sages first. Lying beneath the cerebral hemispheres, it consists of three structures: the cerebellum, the medulla, and the pons, which control such vital functions of the autonomic nervous system as breathing, blood pressure, and heart rate.

The spinal cord is a long bundle of neural tissue continuous with the brain that occupies the interior canal of the spinal column and functions as the primary communication link between the brain and the body. It is the origin of 31 bilateral pairs of spinal nerves which radiate outward from the central nervous system through openings between adjacent vertebrae. The spinal cord receives signals from the peripheral senses and relays them to the brain.

The peripheral nervous system (PNS) includes all parts of the nervous system not covered by bone and carries out sensory and motor functions. It is composed of 12 pairs of cranial and 31 pairs of spinal nerves which lead to the left and right sides of the body. The PNS is divided into two subsystems: the somatic and autonomic nervous systems. The somatic nervous system senses and acts upon the external world. Its sensory neurons transmit signals from receptor cells located in sense organs, such as the skin and eye, to the CNS. Motor neurons carry outgoing messages from the CNS to neuromuscular cells (effectors) found in muscles, joints, glands, and organs, which facilitate action. The skeletal muscles, which are responsible for bodily movement, are controlled by the somatic nervous system.

The autonomic nervous system (ANS) relays messages between the CNS and the heart, lungs, and other glands and organs. These messages increase or decrease their activity in accordance with demands placed on the body. The ANS affects activities that are basically outside of conscious control, such as respiration and digestion. The autonomic nervous system is further subdivided into two branches. The sympathetic system speeds up muscles and mobilizes the body for action. This is the system responsible for the reaction to danger known as the “fight or flight” response. In contrast, the parasympathetic system, which slows down muscles, regulates bodily functions to conserve energy. For example, it is this system that slows heart rate and blood flow after a large meal is eaten to conserve energy for digestion. Disorders of the autonomic nervous system involve reactions such as fainting, uncontrollable sweating, and sexual dysfunction.

The nervous system is composed of two types of cells: neurons, which transmit information through electrochemical impulses, and glial cells, which hold the neurons together and help them communicate with each other. There are three kinds of neurons. Receptor neurons register stimulation from the environment (such as cells in the eye responding to light or skin cells responding to pressure). When they are stimulated, they send signals to the brain, which are then converted into various types of information. Motor, or effector neurons transmit messages from the brain and spinal cord that provide for muscular contraction, which results in movement. Finally, interneurons transmit signals between different parts of the nervous system. Most neurons are composed of five parts: the cell body, which contains the nucleus; dendrites, short fibers that usually receive signals from other neurons; the axon, a long fiber leading away from the cell body that transmits signals to other neurons, muscles, or glands; the myelin sheath, a fatty substance that insulates the axon; and synapses, minute gaps through which signals are transmitted between neurons. The many axon and dendrite fibers radiating from neurons permit each one to be in contact with many thousands of other neurons.

Communication at the synapses between neurons relies on chemicals called neurotransmitters. More than 50 different neurotransmitters have been identified, and more are constantly being discovered. Recently, it was found that the gases nitric oxide and carbon monoxide are neurotransmitters. Different transmitters predominate in different parts of the nervous system, and a particular neurotransmitter may perform different functions in different locations. Researchers have proposed that almost all drugs work through interaction with neurotransmitters. Important neurotransmitters include acetylcholine (ACh), which is used by motor neurons in the spinal cord; the catecholamines (including norepinephrine and dopamine), which are important in the arousal of the sympathetic nervous system; serotonin, which affects body temperature, sensory perception, and the onset of sleep; and a group of transmitters called endorphins, which are involved in the relief of pain.

Among the major functions of the central nervous system is that of the reflex arc, which provides immediate, involuntary reaction to potentially harmful stimuli—actions commonly referred to as reflexes (such as drawing one’s hand back from a hot stove). The reflex arc is a circuit of neurons by which signals travel from a sensory receptor to a motor neuron, rapidly turning sensory input into action. The complexity of the nervous system makes it a challenge to study—millions of neurons may lie beneath a single square centimeter of brain surface, each synapsing with as many as 600 other neurons, and many different parts of the brain may be involved in a single task.

Further Reading
Neurotransmitters either excite the receiving cell (that is, increase its tendency to fire nerve impulses) or inhibit it (decrease its tendency to fire impulses), and often both actions are required to accomplish the desired response. For example, the neurons controlling the muscles that pull your arm down (the triceps) must be inhibited when you are trying to reach up to your nose (biceps excited); if they are not, you will have difficulty bending your arm.

Physiological psychologists are interested in the involvement of the nervous system in behavior and experience. The chemistry and operation of the nervous system is a key component in the complex human puzzle. A number of chemical substances act as neurotransmitters at synapses in the nervous system and at the junction between nerves and muscles. These include acetylcholine, dopamine, epinephrine (adrenalin), and neuropeptides (enkephalins, endorphins, etc.). A decrease in acetylcholine has been noted in Alzheimer's disease which causes deterioration of the thought processes; shortage of dopamine has been linked to Parkinson's disease, whereas elevated dopamine has been observed in schizophrenics.

Drugs that affect behavior and experience—the psychoactive drugs—generally work on the nervous system by influencing the flow of information across synapses. For instance, they may interfere with one or several of the stages in synaptic transmission, or they may have actions like the natural neurotransmitters and excite or inhibit receiving cells. This is also true of the drugs which are used in the treatment of certain psychological disorders.

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