Part I. Clinical Applications

1. How does a blockages of cerebrospinal fluid (CSF) exiting a ventricle cause irreversible brain damage? How is the condition treated?

2. After taking a walk you return home and immediately feel the urge to drink water because you are thirsty. What part of the brain is involved in the urge to drink because you are thirsty?

3. Ever since the mid-1980's an increasing number of young people have developed Parkinson's disease. The reason has been linked to a "street drug" that had a contaminant that destroyed neurons in the substantia nigra of the mesencephalon (midbrain). What clinical explanation substantiates the relationship between this street drug and the development of Parkinson's disease?

- **4.** A person received a blow to the head and is unable to abduct his right eye. What cranial nerve do you suspect is damaged?
- **5.** A young woman is brought into the emergency room with extremely dilated pupils. Her friends state that she has overdosed on cocaine. What cranial nerve is stimulated by the drug?
- 6. Following a train accident, a man with an obvious head injury was observed stumbling about eh scene. An inability to walk properly and a loss of balance were quite obvious. What brain region was injured?

PartIL	I. The t	nree basic functions the nervous sys	tem serves are, (2)	
		, and		
	2i, The (peripheral? central?) nervous syste	m consists of cranial nerves and spinal nerves.	
	3. Nerve transi	e impulses carried from the peripher nitted over (afferent? efferent?) neu	y to the central nervous system (CNS) are rons.	
	4 , The p	eripheral nervous system (PNS) is s	ubdivided into the and	
		nervous system	S.	
	5. Amo	tor neuron conducts impulses from	the to	
		and		
	6. This	subdivision of the autonomic nervou	is system speeds up the heartbeat:	
		nervous system	· · ·	
	7 . The t	wo principal cells associated with th	e nervous system are the	
	<i>yy</i> 1600			
	which	, which conduct	nerve impulses, and	
				. •
		1	ing the name call component with its description	
	Check your un	derstanding of the neuron by match	ing the nerve cen component with its description.	
		axon collaterals	chromatophilic substance	
		axon nillock	lipofuscin	
		axorlasm	neurofibrils	
		axon terminals	synaptic vesicles	
		axon	synaptic end bulb	
	8. A high	ly specialized projection that carries	impulses away from the cell body.	
•	<u>9.</u> Bulb-s	haped structures at the distal ends o	f the axon terminals.	
	io, Cytopl	asmic materials in the axon.		
	Are the	receiving or input portion of a neu	ron.	
	12. Small	cone-shaped elevation at the cell bo	dy (origin of the axon).	
	B. Plasma	membrane of the axon.		
	14, Stores	a chemical substance called a neuro	transmitter.	
	15. Yellow	ish brown granules; is probably rela	ated to aging.	
	16 . Compo cell.	osed of intermediate filaments; form	the cytoskeleton, which provides support and shape for	th
	17. Side b	ranches of axons (branch off typical	ly at a right angle to the axon).	
	18. Many	fine processes at the distal end of an	axon.	

 \mathbf{M} . What is the function of the myelin sheath?

3

schwann cell

20. A neurolemmocyte is responsible for the myelination of axons of the (central? peripheral?) nervous system. After wrapping itself around the axon, the remaining, outer

nucleated cytoplasmic layer is called the _____

Z(, The unmyelinated gaps between the cells that form the myelin sheath are called

Check your understanding of nerve coverings by matching the connective tissue coat with its description.

a

22. _____endoneurium 23. ____epineurium 24. ____perineurium

a. Superficial covering around the entire nerve.

b. Individual axons are wrapped by this coat.

c. This coat wraps around each fascicle.

25. Define the following.

White matter

B, Gray matter

36. The adult brain is divided into four principal parts. List the parts below.

- A. _____
- В. _____
- ۲.____
- **D**._____
- 27, The cerebrospinal fluid (CSF) circulates through the (subdural? subarachnoid?) space around the brain and spinal cord.

.

X. The ______ are networks of capillaries from which cerebrospinal fluid is formed by filtration and secretion. The special mechanism that prevents the passage of certain substances from the blood into the cerebrospinal fluid

is the _____

	• •
a.	
b.	
c.	
2	• A condition in which cerebrospinal fluid pressure rises due to an accumulation of fluid in
	the ventricles is called
34	The (astrocytes? ependymal cells?) are thought to pass some substances selectively from the blood into the brain but inhibit the passage of others.
ч	• The nuclei of origin for cranial nerves (VII-XII? VIII-XI? VIII-XII?) are contained in th medulla.
5.	List the four components of the diencephalon.
a	C
b	
6,	d The thalamus forms part of the (walls? floor?) of the third ventricle. It consists of (2? 3?) oval
б,	d The thalamus forms part of the (walls? floor?) of the third ventricle. It consists of (2? 3?) oval masses that are joined by a bridge of gray matter called the
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6,	d. The thalamus forms part of the (walls? floor?) of the third ventricle. It consists of (2? 3?) oval 'masses that are joined by a bridge of gray matter called the anterior nucleus ventral anterior lateral geniculate ventral lateral medial geniculate ventral posterior 7. hearing 7.
6,	d.
б ,	d.
6, 	d.
6.	d.
6, []	d.

