8

The Nervous System

FOCUS: The nervous system can be divided into the central nervous system (brain and spinal cord) and the peripheral nervous system (nerves and ganglia). Cells of the nervous system are neurons, which conduct action potentials, and neuroglia, which support and protect neurons. Synapses are connections between neurons. The major regions of the brain are the brainstem, diencephalon, cerebrum and cerebellum. The spinal cord connects periph-eral nerves to the brain. The peripheral nervous system can be divided into the afferent and efferent systems. The efferent system can be subdivided into the somatic motor and autonomic systems.

CONTENT LEARNING ACTIVITY

Divisions of the Nervous System

"*The nervous system can be divided into the central and peripheral nervous systems.*"

Match these terms with the correct statement or definition:

Afferent division
Autonomic nervous system
Central nervous system
Efferent division
Peripheral nervous system
Somatic motor nervous system

Central Nervous System 1. Consists of the brain and spinal cord.

Peripheral Nervous System 2. Nerves and ganglia outside the CNS.

Afferent Division 3. Transmits action potentials from sensory organs to CNS.

Somatic Motor Nervous System 4. Subdivision of the efferent division that transmits action potentials from the CNS to skeletal muscle only.

Autonomic Nervous System 5. Subdivision of the efferent division that transmits action potentials to smooth muscle, cardiac muscle, or glands; includes sympathetic and parasympathetic divisions.

Cells of the Nervous System

"*Cells of the nervous system are neurons and neuroglia.*"

A. Match these terms with the correct statement or definition:

Axon
Cell body
Collateral axon
Dendrite
Myelin sheath
Nissl bodies

cell body — 1. Location of the nucleus and source of information for protein synthesis.

nissl bodies — 2. Areas of rough endoplasmic reticulum concentration in the cell body.

dendrite — 3. Usually receives information and transmits it to the cell body.

axon — 4. Long cell process from the cell body; conducts action potentials.

collateral axon — 5. Branch of an axon.

myelin sheath — 6. Insulating layer of cells around an axon.

B. Match these terms with the correct parts labeled in figure 8.1:

Axon
Cell body
Collateral axon
Dendrite
Nucleus
Schwann cell
Terminal boutons
(Presynaptic terminal)

1. nucleus
2. collateral axon
3. Presynaptic terminal
4. Schwann cell
5. axon
6. cell body
7. dendrites

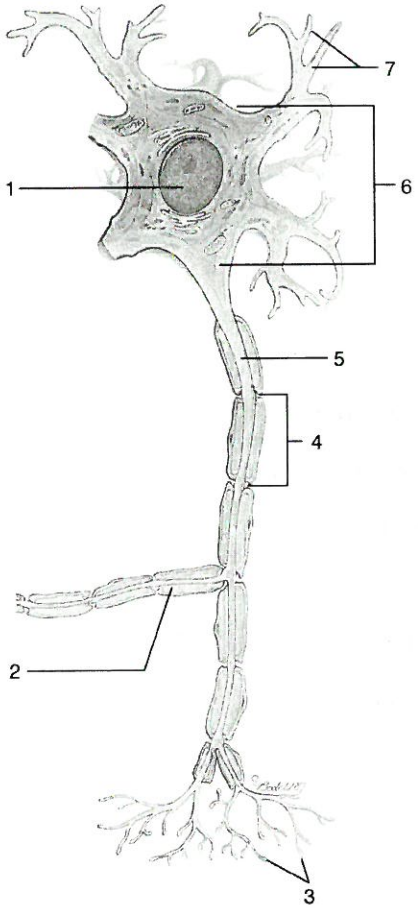

Figure 8.1

C. Match these terms with the correct statement or definition:

Bipolar
Multipolar
Unipolar

multipolar — 1. Neuron with several dendrites and one axon; most efferent neurons.

bipolar — 2. Neuron with one dendrite and one axon; found in the eye and nose.

unipolar — 3. Neuron with single process that functions as an axon and a dendrite; most afferent neurons.

Neuroglia

"*Unlike neurons, neuroglia retain the ability to divide, and are far more numerous.*"

Match these terms with the correct statement or definition:

Astrocytes
Ependymal cells
Microglia
Oligodendrocytes
Schwann cells

astrocytes — 1. Participate with blood vessel endothelium to form a permeability barrier in the CNS between blood and nerve cells.

ependymal cells — 2. Produce and circulate cerebrospinal fluid in the CNS.

microglia — 3. Help remove bacteria and cell debris from the CNS.

oligodendrocytes — 4. Form myelin sheaths around axons in the CNS.

schwann cells — 5. Form myelin sheaths around axons in the PNS.

