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STUDY GUIDE:
HUMAN ANATOMY PART II

In the previous study guide, you learned that the human body is divided into eleven separate systems, and got an in-depth look into the first six. The remaining five systems are the **nervous system**, the **endocrine system**, the **reproductive system**, the **immune system**, and the **integumentary system.**

THE NERVOUS SYSTEM

The **NERVOUS SYSTEM** received stimuli from both outside and inside the body. It transfers messages from one part of the body to another and monitors changes within the body. In essence, it controls and interprets all the activities within the body.

Neurons are the fundamental unit of the nervous system. Neurons are **nerve cells** that act as messengers. Each neuron is comprised of a **cell body**, which contains the **nucleus**. The nucleus regulates the cell's activities. **Dendrites** are threadlike extensions that bring the messages to the cell body. Each cell body has one tail-like **axon** that carries the messages away from the cell body. There are **three types of neurons**:

1. **Sensory neurons** transmit messages from receptors to the brain and spinal cord. Thus receptors in your fingers receive information from your environment. This message is carried to your spinal cord and brain.

2. **Interneurons** are found in the brain and spinal cord and connect the sensory neurons to the motor neurons. They act as a transfer spot between the sensory neurons and the motor neurons.

3. **Motor neurons** carry a response message back to the body from the brain, thus stimulating various muscles and glands in the body, known as effectors.

Nerve Impulses travel by means of electrical and chemical signals. They travel along the length of a neuron via electrical charges. When they come to the next neuron, they must leap a tiny space called a **synapse**. They do so by means of chemical signals. Once they arrive at the next neuron, they switch back to electrical transmission and so forth.

The path an impulse takes along a neurons is as follows:
dendrites – to cell body – to axon – across the synapse – to dendrites – to cell body – to axon – across the synapse, etc.

The nervous system is composed of two systems: The **CENTRAL NERVOUS SYSTEM**, and the **PERIPHERAL NERVOUS SYSTEM**.

The **CENTRAL NERVOUS SYSTEM** contains the **brain** and the **spinal cord**. The brain is the main organ in the nervous system, and the spinal cord connects it to the rest of the body. The brain is composed of the **cerebrum**, the **cerebellum**, the **medulla**, the **hypothalamus**, and the **thalamus**.

The **cerebrum** is the largest part of the brain. It controls all mental activities, such as thinking and decision making. Artistic activity occurs in the right half and intellectual activity occurs in the left half. Each half also controls the opposite body half. The cerebrum also directs the body's voluntary movements.

The surface of the cerebrum is called the **cerebral cortex**, which is made up of many gray-colored folds called **convolutions**. For this reason, the cortex is often called gray matter.

The **cerebellum** is located in the lower back portion of the brain. It regulates muscular, motor, and balance activities.

The **medulla** connects the brain to the spinal cord and controls involuntary actions, such as breathing and heart rate.

The **hypothalamus** is the part of the brain that stimulates the pituitary gland, linking the nervous system and the endocrine system. It controls body temperature, blood pressure, hunger, thirst, and sleepiness.

The **thalamus** is the innermost part of the brain. It helps in the control of our basic drives, and it initiates certain body actions.

The **PERIPHERAL NERVOUS SYSTEM** links the central nervous system to the body. It contains 43 pairs of nerves that transport messages from the brain and spinal cord to the exterior areas of the body. It also transports impulses, and thus messages, from the exterior areas of the body to the spinal cord, and then to the brain where they are interpreted.

THE ENDOCRINE SYSTEM

The **ENDOCRINE SYSTEM** is composed of **glands** that produce **hormones**. **Hormones** are the body's chemical messengers that speed up, slow down, and regulate the specific activities of different organs.

The **endocrine system** works ***with*** the **nervous system**. A good example of this is the fear response. When the nervous system sends danger signals, the endocrine system responds by producing hormones that travel through the circulatory system to alert the correct organs, which in turn issue a physical response. In this case, the physical response is called the fight or flight response. The body either attacks the frightening stimulus, or it withdraws for safety.

Interestingly enough, the body tissues and organs are equipped to recognize the hormones meant for them and reject those meant for another organ, so the glands do not always need to be located adjacent to the organs they regulate.

There are **eight main endocrine glands** in everyone's body, each of which controls different hormone sets.

1. The **hypothalamus** produces the hormones that regulate the other seven endocrine glands. Located at the base of the brain, it is the central link to the nervous system. This organ also controls the body's temperature and the nutrients within.

2. The **pituitary** is a pea-sized gland connected to the hypothalamus by a short stalk. It communicates with the hypothalamus and transmits information about the rest of the body to it. Formerly termed the "master gland," it controls bodily functions such as growth, sexual maturation, reproduction, blood pressure, and metabolism.

3. The **thymus** is an endocrine gland that is located directly behind the sternum. It is extremely active during infancy. It helps develop a child's immune system and protects white blood cells. It shrinks over time, and other organs later take over its function.

4. They **thyroid** is located in the throat. It controls how quickly food is used by the body. It creates the hormone thyroxine which stimulates the rate of metabolism. It also manufactures calcitonin that controls the release of calcium from the bones.

5. The **parathyroids** are four tiny glands that are attached to the thyroid. They manufacture the hormone parathormone that controls the body's calcium level.

6. The **adrenal glands** are located above the kidneys. They comprise the body's emergency response system by manufacturing and releasing adrenaline in times of stress or fear.

7. The **pancreas** is in charge of controlling insulin levels in the bloodstream. It converts excess sugar into glycogen, which can be stored in the body for future use. Insulin is produced by the **Islets of Langerhans** inside the pancreas. These islets also create **glucagon**, which makes more sugar when it is low.

8. The reproductive glands differ in the male and the female. The **ovaries** are the female reproductive glands. They are located at hip level on either side of the female's body. They produce **estrogen** that triggers the development of female characteristics.
   The **testes** are male reproductive glands. They are located within an external sac of skin called the scrotum. The testes produce **testosterone**, which is responsible for a number of male characteristics such as the growth of facial and body hair, the deepening of the voice, and the broadening of the chest.

THE REPRODUCTIVE SYSTEM

The **REPRODUCTIVE SYSTEM** is the system which allows you to have children. It is different in females and males.

The **male reproductive system** consists of several key parts. Sperm is manufactured inside the **testes**, which are located inside a sac called the **scrotum**. The sperm passes through a sperm duct to the urethra, where it mixes with other body fluids to form a thick fluid called **semen**. The urethra is located in the **penis**, from which the liquid is expelled. The sperm must reach and fertilize an egg to create a new organism.

The female of the human species undergoes a **menstrual cycle**, which lasts approximately 28 days and is controlled by hormones. Eggs are produced in the female's ovaries. Around the 14^{th} day of the woman's cycle, the ovaries release a mature egg through an **oviduct** that leads to the **uterus**. If sperm reaches the egg, the female becomes pregnant, and her menstrual cycle halts. If it fails, both the unfertilized egg and the uterus lining to which it is attached decompose and exit the body through the vagina in a cycle called the **menstrual period**, which lasts anywhere between three to seven days. Then the cycle starts over.