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CENTRAL AND PERIPHERAL NERVOUS SYSTEMS

Nerve Cells

Generally speaking, there are three kinds of nerve cells in the nervous system: sensory neurons, motor neurons, and interneurons. **Sensory neurons** (also known as **afferent neurons**) transmit sensory information from receptors to the spinal cord and brain. **Motor neurons** (also known as **efferent neurons**) transmit motor information from the brain and spinal cord to the muscles. **Interneurons** are found between other neurons and are the most numerous of the three types of neurons. Interneurons are located predominantly in the brain

and spinal cord and are linked to reflexive behavior. This type of behavior is controlled by neural circuits called **reflex arcs**. Behavior that is crucial to survival is controlled by **reflexes**.

When receptors in the foot detect pain (e.g., when you step on a nail), the pain signal is transmitted by sensory neurons up to the spinal cord. At that point, the sensory neurons connect with interneurons, which then relay pain impulses up to the brain. Because interneurons in the spinal cord are closer to your foot, it would be faster if they could tell your foot to move instead of waiting for the brain to do it. In fact, this is exactly what happens in the reflex arc. Sensory neurons first send out impulses signaling the presence of pain. As soon as the impulses arrive at the spinal cord, interneurons immediately transmit that information to the motor neurons. Without wasting any time, the motor neurons tell your foot to step away from the nail. Bear in mind that the original sensory information still makes its way up to the brain. But by the time it arrives there, the muscles have already responded to the pain, thanks to the reflex arc.

As mentioned earlier, functionalists such as John Dewey criticized the breaking down of reflex processes into separate stimuli and responses. Functionalists preferred to study the process as a whole. To break down the reflex arc into different motor and sensory phases, was, for Dewey, a useless artificial separation.

Human Nervous System

Let's turn now to the overall structure of the human nervous system, which is diagrammed in Figure 1. The nervous system can be broadly divided into two primary components: the **central** and **peripheral nervous systems.** The central nervous system (**CNS**), is composed of the brain and spinal cord. The peripheral nervous system (**PNS**), in contrast, is made up of nerve tissue and fibers outside the brain and spinal cord (i.e., the PNS connects the CNS to the rest of the body). The peripheral nervous system is subdivided into **somatic** and **autonomic nervous systems.**

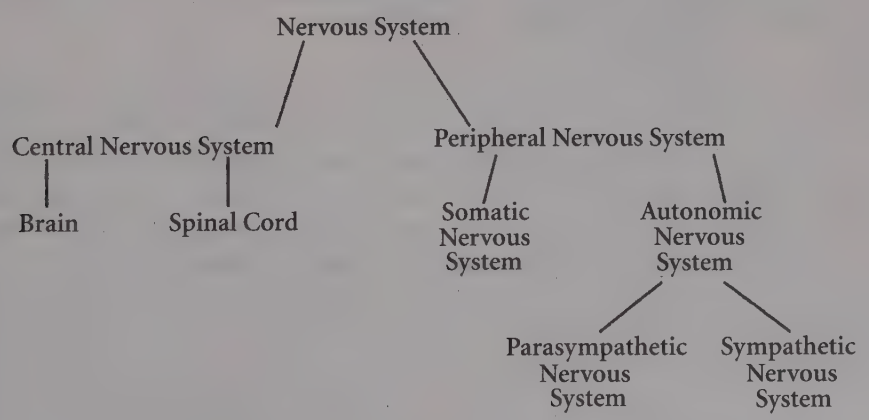

Figure 1. Major Subdivisions of the Nervous System

The somatic nervous system consists of sensory and motor neurons distributed throughout the skin and muscles. Sensory neurons transmit information through **afferent fibers.** Motor impulses, in contrast, travel along **efferent fibers.** Since it's easy to confuse these two, try to remember them like this: sensory impulses travel along *a*fferent fibers, which *a*scend up to the brain; motor impulses travel along *e*fferent fibers, which *e*xit the brain and spinal cord on their way down to the muscles. The GRE Psychology Test tends not to ask much about the somatic nervous system.

The autonomic nervous system (**ANS**) appears often on the GRE Psychology Test, so it's worth knowing in some detail. Pioneering work in regard to the ANS was done by **Walter Cannon.**

The ANS generally regulates heartbeat, respiration, digestion, and glandular secretions. In other words, the ANS manages the involuntary functions associated with many internal organs and glands. The ANS also helps regulate body temperature by activating sweating or shivering, depending on whether we are too hot or too cold. The main thing to understand about these functions is that they are automatic, or independent of conscious control. Note the similarity between the words *autonomic* and *automatic.* This association makes it easy to remember that the autonomic nervous system manages automatic functions such as heartbeat, respiration, digestion, and temperature control.