Myelin Sheaths

"*Myelin sheaths surround many axons in both the CNS and PNS.*"

Using the terms provided, complete these statements:

Cell processes
CNS
Myelinated axons
Nodes of Ranvier
PNS
Unmyelinated axons

Axons are surrounded by the (1) of oligodendrocytes in the (2) or Schwann cells in the (3). (4) rest in indentations of the oligodendrocytes or Schwann cells, whereas (5) have cell processes repeatedly wrapped around them. In myelinated axons, gaps in the myelin sheath called (6) can be seen between the oligodendrocyte segments or between Schwann cells.

1. cell processes
2. CNS
3. PNS
4. Unmyelinated axons
5. Myelinated axons
6. nodes of Ravier

Organization of Nervous Tissue

"*Bundles of axons form nerve tracts or nerves, whereas cell bodies and their dendrites form the cortex, nuclei, or ganglia.*"

Match these terms with the correct statement or definition:

Cortex
Ganglion
Gray matter
Nerve
Nerve tract
Nucleus
White matter

1. gray matter — Color of groups of neuron cell bodies and their dendrites.
2. cortex — Gray matter on the surface of the brain.
3. nucleus — Cluster of gray matter located deep in the brain.
4. ganglion — Cluster of neuron cell bodies in the PNS.
5. white matter — Color produced by bundles of axons with their myelin sheaths.
6. nerve tract — Conduction pathway composed of white matter in the CNS.
7. nerve — Bundle of axons and its connective tissue sheath in the PNS.

Propagation of Action Potentials

"*When a stimulus is applied to a muscle cell or nerve cell, the membrane characteristics are changed for a very brief period of time.*"

A. Using the terms provided, complete these statements:

Ion channels
Negative
Positive
Potassium ions
Proteins and ions
Resting membrane potential
Sodium ions
Sodium-potassium exchange pump

The outside of most cell membranes is (1) positive compared to the inside of the cell membrane. This difference across the membrane of an unstimulated cell is called the (2) resting membrane potential. There is a higher concentration of (3) sodium ions outside the cell membrane than inside, and there is a higher concentration of (4) potassium ions inside the cell membrane than outside. This occurs largely because of the (5) sodium potassium exchange pump, which actively transports these ions. Sodium and potassium ions also move through (6) ion channels formed by proteins that extend across the cell membrane. In an unstimulated polarized cell, channels for (7) sodium ion are closed, whereas some of the channels for (8) potassium ion are open. Therefore, when a cell is at rest, the membrane is more permeable to (9) potassium ion than sodium ions. A few potassium ions leak out of the cell, and negatively charged (10) proteins & ions remain in the cell, setting up a net charge difference across the membrane.

B. Using the terms provided, complete these statements:

Action potential	Positive
All-or-none	Potassium ions
Depolarization	Repolarization
Excitable	Sodium ions
Local potential	Threshold
Negative	

Because they respond to stimulation, muscle and nerve cells are said to be (1). When a stimulus is applied to a nerve cell or muscle cell, some sodium ion channels open and (2) diffuse quickly into the cell. This causes the inside of the cell to become more positive, a change called (3). This depolarization results in a(n) (4). If the local potential reaches a(n) (5) value, many more sodium channels open, and the inside of the cell membrane becomes (6) relative to the outside of the membrane. As a result, sodium ion channels close and more potassium ion channels open, resulting in (7), a return to the resting membrane potential. The charge reversal and return to its resting level is called a(n) (8). Action potentials occur in a(n) (9) fashion.

1. excitable
2. sodium ions
3. depolarization
4. local potential
5. threshold
6. positive
7. repolarization
8. action potential
9. all-or-none

☞ Myelinated axons propagate action potentials much more rapidly than unmyelinated axons. Action potentials in myelinated axons jump from one node of Ranvier to the next, a process called saltatory conduction.

