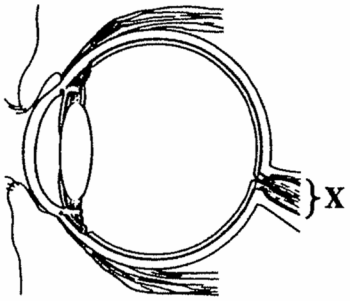
10. Which structure acts as a lever to mechanically amplify sound vibrations?

A. Structure 1
B. Structure 2
C. Structure 3
D. Structure 4

11. A person outside the gravitational field of Earth experiences disruption of normal functions of the inner ear. The region of the brain processing the disruption and the ability affected by this disruption are, respectively, the

A. cerebellum and the ability to walk a straight line
B. cerebrum and the ability to write legibly
C. cerebellum and the ability to hear
D. cerebrum and the ability to speak

The Human Eye



12. For a person to experience sight, neural transmissions from structure X must reach which lobe of the cerebrum?

A. The frontal lobe
B. The parietal lobe
C. The occipital lobe
D. The temporal lobe

13. After having a stroke, a person finds that he cannot contract muscles in his right arm and that he suffers from speech impairment. The person probably has brain damage in the

A. left side of the cerebrum
B. right side of the cerebrum
C. left side of the cerebellum
D. right side of the cerebellum

Polygraphs (lie detectors) monitor some changes in some activities of the nervous system. In theory, an emotionally stressful situation like telling lies will increase perspiration, increase breathing and heart rates, and cause slight dilation of pupils. However, polygraphs cannot exclusively differentiate between telling lies and other stressful situations.

14. The physiological changes that are associated with telling lies are responses produced by impulses coming from

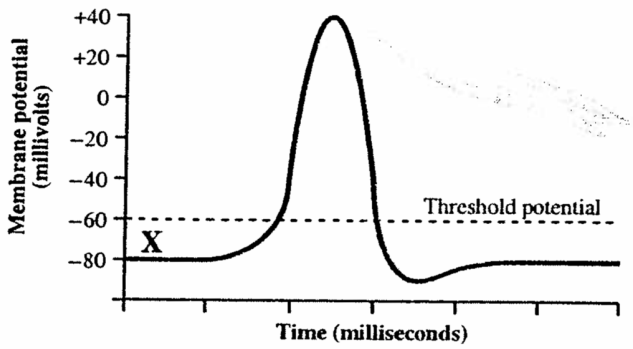
A. motor nerves of the somatic nervous system
B. sensory nerves of the somatic nervous system
C. sympathetic nerves of the autonomic nervous system
D. parasympathetic nerves of the autonomic nervous system

Use the following information to answer the next two questions.

"The [study of the squid, led] to an understanding of the nature of the nerve impulse. [Its] . . . nerves contain the giant axons used in all the early studies of the nerve impulse."

—from *Curtis and Barnes*

An Action Potential



Note: X denotes the electrical potential across the membrane of a particular resting neuron.

15. Which of the following statements is true of the threshold potential?

A. It is the same electrical potential for all neurons.
B. It is the depolarization required to generate an action potential.
C. It determines the time it takes for an action potential to be completed.
D. It determines the time it takes for an impulse to travel along the axon.

16. Relative to inside of a neuron, the extracellular fluid immediately outside a resting neuron's cell membrane is

A. positive and the sodium ion concentration is less
B. negative and the sodium ion concentration is less
C. positive and the sodium ion concentration is greater
D. negative and the sodium ion concentration is greater

17. Twenty-two once-paralyzed rats can now move their hind legs and even take awkward steps. Their damaged spinal cords have been partially repaired by surgically grafting nerve fibres from another part of their bodies to the damaged area.

—from *Flam*

The division of the nervous system that was damaged in these rats is the

A. central nervous system
B. somatic nervous system
C. sympathetic nervous system
D. parasympathetic nervous system

Use the following information to answer the next two questions.

Processes That Occur at a Neuromuscular Junction (A Type of Synapse)

1 Muscle fibres contract when sodium gates open allowing sodium ions to diffuse into the muscle cytoplasm.
2 Acetylcholine is released from the axon terminal.
3 Acetylcholine binds to the receptors on the muscle cell.
4 Cholinesterase breaks down acetylcholine, and the sodium gates close.

