

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 peripheral 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

1. Consists of the brain and spinal cord.
2. Nerves and ganglia outside the CNS.
3. Transmits action potentials from sensory organs to CNS.
4. Subdivision of the efferent division that transmits action potentials from the CNS to skeletal muscle only.
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

1. Location of the nucleus and source of information for protein synthesis.
2. Areas of rough endoplasmic reticulum concentration in the cell body.
3. Usually receives information and transmits it to the cell body.
4. Long cell process from the cell body; conducts action potentials.
5. Branch of an axon.
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. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

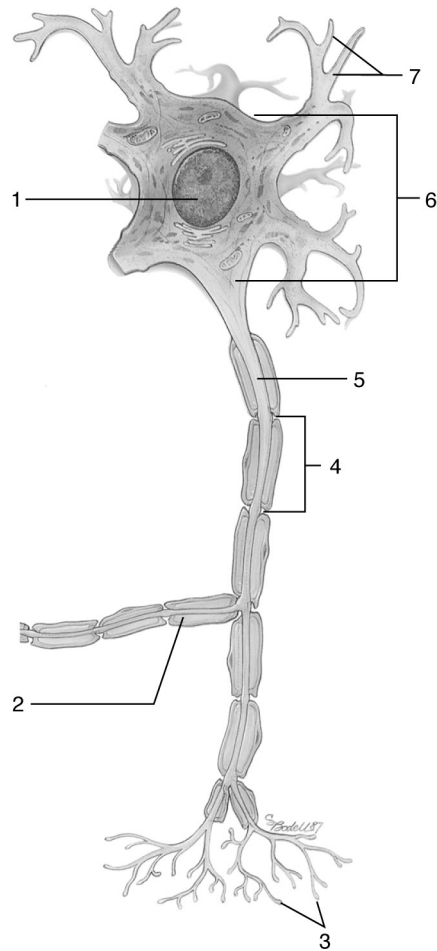


Figure 8.1

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

Bipolar
Multipolar

Unipolar

1. Neuron with several dendrites and one axon; most efferent neurons.
2. Neuron with one dendrite and one axon; found in the eye and nose.
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

1. Participate with blood vessel endothelium to form a permeability barrier in the CNS between blood and nerve cells.
2. Produce and circulate cerebrospinal fluid in the CNS.
3. Help remove bacteria and cell debris from the CNS.
4. Form myelin sheaths around axons in the CNS.
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

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

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.

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. Color of groups of neuron cell bodies and their dendrites. |
| _____ | 2. Gray matter on the surface of the brain. |
| _____ | 3. Cluster of gray matter located deep in the brain. |
| _____ | 4. Cluster of neuron cell bodies in the PNS. |
| _____ | 5. Color produced by bundles of axons with their myelin sheaths. |
| _____ | 6. Conduction pathway composed of white matter in the CNS. |
| _____ | 7. 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	Resting membrane
Negative	potential
Positive	Sodium ions
Potassium ions	Sodium-potassium
Proteins and ions	exchange pump

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

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

B. Using the terms provided, complete these statements:

Action potential
All-or-none
Depolarization
Excitable
Local potential
Negative

Positive
Potassium ions
Repolarization
Sodium ions
Threshold

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

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.



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
Acetylcholinesterase
Depolarized
Hyperpolarized

Neurotransmitters
Postsynaptic membrane
Presynaptic terminal
Synaptic cleft
Synaptic vesicles

- | | |
|-------|---|
| _____ | 1. Axon end that interacts with other neurons or effector organs. |
| _____ | 2. Membrane of the dendrite or effector cell. |
| _____ | 3. Space separating the presynaptic terminal and postsynaptic membrane. |
| _____ | 4. General term for chemical substances released from the presynaptic terminal. |
| _____ | 5. Structures in which the neurotransmitter is stored. |
| _____ | 6. Condition in postsynaptic cell if potassium or chloride channels open. |
| _____ | 7. Most common neurotransmitters. |
| _____ | 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 | Efferent neuron |
| Association neuron | Sensory receptor |
| Effector organ | |

1. _____
2. _____
3. _____
4. _____
5. _____

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).



