



AFCDA01 Hall/Raff

4N051, Module 6, Major Organs and Systems Lesson 2- Systematic Anatomy



Systematic Anatomy

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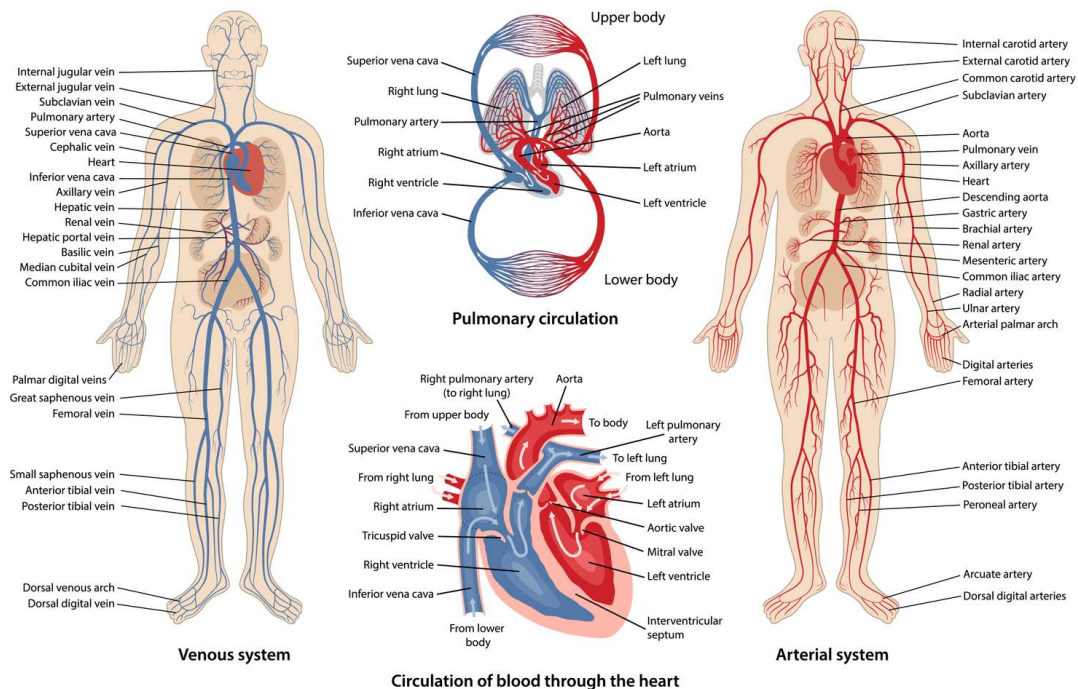
AFCDA01 Hall/Raff

After completing this lesson, the student will be able to identify systematic anatomy principles in accordance with prescribed guidance and publications

Anatomy and Physiology of the Circulatory System

The circulatory system is one of the most vital systems for sustaining life. Made up of the blood, heart and blood vessels the major functions of this system are to transport oxygen and nutrients to all parts of the body and to provide a means for the removal of waste products. The heart is a hollow, muscular organ that lies to the left side of the center of the chest known as the mediastinum. The lungs are located lateral to the heart and the sternum, ribs and thoracic vertebrae provide protection to the heart.

HUMAN CARDIOVASCULAR SYSTEM



Hover and click on the photo to zoom in.

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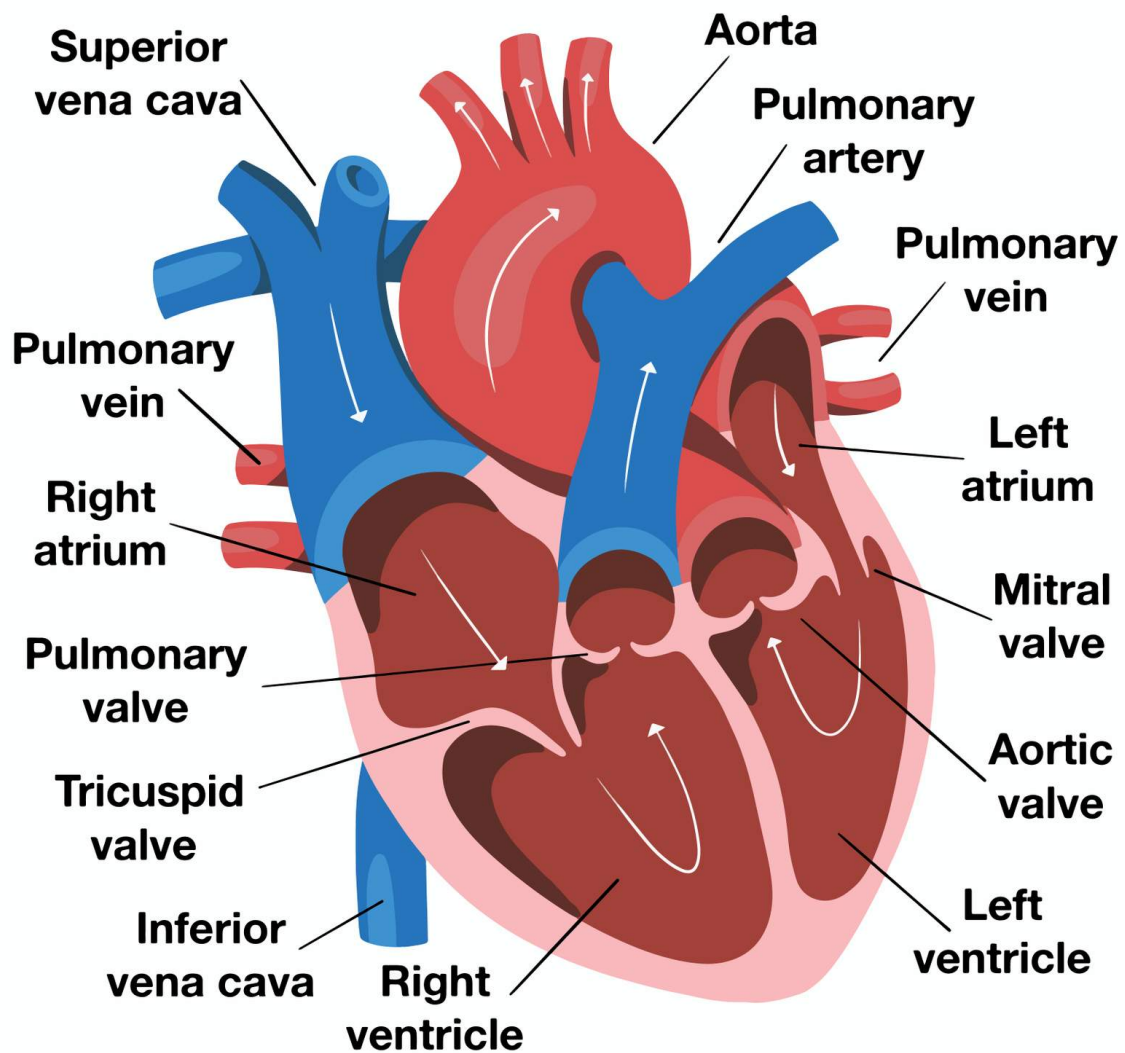
The Heart

Three layers make up the structure of the heart. The outer layer is the pericardium, a thin sac covering the heart muscle. The second layer is the myocardium, which is the thick, muscular portion of the heart. Lastly, the endocardium is the thin membrane that lines the inner surface of the heart muscle.

The heart is divided into **two** upper and **two** lower chambers. The two upper chambers are referred to as the atria and the two lower chambers are the ventricles. Separately the atria and ventricles are referred to as the right atrium, right ventricle, left atrium and left ventricle. The

right and left sides of the heart are divided by a wall called the septum. Within the chambers of the heart are four valves that ensure a constant one-way flow of blood. The valve between the left atrium and left ventricle is the mitral (bicuspid) valve made of two flaps. The valve between the right atrium and right ventricle is called the tricuspid valve, composed of three flaps. A third valve called the aortic valve is located between the left ventricle and the aorta. The fourth valve leads from the right ventricle to the pulmonary artery. This valve is called the pulmonary valve.


Take a look at the diagram below of the heart and when you are ready, test your knowledge by using the drag and drop exercise.



Hover and click on the photo to zoom in.

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Complete the drag and drop exercise below before moving forward.

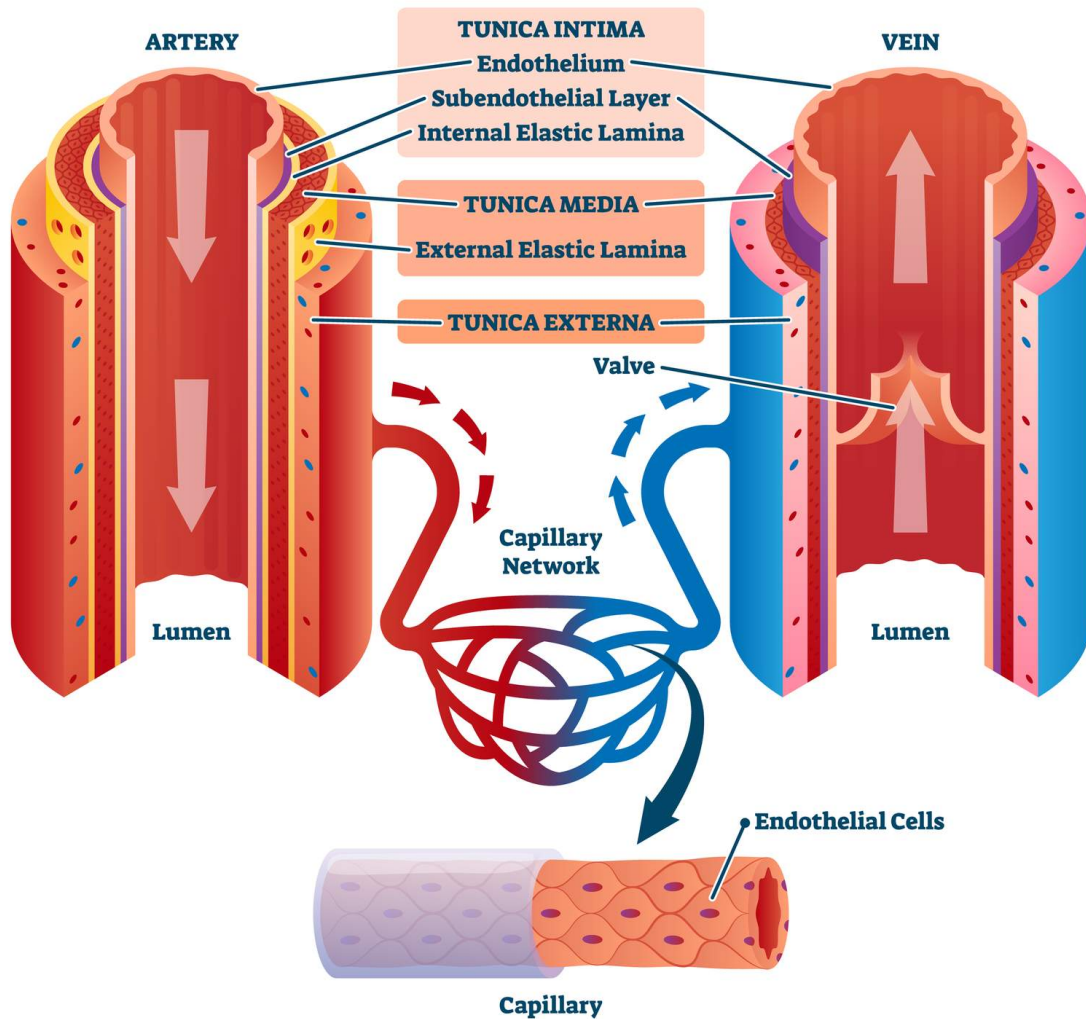
 Thumbnail



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Blood vessels are hollow pathways for blood to travel through. Vessels are divided into **three** types: arteries, capillaries, and veins.

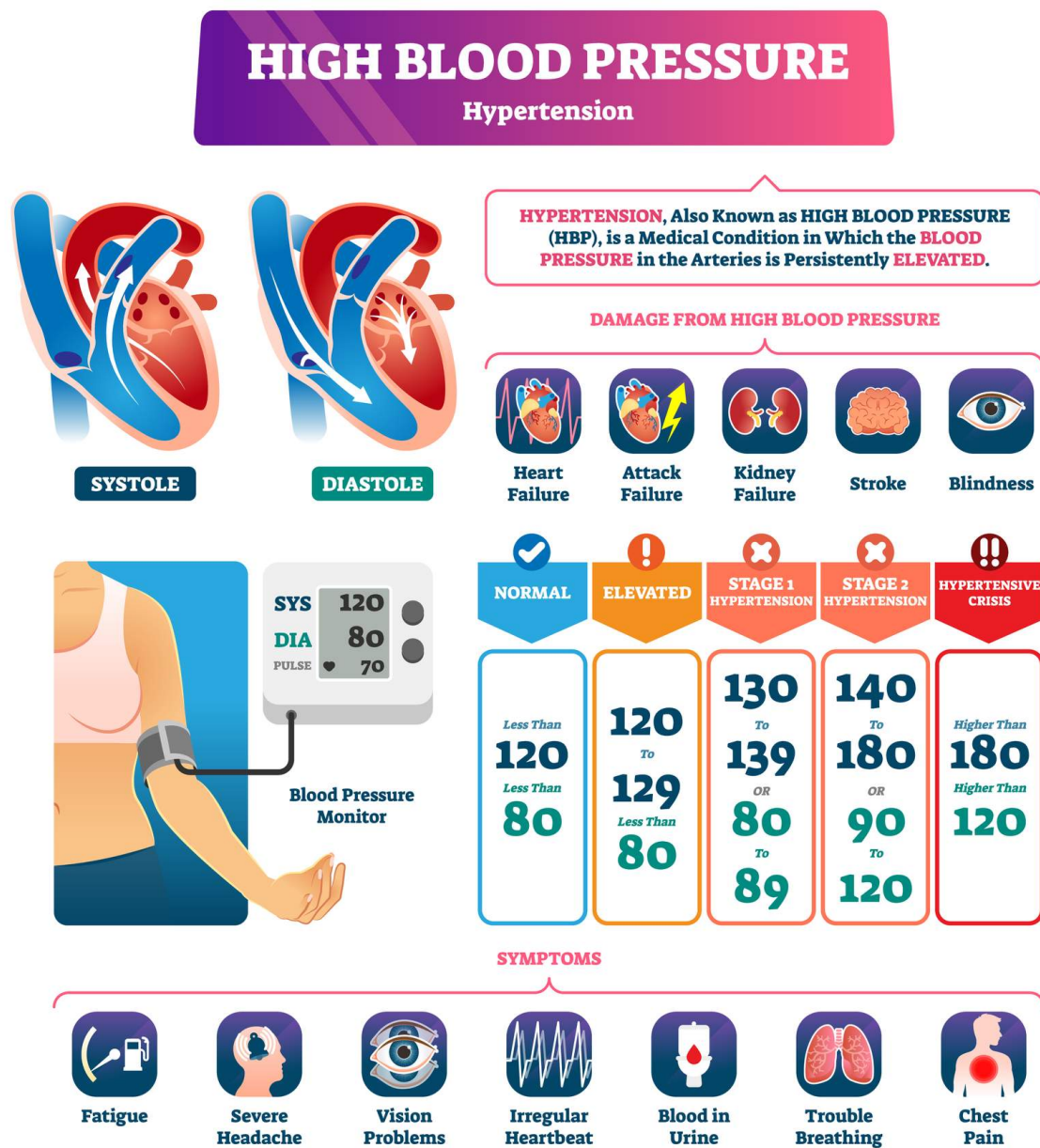
BLOOD VESSELS



Arteries further divide into arterioles and veins divide into venules. Arteries are elastic vessels strong enough to maintain blood under a relatively high pressure. The aorta is the largest artery in the body extending from the left ventricle branching into the body's main arteries. The major arteries branch into arterioles which connects to capillaries. Capillaries are the smallest blood vessels. Composed of a very thin membrane, capillaries permit the exchange of nutrients and waste products with the body's cells.