—from *Guyton*

Numerical Response

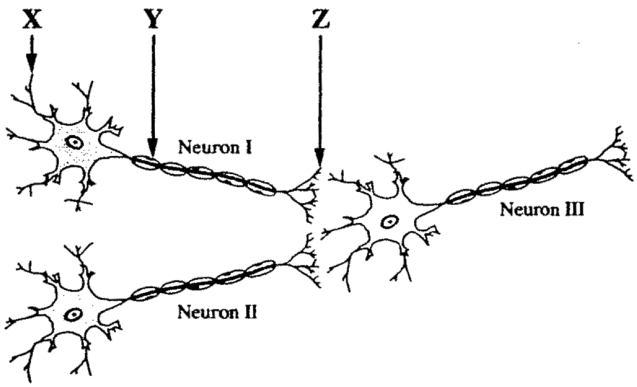
18. An impulse arrives at an axon terminal that synapses with a muscle cell. Record the processes in the order that they occur at the synapse.
Answer: _____
(Record your **four-digit answer.**)

19. Certain chemicals inhibit cholinesterase at neuromuscular junctions. The resulting muscular spasms occur because of the

A. depletion of cholinesterase in the presynaptic neuron
B. depletion of acetylcholine in the neuromuscular junction
C. accumulation of cholinesterase in the presynaptic neuron
D. accumulation of acetylcholine in the neuromuscular junction

Use the following information to answer the next three questions.

Neurons



20. Neurotransmitters are released from

A. site X
B. site Z
C. sites X and Y
D. sites X and Z

21. If neurons I and II are interneurons, neuron III cannot be a

A. parasympathetic neuron
B. sympathetic neuron
C. sensory neuron
D. motor neuron

22. In a typical reflex arc, neuron III would be part of the

A. effector
B. receptor
C. motor pathway
D. sensory pathway

23. Sensory hair cells in the inner ear can be damaged by excessive noise or certain drugs. This may cause deafness or balance disorders. Research suggests that these cells have the ability to regenerate. In one study, the damaged inner ear tissue of guinea pigs was cultured in a dish. The damaged tissue produced new sensory hair cells.

—from *Gutin*

Which parts of the ear contain these sensory hair cells?

A. Auditory nerve and cochlea
B. Eardrum and auditory nerve
C. Eustachian tube and eardrum
D. Cochlea and semicircular canals

24. When adaptation of the eye occurs to view objects in a dark room,

A. the pupil increases in size and the rods become active
B. the pupil decreases in size and the rods become active
C. the pupil increases in size and the cones become active
D. the pupil decreases in size and the cones become active

25. The symptoms of Alzheimer's disease gradually appear as affected individuals age. One symptom of Alzheimer's disease is a loss of memory. Studies have shown that the administration of the hormone estrogen to female patients with Alzheimer's disease dramatically improved their memory

—from *Calgary Herald*, 1996

It appears that the hormone estrogen has an effect on the

A. cerebrum
B. cerebellum
C. hypothalamus
D. medulla oblongata

26. After a head injury, a mountain biker was assessed by a doctor. One of the tests the doctor did was to gently tap just below her kneecap. Also, he shone a light into each of her eyes and made observations. In both tests, he was trying to quickly rule out any neurological damage.

Assume that the biker's nervous system was not injured and that the biker's body responded in a normal way to the gentle tap. The neurological pathway that was followed when this response was elicited was

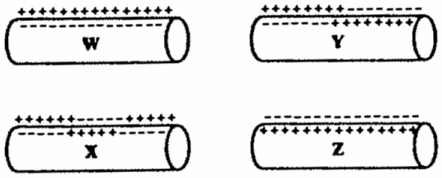
A. receptor, sensory neuron, interneuron, motor neuron, effector
B. effector, sensory neuron, interneuron, motor neuron, receptor
C. receptor, motor neuron, interneuron, sensory neuron, effector
D. effector, motor neuron, interneuron, sensory neuron, receptor

27. Diving improperly into a swimming pool or into a lake may cause injuries that damage the spinal cord. The victims of these injuries often suffer loss of the sensation of heat and touch on the skin and paralysis of muscles below the site of the injury.

Paralysis of muscles below the site of a spinal cord injury is often permanent because neurons in the grey matter of the spinal cord all lack a

A. nucleus
B. dendrite
C. cell body
D. neurilemma

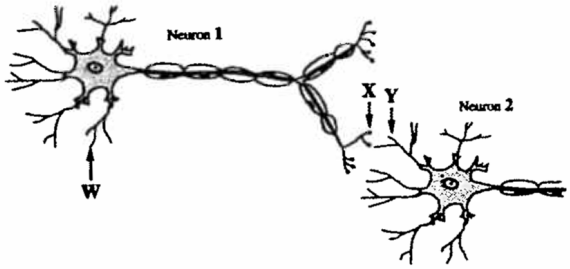
28. **Sections of Axons**



The resting axon is labelled

A. W
B. X
C. Y
D. Z

29. **Synaptic Transmission**



Destruction of the synaptic vesicles of Neuron 1 will

A. block the nerve impulse at W
B. cause X to be constantly stimulated
C. prevent depolarizations from occurring at Y
D. result in the action of cholinesterase in Neuron 2