

Introduction

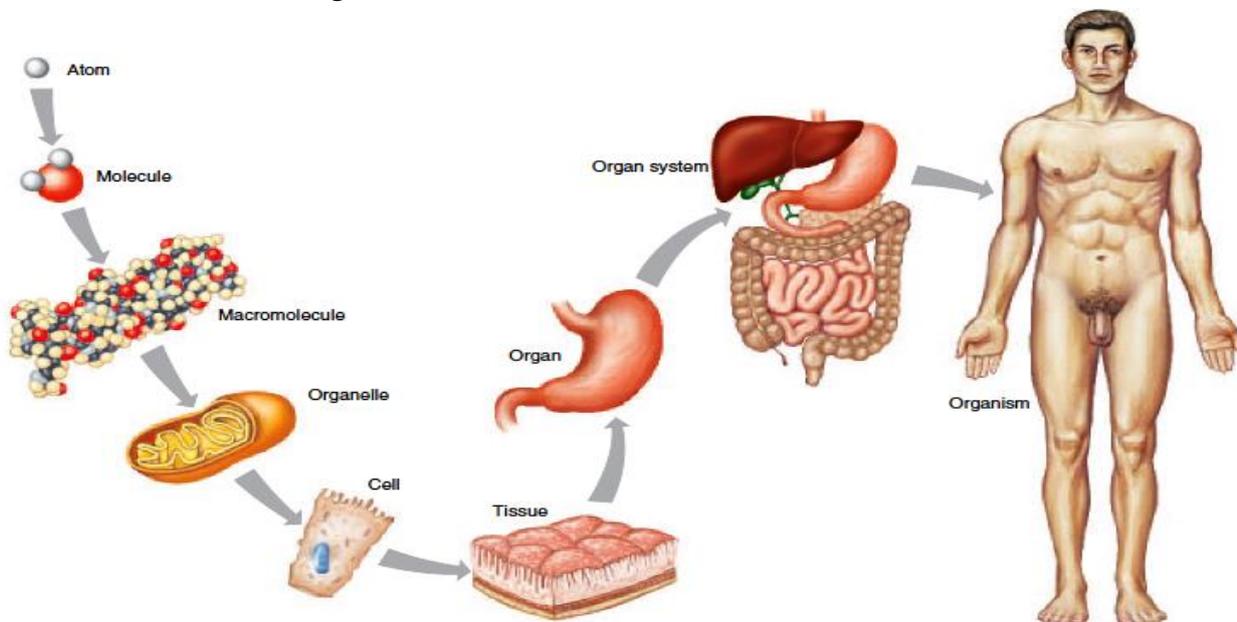
Anatomy is the science of the structure and function of the body.

Clinical anatomy is the study of the macroscopic structure and function of the body as it relates to the practice of medicine and other health sciences.

Basic anatomy is the study of the minimal amount of anatomy consistent with the understanding of the overall structure and function of the body.

Organization of Body Parts

The structure of the body can be studied at different levels of organization. First, all substances, including body parts, are composed of chemicals made up of submicroscopic particles called **atoms** join to form **molecules**, which join to form **macromolecules**. Macromolecules are found in all **cells**, the basic units of all living things. Within cells are **organelles**, tiny structures that perform cellular functions. **Tissues** are the next level of organization. A **tissue** is composed of similar types of cells and performs a specific function. An **organ** is composed of several types of tissues and performs a particular function within an **organ system**. For example, the stomach is an organ that is a part of the digestive system. It has a specific role in this system, whose overall function is to supply the body with the nutrients needed for growth and repair. The other systems of the body also have specific functions. All of the body systems together make up the **organism**—Such as, a human being.

