The Language of Anatomy

MATeRIALs
- Human torso model (dissectible)
- Human skeleton
- Demonstration: sectioned and labeled kidneys (three separate kidneys uncut or cut so that (a) entire, (b) transverse sectional, and (c) longitudinal sectional views are visible)
- Gelatin-spaghetti molds
- Scalpel

OBJECTIVES
1. To describe the anatomical position verbally or by demonstration, and to explain its importance.
2. To use proper anatomical terminology to describe body directions, planes, and surfaces.
3. To name the body cavities and indicate the important organs in each.

PRE-LAB QUIZ
1. Circle True or False. In anatomical position, the body is recumbent (lying down).
2. Circle the correct term. With regard to surface anatomy, axial refers to the division relating to the head, neck, and trunk of the body.
3. The term superficial refers to a structure that is:
   a. attached near the trunk of the body
   b. toward or at the body surface
   c. toward the head
   d. toward the midline
4. The _________ plane runs longitudinally and divides the body into right and left parts.
   a. frontal  
   b. sagittal  
   c. transverse  
   d. ventral
5. Circle the correct terms. The dorsal body cavity can be divided into the cranial / thoracic cavity, which contains the brain, and the **splanchnic** cavity, which contains the spinal cord.
6. What organ would you expect to find in the thoracic cavity surrounded by the pericardium? ________

Most of us are naturally curious about our bodies. This fact is amply demonstrated by infants, who are fascinated with their own waving hands or their mother’s nose. Unlike the infant, however, the student of anatomy must learn to observe and identify the dissectible body structures formally.

When beginning the study of any science, the student is often initially overcome by jargon unique to the subject. The study of anatomy is no exception. But without this specialized terminology, confusion is inevitable. For example, what do **over, on top of, superficial to, above, and behind** mean in reference to the human body? Anatomists have an accepted set of reference terms that are universally understood. These allow body structures to be located and identified with a minimum of words and a high degree of clarity.

This exercise presents some of the most important anatomical terminology used to describe the body and introduces you to basic concepts of **gross anatomy**, the study of body structures visible to the naked eye.
The Language of Anatomy

Anatomical Position

When anatomists or doctors refer to specific areas of the human body, they do so in accordance with a universally accepted standard position called the **anatomical position**. It is essential to understand this position because much of the body terminology employed in this exercise refers to this body positioning, regardless of the position the body happens to be in. In the anatomical position the human body is erect, with the feet only slightly apart, head and toes pointed forward, and arms hanging at the sides with palms facing forward (Figure 1a).

- Assume the anatomical position, and notice that it is not particularly comfortable. The hands are held unnaturally forward rather than hanging partially cupped toward the thighs.

Surface Anatomy

Body surfaces provide a wealth of visible landmarks for study. There are two major divisions of the body:

- **Axial**: Relating to head, neck, and trunk, the axis of the body
- **Appendicular**: Relating to limbs and their attachments to the axis

Anterior Body Landmarks

Note the following regions in Figure 1a:

- **Abdominal**: PERTAINING TO THE ANTERIOR BODY TRUNK REGION INFERIOR TO THE RIBS
- **Acromial**: PERTAINING TO THE POINT OF THE SHOULDER
- **Antebrachial**: PERTAINING TO THE FOREARM
- **Antecubital**: PERTAINING TO THE ANTERIOR SURFACE OF THE ELBOW
- **Axillary**: PERTAINING TO THE ARMPIT
- **Brachial**: PERTAINING TO THE ARM
- **Buccal**: PERTAINING TO THE CHEEK
- **Carpal**: PERTAINING TO THE WRIST
- **Cephalic**: PERTAINING TO THE HEAD
- **Cervical**: PERTAINING TO THE NECK REGION
- **Coxal**: PERTAINING TO THE HIP
- **Crural**: PERTAINING TO THE LEG
- **Digital**: PERTAINING TO THE FINGERS OR TOES
- **Femoral**: PERTAINING TO THE THIGH
- **Fibular (peroneal)**: PERTAINING TO THE SIDE OF THE LEG
- **Frontal**: PERTAINING TO THE FOREHEAD
- **Hallux**: PERTAINING TO THE GREAT TOE
- **Inguinal**: PERTAINING TO THE GROIN
- **Mammary**: PERTAINING TO THE BREAST
- **Manus**: PERTAINING TO THE HAND
- **Mental**: PERTAINING TO THE CHIN
- **Nasal**: PERTAINING TO THE NOSE
- **Oral**: PERTAINING TO THE MOUTH
- **Orbital**: PERTAINING TO THE BONY EYE SOCKET (ORBIT)
- **Palmar**: PERTAINING TO THE PALM OF THE HAND
- **Patellar**: PERTAINING TO THE ANTERIOR KNEE (KNEECAP) REGION
- **Pedal**: PERTAINING TO THE FOOT
- **Pelvic**: PERTAINING TO THE PELVIS REGION
- **Pollex**: PERTAINING TO THE THUMB
- **Public**: PERTAINING TO THE GENITAL REGION
- **Sternal**: PERTAINING TO THE REGION OF THE BREASTBONE
- **Tarsal**: PERTAINING TO THE ANKLE
- **Thoracic**: PERTAINING TO THE CHEST
- **Umbilical**: PERTAINING TO THE NAVEL