The Synapse

"*Synapses are junctions between a neuron and another neuron or an effector organ.*"

Match these terms with the correct statement or definition:

Acetylcholine and norepinephrine	Neurotransmitters
Acetylcholinesterase	Postsynaptic membrane
Depolarized	Presynaptic terminal
Hyperpolarized	Synaptic cleft
	Synaptic vesicles

presynaptic terminal 1. Axon end that interacts with other neurons or effector organs.

postsynaptic membrane 2. Membrane of the dendrite or effector cell.

synaptic cleft 3. Space separating the presynaptic terminal and postsynaptic membrane.

neurotransmitters 4. General term for chemical substances released from the presynaptic terminal.

synaptic vesicles 5. Structures in which the neurotransmitter is stored.

hyperpolarized 6. Condition in postsynaptic cell if potassium or chloride channels open.

acetylcholine & norepinephrine 7. Most common neurotransmitters.

acetylcholinesterase 8. Enzyme that breaks down acetylcholine soon after its release.

Reflexes

"*The reflex arc, or reflex, is the basic functional unit of the nervous system.*"

A. Using the terms provided, complete these statements:

Afferent neuron
Association neuron
Effector organ
Efferent neuron
Sensory receptor

In a reflex arc, stimuli are detected by a(n) (1), causing the production of action potentials that are carried to the central nervous system by a(n) (2). Within the central nervous system, afferent neurons usually synapse with a(n) (3). These neurons synapse with a(n) (4), which carries action potentials to the (5).

1. sensory receptor
2. afferent neuron
3. association neuron
4. efferent neuron
5. efferent organ

Neurons are organized in the CNS to form circuits. Convergent circuits have two or more neurons that converge and synapse, whereas in diverging circuits the axon splits and synapses with more than one neuron.

B. Match these parts of a reflex arc with the correct parts labeled in figure 8.2:

Afferent neuron
Association neuron
Effector organ
Efferent neuron
Sensory receptor

1. sensory receptor
2. afferent neuron
3. association neuron
4. efferent neuron
5. efferent organ

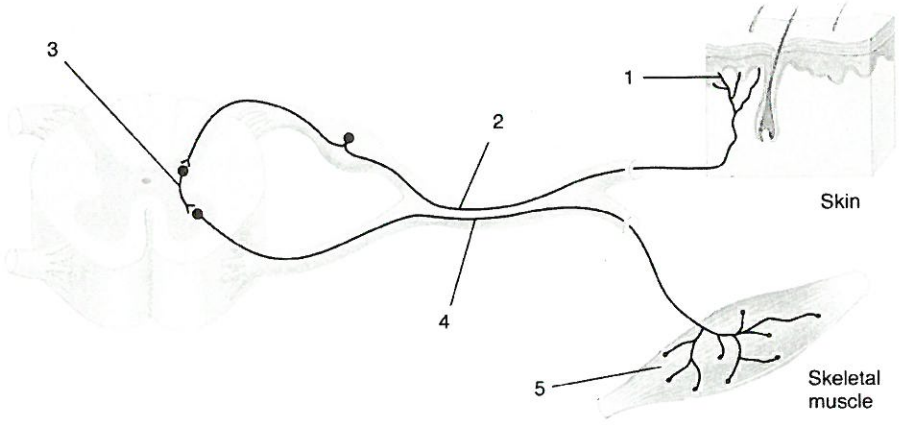

Figure 8.2

Central Nervous System

"*The central nervous system consists of the brain and spinal cord.*"

Match these terms with the correct statement or definition:

Brain
Spinal cord

brain 1. Part of the central nervous system housed within the cranial vault.

spinal cord 2. Part of the central nervous system from the foramen magnum to the second lumbar vertebra.

brain 3. Part of the central nervous system containing the brainstem, diencephalon, cerebrum and cerebellum.

The Brainstem

"*The brainstem connects the spinal cord to the remainder of the brain and is involved in many vital body functions.*"

Match these terms with the correct statement or definition:

Colliculi
Medulla oblongata
Midbrain
Pons
Pyramids
Reticular formation
Substantia nigra

medulla oblongata 1. Most inferior part of the brainstem; regulates heart rate, breathing, swallowing, coughing and sneezing.

pyramids 2. Two prominent enlargements on the medulla; descending nerve tracts involved in conscious control of skeletal muscle.

pons 3. Part of the brainstem superior to the medulla oblongata; a bridge between the cerebrum and cerebellum.

midbrains 4. Smallest and most superior part of the brainstem.

colliculi 5. Four mounds in the roof of the midbrain that are involved in hearing and visual reflexes.

substantia nigra 6. Black mass in the midbrain; part of basal nuclei, involved in regulation of general body movement.

reticular formation 7. Group of nuclei scattered throughout the brainstem that plays a role in arousing and maintaining consciousness; a major component of the reticular activating system.