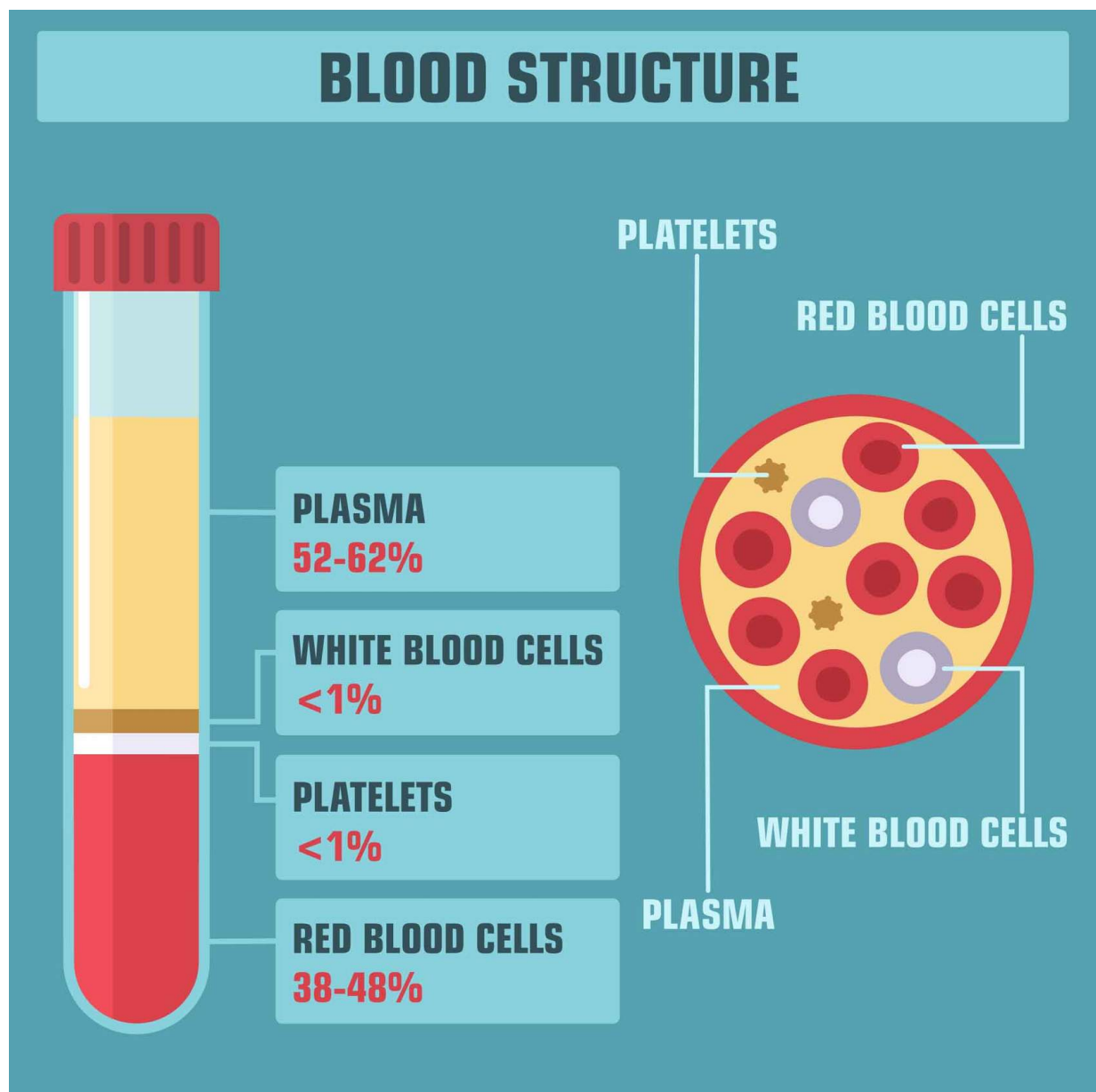
Capillaries then join with venules, where the pathway back to the heart begins. Venules are the smallest branches of the major veins carrying blood from the capillaries to the veins. The

construction of veins is similar to arteries, with the exception they're not as strong in elasticity. The two largest veins in the body are the superior vena cava and the inferior vena cava, both of which connect to the right atrium.



Adults have approximately 5 liters of blood in their body. This whole blood contains red blood cells (RBC), white blood cells (WBC), platelets and plasma. RBCs contain hemoglobin that gives

the blood its red color. RBCs live three to four months and are destroyed by the liver and spleen as they become old. WBCs are colorless cells that protect the body against infection. Produced by bone marrow, when an infectious agent invades the body, WBCs reproduce rapidly to combat the infection. While they live for about nine days, a high WBC count detected in a blood test is a good indication of the presence of some type of infection. Platelets are responsible for the blood's clotting action. They are produced by the bone marrow and live for approximately four days.



Plasma

Plasma is the sticky liquid portion of the blood, consisting of mostly of water. The function of the plasma is to transport the blood cells throughout the circulatory system. Plasma also carries other nutrients and chemical substances throughout the body and transports waste products. In a blood sample, 55 percent of the sample is plasma and the other 45 percent is blood cells. The percentage of cells is called the hematocrit or packed cell volume.

Let's look at the physiological process of circulation. The action of the heart is fundamental to the process of circulation. Both atria are receiving chambers and both ventricles are pumping chambers. The brain stimulates the electrical action of the heart, which results in a constant pumping activity. Blood automatically enters the atria each time that blood is pumped out of the heart by the ventricles. The blood flows throughout the entire circulatory system as a result of the pressure that the pumping activity generates. Blood pressure is referred to in two separate measurements.

The pressure that blood exerts against the walls of the arteries during the pumping (systole) action of the heart is called the systolic blood pressure. When the heart muscle rests between each contraction (diastole), the pressure that remains in the system is known as the diastolic blood pressure. Arterial walls are controlled by nervous stimulation that permits changes in the diameter of the vessels to accommodate the blood volume and pressure within them.

Multiple Choice

What is the sticky liquid portion of the blood, consisting of mostly water?

☐

Plasma

☐ White blood cells

☐ Platelets

☐ Red blood cells

SUBMIT

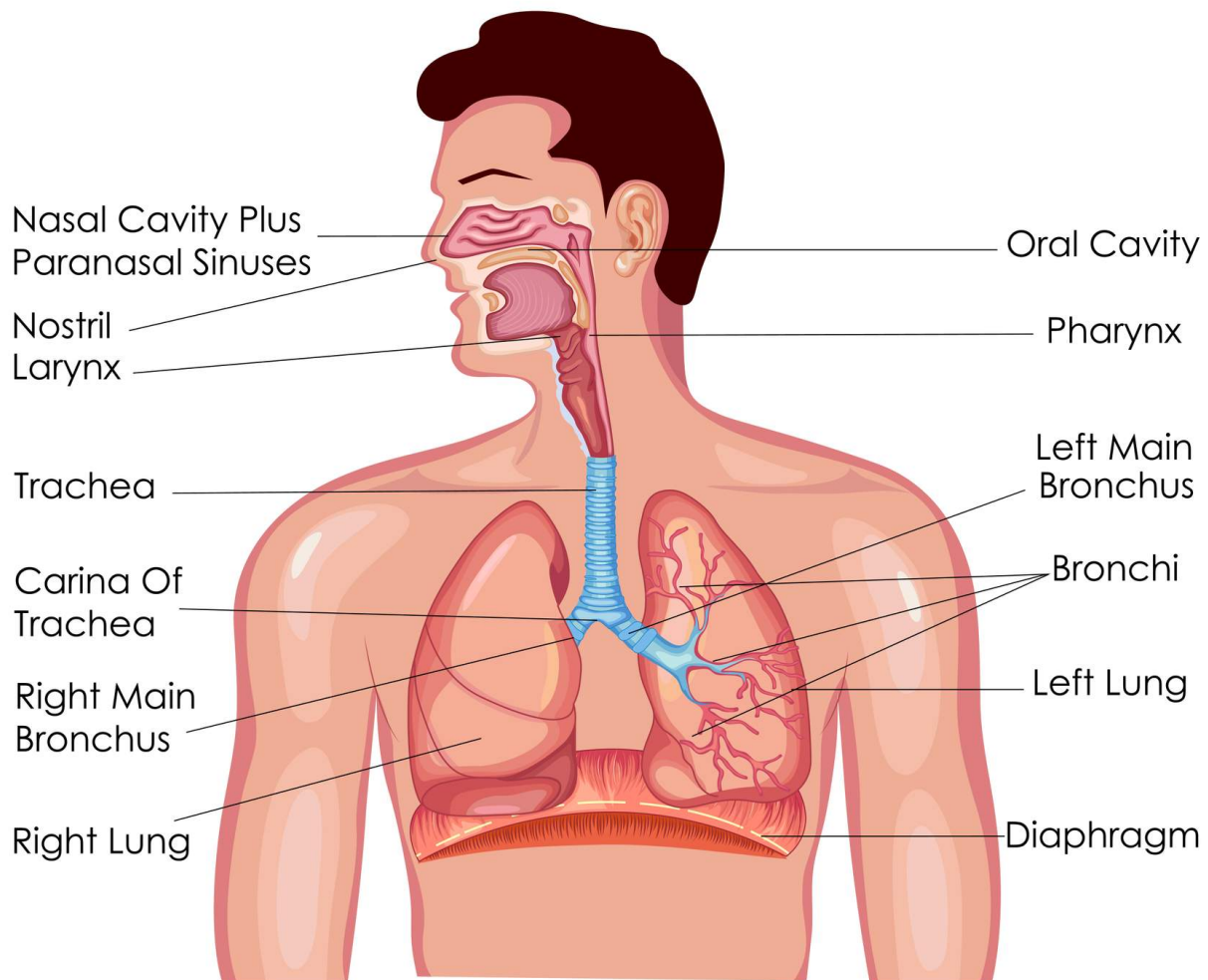


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Anatomy and Physiology of the Respiratory System

Oxygen is required to support the metabolic processes that sustain life. Carbon dioxide is a waste product of the metabolism. Respiration is the process of the inhalation of oxygen, exhalation of carbon dioxide and what is involved in the exchange of these two gases at a cellular level. In order to sustain life the body requires a constant exchange of these gases. The respiratory system is divided into three major sections, the upper respiratory system, lower, and accessory structures.

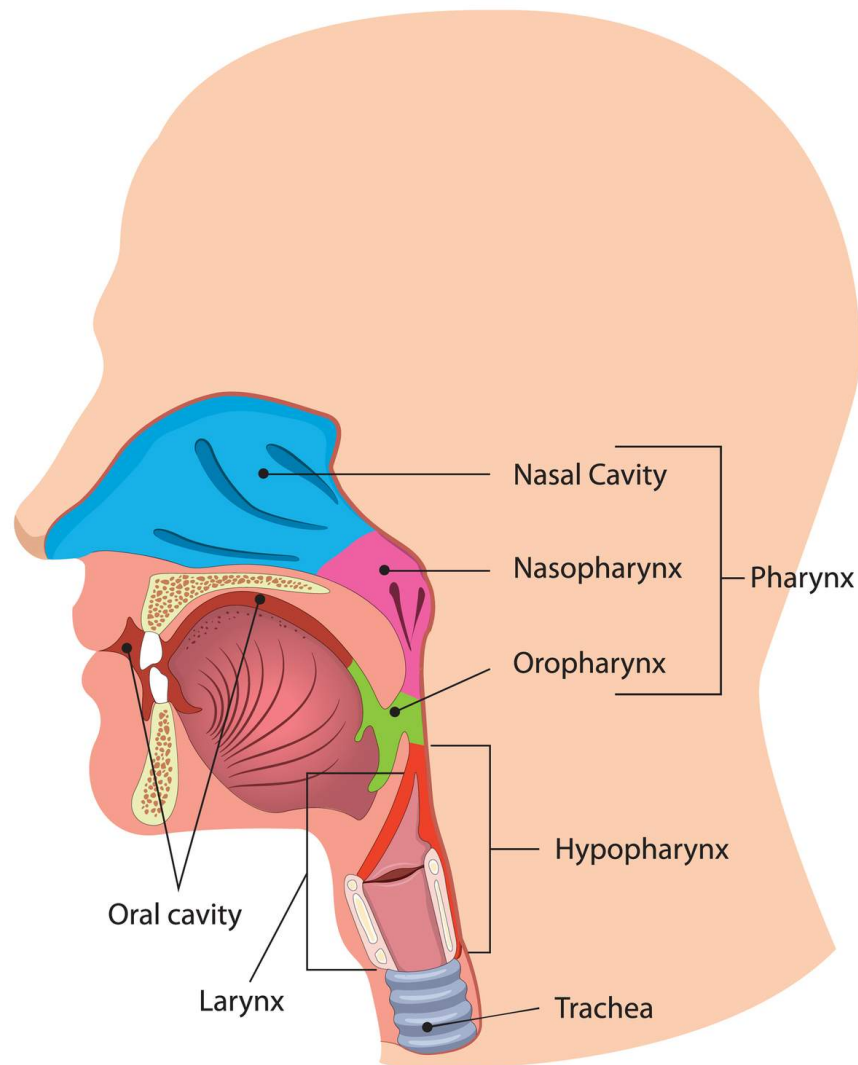
Respiratory System



The upper respiratory system includes the nose, pharynx and larynx. The nose is a framework of bone and cartilage that has an external covering of skin. The two external openings are the nostrils. The nostrils join to form the nasal cavity, which is divided into two parts by the nasal septum and

separated from the mouth by the palate. Bones of the skull and face form the roof of the nasal cavity, which is lined with a mucous membrane and hair-like structures called cilia.

