INTRODUCTION
TO ANATOMY AND HUMAN BODY

ANATOMY, a field in the biological sciences concerned with the identification and description of the body structures of living things. Gross anatomy involves the study of major body structures by dissection and observation and in its narrowest sense is concerned only with the human body.

1. LEVEL OF ORGNAIZATION

Before the begin to study the different structures and functions of the human body, it is helpful to consider its basic architecture; that is, how its smallest parts are assembled into larger structures. It is convenient to consider the structures of the body in terms of fundamental levels of organization that increase in complexity: **subatomic particles, atoms, molecules, macro molecules, organelles, cells, tissues, organs, organ systems, organisms and biosphere** as shown in **(Figure 1).**

cell

smallest independently functioning unit of all organisms, **A human cell** typically consists of flexible membranes that enclose cytoplasm, a water-based cellular fluid together with a variety of tiny functioning units called **organelles**.

tissue

group of similar or closely related cells that act together to perform a specific function.

organs

functionally distinct structure composed of two or more types of tissues.

organ system

group of organs that work together to carry out a particular function.

organisms

living being that has a cellular structure and that can independently perform all physiologic functions necessary for life.

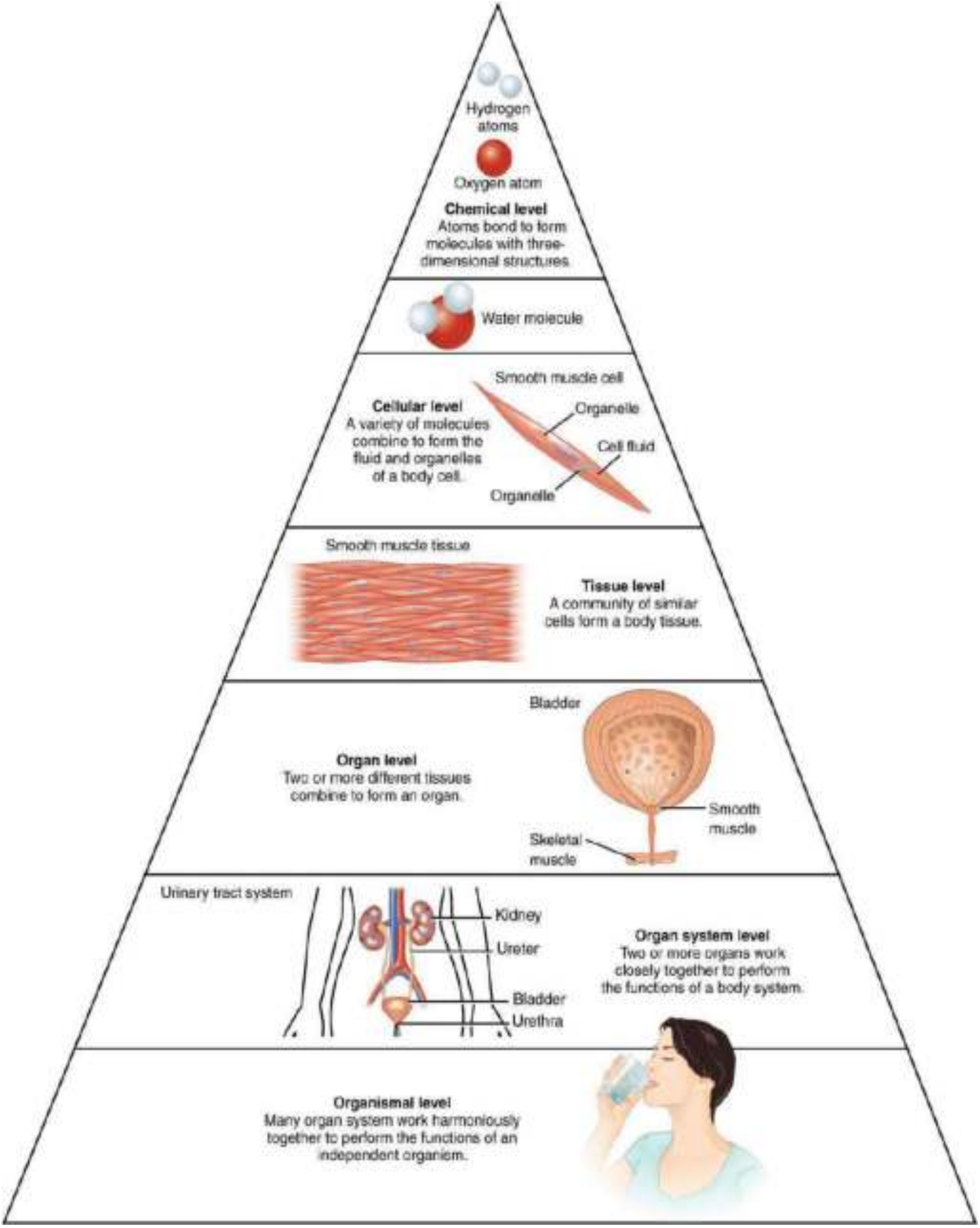


Figure 1. The organization of the body often is discussed in terms of six distinct levels of increasing complexity, from the smallest chemical building blocks to a unique human organism.

2. ANATOMICAL POSITION

When describing any orientation, location, movement, and direction, the reference is the anatomical position. In this universally accepted reference, the person is considered to be standing upright, with the arms hanging by the side, palms facing forward, and thumbs pointing away from the body. The feet are slightly parallel, and toes oriented to the front. In anatomical position, none of the bones are crossed when the body is viewed from the front as shown in fig. 2, **to provide a common frame of reference, regardless of the various positions we can get ourselves into. This position becomes a reference point that is universal.**

Figure 2. Standard Anatomical Position

3. ANATOMICAL REGIONS

The body is divided into many regions (see Figure 3). Knowledge of these regions helps health care professionals identify different areas of the body. Because each region is related to specific internal organs, problems in internal organs often present as pain or swelling in these regions.

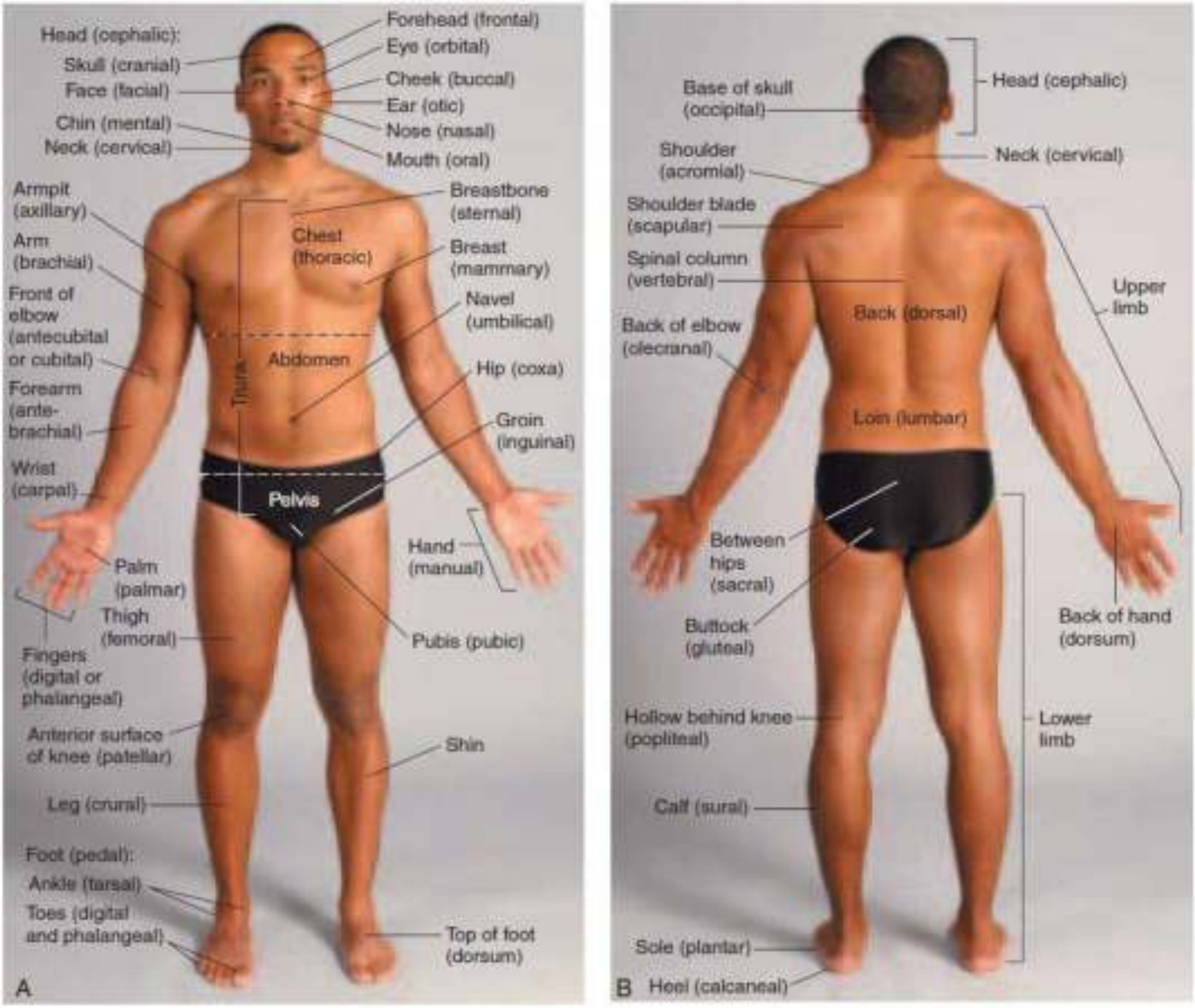


Figure 3. Anatomical Body Regions

HEAD AND NECK

The **head** is divided into the **facial** region, which includes the eyes, nose, and mouth and the **cranial** region the top and back of the head. The **neck,** also known as the **cervical** region, is the area that supports the head. Specific areas of the face are referred to by different terms. The forehead region, **frontal;** eye, **orbital;** ear, **otic;** cheek,**buccal,** nose, **nasal;** mouth, **oral;** and chin, **mental.**

TRUNK

The **trunk** refers to the combination of the **chest** and the **abdomen**. The chest is also known as the **thorax** or **thoracic** region and includes the **mammary**, the **sternal** region (the area between the mammary regions), the **axillary** or armpit region and, posteriorly, the **vertebral** region. The shoulder blade region is referred to as **scapular** because it is the location of the bone scapula.

The abdomen is the region below the chest. The belly button is located in the center of the abdomen. The **pelvic** region is the lowermost part of the abdomen and includes the **pubic** area and the **perineum**. The lower back area is known as the **lumbar** region, and the large hip area is known as the **buttock** region. To locate and relate pain and other problems of the organs lying inside, the abdomen has been divided into many sub regions.

For diagnostic and descriptive purposes, the abdomen is subdivided into **four quadrants**: right upper quadrant (RUQ), left upper quadrant (LUQ), right lower quadrant (RLQ), and left lower quadrant (LLQ). The more detailed topography of the abdomen divides it into 9 regions: right and left hypochondriac, right and left lumbar, right and left iliac, and also epigastric, umbilical, and hypogastric regions in the middle. Remember which organs typically project into each abdominal region. It is essential to know the region's anatomy and topography well to adequately document and interpret a patient's complaints and symptoms, as well as physical findings during the examination **(Figure 4)**.

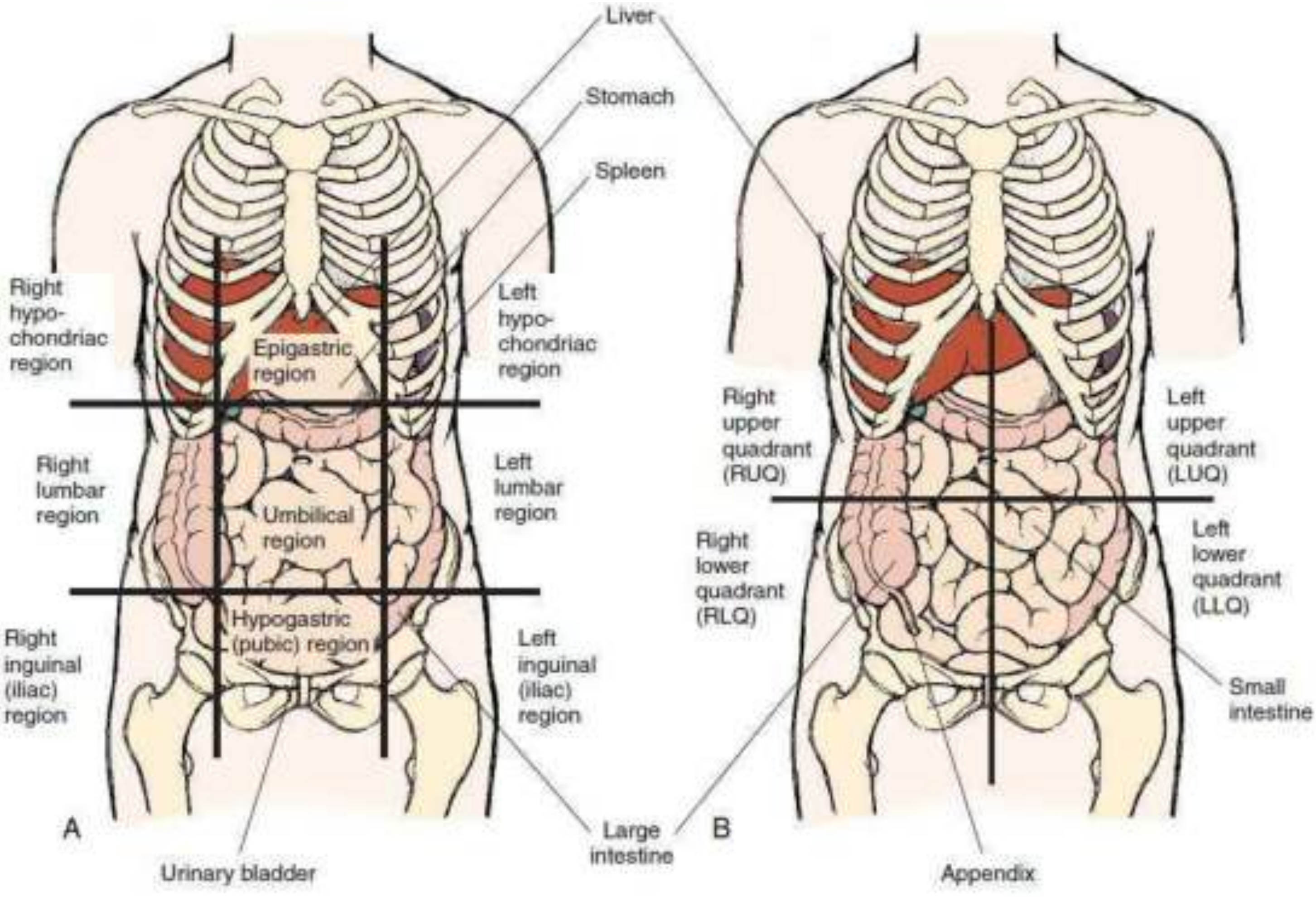


Figure 4. Anatomical Abdominal Regions

UPPER EXTREMITY

The upper limb consists of four major segments, which are further subdivided into regions. **(Fig. 5)**

1. **Shoulder:** proximal segment of the limb that overlaps parts of the trunk (thorax and back) and lower lateral neck. It includes the **pectoral, scapular,** and **deltoid regions** .

2. **Arm :** first segment of the free upper limb (more mobile part of the upper limb independent of the trunk) and the longest segment of the limb. It extends between and connects the shoulder and the elbow, and consists of **anterior** and **posterior regions of the arm,** centered around the humerus.

3. **Forearm :** second longest segment of the limb. It connects the elbow and wrist and includes **anterior** and **posterior regions of the forearm** overlying the radius and ulna.

4. **Hand :** part of the upper limb distal to the forearm that is formed around the carpus, metacarpus, and phalanges.

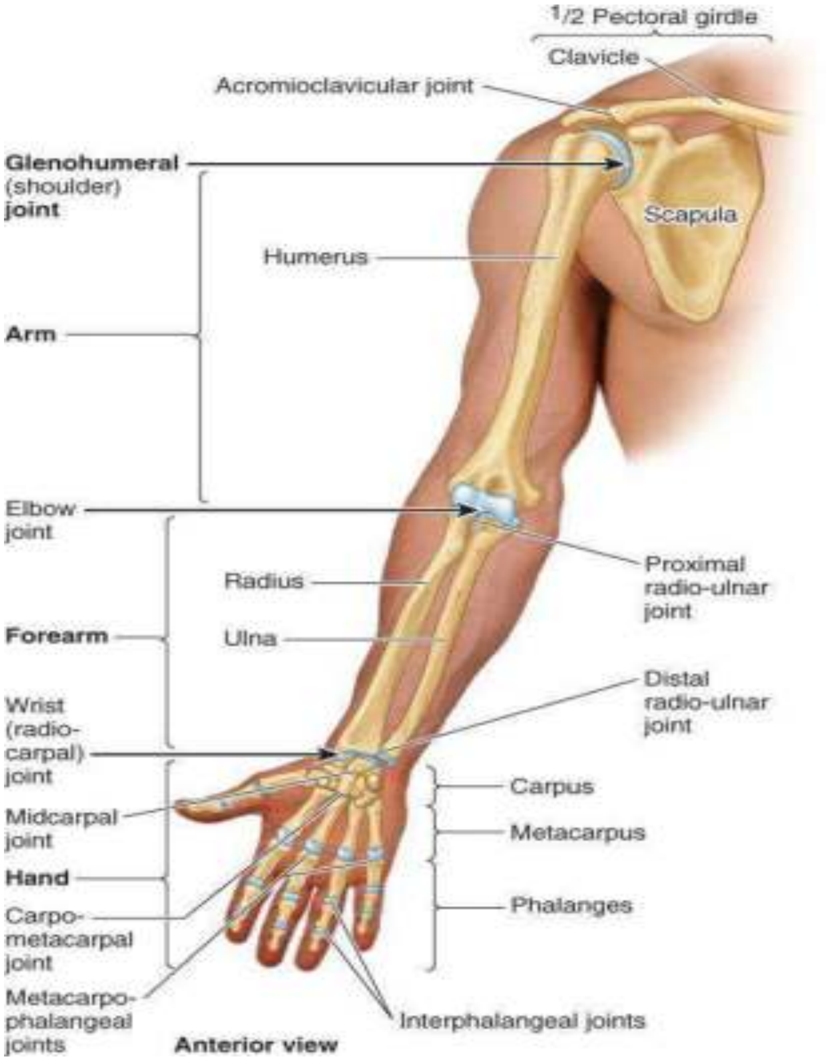


Figure 5. Upper Extremity Regions

LOWER EXTREMITY

The basic structure of the lower limb is similar to that of the upper limb, but it is modified to support the weight of the body and for walking. The lower limb is divided into

1. The **gluteal region** (region of the buttocks).
2. The **thigh** (between the hip and knee).
3. The **leg** (between the knee and ankle).
4. The **foot** (from the heel to the toes). **(Fig. 6)**

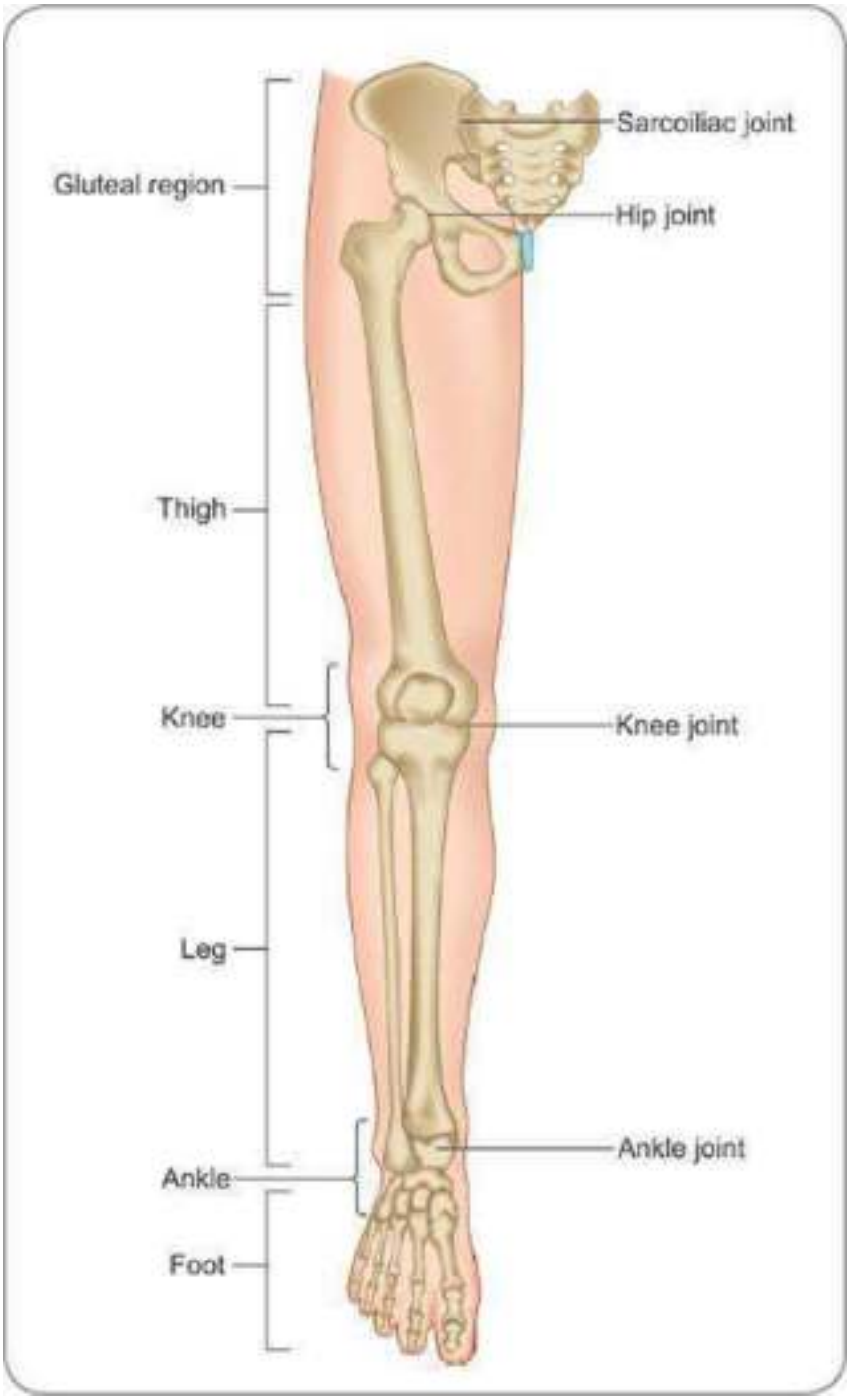


Figure 6. Lower Extremity Regions

4. ANATOMICAL CAVITIES

The body maintains its internal organization by means of membranes, sheaths, and other structures that separate compartments. There are two cavities in human body: dorsal (posterior) cavity and the ventral (anterior) cavity are the largest body compartments. These cavities contain and protect delicate internal organs. The ventral cavity allows for significant changes in the size and shape of the organs as they perform their functions. The lungs, heart, stomach, and intestines, for example, can expand and contract without distorting other tissues or disrupting the activity of nearby organs. **(Fig. 7)**

The posterior (dorsal) and anterior (ventral) cavities are each subdivided into smaller cavities.

DORSAL BODY CAVITY :This cavity is subdivided into a cranial cavity and vertebral cavity.

Cranial cavity lies in the skull and encases the brain.

Vertebral cavity runs through the vertebral column to enclose the spinal.

VENTRAL BODY CAVITY :The anterior (ventral) cavity has two main subdivisions: the thoracic cavity and the abdominal-pelvic cavity.

