The Language of Anatomy

Objectives

1. Describe the anatomical position, and explain its importance.
2. Use proper anatomical terminology to describe body regions, orientation and direction, and body planes.
3. Name the body cavities, and indicate the important organs in each cavity.
4. Name and describe the serous membranes of the ventral body cavities.
5. Identify the abdominopelvic quadrants and regions on a torso model or image.

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

Pre-Lab Quiz

1. Circle True or False. In the anatomical position, the body is lying down.
2. Circle the correct underlined term. With regard to surface anatomy, abdominal / axial refers to the structures along the center line of the body.
3. The term superficial refers to a structure that is:
   a. attached near the trunk of the body
c. toward the head
   b. toward or at the body surface
d. toward the midline
4. The ________ plane runs longitudinally and divides the body into right and left parts.
   a. frontal
c. transverse
   b. sagittal
d. ventral
5. Circle the correct underlined terms. The dorsal body cavity can be divided into the cranial / thoracic cavity, which contains the brain, and the sural / vertebral cavity, which contains the spinal cord.

Most of us are naturally curious about our bodies. This curiosity is particularly evident in 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.

A student new to any science is often overwhelmed at first by the terminology used in that 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.

Anatomical Position

When anatomists or doctors refer to specific areas of the human body, the picture they keep in mind is a universally accepted standard position called the anatomical position. It is essential to understand this position because much of the body
terminology used in this book 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 1.1).

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

Check the box when you have completed this task.

**Surface Anatomy**

Body surfaces provide a wealth of visible landmarks for study of the body (Figure 1.1).

**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 (Figure 1.2a):

**Abdominal**: Anterior body trunk region inferior to the ribs

**Acromial**: Point of the shoulder

**Antebrachial**: Forearm

**Antecubital**: Anterior surface of the elbow

**Axillary**: Armpit

**Brachial**: Arm

**Buccal**: Cheek

**Carpal**: Wrist

**Cephalic**: Head

**Cervical**: Neck region

**Coxal**: Hip

**Crural**: Leg

**Digital**: Fingers or toes

**Femoral**: Thigh

**Fibular (peroneal)**: Side of the leg

**Frontal**: Forehead

**Hallux**: Great toe

**Inguinal**: Groin area

**Mammary**: Breast region

**Manus**: Hand

**Mental**: Chin
Posterior Body Landmarks

Note the following body surface regions (Figure 1.2b):

- **Acromial**: Point of the shoulder
- **Brachial**: Arm
- **Calcaneal**: Heel of the foot
- **Cephalic**: Head
- **Dorsal**: Back
- **Femoral**: Thigh
- **Gluteal**: Buttocks or rump
- **Lumbar**: Area of the back between the ribs and hips; the loin
- **Manus**: Hand
- **Occipital**: Posterior aspect of the head or base of the skull
- **Olecranal**: Posterior aspect of the elbow

**Nasal**: Nose  
**Oral**: Mouth  
**Orbital**: Bony eye socket (orbit)  
**Palmar**: Palm of the hand  
**Patellar**: Anterior knee (kneecap) region  
**Pedal**: Foot  
**Pelvic**: Pelvis region  
**Pollex**: Thumb  
**Pubic**: Genital region  
**Sternal**: Region of the breastbone  
**Tarsal**: Ankle  
**Thoracic**: Chest  
**Umbilical**: Navel
Figure 1.3 Planes of the body, with corresponding magnetic resonance imaging (MRI) scans.
Otic: Ear
Pedal: Foot
Perineal: Region between the anus and external genitalia
Plantar: Sole of the foot
Popliteal: Back of the knee
Sacral: Region between the hips (overlying the sacrum)
Scapular: Scapula or shoulder blade area
Sural: Calf or posterior surface of the leg
Vertebral: Area of the spinal column

**Activity 1**

**Locating Body Regions**

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

**Body Planes and Sections**

The body is three-dimensional, and 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, or sections, that lie at right angles to one another.

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.

A sagittal or frontal plane section of any nonspherical object, be it a banana or a body organ, provides quite a different view from a transverse section (Figure 1.4).

**Activity 2**

**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 Orientation and Direction

Study the terms that follow (refer to Figure 1.5). 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.

These terms of position assume the person is in the anatomical position. The next four term pairs are more absolute. They apply in any 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 the same as 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 the same as *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.