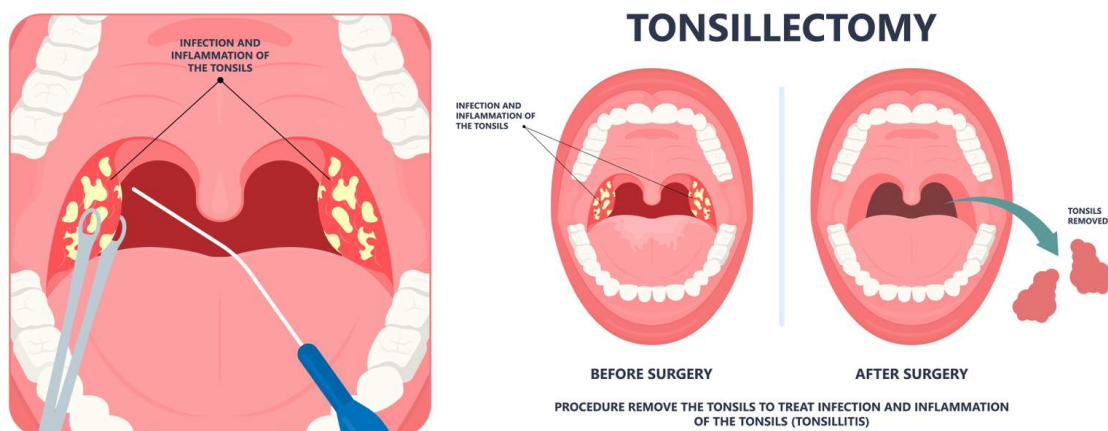
Anatomy (Larynx / Pharynx)



The pharynx or throat is the passageway between the nose and the larynx. It consists of three parts: nasopharynx, oropharynx and laryngopharynx. The nasopharynx is the superior portion

of the pharynx and contains the two eustachian tubes that connect to the middle ears. The mucous membrane that lines the pharynx extends continuously to the eustachian tubes.

The nasopharynx also contains a mass of lymphoid tissue called the adenoids. The oropharynx is located directly posterior to the mouth and contains the tonsils. The only known function of the tonsils is the formation of lymphocytes. The tonsils often become infected, resulting in tonsillitis.



A tonsillectomy is the surgical removal of the tonsils. The laryngopharynx contains an anterior opening into the larynx and a posterior opening into the esophagus. The larynx or voice box lies in the middle of the neck, between the base of the tongue and the trachea. It is the passageway from the pharynx to the trachea. The larynx is a triangular, cartilaginous structure that is composed of nine cartilages that are joined by ligaments.

These nine cartilages include three single cartilages and three paired cartilages. The largest of these cartilages is the thyroid cartilage, which is butterfly-shaped and forms a large prominence known as the Adam's apple.

The lower respiratory system consists of the trachea, bronchi, alveoli and lungs. The trachea or windpipe is located anterior to the esophagus extending from the larynx terminating at the point it divides into the right and left bronchi. It is a cylindrical tube that is composed of 16 to 20

C-shaped cartilage rings lined with cilia and a mucous membrane. The cartilage rings add strength to the trachea to prevent it from collapsing. The trachea branches off into two main passageways known as the bronchi. The right bronchus extends into the right lung; the left bronchus extends into the left lung.

Each bronchus is further divided inside the lungs into smaller passages leading to each lobe within the lungs. Once inside the lobes, the bronchus then branches into bronchioles leading to the alveoli. The alveoli are the air sacs of the lungs connecting to the capillaries of the circulatory system within the lungs. The lungs are the primary organs of respiration, located inside the thoracic cavity and enclosed in a protective lining, the pleura. The right lung contains three lobes and the left lung contains two. The lungs are soft and spongy and constantly change shape to facilitate breathing.

Three main accessories that assist the respiratory system are: pleurae, diaphragm and intercostal muscles.



The phrenic nerves control the action of the diaphragm and the intercostal nerves control the action of the intercostal muscles. The diaphragm and intercostal muscles contract to become smaller creating additional room in the thoracic cavity for lungs to expand as they fill with air. The diaphragm moves downward as it contracts, while intercostal muscular contraction permits the ribs to move forward and slightly upward. All of this activity results in a decrease in intrathoracic pressure.

When pressure in the intrathoracic space (the space between the outer surface of the lungs and the internal lining of the thorax) decreases; atmospheric pressure outside of the body forces air into the lungs through the passages of the respiratory system. Air then enters the upper respiratory system through the nose from the nostrils. As it passes through the nasal cavity, it is warmed and moisturized through contact with the mucous membrane. The cilia in the nasal cavity cause a wave-like motion that directs foreign matter toward the pharynx. The foreign matter is then either expelled through the mouth from coughing or swallowed. As the air passes through the trachea, the cilia and mucous membrane lining help to trap additional foreign matter.

Fill in the Blank

The _____ is the main muscle of respiration and is located inferior to the lungs.

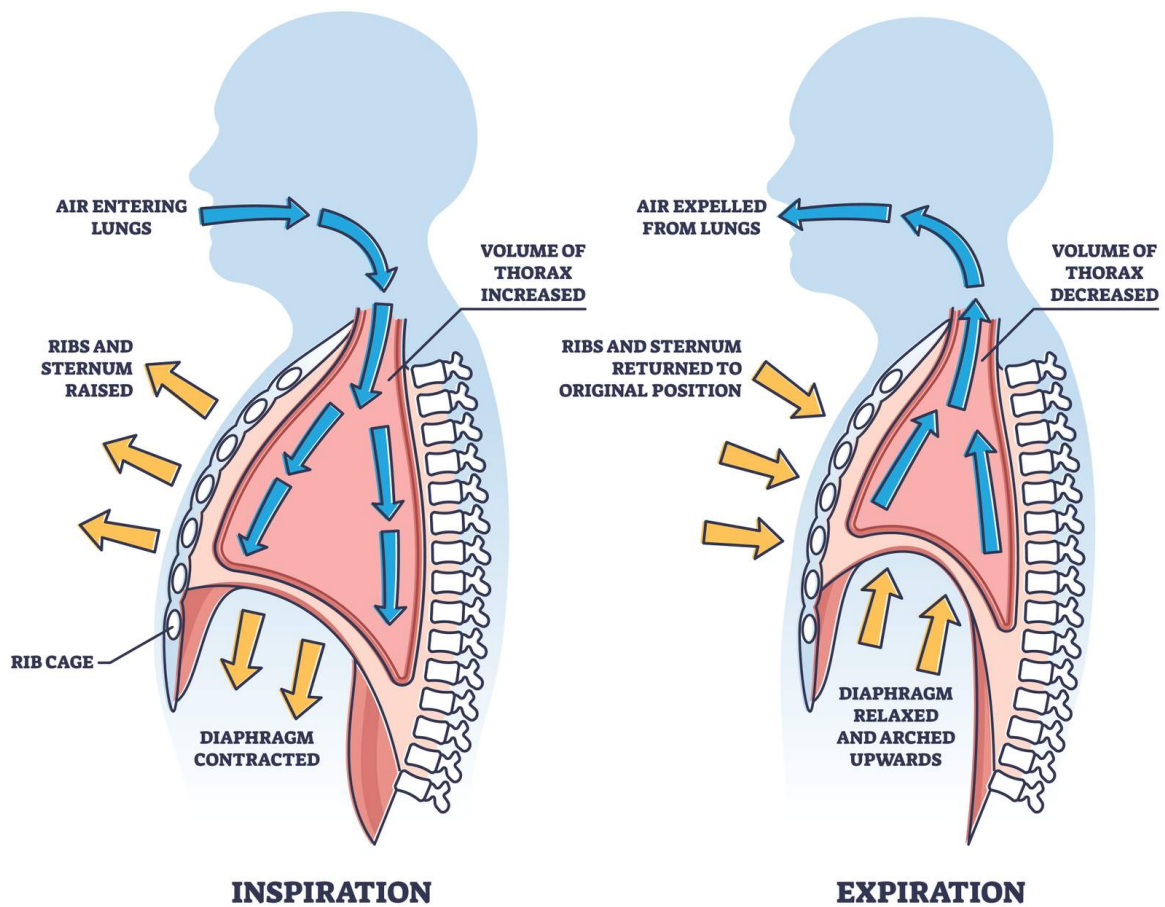
Type your answer here

SUBMIT



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MECHANISM OF BREATHING

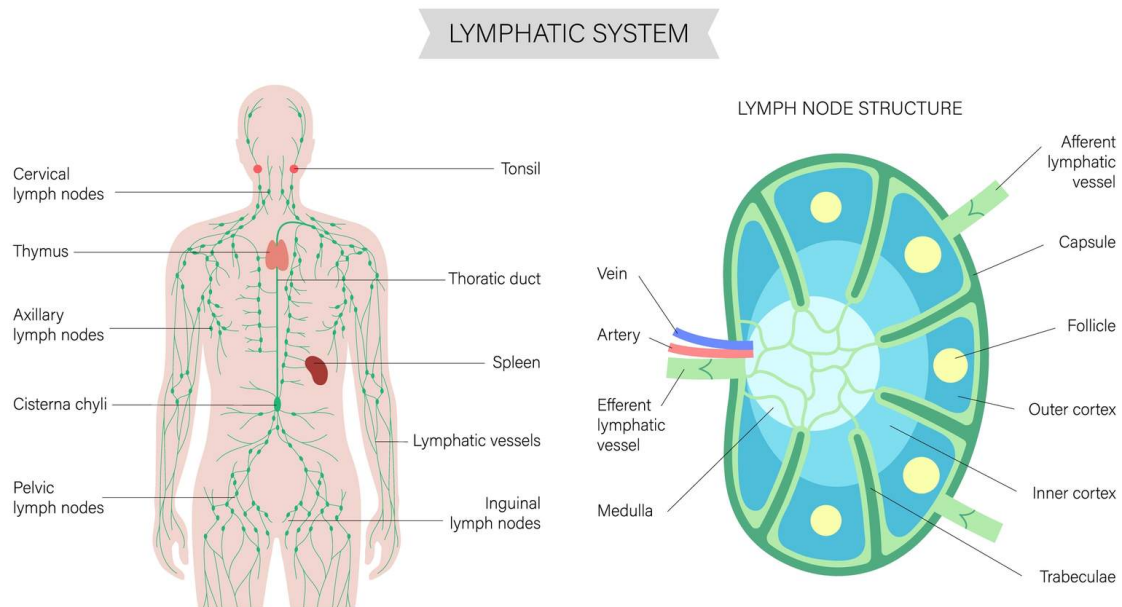


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The Lymphatic System

The lymphatic system works closely with the circulatory system to circulate body fluids. The lymphatic system consists of two functions:

- 1 Help maintain a proper fluid balance by removing excess fluid from the interstitial spaces that exist between cells and within most body tissues.
- 2 Help defend the body against infection. The components of the lymphatic system include lymphatic capillaries, lymphatic vessels, lymph nodes, lymphatic trunks, collecting ducts, the thymus and the spleen.



Lymphatic capillaries run parallel to the capillaries of the circulatory system. They are microscopic tubes that extend into the spaces within the body tissues. Like blood capillaries, lymphatic capillaries have a thin membrane wall. Lymphatic capillaries merge and form

lymphatic vessels. These vessels are similar to the veins in structure. The larger lymphatic vessels lead to lymph nodes.

Lymph nodes act as the filters of the lymphatic system. The vessels that lead into the node are called afferent lymphatic vessels. The vessels that lead out of the node are known as efferent lymphatic vessels. After lymphatic vessels pass through the lymph nodes, they merge to form larger vessels known as lymphatic trunks. All of the lymphatic trunks join to form one of the two collecting ducts, the thoracic duct or the right lymphatic duct.

The thoracic duct joins with the left subclavian vein. The right lymphatic duct joins with the right subclavian vein. The merging of these two ducts with the left and right subclavian veins is what ties the lymphatic system to the circulatory system. The thymus functions similar to the lymph nodes. Located in the mediastinum, anterior to the aorta and posterior to the sternum; the thymus extends from the base of the neck to the pericardium. The spleen is the largest lymphatic organ. Functioning similar to lymph nodes, the spleen is located in the upper left quadrant of the abdomen, inferior to the diaphragm and posterior to the stomach.

Let's look at the **physiological** process of the lymphatic system.

The lymphatic system removes excess fluid from the body tissues and helps defend the body against infection. Excess fluid from the body tissues enters the lymphatic capillaries. Known as lymph after entering the capillaries it then travels through the lymphatic vessels to the various lymph nodes. Lymph is then transported through the lymphatic trunk to one of the two collecting ducts. The lymph now becomes part of the blood plasma within the circulatory system, just before it enters the right atrium.

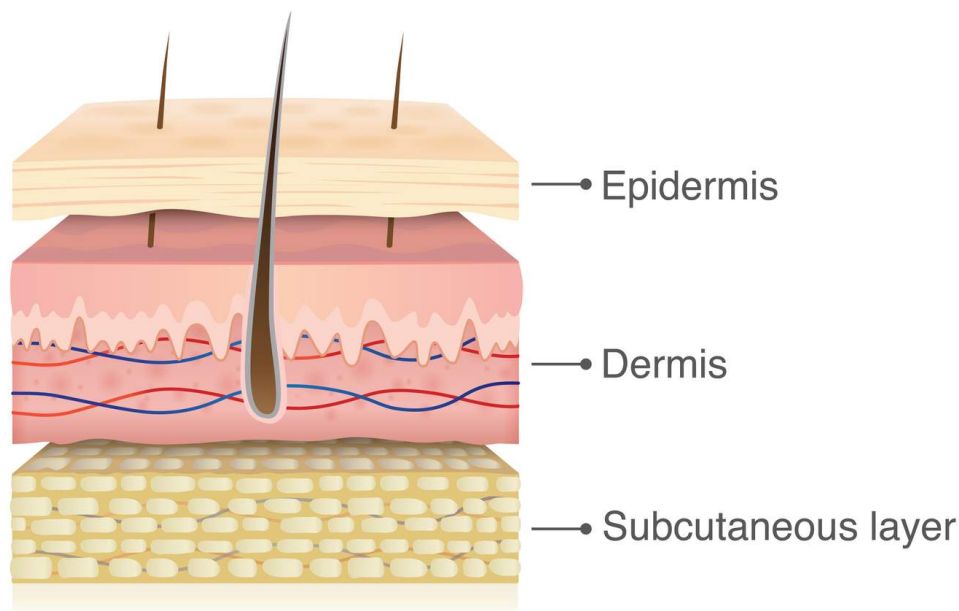
The lymph nodes contain two infection-fighting organisms called lymphocytes and macrophages. As the lymph is filtered in the nodes, the lymphocytes attack any bacterial cells

and viruses that may be present. The macrophages surround and destroy foreign substances, damaged cells and cellular debris.