Answer (T) true or (F) false to the fol	lowing questions.
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13 The hypothalamus pla	ys a role in regulating body temperature.
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- The control of hunger and satiety are not part of the hypothalamus's function.
- 15. _____ The hypothalamus is one of the centers that maintain the waking state and sleep patterns.
- 16. _____ The hypothalamus maintains normal osmotic pressure of the extracellular fluid volume by regulating the thirst center.
- 17, _____ Feelings of rage and aggression are associated with the hypothalamus.

Cerebrum

Test your knowledge of the cerebrum by answering the following questions.

- N. The surface of the cerebrum is composed of (gray? white?) matter and is called the (cortex? medulla?).
- 19. Due to rapid embryonic development, the cortical region of the cerebrum rolls or folds

upon itself. The folds are called ______ or _____. The

deepest g	rooves between	the folds are called		and the shallower
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grooves are referred to as _____.

- - mater called the ______ extends into this fissure.
- \mathfrak{A} . The cerebral hemispheres are connected internally by a bundle of transverse white matter

fibers called the _____

Match the name of a disorder with its definition.

Alzheimer's disease	multiple sclerosis
cerebral palsy	Parkinson's disease

- Debilitating neurological disorder of unknown origin; it afflicts about 11% of the U.S. population over age 65.
- <u>23</u>, Involves progressive degeneration of the myelin sheaths, to form hard plaques in the central nervous system.
- <u>24.</u> Degeneration of dopamine-releasing neurons in substantia nigra; results in unnecessary skeletal movement such as tremors.
 - A group of motor disorders resulting in muscular incoordination and loss of muscle control.

Answer (T) True or (F) False to the following questions.

- 2. _____ Cerebrospinal fluid is formed by the choroid plexuses in the ventricles.
- 23, _____ The two masses of gray matter that form the thalamus are joined by the medial lemniscus.
- **24**, _____ The white matter of the cerebrum is often called the arbor vitae.
- 30, _____ After exiting the optic foramen, the optic nerves unite to form the optic tracts.



17

 \aleph . The epithalamus, thalamus, and hypothalamus are anatomical structures of the:

- a. cerebellum
- b. diencephalon
- c. mesencephalon
- d. metencephalon

 \mathcal{G} . Relay and processing centers for sensory information are found in the:

- a. hypothalamus
- b. epithalamus
- c. pineal gland
- d. thalamus

Using the terms below, complete the following statements.

fissures	hypothalamus	
	hippocampus	fornix
thalamus	pituitary gland	spinal cord
commissural	aqueduct of Sylvius	third ventricle
sulci		

- 20. The walls of the diencephalon are formed by the _____
- 21. The primary link between the nervous and endocrine system is the _____
- 22. The fibers that permit communication between the two cerebral hemispheres are called ___ fibers.
- 23. The part of the limbic system that appears to be important in learning and storage of long-term memory is the ____
- \mathcal{H} The tract of white matter that connects the hippocampus with the hypothalamus is the
- .35. Because the cerebrum has a pair of lateral ventricles, the diencephalic chamber is called the Instead of a ventricle, the mesencephalon has a slender canal known as the _____
- $\lambda 7$. In the caudal half of the medulla the fourth ventricle narrows and becomes continuous with the central canal of the _____
- \mathfrak{R} . The shallow depressions that separate the cortical surface of the cerebral hemispheres are called
- \mathfrak{I} Deep grooves separating the cortical surface of the cerebral hemispheres are called
- \mathfrak{Z}_{\bullet} The component of the brain that integrates with the endocrine system is the ____
- 31. The ventricles in the brain form hollow chambers that serve as passageways for the circulation of:
 - a. blood
 - b. cerebrospinal fluid
 - c. interstitial fluid
 - d. lymph
- 32. The central white matter of the cerebrum is found:
 - a. in the superficial layer of the neural cortex
 - b. beneath the neural cortex and around the cerebral nuclei
 - c. in the deep cerebral nuclei and the neural cortex
 - d. in the cerebral cortex and in the cerebral nuclei
- 33. The series of elevated ridges that increase the surface area of the cerebral hemispheres and the number of neurons in the cortical area are called:
 - a. sulci
 - b. fissures
 - c. gyri
 - d. a, b, and c are correct
- 34. Coordination and refinement of learned movement patterns at the subconscious level are performed by the:
 - a. cerebellum
 - b. hypothalamus
 - c. pons
 - d. association fibers

