# CHAPTER 1: INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY

## 1.1 Introduction

Learning Outcome 1: Identify some of the early discoveries that led to our understanding of the body.

1. Lecture Suggestions and Guidelines
2. Give an overview of the roles of primitive doctors.
3. Compare various beliefs regarding the connection between natural forces and the human body.
4. Identify the origins of basic terms used in the study of anatomy and physiology.
5. Application Question(s)
6. Ask students to develop a chart of basic terms found in the language of anatomy and physiology.

Answer: Responses should include a minimum of 50 modern terms accompanied by their Greek/Latin derivatives.

1. Critical Thinking Issue(s)
2. Compare and contrast several ancient uses of herbs and potions.

Answer: Students may be required to research this topic via the library, used bookstores, or Internet.

## 1.2 Anatomy and Physiology

Learning Outcome 1: Explain how anatomy and physiology are related.

1. Lecture Suggestions and Guidelines
2. Describe anatomy as the study of the structure of the human body.
3. Describe physiology as the study of the function of the human body.
4. Discuss ways in which the function of a body part depends upon the way it is constructed.
5. Application Question(s)
6. Ask students to choose a body part and explain how its unique structure is related to its function.

Answer: Some excellent examples would include the hand, (adapted for grasping), the heart, (adapted for receiving and pumping blood), the mouth, (adapted for speaking and receiving food), and the urinary bladder (adapted for storing urine).

1. Critical Thinking Issue(s)
2. Ask students to consider the implications of changes in function of a body part that has been altered in structure.

Answer: Examples may include loss of pumping ability of the heart due to scar tissue formation, loss of the ability to grasp when the thumb, (opposable digit), is injured, inability to plantar flex and evert the foot due to injury to the peroneus muscles.

## 1.3 Levels of Organization

Learning Outcome 1: List the levels of organization in the human body and the characteristics of each.

1. Lecture Suggestions and Guidelines
2. Emphasize the fact that the body is composed of parts with different levels of organization.
3. Introduce the levels of complexity from simplest to most complex, including atoms, molecules, macromolecules, cells, tissues, organs, organ systems, organism.
4. Discuss how organs within a system are grouped together to accomplish a unified purpose.
5. Application Question(s)
6. Ask students to apply their knowledge of levels of organization to an example outside the human body.

Answer: For example, begin with a single book. Combining several books together will form a bookshelf. Several bookshelves combine to form a bookcase. Many bookcases are joined together to form a section of a library. Many sections of the library can combine to form one whole library. Many libraries are linked together to form a library system, etc.

1. Critical Thinking Issue(s)

a. Ask students to describe a system from the simplest to most complex level.

Answer: The skeletal system serves as an excellent example. Discussion should begin with a brief overview of atoms, molecules, and macromolecules, followed by a description of bone cells (osteocytes), which combine to form osseous tissue, which form more complex structures called bones (organs). The 206 bones of the human body, when taken together, form the skeletal system (organ system). This system combines with other organ systems to become an organism.

## 1.4 Characteristics of Life

Learning Outcome 1: List and describe the major characteristics of life.

1. Lecture Suggestions and Guidelines
2. Define the characteristics of life as traits that all organisms share.
3. List the major characteristics of life and give an example of each. Include a discussion of growth, reproduction, responsiveness, movement, and metabolism.
4. Explain to students that metabolism includes respiration, digestion, circulation, and excretion.
5. Application Question(s)
6. Ask students to list the major characteristics of life and briefly describe why each characteristic is important in maintaining human life. Relate each characteristic to a specific body system.

Answer: Responses should include a discussion of growth (all body systems), reproduction (reproductive system), responsiveness (nervous, endocrine, integumentary systems), movement (muscular and skeletal systems), metabolism (respiratory system (respiration), digestive system (digestion, excretion), cardiovascular system (circulation), lymphatic system (circulation), urinary system (excretion)).

1. Critical Thinking Issue(s)
2. Ask students to describe the importance of monitoring vital signs and their relationships to the major characteristics of life.