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 | 1. _____ |
| Association neuron | 2. _____ |
| Effector organ | 3. _____ |
| Efferent neuron | 4. _____ |
| Sensory receptor | 5. _____ |

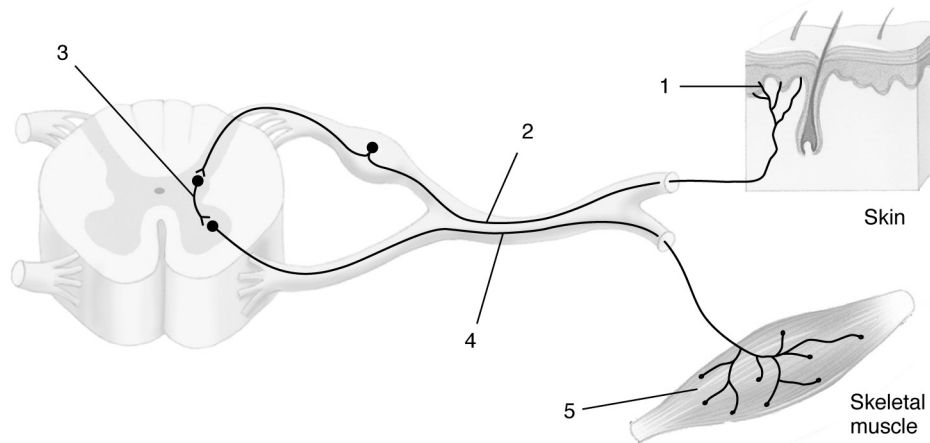


Figure 8.2

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

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

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

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

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

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

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

4. Smallest and most superior part of the brainstem.

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

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

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

1. Largest part of the diencephalon; processes most sensory input from the brainstem.
2. Endocrine gland in the epithalamus that may influence the onset of puberty.
3. Contains several small nuclei important in maintaining homeostasis; plays a central role in control of temperature, hunger and thirst.
4. Funnel-shaped stalk that extends from the floor of the hypothalamus to the pituitary gland.
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. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

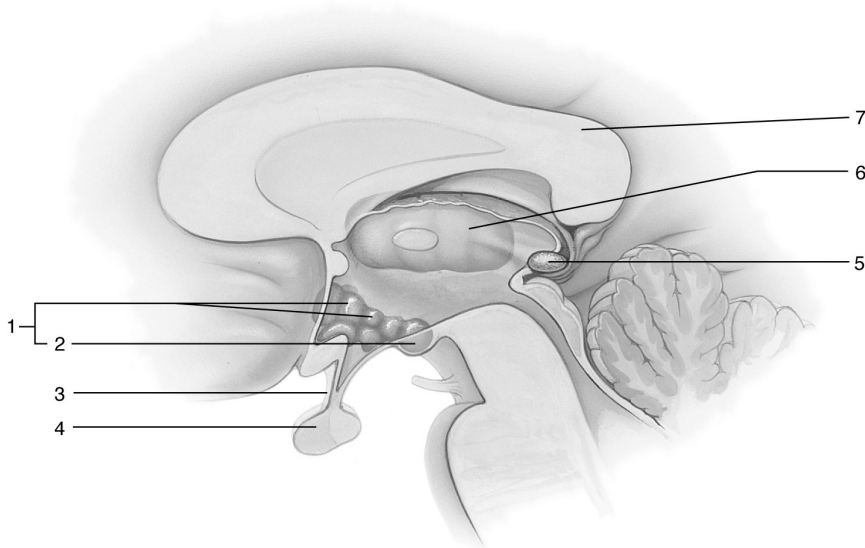


Figure 8.3

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

1. Deep groove that separates right and left cerebral hemispheres.
2. Raised folds on the surface of each cerebral hemisphere.
3. Groove that separates the frontal and parietal lobes.
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

1. Voluntary motor function, motivation, aggression, mood, and smell.
2. Reception and evaluation of most sensory information, such as touch, balance, and taste.
3. Reception and integration of visual input.
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

1. Specific regions of the cerebral cortex where sensory sensations are perceived.
2. Located posterior to the central sulcus; receives general sensory information such as pain, pressure, and temperature.
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

1. Located in the posterior portion of the frontal lobe; controls voluntary movements of skeletal muscle.
2. Staging area for organization of motor functions before they are initiated.
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

1. Sensory speech area in the parietal lobe.
2. Motor speech area in the inferior portion of the frontal lobe.
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