- $3 \le 1$. The hypothalamus contains centers involved with:
 - a. voluntary somatic motor responses
 - b. somatic and visceral motor control
 - c. emotions, autonomic function, and hormone production
 - d. maintenance of consciousness
- 36 The sea-horse-like structure in the limbic system responsible for storage and retrieval of new long-term memories is the:
 - a. corpus callosum
 - b. amygdaloid body
 - c. hippocampus
 - d. cingulate gyrus
- 37 The cardiovascular centers and the respiratory rhythmicity centers are located in the:
 - a. spinal cord
 - b. medulla oblongata
 - c. pons
 - d. cerebellum
- 37 The medulla oblongata contains sensory and motor nuclei associated with cranial nerves:
 - a. I, II, III, IV, V
 - b. II, IV, VI, VIII, X
 - c. VIII, IX, X, XI, XII
 - d. III, IV, IX, X, XII
- 39 The corpora quadrigemina of the mesencephalon are responsible for processing:
 - a. sensations of taste and smell
 - b. complex coordinated movements
 - c. visual and auditory sensations
 - d. balance and equilibrium
- uc. The slender canal that connects the third ventricle with the fourth ventricle is the:
 - a. aqueduct of Sylvius
 - b. foramen of Munro
 - c. septum pellucidum
 - d. diencephalic chamber
- YI Excess cerebrospinal fluid is returned to venous circulation by:
 - a. diffusion across the arachnoid villi
 - b. active transport across the choroid plexus
 - c. diffusion through the lateral and medial apertures
 - d. passage through the subarachnoid space
- 42 Through a combination of active and passive transport mechanisms, ependymal cells secrete cerebrospinal fluid at a rate of approximately:
 - a. 100 ml/day
 - b. 500 ml/day
 - c. 1200 ml/day
 - d. 1500 ml/day



PartI

_____ k, The white matter of the spinal cord contains:

- a. cell bodies of neurons and glial cells
- b. somatic and visceral sensory nuclei
- c. large numbers of myelinated and unmyelinated axons
- d. sensory and motor nuclei
- 2. The area of the spinal cord that surrounds the central canal and is dominated by the cell bodies of neurons and glial cells is the:
 - a. white matter
 - b. gray matter
 - c. ascending tracts
 - d. descending tracts
- 3. The type of cells that surround the nerve cell bodies in peripheral ganglia are:
 - a. Schwann cells
 - b. satellite cells
 - c. microglia
 - d. oligodendrocytes
- 4. Schwann cells are glial cells responsible for:
 - a. producing a complete neurilemma around peripheral axons
 - b. secretion of cerebrospinal fluid
 - c. phagocytic activities in the neural tissue of the PNS
 - d. surrounding nerve cell bodies in peripheral ganglia
- 5. The central nervous system (CNS) consist of the:
 - a. neuron cell bodies located in ganglia
 - b. axons bundled together in nerves
 - c. spinal and cranial nerves
 - d. brain and spinal cord
- 6. In the peripheral nervous system (PNS):
 - a. neuron cell bodies are located in ganglia
 - b. spinal nerves connect to the spinal cord
 - c. cranial nerves connect to the brain
 - d. a, b, and c are correct

7. In the central nervous system (CNS), the center and tracts that link the brain with the rest of the body are the:

- a. sensory and motor pathways
- b. tracts and columns
- c. nuclei and neural cortex
- d. none of the above
- $\mathcal{S}_{\mathbf{C}}$ The spinal cord is part of the:
 - a. peripheral nervous system
 - b. somatic nervous system
 - c. autonomic nervous system
 - d. central nervous system
- \mathcal{Q} , The identifiable areas of the spinal cord that are based on the regions they serve include:
 - a. cervical, thoracic, lumbar, sacral
 - b. pia mater, dura mater, arachnoid mater
 - c. axillary, radial, median, ulnar
 - d. cranial, visceral, autonomic, spinal

- D. The inferior colliculi are associated with the
 - A. thalamus
- D. mesencephalon
- B. pons C. medulla
- (midbrain) E. cerebral cortex
- 11, The nuclei for cranial nerves V, VI, VII, and part of VIII are contained within the
 - A. midbrain
- D. medulla E. cerebrum
- B. pons
- C. diencephalon
- 12, Cerebrospinal fluid exits from the fourth ventricle via the
 - A. interventricular foramina
 - B. cerebral aqueduct
 - C. lateral and median apertures
 - D. arachnoid villi
 - E. dural venous sinuses
- 13, The crossing over of motor fibers in the medulla occurs in the
 - A. nucleus gracilis
 - B. nucleus cuneatus
 - C. decussation of
- D. inferior olive
- E. accessory
- pyramids
- - olivary nuclei

- 14. If cerebrospinal fluid was withdrawn during a spinal tap, a needle would be inserted into the:
 - a. pia mater
 - b. subdural space
 - c. subarachnoid space
 - d. epidural space
- 15. The meninx that is firmly bound to neural tissue and deep to the other meninges is the:
 - a. pia mater
 - b. arachnoid membrane

E. none of the

above answers

are correct

- c. dura mater
- d. epidural space

16._ _____ fibers transmit impulses from the gyri in one cerebral hemisphere to the corresponding gyri in the opposite hemisphere.

