

Body Organization and Terminology

Time Estimates for Completing This Lab

The activities in this laboratory exercise can be completed in 2 to 2.5 hours. Extra time may be needed to complete the review sheets at the end, or they may be assigned as homework. Times listed are only estimates.

Activity 1.1: Using Anatomical Terms to Describe Body Organization
15 minutes

Activity 1.2: Defining Anatomical Planes and Sections
30 minutes

Activity 1.3: Identifying Organs and Organ Systems
30 minutes

Activity 1.4: Identifying Anatomical Regions
30 minutes

Activity 1.5: Exploring Body Cavities
10 minutes

List of Materials

This list of materials shows the quantities needed for a standard 24-seat lab, with six tables and four seats at each table.

- Up to six human torso models, with dissectible parts; one per table
- Six sets of various anatomical models of organs and organ systems, with dissectible parts; one set per table
- Fresh vegetables that are long and cylindrical in shape (e.g., cucumbers, carrots, zucchini, or eggplants)—enough for three vegetables per person or per pair
- Small kitchen knives or scalpels—one per person or per pair
- Human skeleton or skull
- 24 sets of coloring pencils (students may be required to buy their own)

To Do in Advance

- ✓ ____ 1. Set out all supplies on the lab tables.
- ✓ ____ 2. Place knives or scalpels in a secure location to avoid accidents.
- ✓ ____ 3. If supplies are limited, you can set up stations around the room through which the students will rotate.

Tips and Trouble Spots

Introduction

Clarify for your students the difference between anatomy and physiology, but also explain how the two disciplines are interdependent. A good way to emphasize this is to introduce homeostasis—why it is important, how it is maintained, and specific examples. An easy concept for students to comprehend is how the body responds to a change in temperature. Increased temperature causes vasodilation in the skin and increased sweating; decreased temperature causes vasoconstriction in the periphery and shivering, by which muscles generate heat.

Activity 1.1: Using Anatomical Terms to Describe Body Organization

Learning Outcome: Describe and demonstrate anatomical position and use anatomical terminology to describe relative positions of structures in the human body.

The basic terminology here is challenging. Stress that these terms always assume anatomical position, and have students stand and “assume the position” so they become familiar with anatomical position. Emphasize that these are *relative* position terms. For example, the pericardium is superficial to the heart, yet deep to the ribs. Explain that ventral/anterior and dorsal/posterior have the same meaning in humans (bipeds) but not in other animals (quadrupeds). The most challenging of the terms are usually *proximal* versus *distal*. Students need to identify the point of origin for these terms, which are often used for extremities. In that case, the point of origin is the attachment to the trunk (elbow is distal to shoulder but proximal to wrist). If these terms are used for organ systems, think of the movement through the system (the esophagus is distal to the mouth but proximal to the stomach). To get students accustomed to the relative position terms, tag pairs of structures on models (label them 1A and 1B, for example), ask them to decide the best relative position terms, and then discuss their answers. Beware the tendency for students to default to ipsilateral and contralateral because they are broader terms. Becoming adept at selecting the most appropriate terms takes practice.

Activity 1.2: Defining Anatomical Planes and Sections

Learning Outcome: Describe and demonstrate the various anatomical planes and sections.

Be sure students understand the difference between a *plane* (a line that passes through a three-dimensional object such as the human body) and a *section* (a surface formed by a cut made along a plane). Coronal and transverse planes may be hard to remember, but students can easily comprehend the other terms used for these planes: *coronal*, or *frontal*, gives *front* and *back* portions. *Transverse*, or *horizontal*, parallels the *horizon*, giving *top* and *bottom* parts. To be sure students understand that these planes are constant on the body, regardless of the body position, ask the class what type of cut a magician uses to cut the volunteer in the box in half. The volunteer is lying down, but the magician “cuts” through the waist, so it is a transverse/horizontal cut even though the magician cuts in an up-and-down motion—remind them to always assume the body is in anatomical position.

To assess student knowledge, place some specific models in view and ask students to describe the section or plane. Place the answer on the back of a sheet of paper at each model and let the students self-test through the lesson. For the vegetables, to cut costs, students can work in pairs or by table. Alternatively, they could cut all sections on a single item. They should end up with six pieces. Please caution students about being careful with the knives or scalpels and securing them in a safe area when not in use.

Activity 1.3: Identifying Organs and Organ Systems

Learning Outcome: Summarize functions of each organ system, and list the organs in each.

This activity can be challenging because most students are just beginning anatomy and therefore will not know many of these organs. You may need to guide them as they locate the organs and decide in which system each belongs. The illustration in the lab manual is helpful, but be sure the students also locate the organs on the models. Students will likely have to share the models, but that can lead to collaboration, and talking about the structures further enhances the learning.