Diencephalon

"*The diencephalon is the part of the brain between the brainstem and cerebrum.*"

A. Match these terms with the correct statement or definition:

Hypothalamus
Infundibulum
Mamillary bodies
Pineal body
Thalamus

thalamus — 1. Largest part of the diencephalon; processes most sensory input from the brainstem.

pineal body — 2. Endocrine gland in the epithalamus that may influence the onset of puberty.

hypothalamus — 3. Contains several small nuclei important in maintaining homeostasis; plays a central role in control of temperature, hunger and thirst.

infundibulum — 4. Funnel-shaped stalk that extends from the floor of the hypothalamus to the pituitary gland.

mamillary bodies — 5. Most posterior portion of the hypothalamus, involved in emotional responses to odors and memory.

B. Match these terms with the correct parts labeled in figure 8.3:

Corpus callosum
Hypothalamus
Infundibulum
Mamillary body
Pineal body
Pituitary gland
Thalamus

1. hypothalamus
2. mamillary body
3. infundibulum
4. pituitary gland
5. pineal body
6. thalamus
7. corpus callosum

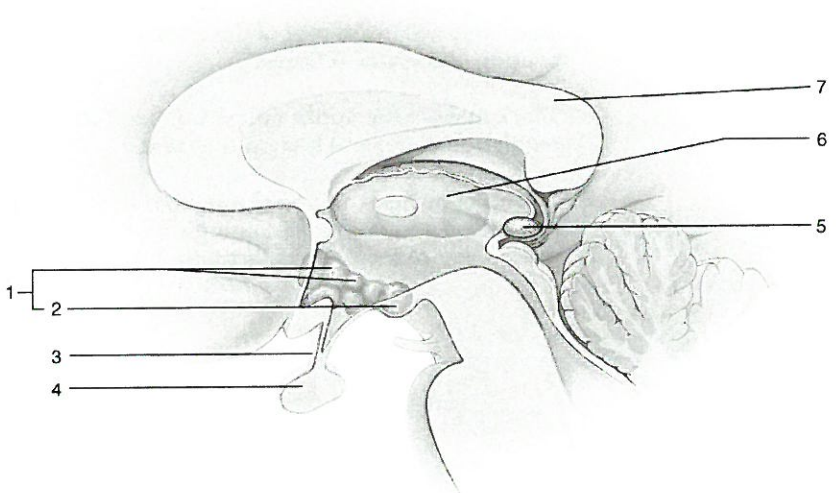

Figure 8.3

Cerebrum

"*The cerebrum is the largest part of the brain.*"

A. Match these terms with the correct statement or definition:

Central sulcus
Gyri
Lateral fissure
Longitudinal fissure
Sulci

longitudinal fissure — 1. Deep groove that separates right and left cerebral hemispheres.

gyri — 2. Raised folds on the surface of each cerebral hemisphere.

central sulcus — 3. Groove that separates the frontal and parietal lobes.

lateral fissure — 4. Deep groove that separates the temporal lobe from the rest of the cerebrum.

B. Match these lobes of the cerebrum with the correct primary function:

Frontal lobe
Occipital lobe
Parietal lobe
Temporal lobe

frontal lobe — 1. Voluntary motor function, motivation, aggression, mood, and smell.

parietal lobe — 2. Reception and evaluation of most sensory information, such as touch, balance, and taste.

occipital lobe — 3. Reception and integration of visual input.

temporal lobe — 4. Evaluation of auditory and olfactory input; also memory, abstract thought and judgment.

Cerebral Cortex

"*The gray matter on the outer surface of the cerebrum is the cortex.*"

A. Match these terms with the correct statement or definition:

Association areas
Primary sensory areas
Primary somatic sensory cortex

primary sensory areas — 1. Specific regions of the cerebral cortex where sensory sensations are perceived.

primary somatic sensory cortex — 2. Located posterior to the central sulcus; receives general sensory information such as pain, pressure, and temperature.

association areas — 3. Areas of the cortex next to primary sensory areas; involved in recognition of sensory input.

B. Match these areas of the cerebral cortex with the correct description:

Prefrontal area
Premotor area
Primary motor cortex

primary motor cortex — 1. Located in the posterior portion of the frontal lobe; controls voluntary movements of skeletal muscle.

premotor area — 2. Staging area for organization of motor functions before they are initiated.

prefrontal area — 3. Location for motivation and foresight to plan and initiate movements; regulation of emotional behavior and mood.