Posterior Body Landmarks

Note the following body surface regions in Figure 1b:

- **Acromial**: PERTAINING TO THE POINT OF THE SHOULDER
- **Brachial**: PERTAINING TO THE ARM
- **Calcaneal**: PERTAINING TO THE HEEL OF THE FOOT
- **Cephalic**: PERTAINING TO THE HEAD
- **Dorsum**: PERTAINING TO THE BACK
- **Femoral**: PERTAINING TO THE THIGH
- **Gluteal**: PERTAINING TO THE BUTTOCKS OR RUMP
- **Lumbar**: PERTAINING TO THE AREA OF THE BACK BETWEEN THE RIBS AND HIPS; THE LOIN
- **Manus**: PERTAINING TO THE HAND
- **Occipital**: PERTAINING TO THE POSTERIOR ASPECT OF THE HEAD OR BASE OF THE SKULL
- **Olecranal**: PERTAINING TO THE POSTERIOR ASPECT OF THE ELBOW
- **Otic**: PERTAINING TO THE EAR
- **Pedal**: PERTAINING TO THE FOOT
- **Perineal**: PERTAINING TO THE REGION BETWEEN THE ANUS AND EXTERNAL GENITALIA
- **Plantar**: PERTAINING TO THE SOLE OF THE FOOT
- **Popliteal**: PERTAINING TO THE BACK OF THE KNEE
- **Sacral**: PERTAINING TO THE REGION BETWEEN THE HIPS (OVERLying THE SACRUM)
- **Scapular**: PERTAINING TO THE SCAPULA OR SHOULDER BLADE AREA
- **Sural**: PERTAINING TO THE CALF OR POSTERIOR SURFACE OF THE LEG
- **Vertebral**: PERTAINING TO THE AREA OF THE SPINAL COLUMN
Activity 1
Locating Body Regions

Locate the anterior and posterior body landmarks on yourself, your lab partner, and a human torso model before continuing.

Body Orientation and Direction

Study the terms below, referring to Figure 2. Notice that certain terms have a different meaning for a four-legged animal (quadruped) than they do for a human (biped).

Superior/inferior (above/below): These terms refer to placement of a structure along the long axis of the body. Superior structures always appear above other structures, and inferior structures are always below other structures. For example, the nose is superior to the mouth, and the abdomen is inferior to the chest.

Anterior/posterior (front/back): In humans the most anterior structures are those that are most forward—the face, chest, and abdomen. Posterior structures are those toward the backside of the body. For instance, the spine is posterior to the heart.

Medial/lateral (toward the midline/away from the midline or median plane): The sternum (breastbone) is medial to the ribs; the ear is lateral to the nose.

The terms of position just described assume the person is in the anatomical position. The next four term pairs are more absolute. Their applicability is not relative to a particular body position, and they consistently have the same meaning in all vertebrate animals.
Cephalad (cranial)/caudal (toward the head/toward the tail): In humans these terms are used interchangeably with superior and inferior, but in four-legged animals they are synonymous with anterior and posterior, respectively.

Dorsal/ventral (backside/belly side): These terms are used chiefly in discussing the comparative anatomy of animals, assuming the animal is standing. Dorsum is a Latin word meaning “back.” Thus, dorsal refers to the animal’s back or the backside of any other structures; for example, the posterior surface of the human leg is its dorsal surface. The term ventral derives from the Latin term venter, meaning “belly,” and always refers to the belly side of animals. In humans the terms ventral and dorsal are used interchangeably with the terms anterior and posterior, but in four-legged animals ventral and dorsal are synonymous with inferior and superior, respectively.

Proximal/distal (nearer the trunk or attached end/farther from the trunk or point of attachment): These terms are used primarily to locate various areas of the body limbs. For example, the fingers are distal to the elbow; the knee is proximal to the toes. However, these terms may also be used to indicate regions (closer to or farther from the head) of internal tubular organs.

