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STUDY GUIDE: HUMAN ANATOMY I

The smallest unit part of any living organism is the cell. In multicellular organisms, such as the human, cells of the same type join together to form tissues. For example, skin cells form skin tissue.

THERE ARE FOUR BASIC DIFFERENT TYPES OF TISSUE IN THE HUMAN BODY:

1. muscle tissue
2. connective tissue
3. nerve tissue
4. epithelial tissue

Muscle tissue is the only type of tissue that can contract, or shorten. Connective tissue provides support for the body and connects all its parts. Bones, blood and fat are examples of connective tissue. Nerve tissue carries messages back and forth between the brain, spinal cord, and the rest of the body. Epithelial tissue forms a protective surface on the body. Skin is epithelial tissue. Epithelial tissue also lines the mouth, nasal cavities, and throat and provides a protective covering for the stomach and other body parts.

Different types of tissues are then combined to create organs. An organ is a group of different tissues working together to perform a job. The stomach, lungs, eyes, and pancreas are examples of organs. The heart is also an organ. Although it contains mainly muscle tissue, it also contains connective and nerve tissue, and is covered and protected by epithelial tissue.

Organs combine with other organs to create organ systems. Each system of organs has a particular function. There are eleven major systems in the human body. Six of these systems will be discussed in this study guide. The remaining five systems will be dealt with in an upcoming guide. All eleven systems are listed in the next section.

THE 11 MAJOR SYSTEMS OF THE HUMAN BODY

1. **Skeletal:** Supports the body and gives it shape, protects inner organs, produces blood cells, allows movement, and stores some minerals.
2. **Muscular:** Allows for body movement and controls posture.
3. **Digestive:** Breaks down food and absorbs the nutrients.
4. **Circulatory:** Carries nutrients to all parts of the body.
5. **Respiratory:** Exchanges oxygen and carbon dioxide between the blood and air.
6. **Excretory (or urinary):** Removes solid and liquid wastes from the body.
7. **Nervous:** Carries messages from the brain to all parts of the body, detects sensations, and controls any other functions.
8. **Endocrine:** Regulates the body chemistry, controls metabolism, and maintains integration of other body functions.
9. **Reproductive:** Performs reproduction and regulates the secondary sex characteristics.
10. **Immune (or lymphatic):** Fights diseases.
11. **Integumentary:** Protects the body, helps regulate body temperatures, and receives outside stimuli.

THE SKELETAL SYSTEM

The skeletal system is composed of the 206 bones in the body, cartilage, nerve tissue, blood vessels, and connective tissues. Cartilage is a dense, fibrous connective tissue that can be bent. It is found in the nose and outer ears. It is also located at the ends of bones and serves as a slippery surface to reduce friction at the joints.

JOINTS: A joint is a place in the body where two or more bones are connected. Movement occurs at a joint. There are several types of joints.

1. Hinge joints: examples-knee and elbow allows movement in a forward and backward direction.
2. Ball-and-socket joints: examples- shoulder and hip, provides for circular motion of bone, and consists of a round bone that fits into a cup like pocket of another bone.
3. Fixed joints (or immovable joints): examples- bones of the skull. Permits no movement.
4. Pivot joints: examples- first two vertebrae in the neck, allows for rotation of one bone around another.
5. Sliding joints: example- carpals or wrist, allows one or more bones to roll over other bones.

STRUCTURE OF BONES:

The outer covering of a bone is called the pericardium. Beneath the pericardium is the hard, compact bone. Within the shaft of a long bone is a hollow cavity or space filled with marrow. Marrow is a soft, yellow material that contains fat and blood vessels. Red marrow is found in the inner areas of the skull, ribs, breastbone, and vertebral columns. Red marrow produces the body's blood cells. At each end of the bone shaft is a knob that contains spongy bone. It is actually quite strong and adds strength to the bone without adding mass. Bones need calcium and phosphorus to maintain their strength. Dairy products are an excellent source of calcium.

SKELETAL SYSTEM TRIVIA FACTS:

1. The backbone is composed of 26 bones called vertebrae (singular-vertebra) that are separated from one another by pads of cartilage.
2. The femur is the longest single bone in the entire body.
3. Ligaments are stringy tissues that attach bones to other bones.
4. Tendons attach muscles to the bones.
5. There are a total of 12 pairs of ribs (24 ribs). The bottom two pairs of ribs are attached to the back, but are not attached to the sternum at all. They're called floating ribs.
6. The bones in the fingers are called phalanges. Each finger has 3 phalanges and each thumb has two, making a total of 14 phalanges on each hand.
7. The knee joint is protected by the kneecap. It's scientific name is the patella.
8. Seven round bones are found at the wrists. They are called carpals.