C. Match these terms with the correct statement or definition:

Aphasia
Broca's area
Wernicke's area

Wernicke's area — 1. Sensory speech area in the parietal lobe.

Broca's area — 2. Motor speech area in the inferior portion of the frontal lobe.

aphasia — 3. Absent or defective speech or language comprehension.

D. Match these terms with the correct statement or definition:

Long-term memory
Memory engrams
Sensory memory
Short-term memory

sensory memory — 1. Brief retention of sensory input received by the brain while something is scanned, evaluated, and acted upon.

short-term memory — 2. Sensory information that is held for a few seconds to a few minutes; usually limited to about seven bits of information.

long-term memory — 3. Memory that may become permanent.

memory engrams — 4. Whole series of neurons probably involved in long-term retention of information.

☞ Electrodes placed on a person's scalp can record an electroencephalogram (EEG). The EEG displays wavelike patterns (brain waves) of the brain's electrical activity.

E. Match the structure with the correct function:

Corpus callosum
Left cerebral hemisphere
Right cerebral hemisphere

left cerebral hemisphere — 1. Controls muscular function in and receives sensory input from the right half of the body.

corpus callosum — 2. Largest commissure connecting the two cerebral hemispheres.

left cerebral hemisphere — 3. Thought to be the analytic hemisphere, emphasizing such skills as mathematics and speech.

Basal Nuclei, Limbic System, and Cerebellum

"*The basal nuclei, limbic system, and cerebellum are important in controlling body functions.*"

Match these terms with the correct statement or definition:

Basal nuclei
Cerebellum
Limbic system

basal nuclei
1. Functionally related nuclei consisting primarily of the corpus striatum and substantia nigra; involved in posture and planning and coordinating motor movements.

limbic system
2. Includes olfactory cortex and portions of diencephalon and cerebrum; initiates responses necessary for survival, such as hunger and thirst.

cerebellum
3. Functions as a comparator; involved in balance, maintenance of muscle tone, and fine motor movement.

cerebellum
4. Capable of "learning" motor skills.

limbic system
5. Influences emotions, visceral responses to emotions, motivation, and mood.

☞ Proprioceptive neurons innervate joints and tendons, providing information about the position of body parts.

Spinal Cord

"*The spinal cord extends from the foramen magnum of the skull to the second lumbar vertebra.*"

A. Match these terms with the correct statement or definition:

Anterior (ventral) horn
Dorsal root
Dorsal root ganglia
Lateral horn
Nerve tract
Posterior (dorsal) horn
Spinal nerve
Ventral root

posterior (dorsal) horn
1. Gray matter in the spinal cord containing sensory neurons.

anterior (ventral) horn
2. Gray matter in the spinal cord containing motor neurons.

lateral horn
3. Gray matter in the spinal cord containing sympathetic autonomic neurons.

nerve tract
4. Part of white matter; ascending or descending axons that are grouped by function; nerve pathway.

dorsal root
5. Afferent nerve processes that carry action potentials to the spinal cord.

ventral root
6. Efferent nerve processes that carry action potentials away from the spinal cord.

dorsal root ganglia
7. Structures containing the cell bodies of afferent neurons.

spinal nerve
8. Formed by joining of dorsal and ventral roots.

B. Match these terms with the correct parts labeled in figure 8.4:

Anterior (ventral) horn
Dorsal root
Dorsal root ganglion
Gray matter
Lateral horn
Posterior (dorsal) horn
Spinal nerve
Ventral root
White matter
(nerve tracts)

1. dorsal root
2. dorsal root ganglion
3. spinal nerve
4. ventral root
5. white matter
6. gray matter
7. anterior horn
8. lateral horn
9. posterior horn

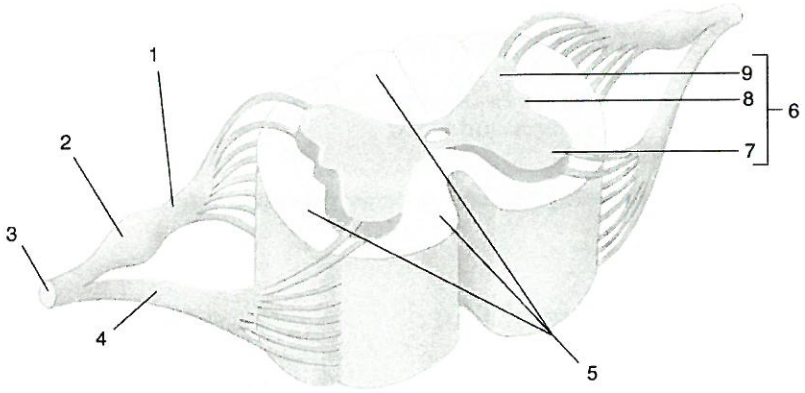

Figure 8.4

Spinal Pathways

"*The names of most pathways in the central nervous system reflect their general function.*"