Superficial (external)/deep (internal) (toward or at the body surface/away from the body surface): These terms locate body organs according to their relative closeness to the body surface. For example, the skin is superficial to the skeletal muscles, and the lungs are deep to the rib cage.

**Activity 2**
Practicing Using Correct Anatomical Terminology

Before continuing, use a human torso model, a human skeleton, or your own body to specify the relationship between the following structures when the body is in the anatomical position.

1. The wrist is __________ to the hand.
2. The trachea (windpipe) is __________ to the spine.
3. The brain is __________ to the spinal cord.
4. The kidneys are __________ to the liver.
5. The nose is __________ to the cheekbones.
6. The thumb is __________ to the ring finger.
7. The thorax is __________ to the abdomen.
8. The skin is __________ to the skeleton.

**Body Planes and Sections**

The body is three-dimensional, and in order to observe its internal structures, it is often helpful and necessary to make use of a section, or cut. When the section is made through the body wall or through an organ, it is made along an imaginary surface or line called a plane. Anatomists commonly refer to three planes (Figure 3), or sections, that lie at right angles to one another.

![Anatomical terminology describing body orientation and direction.](image_url)
The Language of Anatomy

Frontal plane

Median (midsagittal) plane

Transverse plane

(a) Frontal section (through torso)

(b) Transverse section (through torso, inferior view)

(c) Median (midsagittal) section

FIGURE 3 Planes of the body with corresponding magnetic resonance imaging (MRI) scans.
**The Language of Anatomy**

**Sagittal plane**: A plane that runs longitudinally and divides the body into right and left parts is referred to as a sagittal plane. If it divides the body into equal parts, right down the midline of the body, it is called a **median**, or **midsagittal, plane**.

**Frontal plane**: Sometimes called a **coronal plane**, the frontal plane is a longitudinal plane that divides the body (or an organ) into anterior and posterior parts.

**Transverse plane**: A transverse plane runs horizontally, dividing the body into superior and inferior parts. When organs are sectioned along the transverse plane, the sections are commonly called **cross sections**.

On microscope slides, the abbreviation for a longitudinal section (sagittal or frontal) is l.s. Cross sections are abbreviated x.s. or c.s.

As shown in Figure 4, a sagittal or frontal plane section of any nonspherical object, be it a banana or a body organ, provides quite a different view than a transverse section.

**ACTIVITY 3**

**Observing Sectioned Specimens**

1. Go to the demonstration area and observe the transversely and longitudinally cut organ specimens (kidneys). Pay close attention to the different structural details in the samples because you will need to draw these views in the Review Sheet at the end of this exercise.
2. After completing instruction 1, obtain a gelatin-spaghetti mold and a scalpel and bring them to your laboratory bench. (Essentially, this is just cooked spaghetti added to warm gelatin, which is then allowed to gel.)
3. Cut through the gelatin-spaghetti mold along any plane, and examine the cut surfaces. You should see spaghetti strands that have been cut transversely (x.s.), some cut longitudinally, and some cut obliquely.
4. Draw the appearance of each of these spaghetti sections below, and verify the accuracy of your section identifications with your instructor.

**Body Cavities**

The axial portion of the body has two large cavities that provide different degrees of protection to the organs within them (Figure 5).

**Dorsal Body Cavity**

The dorsal body cavity can be subdivided into the **cranial cavity**, in which the brain is enclosed within the rigid skull,
and the **vertebral** (or **spinal**) cavity, within which the delicate spinal cord is protected by the bony vertebral column. Because the spinal cord is a continuation of the brain, these cavities are continuous with each other.

**Ventral Body Cavity**

Like the dorsal cavity, the ventral body cavity is subdivided. The superior **thoracic cavity** is separated from the rest of the ventral cavity by the dome-shaped diaphragm. The heart and lungs, located in the thoracic cavity, are afforded some measure of protection by the bony rib cage. The cavity inferior to the diaphragm is often referred to as the **abdominopelvic cavity**. Although there is no further physical separation of the ventral cavity, some prefer to describe the abdominopelvic cavity in terms of a superior abdominal cavity, the area that houses the stomach, intestines, liver, and other organs, and an inferior pelvic cavity, the region that is partially enclosed by the bony pelvis and contains the reproductive organs, bladder, and rectum. Notice in Figure 5 that the abdominal and pelvic cavities are not continuous with each other in a straight plane but that the pelvic cavity is tipped away from the perpendicular.