The major bones are labeled on the skeleton found at the end of this study guide.

THE MUSCULAR SYSTEM

THREE MAIN TYPES OF MUSCLES IN THE HUMAN BODY:

1. Skeletal: These muscles attach directly to the bones and move the bones. They are called voluntary muscles, because you can move them whenever you want. These muscles are striated. This means they are composed of bands of muscle tissue that are connected together. Skeletal muscles are attached to the bones by TENDONS.
2. Smooth muscles: These muscles are involuntary, and move or contract without your direction. They help to control breathing, blood pressure, and the movement of food throughout the digestive system.
3. Cardiac muscle: This type of muscle is found only in the heart. Cardiac muscles are involuntary. Your heart beats when your cardiac muscle contracts.

MAJOR MUSCLES AND THEIR LOCATION WITHIN THE BODY:

1. Biceps and triceps: These muscles are found in the upper arm. The biceps is on the top of the humerus and the triceps is on the bottom. They work in a pair. When the biceps contract, the triceps relax.
2. Deltoid: Located at the shoulder, it allows you to raise your arm to the front, side, or back.
3. Pectoralis major: This large fan-shaped muscle of your upper chest pulls your arm toward your body.
4. Gastrocnemius: This is the calf muscle. It is attached to the heel bone by the Achilles Tendon.
5. Trapezius: This muscle is located at the back of the neck and in the upper back region.
6. Gluteus Maximus: These muscles are located in the buttocks region, and you sit on them.

A muscle that bends, or flexes a joint is called a FLEXOR muscle. If a muscle straightens a joint, it's called an EXTENSOR.

THE DIGESTIVE SYSTEM

The digestive system breaks down the food into simpler substances that can be used by the human body. These simple nutrients are then carried by the blood to all the cells in the body. Here is the basic path the food takes as it makes its way through the digestive system..

- | | |
|--------------------|--------------------|
| 1. Mouth | 5. Large Intestine |
| 2. Esophagus | 6. Rectum |
| 3. Stomach | 7. Anus |
| 4. Small Intestine | |

The liver, gall bladder, and pancreas are also digestive organs, but the food does not actually pass through them.

Digestion begins in the mouth. Saliva mixes with the food in the mouth. An enzyme called ptyalin is in the saliva. It breaks down the starches in foods and begins to change them to sugars. The saliva also makes the food slippery so it can be easily swallowed.

When the food is swallowed, it goes down a tube that connects the back of the throat (pharynx) with the stomach. Muscular contractions of the esophagus help push the food downward. These muscular contractions are called peristalsis.

The food then enters the stomach. The walls of the stomach release gastric juices that help to break up the food and make it runnier. These juices contain the enzyme pepsin, hydrochloric acid, and a thick mucus. The stomach muscles contract to churn the food. Then the food is pushed by peristalsis to the small intestine.

Most digestion occurs in the small intestine. More digestive juices are secreted by the walls of the small intestine. The liver produces a substance called bile that helps to break up fatty foods. Bile is stored in the gall bladder until it is needed. Then it is released into the small intestine. **THE LIVER IS THE BODY'S HEAVIEST ORGAN.** It is also the second largest organ. Only the skin is a larger organ!

The pancreas produces insulin that is sent into the small intestine to control the body's use of sugar.

After a period of five hours, most of the food in the small intestine is digested. It then passes through finger like structures called villi that are found in the walls of the small intestine. The villi contain small blood vessels that absorb and carry away the digested food.

The undigested food is pushed by peristalsis to the large intestine. The excess water is absorbed from these wastes in the large intestine. The solid wastes that remain are pushed through a short tube at the end of the large intestine, called the rectum, and then pushed through an opening at the end of the rectum called the anus.

THE CIRCULATORY SYSTEM

The circulatory system is composed of three main parts: the heart, the blood, and the blood vessels. Its main job is to deliver food and oxygen to all body cells and to carry away waste products and carbon dioxide from the cells.

There are three main types of blood vessels through which the blood travels:

1. **ARTERIES:** These carry blood away from the heart. The aorta is the largest artery in the human body.
2. **VEINS:** These carry blood from all parts of the body back to the heart.
3. **CAPILLARIES:** These are the smallest of the blood vessels. The walls of the capillaries are so thin that food and oxygen leak through them to the body cells, and wastes from the body cells enter the blood through these walls. They also connect the arteries to the veins.

There are four main components of the blood: **PLASMA, RED BLOOD CELLS, WHITE BLOOD CELLS,** and **PLATELETS.** Plasma is the liquid portion of the blood. It consists mainly of water. The other three blood components float in the plasma.