Match these terms with the correct statement or definition:

Ascending pathways
Descending pathways
Lower motor neurons
Upper motor neurons

ascending pathways 1. Spinothalamic, dorsal column, and spinocerebellar pathways.

descending pathways 2. Direct (corticospinal) and indirect pathways.

lower motor neurons 3. Axons of these cells pass from either the anterior horn of spinal cord gray matter or cranial nerve nuclei of the brainstem to skeletal muscles.

upper motor neurons 4. Axons of these cells pass from the cerebral cortex, cerebellum, and brainstem to lower motor neurons.

Meninges

"*Three connective tissue layers, the meninges, surround and protect the brain and spinal cord.*"

Match these terms with the correct statement or definition:

Arachnoid mater
Dura mater
Dural sinus
Epidural space
Pia mater
Subarachnoid space

dura mater — 1. Most superficial and thickest layer of the meninges.

dural sinus — 2. Spaces within the dura mater that collect blood from the small veins of the brain.

epidural space — 3. Space that surrounds the dura mater of the spinal cord.

arachnoid mater — 4. Thin, wispy middle meningeal layer.

pia mater — 5. Meningeal layer that is very tightly bound to the surface of the brain and spinal cord.

subarachnoid space — 6. Space between the arachnoid mater and the pia mater that is filled with cerebrospinal fluid.

Ventricles and Cerebrospinal Fluid

"*The CNS contains fluid-filled cavities called ventricles.*"

Using the terms provided, complete these statements:

Arachnoid granulations
Central canal
Cerebral aqueduct
Choroid plexus
Fourth ventricle
Lateral ventricle
Third ventricle

Each cerebral hemisphere contains a relatively large cavity, the (1). A smaller midline cavity, the (2), is in the center of the diencephalon between the two halves of the thalamus and is connected by foramina to the lateral ventricles. The (3) is located at the base of the cerebellum and is connected to the third ventricle by a narrow canal, the (4). The fourth ventricle is continuous with the (5) of the spinal cord. Cerebrospinal fluid, which fills the ventricles, central canal, and subarachnoid space, is produced as a blood filtrate by the (6) in the ventricles. Cerebrospinal fluid passes from the subarachnoid space into the blood through the (7) in the superior sagittal sinus.

1. lateral ventricle
2. third ventricle
3. fourth ventricle
4. cerebral aqueduct
5. central canal
6. choroid plexus
7. arachnoid granulations

Peripheral Nervous System

"*The peripheral nervous system collects information and relays it by way of afferent fibers to the central nervous system.*"

Match these terms with the correct statement or definition:

Afferent
Cranial
Efferent
Spinal

cranial — 1. Part of the peripheral nervous system with 12 pairs of nerves.

spinal — 2. Part of the peripheral nervous system with 31 pairs of nerves.

afferent — 3. Fibers that collect information and carry it to the CNS.

efferent — 4. Fibers that relay information from the CNS to various parts of the body.

Cranial Nerves

"*There are three general categories of cranial nerve function: (1) sensory (afferent), (2) motor (efferent), and (3) parasympathetic (efferent).*"

Match the cranial nerve with the correct function:

Olfactory (I)
Optic (II)
Oculomotor (III)
Trochlear (IV)
Trigeminal(V)
Abducens (VI)
Facial (VII)
Vestibulocochlear (VIII)
Glossopharyngeal (IX)
Vagus (X)
Accessory (XI)
Hypoglossal (XII)

olfactory (I) — 1. Smell.

optic — 2. Vision.

oculomotor — 3. Controls four of the six eye muscles, constricts the pupil, and thickens the lens.

trigeminal — 4. Sensory to face and teeth.

facial — 5. Motor to muscles of facial expression; parasympathetic to salivary and tear glands.

vestibulocochlear — 6. Hearing and balance.

vagus — 7. Parasympathetic to viscera of the thorax and abdomen.

hypoglossal — 8. Movement of the tongue.

