

The human nervous system consists of millions of nerve cells (neurons, see Plate 98) and related specialized supporting cells (neuroglia) arranged into organs to form a central nervous system, consisting of the brain and spinal cord, and a peripheral nervous system, consisting of cranial and spinal nerves and their numerous branches.

**Color the headings Central Nervous System, Brain, and Brain Stem, titles A through I, and the related structures at the upper right.**

The brain resides in the cranial cavity of the skull and consists of a pair of hemispheres, a central brain stem, and a cerebellum. Each *cerebral hemisphere* has a large central cavity, the lateral ventricle; an outer rim of gray matter, the cerebral cortex; a central mass of white matter, composed of axons connecting the cortical neurons with lower centers; and a few masses of gray matter (called nuclei in the central nervous system) at the base (not shown).

The cerebral cortex has numerous fissures (sulci) and ridges (gyri) that make up distinct lobes. Certain higher nervous functions, such as vision, language, sensory awareness, and hearing, are performed in specific lobes. Memory and emotional responses are found among all these lobes, especially in the limbic lobe (not shown). The basal ganglia (nuclei) at the base of the hemispheres are concerned with control of postural and other unskilled movements.

At the uppermost part of the brain stem are the *epithalamus* and *thalamus*. The epithalamus, including the pineal gland, is in part concerned with day-night cycles and related physiological changes. The thalamus is the great relay center for all sensory input except smell. The *hypothalamus* is concerned with such things as hunger, satiety, temperature control, expression of emotions, and control of the visceral nervous system and part of the endocrine system.

The rest of the brain stem is organized into the midbrain, pons, and medulla, through which run larger masses of axons called tracts conducting impulses up and down the brain stem. The midbrain is concerned in part with visual and auditory reflexes (automatic responses), the pons in part with impulses going to the cerebellum, and the medulla in part with regulation of heartbeat and respiration.

The *cerebellum* consists of an outer rim of gray matter, a central mass of white matter, and a central group of nuclei. The cerebellum is associated with balance and equilibrium, fine movement, and muscular coordination.

The spinal cord begins at the base of the skull and continues through the spinal canal of the vertebral column to terminate at the level of the second lumbar vertebra (a level about a hand's breadth above the navel). It consists of an H-shaped central column of gray matter surrounded by white matter. By way of spinal nerves, the spinal cord receives sensory input from and sends motor commands to all parts of the body below the head.

**Color the heading Peripheral Nervous System, titles J and K, and the related structures at left. Note that the spinal cord ends at midback and that spinal nerves descend within the spinal canal to reach their point of exit from the vertebral column.**

The peripheral nervous system consists of 12 pairs of *cranial nerves* and 31 pairs of *spinal nerves* and their branches, which connect the central nervous system to receptors, glands, and muscles throughout the body. The neurons that compose these nerves are classified as "sensory neurons" if they bring impulses toward the central nervous system and as "motor neurons" if they bring impulses away from it. A nerve is a bundle of axons and/or sensory neuron processes that are axonal in structure and dendritic in function. Nerves may consist of sensory and/or motor processes. Spinal nerves arise from the cord by sensory and motor roots (see below).

**Color the heading Simple Spinal Reflex, titles L through O, and the related structures at the right.**

When your hand jerks back suddenly and involuntarily from a hot stove before you are even aware that you have burned yourself, you are using a neural pathway called a "spinal reflex arc." It includes a *receptor*, a *sensory neuron*, at least one synapse in the spinal cord, and a motor neuron. Each sensory neuron stimulated by the stove sends an impulse up its axonlike dendritic process, into the *posterior root* of the spinal nerve, past the *posterior root ganglion* containing the cell body of that sensory neuron, and into the gray matter of the spinal cord. There it synapses with one or more neurons that will convey the information to the brain, but it also synapses with a *motor neuron*, either directly or via a short interneuron (association neuron). Before your brain is even aware of the skin burn, the axons of the motor neurons involved have stimulated the appropriate skeletal muscles to contract rapidly and vigorously to jerk your hand out of harm's way.