**Serous Membranes of the Ventral Body Cavity**

The walls of the ventral body cavity and the outer surfaces of the organs it contains are covered with an exceedingly thin, double-layered membrane called the **serosa**, or **serous membrane**. The part of the membrane lining the cavity walls is referred to as the **parietal serosa**, and it is continuous with a similar membrane, the **visceral serosa**, covering the external surface of the organs within the cavity. These membranes produce a thin lubricating fluid that allows the visceral organs to slide over one another or to rub against the body wall with minimal friction. Serous membranes also compartmentalize the various organs so that infection of one organ is prevented from spreading to others.

The specific names of the serous membranes depend on the structures they envelop. Thus the serosa lining the abdominal cavity and covering its organs is the **peritoneum**, that enclosing the lungs is the **pleura**, and that around the heart is the **pericardium**.

**Abdominopelvic Quadrants and Regions**

Because the abdominopelvic cavity is quite large and contains many organs, it is helpful to divide it up into smaller areas for discussion or study.

A scheme used by most physicians and nurses divides the abdominal surface (and the abdominopelvic cavity deep to it) into four approximately equal regions called **quadrants**. These quadrants are named according to their relative position—that is, right upper quadrant, right lower quadrant, left upper quadrant, and left lower quadrant (see Figure 6a). Note that the terms left and right refer to the left and right of the figure, not your own. The left and right of the figure are referred to as **anatomical left and right**.
FIGURE 6 Abdominopelvic surface and cavity. (a) The four quadrants, showing superficial organs in each quadrant. (b) Nine regions delineated by four planes. The superior horizontal plane is just inferior to the ribs; the inferior horizontal plane is at the superior aspect of the hip bones. The vertical planes are just medial to the nipples. (c) Anterior view of the abdominopelvic cavity showing superficial organs.
ACTIVITY 4
Identifying Organs in the Abdominopelvic Cavity

Examine the human torso model to respond to the following questions.

Name two organs found in the left upper quadrant.
_____________ and ____________

Name two organs found in the right lower quadrant.
_____________ and ____________

What organ (Figure 6a) is divided into identical halves by the median plane line? ____________

A different scheme commonly used by anatomists divides the abdominal surface and abdominopelvic cavity into nine separate regions by four planes, as shown in Figure 6b. Although the names of these nine regions are unfamiliar to you now, with a little patience and study they will become easier to remember. As you read through the descriptions of these nine regions and locate them in Figure 6b, also look at Figure 6c to note the organs the regions contain.

Umbilical region: The centermost region, which includes the umbilicus
Epigastric region: Immediately superior to the umbilical region; overlies most of the stomach
Hypogastric (pubic) region: Immediately inferior to the umbilical region; encompasses the pubic area
Iliac (inguinal) regions: Lateral to the hypogastric region and overlying the superior parts of the hip bones

Lumbar regions: Between the ribs and the flaring portions of the hip bones; lateral to the umbilical region
Hypochondriac regions: Flanking the epigastric region laterally and overlying the lower ribs

ACTIVITY 5
Locating Abdominal Surface Regions
Locate the regions of the abdominal surface on a human torso model and on yourself before continuing.

Other Body Cavities
Besides the large, closed body cavities, there are several types of smaller body cavities (Figure 7). Many of these are in the head, and most open to the body exterior.

Oral cavity: The oral cavity, commonly called the mouth, contains the tongue and teeth. It is continuous with the rest of the digestive tube, which opens to the exterior at the anus.
Nasal cavity: Located within and posterior to the nose, the nasal cavity is part of the passages of the respiratory system.
Orbital cavities: The orbital cavities (orbits) in the skull house the eyes and present them in an anterior position.
Middle ear cavities: Each middle ear cavity lies just medial to an eardrum and is carved into the bony skull. These cavities contain tiny bones that transmit sound vibrations to the organ of hearing in the inner ears.
Synovial (si-no'v-al) cavities: Synovial cavities are joint cavities—they are enclosed within fibrous capsules that surround the freely movable joints of the body, such as those between the vertebrae and the knee and hip joints. Like the serous membranes of the ventral body cavity, membranes lining the synovial cavities secrete a lubricating fluid that reduces friction as the enclosed structures move across one another.

FIGURE 7 Other body cavities. The oral, nasal, orbital, and middle ear cavities are located in the head and open to the body exterior. Synovial cavities are found in joints between many bones such as the vertebrae of the spine, and at the knee, shoulder, and hip.
The Language of Anatomy

Surface Anatomy
1. Match each of the following descriptions with a key equivalent, and record the key letter or term in front of the description.

   Key:  
   a. buccal  
   b. calcaneal  
   c. cephalic  
   d. digital  
   e. patellar  
   f. scapular  

   1. cheek  
   2. pertaining to the fingers  
   3. shoulder blade region  
   4. anterior aspect of knee  
   5. heel of foot  
   6. pertaining to the head

2. Indicate the following body areas on the accompanying diagram by placing the correct key letter at the end of each line.