Answer: Vital signs include the measurement of various organ system functions that are necessary to maintain life. They include measurements of breathing, pulse, responsiveness, blood pressure, temperature, movement, reflexes, and brain activity.

Learning Outcome 2: Give examples of metabolism.

1. Lecture Suggestions and Guidelines
2. Define metabolism as the sum total of all the chemical reactions in the body.
3. Describe respiration as an example of a metabolic process.
4. Describe digestion as an example of a metabolic process.
5. Application Question(s)
6. Ask students to compare human metabolic processes with processes of other animals.

Answer: Comparisons may include mammals, fish, invertebrates, insects, etc.

1. Critical Thinking Issue(s)
2. Ask students to predict the dire effects on the human body when one of the major metabolic processes malfunctions.

Answer: Responses should include a discussion of the effects on homeostasis. For example, the effects of an asthma attack that restricts airflow into and out of the lungs and the resulting effect on gas exchange.

## 1.5 Maintenance of Life

Learning Outcome 1: List and describe the major requirements of organisms.

1. Lecture Suggestions and Guidelines
2. Describe how the structures and functions of body parts maintain the life of the organism.
3. Discuss the major requirements of organisms, including water, heat, and pressure.
4. Describe the implications of excesses and deficiencies of the major requirements of organisms.
5. Application Question(s)
6. Apply the requirements of organisms to the structure and function of body parts. Ask students to explain how each requirement helps to maintain life.

Answer: Responses should include a discussion of water, heat, and pressure. For example, blood pressure is necessary to filter the blood in the kidneys, and water is necessary for certain membranes to adhere to one another (such as the pleura of the lungs), and for certain chemical reactions to occur (such as the breakdown of starch to glucose molecules).

1. Critical Thinking Issue(s)
2. Ask students to describe an example of the effects upon a body system when it is subjected to a less than optimal quantity and quality of its basic environmental requirements.

Answer: Examples may include a dysfunctional cardiovascular system when blood pressure falls above or below normal limits, dehydration of tissues when water levels are too low, or edema when fluids accumulate in the tissues, or malnutrition when food does not supply the body with the correct nutrients in optimal amounts. It should be noted that malnutrition might result from overeating the “wrong” things as well as not eating enough of the “right” things.

Learning Outcome 2: Explain the importance of homeostasis to survival.

1. Lecture Suggestions and Guidelines
2. Define homeostasis in terms of maintaining an internal stable environment.
3. Ask students to describe their major field of study and give examples of patient conditions that would upset a level of homeostasis.
4. Introduce the concept of a negative feedback mechanism.
5. Application Question(s)
6. Ask students to apply their knowledge of a homeostatic mechanism to a situation outside of the human body.

Answer: Responses may include the analogy of a homeostatic mechanism used by a furnace or air conditioning system. In any case, the discussion should include a self-regulating mechanism that receives signals about changes within the system that have deviated from the norm. The self-regulating mechanism provides feedback to the system to allow it to initiate the changes necessary to return to normal conditions.

1. Critical Thinking Issue(s)
2. Ask students to trace the steps of a homeostatic mechanism within the human body.

Answer: One example is the maintenance of optimal body temperature. When body temperature rises, the brain detects the change and causes increased sweating and the dilation of skin blood vessels. These reactions initiate the loss of heat, thus stimulating the body temperature to return to normal. Another example is the maintenance of normal blood sugar levels. When blood sugar (glucose) levels increase, the pancreas secretes the hormone insulin into the blood, and insulin acts on certain body cells to allow glucose transport into the cells, which helps lower blood sugar back toward normal.

Learning Outcome 3: Describe the parts of a homeostatic mechanism and explain how they function together.

1. Lecture Suggestions and Guidelines
2. Apply the concept of homeostasis to the maintenance of blood pressure.
3. Apply the concept of homeostasis to the maintenance of body temperature.
4. Give examples of situations or processes that would not be considered homeostatic mechanisms.
5. Define receptors, effectors, and control centers.
6. Application Question(s)
7. Ask students to apply the concept of homeostasis to the maintenance of blood pressure.

Answer: The maintenance of blood pressure is based upon sensors in the walls of the blood vessels that send feedback to a control center in the brain. This initiates messages from the brain to the heart, telling it to contract more slowly or more rapidly depending upon the situation.

