

HUMAN ANATOMY

1. The human body is a remarkably complex and efficient machine. It takes in and absorbs oxygen through the respiratory system. Then the oxygen-enriched blood is distributed through the cardiovascular system to all tissues. The digestive system converts digestible food to energy and disposes of the rest. The skeletal-muscular system gives form to the body. And covering almost the entire mass is the skin, the largest organ of the body. The science of the structure of this complicated “machine” is called *anatomy*.

2. One of the major systems is the **musculoskeletal system**. The body is supported and given shape by this structure, it consists of more than 200 bones and the muscles and **tendons** which are connected to them. Bones are strong and can bend at their **joints**. They also serve as a shield, protecting the vital internal organs from injury.

3. **Bones** are as strong as steel but much lighter and more flexible. They are composed of minerals, organic matter, and water, held together by a cement-like substance called **collagen**, and are filled with red and yellow **bone marrow**. The red marrow produces the red blood cells used throughout the body to transport oxygen, while the yellow marrow consists primarily of fat cells. A tough membrane called the **periosteum** covers most of the bone surface and allows bones to be nourished by blood.

4. A major bone structure in the body is the **vertebral (spinal) column**. It runs up and down the back and protects the spinal cord, where many of the major nerves are located. It is composed of bony **vertebrae** which are held together by ligaments of connective tissue and separated from each other by spinal **discs**. At the top of the vertebral column, there is the **skull**, which surrounds and protects the brain. Twelve pairs of **ribs**, comprising the **rib cage**, are attached to the vertebral column below the neck. At the bottom is the **sacrum**, which connects the vertebral column to the **pelvis**. Bones are united by joints and held together by **ligaments**.

5. **Muscles** are special fibrous tissues found throughout the body. They control movement and many organic functions by contracting in response to nerve signals. Skeletal muscles are called **voluntary** because they can be consciously controlled. They are attached to bones by tough fibrous tissues called tendons. Other muscles, such as the stomach muscles and the heart, are **involuntary** and are operated automatically by the central nervous system

6. When a muscle becomes fatigued, it sometimes contracts violently and painfully. This condition is known as **cramping**. Too much strenuous activity may produce a **strain**.

7. The most important muscle in the body is the **heart**. Without the heart and its **cardiovascular (circulatory) system**, human life would not be possible. The heart is roughly the size of a fist. It contracts at an average rate of 72 times per minute or nearly 38,000,000 times in a year. These rhythmic contractions are called the **pulse rate** and can be felt in the radial artery of the wrist.

8. The human heart consists of four chambers, two **atria** (or auricles) and two **ventricles**. Each is made up of several layers of cardiac muscle arranged in circles and spirals. During the contraction phase, called the **systole**, oxygenated blood is pumped out of the left ventricle into the aorta and from there through the arteries to all organs of the body. Carbon dioxide, a waste product of this process, is collected in the blood. The blood is passed back to the right atrium through the veins and the *vena cava* during the **diastole** (or relaxation) period of the heart. From there, it is pumped into the right ventricle and to the pulmonary artery to be sent to the lungs, where carbon dioxide is removed and oxygen is added.

9. The rest of the system consists of **arterioles** (small arteries), **venules** (small veins), and capillaries, the smallest of blood vessels. In total, there are more than 70,000 miles of blood vessels in the human body!

10. The cardiovascular system also carries **hormones** which are secreted by glands of the endocrine system directly into the bloodstream. These hormones control many functions of the body. The **thyroid gland**, for example, secretes thyroxin, which controls the rate at which energy is produced (the metabolic rate).

11. The blood is made up of two parts - plasma and **blood cells**. The plasma is a clear, yellowish liquid which transports the 25 trillion red blood cells (erythrocytes) and the many fewer white cells (leukocytes). The red cells carry the protein **hemoglobin**, which carries oxygen to the body cells. The white cells are important in fighting disease. **Platelets** in the blood permit clotting to take place at the site of a wound, thus preventing excessive bleeding.