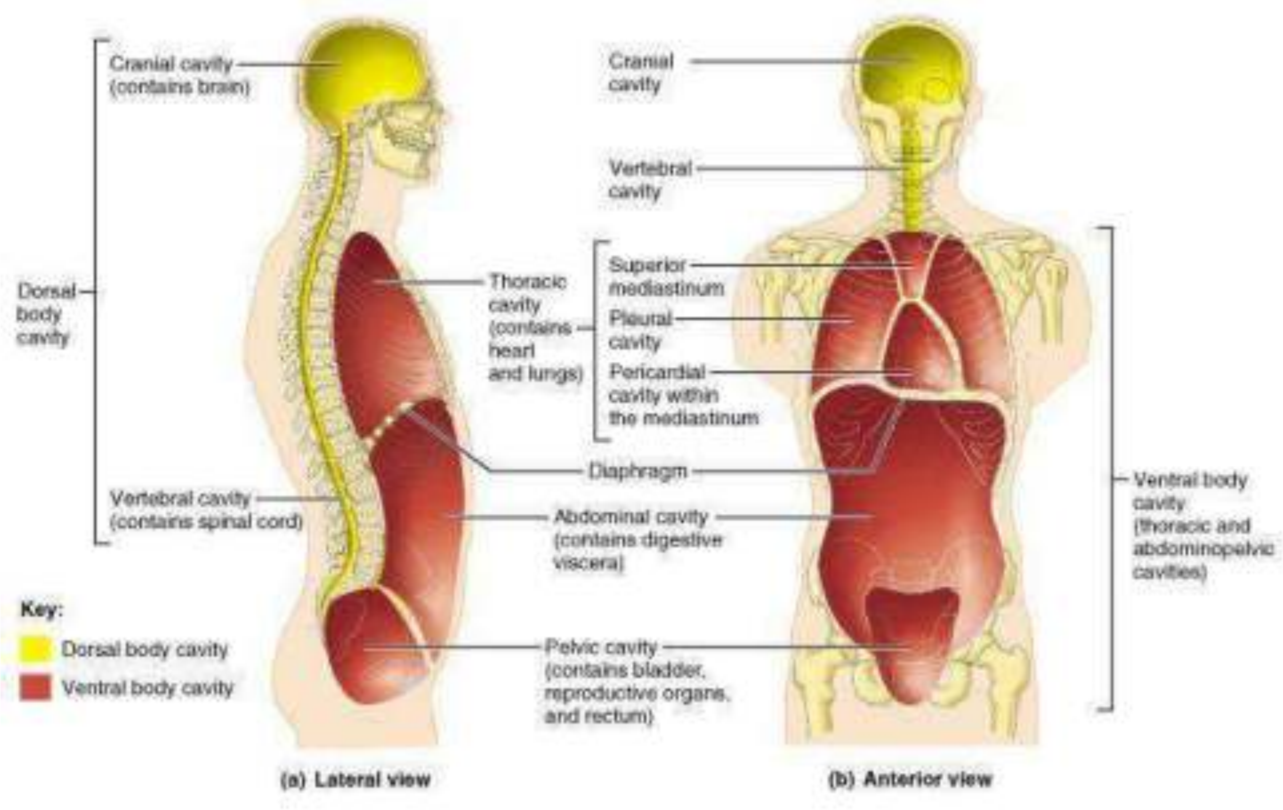


Figure 7. Anatomical Cavities

5. ANATOMICAL PLANES

Anatomical descriptions are based on four imaginary planes (median, sagittal, frontal, and transverse). **(Fig. 8)**

- **Median plane** median plane passing longitudinally through the body, divides the body into right and left halves. The plane defines the midline of the head, neck, and trunk where it intersects the surface of the body.

- **Sagittal planes** are vertical planes passing through the body parallel to the median plane, the sagittal plane, also known as the longitudinal plane, divides the body into left and right halves.

- **Frontal (coronal) planes** are vertical planes passing through the body at right angles to the median plane, dividing the body into anterior (front) and posterior (back) parts.

- **Transverse planes** are horizontal planes passing through the body, dividing the body into superior (upper) and inferior (lower) parts. Radiologists refer to transverse planes as **trans-axial**, which is commonly shortened to axial planes.

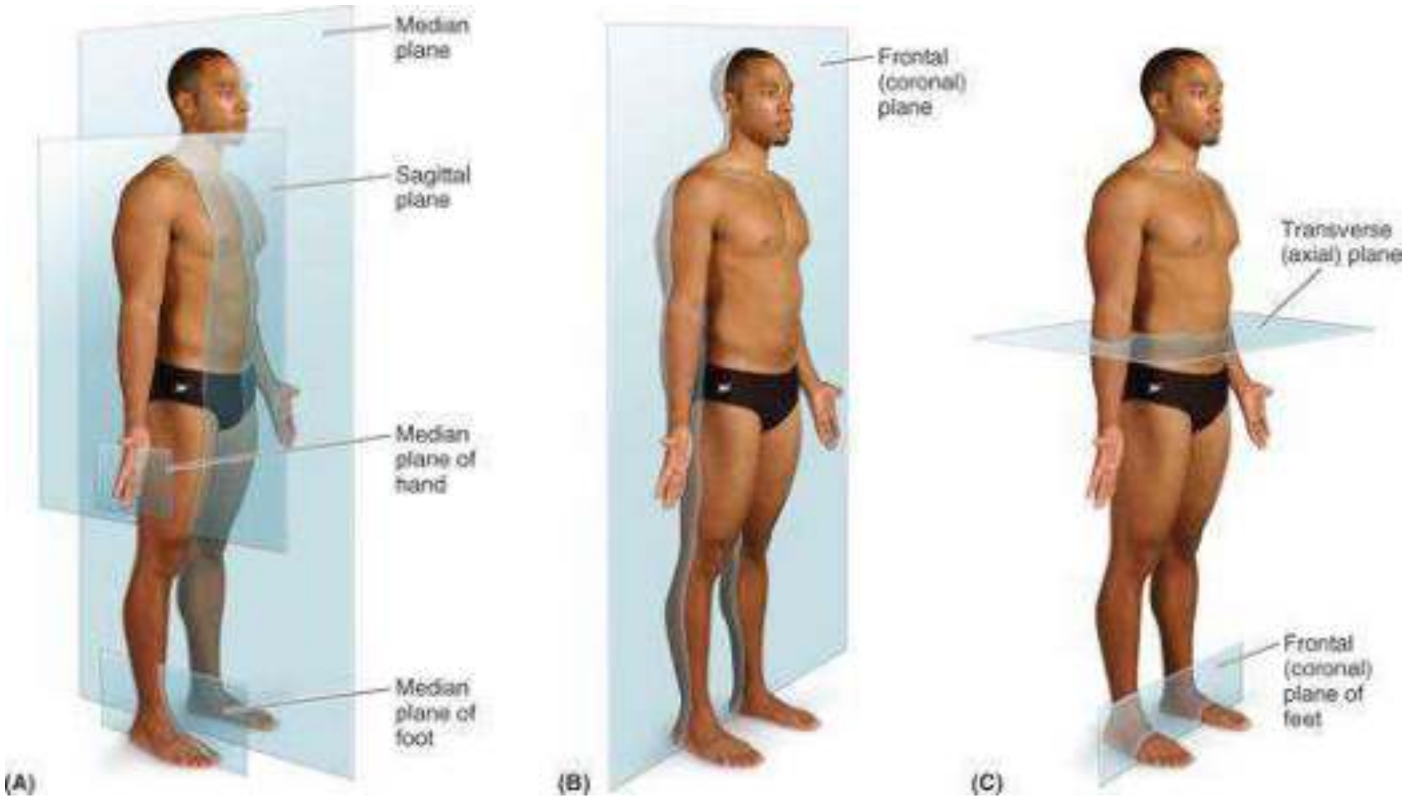


Figure 8. Anatomical Planes

The main use of anatomical planes is to describe sections (Fig. 9)

- **Longitudinal sections** : parallel to the long axis of the body or of any of its parts, and the term applies regardless of the position of the body. Although median, sagittal, and frontal planes are the standard (most commonly used) longitudinal sections, there is a 180° range of possible longitudinal sections.

- **Transverse sections,** or cross sections, are slices of the body or its parts that are cut at right angles to the longitudinal axis of the body or of any of its parts. Because the long axis of the foot runs horizontally, a transverse section of the foot lies in the frontal plane.

- **Oblique sections** are slices of the body or any of its parts that are not cut along the previously listed anatomical planes. In practice, many radiographic images and anatomical sections do not lie precisely in sagittal, frontal, or transverse planes; often they are slightly oblique.

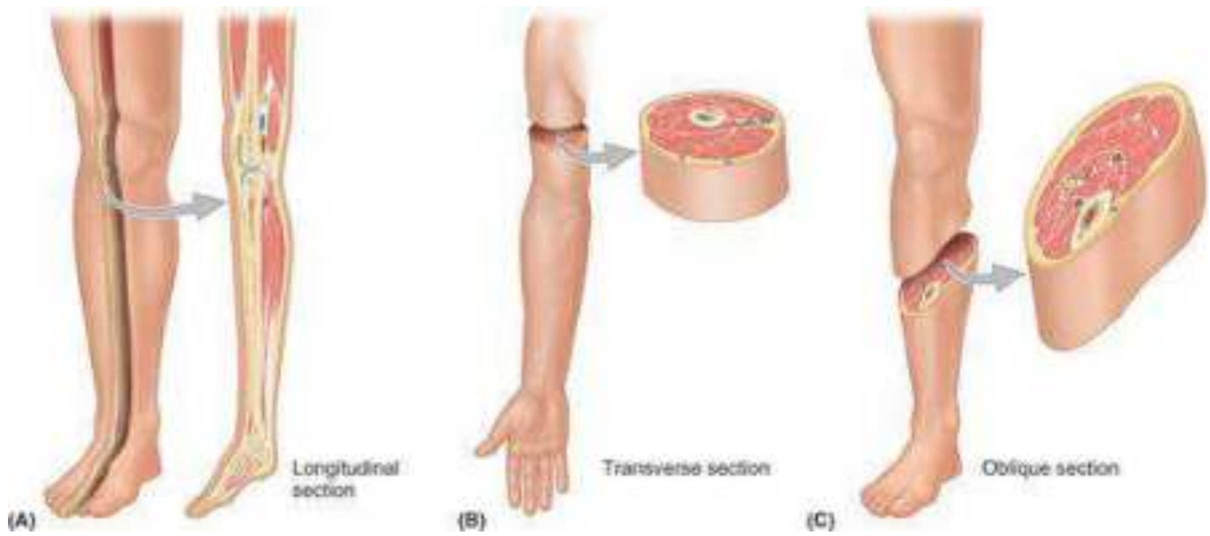


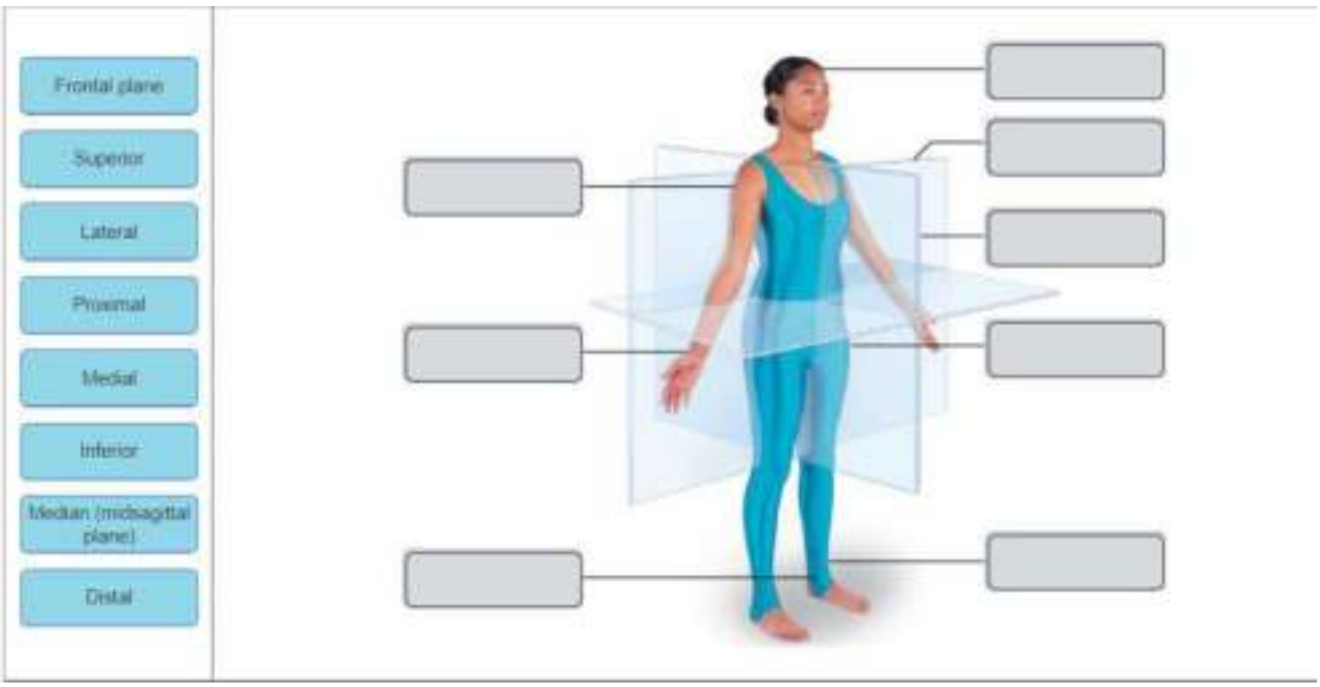
Figure 9. Anatomical Sections

6. DIRECTIONAL TERMS

Directional terms are critical in understanding the location and relation of the body parts with the body's other structures. Following are the main directional terms used in the anatomy:

- **Anterior and posterior:** Anterior defines the body structure or a part lying in front, while the posterior indicates the structures at the back.

- **Ventral and dorsal:** Ventral indicates the body's anterior, whereas dorsal denotes the backside.
- **Right and left:** Right is used to describe the right side or right side of something, while the left is used to describe the left side or left side of the body.
- **Distal and proximal:** The term "distal" refers to the distance between the body's trunk and the point of origin of a body component. Proximal refers to how close something is to the body's trunk or point of origin.
- **Median:** The median, also known as the midline, is an imaginary line that runs down the body's center, dividing it into equal parts, left and right.
- **Medial and lateral:** These terms are used in context with the median where medial indicates toward the median and lateral is away from it, that is, towards the body's side.
- **Superior and inferior:** Superior refers toward the head or upper side, whereas the inferior specifies the lower side or to the feet.
- **External and internal:** External is a term that refers to something close to the surface. The term internal refers to deep and is located underneath the body's surface.



Lab 1

Introduction to Anatomy

Anatomy is the identification and description of the structures of living things. It is a branch of biology and medicine.There are three broad areas:

- human anatomy
- animal anatomy
- plant anatomy

Human anatomy is the study of the structures of the human body. An understanding of anatomy is key to the practice of medicine and other areas of health. The word "anatomy" comes from the Greek words "ana," meaning "up," and "tome," meaning "a cutting." Traditionally, studies of anatomy have involved cutting up, or dissecting, organisms.

LEVELS OF STRUCTURAL ORGANIZATION OF THE HUMAN BODY

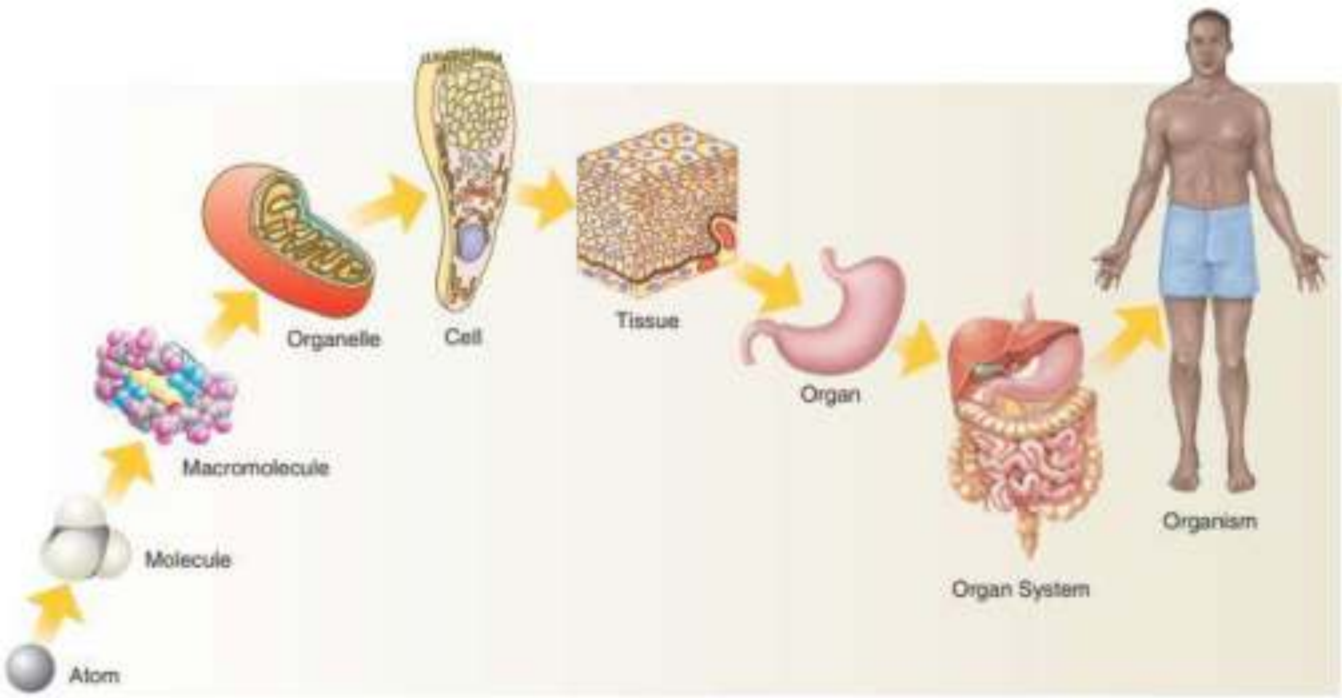


FIGURE 1-1 Organization levels of the body.

Adapted from [illegible] Essentials of Human Anatomy & Physiology, Tenth edition. McGraw-Hill Higher Education, [illegible]

ANATOMICAL POSITION

Stander reference position of body used to describe location of structures.

- Person stand upright and erect.
- Upper limbs adjacent to side.
- Lower limbs closed together.

Face

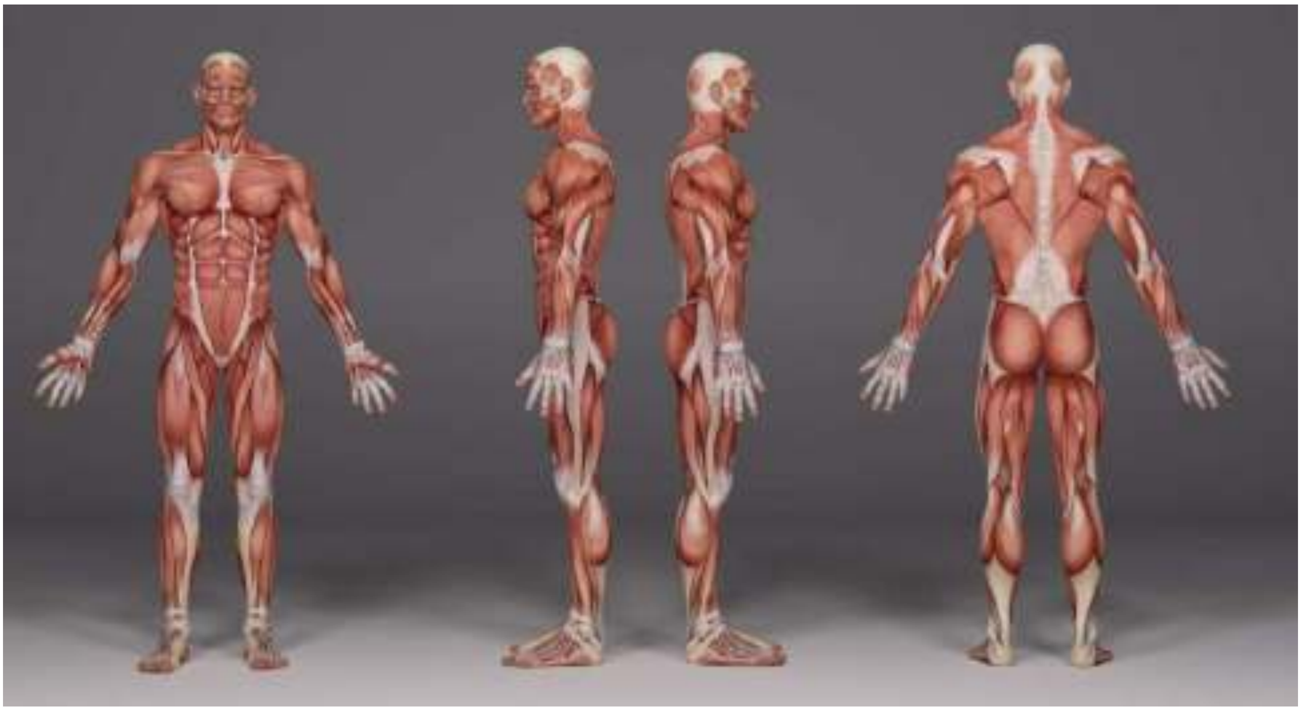
- Mouth = closed
- Facial expression = natural
- Rim of bone under eyes = same horizontal plane of ear opening.
- Eyes = open and look anteriorly.

Upper limbs (on the side)

- Hand = on body side
- Palms = face forward
- Finger = straight and together
- Thumb = be in 90 degree to other fingers.

Lower limbs

- Feet = parallel and together
- Sole = on the ground
- Toes = point forward

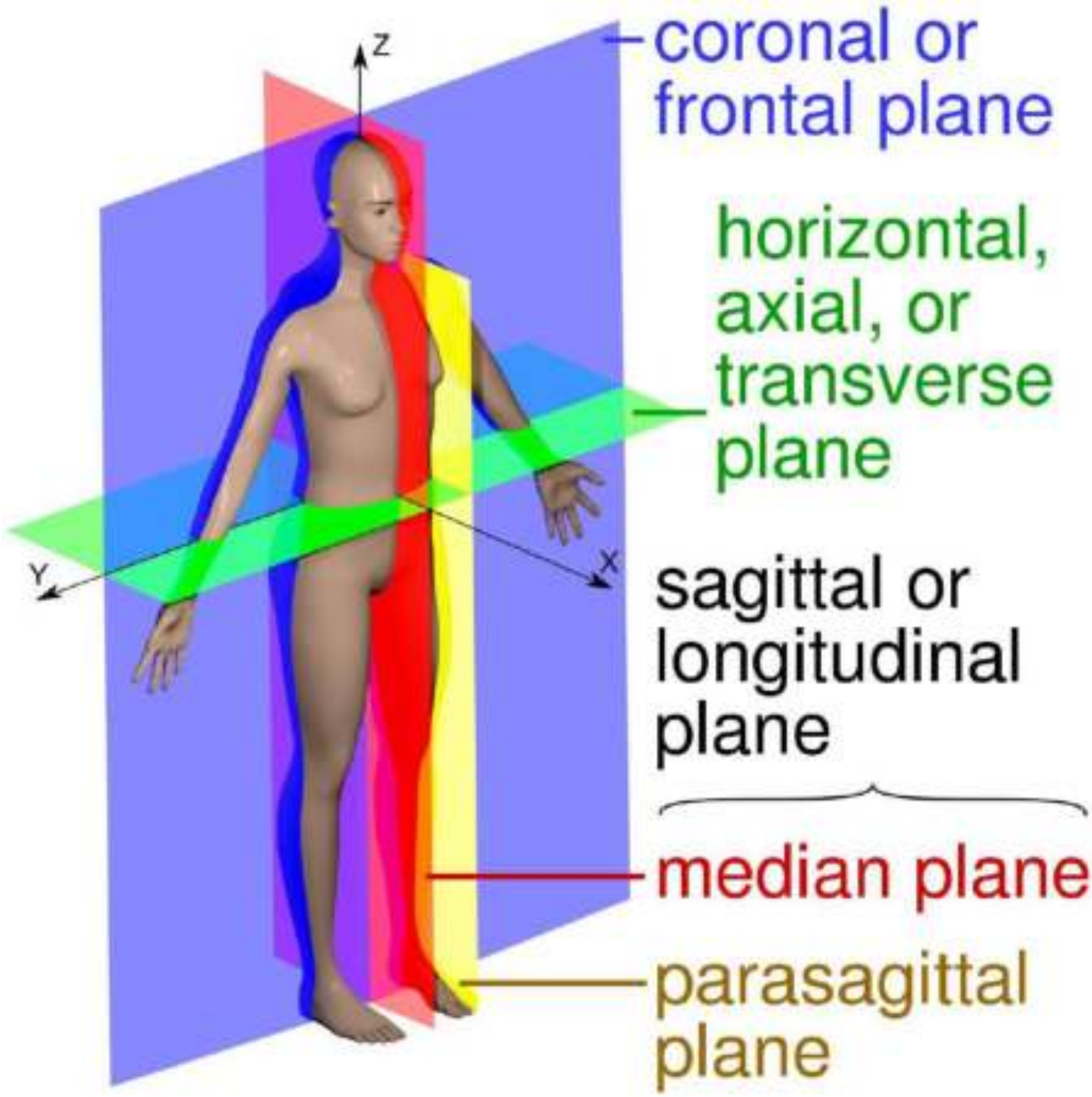


HUMAN BODY PLANES AND SECTION

Body planes are hypothetical geometric planes used to divide the body into sections.