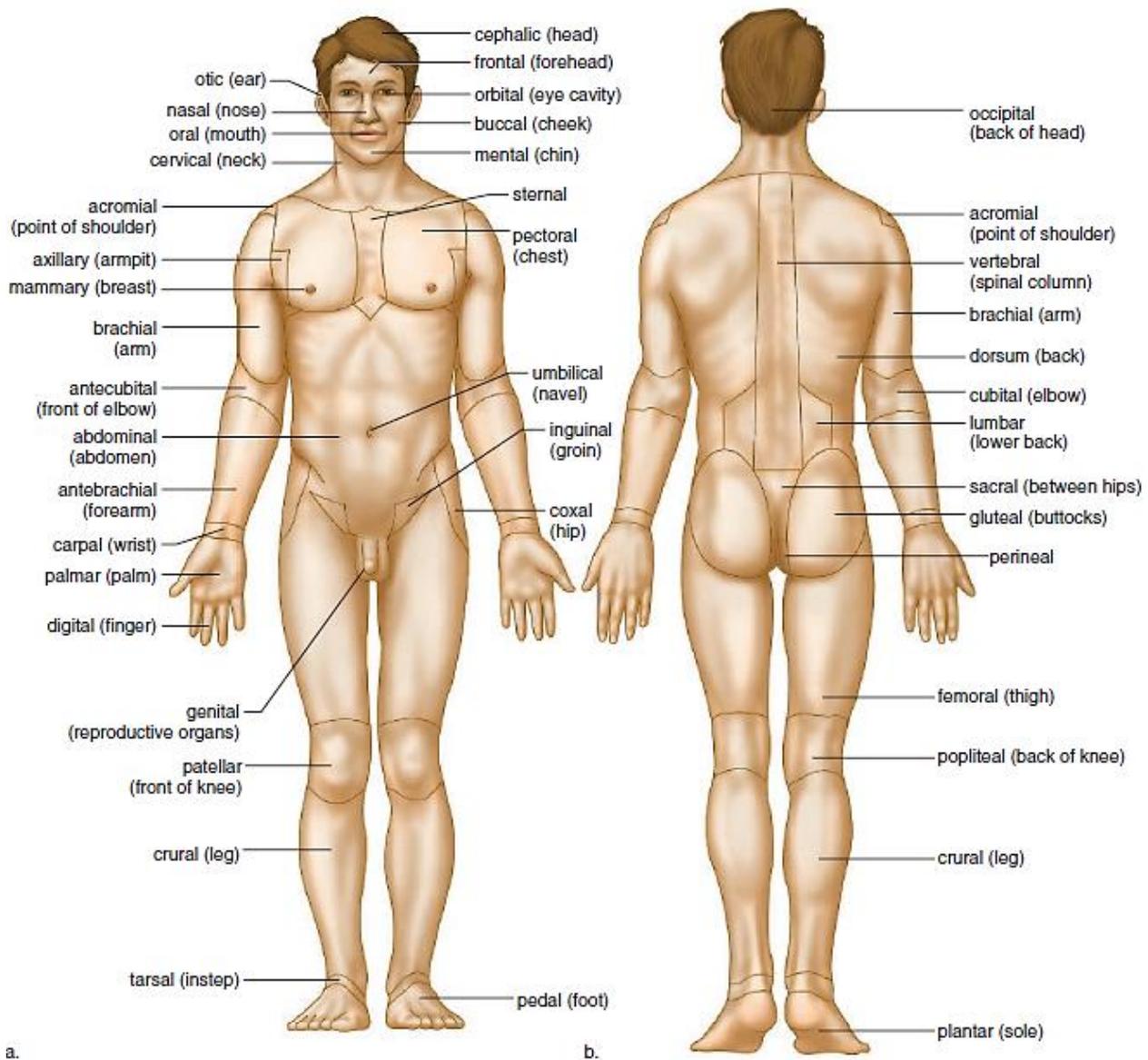


Major Body Regions

The external anatomy and landmarks of the body is important in performing a physical examination and many other clinical procedures. For purposes of study, the body is divided into two major regions called the **axial** and **appendicular regions**. Smaller areas within the major regions.