Spinal Nerves

"*The spinal nerves arise along the spinal cord from the union of the dorsal root and ventral root.*"

Using the terms provided, complete these statements:

Brachial	Lumbosacral
Cervical	Phrenic
Femoral	Plexuses
Ischiadic (sciatic)	Radial

All the spinal nerves are mixed nerves, containing both sensory and somatic motor fibers. Most of the spinal nerves are organized into three (1), where nerves come together and then separate. The (2) plexus originates from spinal nerves C1 to C4. One of the most important branches of this plexus is the (3) nerve, which innervates the diaphragm. The (4) plexus originates from nerves C5 to T1, and has five major nerves arising from it: the axillary, (5), ulnar, musculocutaneous, and median nerves. The (6) plexus originates from spinal nerves L1 to S4, and the obturator, (7), tibial, and common fibular nerves exit this plexus. Together, the tibial and common fibular nerves are called the (8) nerve.

1. plexuses
2. cervical
3. phrenic
4. brachial
5. radial
6. lumbosacral
7. femoral
8. ischiadic

Autonomic Nervous System

"*The autonomic system differs structurally and functionally from the somatic motor system.*"

Match these terms with the correct statement or definition:

Autonomic ganglion	Preganglionic neuron
Autonomic system	Somatic motor system
Postganglionic neuron	

somatic motor nervous system — 1. Efferent neurons with single axons extending from the CNS to skeletal muscle.

autonomic nervous system — 2. Efferent system with two neurons in series extending from the CNS to smooth muscle, cardiac muscle, and glands.

preganglionic neuron — 3. First neuron in an autonomic pathway.

autonomic ganglion — 4. Location where preganglionic neurons synapse with postganglionic neurons.

Sympathetic and Parasympathetic Divisions

"*The sympathetic division is sometimes referred to as the "fight or flight" system.*"

A. Using the terms provided, complete these statements:

Anterior (ventral)
Brainstem nuclei
Collateral ganglia
Sympathetic chain ganglia
Lateral
Posterior (dorsal)
Terminal ganglia

Cell bodies of sympathetic preganglionic neurons are in the (1) horn of spinal cord gray matter between T1 and L2. Axons of the sympathetic preganglionic neurons exit through ventral roots and project to the (2), which are connected to each other along both sides of the spinal cord. Although some sympathetic preganglionic axons synapse here, others pass through and synapse in (3), which are located nearer the target organs. Cell bodies of parasympathetic preganglionic neurons are located within (4) of cranial nerves, or the lateral part of the gray matter of S2 to S4 regions of the spinal cord. Axons of parasympathetic preganglionic neurons extend to (5) located either near or embedded in the wall of target organs.

1. lateral
2. sympathetic chain ganglia
3. collateral ganglia
4. brainstem nuclei
5. terminal ganglia

B. Match these divisions of the autonomic system with the correct description:

Parasympathetic division
Sympathetic division

sympathetic division — 1. Division that increases heart rate, blood pressure, respiration, blood glucose, and mental activity.

parasympathetic division — 2. Division that stimulates activities such as digestion, defecation, and urination, and slows heart rate and respiration.

sympathetic division — 3. Most postganglionic neurons of this division secrete norepinephrine.

parasympathetic division — 4. All postganglionic neurons of this division secrete acetylcholine.

Quick Recall

1. Name five functions of the nervous system.

2. Name two systems of the efferent division of the nervous system. Give an important characteristic of each.

3. List three types of neurons based on their shape and give an example of where each is found in the body.

4. List five types of neuroglia. Give a function of each type.

5. List two causes of differences in ion concentration inside and outside the cell membrane.

6. List three components of a synapse.

7. List the four major parts of the brain.

8. List four lobes of the cerebrum, and give an important function of each.

9. List the three meninges surrounding the brain and spinal cord.

10. List the three general categories of cranial nerve function.

11. Name three plexuses of spinal nerves, and list a major nerve that arises from each.

Word Parts

Give an example of a new vocabulary word that contains each word part.

WORD PART	MEANING	EXAMPLE
af-	to	1. _____
ef-	out	2. _____
gli-	glue	3. _____
dendr-	tree	4. _____
gangli-	knot; swelling	5. _____
neur-	nerve	6. _____

Mastery Learning Activity

Place the letter corresponding to the correct answer in the space provided.