1. Brief retention of sensory input received by the brain while something is scanned, evaluated, and acted upon.
2. Sensory information that is held for a few seconds to a few minutes; usually limited to about seven bits of information.
3. Memory that may become permanent.
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

1. Controls muscular function in and receives sensory input from the right half of the body.
2. Largest commissure connecting the two cerebral hemispheres.
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

1. Functionally related nuclei consisting primarily of the corpus striatum and substantia nigra; involved in posture and planning and coordinating motor movements.
2. Includes olfactory cortex and portions of diencephalon and cerebrum; initiates responses necessary for survival, such as hunger and thirst.
3. Functions as a comparator; involved in balance, maintenance of muscle tone, and fine motor movement.
4. Capable of "learning" motor skills.
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

1. Gray matter in the spinal cord containing sensory neurons.
2. Gray matter in the spinal cord containing motor neurons.
3. Gray matter in the spinal cord containing sympathetic autonomic neurons.
4. Part of white matter; ascending or descending axons that are grouped by function; nerve pathway.
5. Afferent nerve processes that carry action potentials to the spinal cord.
6. Efferent nerve processes that carry action potentials away from the spinal cord.
7. Structures containing the cell bodies of afferent neurons.
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. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

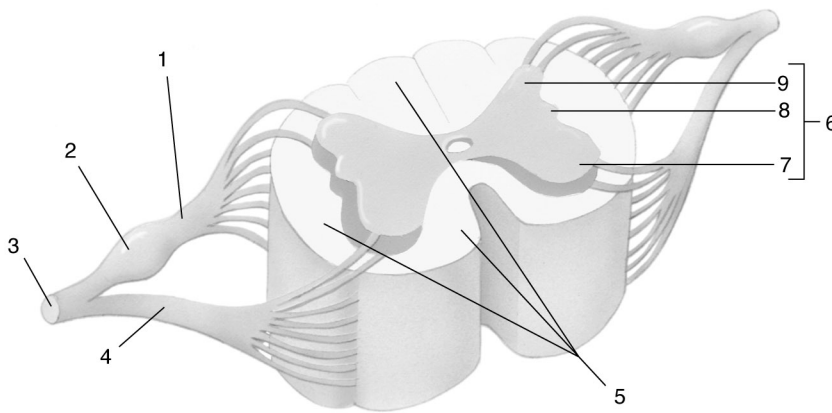


Figure 8.4

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

- _____
- _____
- _____
- _____

1. Spinothalamic, dorsal column, and spinocerebellar pathways.
2. Direct (corticospinal) and indirect pathways.
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.
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

1. Most superficial and thickest layer of the meninges.
2. Spaces within the dura mater that collect blood from the small veins of the brain.
3. Space that surrounds the dura mater of the spinal cord.
4. Thin, wispy middle meningeal layer.
5. Meningeal layer that is very tightly bound to the surface of the brain and spinal cord.
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

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

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.

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

1. Part of the peripheral nervous system with 12 pairs of nerves.
2. Part of the peripheral nervous system with 31 pairs of nerves.
3. Fibers that collect information and carry it to the CNS.
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)

1. Smell.
2. Vision.
3. Controls four of the six eye muscles, constricts the pupil, and thickens the lens.
4. Sensory to face and teeth.
5. Motor to muscles of facial expression; parasympathetic to salivary and tear glands.
6. Hearing and balance.
7. Parasympathetic to viscera of the thorax and abdomen.
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

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

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.

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	

- _____
- _____
- _____
- _____

1. Efferent neurons with single axons extending from the CNS to skeletal muscle.
2. Efferent system with two neurons in series extending from the CNS to smooth muscle, cardiac muscle, and glands.
3. First neuron in an autonomic pathway.
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) | Lateral |
| Brainstem nuclei | Posterior (dorsal) |
| Collateral ganglia | Terminal ganglia |
| Sympathetic chain ganglia | |

1. _____
2. _____
3. _____
4. _____
5. _____

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.

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

- | | |
|--|--------------------------|
| | Parasympathetic division |
| | Sympathetic division |

- | | |
|-------|--|
| _____ | 1. Division that increases heart rate, blood pressure, respiration, blood glucose, and mental activity. |
| _____ | 2. Division that stimulates activities such as digestion, defecation, and urination, and slows heart rate and respiration. |
| _____ | 3. Most postganglionic neurons of this division secrete norepinephrine. |
| _____ | 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.