CONTINUE

The Integumentary System

Three Main Layers of The Skin



The integumentary system encompasses the entire human body. This system provides a body covering for protection and it regulates body temperature. Characteristics that determine some of a person's physical appearance also can be attributed to the integumentary system. The organs of the integumentary system fall into one of two categories: skin and skin appendages. The skin being the largest organ of the body consists of three layers of tissue.

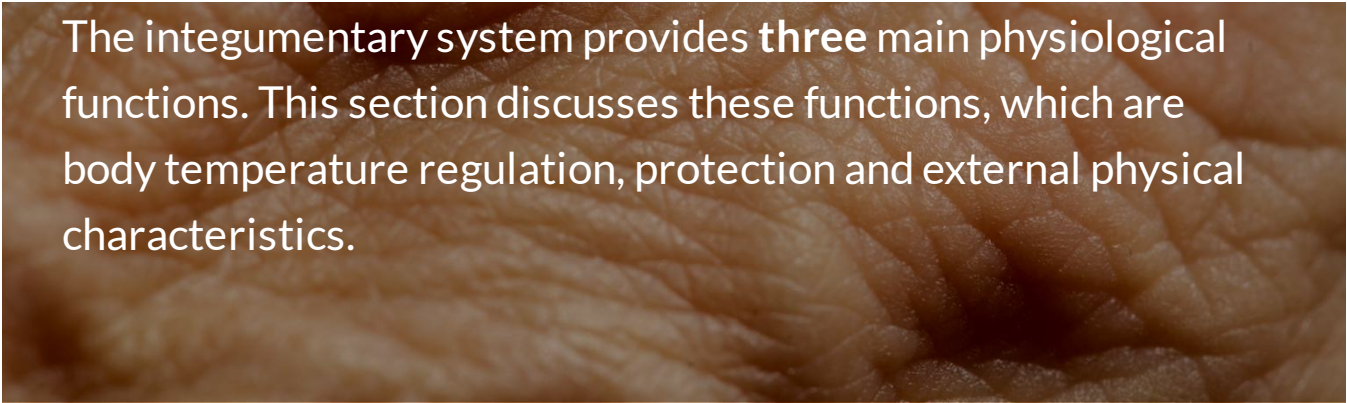
The two main layers of tissue are called the **epidermis** and the **dermis**. The third layer of tissue, which serves as a connector to internal body structures, is called the subcutaneous layer or hypodermis.

The epidermis is the outer layer of the skin. The epidermis lacks blood vessels; however, the blood vessels of the dermis nourish the deeper layer of the epidermis. The epidermis contains both living and dead cells with three cellular layers in most body areas with an exception of the palm of the hands and soles of the feet. In these particular areas, four layers can be found. The stratum corneum, containing mostly dead cells is the outermost layer of the epidermis. Stratum granulosum is the second layer containing only three to five layers of cells. In body areas where the epidermis contains only three layers, the stratum granulosum is missing.

Stratum spinosum is the third layer of epidermis containing many layers of cells. Stratum basale is the fourth and deepest layer of the epidermis, also referred to as the basal cell layer. The dermis is composed of connective tissue providing toughness and elasticity to the skin. The thickness of the dermis varies depending on the body area. Blood vessels, nerves, sweat glands, sebaceous glands and hair follicles can all be found in the dermis. Beneath the epidermis and dermis lies the subcutaneous layer. This layer consists mainly of connective and adipose or fatty tissue.

Like the dermis, the thickness of the subcutaneous layer varies depending on the body area. The amount of adipose tissue also varies depending on an individual's nutritional status. The major blood vessels that support the integumentary system are located in the subcutaneous layer.





The integumentary system provides **three** main physiological functions. This section discusses these functions, which are body temperature regulation, protection and external physical characteristics.

Body Temperature Regulation - A primary function of the integumentary system is to regulate internal body temperature. The integumentary system works with the circulatory system to perform this function. Blood vessels dilate to permit an increase in blood flow to the body surface when external temperatures are high. This also stimulates an increase in sweating, which helps cool the body through evaporation. Lower external temperatures result in a constriction of vessels, enabling the body to retain heat.

Protection - As a covering for the entire body, the skin provides protection in two main ways. The first way that the skin provides protection is by protecting against external damaging factors. The admission of bacteria and other foreign matter directly into the body is normally prevented by an intact skin surface. The skin also helps guard internal organs from injury. Additionally, the nerve endings in the skin serve to warn of factors that can be dangerous to a person, such as excessive heat, cold, pressure or pain. The second way skin provides protection is that it keeps the body from losing excessive internal water content.

External Physical Characteristics - The external physical appearance of an individual is greatly attributed to the integumentary system. The most notable of these traits is skin color. The deepest layer of the epidermis contains cells known as melanocytes. Melanocytes produce a substance called melanin. The melanin serves two purposes—pigmentation (color) of the skin and protection against damaging ultraviolet rays of the sun. The ultraviolet ray protection is made possible by the melanin's ability to absorb light energy. Other skin traits that contribute to external physical characteristics include the amount of adipose tissue, hair amount and color

and the strength and condition of the dermis. As elasticity and strength diminish with aging, the appearance of the skin tends to become more wrinkled.

Multiple Choice

What are the three main layers of the skin? Mark all that apply.

☐

Epidermis

☐

Dermis

☐

Subcutaneous

☐

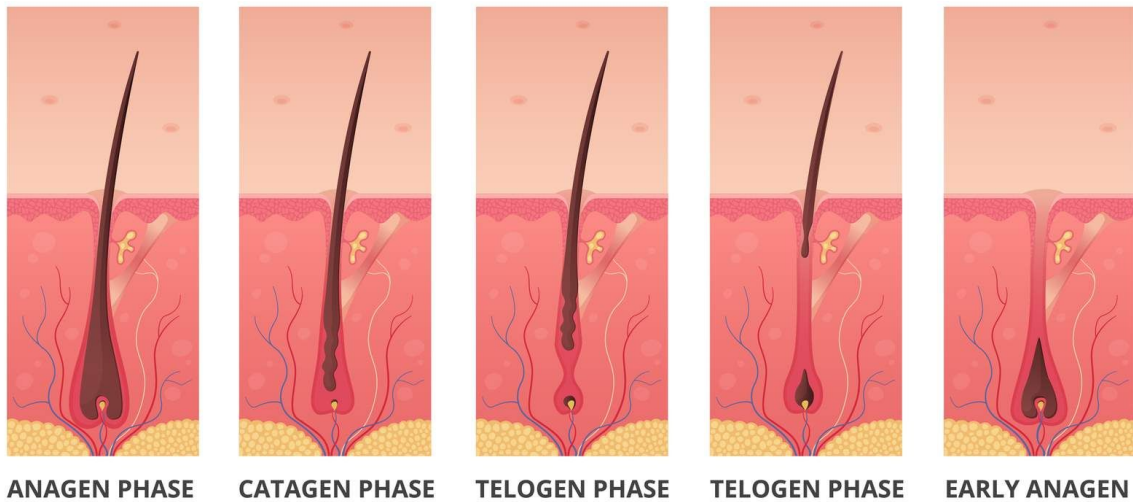
Sub-dermis

SUBMIT



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PHASE OF HAIR GROWTH



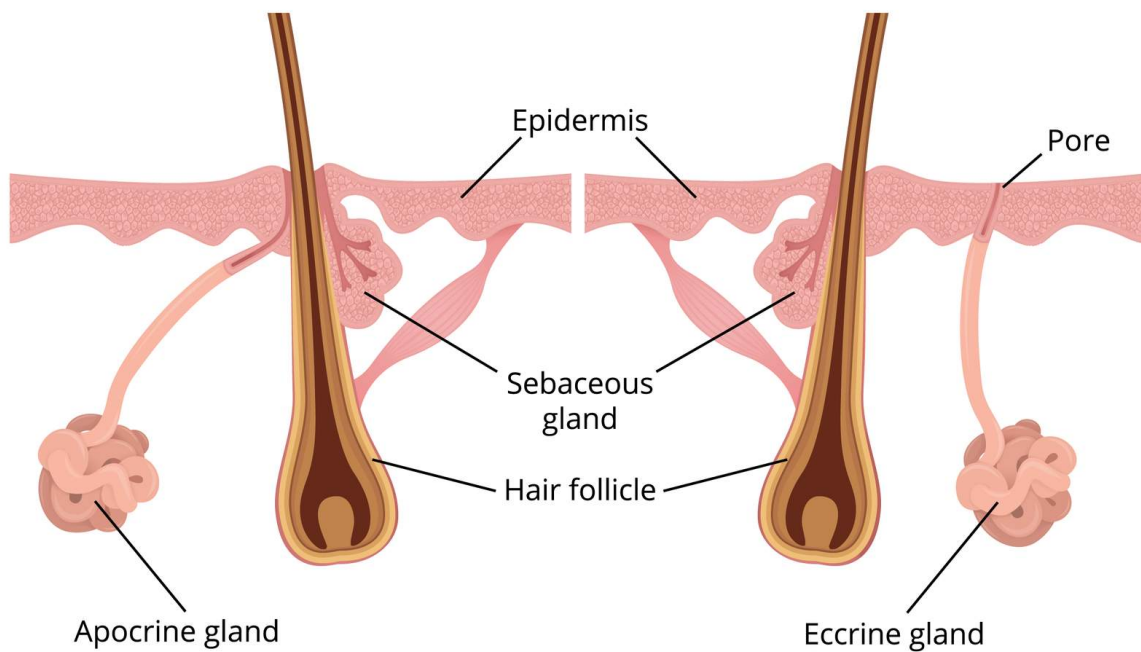
Skin appendages are additional features which are the hair follicles, nails, sweat glands and sebaceous glands. Hair development begins below the surface of the skin and extends into the dermis. The hair follicles are nourished by blood vessels within the dermis. Hair shafts, composed mostly of dead epidermal cells pushes upward through the epidermis and to the exterior skin surface.

Nails are located on the tips of the fingers and toes. Each nail consists of a nail plate, the visible exterior and a nail bed, the skin surface area that the plate lies on top. Nails grow outward from the white area at the base called the lunula.

Hair is located on all surfaces of the skin with the exception of the palms of the hands, soles of the feet, lips and various

reproductive organ surfaces.

SWEAT GLANDS



Sweat glands are most prominent in the palms of the hands and soles of the feet. Each gland originates as a small coil in either the deeper portion of the dermis or the superficial layer of the

subcutaneous tissue. The two types of sweat glands are apocrine glands and eccrine glands. Apocrine glands are usually connected to hair follicles and are stimulated by emotional stress.

These types of sweat glands are referred to as scent glands, as they typically produce an odor. Apocrine glands normally do not begin to function until a person becomes sexually mature at puberty.

Eccrine glands are not connected to hair follicles. These glands extend to the outer skin surface through small openings in the epidermis called pores. Eccrine glands are stimulated by an elevation in body temperature and are most prominent on the back, neck and forehead.

Sebaceous gland, sometimes referred to as oil glands, are usually connected to hair follicles and located in all body areas except the palms and soles, however, they open directly to the skin surface in areas such as the outer corners of the mouth, lips and on the surface of exterior reproductive organs.

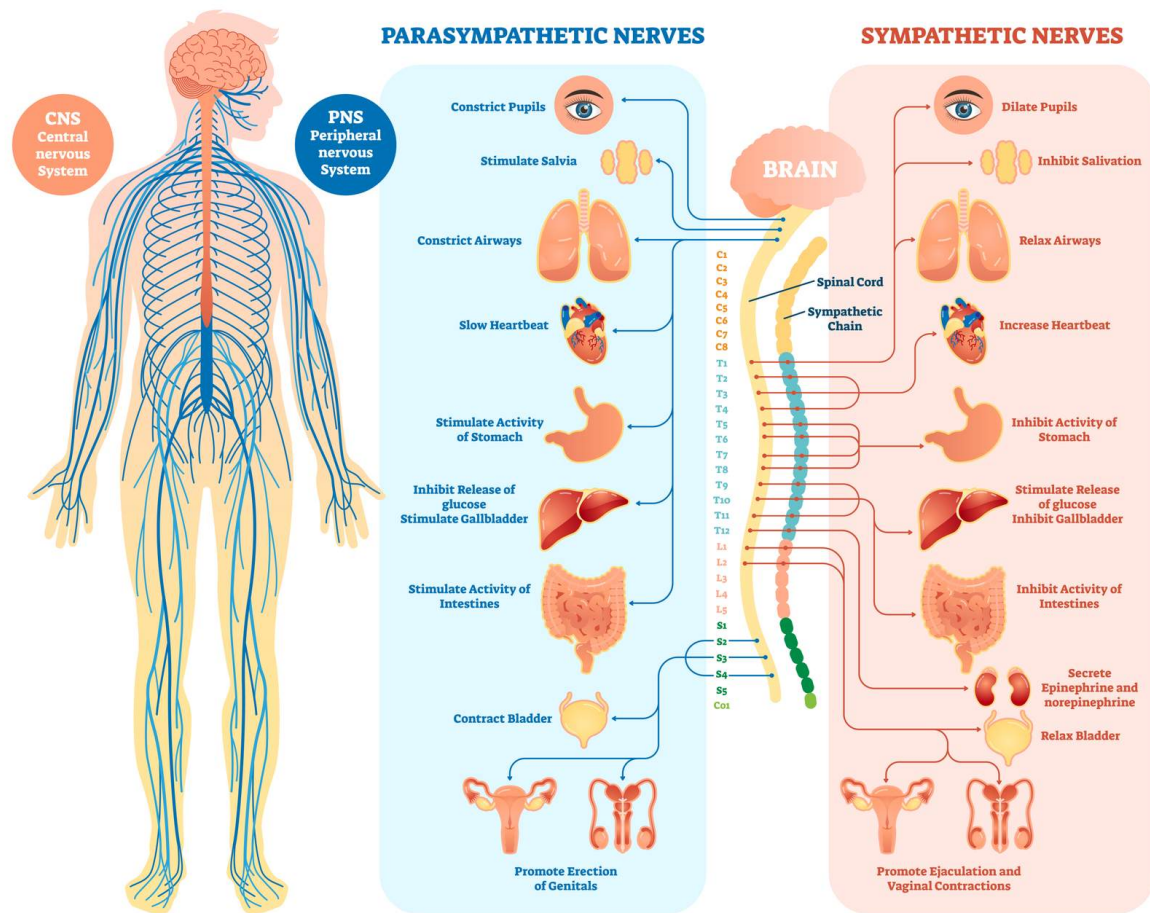
These glands secrete an oily substance called sebum directly into the hair follicles. The sebum keeps the hair and skin surface soft and virtually waterproof.