_____ 1. The part of the nervous system that transmits impulses from the CNS to skeletal muscle is the
a. somatic motor nervous system.
b. autonomic nervous system.
c. central nervous system.
d. afferent division.

_____ 2. A neuron with many short dendrites and one long axon is a
a. multipolar neuron.
b. bipolar neuron.
c. unipolar neuron.

_____ 3. Neuroglia that help remove bacteria and debris from the CNS are called
a. oligodendrocytes.
b. microglia.
c. ependymal cells.
d. astrocytes.
e. somas.

_____ 4. Myelin sheaths can be formed by
a. cell process of oligodendrocytes.
b. Schwann cells.
c. astrocytes.
d. ependymal cells.
e. both a and b

_____ 5. Clusters of nerve cell bodies within the PNS are called
a. nuclei.
b. nodes of Ranvier.
c. myelin sheaths.
d. ganglia.

_____ 6. Concerning conditions in a resting cell membrane
a. there are more potassium ions outside the cell than inside.
b. there are more sodium ions inside the cell than outside.
c. the cell membrane is more permeable to sodium ions than potassium ions.
d. the sodium-potassium exchange pump moves sodium out of the cell.
e. all of the above

_____ 7. To produce an action potential in a neuron,
a. depolarization must occur.
b. the threshold level of membrane potential must be reached.
c. the cell membrane must become permeable to sodium ions.
d. all of the above.

_____ 8. Neurotransmitters are released in a synapse and bind to
a. presynaptic terminals.
b. the synaptic cleft.
c. the base of the axon.
d. receptors on the postsynaptic terminal.

_____ 9. Important centers for control of heart rate, blood vessel diameter, breathing, swallowing and coughing are located in the
a. cerebrum.
b. cerebellum.
c. medulla oblongata.
d. basal nuclei.

_____ 10. Our conscious state is maintained by activity generated in the
a. cerebellum.
b. reticular formation.
c. limbic system.
d. medulla oblongata.

_____ 11. The major relay station for action potentials going to and from the cerebral cortex is the
a. hypothalamus.
b. pineal body.
c. pons.
d. cerebellum.
e. thalamus

_____ 12. General sensory input, such as pain, touch, and temperature are carried to the
a. primary motor area.
b. association areas.
c. primary somatic sensory area.
d. prefrontal area.

_____ 13. Given these areas of the cerebral cortex:
1. Broca's area
2. premotor area
3. primary motor area
4. Wernicke's area

If a person hears and understands a word and then says the word out loud, in what order are the areas used?
a. 1,4,2,3
b. 1,4,3,2
c. 4,1,2,3
d. 4,1,3,2

_____ 14. The main connection between the right and left hemisphere of the cerebrum is the
a. basal nuclei.
b. limbic system.
c. corpus callosum.
d. cerebellum.

_____ 15. All sensory neurons entering the spinal cord
a. enter through the dorsal horn.
b. have their cell bodies in the dorsal root ganglia.
c. are part of a spinal nerve.
d. all of the above

_____ 16. Which of these would be a descending tract in the spinal cord?
a. spinothalamic tract
b. corticospinal tract
c. spinocerebellar tract
d. dorsal column

_____ 17. The outermost meninges layer is a thick, tough membrane called the
a. dura mater.
b. arachnoid.
c. pia mater.
d. subarachnoid layer.

_____ 18. There are ____ pairs of cranial nerves, and ____ pairs of spinal nerves.
a. 12, 24
b. 31, 12
c. 12, 31
d. 10, 12

_____ 19. A collection of spinal nerves that join together after leaving the spinal cord is called a
a. ganglion.
b. nucleus.
c. projection nerve.
d. plexus.

_____ 20. Which of these is expected if the sympathetic nervous system is activated?
a. Blood flow to the digestive organs increases.
b. Blood flow to skeletal muscles increases.
c. Heart rate decreases.
d. Glucose release from the liver decreases.
e. both a and b

Use a separate sheet of paper to complete this section.

1. Given two series of neurons, explain why action potentials could be propagated along one series more rapidly than the other series.

2. Although alcohol has effects on other areas of the brain, it has a considerable effect on cerebellar function. What kinds of motor tests would help reveal the drunken condition?

3. Would a patient with Parkinson's disease be expected to have reduced or exaggerated reflexes? Explain.

4. A patient has a severe case of the hiccoughs. The physician injects an anesthetic solution into the neck about an inch above the clavicle. What nerve was injected?