The ANS has two subdivisions: the **sympathetic nervous system** and the **parasympathetic nervous system.** These two branches often act in opposition to one another, meaning that they are **antagonistic.** An illustration of this is that the sympathetic nervous system acts to accelerate heartbeat and inhibit digestion. Activation of the parasympathetic nervous system, in contrast, decelerates heartbeat and increases digestion.

The main role of the parasympathetic nervous system is to conserve energy. It is associated with resting and sleeping states, and acts to reduce heart and respiration rates. The parasympathetic nervous system is also responsible for managing digestion. The parasympathetic nervous system thus promotes "**resting and digesting**"—a phrase that captures what you need to know for the test. **Acetylcholine** is the neurotransmitter responsible for parasympathetic responses in the body.

In contrast, the sympathetic nervous system is activated whenever you face stressful situations. This can include everything from a mild stressor, such as keeping up with your schoolwork, to emergencies that mean the difference between life and death. The sympathetic nervous system is closely associated with fear and rage reactions, also known as "**fight or flight**" reactions. Because the sympathetic nervous system often appears on the test, it's a good idea to know some specific physiological responses associated with "fight or flight" reactions. When the sympathetic nervous system is activated, the body mobilizes for fighting for one's life, or for running for one's life. Therefore, there are increases in heart rate, blood-sugar level, and respiration. In contrast to the parasympathetic activation, "fight or flight" reactions act to decrease digestive processes. The sympathetic nervous system also causes the pupils in the eyes to dilate (open wider) in order to increase the amount of visual information reaching the retina. Also, the neurotransmitter adrenaline is released into the

bloodstream during fear and rage reactions. An "adrenaline rush" gives you more energy than usual in order to contend with emergencies; it helps you run faster or fight harder at times when you need everything you've got. Overall, most of the physiological responses associated with the sympathetic nervous system act in ways to maximize energy for quick responses to threatening situations.

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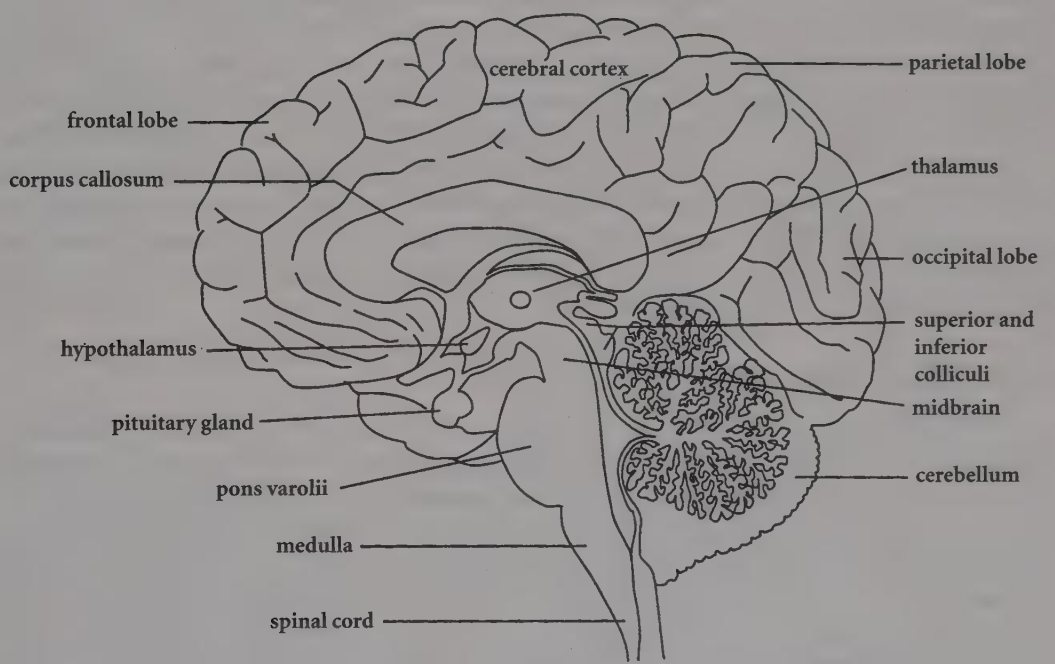

Figure 2. Anatomical Structures Inside the Human Brain