The Nervous System

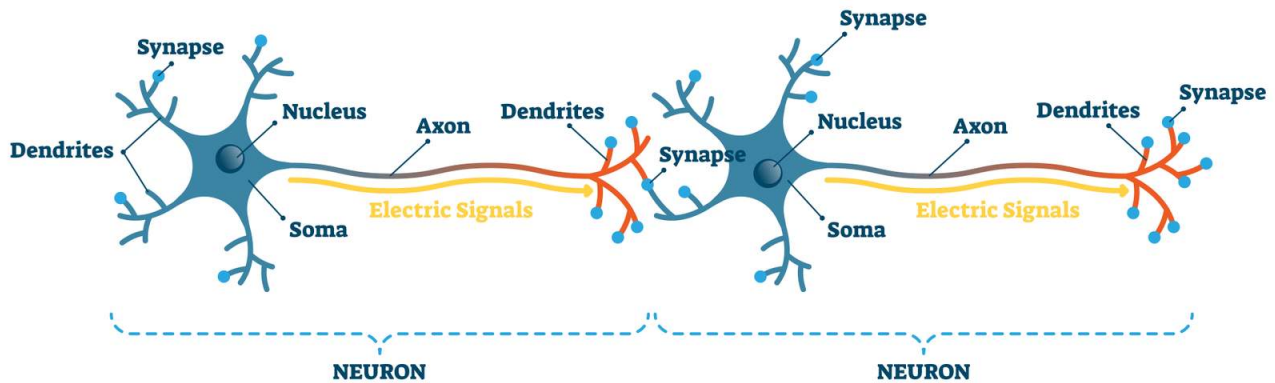
The nervous system is responsible for directing all body systems and functions. There are two main divisions of the nervous system: the central nervous system (CNS) and the peripheral nervous system (PNS). Both of these main divisions are further subdivided working together to permit proper functioning of the nervous system as a whole.

CONTINUE

HUMAN NERVOUS SYSTEM



The **nervous system** is composed mainly of neural tissue. This tissue contains **two** basic types of cells: neurons or nerve cells and neuroglia, referred to as glia. **Neuroglia** cells are responsible for nourishing neurons, as well as assisting in determination of the specific function each neuron is to perform.



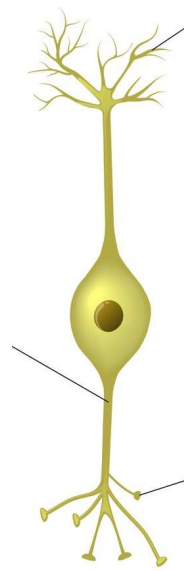
The small spaces between the neurons are called the synapses in which neurotransmitters carry messages between neurons in these synapses. Neurons vary in size and shape but include a cell body and tubular processes filled with cytoplasm to transmit nerve impulses to or from the cell body. Each neuron contains a soma or cell body, dendrites and axons. Axons carry impulses away from the soma; dendrites carry impulses to the soma. The axon of each neuron is surrounded by layers of cell membranes that are filled with the lipoprotein myelin.

i This protective coating is known as the myelin sheath. Some neurons have an additional thin layer of membrane surrounding the myelin sheath known as the neurilemmal sheath.

There are **three** types of neurons: bipolar, unipolar and multipolar.

Bipolar —

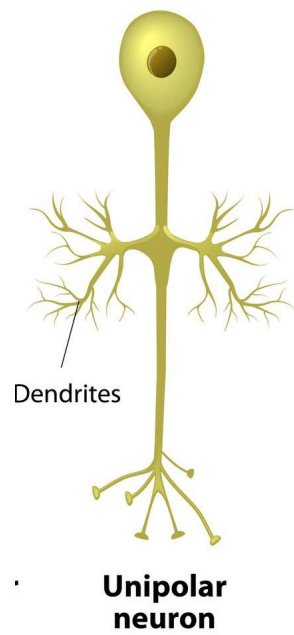
The bipolar has one axon extending from one end of the soma and one dendrite extending from the other end. Bipolar neurons are found in the eyes, nose and ears.



**Bipolar
neuron**

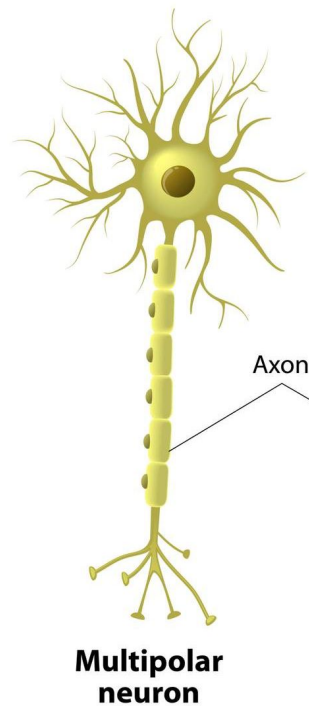
Unipolar —

Unipolar neurons have a single fiber extending from the soma. The fiber then branches into an axon and a dendrite away from the soma. Most unipolar neurons originate in masses of nerve tissue called ganglia, located outside the brain and spinal cord.



Multipolar —

Multipolar neurons have one axon and many dendrites extending from the soma. Multipolar neurons are the most common type found in the brain and spinal cord.



Additionally, there are three classified functions of neurons:
sensory, interneuron and motor.

1

Sensory, known as afferent neurons, conduct impulses from peripheral body locations to the brain or spinal cord. Most are unipolar neurons, some are bipolar.

2

Interneuron, known as association or internuncial neurons, transmit impulses within the brain or spinal cord. Interneurons are all multipolar.

3

Motor, known as efferent neurons, conducts impulses from the brain or spinal cord out to peripheral muscles and glands in the body. Motor neurons are also multipolar.

The nervous system is functionally divided into two subsystems, the CNS and PNS.

CENTRAL NERVOUS SYSTEM

PERIPHERAL NERVOUS SYSTEM

The CNS consists of the brain and the spinal cord. The brain lies within the cranium and the spinal cord lies within the vertebral column. The brain receives and interprets impulses that result from stimuli and sends out responses for the body's reaction. The brain consists of a large mass of nerve tissue and it has three major parts: cerebrum, cerebellum and the brain stem.

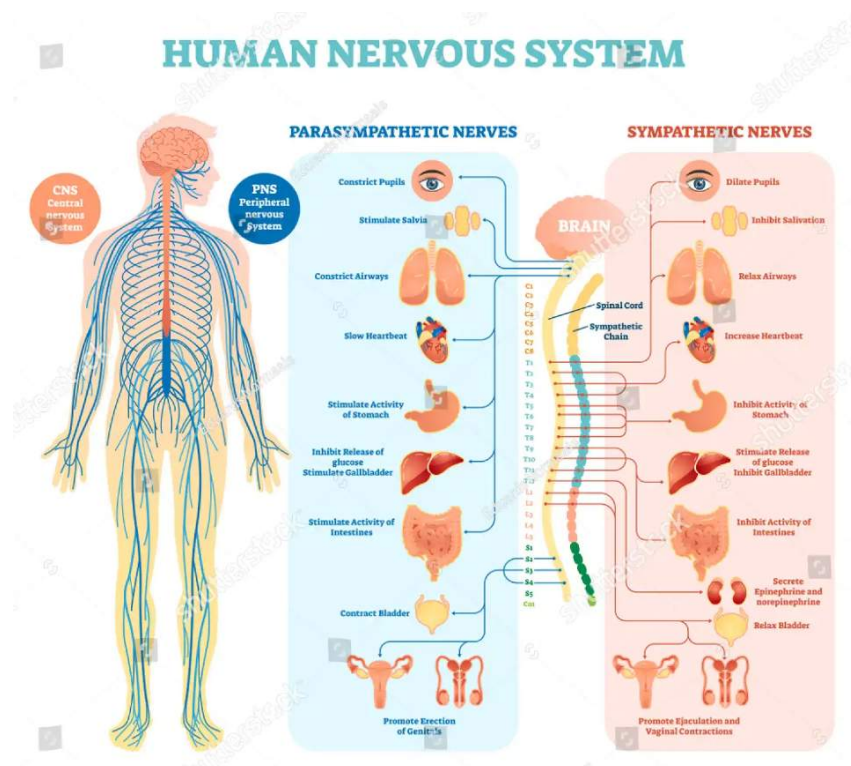
The cerebrum is the largest part of the brain and the center of intelligence and personality. The cerebrum is divided into the right and left hemispheres. Each hemisphere is divided into lobes that are named after the cranial bones, to which they attach. The interior of the cerebrum is responsible for storing knowledge or memory and interpreting sensations. The interior of the cerebrum contains bundles of axons and nerve tracts that are covered with myelin sheaths, which give it its white color. The gray outer layer of the cerebrum, the cortex, governs all conscious functions. Masses of nerve tissue give the cortex its characteristic gray appearance. Because of this coloration, it is often referred to as the gray matter.

The cerebellum is the second largest part of the brain. Located below the cerebrum, in the lower posterior part of the cranial cavity, its primary functions are to control the activities of the brain and coordinate muscular movements and body equilibrium. The third major part of the brain is the brain stem. Located where the spinal cord connects to the base of the brain it consists of three parts, the midbrain, pons and medulla oblongata. The midbrain is the superior portion of the brain stem; responsible for reflex control. Pons is the middle part of the brain stem; serving as a connecting bridge to the cerebellum. It is also the point of exit for cranial nerves and assists in regulating respiration.

Lastly, the medulla oblongata, inferior portion of the brain stem, connects directly to the spinal cord. It is the center for control of respiration, heartbeat and blood pressure. In addition, any

reflex actions, such as sneezing, coughing and peristalsis are also controlled by the medulla oblongata. The spinal cord lies within the vertebral column. It contains pathways that carries messages to and from the brain; exiting through a skull opening known as the foramen magnum. Both the brain and the spinal cord are protected by three layers of tissue called meninges. The dura mater is the outer layer, consisting of tough, white fibrous connective tissue containing blood vessels and nerves. Arachnoid mater is the thin, center layer. This layer is a web-like membrane that doesn't contain blood vessels.

Lastly, the pia mater is the innermost layer attaching directly to the surfaces of the brain and spinal cord. It contains nerves and blood vessels that nourish the cells of the brain and spinal cord. Additionally, the CNS is protected by the cerebrospinal fluid (CSF), located in the arachnoid space contained within the meninges. The CSF is a clear, watery fluid that acts as a shock absorber for things that could injure the brain and spinal cord structures.



CENTRAL NERVOUS SYSTEM

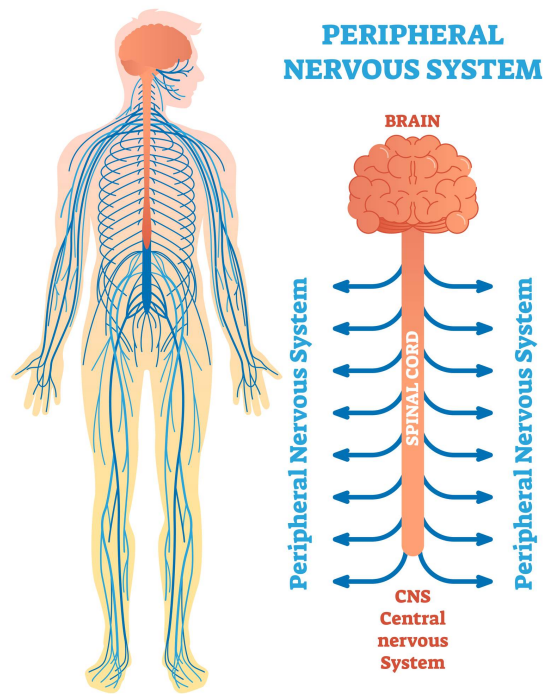
PERIPHERAL NERVOUS SYSTEM

The PNS has 12 pair of cranial nerves and 31 pairs of spinal nerves. Cranial nerves extend from the brain, controlling functions that are sensory or motor or a combination of the two. Spinal nerves extend from the spinal cord, through an opening in the vertebrae known as the intervertebral foramina and to the body.

The pairs of spinal nerves are divided into five areas: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal. The names of these areas correspond to the section of the vertebral column that is located nearby. In some regions of the body, spinal nerves interlace to form a large intersection of nerves known as a plexus. The four major plexuses are the cervical, brachial, lumbar and sacral regions.

The two functional divisions of the PNS are the somatic nervous system and the autonomic nervous system. The somatic nervous system includes all nerves that are involved in voluntary (or conscious) body movement. The autonomic nervous system is responsible for involuntary (or unconscious) body functions. Functions controlled by the autonomic nervous system occur automatically (i.e. heart rate and breathing). Because of the variations in involuntary body functions, the autonomic nervous system is further divided into the sympathetic nervous system and the parasympathetic nervous system. The sympathetic nervous system is responsible for speeding up body functions.

Sometimes referred to as the “fight-or-flight reaction,” the sympathetic nervous system causes the body to hurry, gain strength, stamina and so forth, when it is most needed. The parasympathetic nervous system is responsible for returning the body to normal condition in order to prevent extensive overworking of the body.



CONTINUE

Multiple Choice

Which type of neurons have a single fiber extending from the soma? That fiber then branches into an axon and a dendrite away from the soma.



Bipolar

☐

Unipolar

☐

Multipolar

SUBMIT

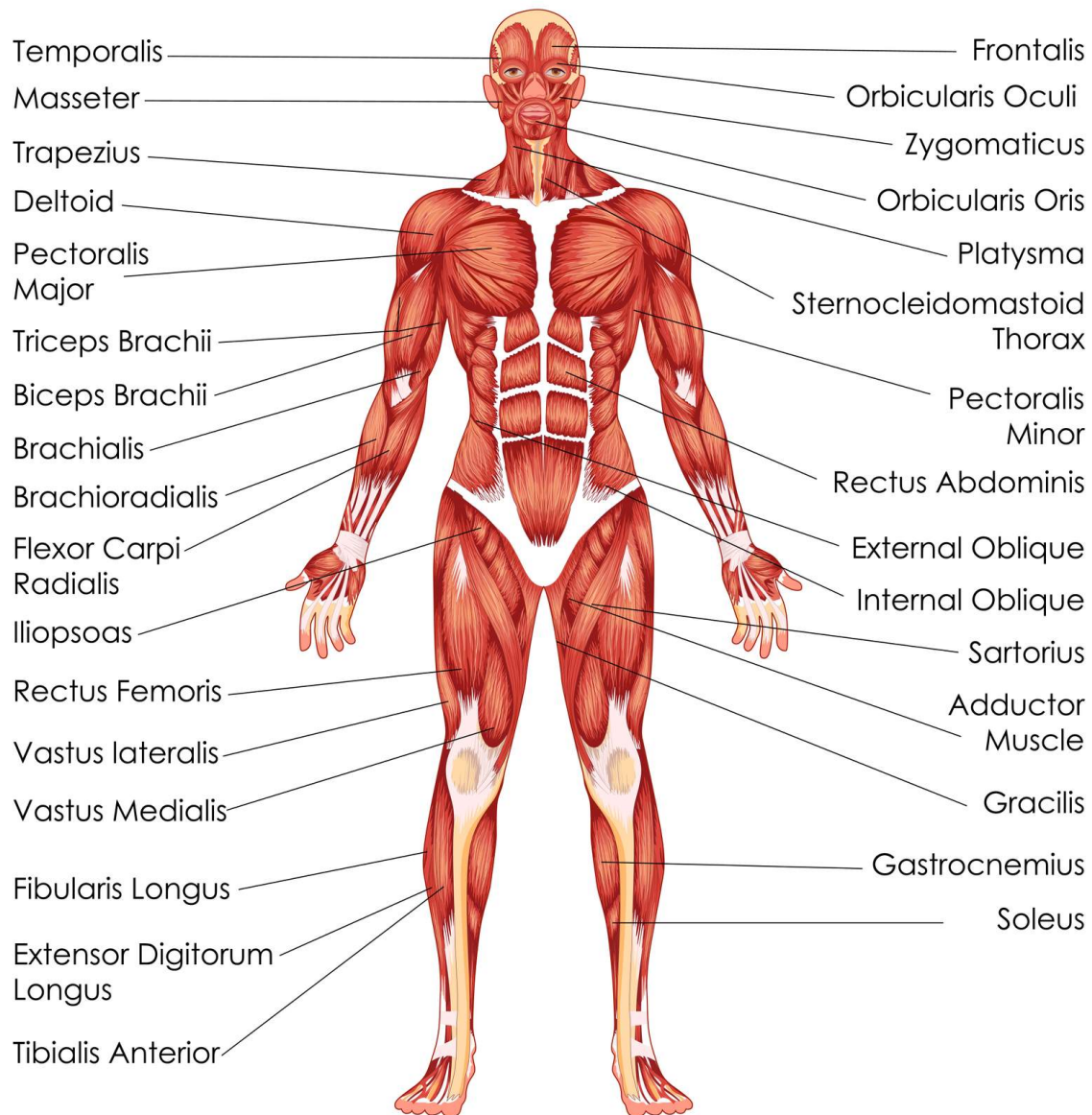


Complete the content above before moving on.