12. The **respiratory system** starts at the nasal passages (nose), where air is breathed in during inspiration. There the air is filtered and its temperature regulated. It then passes through the **larynx** (voice box) and **trachea** (windpipe) into the **bronchi** and **bronchioles**, and ends in little air pockets called **alveoli** within the **lungs**. The used blood is cleansed of carbon dioxide, which is expelled in the process known as *expiration*. The cleansed blood is then oxygenated and redistributed along the circulatory system. The entire process is called **respiration** and occurs at the rate of about 16 to 20 times per minute.

13. The largest organ in the body is the outer covering called **skin** plus its associated structures (hair, nails, sebaceous and sweat glands, and specialized sensory receptors that enable the body to be aware of touch, cold, heat, pain, and pressure. They altogether make up the **integumentary system**. Skin protects the body from microbes and other impurities, prevents the loss of body fluids, and regulates body temperature. Three layers of tissue make up the skin - the **epidermis**, the **dermis**, and the **subcutis** (subcutaneous layer). The epidermis is in constant growth, with its outer layer of dead cells continuously being replaced as new cells are formed in the lower layer. Hair, fingernails, and toenails are specialized forms of epidermis. The coloring pigment called *melanin* is also found in the epidermis. The middle layer (or dermis) is the location for two main types of glands: sweat glands and oil glands. The innermost subcutis contains fat cells, blood vessels, and nerves.

14. Another major body complex is the **digestive system**, which processes the food so that it can be used for energy. The process begins in the **mouth**, where food is chopped and crushed by the teeth. In the mouth **saliva**, excreted by the salivary glands, provides enzymes that help to break down the food's carbohydrates.

15. After food has been chewed, it passes through the esophagus in the **stomach**. Peristaltic movements in the walls of the **esophagus** help push the food along the alimentary canal. The muscular walls of the stomach continue the mixing process while secreting hydrochloric acid from 35,000,000 glands in the stomach lining. After 30 minutes to three hours the stomach, the food is converted into a semiliquid state and passes into **small intestine**, a tube about 20 feet long located in the lower abdomen. Here, enzymes from pancreatic fluid and bile from the **liver** complete digestive process. Nutrients are absorbed into the blood through the **villi** which line the walls of the digestive organs. These nutrients are either used maintaining the body or are burned for energy. What cannot be absorbed passed out through the **large intestine** as feces. Liquid wastes are eliminated through the **urinary system**. They are picked up by the blood and removed by the **kidneys**. From there they pass through the **ureter**, **bladder**, a **urethra**, and are excreted from the body as urine.

16. Closely associated with the urinary system is the **reproductive system**, by which human life is carried on to future generations. Sperms are produced in the testicles of the male. The fertilization of the female's ovum (egg) by male's sperm is called **conception**. It usually occurs in one of the **fallopian tubes**, which the sperm reaches through active movement from the place deposition. Normally, the fertilized egg then travels to the **uterus** where it becomes an **embryo**, is implanted, and develops for about 280 days (childbirth).

17. The **nervous system** controls all other systems and bodily moments. Nerves carry sensory impulses to the central nervous system and motor impulses from the central nervous system. Motor impulses control muscles. Sensory impulses affect the senses that enable hum beings to feel, see, taste, and so forth.

18. The nervous system is divided into the **central nervous system** (the brain and spinal cord) and the **peripheral nervous system**, which consists of the nerves that connect muscles and sensory organs with the central nervous system. The central nervous system is responsible for sending impulses to the voluntary muscles. The autonomic system, a part of the peripheral nervous system, regulates the involuntary muscles and organs.

19. The **brain** is not only the most important component of the nervous system; it is also the controlled of all bodily activities, thoughts, and emotions. It is composed of the **pons, medulla oblongata, cerebellum, a cerebrum**. The cerebellum is the area of the brain that coordinates the voluntary muscles; the medulla oblongata controls the involuntary muscles; the pons is where many important nerves originate.

20. It is the **cerebrum** that gives humans their ability to think, remember, and conceptualize. It is divided vertically into two halves known as the left and right **hemispheres**. The left hemisphere processes verbal functions, while the right hemisphere is involved in nonverbal activities and is the seat of human creativity. Many scientists believe that, in each individual, one of the two hemispheres is dominant.

21. It is amazing how well each system functions and coordinates with other systems to enable humans to live, reproduce, and create.