Anatomical Planes

- Coronal Plane or Frontal Plane
- Sagittal Plane or Lateral Plane
- Axial Plane or Transverse Plane
- Median Plane



Anatomical section

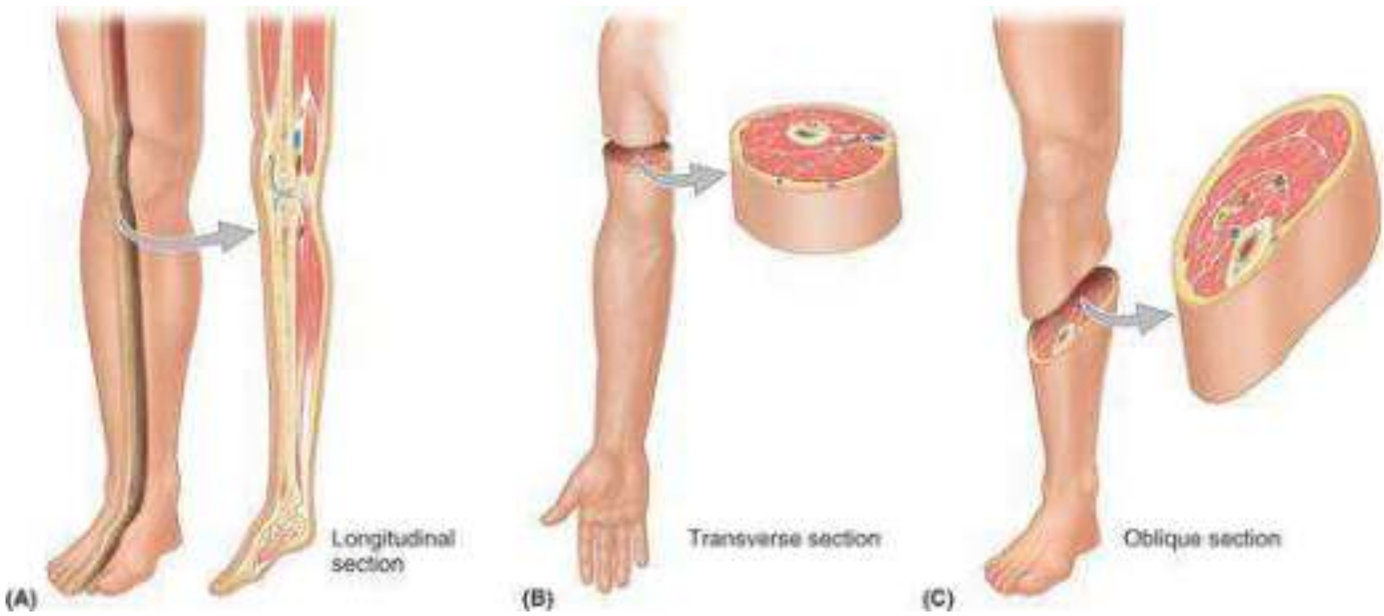
Describe the anatomical planes

- **Slice with specific thickness**

1. Radiologic imaging (CT SCAN)
2. Real slice through the body

Anatomical section involved

- Longitudinal section
- Transverse sections, or cross
- Oblique sections



TISSUES AND TISSUE MEMBRANES

1. TISSUES

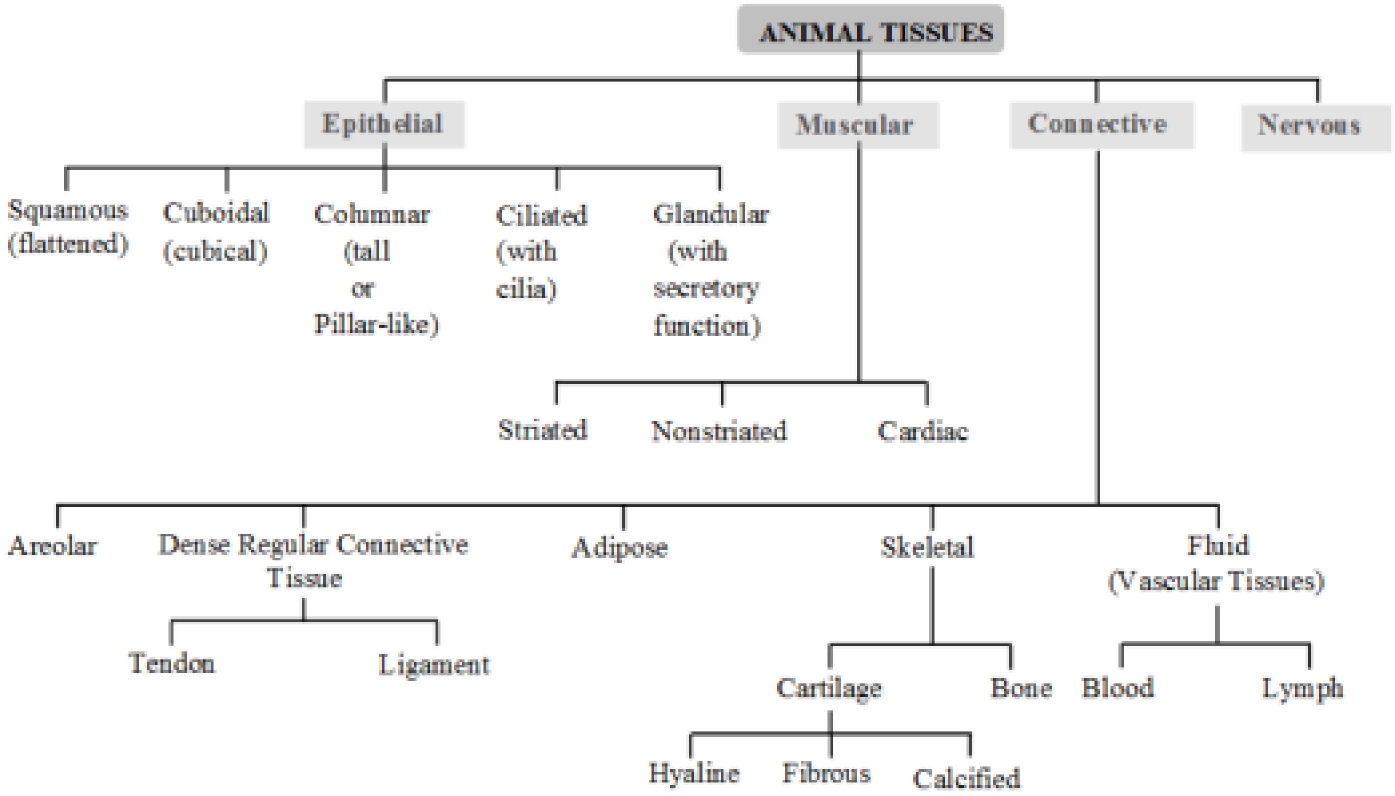
The term **tissue** is used to describe a group of cells found together in the body. The cells within a tissue share a common embryonic origin. Microscopic observation reveals that the cells in a tissue share morphological features and are arranged in an orderly pattern that achieves the tissue's functions. Although there are many types of cells in the human body, they are organized into four broad categories of tissues: epithelial, connective, muscle, and nervous.

TYPES OF TISSUES

Epithelial tissue, also referred to as epithelium, refers to the sheets of cells that cover exterior surfaces of the body, lines internal cavities and passageways, and forms certain glands. **Connective tissue**, as its name implies, binds the cells and organs of the body together and functions in the protection, support, and integration of all parts of the body. **Muscle tissue** is excitable, responding to stimulation and contracting to provide movement, and occurs as three major types: skeletal muscle, smooth muscle, and cardiac muscle in the heart. **Nervous tissue** is also excitable, allowing the propagation of electrochemical signals in the form of nerve impulses that communicate between different regions of the body.

EMBRYONIC ORIGIN OF TISSUES

The zygote, or fertilized egg, is a single cell formed by the fusion of an egg and sperm. After fertilization the zygote gives rise to rapid mitotic cycles, generating many cells to form the embryo. The first embryonic cells generated have the ability to differentiate into any type of cell in the body and, as such, are called **totipotent**, meaning each has the capacity to divide, differentiate, and develop into a new organism. As cell proliferation progresses, three major cell lineages are established within the embryo. As explained in a later chapter, each of these lineages of embryonic cells forms the distinct germ layers from which all the tissues and organs of the human body eventually form. Each germ layer is identified by its position: **ectoderm** (ecto- = "outer"), **mesoderm** (meso- = "middle"), and **endoderm** (endo- = "inner").



EPITHELIAL TISSUES

Epithelial tissues cover the outside of organs and structures in the body and line the lumens of organs in a single layer or multiple layers of cells. The types of epithelia are classified by the shapes of cells present and the number of layers of cells. Epithelia composed of a single layer of cells is called simple epithelia; epithelial tissue composed of multiple layers is called stratified epithelia.

Different Types of Epithelial Tissues

Cell shape	Description	Location
squamous	flat, irregular round shape	simple: lung alveoli, capillaries; stratified: skin, mouth,
cuboidal	cube shaped, central nucleus	glands, renal tubules
columnar	tall, narrow, nucleus toward base; tall, narrow, nucleus along cell	simple: digestive tract; pseudostratified: respiratory tract
transitional	round, simple but appear stratified	urinary bladder

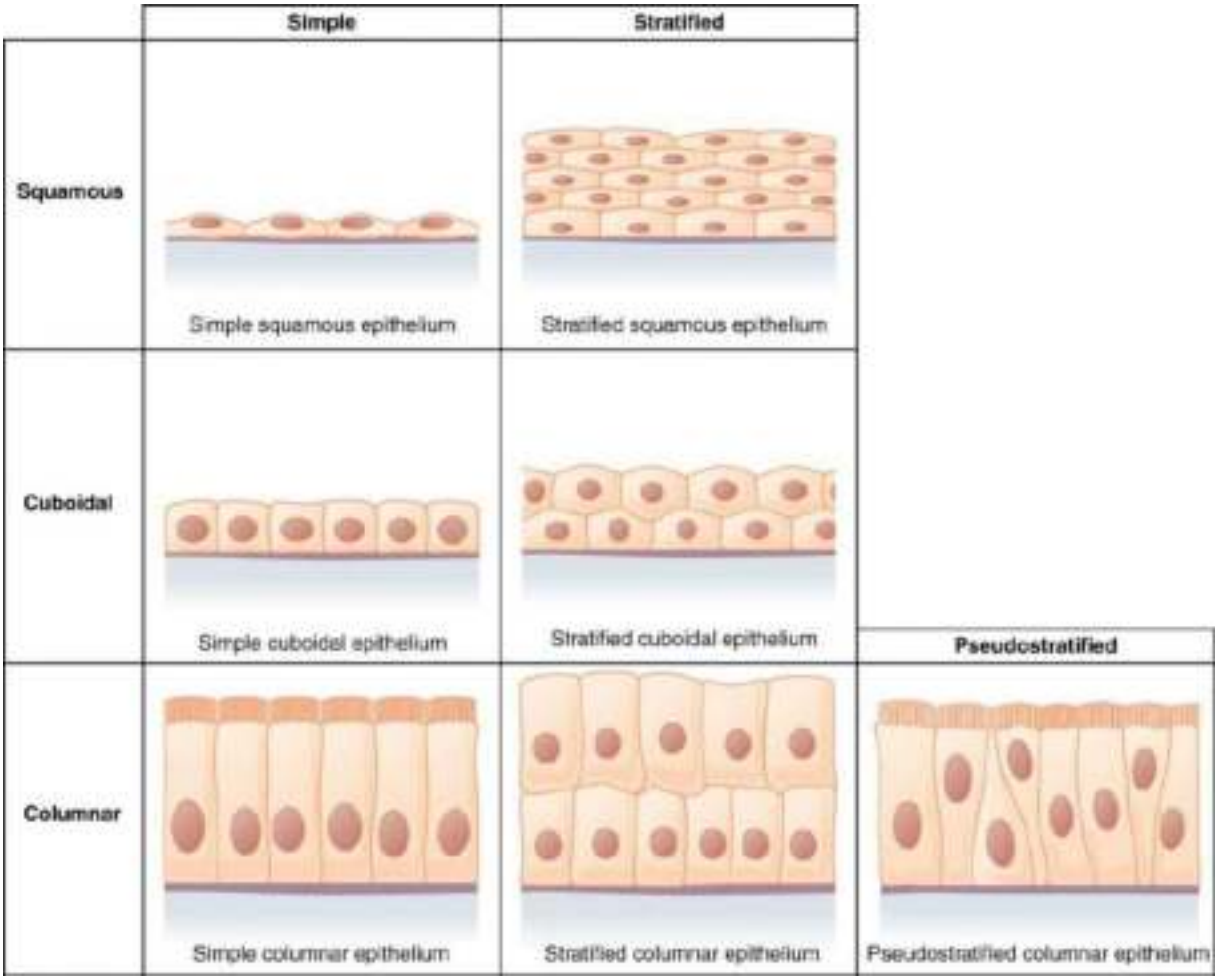


Figure 1. Cells of Epithelial Tissue. Simple epithelial tissue is organized as a single layer of cells and stratified .epithelial tissue is formed by several layers of cells

Squamous Epithelia

Squamous epithelial cells are generally round, flat, and have a small, centrally located nucleus. The cell outline is slightly irregular, and cells fit together to form a covering or lining. When the cells are arranged in a single layer (simple epithelia), they facilitate diffusion in tissues, such as the areas of gas exchange in the lungs and the exchange of nutrients and waste at blood capillaries.

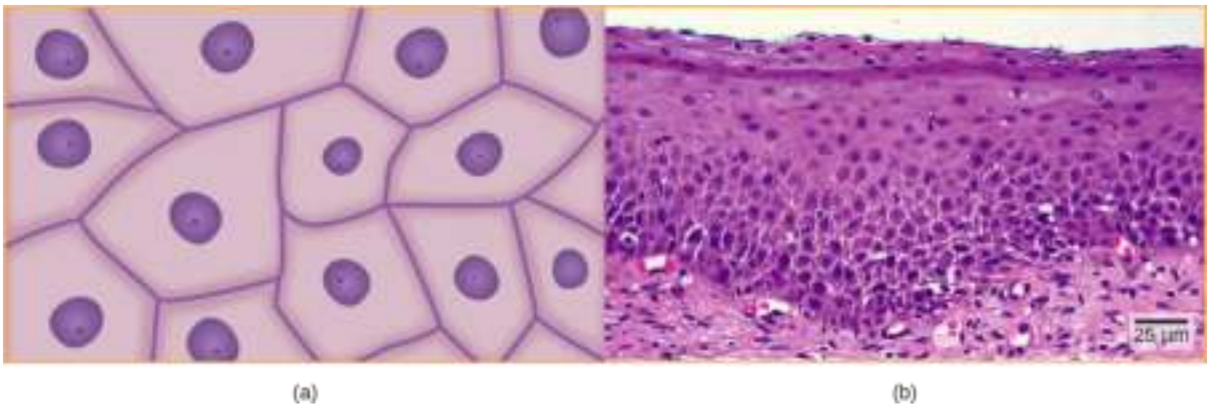


Figure 2. Squamous epithelia cells (a) have a slightly irregular shape, and a small, centrally located nucleus. These cells can be stratified into layers, as in (b) this human cervix specimen.

Cuboidal Epithelia

Cuboidal epithelial cells, shown in **(Figure 3)**, are cube-shaped with a single, central nucleus. They are most commonly found in a single layer representing a simple epithelia in glandular tissues throughout the body where they prepare and secrete glandular material. They are also found in the walls of tubules and in the ducts of the kidney and liver.

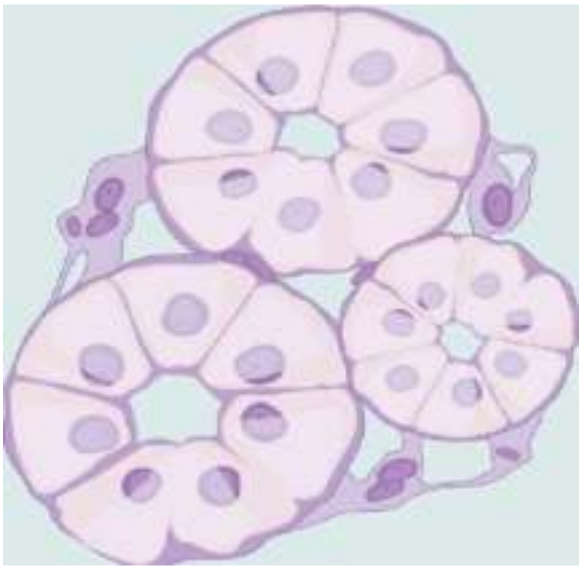


Figure 3. Simple cuboidal epithelial cells line tubules in the .mammalian kidney, where they are involved in filtering the blood.

Columnar Epithelia

Columnar epithelial cells are taller than they are wide: they resemble a stack of columns in an epithelial layer, and are most commonly found in a single-layer arrangement. The nuclei of columnar epithelial cells in the digestive tract appear to be lined up at the base of the cells, as illustrated in **(Figure 4)**. These cells absorb material from the lumen of the digestive tract and prepare it for entry into the body through the circulatory and lymphatic systems.

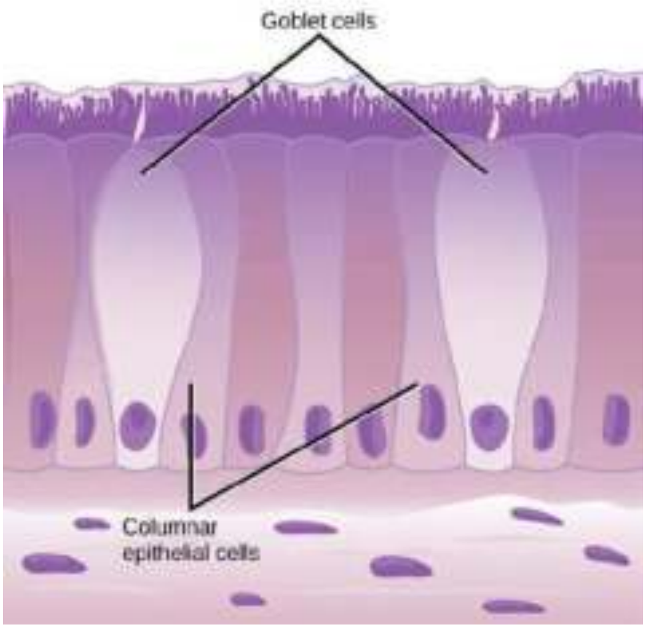


Figure 4. Simple columnar epithelial cells absorb material from the digestive tract. Goblet cells secret mucous into the digestive tract lumen.

Columnar epithelial cells lining the respiratory tract appear to be stratified. However, each cell is attached to the base membrane of the tissue and, therefore, they are simple tissues. The nuclei are arranged at different levels in the layer of cells, making it appear as though there is more than one layer, as seen in **(Figure 5)**. This is called pseudostratified, columnar epithelia. This cellular covering has cilia at the apical, or free, surface of the cells. The cilia enhance the movement of mucous and trapped particles out of the respiratory tract, helping to protect the system from invasive microorganisms and harmful material that has been breathed into the body. Goblet cells are interspersed in some tissues (such as the lining of the trachea). The goblet cells contain mucous that traps irritants, which in the case of the trachea keep these irritants from getting into the lungs.

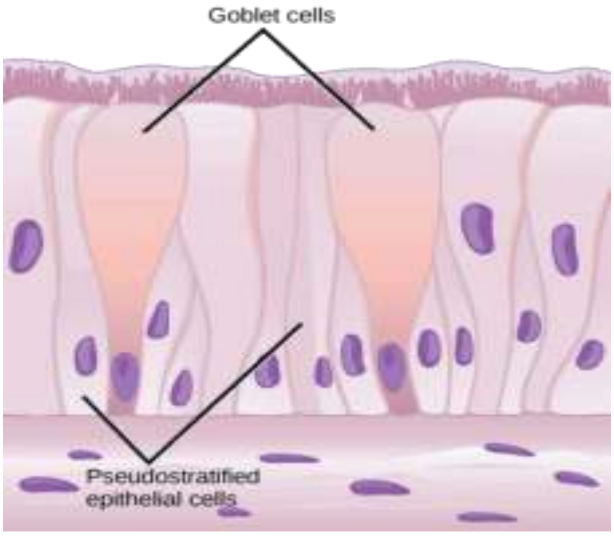


Figure 5. Pseudostratified columnar epithelia line the respiratory tract.

CONNECTIVE TISSUES

Connective tissues are made up of a **matrix** consisting of **living cells and a nonliving substance**, called the **ground substance**. The ground substance is made of an **organic substance (usually a protein) and an inorganic substance (usually a mineral or water).** The **principal** cell of connective tissues is the **fibroblast**. This cell makes the **fibers** found in nearly all of the connective tissues. Fibroblasts are motile, able to carry out mitosis, and can synthesize whichever connective tissue is needed. Macrophages, lymphocytes, and, occasionally, leukocytes can be found in some of the tissues. Some tissues have specialized cells that are not found in the others. The organic portion or protein fibers found in connective tissues are either **collagen, elastic, or reticular fibers.** Collagen fibers provide strength to the tissue, preventing it from being torn or separated from the surrounding tissues. Elastic fibers are made of the protein elastin; this fiber can stretch to one and one half of its length and return to its original size and shape. Elastic fibers provide flexibility to the tissues. Reticular fibers are the third type of protein fiber found in connective tissues. The various types of connective tissues, the types of cells and fibers they are made of, and sample locations of the tissues is summarized in below.

Connective Tissues

Tissue	Cells	Fibers	Location
loose/areolar	fibroblasts, macrophages, some lymphocytes, some neutrophils	few: collagen, elastic, reticular	around blood vessels; anchors epithelia
dense, fibrous connective tissue	fibroblasts, macrophages	mostly collagen	irregular: skin; regular: tendons, ligaments
cartilage	chondrocytes, chondroblasts	hyaline: few: collagen fibrocartilage: large amount of collagen	shark skeleton, fetal bones, human ears, intervertebral discs
bone	osteoblasts, osteocytes, osteoclasts	some: collagen, elastic	vertebrate skeletons
adipose	adipocytes	few	adipose (fat)
blood	red blood cells, white blood cells	none	blood

Loose/Areolar Connective Tissue

Loose connective tissue, also called areolar connective tissue, has all of the components of a connective tissue. As in **(Figure 6)**, loose connective tissue has some fibroblasts; macrophages are present as well. Collagen fibers are relatively wide and stain a light pink, while elastic fibers are thin and stain dark blue to black. The space between the formed elements of the tissue is filled with the matrix. The material in the connective tissue gives it a loose consistency similar to a cotton ball that has been pulled apart. Loose connective tissue is found **around every blood vessel and helps to keep the vessel in place. The tissue is also found around and between most body organs.** In summary, areolar tissue is tough, yet flexible, and comprises membranes.

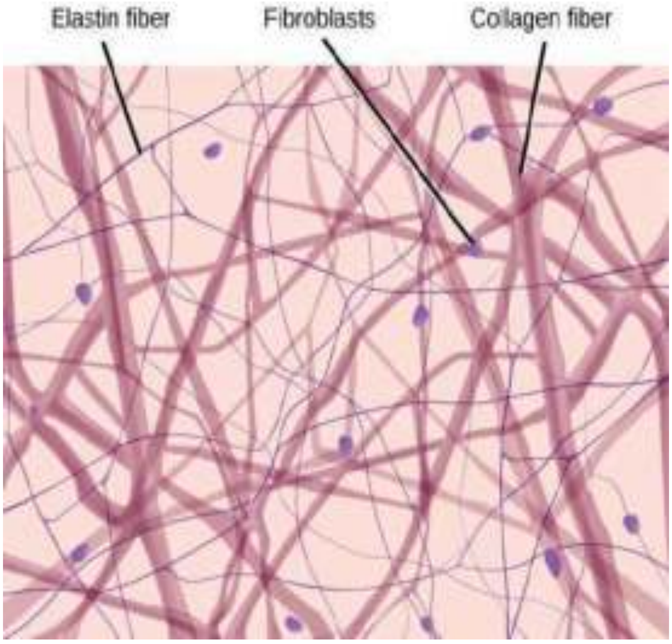


Figure 6. Loose connective tissue

Fibrous Connective Tissue

Fibrous connective tissues contain large amounts of collagen fibers and few cells or matrix material. The fibers can be arranged **irregularly or regularly** with the strands lined up in parallel. **Irregularly** fibrous connective tissues are found in areas of the body where stress occurs from all directions, such **as the dermis of the skin**. **Regular** fibrous connective tissue, shown in **(Figure 7),** is found in **tendons** (which connect muscles to bones) and **ligaments** (which connect bones to bones).