The Musculoskeletal System

This system provides the framework for the body. The bones and muscles of the body function together to support the entire body, movement, protection of vital organs, heat production and blood cell production. These systems are the skeletal and muscular system. The skeletal system includes all the bones and joints of the body.

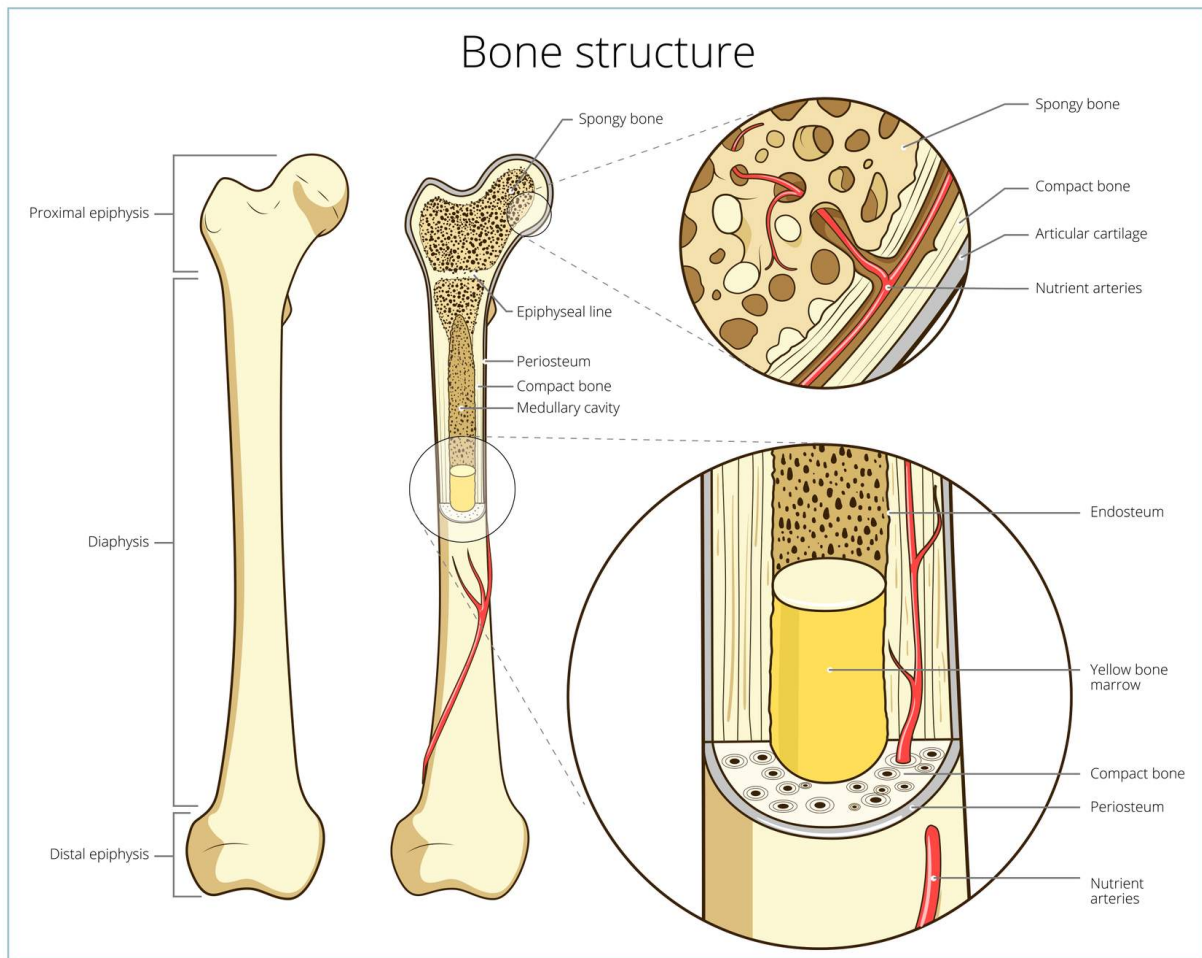
Muscular System



The outermost portion of bones is composed of a tough tissue known as the periosteum. Beneath the outer layer lies the main portion of the entire bone that doesn't bend, referred to as compact bone. The ends of the bones are covered with a layer of articular cartilage containing very little compact bone; instead, being composed of a spongy substance known as cancellous bone.

Beneath the compact and cancellous bone is a hollow area called the medullary cavity or medullary canal, lined with a thin layer of cells, endosteum, and filled with a soft substance,

marrow. Nerves and blood vessels are also located within the medullary cavity.



The four main classifications used to identify the bones are long, short, flat and irregular.

1

Long bones have a central body known as the diaphysis. The ends of long bones expand outward known as the epiphysis.

2

Short bones are compact and long as they are wide.

3

Flat bones are plate like with a broad surface.

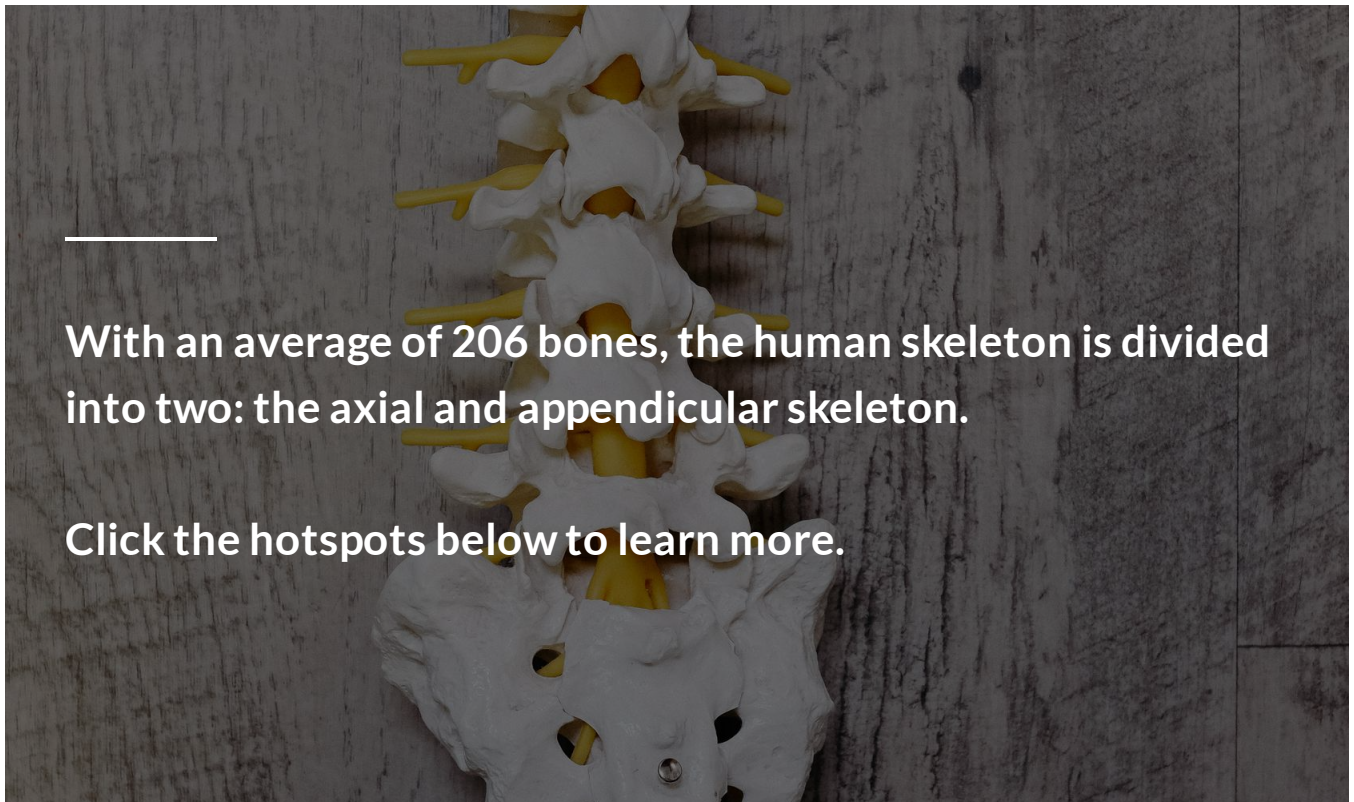
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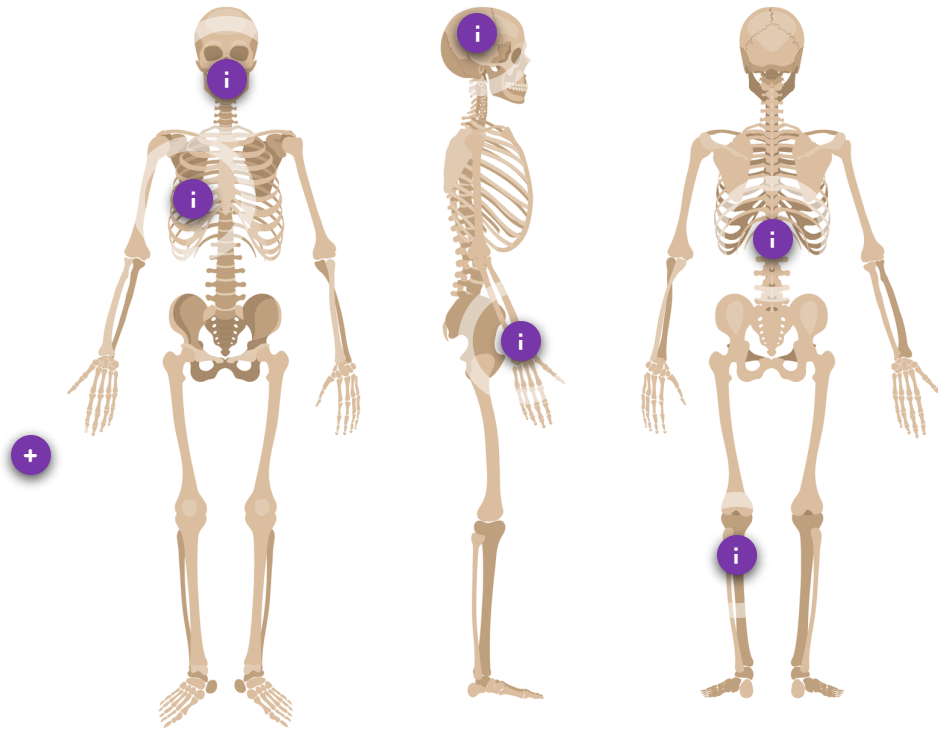
Irregular bones are found in various shapes and sizes and almost always connected to other bones.

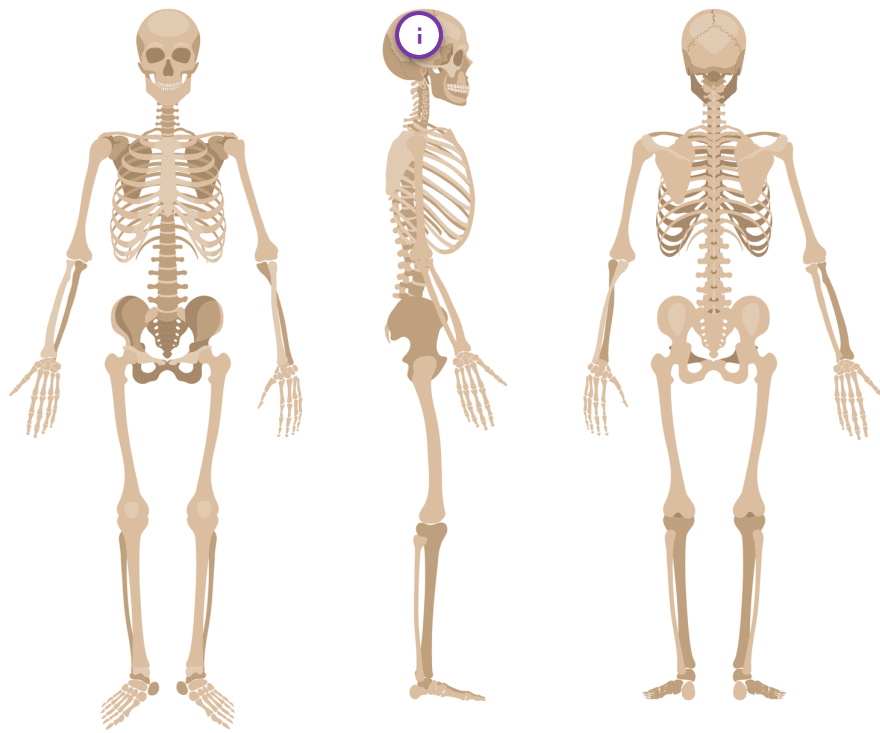
There is a fifth classification known as round or sesamoid used to describe a few bones of the body. Sesamoid bones are small bones that are usually located within tendons where pressure is frequently applied. Most of the sesamoid bones lie near joints.

With an average of 206 bones, the human skeleton is divided into two: the axial and appendicular skeleton.

Click the hotspots below to learn more.



