

INTRODUCTION TO ANATOMY AND PHYSIOLOGY

Learning Outcomes

1. Define anatomy and physiology
2. Demonstrate the anatomical position
3. Describe the human body using directional and regional terms
4. Identify the three planes used in anatomy
5. Describe the major trunk cavities
6. Describe serous membrane and its function

Key Terms

Anatomy: Study of body structures and their relationships.

Physiology: Study of body functions and processes.

Anatomical Terminology

- Anatomists and health care providers use terminology that can be bewildering to the uninitiated.
- However, the purpose of this language is not to confuse, but rather to increase precision and reduce medical errors.
- For example, is a scar “above the wrist” located on the forearm two or three inches away from the hand? Or is it at the base of the hand? Is it on the palm-side or back-side?
- By using precise anatomical terminology, we eliminate ambiguity.
- Anatomical terms derive from ancient Greek and Latin words.
- Because these languages are no longer used in everyday conversation, the meaning of their words does not change.
- Anatomical terms are made up of roots, prefixes, and suffixes.
- The root of a term often refers to an organ, tissue, or condition, whereas the prefix or suffix often describes the root.
- For example, in the disorder hypertension, the prefix “hyper-” means “high” or “over,” and the

root word “tension” refers to pressure, so the word “hypertension” refers to abnormally high blood pressure.

Anatomical Position and Directional Terms

Anatomical Position

- The standard anatomical position is that of the body standing upright, with the feet at shoulder width and parallel, toes forward.
- The upper limbs are held out to each side, and the palms of the hands face forward.

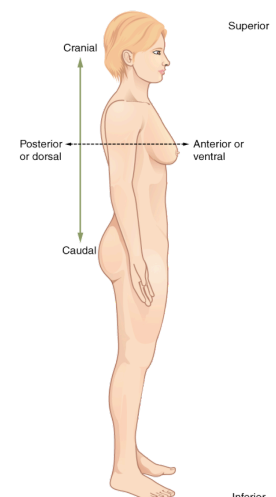


- Using this standard position reduces confusion.
- It does not matter how the body being described is oriented, the terms are used as if it is in anatomical position.

- For example, a scar in the “anterior (front) carpal (wrist) region” would be present on the palm side of the wrist.
- The term “anterior” would be used even if the hand were palm down on a table.

Directional terms

- These terms are essential for describing the relative locations of different body structures
- **Anterior** (or ventral) Describes the front or direction toward



the front of the body.

- **Posterior** (or dorsal) Describes the back or direction toward the back of the body.
- **Superior** (or cranial) describes a position above or higher than another part of the body proper.
- **Inferior** (or caudal) describes a position below or lower than another part of the body proper; near or toward the tail (in humans, the coccyx, or lowest part of the spinal column).

- **Lateral** describes the side or direction toward the side of the body.

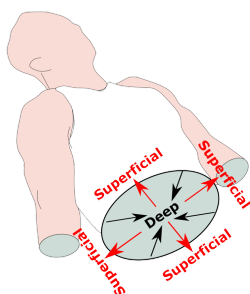
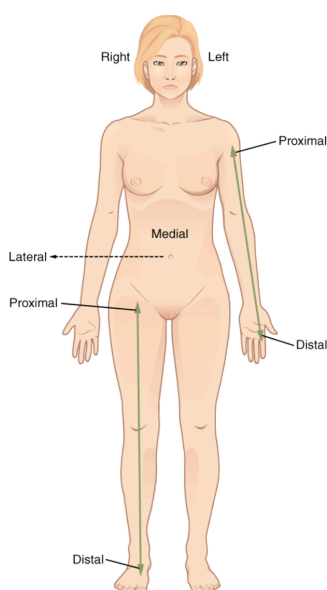
- **Medial** describes the middle or direction toward the middle of the body.

- **Proximal** describes a position in a limb that is nearer to the point of attachment or the trunk of the body.

- **Distal** describes a position in a limb that is farther from the point of attachment or the trunk of the body.

- **Superficial** describes a position closer to the surface of the body.

- **Deep** describes a position farther from the surface of the body. The brain is deep to the skull.