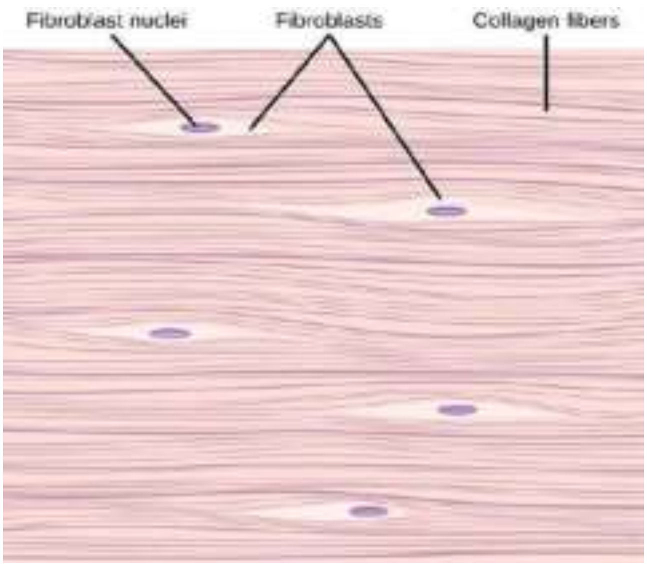


Figure 7. Fibrous connective tissue from the tendon

Cartilage

Cartilage is a connective tissue with a large amount of the matrix and variable amounts of fibers. The cells, called **chondrocytes**, make the matrix and fibers of the tissue. Chondrocytes are found in spaces within the tissue called **lacunae**. The **three** main types of cartilage tissue are hyaline cartilage, fibrocartilage, and elastic cartilage. **Hyaline cartilage**, the most common type of cartilage in the body, consists of short and dispersed collagen fibers and contains large amounts of proteoglycans. The surface of hyaline cartilage is smooth. Both strong and flexible, it is found in **the rib cage and nose and covers bones where they meet to form moveable joints. Fibrocartilage** is tough because it has thick bundles of collagen fibers dispersed through its matrix. **The knee and jaw joints and the intervertebral discs are examples of fibrocartilage**. **Elastic cartilage** contains elastic fibers as well as collagen and proteoglycans. This tissue gives rigid support as well as elasticity. Tug gently at your ear lobes, and notice that the lobes return to their initial shape. **The external ear contains elastic cartilage.**

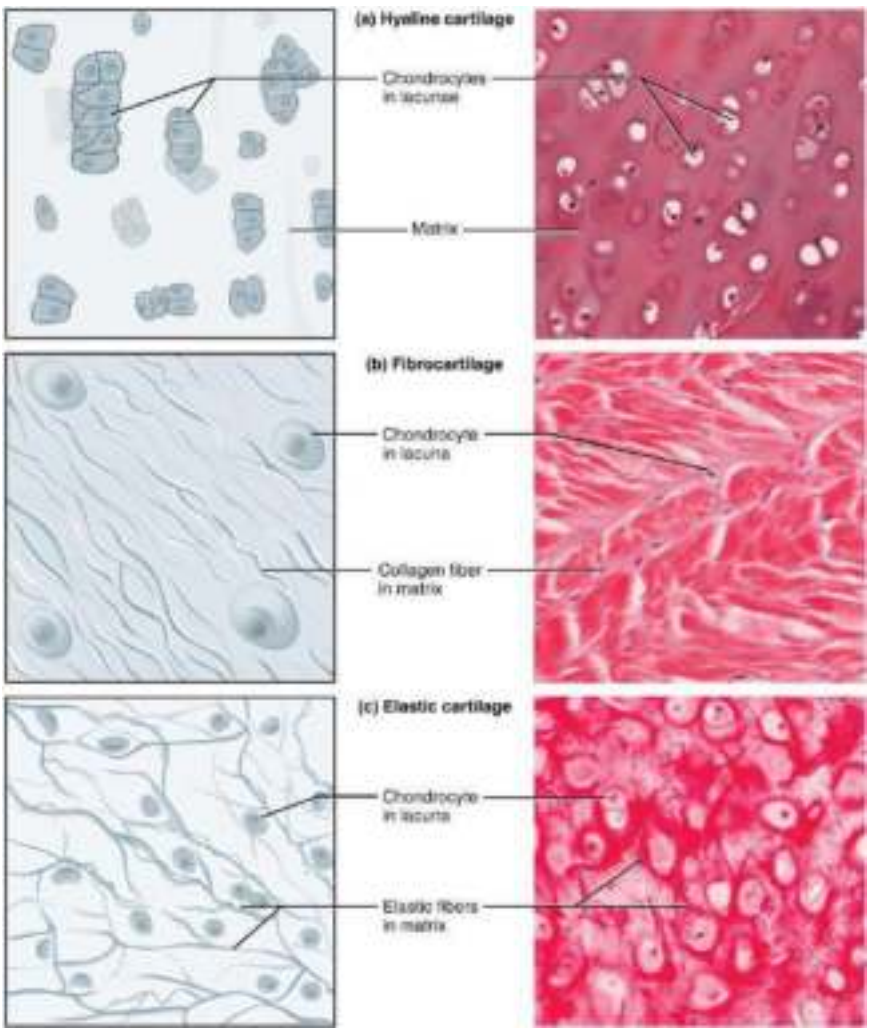


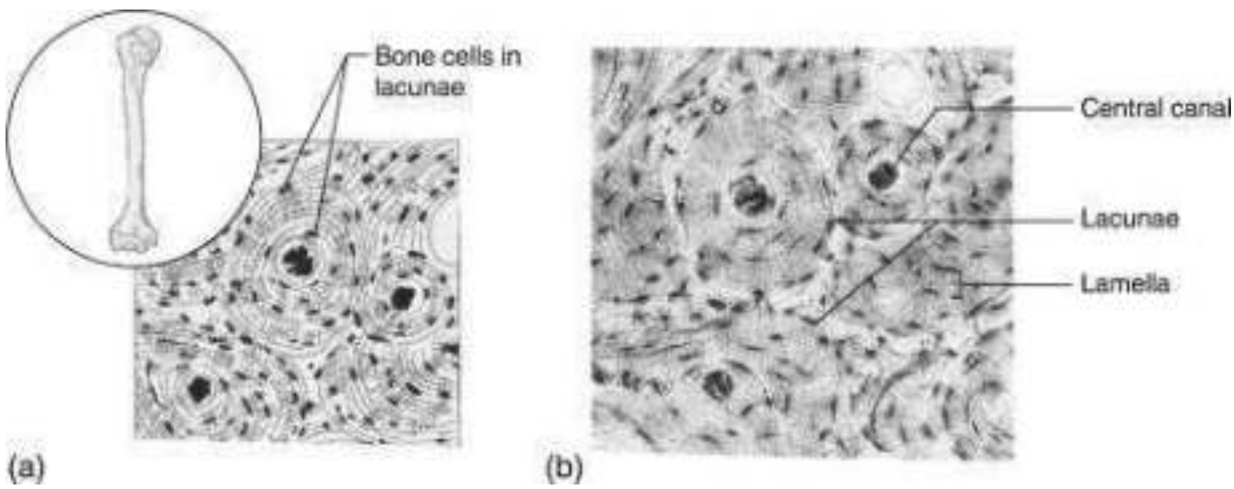
Figure 8. Types of Cartilage. (a) Hyaline cartilage y. (b) Fibrocartilage (c) Elastic cartilage

Bone

Bone, or osseous tissue, is a connective tissue that has a large amount of two different types of matrix material. The organic matrix is similar to the matrix material found in other connective tissues, including some amount of collagen and elastic fibers. This gives strength and flexibility to the tissue. The inorganic matrix consists of mineral salts mostly calcium salts that give the tissue hardness. Without adequate organic material in the matrix, the tissue breaks; without adequate inorganic material in the matrix, the tissue bends.

There are three types of cells in bone: osteoblasts, osteocytes, and osteoclasts. Osteoblasts are active in making bone for growth and remodeling. Osteoblasts deposit bone material into the matrix and, after the matrix surrounds them. Osteocytes are found in lacunae of the bone. Osteoclasts are active in breaking down bone for bone remodeling, and they provide access to calcium stored in tissues. Osteoclasts are usually found on the surface of the tissue.

Bone can be divided into two types: compact and spongy. Compact bone is found in the shaft (or diaphysis) of a long bone and the surface of the flat bones, while spongy bone is found in the end (or epiphysis) of a long bone. Compact bone is organized into subunits called osteons, as illustrated in **(Figure 9)**. A blood vessel and a nerve are found in the center of the structure within the Haversian canal, with radiating circles of lacunae around it known as lamellae. The wavy lines seen between the lacunae are microchannels called canaliculi; they connect the lacunae to aid diffusion between the cells. Spongy bone is made of tiny plates called trabeculae; these plates serve as struts to give the spongy bone strength. Over time, these plates can break causing the bone to become less resilient. Bone tissue forms the internal skeleton of vertebrate animals, providing structure to the animal and points of attachment for tendons.



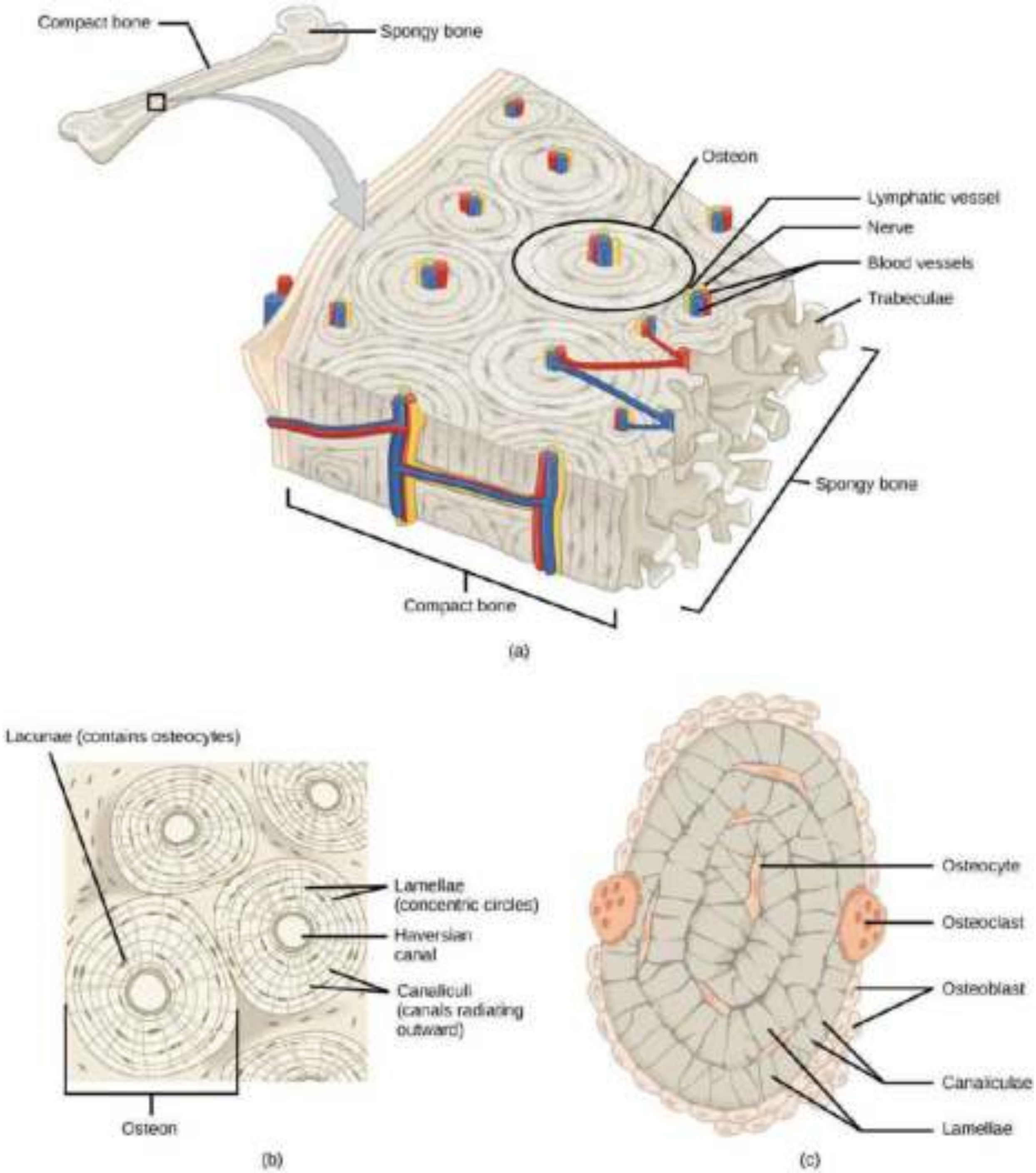


Figure 9. (a) Compact bone is a dense matrix on the outer surface of bone. Spongy bone, inside the compact bone, is porous with web-like trabeculae. (b) Compact bone is organized into rings called osteons. Blood vessels, nerves, and lymphatic vessels are found in the central Haversian canal. Rings of lamellae surround the Haversian canal. Between the lamellae are cavities called lacunae. Canaliculi are microchannels connecting the lacunae together. (c) Osteoblasts surround the exterior of the bone. Osteoclasts bore tunnels into the bone and osteocytes are found in the lacunae.

Adipose Tissue

Adipose tissue, or fat tissue, is considered a connective tissue even though it does not have fibroblasts or a real matrix and only has a few fibers. Adipose tissue is made up of cells called adipocytes that collect and store fat in the form of triglycerides, for energy metabolism. Adipose tissues additionally serve as insulation to help maintain body temperatures, allowing to be endothermic, and they function as cushioning against damage to body organs. Under a microscope, adipose tissue cells appear empty due to the extraction of fat during the processing of the material for viewing, as seen in **(Figure 10)**. The thin lines in the image are the cell membranes, and the nuclei are the small, black dots at the edges of the cells.

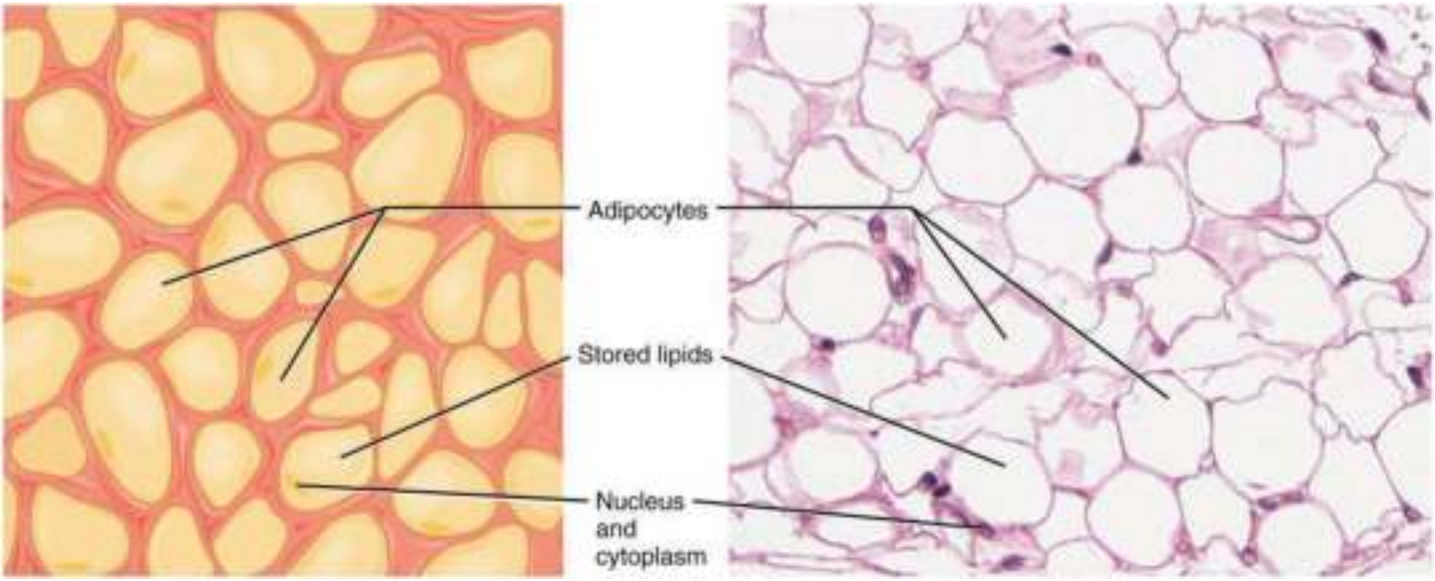
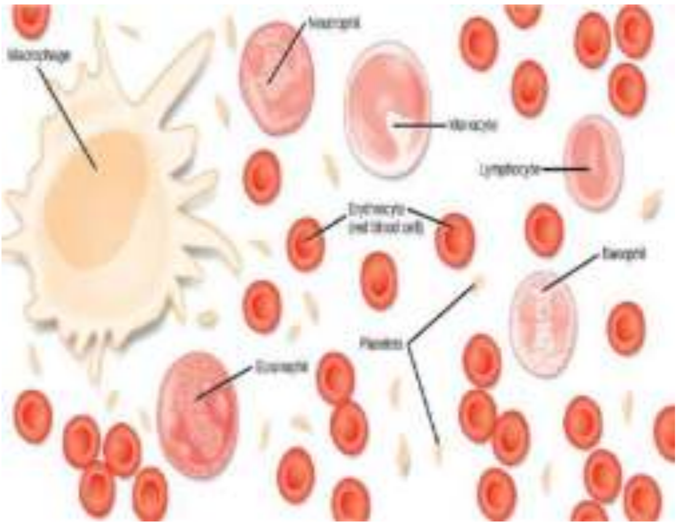


Figure 10. Adipose Tissue

Blood

Blood is considered a connective tissue because it has a matrix. The living cell types are red blood cells (RBC), also called erythrocytes, and white blood cells (WBC), also called leukocytes. The fluid portion of whole blood, its matrix, is commonly called plasma.

Blood is a connective tissue that has a fluid matrix, called plasma, and no fibers. Erythrocytes (red blood cells), the predominant cell type, are involved in the transport of oxygen and carbon dioxide. Also present are various leukocytes (white blood cells) involved in immune response.



The cell found in greatest abundance in blood is the erythrocyte. Erythrocytes are counted in millions in a blood sample: the average number of red blood cells in primates is 4.7 to 5.5 million cells per microliter. Erythrocytes are consistently the same size in a species, but vary in size between species. For example, the average diameter of a primate red blood cell is 7.5 µl, a dog is close at 7.0 µl, but a cat's RBC diameter is 5.9 µl. Sheep erythrocytes are even smaller at 4.6 µl. Mammalian erythrocytes lose their nuclei and mitochondria when they are released from the bone marrow where they are made. Fish, amphibian, and avian red blood cells maintain their nuclei and mitochondria throughout the cell's life. The principal job of an erythrocyte is to carry and deliver oxygen to the tissues.

Leukocytes are the predominant white blood cells found in the peripheral blood. Leukocytes are counted in the thousands in the blood with measurements expressed as ranges: primate counts range from 4,800 to 10,800 cells per µl, dogs from 5,600 to 19,200 cells per µl, cats from 8,000 to 25,000 cells per µl, cattle from 4,000 to 12,000 cells per µl, and pigs from 11,000 to 22,000 cells per µl. Lymphocytes function primarily in the immune response to foreign antigens or material. Different types of lymphocytes make antibodies tailored to the foreign antigens and control the production of those antibodies. Neutrophils are phagocytic cells and they participate in one of the early lines of defense against microbial invaders, aiding in the removal of bacteria that has entered the body. Another leukocyte that is found in the peripheral blood is the monocyte. Monocytes give rise to phagocytic macrophages that clean up dead and damaged cells in the body, whether they are foreign or from the host animal. Two additional leukocytes in the blood are eosinophils and basophils—both help to facilitate the inflammatory response. The slightly granular material among the cells is a cytoplasmic fragment of a cell in the bone marrow. This is called a platelet or thrombocyte. Platelets participate in the stages leading up to coagulation of the blood to stop bleeding through damaged blood vessels. Blood has a number of functions, but primarily it transports material through the body to bring nutrients to cells and remove waste material from them.

Muscle Tissues

There are three types of muscle in human bodies: **smooth, skeletal, and cardiac.** They differ by the presence or absence of striations or bands, the number and location of nuclei, whether they are voluntarily or involuntarily controlled, and their location within the body. **(Figure 11)** summarizes these differences.

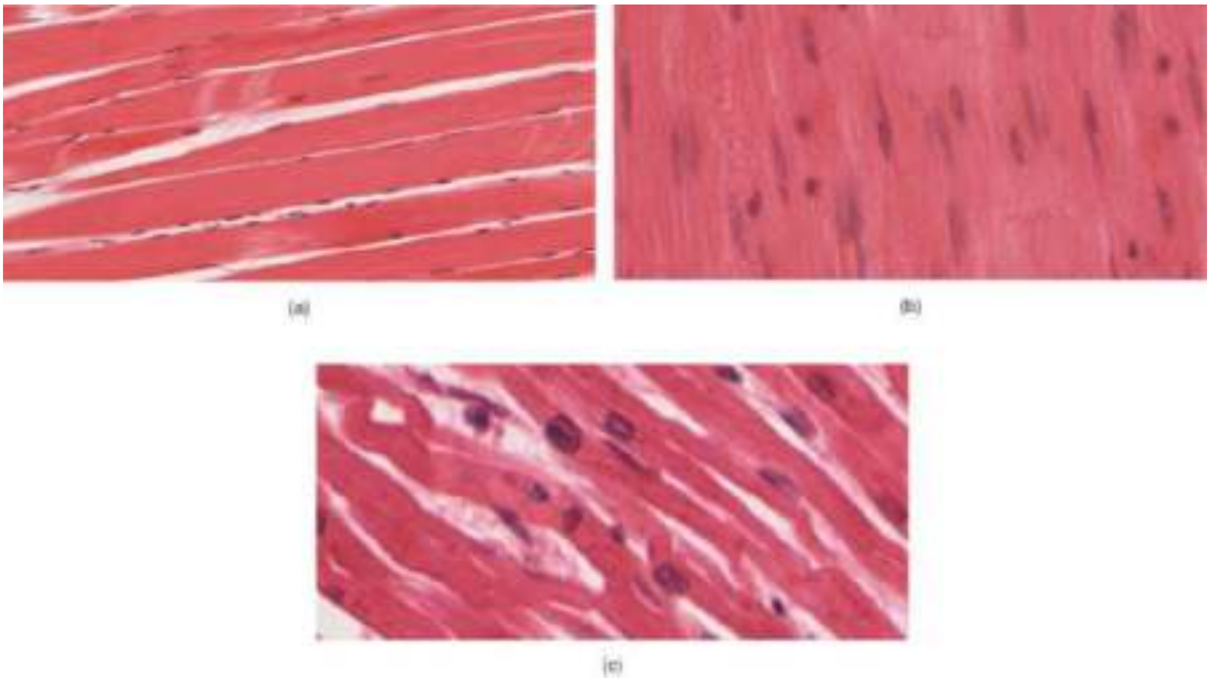


Figure 11. Muscle Tissue. (a) Skeletal muscle cells have prominent striation and nuclei on their periphery. (b) Smooth muscle cells have a single nucleus and no visible striations. (c) Cardiac muscle cells appear striated and have a single nucleus.

Table 1. Comparison of Structure and Properties of Muscle Tissue Types

Tissue	Histology	Function	Location
Skeletal	Long cylindrical fiber, striated, many peripherally located nuclei	Voluntary movement, produces heat, protects organs	Attached to bones and around entrance points to body (e.g., mouth, anus)
Cardiac	Short, branched, striated, single central nucleus	Contracts to pump blood	Heart
Smooth	Short, spindle-shaped, no evident striation, single nucleus in each fiber	Involuntary movement, moves food, involuntary control of respiration, moves secretions	Walls of major organs and passageways, visceral organs

Smooth Muscle

Smooth muscle does not have striations in its cells. It has a single, centrally located nucleus.. Constriction of smooth muscle occurs under involuntary, autonomic nervous control and in response to local conditions in the tissues. Smooth muscle tissue is also called non-striated as it lacks the banded appearance of skeletal and cardiac muscle. The walls of blood vessels, the tubes of the digestive system, and the tubes of the reproductive systems are composed of mostly smooth muscle.

Skeletal Muscle

Skeletal muscle has striations across its cells caused by the arrangement of the contractile proteins actin and myosin. These muscle cells are relatively long and have multiple nuclei along the edge of the cell. Skeletal muscle is under voluntary, somatic nervous system control and is found in the muscles that move bones.