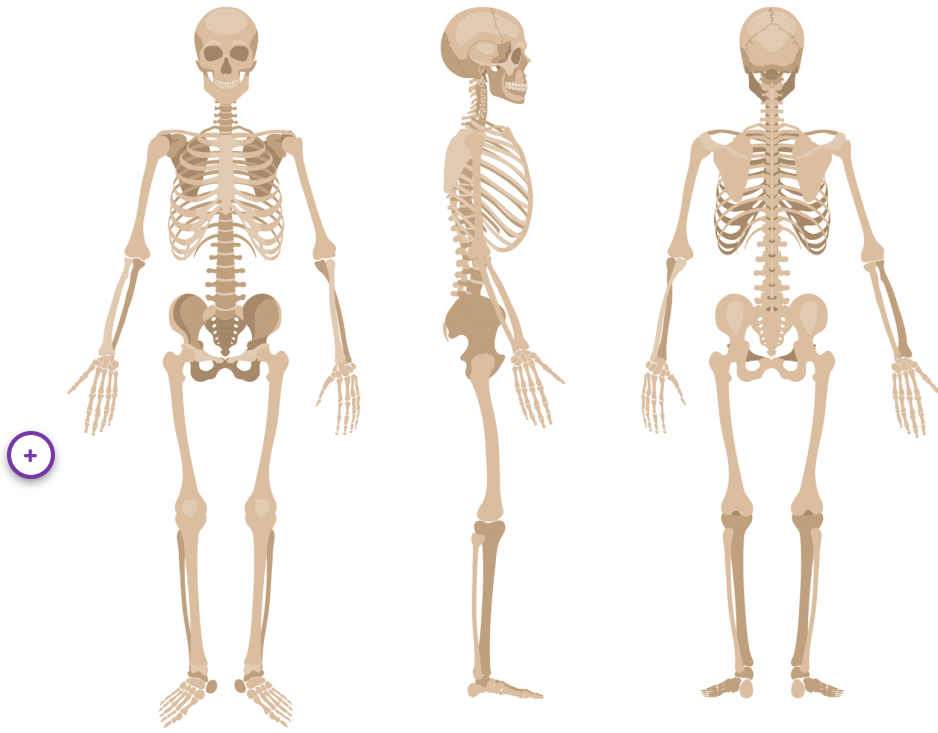


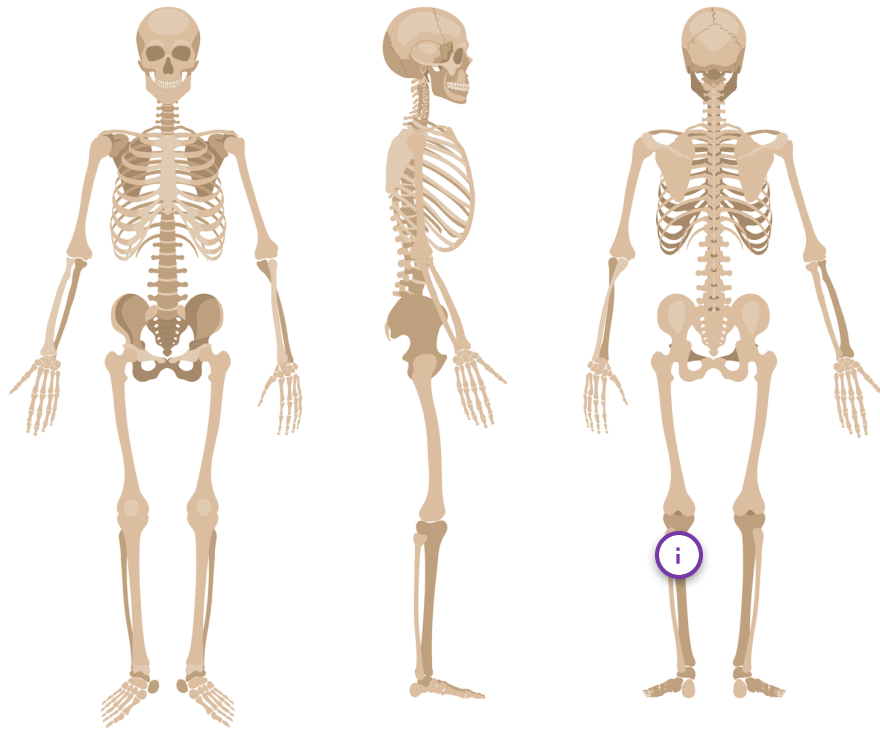


The Axial Skeleton

The axial skeleton contains the bones that support the head, neck and torso. These bones of the axial skeleton are found in one of four areas: skull, laryngeal skeleton, vertebral column, and the thoracic cage.

The skull, made up of the cranium and facial bones consists of 28 bones. Eight are interlocked along sutures to make up the cranium.



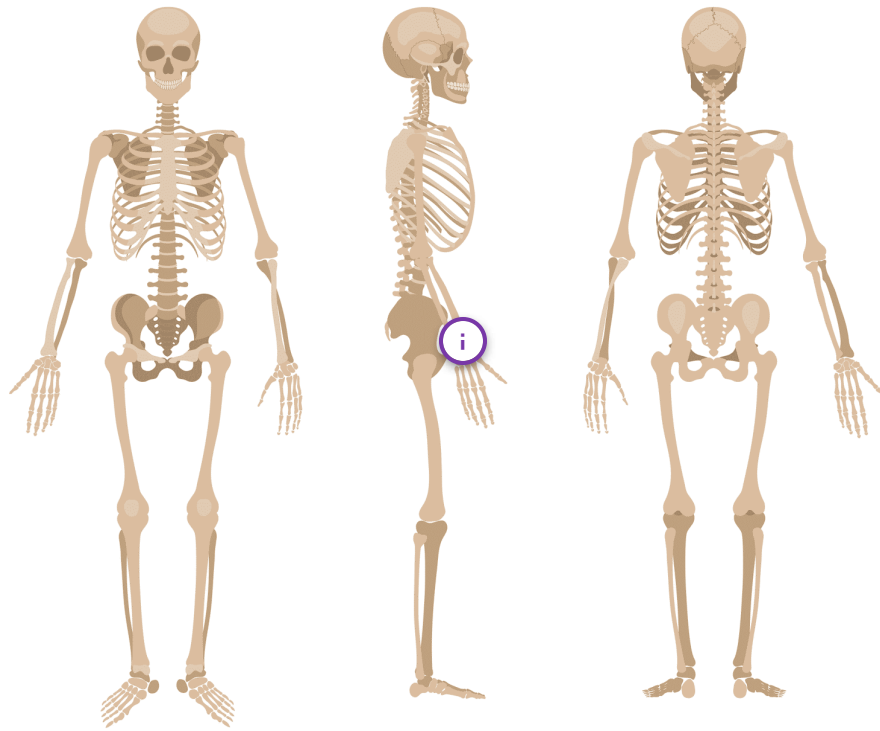


The Legs

The legs contain three long bones: the femur, tibia and the fibula. The femur, referred to as the upper leg bone, is the largest bone in the body.

The tibia lies anterior to the smaller fibula. Together, three leg bones join at the midpoint of the leg to form the knee joint. A triangular-shaped bone, the patella, lies over the anterior portion of the knee joint to form the kneecap.

Seven short bones, called tarsals, join to form the ankle. The metatarsals are the short bones of the foot, and like the fingers, phalanges are the bones of the toes.



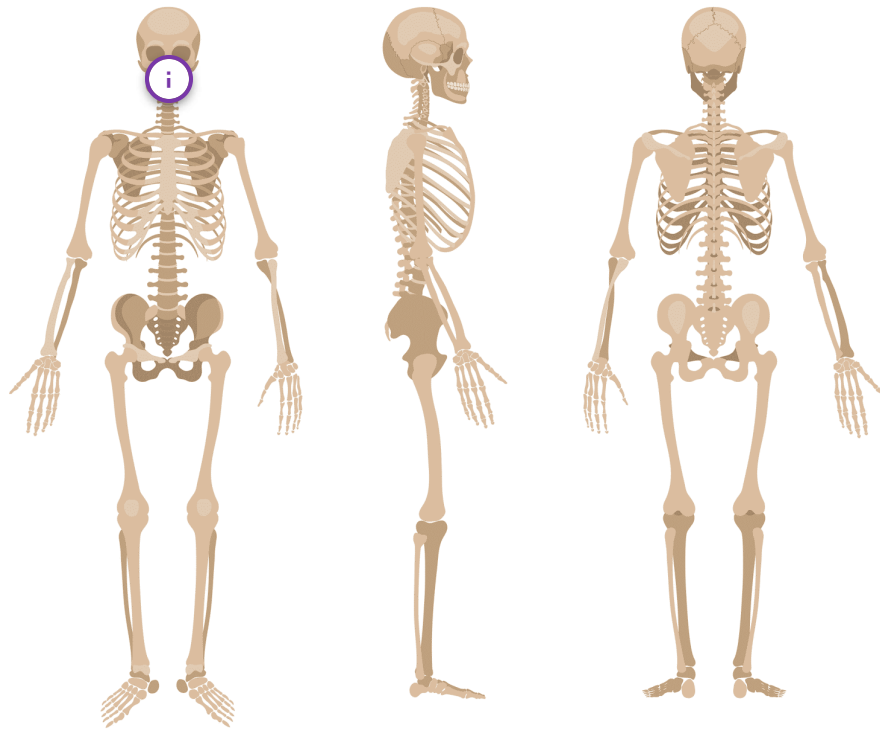
The Appendicular Skeleton

The appendicular skeleton includes bones of both upper and lower extremities, as well as the bones that join the limbs to the axial skeleton. The upper bone of each arm is the humerus.

Two bones lie parallel in the lower arm; the radius being the lateral bone and the ulna is the medial bone. Together, the humerus, radius and ulna join at the midpoint of the arm to form the elbow.

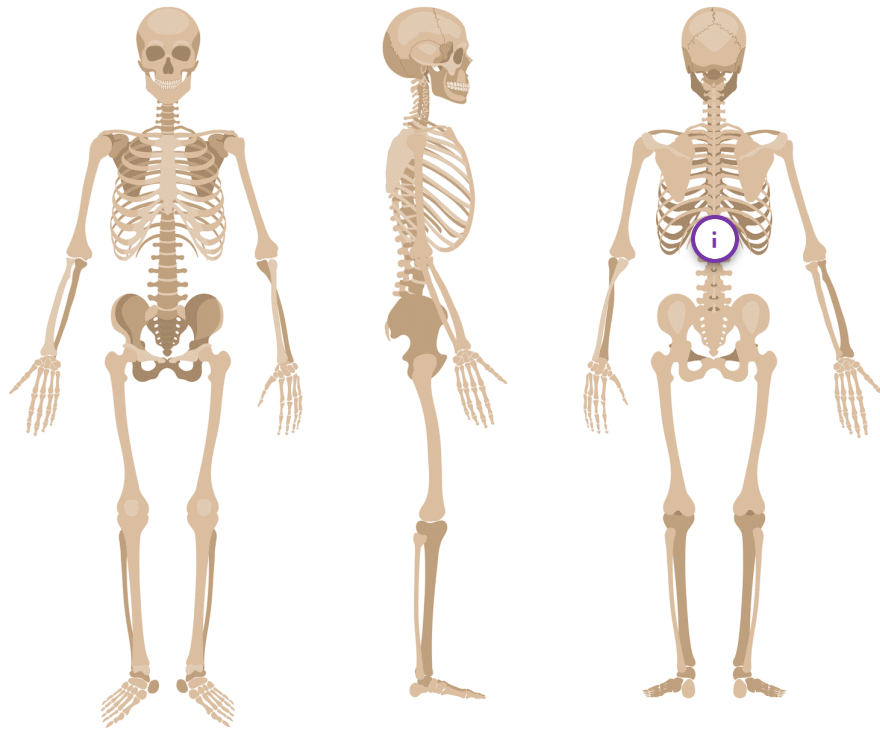
Distal to the radius and ulna are the short bones of the wrist, hand and fingers. There are eight carpal bones that compose the wrist. The metacarpals are bones of the hand and phalanges are the bones of the fingers.

The arms are connected to the axial skeleton by the pectoral girdle which includes the scapula or shoulder blades and the clavicle or collarbone. The legs are connected to the axial skeleton by the pelvic girdle containing two flat coxal bones forming the pelvis.



Facial Bones

Thirteen bones unite to form the facial structure; six small bones are in the ear; and one bone, the mandible, is the moveable skull bone that is connected to the cranium by ligaments. Then is the hyoid bone located between the mandible and larynx in the neck.

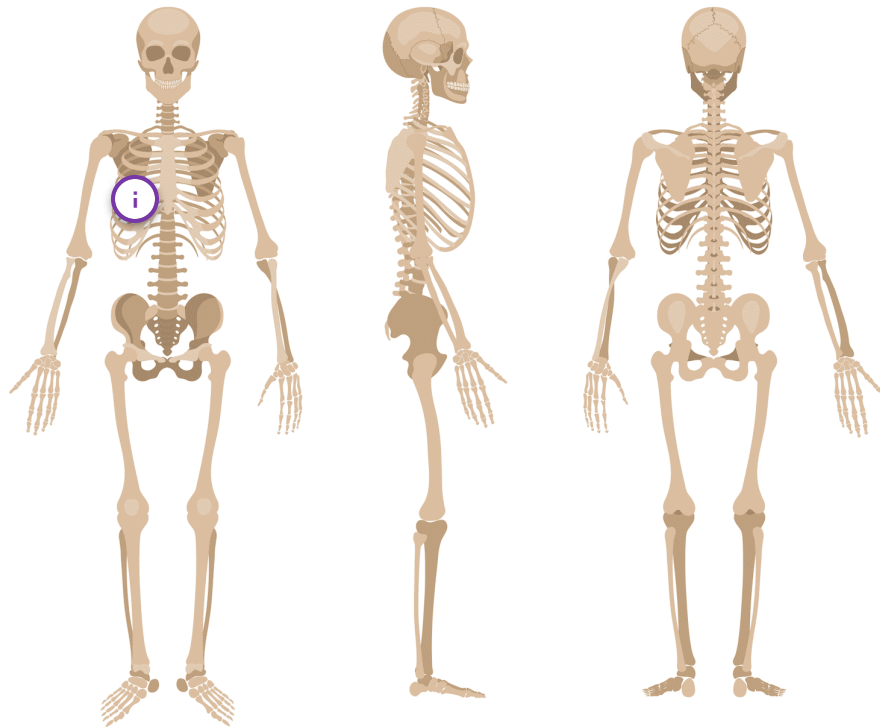


The Spine

The vertebral column or spine is composed of 26 separate, irregular bones joined together by cartilaginous disks.

Additionally, the vertebral column is split into five separate regions: cervical, thoracic, lumbar, sacrum and coccyx. The cervical, thoracic and lumbar areas are composed of vertebrae attached to each other.