   Key:  
   a. abdominal  
   b. antecubital  
   c. brachial  
   d. cervical  
   e. crural  
   f. femoral  
   g. fibular  
   h. gluteal  
   i. lumbar  
   j. occipital  
   k. oral  
   l. popliteal  
   m. pubic  
   n. sural  
   o. thoracic  
   p. umbilical

3. Classify each of the terms in the key of question 2 above into one of the large body regions indicated below. Insert the appropriate key letters on the answer blanks.

   1. appendicular  
   2. axial

Body Orientation, Direction, Planes, and Sections

4. Describe completely the standard human anatomical position.
5. Define *section*.

6. Several incomplete statements are listed below. Correctly complete each statement by choosing the appropriate anatomical term from the key. Record the key letters and/or terms on the correspondingly numbered blanks below.

   In the anatomical position, the face and palms are on the _1_ body surface; the buttocks and shoulder blades are on the _2_ body surface; and the top of the head is the most _3_ part of the body. The ears are _4_ and _5_ to the shoulders and _6_ to the nose. The heart is _7_ to the vertebral column (spine) and _8_ to the lungs. The elbow is _9_ to the fingers but _10_ to the shoulder. The abdominopelvic cavity is _11_ to the thoracic cavity and _12_ to the spinal cavity. In humans, the dorsal surface can also be called the _13_ surface; however, in quadruped animals, the dorsal surface is the _14_ surface.

   If an incision cuts the heart into right and left parts, the section is a _15_ section; but if the heart is cut so that superior and inferior portions result, the section is a _16_ section. You are told to cut a dissection animal along two planes so that both kidneys are observable in each section. The two sections that will always meet this requirement are the _17_ and _18_ sections. A section that demonstrates the continuity between the spinal and cranial cavities is a _19_ section.

   1. __________________________  8. __________________________  14. __________________________  
   2. __________________________  9. __________________________  15. __________________________  
   3. __________________________  10. __________________________  16. __________________________  
   4. __________________________  11. __________________________  17. __________________________  
   5. __________________________  12. __________________________  18. __________________________  
   6. __________________________  13. __________________________  19. __________________________  
   7. __________________________

7. Correctly identify each of the body planes by inserting the appropriate term for each on the answer line below the drawing.

   (a) __________________________  (b) __________________________  (c) __________________________
8. Draw a kidney as it appears when sectioned in each of the three different planes.

9. Correctly identify each of the nine areas of the abdominal surface by inserting the appropriate term for each of the letters indicated in the drawing.

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)
- (g)
- (h)
- (i)

Body Cavities

10. Which body cavity would have to be opened for the following types of surgery or procedures? (Insert letter of key choice in same-numbered blank. More than one choice may apply.)

Key:  
- a. abdominopelvic  
- b. cranial  
- c. dorsal  
- d. spinal  
- e. thoracic  
- f. ventral

- ______ 1. surgery to remove a cancerous lung lobe
- ______ 2. removal of the uterus, or womb
- ______ 3. removal of a brain tumor
- ______ 4. appendectomy
- ______ 5. stomach ulcer operation
- ______ 6. delivery of pre-operative "saddle" anesthesia
11. Name the muscle that subdivides the ventral body cavity. ________________________________

12. Which organ system would not be represented in any of the body cavities? ____________________

13. What are the bony landmarks of the abdominopelvic cavity? ______________________________

14. Which body cavity affords the least protection to its internal structures? ____________________

15. What is the function of the serous membranes of the body? ________________________________

16. Using the key choices, identify the small body cavities described below.

   Key:  
   a. middle ear cavity  
   b. nasal cavity  
   c. oral cavity  
   d. orbital cavity  
   e. synovial cavity  

   1. holds the eyes in an anterior-facing position  
   2. houses three tiny bones involved in hearing  
   3. contained within the nose  
   4. contains the tongue  
   5. lines a joint cavity

17. On the incomplete flowchart provided below:
   • Fill in the cavity names as appropriate to boxes 3–8.
   • Then, using either the name of the cavity or the box numbers, identify the descriptions in the list that follows.

   Body cavities

   1 Dorsal body cavity

   2 Ventral body cavity

   3 (superior) cavity

   4 (inferior) cavity

   5 (superior) cavity

   6 (inferior) cavity

   7 (superior) cavity

   8 (inferior) cavity

   a. contained within the skull and vertebral column  
   b. houses female reproductive organs  
   c. the most protective body cavity  
   d. its name means belly  
   e. contains the heart  
   f. contains the small intestine  
   g. bounded by the ribs  
   h. its walls are muscular