Axial Region

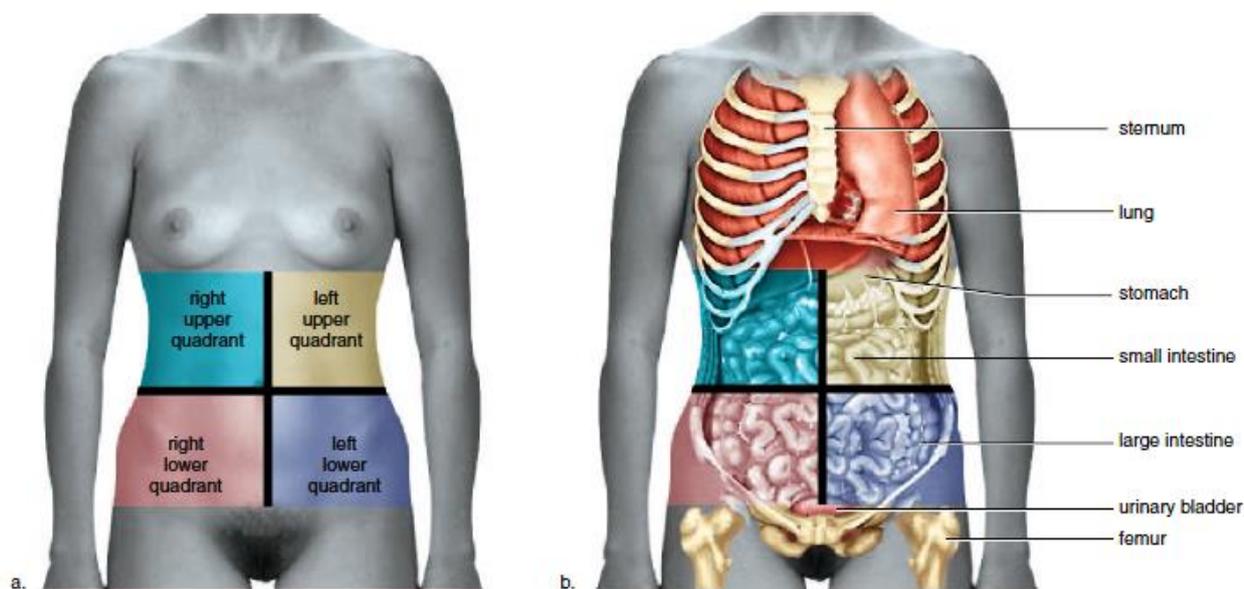
The axial region consists of the **head**, **neck (cervical region)**, and **trunk**. The trunk is further divided into the **thoracic** region above the diaphragm and the **abdomin** region and **pelvis** region below it.



Appendicular Region

The **appendicular region** of the body consists of the **upper limbs** and **lower limbs**. The upper limb includes the **arm (brachial region)**, **forearm region**, **wrist (carpal region)**, **hand (manual region)**, and **fingers (digits)**. The lower limb includes the **thigh (femoral region)**, **leg (crural region)**, **ankle (tarsal region)**, **foot (pedal region)**, and **toes (digits)**. In strict anatomical terms, *arm* refers only to that part of the upper limb between the shoulder and elbow. *Leg* refers only to that part of the lower limb between the knee and ankle.

The abdominopelvic cavity is divided into four quadrants by running a transverse plane across the midsagittal plane at the point of the navel. Physicians commonly use these quadrants to identify the locations of patients' symptoms. The four quadrants are: (1) *right upper quadrant*, (2) *left upper quadrant*, (3) *right lower quadrant*, and (4) *left lower quadrant*.



Anatomical position: standing erect, with face forward, arms at the sides, and palms and toes directed forward.

Directional Terms

Directional terms are used to describe the location of one body part in relation to another:

Anterior (ventral) means that a body part is located toward the front. The windpipe (trachea) is anterior to the esophagus.

Posterior (dorsal) means that a body part is located toward the back. The heart is posterior to the rib cage.

Superior means that a body part is located above another part, or toward the head. The face is superior to the neck.

Inferior means that a body part is below another part, or toward the feet. The navel is inferior to the chin.

Medial means that a body part is nearer than another part to an imaginary midline of the body. The bridge of the nose is medial to the eyes.

Lateral means that a body part is farther away from the midline. The eyes are lateral to the nose.

Proximal means that a body part is closer to the point of attachment or closer to the trunk. The elbow is proximal to the hand.