Cardiac Muscle

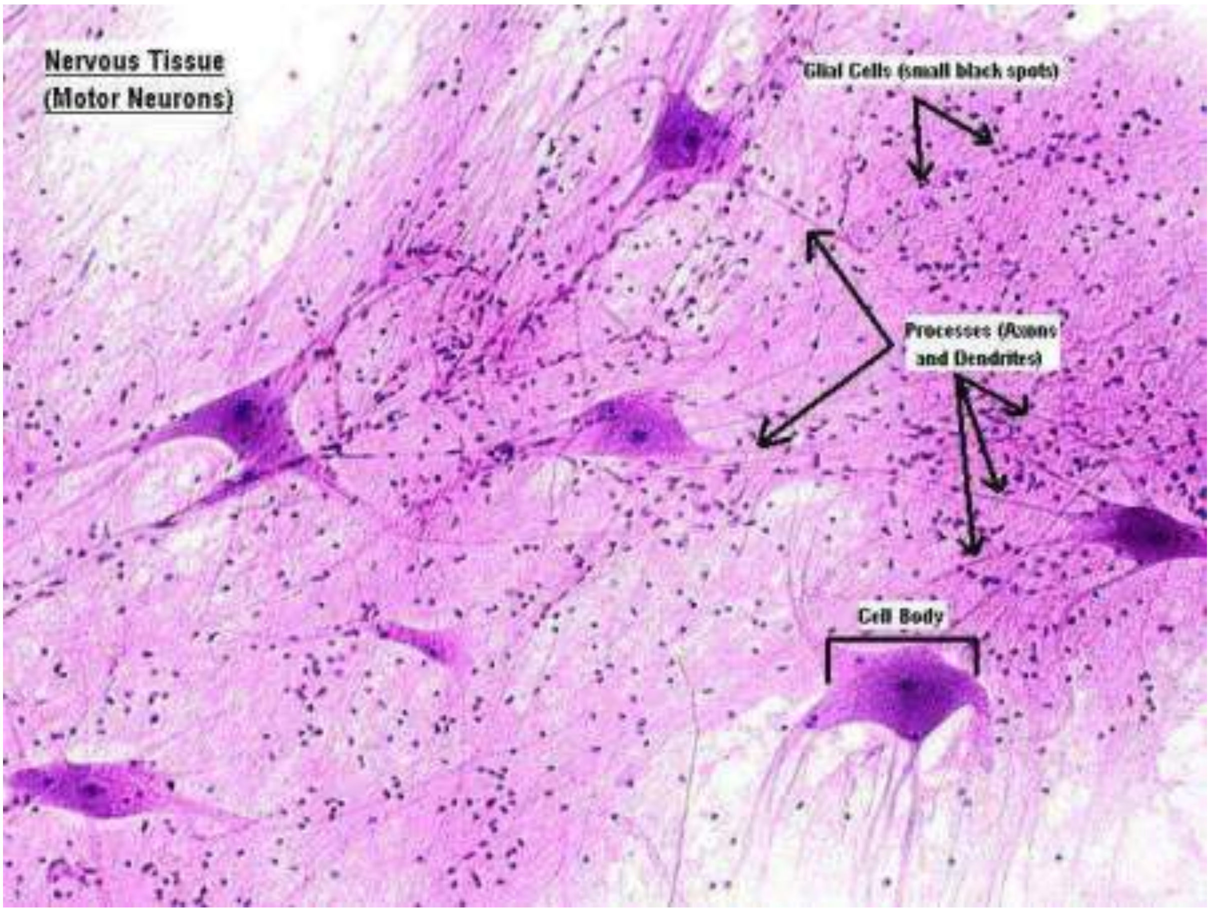
Cardiac muscle is found only in the heart. Like skeletal muscle, it has cross striations in its cells, but cardiac muscle has a single, centrally located nucleus. Cardiac muscle is not under voluntary control but can be influenced by the autonomic nervous system to speed up or slow down. An added feature to cardiac muscle cells is a line than extends along the end of the cell as it abuts the next cardiac cell in the row. This line is called an intercalated disc: it assists in passing electrical impulse efficiently from one cell to the next and maintains the strong connection between neighboring cardiac cells.

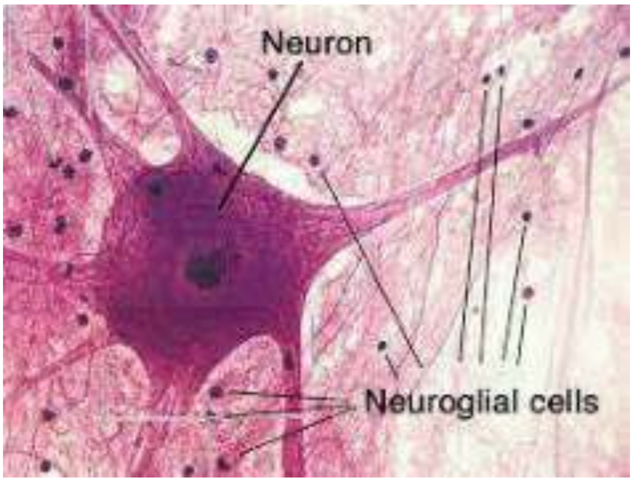
Nervous Tissues

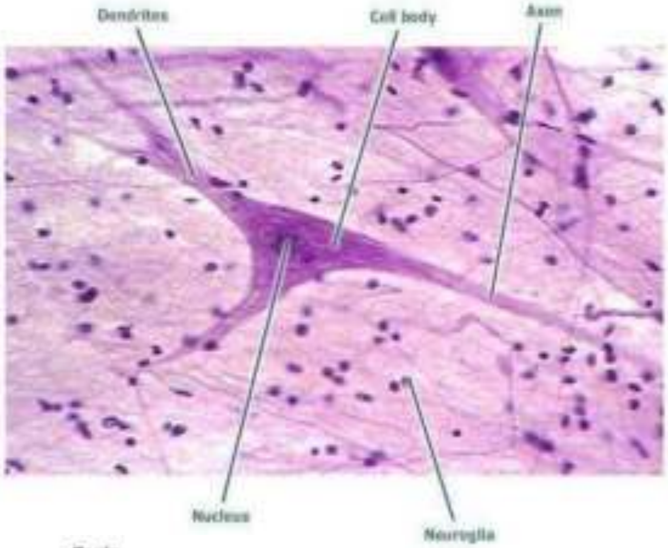
Nervous tissue is found in the brain, spinal cord, and nerves. Nervous tissues are made of cells specialized to receive and transmit electrical impulses from specific areas of the body and to send them to specific locations in the body. Two main classes of cells make up nervous tissue: the **neuron** and **neuroglia**. The large structure with a central nucleus is the cell body of the **neuron**. Projections from the cell body are either dendrites specialized in receiving input or a single axon specialized in transmitting impulses.

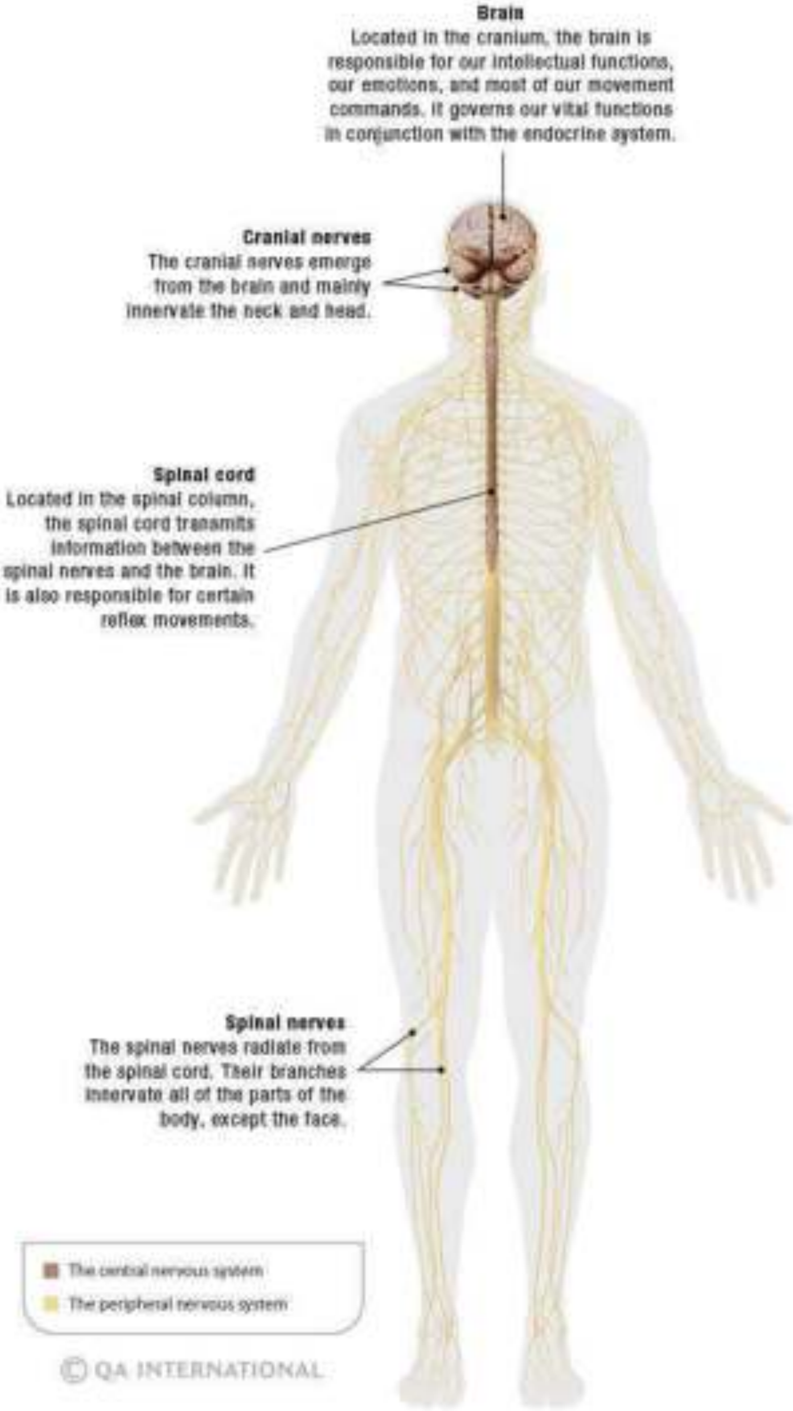
Astrocytes regulate the chemical environment of the nerve cell, and oligodendrocytes insulate the axon so the electrical nerve impulse is transferred more efficiently. Other glial cells that are not shown support the nutritional and waste requirements of the neuron. Some of the glial cells are phagocytic and remove debris or damaged cells from the tissue. A nerve consists of neurons and glial cells. Nervous tissue is characterized as being excitable and capable of sending and receiving electrochemical signals that provide the body with information. Neurons propagate information via electrochemical impulses, called action potentials, which are biochemically linked to the release of chemical signals. Neuroglia play an essential role in supporting neurons and modulating their information propagation.

Neurons display distinctive morphology, well suited to their role as conducting cells, with three main parts. The cell body includes most of the cytoplasm, the organelles, and the nucleus. Dendrites branch off the cell body and appear as thin extensions. A long "tail," the axon, extends from the neuron body and can be wrapped in an insulating layer known as **myelin**, which is formed by accessory cells. The synapse is the gap between nerve cells, or between a nerve cell and its target, for example, a muscle or a gland, across which the impulse is transmitted by chemical compounds known as neurotransmitters.




Neuron
Neuroglial cells


Dendrites
Cell body
Axon
Nucleus
Neuroglia


Brain
Located in the cranium, the brain is responsible for our intellectual functions, our emotions, and most of our movement commands. It governs our vital functions in conjunction with the endocrine system.
Cranial nerves
The cranial nerves emerge from the brain and mainly innervate the neck and head.
Spinal cord
Located in the spinal column, the spinal cord transmits information between the spinal nerves and the brain. It is also responsible for certain reflex movements.
Spinal nerves
The spinal nerves radiate from the spinal cord. Their branches innervate all of the parts of the body, except the face.
The central nervous system
The peripheral nervous system
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2. TISSUE MEMBRANES

A **tissue membrane** is a thin layer or sheet of cells that covers the outside of the body (for example, skin), the organs (for example, pericardium), internal passageways that lead to the exterior of the body (for example, abdominal mesenteries), and the lining of the moveable joint cavities. There are two basic types of tissue membranes: connective tissue and epithelial membranes.

Tissue Membranes

The two broad categories of tissue membranes in the body are (1) connective tissue membranes, which include synovial membranes, and (2) epithelial membranes, which include mucous membranes, serous membranes, and the cutaneous membrane, in other words, the skin.

Connective Tissue Membranes

The **connective tissue membrane** is formed solely from connective tissue. These membranes encapsulate organs, such as the kidneys, and line our movable joints. A **synovial membrane** is a type of connective tissue membrane that lines the cavity of a freely movable joint. For example, synovial membranes surround the joints of the shoulder, elbow, and knee. Fibroblasts in the inner layer of the synovial membrane release hyaluronan into the joint cavity. The hyaluronan effectively traps available water to form the synovial fluid, a natural lubricant that enables the bones of a joint to move freely against one another without much friction. This synovial fluid readily exchanges water and nutrients with blood, as do all body fluids.

Epithelial Membranes

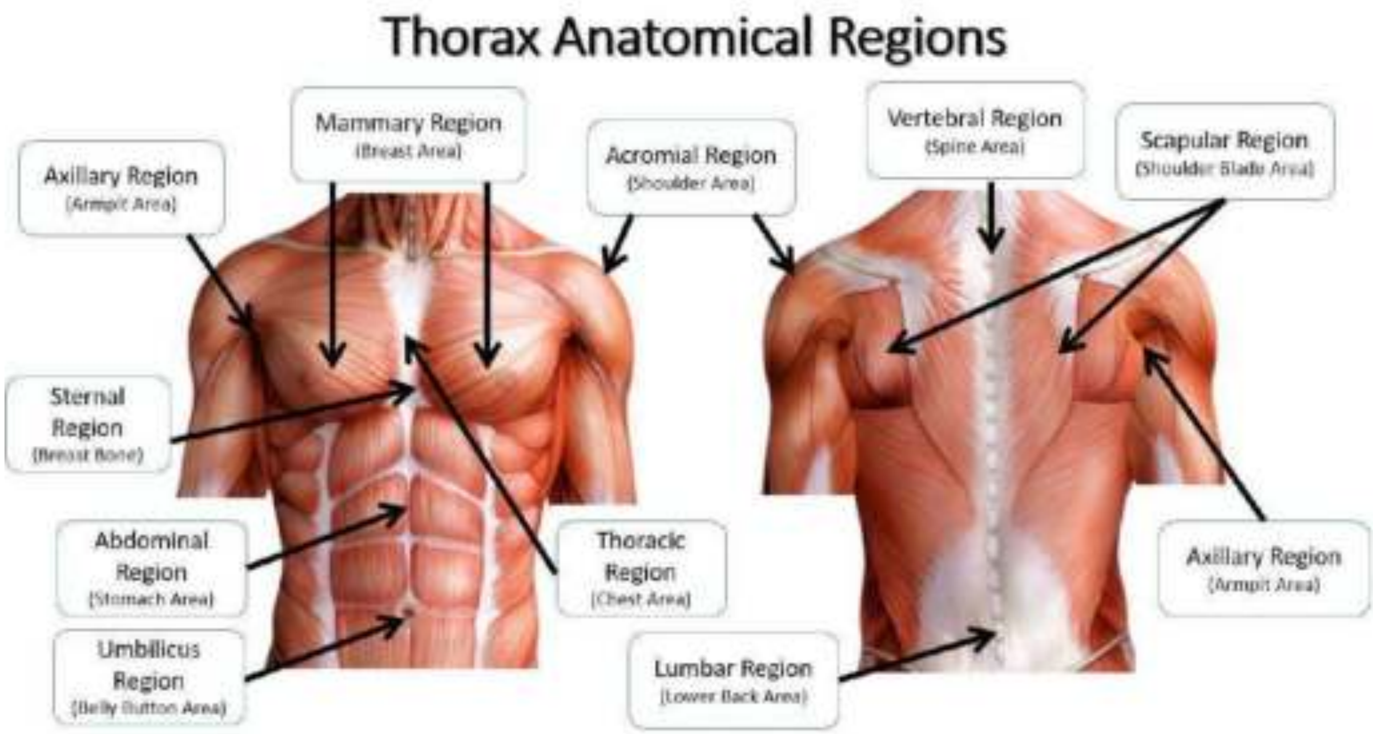
The **epithelial membrane** is composed of epithelium attached to a layer of connective tissue, for example, your skin. The **mucous membrane** is also a composite of connective and epithelial tissues. Sometimes called mucosae, these epithelial membranes line the body cavities and hollow passageways that open to the external environment, and include the digestive, respiratory, excretory, and reproductive tracts. Mucous, produced by the epithelial exocrine glands, covers the epithelial layer. The underlying connective tissue, called the **lamina propria** (literally “own layer”), help support the fragile epithelial layer.

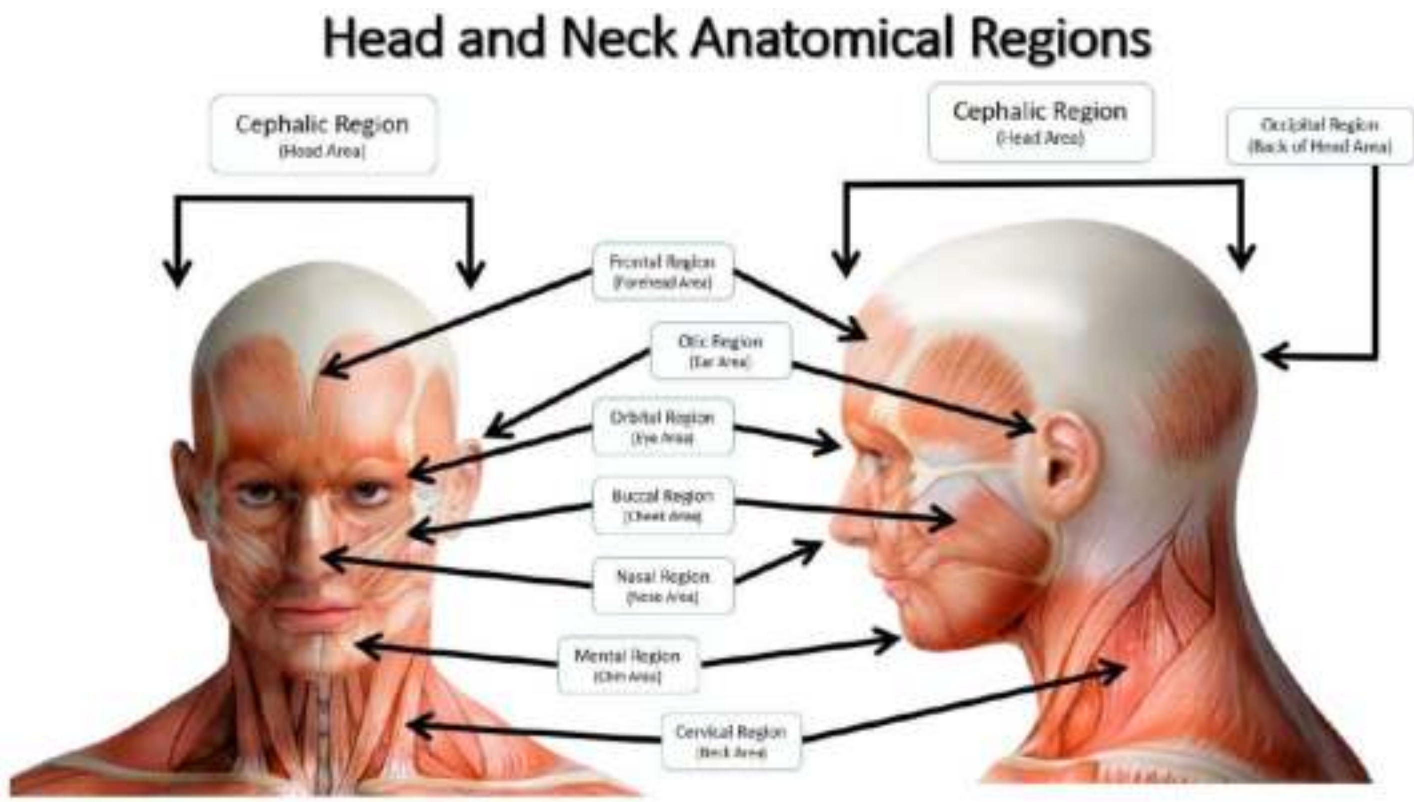
A **serous membrane** is an epithelial membrane composed of mesodermally derived epithelium called the mesothelium that is supported by connective tissue. These membranes line the coelomic cavities of the body, that is, those cavities that do not open to the outside, and they cover the organs located within those cavities. They are essentially membranous bags, with mesothelium lining the inside and connective tissue on the outside. Serous fluid secreted by the cells of the thin squamous mesothelium lubricates the membrane and reduces abrasion and friction between organs. Serous membranes are identified according locations. Three serous membranes line the thoracic cavity; the two pleura that cover the lungs and the pericardium that covers the heart. A fourth, the peritoneum, is the serous membrane in the abdominal cavity that covers abdominal organs and forms double sheets of mesenteries that suspend many of the digestive organs.

The skin is an epithelial membrane also called the **cutaneous membrane**. It is a stratified squamous epithelial membrane resting on top of connective tissue. The apical surface of this membrane is exposed to the external environment and is covered with dead, keratinized cells that help protect the body from desiccation and pathogens.