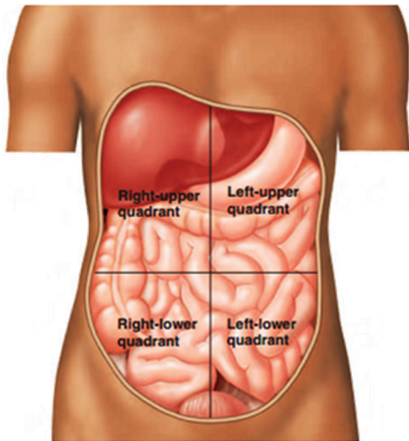
- A body that is lying down is described as either prone or supine.
- Prone describes a face-down orientation, and supine describes a face up orientation.
- These terms are sometimes used in describing the position of the body during specific physical examinations or surgical procedures.
- The position of the body can affect the description of body parts relative to each other. In the anatomical position, the elbow is above the hand, but in the supine or prone position, the elbow and hand are at the same level.
- To avoid confusion, relational descriptions are always based on the anatomical position, no matter the actual position of the body.

Body Parts and regions

- The central region of the body consists of the head, neck, and trunk.
- The trunk can be divided into the:
 - thorax(chest)
 - abdomen(region between the thorax and pelvis)
 - pelvis (the inferior end of the trunk associated with the hips).
- The upper limb is divided into the arm, forearm, wrist, and hand.
- The arm extends from the shoulder to the elbow, and the forearm extends from the elbow to the wrist.
- The lower limb is divided into the thigh, leg, ankle, and foot.
- The thigh extends from the hip to the knee, and the leg extends from the knee to the ankle.
- Note that, contrary to popular usage, the terms arm and leg refer to only a part of the respective limb.

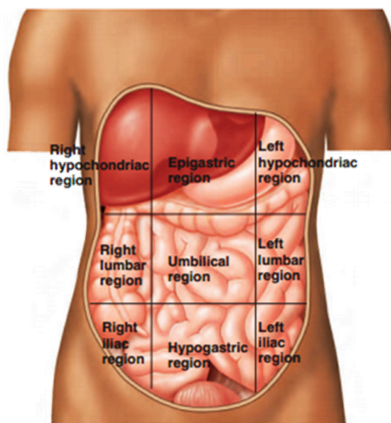
Abdominal Quadrants

- The abdomen is often subdivided superficially into four sections, or quadrants, by two imaginary lines—one horizontal and one vertical—that intersect at the navel.
- The quadrants formed are the right-upper, left-upper, right-lower, and left-lower



quadrants.

- In addition to the quadrants, the abdomen is sometimes subdivided into regions by four imaginary lines—two horizontal and two vertical resulting in nine regions: epigastric, right and left hypochondriac, umbilical, right and left lumbar, hypogastric, and right and left iliac.



Significance of Abdominal Subdivisions

- Clinicians use the quadrants or regions as reference points for locating the underlying organs.

- For example, the appendix is in the right-lower quadrant, and the pain of an acute appendicitis is usually felt there.

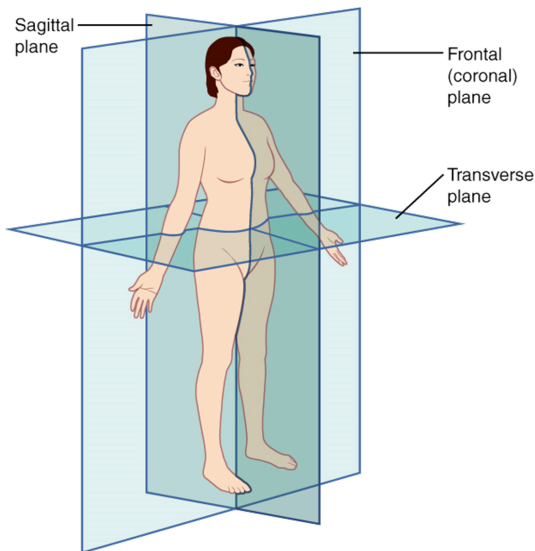
CASE STUDY – Epigastric pain

John has pain in the epigastric region, which is most noticeable following meals and at night when he is lying in bed. He probably has gastroesophageal reflux disease (GERD) in which stomach acid improperly moves into the esophagus, damaging and irritating its lining.

Body Planes

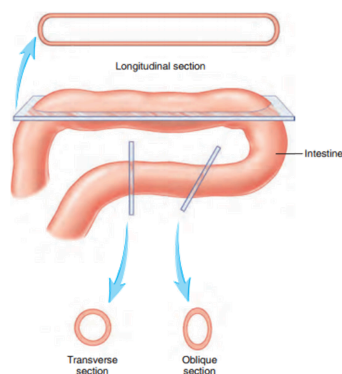
- A section is a two-dimensional surface of a three-dimensional structure that has been cut.
- Modern medical imaging devices enable clinicians to obtain “virtual sections” of living bodies.
- We call these scans.
- Body sections and scans can be correctly interpreted, however, only if the viewer understands the plane along which the section was made.
- A plane is an imaginary two-dimensional surface that passes through the body.
- There are three planes commonly referred to in anatomy and medicine.
- The sagittal plane is the plane that divides the body or an organ vertically into right and left sides.
- If this vertical plane runs directly down the middle of the body, it is called the midsagittal or median plane.
- If it divides the body into unequal right and left sides, it is called a parasagittal plane or less commonly a longitudinal section.
- The frontal plane is the plane that divides the body or an organ into an anterior (front) portion and a posterior (rear) portion.
- The frontal plane is often referred to as a coronal plane.