Activity 1.4: Identifying Anatomical Regions

Learning Outcome: Name the anatomical regions of the body.

The names of the anatomical regions listed are one common version. Be aware of any slight differences used in your text. Students may be overwhelmed by the number of terms. Suggest that they read through all the terms and see which they already know (cranial, facial, oral, nasal) and help them see what the names *mean* so they don't try to just memorize the words.

Activity 1.5: Exploring Body Cavities

Learning Outcome: Identify the body cavities and the organs that are located in each.

The body cavities are usually not difficult, but the mediastinum can be tricky. Books often discuss it as if it were a structure, when it is actually just the space between the two pleural sacs. Students may also mistakenly think that the cavities inside the serous sacs contain the organs—they think the pericardial cavity contains the heart. In reality, these cavities surround the organ (the pericardial cavity surrounds the heart) and contain only a small amount of serous fluid.

Additional Student Engagement Ideas

- Students often struggle with the anatomical terms. One shortfall is that they often consider only one part of the structures they are comparing and fail to think of the structures in their entirety. This may lead to errors such as saying that the skull is anterior to the brain, instead of considering that the skull completely surrounds the brain and, thus, the best term would be superficial—the skull is superficial to the brain. To provide practice, try setting up a station using torso and other anatomical models, and tagging several pairs of structures that need to be considered beyond just where the tag is. Here are some ideas:
 - The ribs are _____ to the lungs.
 - The skull is _____ to the brain but _____ to the skin.
 - The heart is _____ to the pericardial cavity.
- Students also struggle with proximal and distal. Much of this stems from their lack of understanding about where the starting point is for these situations. Consider setting up another station using models and asking students first to list the starting point and then to determine which structure is proximal and which is distal:
 - The digestive system starts at the _____. Based on this, the esophagus is _____ to the stomach.
 - The cardiovascular system starts at the _____. Based on this, the renal artery is _____ to the abdominal aorta, but _____ to the renal vein.
 - The lower limb begins at the _____. Based on this, is the ankle proximal or distal to the knee? _____

- When having students learn about sections, consider substituting or adding drinking straws for them to cut, preferably with scissors. Because the straws are hollow, they are excellent models for glands and vessels in the body, which your students will examine through the microscope soon. When they section a straw longitudinally, have them look at it lengthwise so they understand how a tube-like structure would appear in a microscope slide. Then have them do a cross section and oblique section and look at them from different angles to see the difference in appearance. Consider having a few microscopes set up at the side of your class with blood vessels or glands visible in longitudinal, oblique, and cross sections. This helps the students translate the cutting exercise directly to its application in the human body, providing relevance.

Exercise 1 Answers

Pre-Lab Quiz

1. anatomical position
2. d
3. the head
4. b
5. a
6. a
7. True
8. False (a sagittal plane divides the body into right and left sides)
9. nine
10. True

Activity 1.1 Answers

- A 1. ➤ The palms would be posterior and the thumbs would become medial.
- 2. ➤ Anatomical position ensures that all references to anatomical locations are standardized.
- B 1a. ➤ Left eye to left ear: *medial* (ipsilateral is also correct)
- 1b. ➤ Thumb to little finger: *lateral*
- 1c. ➤ Right ankle joint to right knee joint: *distal* (*inferior* or ipsilateral is also correct)
- 1d. ➤ Left elbow joint to right elbow joint: *contralateral*
- 2a. ➤ Left kidney to spleen: *inferior* (ipsilateral or medial is also correct)
- 2b. ➤ Right lung to right lobe of the liver: *superior* (ipsilateral is also correct)
- 2c. ➤ Pancreas to stomach: *posterior*
- 2d. ➤ Ascending colon to descending colon: *contralateral*
- MAKING CONNECTIONS: The heart is located both superior and medial to the ascending colon.

Activity 1.2 Answers

- A 1. ➤ Students will identify anatomical planes.
- 2. ➤ Students will identify types of sections.
- B 2. ➤ Students will draw the sections they have cut.

- **MAKING CONNECTIONS:** A midsagittal plane passes vertically from anterior to posterior through the midline of the thorax, so it would pass through the center of the heart, between the lungs, producing equal right and left portions. A transverse plane would pass horizontally through the thorax and thus would pass through the heart and also through both lungs, producing superior and inferior portions.

Activity 1.3 Answers

A ►

Aorta: <i>Cardiovascular</i>	Skull: <i>Skeletal</i>	Ovaries: <i>Endocrine/Reproductive</i>	Tonsils: <i>Lymphatic</i>
Brain: <i>Nervous</i>	Small intestine: <i>Digestive</i>	Pancreas: <i>Digestive/Endocrine</i>	Trachea: <i>Respiratory</i>
Heart: <i>Cardiovascular</i>	Spinal cord: <i>Nervous</i>	Skeletal muscles: <i>Muscular</i>	Urinary bladder: <i>Urinary</i>
Kidneys: <i>Urinary</i>	Spleen: <i>Lymphatic</i>	Skin: <i>Integumentary</i>	Uterus: <i>Reproductive</i>
Lungs: <i>Respiratory</i>	Testes: <i>Endocrine/Reproductive</i>	Liver: <i>Digestive</i>	Stomach: <i>Digestive</i>

B Answers will vary.