Lab 2

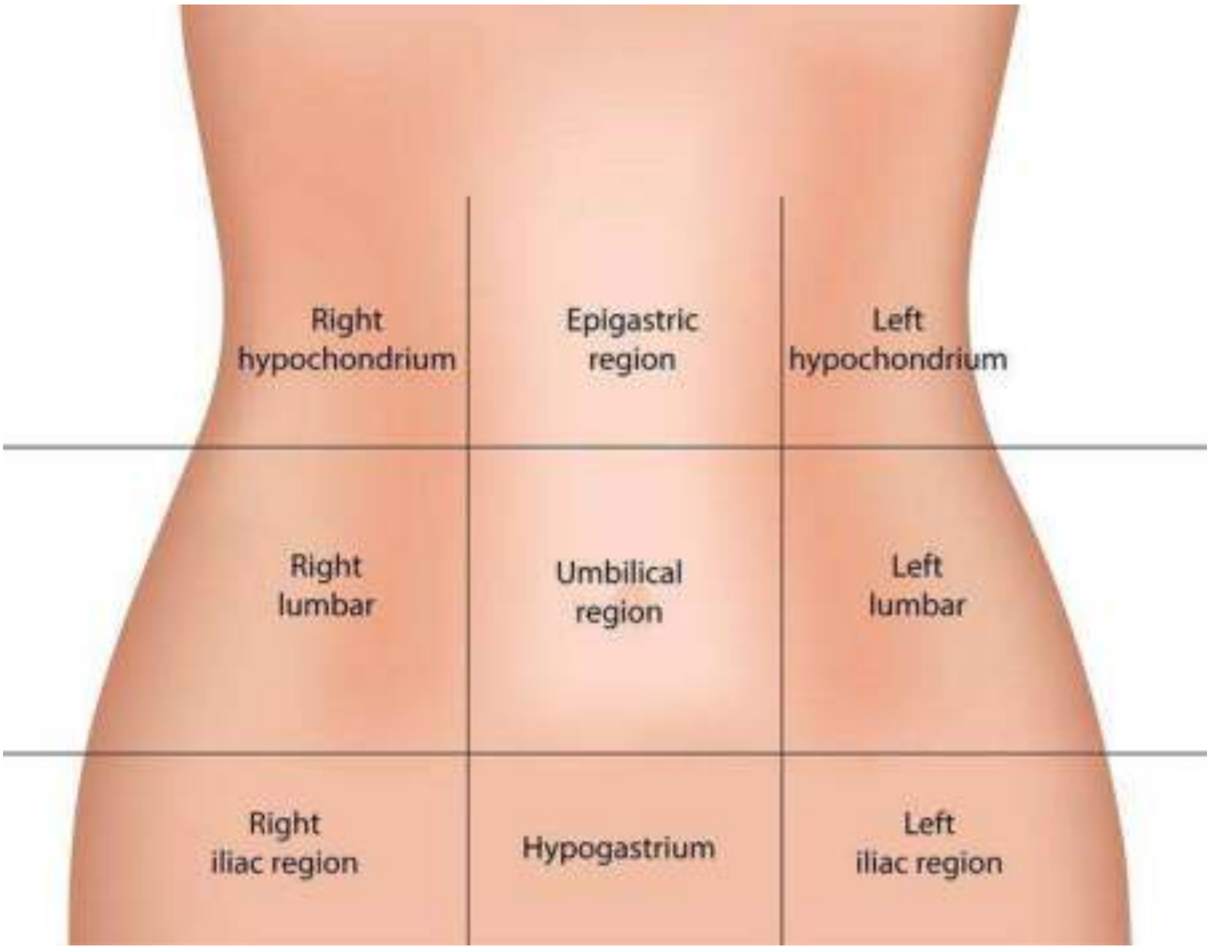
1. ANATOMICAL REGIONS OF THE HUMAN BODY



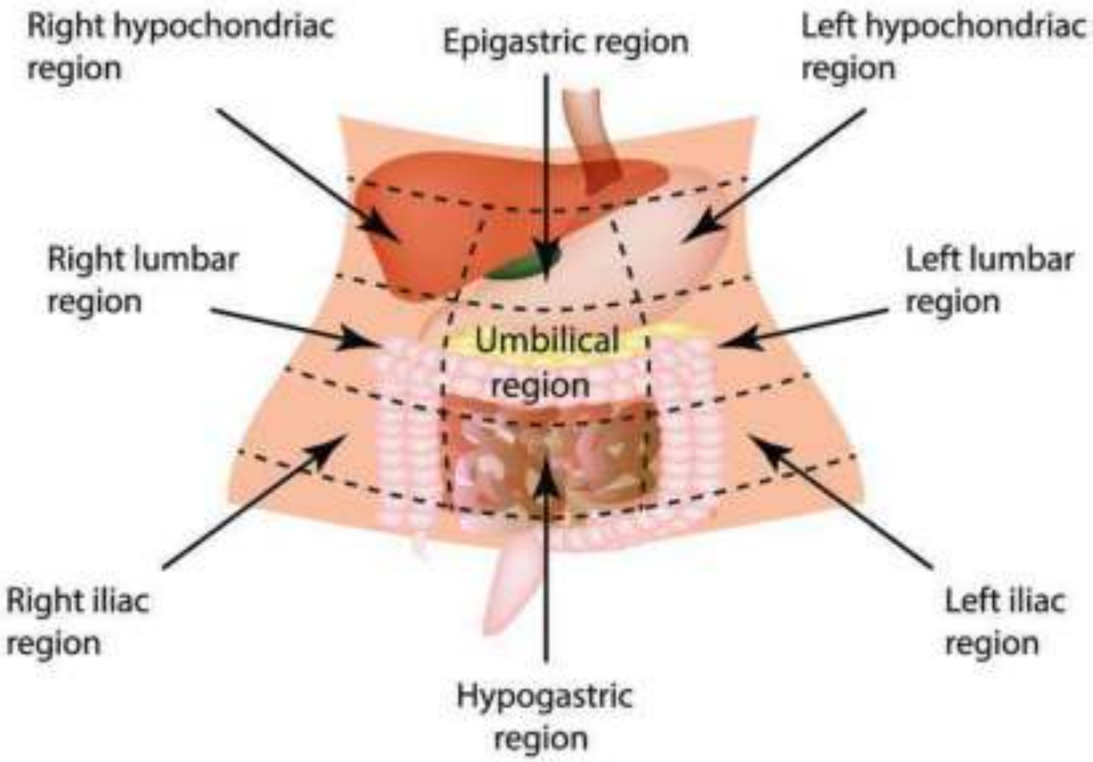


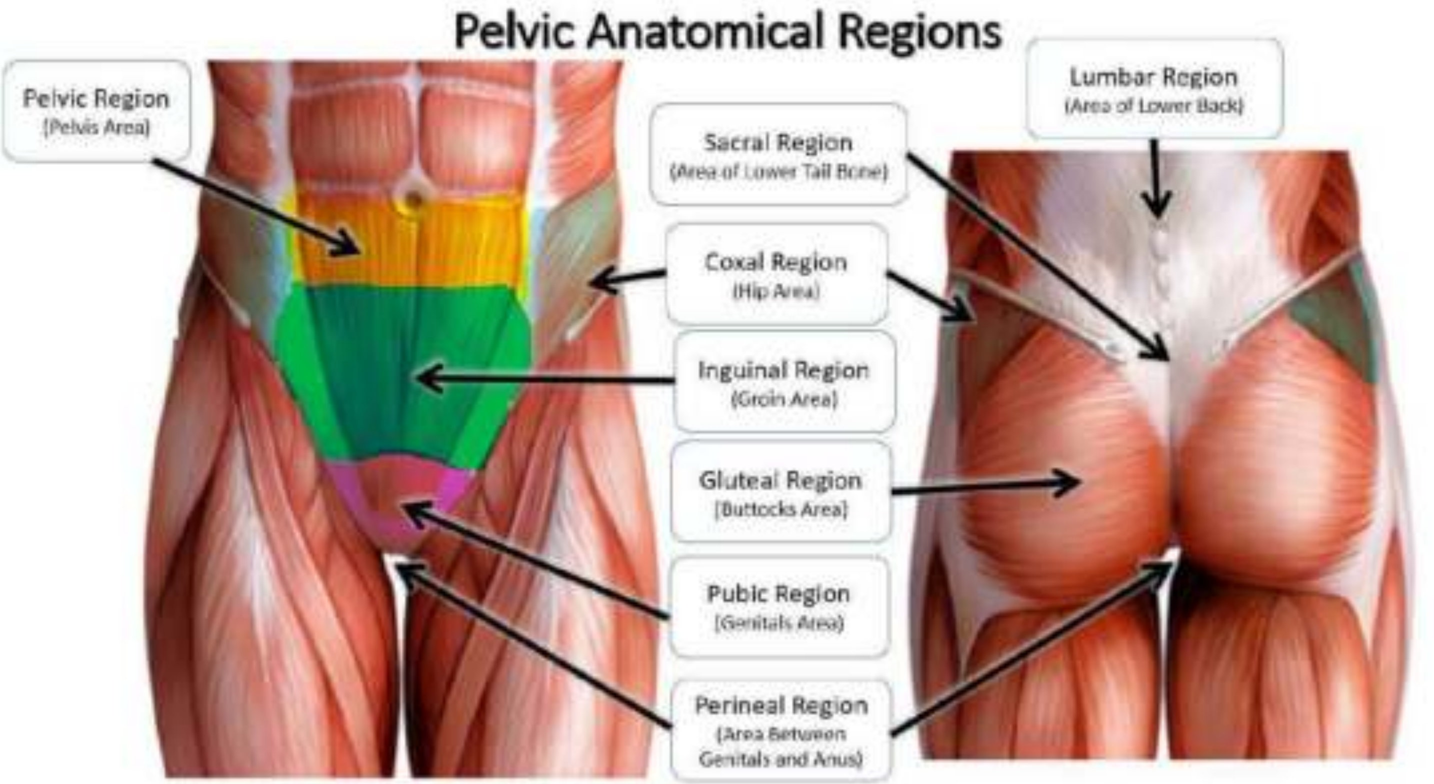
ANATOMICAL REGIONS OF THE ABDOMEN AREA

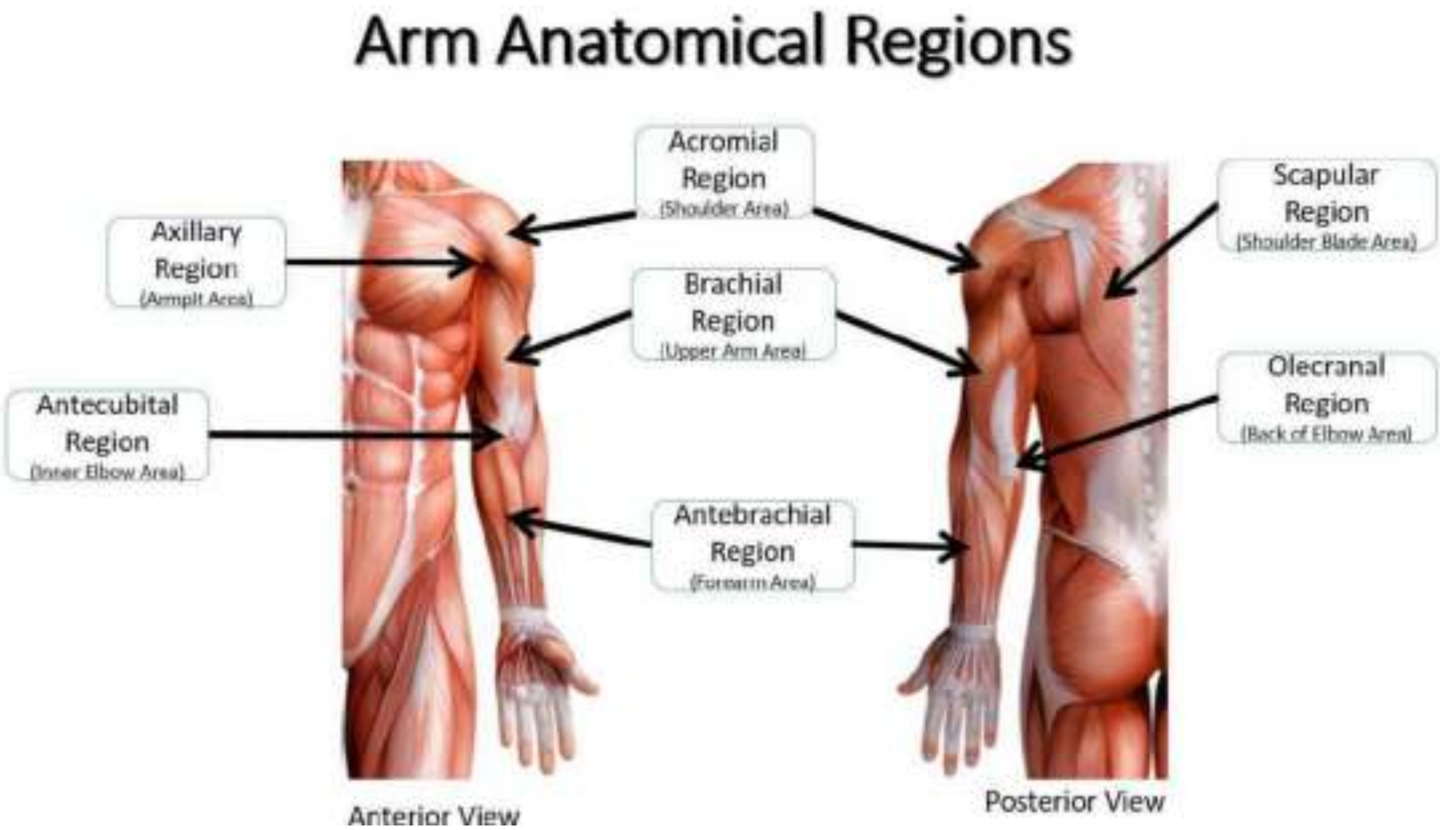
In anatomy, the regions of the abdominal area are broken up into **9** regions. **The Right and Left Hypochondriac (Hypochondrium) (Hypochondrial) Regions**. Knowing the language is the best way to remember anatomical terminology. Hypochondriac (hypochondrium) (hypochondrial) is a term derived from the Greek word **hypochondros** which means **"abdomen" or "below the cartilage".** The right and left hypochondriac regions are the two regions of the abdomen that lie below the right and left rib cage, respectively.



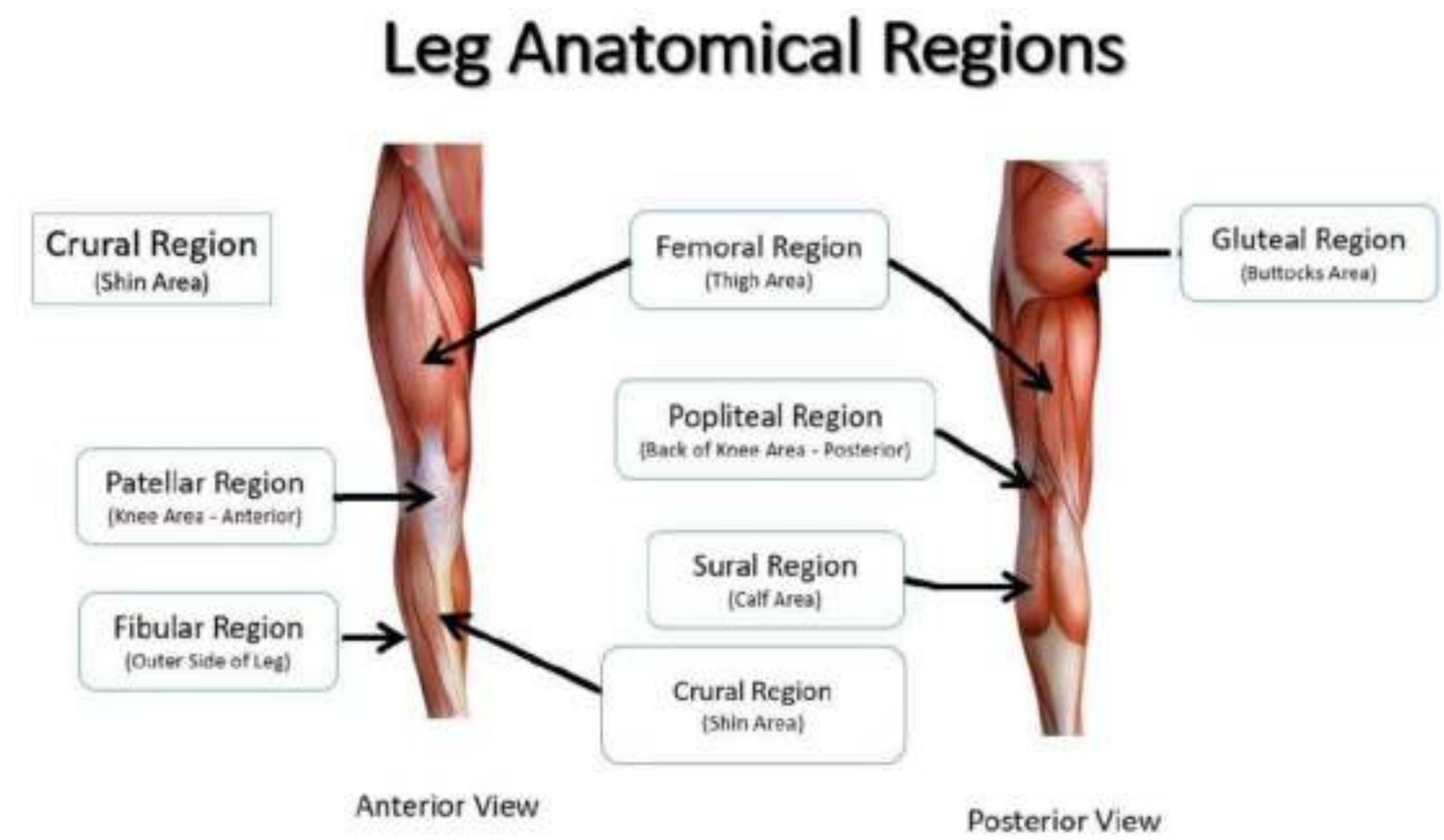
ANATOMICAL REGIONS

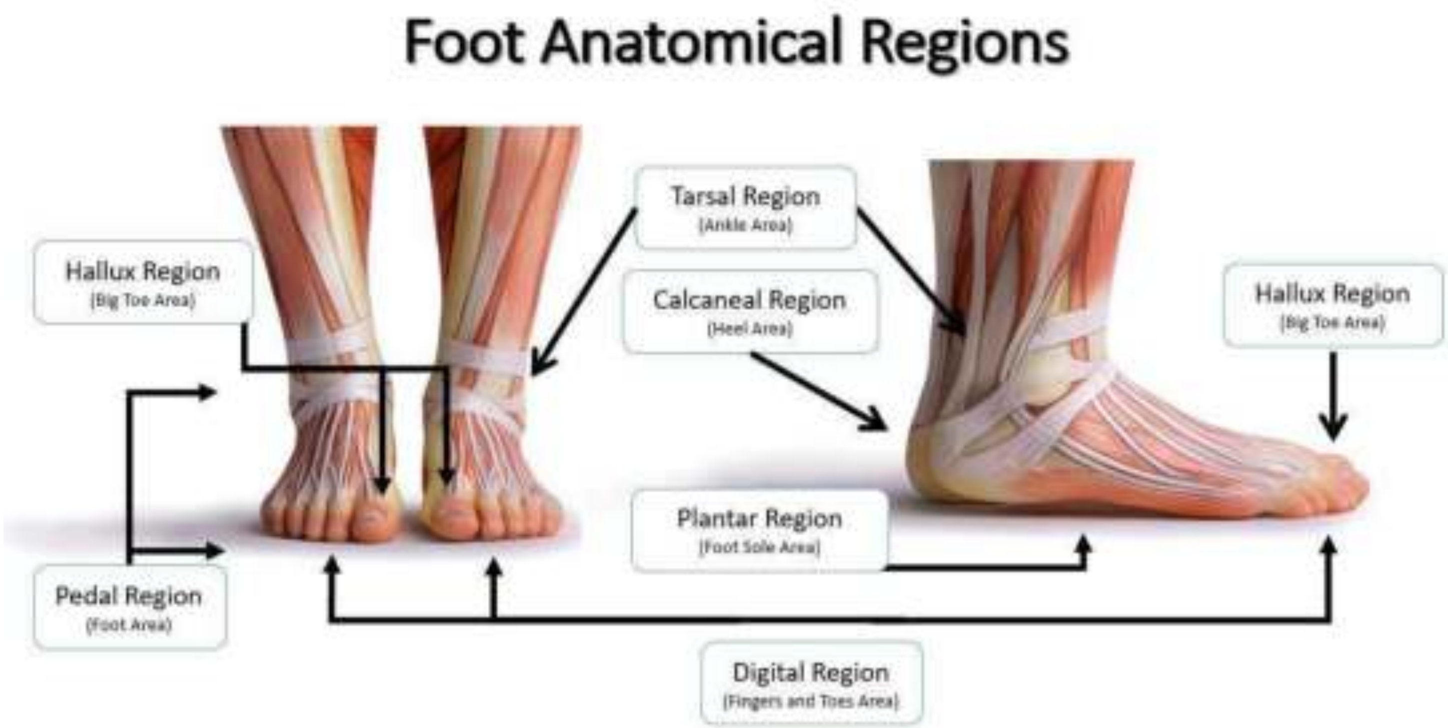





Arm Anatomical Regions
Acromial Region (Shoulder Area)
Axillary Region (Armpit Area)
Scapular Region (Shoulder Blade Area)
Brachial Region (Upper Arm Area)
Antecubital Region (Inner Elbow Area)
Olecranal Region (Back of Elbow Area)
Antebrachial Region (Forearm Area)
Anterior View
Posterior View

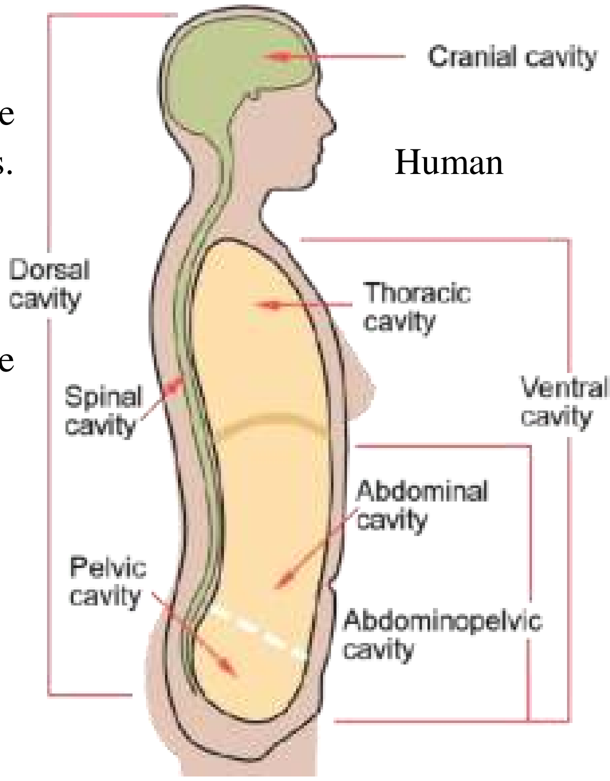

Hand Anatomical Regions
Manus Region (Hand Area)
Carpal Region (Wrist Area)
Palma Region (Palm Area)
Pollex Region (Thumb Area)
Digital Region (Fingers and Toes Area) (Also called Phalanges)
Anterior View
Posterior View


Leg Anatomical Regions
Crural Region
(Shin Area)
Femoral Region
(Thigh Area)
Gluteal Region
(Buttocks Area)
Popliteal Region
(Back of Knee Area - Posterior)
Patellar Region
(Knee Area - Anterior)
Sural Region
(Calf Area)
Fibular Region
(Outer Side of Leg)
Crural Region
(Shin Area)
Anterior View
Posterior View


Foot Anatomical Regions
Tarsal Region
(Ankle Area)
Hallux Region
(Big Toe Area)
Calcaneal Region
(Heel Area)
Hallux Region
(Big Toe Area)
Plantar Region
(Foot Sole Area)
Pedal Region
(Foot Area)
Digital Region
(Fingers and Toes Area)

2. HUMAN BODY CAVITIES

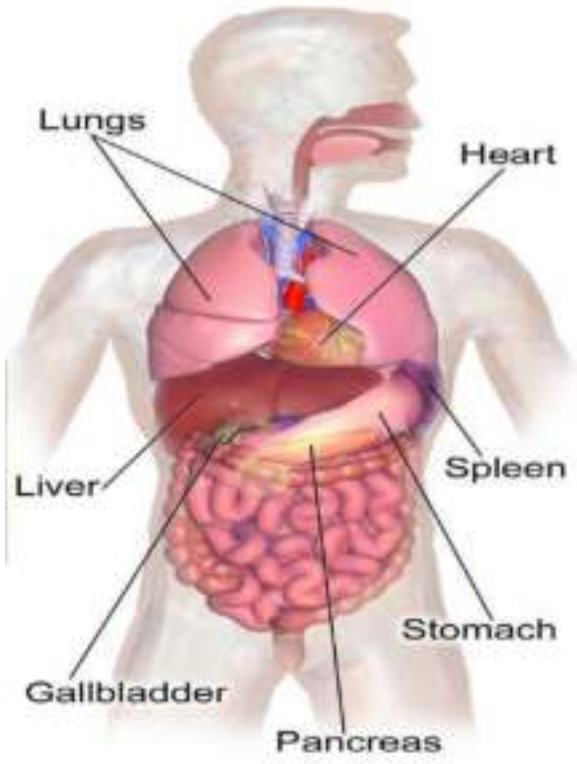
body cavity is a fluid-filled space inside the body that holds and protects internal organs. body cavities are separated by membranes and other structures. The two largest human body cavities are the **ventral cavity** and the **dorsal cavity**. These two body cavities are subdivided into smaller body cavities.



HUMAN BODY CAVITIES

Dorsal Cavity is at the posterior, or back, of the body, the dorsal cavity is subdivided into the **cranial and spinal cavities**. The cranial cavity fills most of the upper part of the skull and contains the brain. The spinal cavity is a very long, narrow cavity inside the vertebral column. It runs the length of the trunk and contains the spinal cord.

The ventral cavity is at the anterior, or front, of the trunk. Organs contained within this body cavity include the lungs, heart, stomach, intestines, and reproductive organs. The ventral cavity is subdivided into the **thoracic** and **abdominopelvic cavities**.



THE MUSCULOSKELETAL SYSTEM

1. HUMAN MUSCLE SYSTEM

The muscular system is an organ system responsible for providing strength, keeping up the balance, maintaining posture, allowing movement, and producing heat. It includes all the muscle tissues, such as the skeletal muscle tissues, smooth muscle tissues, and cardiac muscle tissues. The skeletal muscles are muscles attached to the bones and are responsible for the voluntary movements of the body. The muscular system is composed of specialized cells called muscle fibers. Their predominant function is contractibility. Muscles, attached to bones or internal organs and blood vessels, are responsible for movement. Nearly all movement in the body is the result of muscle contraction. Exceptions to this are the action of cilia, the flagellum on sperm cells, and amoeboid movement of some white blood cells. the muscles of the human body that work the skeletal system, that are under voluntary control, and that are concerned with movement, posture, and balance. Broadly considered, human muscle like the muscles of all vertebrates is often divided into striated muscle (or skeletal muscle), smooth muscle, and cardiac muscle. Smooth muscle is under involuntary control and is found in the walls of blood vessels and of structures such as the urinary bladder, the intestines, and the stomach. Cardiac muscle makes up the mass of the heart and is responsible for the rhythmic contractions of that vital pumping organ; it too is under involuntary control. With very few exceptions, the arrangement of smooth muscle and cardiac muscle in humans is identical to the arrangement found in other vertebrate animals.

Muscles

What are the main parts of the muscular system? There are three types of muscles in the muscular system along with skeletal system bones. Anatomically, muscular system organs are described as:

Skeletal muscle

The muscles of the skeleton have muscle tissues that are associated with other various tissues, such as vascular tissues, connective tissues, and nerve tissues. The main difference between muscles of the muscular system is the anatomy of each muscle fiber. This variation may be in the size where some muscles are large such as muscles of the thigh while others are tiny such as those found in the middle ear **“stapedius muscle”.** Muscle fibers may also vary in shape so they may be broad or narrow, in the arrangement of fibers where some are parallel to the long axis of muscle or oblique. The muscular system consists of the muscle fibers which are covered by a connective tissue sheath called the **epimysium**. Human muscles are separated into compartments consisting of bundles of muscle fibers. Each bundle is covered by another connective tissue called **perimysium**. **The main function of connective tissue covering muscles is to support and protect the muscle to bear the contraction force. As well as providing a pathway to allow the passage of blood and nerves to each muscle.**

Cardiac muscle

The heart is one of the major muscles of the body, it consists of cardiac muscles only called the myocardium. Cardiac muscles are involuntary muscles, they have rhythmic contraction controlled by the sinoatrial node in the heart. Cardiac muscles consist of chains of myofibrils. As such, the cardiac muscles contract continuously. Cardiac cells are rectangular in shape and have only one central nucleus. They also contain lots of mitochondria to form ATP and myoglobin to produce and store oxygen to provide energy to muscles in order to resist fatigue. Each cardiac cell is covered by a barrier between the extracellular and intracellular content called the sarcolemma.