- A. projection
- B. association
- C. commissural
- D. modulation

17. The primary visual area is located in the

lobe.

A.	nontal	D.	temporal
В.	parietal	E.	A and C are
C.	occipital		correct

18. The feeding and satiety centers are located in the

- A. thalamus
- D. hypothalamus E. cerebellum
- B. epithalamus
- C. pons

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- 19. The reflex control centers for heart rhythm, respiration, and blood vessel diameter are located in the
 - A. cerebellum D. midbrain B. cerebrum
 - C. pons
- E. medulla
- 20. Which cells are responsible for the myelin sheath in the central nervous system?

A.	neurolemmo-	C. astroglia
	cytes	D. microglia
B.	oligodendrocytes	E. satellite cells

2. The functional contact between two neurons or between a neuron and an effector is called

22 The brain and spinal cord are part of the ______ nervous system.

- $\mathfrak{G3}$. The contact point between a nerve fiber and a muscle or gland is called the
 - A. synapse
 - B. axon hillock
 - C. collateral
 - junction
- ∂Y . Unmyelinated gaps on a myelinated axon are called
 - A. gap junctions D. oligodendritic nodes
 - B. neurofibral nodes
 - C. tight junctions
- E. C and D are both correct

D. ganglion

E. tract

- 25. In what part of a neuron would you find the stored neurotransmitter substance?
 - A. dendrites B. cell body

C. axon hillock

- D. axon terminal
- E. synaptic vesicles
- **2** The term perikaryon refers to which part of a neuron?
 - A. axon
 - B. dendrite
- D. cell body
- E. axon terminal
- C. chromatophilic substance



Part VII

Match the distinguishing feature to the proper division of the autonomic nervous system.

- a. Sympathetic system c. Both sympathetic and parasympathetic nervous system
- b. Parasympathetic system d. Neither sympathetic nor parasympathetic nervous system
 - 1. Short cholinergic preganglionic fibers.
 - 2. Originates in the cranial and sacral regions of the CNS
 - 3. Originates in the thoracic and lumbar regions of the CNS
 - 4. Short cholinergic postganglinic fibers
 - 5. Long adrenergic postganglionic fibers
 - 6. Long cholinergic preganglionic fibers
 - 7. Nicotinic receptors on postganglionic fibers
 - 8. System that dominates in emergency "flight or flight" situations
 - 9. Muscarinic receptors for neurotransmitters
 - 10. Innervates smooth muscle, cardiac muscle, and exocrine glands
 - 11. Innervates skeletal muscle
 - 12. Dominates in relaxed situations

Part VIII

. The following table indicates a number of conditions. Use a check (\checkmark) to show which division of the autonomic nervous system is involved in each condition.



Condition	Sympathetic	Parasympathetic
1. Postganglionic axons secrete norepinephrine; adrenergic fibers		
2. Postganglionic axons secrete acetylcholine; cholinergic fibers		
3. Long preganglionic axon, short postganglionic axon		
 Short preganglionic axon, long postganglionic axon 		
5. Arises from cranial and sacral nerves		
6. Arises from spinal nerves T_1 to L_3		
7. Increases heart rate		
8. Fight-or-flight system		
9. Stimulation causes an erection		
10. Causes a dry mouth, dilates bronchioles		
11. Constricts eye pupils, decreases heart rate		

13. The system that coordinates cardiovascular, respiratory, digestive, urinary, and reproductive functions is the:

- a. somatic nervous system (SNS)
- b. autonomic nervous system (ANS)
- c. central nervous system (CNS)
- d. enteric nervous system (ENS)

14. Preganglionic fibers from the thoracic and lumbar segments form the:

- a. sympathetic division of the ANS
- b. parasympathetic division of the ANS
- c. processing centers of the CNS
- d. cell bodies in the CNS
- S The parasympathetic division of the ANS is formed by:
 - a. preganglionic fibers from the thoracic and lumbar segments
 - b. preganglionic neurons between segements T_1 and L_2
 - c. ganglionic neurons in the vertebral column
 - d. preganglionic fibers leaving the brain and sacral segments
- 16. The division of the nervous system that "kicks in" during periods of exertion, stress, or emergency is the:
 - a. enteric division of the CNS
 - b. sympathetic division of the ANS
 - c. somatic motor division of the PNS
 - d. parasympathetic division