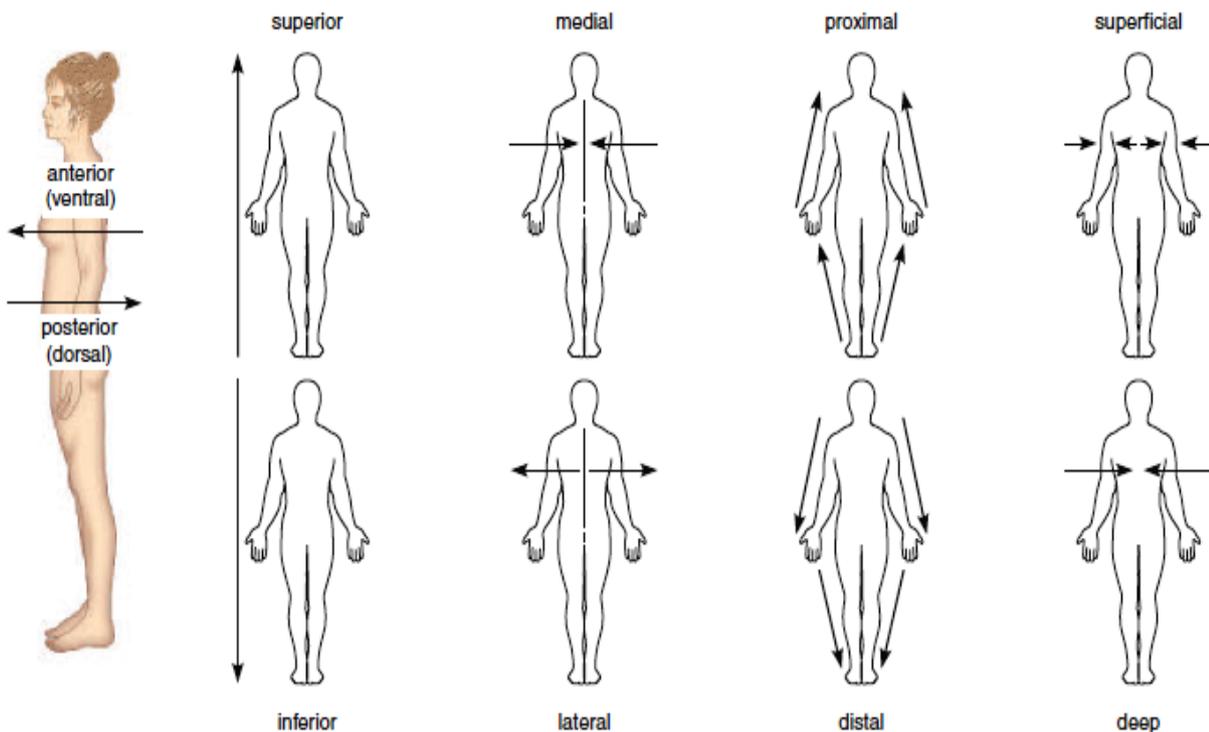
Distal means that a body part is farther from the point of attachment or farther from the trunk or torso. The hand is distal to the elbow.

Superficial (external) means that a body part is located near the surface. The skin is superficial to the muscles.

Deep (internal) means that the body part is located away from the surface. The intestines are deep to the spine.

Central means that a body part is situated at the center of the body or an organ. The central nervous system is located along the main axis of the body.

Peripheral means that a body part is situated away from the center of the body or an organ. The peripheral nervous system is located outside the central nervous system.



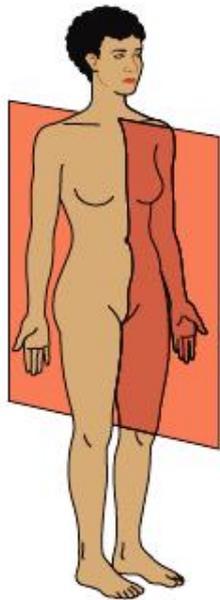
Planes and Sections of the Body

To observe the structure of an internal body part, it is customary to section (cut) the body along a plane. A plane is an imaginary flat surface passing through the body. The body is customarily sectioned along the following planes:

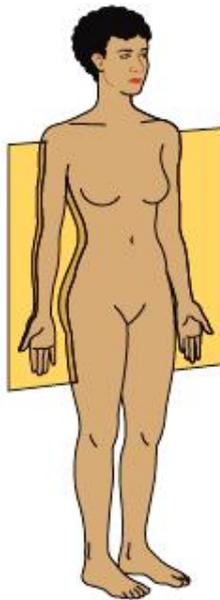
- **Sagittal** (median) **plane** extends lengthwise and divides the body into right and left portions. A midsagittal plane passes exactly through the midline of the body. Sagittal cuts that are not along the midline are called parasagittal sections.
- **Frontal** (coronal) **plane** also extends lengthwise, but it is perpendicular to a sagittal plane and divides the body or an organ into anterior and posterior portions.
- **Transverse** (horizontal) **plane** is perpendicular to the body's long axis and therefore divides the body horizontally to produce a cross section. A

transverse cut divides the body or an organ into superior and inferior portions.