- The transverse plane is the plane that divides the body or organ horizontally into upper and lower portions.
- Transverse planes produce images referred to as cross sections.



Planes of Section Through an Organ

- Organs are often sectioned to reveal their internal structure.
- A cut through the long axis of the organ is a longitudinal section
- A cut at a right angle to the long axis is a transverse section, or cross section.
- If a cut is made across the long axis at other than a right angle, it is called an oblique section.



Body Cavities and Serous Membranes

Body Cavities

- The body contains many cavities.
- Some of these cavities, such as the nasal cavity, open to the outside of the body, and some do not.

- The trunk contains three large cavities that do not open to the outside of the body:
 1. the thoracic cavity
 2. the abdominal cavity
 3. the pelvic cavity

Thoracic cavity

- The thoracic cavity is surrounded by the rib cage and is separated from the abdominal cavity by the muscular diaphragm.
- It is divided into right and left parts by a median structure called the mediastinum.
- The mediastinum is a partition containing the heart, the thymus, the trachea, the esophagus, and other structures.
- The two lungs are located on each side of the mediastinum.

Abdominal and pelvic cavities

- The abdominal cavity is bounded primarily by the abdominal muscles and contains the stomach, the intestines, the liver, the spleen, the pancreas, and the kidneys.
- The pelvic cavity is a small space enclosed by the bones of the pelvis and contains the urinary bladder, part of the large intestine, and the internal reproductive organs.
- The abdominal and pelvic cavities are not physically separated and sometimes are called the abdomino pelvic cavity.

Serous membranes

- A serous membrane (also referred to a serosa) is one of the thin membranes that cover the walls and organs in the thoracic and abdominopelvic cavities.
- The parietal layers of the membranes line the walls of the body cavity (pariet- refers to a cavity wall).
- The visceral layer of the membrane covers the organs (the viscera).

- Between the parietal and visceral layers is a very thin, fluid-filled serous space, or cavity.
- There are three serous cavities and their associated membranes.
 1. The pleura is the serous membrane that surrounds the lungs in the pleural cavity.
 2. The pericardium is the serous membrane that surrounds the heart in the pericardial cavity.
 3. The peritoneum is the serous membrane that surrounds several organs in the abdominopelvic cavity.
- The serous membranes form fluid-filled sacs, or cavities, that are meant to cushion and reduce friction on internal organs when they move, such as when the lungs inflate or the heart beats.

Mesenteries

- The mesenteries anchor the organs to the body wall and provide a pathway for nerves and blood vessels to reach the organs.
- Other abdominopelvic organs are more closely attached to the body wall and do not have mesenteries,
- Parietal peritoneum covers these other organs, which are said to be retroperitoneal (retro - behind).
- The retroperitoneal organs include the kidneys, the adrenal glands, the pancreas, parts of the intestines, and the urinary bladder.
- Both the parietal and visceral serosa secrete the thin, slippery serous fluid located within the serous cavities.
- The pleural cavity reduces friction between the lungs and the body wall.
- The pericardial cavity reduces friction between the heart and the wall of the pericardium.
- The peritoneal cavity reduces friction between the abdominal and pelvic organs and the body wall.
- Therefore, serous membranes provide additional protection to the viscera they enclose by reducing friction that could lead to inflammation of the organs.
- The serous membranes can become inflamed—usually as a result of an infection.
- Pericarditis is inflammation of the pericardium
- Pleurisy is inflammation of the pleu-ra
- Peritonitis is inflammation of the peritoneum

CASE STUDY - Peritonitis

Leah is rushed to the hospital emergency room. Earlier today, she experienced diffuse abdominal pain, but no fever. Then the pain became more intense and shifted to her right-lower quadrant. She also developed a fever. The examining physician concludes that she has appendicitis, an inflammation of the appendix that is usually caused by an infection. The appendix is a small, wormlike sac attached to the large intestine. The outer surface of the appendix is visceral peritoneum. An infection of the appendix can rupture its wall, releasing bacteria into the peritoneal cavity and causing peritonitis. Appendicitis is the most common cause of emergency abdominal surgery in children, and it often leads to peritonitis if not treated. Leah has her appendix removed, is treated with antibiotics, and makes a full recovery.