Organ System	Major Function
Integumentary system	<i>Protection, temperature regulation</i>
Skeletal system	<i>Support, protection, mineral storage, blood formation</i>
Muscular system	<i>Locomotion, support, heat production</i>
Nervous system	<i>Control/coordinate body functions; monitor internal and external conditions; sensory input and motor control</i>
Endocrine system	<i>Produce/release hormones—chemical signals that control/coordinate functions of other organs</i>
Cardiovascular system	<i>Transport (blood cells, oxygen, nutrients, water, heat, waste)</i>
Lymphatic system	<i>Defense, and returns excess fluid to blood</i>
Respiratory system	<i>Gas exchange—brings in oxygen, clears out carbon dioxide</i>
Digestive system	<i>Breaks down food and absorbs nutrients</i>
Urinary system	<i>Eliminates excess water, wastes, salts</i>
Reproductive system	<i>Production of egg/sperm, pregnancy, nursing, and hormones of reproduction</i>

- **MAKING CONNECTIONS:** Answers will vary depending on what students previously listed. One possible functional significance of organs having roles in multiple systems is that the organ systems are integrated and interdependent on one another. Here are some possible examples that they may list. The pancreas secretes chemicals for two systems: digestive, to break down foods, such as carbohydrates; and endocrine, to regulate the amount of glucose circulating in the blood after the nutrients from digestion are absorbed. The testes and ovaries are both reproductive and endocrine, and in the latter role, they secrete hormones that regulate reproductive behavior.

Activity 1.4 Answers

- A ▶ a. groin
▶ b. arm
▶ c. thigh
▶ d. face
▶ e. thorax
▶ f. wrist
▶ g. skull
▶ h. back of knee

B Table 1.3. Answers will vary.

- ▶ MAKING CONNECTIONS: For anatomy, the nine regions allow more precise localization of internal structures. For clinical purposes, the four quadrants are adequate.

Activity 1.5 Answers

C Table 1.4. Major organs are listed below.

Cranial cavity	Brain
Vertebral canal	Spinal cord
Pleural cavity	Lung
Pericardial cavity	Heart
Abdominal cavity	Stomach, liver, small intestine, large intestine, pancreas, liver, gallbladder, spleen, kidneys, adrenal glands
Pelvic cavity	Rectum, anus, urinary bladder. Female: uterus, ovaries. Male: prostate, seminal vesicles.

- ▶ MAKING CONNECTIONS: The brain is protected by the cranial bones and the spinal cord is protected by the vertebral column. The thoracic cavity is surrounded by the sternum and ribs, which form a protective cage. The abdominal cavity is enclosed by multiple layers of strong muscles that securely hold the abdominal organs in.

Looking Back

Cells join to form tissues, and tissues are organized together to form organs, which, in turn, are linked functionally into organ systems. An organ's work is really done by its cells, so understanding the basics of cell function, as well as specialized functions of some cells, such as muscle cells or neurons, helps us understand how organs and organ systems do what they do.

Answers to Review Sheet

1. Anatomical position is a standard point of reference. It refers to the body in an erect position with all parts fully extended (straight) and the palms facing forward. It is important to always refer to anatomical position so everyone is using a common reference point. It is also important that the palms face forward so the bones in the forearm are parallel, not crossed, and to maintain standard references to anterior versus posterior and medial versus lateral for hand structures.
2. Biceps brachii is positioned in front of the brachialis muscle.
3. The radial artery is farther out to the side than the ulnar artery.

4. The uterus sits just above the bladder, and the prostate gland sits just below the bladder.
5. The knee joint is closer to the trunk than the ankle joint, but it is further away from the trunk than the hip joint.
6. Sagittal plane
7. Transverse or horizontal plane
8. Frontal or coronal plane
9. A midsagittal plane passes through the exact midline, giving equal right and left sides. A parasagittal plane passes through in the same direction, but not along the midline, producing unequal right and left portions.
10. Students' drawings will vary but should accurately represent the three sections.
11. b
12. c
13. g
14. e
15. a
16. f
17. d
18. c
19. d
20. f
21. e
22. b
23. a
24. a. Lungs
 - b. Respiratory system
 - c. Pericardial cavity
 - d. Cardiovascular system
 - e. Stomach
 - f. Pelvic cavity
 - g. Female reproductive system
 - h. Male reproductive system