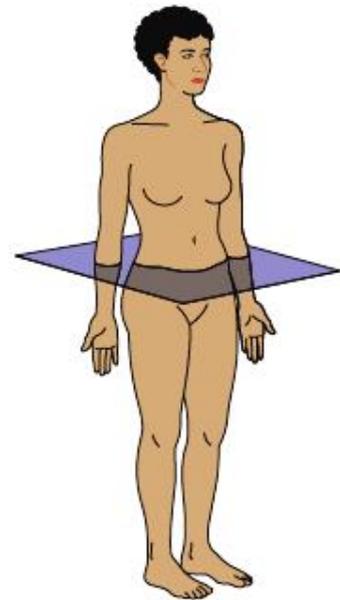
The terms *longitudinal section* and *cross section* are often applied to body parts that have been removed and cut either lengthwise or straight across, respectively.



a. Sagittal (median) plane



b. Frontal (coronal) plane



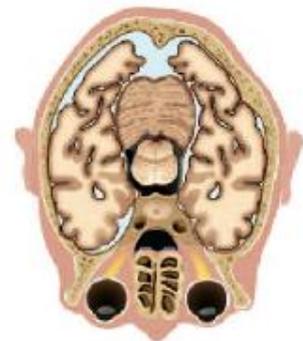
c. Transverse (horizontal) plane



d. Sagittal section of pelvic cavity



e. Frontal section of thoracic cavity



f. Transverse section of head at eye level

Body Cavities and Membranes

During embryonic development, the body is first divided into two internal cavities: the posterior (dorsal) body cavity and the anterior (ventral) body cavity. Each of these major cavities is then subdivided into smaller cavities. The cavities, as well as the organs in the cavities (called the **viscera**), are lined by membranes.

Posterior (Dorsal) Body Cavity

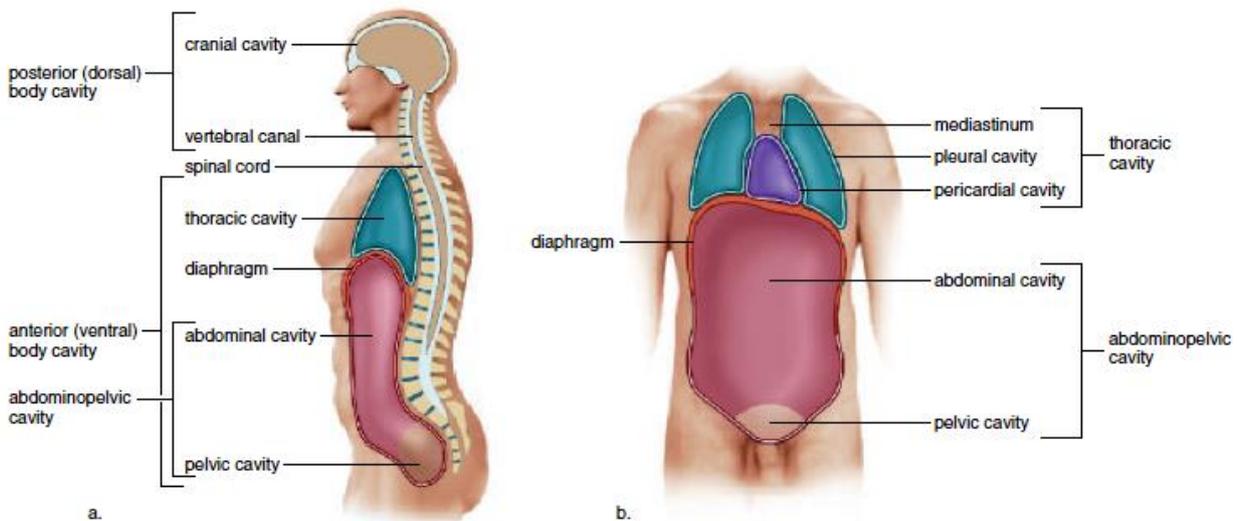
The posterior body cavity is subdivided into two parts:

- (1) The **cranial cavity**, enclosed by the bony cranium, contains the brain.
- (2) The **vertebral canal**, enclosed by vertebrae, contains the spinal cord

The posterior body cavity is lined by three membranous layers called the **meninges**.

.Anterior (Ventral) Body Cavity

The large anterior body cavity is subdivided into the superior **thoracic cavity** and the inferior **abdominopelvic cavity**. A muscular partition called the **diaphragm** separates the two cavities. Membranes that line these cavities are called **serous membranes**. Serous fluid between the smooth serous membranes reduces friction as the viscera rub against each other or against the body wall. To understand the relationship between serous membranes and an organ, imagine a ball that is pushed in on one side by your fist. Your fist would be covered by one membrane (called a **visceral membrane**), and there would be a small space between this inner membrane and the outer membrane (called a **parietal membrane**):



Thoracic Cavity

The thoracic cavity is enclosed by the rib cage, and has three portions: the left, right, and medial portions. The medial portion, called the **mediastinum**, contains the heart, thymus gland, trachea, esophagus, and other structures. The right and left portions of the thoracic cavity contain the lungs. The lungs are surrounded by a serous membrane called the **pleura**. In the mediastinum, the heart is covered by the two-layered membrane called the **pericardium**.