Smooth muscle

Where is smooth muscle found? Smooth muscles represent parts of the body’s internal organs. It is mainly found in the gastrointestinal tract as well as blood vessels. Smooth muscle location varies, as they may be found in other sites such as renal, genital, and respiratory tract. Their function differs according to their location. For example, in the respiratory tract and the cardiovascular system, the function of the smooth muscle is to control the diameter of bronchioles in the respiratory tract and blood flow as well as pressure in the cardiovascular system.

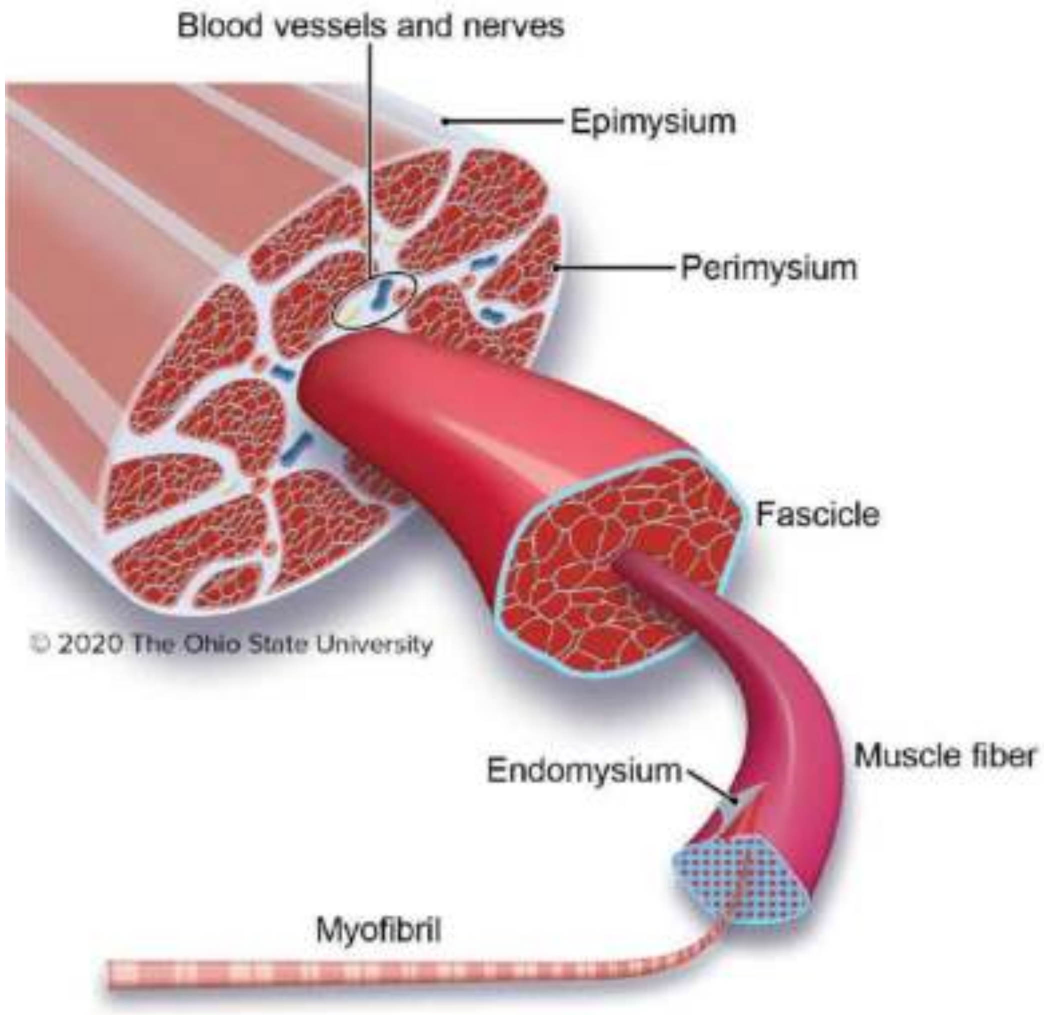
Smooth muscles are non-striated involuntary muscles. These muscles maintain their tone for long periods of time. The main proteins responsible for their contraction are the thick, dark myosin filaments and thin, light actin filaments. Smooth muscles have a particular shape which is fusiform, as they have tapered ends. Being non-striated muscles, smooth muscles are more elastic than striated muscles. So, they can keep the contractile tone for a long time as keeping the tone of the urinary bladder.

Gross anatomy of a skeletal muscle

Muscle fibers are the main components forming the skeletal muscle. Skeletal muscles have thousands of muscle fibers that are united in bundles or fascicles.

Anatomically, each skeletal muscle consists of the following:

- **Each muscle fiber is covered by a connective tissue called the endomysium.**
- **A group of muscle fibers called Fasciculi is covered by connective tissue with elastin known as the perimysium.**
- **A group of fasciculi forms the muscle covered by epimysium, which is a dense connective tissue. These connective tissues play an important role in facilitating muscle contraction. Skeletal muscles are attached to the skeleton "bones" by tendons. Tendons are tough connective tissues that connect the muscles and the bones. They are under extreme stress when muscles pull on them as the muscles shorten their lengths.**
-

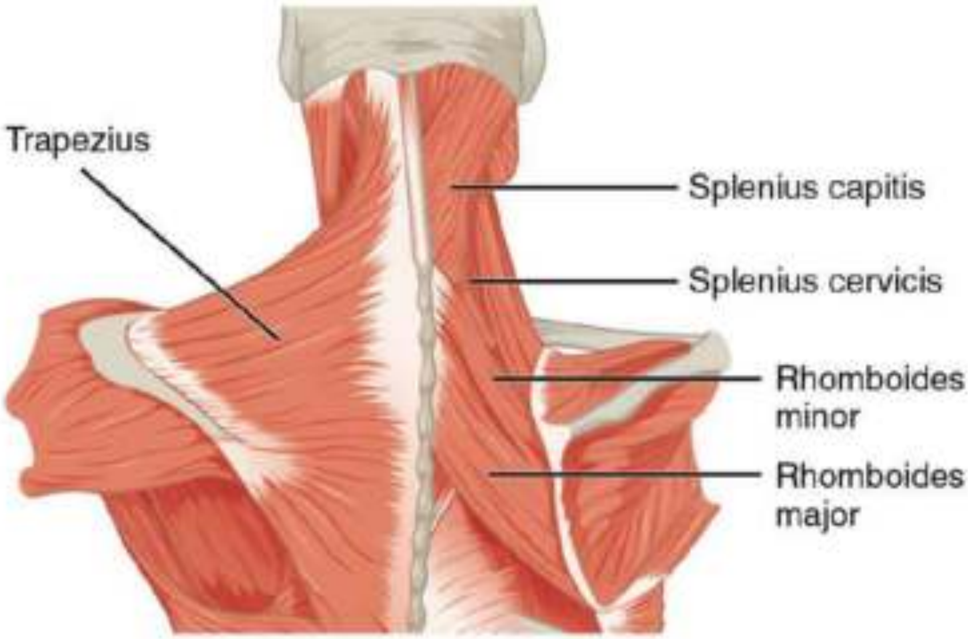


There are different subtypes of skeletal muscles depending on the attachment of muscle fibers as follows:

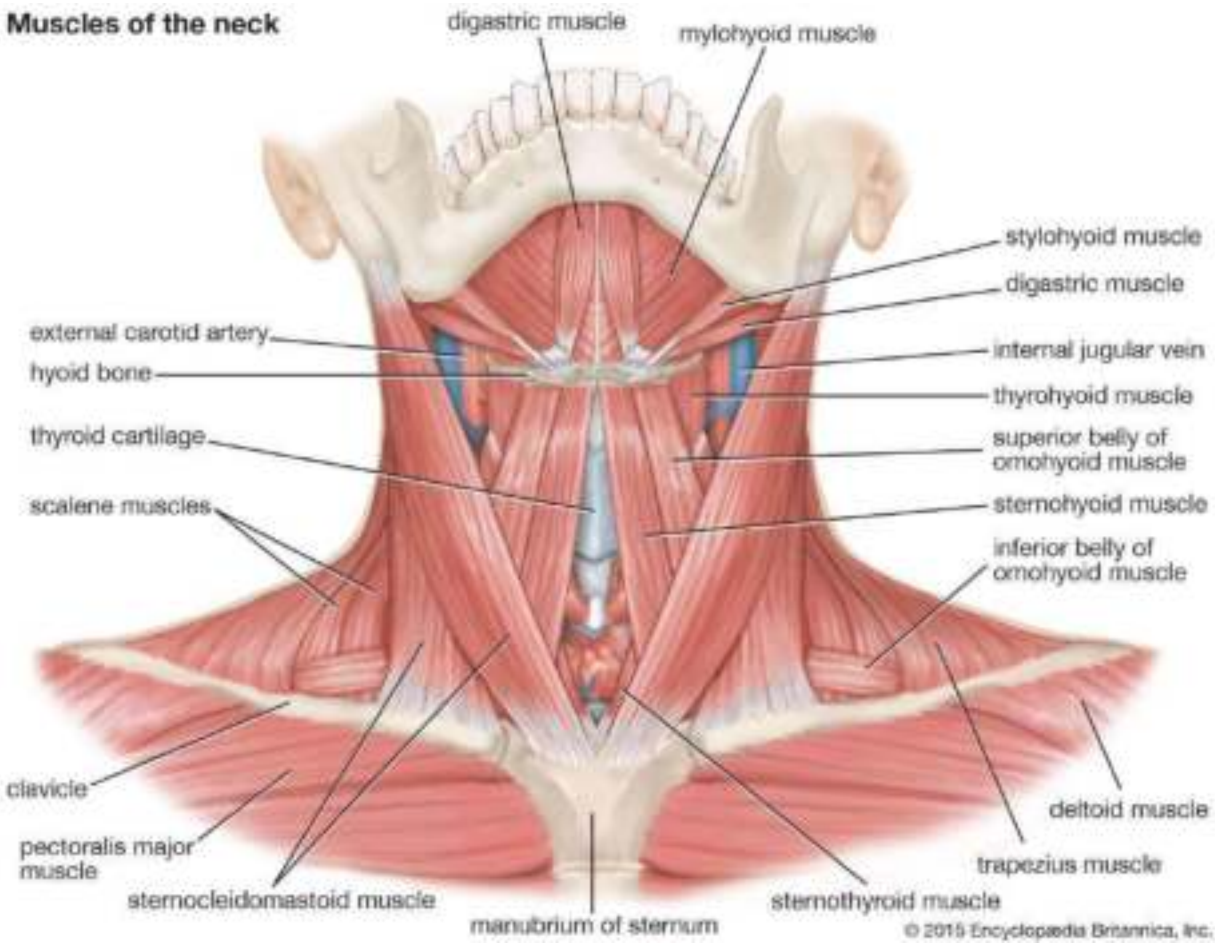
1. **Longitudinal muscles**: muscle fibers are attached in a parallel manner such as fusiform like biceps or strap-like rectus abdominis.
2. **Pennate muscles**: muscle fibers are attached in an oblique manner to the tendon such as unipennate like soleus muscle or bipennate like rectus femoris muscle or multipennate like a deltoid muscle.
3. **Convergent muscles**: like temporalis muscle
4. **Circular muscles**: such as orbicularis oculi.

Names of skeletal muscles

1. **Location**: the location of the muscle according to the nearby bone is important to give its name. such as the temporalis muscle which surrounds the temporal bone. The Frontalis muscle is found on the top of the frontal bone of the skull.
2. **Shape**: muscle can be described by its shape. Such as the deltoid muscle which is triangular, Trapezius which is trapezoid in shape is one of the muscles of the back, and Serratus which is like saw-toothed.
3. **The direction of muscle fibers:** As parallel muscles are rectus, such as in rectus abdominals, Oblique muscle fibers are at an angle, such as the abdomen muscles, and Transverse fibers are perpendicular.
4. **Size**: Some suffixes may be included in muscle names such as maximus (largest), minimus (smallest), Longus (longest), and Brevis (shortest). For example, the gluteus maximus is the biggest muscle in the body.
5. **Position**: muscles may be given the name by the position according to the midline. Lateralis means that muscle is away from the midline. Medialis means that the muscle is near the midline.
6. **The number of origins**: the number of muscles in the group can be included in the name of muscles. Biceps, triceps, and quadriceps have two, three, and four muscles respectively.
7. **Action: some terms of action are prefixes in muscle names.** For example, flexor means flexing the arm, extensor means extending the arm, abductor means to move the arm out of the torso, and adductor means to return the arm back to the torso.



1. The neck : the motion of the neck is described in terms of rotation, flexion, extension, and side bending (i.e., the motion used to touch the ear to the shoulder). The direction of the action can be ipsilateral, which refers to movement in the direction of the contracting muscle, or contralateral, which refers to movement away from the side of the contracting muscle. Rotation is one of the most-important actions of the cervical (neck) spine. Rotation is accomplished primarily by the sternocleidomastoid muscle, which bends the neck to the ipsilateral side and rotates the neck contralaterally. Together, the sternocleidomastoid muscles on both sides of the neck act to flex the neck and raise the sternum to assist in forced inhalation. The anterior and middle scalene muscles, which also are located at the sides of the neck, act ipsilaterally to rotate the neck, as well as to elevate the first rib. The sternocleidomastoid muscles are involved in cervical side bending. The posterior scalene muscles, located on the lower sides of the neck, ipsilaterally bend the neck to the side and elevate the second rib. The splenius capitis and splenius cervicis also assist in neck side bending. The erector spinae muscles (iliocostalis, longissimus, and spinalis) are large, deep muscles that extend the length of the back. All three act to ipsilaterally side bend the neck.


Muscles of the neck
digastric muscle
mylohyoid muscle
stylohyoid muscle
digastric muscle
external carotid artery
hyoid bone
internal jugular vein
thyrohyoid muscle
thyroid cartilage
superior belly of omohyoid muscle
scalene muscles
sternohyoid muscle
inferior belly of omohyoid muscle
clavicle
deltoid muscle
pectoralis major muscle
trapezius muscle
sternocleidomastoid muscle
sternothyroid muscle
manubrium of sternum
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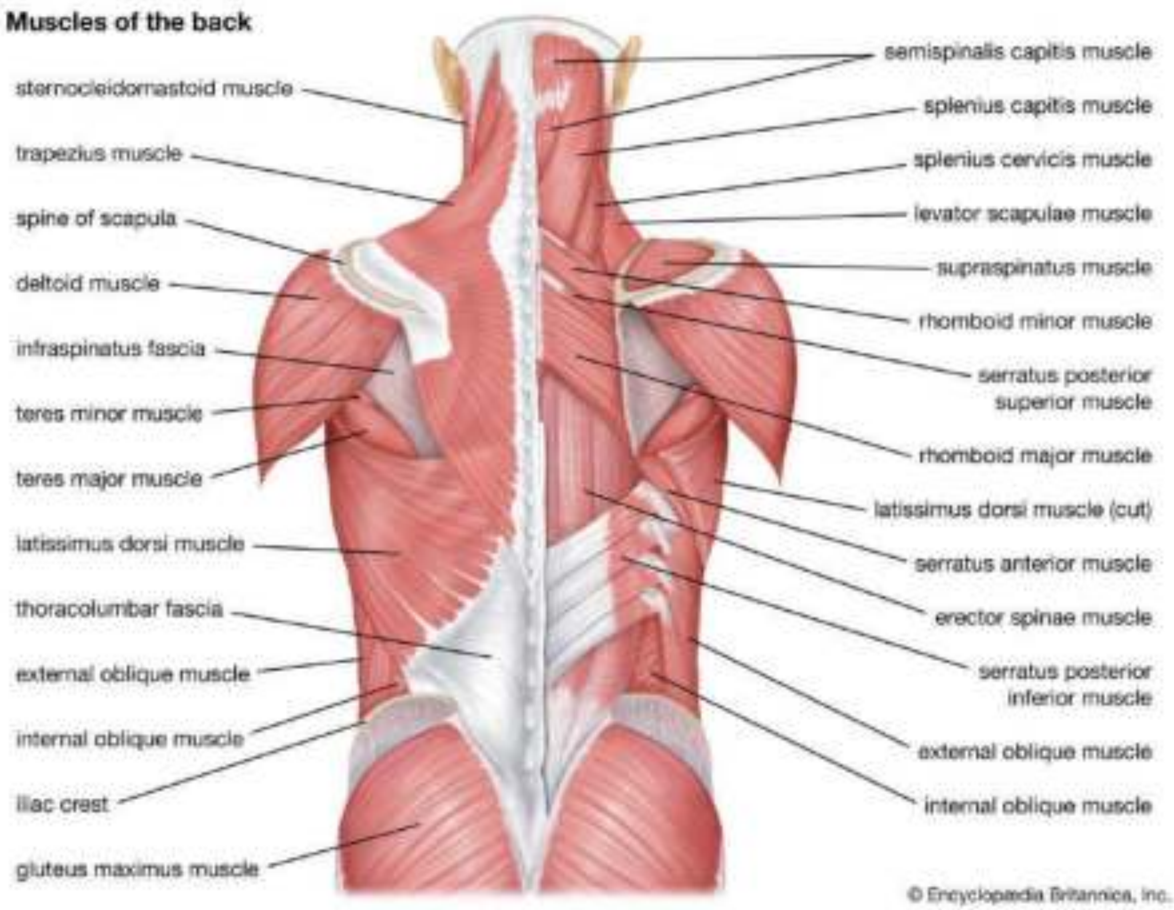
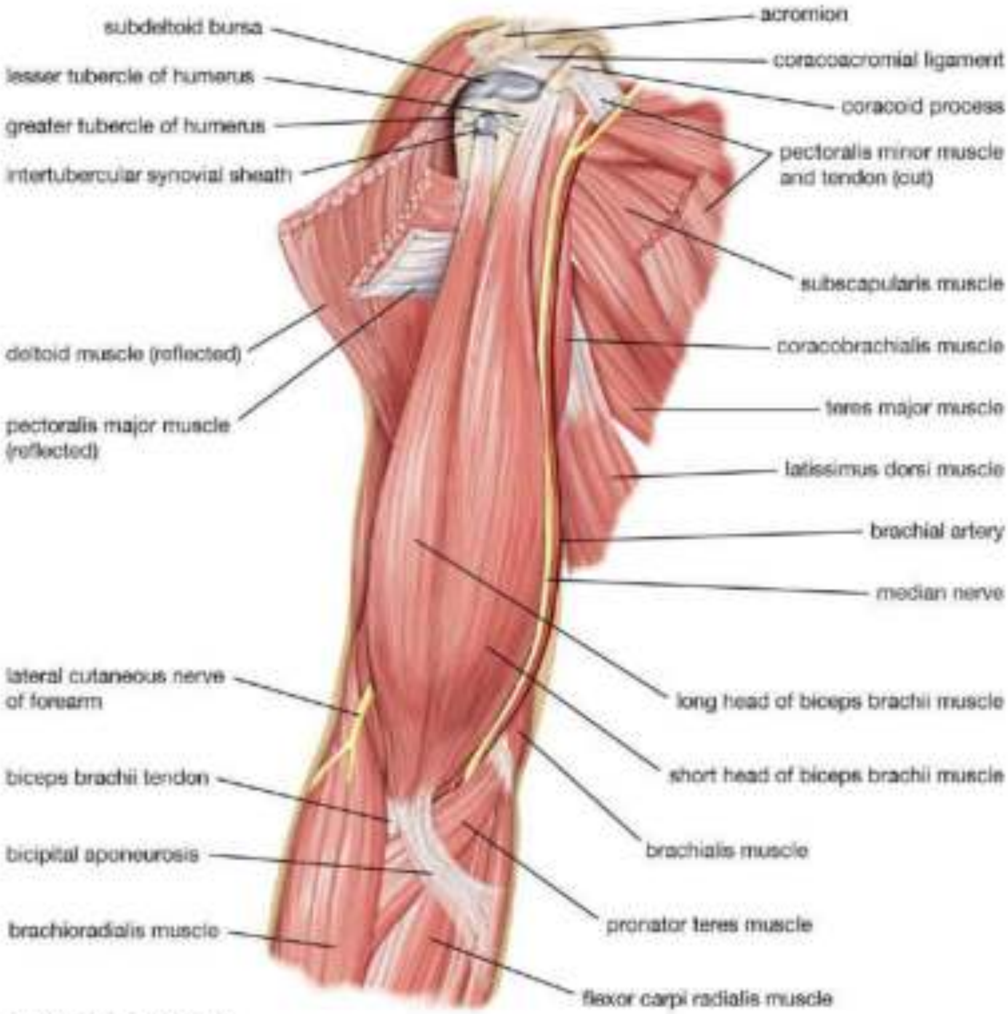
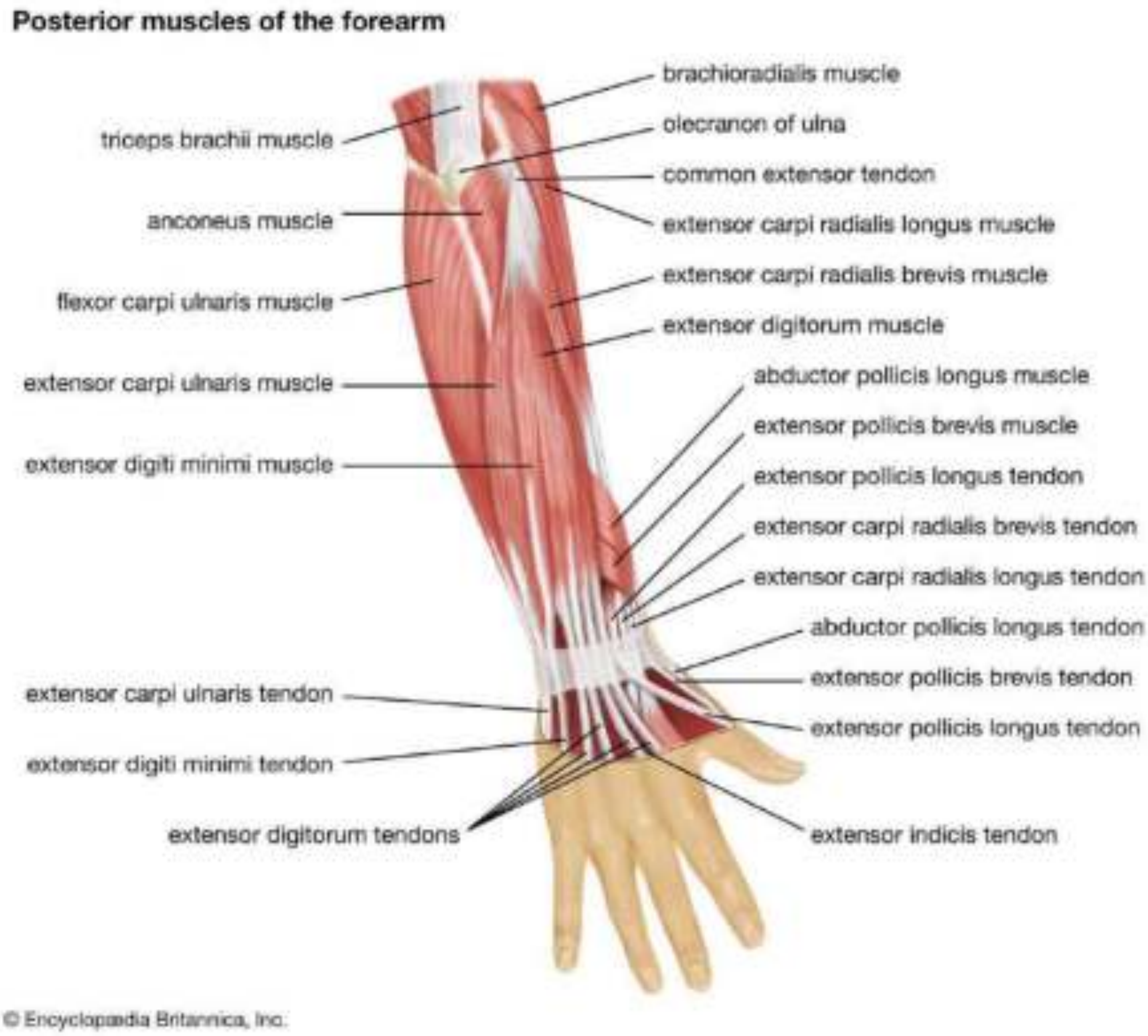
2. The back : The back contains the origins of many of the muscles that are involved in the movement of the neck and shoulders. In addition, the axial skeleton that runs vertically through the back protects the spinal cord, which innervates almost all the muscles in the body. Multiple muscles in the back function specifically in movements of the back. The erector spinae muscles, for example, extend the back (bend it backward) and side bend the back. The semispinalis dorsi and semispinalis capitis muscles also extend the back. The small muscles of the vertebrae (the multifidi and rotators) help rotate, extend, and side bend the back. The quadratus lumborum muscle in the lower back side bends the lumbar spine and aids in the inspiration of air through its stabilizing affects at its insertion at the 12th rib (the last of the floating ribs). The scapula (shoulder blade) is elevated by the trapezius muscle, which runs from the back of the neck to the middle of the back, by the rhomboid major and rhomboid minor muscles in the upper back, and by the levator scapulae muscle, which runs along the side and back of the neck.