Red blood cells, or Erythrocytes, float in the plasma. They carry oxygen from the lungs to the body cells, where oxygen is exchanged for carbon dioxide. These doughnut shaped components are made in the bone marrow and contain hemoglobin, a protein that contains iron. Hemoglobin easily combines with oxygen when the oxygen

content is high, and easily releases the oxygen again when the oxygen content is low.

White blood cells, or Leukocytes, are larger than red blood cells, but there are fewer of them in the blood. Their job is to protect the body against infection and to fight infection when it occurs in the body.

Platelets, or Thrombocytes, are the smallest of the blood components. They cause the blood to clot.

There are four main blood types: A, B, AB, and O.

Type O is called the universal donor, because type O blood can be safely given to everyone. Type AB is the universal receiver. People having this type of blood can safely receive blood from any donor. A blood transfusion is the name for the process of taking blood from one person and giving it to another person.

THE CIRCULATION OF THE BLOOD:

The blood leaves the heart, travels to the lungs, returns to the heart, is sent to all parts of the body, and is again returned to the heart. The heart is muscular organ that is composed of four distinct chambers, or parts. The two top chambers of the heart are each called an atrium (plural: atria). The two bottom chambers of the heart are each called ventricles. The entire heart is enclosed in a protective bag called the pericardium.

The heart is divided into two sides by a strong, thick, muscular wall called the septum. Here are the basic steps that occur in the circulation of blood through the heart.

1. The blood enters the RIGHT ATRIUM of the heart through two main veins called the SUPERIOR VENA CAVA AND INFERIOR VENA CAVA.
2. It passes through the TRICUSPID VALVE to the RIGHT VENTRICLE.
3. The RIGHT VENTRICLE pumps the blood to the lungs through the PULMONARY ARTERIES.
4. The blood receives oxygen from the alveoli in the lungs, and loses the carbon dioxide that it has been carrying.
5. The newly oxygenated blood is sent back to the heart through the PULMONARY VEINS. It reenters the heart in the LEFT ATRIUM.
6. It then passes through the BICUSPID VALVE (also called the MITRAL VALVE) to the LEFT VENTRICLE.
7. The LEFT VENTRICLE then pumps the blood through the AORTA and then to all the tissues in the body. It is returned to the heart and reenters the RIGHT ATRIUM where the cycle once again continues.

THE RESPIRATORY SYSTEM

The main job of the respiratory system is to bring oxygen into the body and to remove carbon dioxide and water from the body. The main respiratory organs are the

NOSE, PHARYNX, TRACHEA, BRONCHIAL TUBES, LUNGS, BRONCHI, ALVEOLI, and DIAPHRAGM.

Air enters the NOSE where it is both warmed and filtered. It then passes down the back of the throat, called the PHARYNX, and down the wind-pipe, or TRACHEA. The trachea divides at the end into two BRONCHIAL TUBES that each lead to a LUNG. When the air enters the lungs, it flows into smaller branches called BRONCHI, and then into tiny air sacs called ALVEOLI. Each alveoli is surrounded by thousands of tiny blood vessels called capillaries. Oxygen and carbon dioxide are exchanged in the alveoli. As blood moves through the capillaries, it picks up oxygen and carries it to cells throughout the body.

A strong muscle called the DIAPHRAGM contracts to bring the air into your chest area. When you exhale, the diaphragm relaxes, causing the space inside the chest cavity to decrease, thus sending the air out the body.

THE EXCRETORY SYSTEM

The job of the excretory system is to remove wastes from the body. Since the lungs remove carbon dioxide and water from the body, they are also considered part of the excretory system. Other organs in the excretory system are the KIDNEYS, LIVER, SKIN, and URINARY BLADDER.

The KIDNEYS are the main organ in this system. They filter nearly one liter of blood per minute. The filtering takes place in the NEPHRONS, which are a network of tubes that are enclosed in a complex network of capillaries. The nephrons filter out water, salts, urea, and nutrients, which are reabsorbed into the blood. The liquid that remains is called urine. It is composed mainly of water with some excess urea and salts. This urine is sent through two narrow tubes called URETERS to a muscular sac called the URINARY BLADDER. The urine is stored in the bladder until it is released from the body through another small tube called the URETHRA.

The LIVER also helps to filter the blood. It removes excess amino acids, and cleanses the blood by removing most of the bacteria that enters it.

The SKIN removes wastes through perspiration. The skin is composed of two layers. The upper layer is called the epidermis and the lower layer is called the dermis.