## NERVOUS SYSTEM.

### CENTRAL NERVOUS SYSTEM\*

#### BRAIN\*

#### CEREBRAL HEMISPHERE<sup>A</sup>

#### BRAIN STEM\*

#### EPITHALAMUS<sup>B</sup>

#### THALAMUS<sup>C</sup>

#### HYPOTHALAMUS<sup>D</sup>

#### MIDBRAIN<sup>E</sup>

#### PNONS<sup>F</sup>

#### MEDULLA<sup>G</sup>

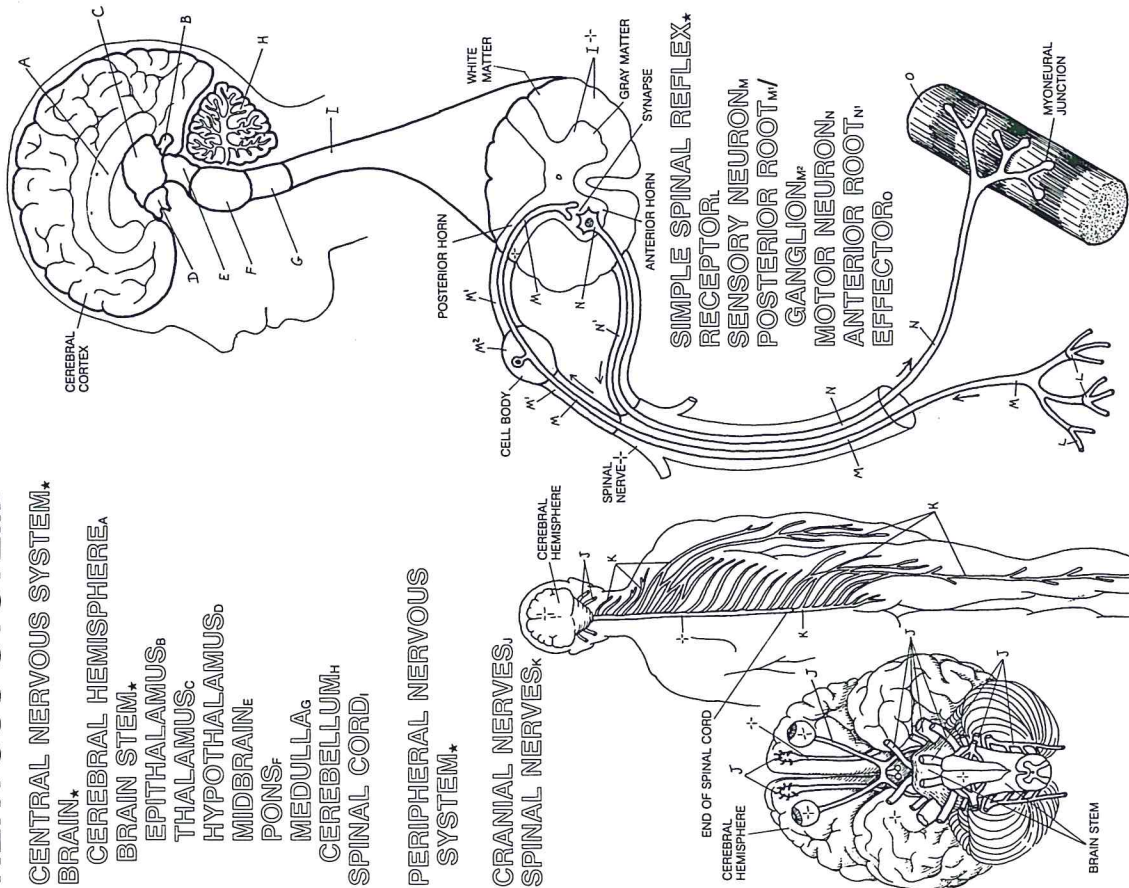
#### CEREBELLUM<sup>H</sup>

#### SPINAL CORD

### PERIPHERAL NERVOUS SYSTEM\*

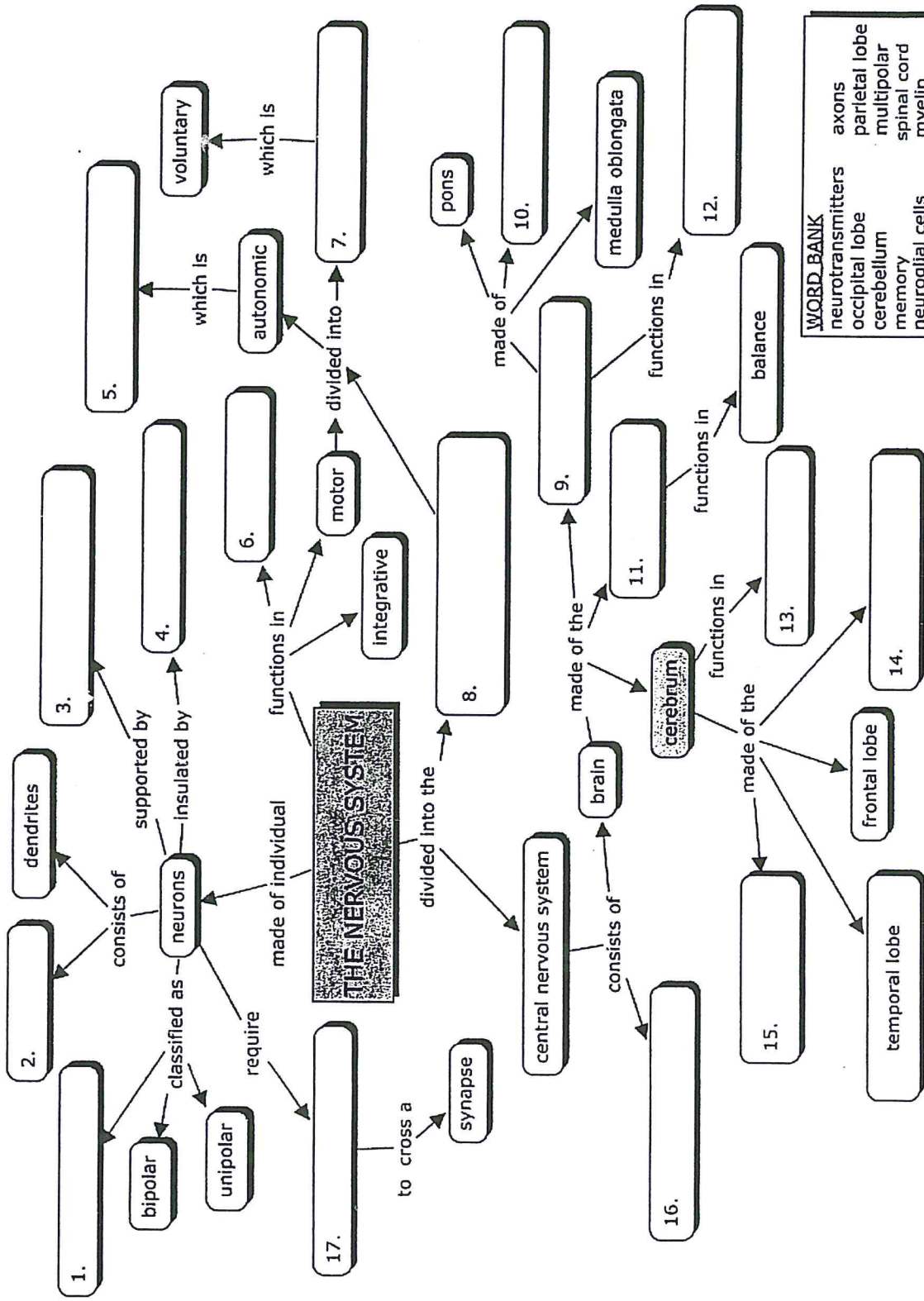
#### CRANIAL NERVES<sup>J</sup>

#### SPINAL NERVES<sup>K</sup>



Name \_\_\_\_\_

### Nervous System Concept Map



WORD BANK	
neurotransmitters	axons
occipital lobe	parietal lobe
cerebellum	multipolar
memory	spinal cord
neuroglial cells	myelin
sensory	regulation
somatic	involuntary
brain stem	midbrain
peripheral nervous system	