Abdominopelvic cavity

has two portions: the superior **abdominal cavity** and the inferior **pelvic cavity**. The stomach, liver, spleen, gallbladder, and most of the small and large intestines are in the abdominal cavity. The pelvic cavity contains the rectum, the urinary bladder, the internal reproductive organs, and the rest of the large intestine. Males have an external extension of the abdominal wall, called the **scrotum**, where the testes are found. Many of the organs of the abdominopelvic cavity are covered by the **visceral peritoneum**, while the wall of the abdominal cavity is lined with the **parietal peritoneum**.

Systems of the human Body

There are 11 major organ systems in the human body, each with specific functions, yet all are interrelated and work together to sustain life.

Integumentary System: Integument means “skin.” It consists of the skin and the various accessory organs associated with it. These accessories include hair, nails, sweat glands, and sebaceous (oil) glands. The components of the integumentary system protect the underlying tissues from injury, protect against water loss, contain sense receptors, assist in temperature regulation, and synthesize chemicals to be used in other parts of the body.

Skeletal System : forms the framework of the body and protects underlying organs such as the brain, lungs, and heart. It consists of the bones and joints along with ligaments and cartilage that bind the bones together. Bones serve as attachments for muscles and act with the muscles to produce movement. Tissues within bones produce blood cells and store inorganic salts containing calcium and phosphorus.

Muscular System: Muscles are the organs of the *muscular system*. As muscles contract, they create the forces that produce movement and maintain posture. Muscles can store energy in the form of glycogen and are the primary source of heat within the body.

Nervous System: consists of the *brain, spinal cord, and associated nerves*. These organs work together to coordinate body activities. Nerve cells, or neurons, are specialized to transmit impulses from one point to another. In this way, body parts can communicate with each other and with the outside environment. Some nerve cells have special endings called sense receptors that detect changes in the environment.

Endocrine System: This system includes all the glands that secrete chemicals called hormones. These hormones travel through the blood and act as messengers to regulate cellular activities. The endocrine and nervous systems work together to coordinate and regulate body activities to maintain a proper balance. The nervous system typically acts quickly, whereas the endocrine system acts slowly but with a more sustained effect. The endocrine system also regulates reproductive functions in both males and females.

Cardiovascular System: The cardiovascular system consists of the blood, heart, and blood vessels. The blood transports nutrients, hormones, and oxygen to tissue cells and removes waste products such as carbon dioxide. Certain cells within the blood defend the body against disease. The heart acts as a pump to create the forces necessary to maintain blood pressure and to circulate the blood. The blood vessels serve as pipes or channels for the flow of blood.

Lymphatic System: The lymphatic system consists of a series of vessels that transport a fluid called lymph from the tissues back into the blood. In addition to

lymph, the system includes lymph nodes and lymphoid organs such as the tonsils, spleen, and thymus that filter the lymph to remove foreign particles as a protection against disease. Lymphoid organs also function in the body's defense mechanism by enhancing the activities of cells that inactivate specific pathogenic agents. The lymphatic system is sometimes considered to be a part of the cardiovascular system.

Digestive System: The organs of the digestive system include the mouth, pharynx, esophagus, stomach, small intestine, and large intestine (colon), which make up the digestive tract. Accessory organs of this system include the teeth, tongue, salivary glands, liver, gallbladder, and pancreas. The functions of this system are to ingest food, process it into molecules that can be used by the body, and then eliminate the residue.

Respiratory System: The respiratory system brings oxygen, in the form of air, into the lungs, removes the carbon dioxide that is produced in metabolism, and provides a membrane for the exchange of these gases between the blood and lungs. The system consists of the nasal cavities, pharynx, larynx, trachea, bronchi, and lungs.

Urinary System: The kidneys, ureters, urinary bladder, and urethra make up the urinary system. The kidneys remove various waste materials, especially nitrogenous wastes, from the blood and help to regulate the fluid level and chemical content of the body. The product of kidney function is urine, which is transported through the ureters and urethra. The urinary bladder serves as a reservoir or storage area for the urine.

Reproductive System: The purpose of the reproductive system is the production of new individuals. The primary organs of the system are the gonads that produce the reproductive cells. These are the ovaries in females and testes in males. In addition to gonads, there are accessory glands, supporting structures, and duct systems for the transport of reproductive cells.

The body must maintain a relatively constant internal environment despite changes in external conditions. This constancy, or balance, is called **homeostasis**.