At the distal end of the lumbar vertebrae, several bones are fused into a single structure called the sacrum. Attached to the sacrum is a final projection, the coccyx or tailbone.



The Thoracic Cage

The thoracic cage that encloses the chest, sides and upper back. This protective structure consists of **12 pairs** of ribs and the sternum. The first seven pairs attach directly to the sternum and are known as true ribs.

The next three pairs do not attach directly to the sternum but are attached to the seventh rib on each side. The final two pairs of ribs are sometimes called floating ribs since their distal ends hang free in the thoracic cavity.

The sternum or breastbone has a small inferior tip called the xiphoid process.

Multiple Choice

These types of bones are found in various shapes and sizes and almost always connected to other bones.

- ☐ Long
- ☐ Short
- ☐ Irregular
- ☐ Flat

SUBMIT



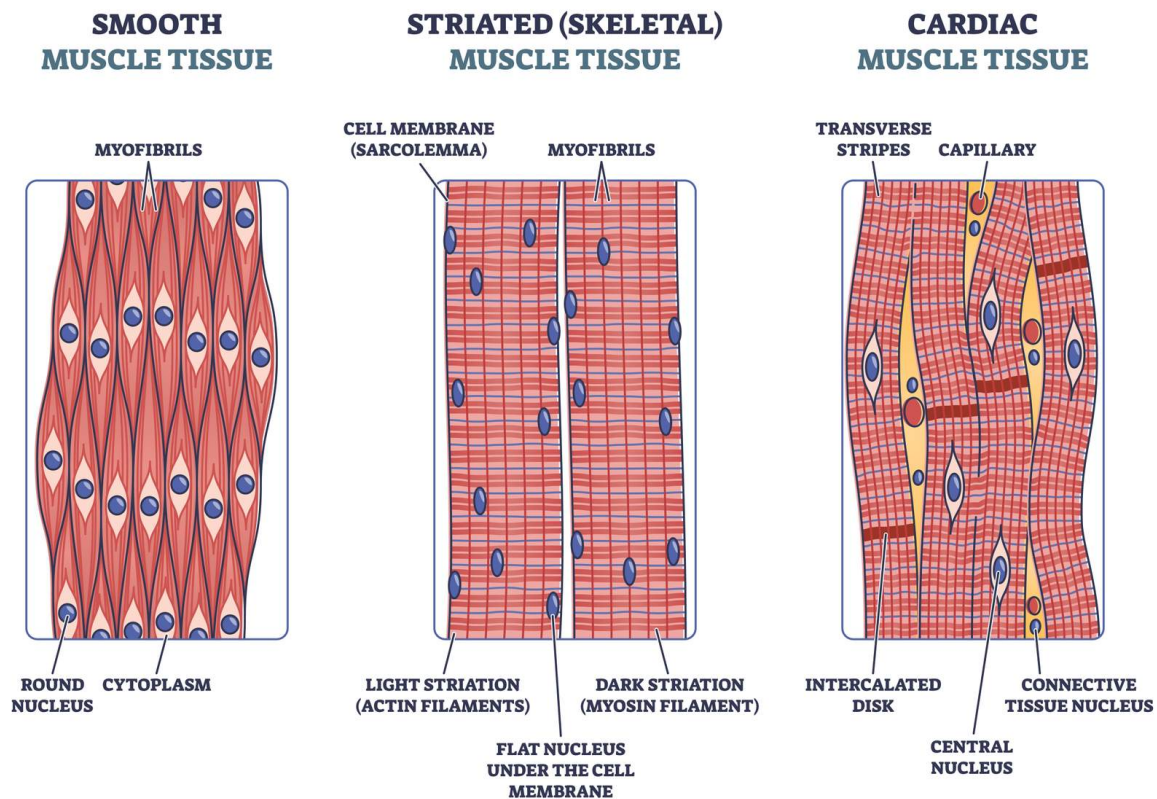
Complete the content above before moving on.

Muscles

The body contains over **500 muscles**, some are controlled or voluntary and others are involuntary. There are three types of muscles: skeletal, smooth and cardiac. Skeletal muscles are voluntary muscles composed of various layers of tissue and are striated due to its string-like appearance. The outermost layer surrounding the muscle attaching it to bone surfaces is the fascia. Where skeletal muscles are attached, the fascia extends outward to form a cord-like

attachment, the tendon. Tendon fibers connect to the periosteum of bones. However, in some locations, fibrous sheets, aponeuroses, serve to attach muscles to each other.

Beneath the fascia lies the outer surface of the muscle itself, the epimysium. Below this layer is the perimysium, which separates the actual muscle into small sections called fascicles which are covered with a layer known as the endomysium. Smooth muscles are under involuntary control. There are two types of muscle tissue found in the walls of both hollow and visceral organs; multiunit and visceral. Multiunit smooth muscles are found in the walls of blood vessels and in the irises of the eyes.



Additionally, these muscles are constructed in separate fibers instead of sheets. Visceral muscles, more common type can be found in the walls of hollow organs, such as the stomach, bladder, intestines and uterus. Additionally, these muscles are sheets of cells that lie very close

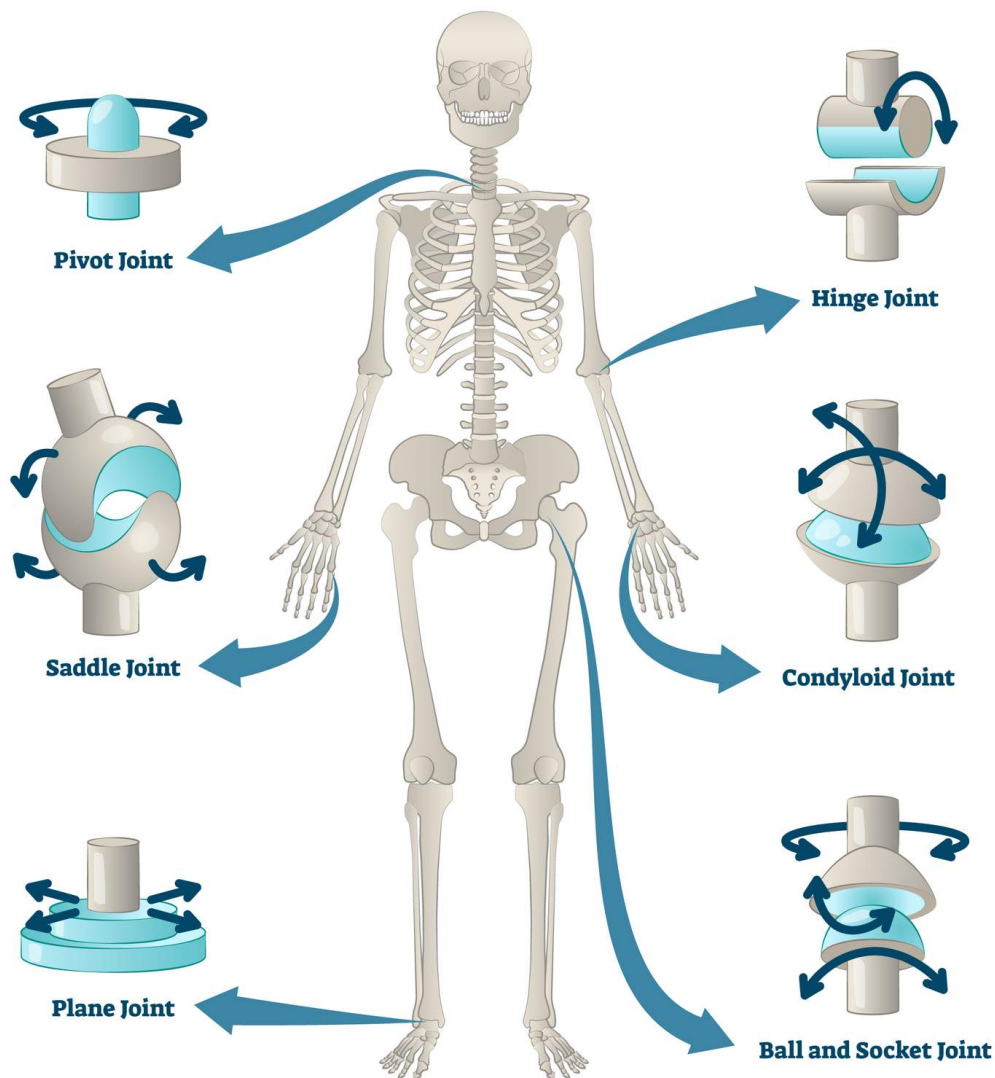
to each other. Cardiac muscle is only found in the heart with a striated appearance. The structure of cardiac muscle permits the unique action necessary for heart function.

The physiological functions of the musculoskeletal system include support for the entire body, movement, protection of vital organs, heat production and blood cell production. The entire body is supported in a manner that permits weight-bearing, due to the structure of the musculoskeletal system with the bones providing a framework. Bone joints and muscle action make body movement possible. Joints are classified as fibrous, cartilaginous and synovial joints.

Each named according to the type of tissue the joint contains, there are three types of fibrous joints, two types of cartilaginous joints and six types of synovial joints. Most joints of the body are synovial joints, which has a more complex structure than fibrous or cartilaginous joints. The ends of the bones connected by a synovial joint are covered with a thin layer, articular cartilage which prevents wear and excessive friction during movement. Two layers of connective tissue known as the joint capsule hold the bones together. The outer layer encloses the entire joint while the inner layer, a very thin membrane lining known as the synovial membrane, secretes a clear fluid into the joint known as synovial fluid.

The fluid acts as both a joint lubricant and as a nutrient supplier for the cartilage within the joint. Muscles play a vital role through their ability to contract and relax. Neurotransmitters of the nervous system stimulate muscle action. The vital organs of the body are protected by the musculoskeletal system, particularly by the bones. Examples include the skull, which protects the brain; the thoracic cage, which protects organs within the chest and upper abdomen; the vertebral column, which protects the spinal cord; and the pelvic bones, which protect lower abdominal structures. Additionally, the bones of the extremities protect the blood vessels and nerves found in the arms and legs. Muscles also serve in the production and release of excessive body heat.

TYPES OF JOINTS



Due to the large content of muscle tissue, when muscles are active, heat is released. An example of this action is the shivering that occurs when a person is very cold. Excessive heat is released when the hypothalamus in the brain detects an excessive internal body temperature. This occurs by a stimulus that causes muscles within the walls of blood vessels to relax, thereby making the release of heat to the outside of the body possible. The process of blood cell formation is referred to as hematopoiesis. The bones play an important role in blood cell production.

A soft mass of tissue known as marrow is found within the medullary cavities of some bones and is essential to the production of new blood cells.

There are **two** types of marrow: red and yellow.

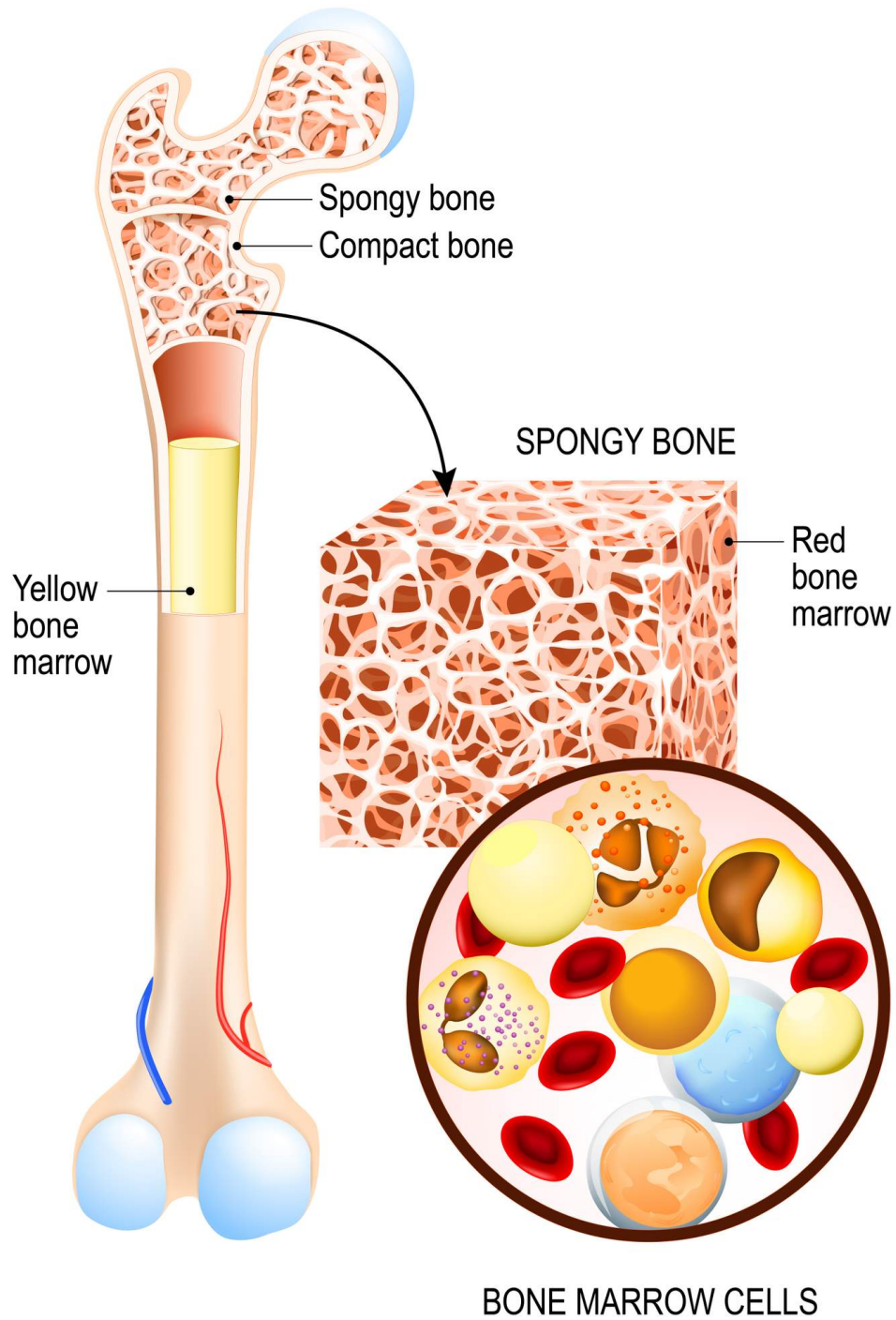
1

Red marrow serves to assist in the formation of erythrocytes, leukocytes and thrombocytes in infants and children. This type of marrow is red because of the hemoglobin content of the erythrocytes. As a person ages, much of the red marrow is gradually replaced by yellow marrow.

2

Yellow marrow serves mostly as a fat storage tissue and does not play a major role in blood cell production. Instead, as a person ages, the process of blood cell production is gradually transferred to the liver and spleen.

BONE MARROW



END OF LESSON