- | | |
|---|--|
| <p>_____ 1. The part of the nervous system that transmits impulses from the CNS to skeletal muscle is the</p> <ol style="list-style-type: none"> a. somatic motor nervous system. b. autonomic nervous system. c. central nervous system. d. afferent division. | <p>_____ 2. A neuron with many short dendrites and one long axon is a</p> <ol style="list-style-type: none"> a. multipolar neuron. b. bipolar neuron. c. unipolar neuron. |
|---|--|

- _____ 3. Neuroglia that help remove bacteria and debris from the CNS are called
- oligodendrocytes.
 - microglia.
 - ependymal cells.
 - astrocytes.
 - somas.
- _____ 4. Myelin sheaths can be formed by
- cell process of oligodendrocytes.
 - Schwann cells.
 - astrocytes.
 - ependymal cells.
 - both a and b
- _____ 5. Clusters of nerve cell bodies within the PNS are called
- nuclei.
 - nodes of Ranvier.
 - myelin sheaths.
 - ganglia.
- _____ 6. Concerning conditions in a resting cell membrane
- there are more potassium ions outside the cell than inside.
 - there are more sodium ions inside the cell than outside.
 - the cell membrane is more permeable to sodium ions than potassium ions.
 - the sodium-potassium exchange pump moves sodium out of the cell.
 - all of the above
- _____ 7. To produce an action potential in a neuron,
- depolarization must occur.
 - the threshold level of membrane potential must be reached.
 - the cell membrane must become permeable to sodium ions.
 - all of the above.
- _____ 8. Neurotransmitters are released in a synapse and bind to
- presynaptic terminals.
 - the synaptic cleft.
 - the base of the axon.
 - receptors on the postsynaptic terminal.
- _____ 9. Important centers for control of heart rate, blood vessel diameter, breathing, swallowing and coughing are located in the
- cerebrum.
 - cerebellum.
 - medulla oblongata.
 - basal nuclei.
- _____ 10. Our conscious state is maintained by activity generated in the
- cerebellum.
 - reticular formation.
 - limbic system.
 - medulla oblongata.
- _____ 11. The major relay station for action potentials going to and from the cerebral cortex is the
- hypothalamus.
 - pineal body.
 - pons.
 - cerebellum.
 - thalamus
- _____ 12. General sensory input, such as pain, touch, and temperature are carried to the
- primary motor area.
 - association areas.
 - primary somatic sensory area.
 - prefrontal area.
- _____ 13. Given these areas of the cerebral cortex:
- Broca's area
 - premotor area
 - primary motor area
 - 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?
- 1,4,2,3
 - 1,4,3,2
 - 4,1,2,3
 - 4,1,3,2
- _____ 14. The main connection between the right and left hemisphere of the cerebrum is the
- basal nuclei.
 - limbic system.
 - corpus callosum.
 - cerebellum.

- _____ 15. All sensory neurons entering the spinal cord
- enter through the dorsal horn.
 - have their cell bodies in the dorsal root ganglia.
 - are part of a spinal nerve.
 - all of the above
- _____ 16. Which of these would be a descending tract in the spinal cord?
- spinothalamic tract
 - corticospinal tract
 - spinocerebellar tract
 - dorsal column
- _____ 17. The outermost meninges layer is a thick, tough membrane called the
- dura mater.
 - arachnoid.
 - pia mater.
 - subarachnoid layer.
- _____ 18. There are _____ pairs of cranial nerves, and _____ pairs of spinal nerves.
- 12, 24
 - 31, 12
 - 12, 31
 - 10, 12
- _____ 19. A collection of spinal nerves that join together after leaving the spinal cord is called a
- ganglion.
 - nucleus.
 - projection nerve.
 - plexus.
- _____ 20. Which of these is expected if the sympathetic nervous system is activated?
- Blood flow to the digestive organs increases.
 - Blood flow to skeletal muscles increases.
 - Heart rate decreases.
 - Glucose release from the liver decreases.
 - both a and b



FINAL CHALLENGES



Use a separate sheet of paper to complete this section.

- Given two series of neurons, explain why action potentials could be propagated along one series more rapidly than the other series.
- 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?
- Would a patient with Parkinson's disease be expected to have reduced or exaggerated reflexes? Explain.
- 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?