**Figure 1.5** Anatomical terminology describing body orientation and direction.
(a) With reference to a human. (b) With reference to a four-legged animal.
The vertebral (or spinal) cavity, which is within the bony vertebral column, protects the delicate spinal cord. 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 protected 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 describe the abdominopelvic cavity as two areas, 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). The abdominal and pelvic cavities are not continuous with each other in a straight plane; the pelvic cavity is tipped forward (Figure 1.6).

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 move within the cavity.
The specific names of the serous membranes depend on the structures they surround. 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** (Figure 1.7).

**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.

Most physicians and nurses use a scheme that divides the abdominal surface and the abdominopelvic cavity 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** (Figure 1.8). (Note that the terms **left** and **right** refer to the left and right side of the body in Figure 1.8, not the left and right side of the art on the page). The left and right of the body viewed are referred to as **anatomical left** and **right**.

**Activity 4**

**Identifying Organs in the Abdominopelvic Cavity**

Examine the torso model to respond to the following directions and questions.

Name two organs found in the left upper quadrant.

__________________________________________________________________________ and __________________________________________________________________________
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 1.10). 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 hearing receptor in the inner ears.

Synovial 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 1.10 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.

GROUP CHALLENGE

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Working in small groups, complete the tasks described below. Work together, but refrain from using a figure or other reference to answer the questions. As usual, assume that the human body is in the anatomical position.

1. Arrange the following terms from superior to inferior: cervical, coxal, crural, femoral, lumbar, mental, nasal, plantar, sternal, and tarsal.

2. Arrange the following terms from proximal to distal: antebrachial, antecubital, brachial, carpal, digital, and palmar.

3. Arrange the following terms from medial to lateral: acromial, axillary, buccal, otic, pollex, and umbilical.

4. Arrange the following terms from distal to proximal: calcaneal, femoral, hallux, plantar, popliteal, and sural.

5. Name a plane that you could use to section a four-legged chair and still be able to sit in the chair without falling over.

6. Name the abdominopelvic region that is both medial and inferior to the right lumbar region.

7. Name the type of inflammation (think “-itis”) that is typically accompanied by pain in the lower right quadrant.
Surface Anatomy

1. Match each of the numbered descriptions with the related term in the key.

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

   ____________ 1. cheek ____________ 4. anterior aspect of knee
   ____________ 2. the fingers ____________ 5. heel of foot
   ____________ 3. shoulder blade region ____________ 6. 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. Some terms are used more than once.

Key: a. anterior  d. inferior  g. posterior  j. superior
b. distal  e. lateral  h. proximal  k. transverse
c. frontal  f. medial  i. sagittal

In the anatomical position, the face and palms are on the body surface; the buttocks and shoulder blades are on the body surface; and the top of the head is the most part of the body. The ears are and to the shoulders and to the nose. The heart is to the vertebral column (spine) and to the lungs. The elbow is to the fingers but to the shoulder. The abdominopelvic cavity is to the thoracic cavity and to the spinal cavity. In humans, the dorsal surface can also be called the surface; however, in quadruped animals, the dorsal surface is the surface.

If an incision cuts the heart into right and left parts, the section is a section; but if the heart is cut so that superior and inferior portions result, the section is a 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 and sections. A section that demonstrates the continuity between the spinal and cranial cavities is a section.

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 regions of the abdominopelvic cavity 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 surgeries or procedures? (Use the key to find the correct choice, and write the letter in same-numbered blank. More than one choice may apply for some surgeries/procedures.)

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

   _____  1. surgery to remove a cancerous lung lobe  _____  4. appendectomy
   _____  2. removal of the uterus, or womb  _____  5. stomach ulcer operation
   _____  3. removal of a brain tumor  _____  6. delivery of preoperative “saddle” anesthesia
11. Name the muscle that subdivides the ventral body cavity. 

12. What are the bony landmarks of the abdominopelvic cavity? 

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

14. What is the function of the serous membranes of the body? 

15. A nurse informs you that she is about to take blood from the antecubital region. What portion of your body should you present to her? 

16. Using the key, identify the small body cavities described below. Write the correct letter in each blank line. 

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

17. On the incomplete flowchart provided below: 
   • Fill in the cavity names as appropriate to boxes 3 through 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 ________ cavity 
   4 ________ cavity 
   5 ________ cavity 
   6 ________ cavity 
   7 ________ cavity 
   8 ________ 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