3. **The arm :** In addition to aiding the movement of the shoulder, the muscles of the upper arm produce various movements of the forearm. For example, the primary muscles involved in forearm flexion, in which the angle formed at the elbow becomes smaller (i.e., the hand moves closer to the shoulder), are the biceps brachii, the brachialis (situated beneath the biceps brachii in the upper arm), and the brachioradialis (the origin of which is on the humerus). Minor contributions to forearm flexion are provided by the coracobrachialis and by flexor muscles situated in the anterior compartment of the forearm (the palm side of the forearm; also known as the flexor compartment), including the pronator teres, the flexor carpi radialis, the flexor digitorum superficialis, the palmaris longus, and the flexor carpi ulnaris. Extension of the forearm increases the angle at the elbow, moving the hand away from the shoulder. That action is accomplished primarily by the triceps brachii. Other muscles that make minor contributions to forearm extension include the extensor muscles of the posterior compartment of the forearm (the side of the forearm that is contiguous with the back of the hand; also known as the extensor compartment), including the extensor carpi radialis longus, the extensor carpi radialis brevis, the extensor digitorum, the extensor carpi ulnaris, and the anconeus.



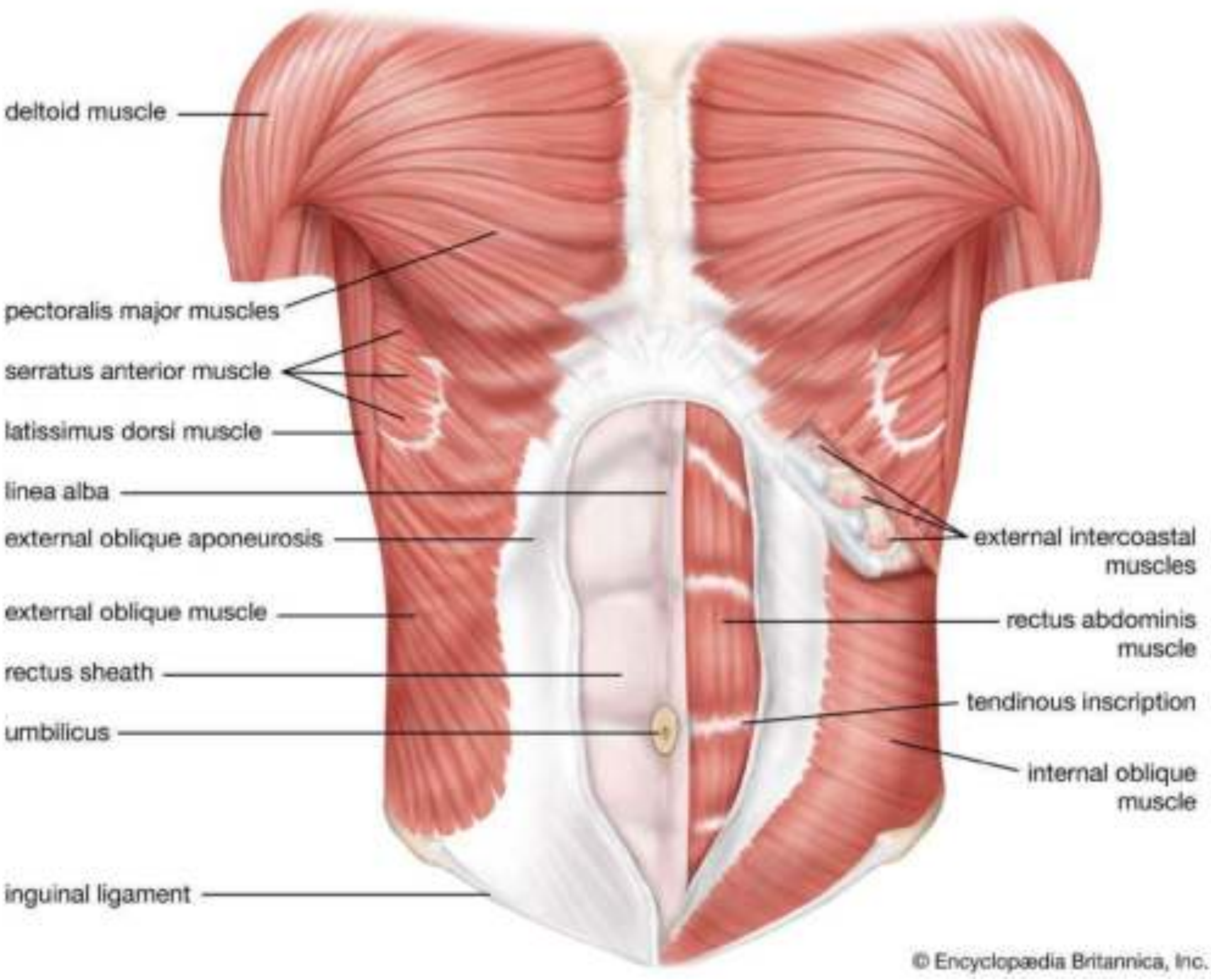
4. The wrist: wrist flexion refers to movement of the wrist that draws the palm of the hand downward. That action is carried out by the flexor carpi radialis, the flexor carpi ulnaris, the flexor digitorum superficialis, the flexor digitorum profundus, and the flexor pollicis longus. Wrist extension, by contrast, shortens the angle at the back of the wrist. The muscles responsible for that action are the extensor carpi radialis longus and the extensor carpi radialis brevis, which also abduct the hand at the wrist (move the hand in the direction of the thumb, or first digit); the extensor digitorum, which also extends the index to little finger (the second to fifth digits); the extensor digiti minimi, which also extends the little finger and adducts the hand (moves the hand in the direction of the little finger); and the extensor carpi ulnaris, which also adducts the hand. Other small muscles that cross the wrist joint may add to wrist extension, but they do so to only a small degree. Wrist supination is the rotation of the wrist that brings the palm facing up. The supinator muscle in the posterior compartment acts to supinate the forearm. The biceps brachii also adds to supination. Pronation is the opposing action, in which the wrist is rotated so that the palm is facing down. The pronator quadratus, a deep muscle in the anterior compartment, along with the pronator teres, pronates the forearm.



5. The hand: The hand is a complex structure that is involved in fine motor coordination and complex task performance. Its muscles generally are small and extensively innervated. Even simple actions, such as typing on a keyboard, require a multitude of precise movements to be carried out by the hand muscles. Because of that complexity, the following paragraphs cover only the primary action of each hand muscle. Several muscles that originate at the posterior surface of the ulna or the radius (the other bone in the forearm) have their actions in the hand. Those include the abductor pollicis longus, which abducts and extends the thumb; the extensor pollicis brevis, which extends the metacarpophalangeal (MCP) joint of the thumb; the extensor pollicis, which extends the distal phalanx (finger bone) of the thumb; and the extensor indicis, which extends the index finger at the MCP joint. (MCP joints are located between the metacarpal bones, which are situated in the hand, and the phalanges, which are the small bones of the fingers.) Although several of the muscles that move the hand have their origins in the forearm, there are many small muscles of the hand that have both their origin and their insertion within the hand. Those are referred to as the intrinsic muscles of the hand. They include the palmaris brevis, which assists with grip; the umbricals, which flex the MCP joints and extend the interphalangeal joints (IPs; the joints between the phalanges) of the fingers; the palmar interossei, which adduct the fingers toward the middle finger (the third digit); and the dorsal interossei, which abduct the fingers away from the middle finger. All the interossei flex the MCP joints and extend the IP joints. The thenar eminence is located on the palm side of the base of the thumb and is composed of three muscles, the abductor pollicis brevis, the flexor pollicis brevis, and the opponens pollicis, all of which are innervated by the median nerve. The abductor pollicis brevis abducts the thumb; the flexor pollicis brevis flexes the MCP joint of the thumb; and the opponens pollicis acts to oppose the thumb to the other fingers. The adductor pollicis, which is not part of the thenar eminence, acts to adduct the thumb. The hypothenar enimence is located on the palm side of the hand below the little finger. It contains three muscles that are innervated by the deep branch of the ulnar nerve. The abductor digiti minimi abducts the little finger. The flexor digiti minimi flexes the little finger. The opponens digiti minimi opposes the little finger with the thumb.

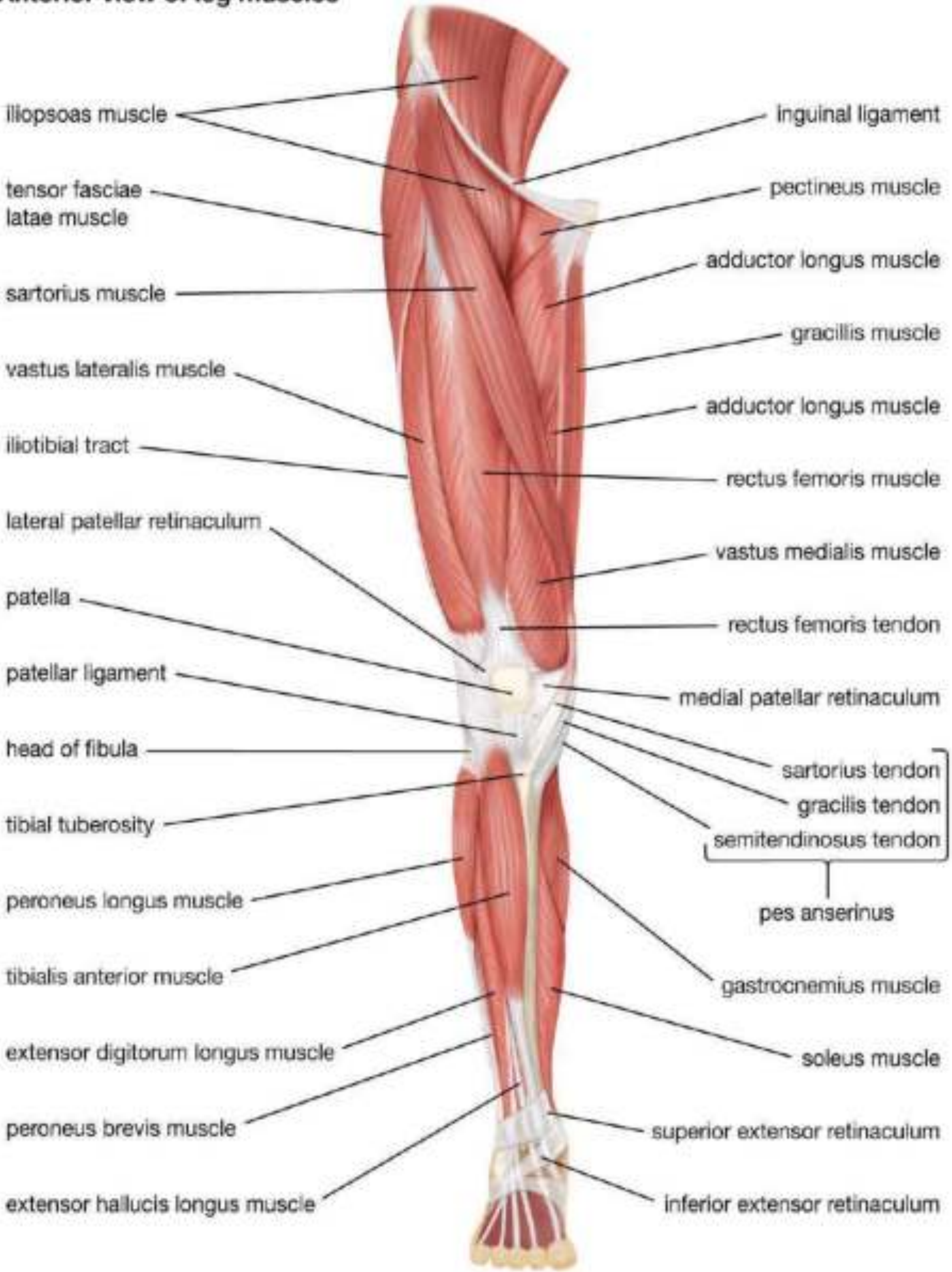
6. The abdomen : There are three muscular layers of the abdominal wall, with a fourth layer in the middle anterior region. The fourth layer in the midregion is the rectus abdominis, which has vertically running muscle fibres that flex the trunk and stabilize the pelvis. To either side of the rectus abdominis are the other three layers of abdominal muscles. The deepest of those layers is the transversus abdominis, which has fibres that run perpendicular to the rectus abdominus; the transversus abdominis acts to compress and support the abdomen and provides static core stabilization. The internal oblique layers run upward and forward from the sides of the abdomen, and the external oblique layers, which form the outermost muscle layers of the abdomen, run downward and forward. The internal oblique layers act in conjunction with the external oblique on the opposite side of the body to flex and rotate the trunk toward the side of the contracting internal oblique ("same-side rotator").

Muscles of the abdominal wall



7. The hip: The hip joint is a complex weight-bearing ball-and-socket joint that can sustain considerable load. The socket of the joint is relatively deep, allowing for stability but sacrificing some degree in range of motion. The movements described in this section include flexion, extension, abduction, and adduction. Hip flexion is the hip motion that brings the knee toward the chest. The major muscles of hip flexion include the iliopsoas, which is made up of the psoas major, psoas minor, and iliacus. Together, those muscles act mainly to flex the hip, but they also contribute to abdominal flexion and hip stabilization. Other hip flexors include the sartorius, the rectus femoris, the pectineus, and the gracilis. The sartorius also contributes to external hip rotation and knee extension and abduction, and the rectus femoris also acts in knee extension. The pectineus is also involved in hip adduction and internal rotation. Hip extension is accomplished primarily by the muscles of the posterior thigh and buttocks, which when contracted serve to move the thigh from a flexed position toward the midline of the body or the trunk of the body from a bent position toward a more-erect posture. Hip extension is accomplished mostly by the gluteus maximus, the biceps femoris (which is divided into two heads, the long head and the short head), the semitendinosus, and the semimembranosus. A minor contribution is also provided by the adductor magnus and other small pelvic muscles. The movement of adduction is used to describe a direction of limb motion that serves to take the limb from a lateral position to its more-axial alignment. During a jumping-jack exercise, for example, abduction of the leg occurs when it is moved away from the midline and adduction when it is moved back toward the midline. The main abductors of the hip are the gluteus medius, gluteus minimus, and tensor fascia lata. Those three muscles also serve to internally rotate the thigh in an extended position and externally rotate the thigh in the flexed position. Another minor contributor is the piriformis. The main hip adductors are the adductor magnus, the adductor brevis, and the adductor longus. A minor contribution to hip adduction is performed by the pectineus and the gracilis.

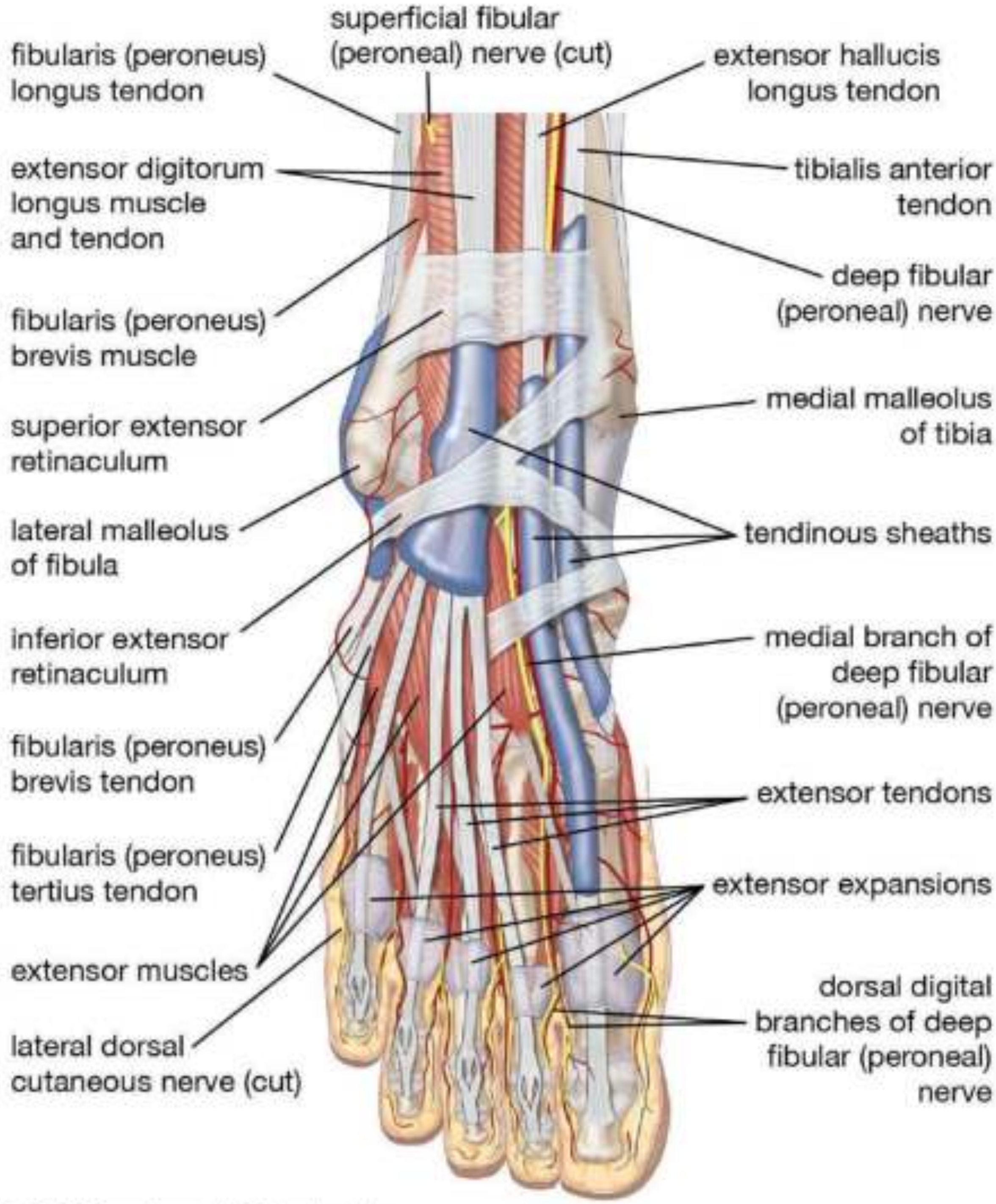
Anterior view of leg muscles



8. The upper leg and knee: Extension of the knee is accomplished by a group of muscles collectively referred to as the quadriceps femoris, which increases the angle of the knee, bringing the lower leg into a straight position. Knee extension is used in the forward, swing phase of the gait and is integral in movements such as kicking. The quadriceps femoris group includes the vastus medius, vastus lateralis, vastus intermedius, and rectus femoris. A minor contribution to knee extension is provided by the sartorius. Knee flexion refers to bending of the knee from the straight position. The muscles that perform that action oppose those of knee extension and are generally referred to as the hamstring muscles. The hamstring muscles are situated in the back of the thigh and include the biceps femoris, the semitendinosus, and the semimembranosus. Small contributions to knee flexion are made by the gastrocnemius muscle in the back of the calf and by several small muscles that cross the knee joint posteriorly.

9. The lower leg and foot: The muscles of the lower leg and foot are complex and work in many planes. Their actions depend on whether the person is bearing weight, as well as on the position of the foot. The following paragraphs provide a brief overview of the actions of the muscles of the lower leg and foot.

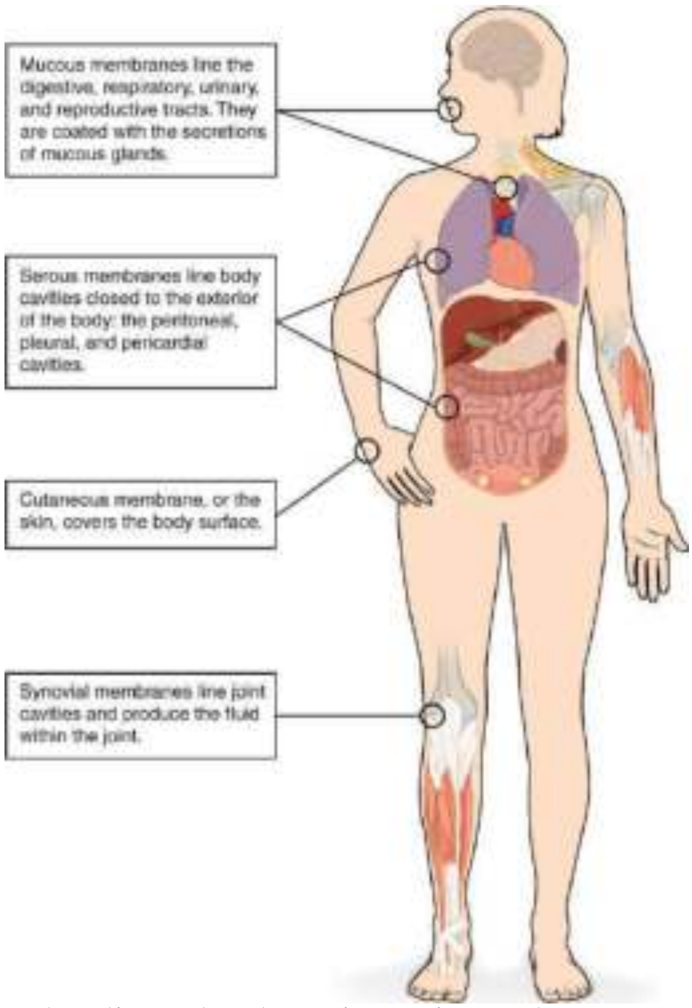
Dorsiflexion refers to ankle flexion in the direction of the dorsum, or anterior surface of the foot (the surface of the foot viewed from above). Dorsiflexion is accomplished by several muscles, including the tibialis anterior, which in addition to dorsiflexion also inverts the foot (tilts the foot toward the midline), stabilizes the foot when striking the ground, and locks the ankle when kicking. The extensor digitorum longus (EDL) also acts in dorsiflexion and functions to extend the last four toes. In addition to the EDL, some individuals also have a muscle called the peroneus tertius (fibularis tertius), which participates to a limited extent in dorsiflexion and eversion of the foot (tilting of the foot away from the midline). The extensor hallucis longus primarily acts in big toe (hallux) dorsiflexion, but it also acts to dorsiflex, as well as weakly invert, the ankle. Plantarflexion refers to flexion of the ankle in the direction of the sole of the foot. That is most easily demonstrated by having a person stand on his or her toes. The majority of ankle plantarflexion is performed by the large calf musculature, including the gastrocnemius and the soleus, which lies just behind the gastrocnemius. It is generally accepted that those are two distinct muscles; however, there is some debate as to whether the gastrocnemius and the soleus are two parts of the same muscle. Other muscles of the lower leg and foot include the plantaris, which runs obliquely between the gastrocnemius and the soleus; the flexor hallucis longus, which contributes to ankle flexion but is involved primarily in big toe flexion; the flexor digitorum longus, which also flexes the second to fifth toes; the peroneus longus, which flexes the ankle and everts the foot; and the peroneus brevis, which is involved in plantarflexion and eversion of the foot.



TISSUE AND TISSUE MEMBRANES

1. MEMBRANE

Body membranes are thin sheets of tissue that cover the body, line body cavities, and cover organs within the cavities in hollow organs. They can be categorized into epithelial and connective tissue membrane.



EPITHELIAL MEMBRANE : consist of epithelial tissue and the connective tissue to which it is attached. There are three types of epithelial membranes:

1. **Mucous membranes** are epithelial membranes that consist of a mucous forming epithelium. These membranes line the body cavities that open to the outside. The entire digestive tract is lined with mucous membranes. Other examples include the respiratory, excretory, and reproductive tracts

2. **Serous membranes** line body cavities that do not open directly to the outside, and they cover the organs located in those cavities. For example, the serous membrane that lines the thoracic cavity and covers the lungs is called pleura

3. **The Cutaneous membrane:** (skin and integumentary system)

CONNECTIVE TISSUE MEMBRANE

There are two types of connective tissue membranes:

1. **The Synovial membrane :** are connective tissue membranes that line the cavities of the freely movable joints such as the shoulder, elbow, and knee.

2. **Meningeal membranes:** The meninges are three connective tissue membranes that lie just external to the brain and spinal cord.

1. TISSUES

The human body is primarily made up of four major types of tissues: epithelial, connective, muscle, and nervous. **Epithelial tissues** cover body surfaces, cover and line internal organs, and make up the glands. **Connective tissues** are widely distributed throughout the body, filling internal spaces, and function to bind, support, and protect body structures. **Muscle tissues** are specialized for contraction and include the skeletal muscles of the body, the heart, and the muscular walls of hollow organs. Skeletal muscles are attached to bones and are used for movement of the body. **Nervous tissues** carry information from one part of the body to another via electrical impulses. They are found in the brain, spinal cord, and nerves.