1. Critical Thinking Issue(s)
2. Ask students to describe the effects of environmental pollution, i.e., water, air, or soil upon maintaining homeostasis in the human body.

Answer: The possible responses are limitless but should include a discussion of the body’s attempts to maintain a stable internal environment.

## 1.6 Organization of the Human Body

Learning Outcome 1: Identify the locations of the major body cavities.

1. Lecture Suggestions and Guidelines
2. Identify the cavities of the axial portion of the human organism, which include the cranial cavity, vertebral cavity, thoracic cavity, and abdominopelvic cavity.
3. Identify the diaphragm that separates the thoracic and abdominopelvic cavities, and the mediastinum between the right and left sides of the thoracic cavity.
4. Distinguish between the abdominal cavity and pelvic cavity.
5. Identify the smaller body cavities of the head.
6. Application Question(s)
7. Ask students to identify the major cavity that is: directly above the pelvic cavity; behind the thoracic and abdominopelvic cavities; body cavity on the head; body cavity below the abdominal cavity

Answer: Directly above the pelvic cavity = abdominal cavity; behind the thoracic and abdominopelvic cavities = vertebral cavity; body cavity on the head = cranial cavity; body cavity below the abdominal cavity = pelvic cavity.

Learning Outcome 2: List the organs located in each major body cavity.

1. Lecture Suggestions and Guidelines
2. Identify the body organs located within each cavity of the axial portion of the human organism, including the brain, spinal cord, heart, spleen, gallbladder, lungs, liver, stomach, intestines, and urinary bladder.
3. Identify the major body organs located in the mediastinum.
4. Identify the organs associated with the smaller body cavities.
5. Application Question(s)
6. Ask students to identify the body cavity that would be the focus of an image, such as a CT scan, MRI, angiogram, or X-ray, given the following: gallstones obstructing the bile duct, herniated (“slipped”) disc, collapsed lung; coronary artery blockage, colorectal cancer, ovarian cyst.

Answer: Gallstones obstructing the bile duct = abdominal cavity, herniated (“slipped”) disc = vertebral cavity, collapsed lung = thoracic cavity, coronary artery blockage = thoracic cavity/mediastinum, colorectal cancer = abdominal cavity, ovarian cyst = pelvic cavity.

1. Ask students to identify the smaller body cavity that would be the focus of a physician’s examination given the following: a baseball pitch hitting a batter’s eye, a root canal, a deviated septum, an ear infection.

Answer: A baseball pitch hitting a batter’s eye = orbital cavity, a root canal = oral cavity, a deviated septum = nasal cavity, an ear infection = middle ear cavities.

Learning Outcome 3: Name and identify the locations of the membranes associated with the thoracic and abdominopelvic cavities.

1. Lecture Suggestions and Guidelines
2. Distinguish between the parietal and visceral membranes.
3. Application Question(s)
4. Ask students to imagine gently punching their fist into a partially inflated balloon, and then ask the students to discuss the similarities between this and the arrangement of the membranes and their associated cavity.

Answer: The part of the balloon that is against the skin of the fist is the visceral membrane. The outer surface of the balloon is the parietal membrane. The cavity between these two membranes is represented by the air within the balloon.

1. Critical Thinking Issue(s)
2. How would an infection that causes excess fluid within the pericardial cavity affect function of the heart?

Answer: The heart’s movement would be restricted, and therefore, it would not be able to pump blood as effectively.

Learning Outcome 4: Name the major organ systems, and list the organs associated with each.

1. Lecture Suggestions and Guidelines
2. Identify the eleven body organ systems.
3. Distinguish the body organ system that contain the following organs
4. Application Question(s)
5. Provide the students with an illustration of the human body. Ask them to label each organ system and to identify as many organs as possible within each of those systems.

Answer: Illustrations should include identification of the organs in the integumentary system, skeletal system, muscular system, nervous system, endocrine system, cardiovascular system, lymphatic system, respiratory system, digestive system, urinary system, and reproductive system.

Learning Outcome 5: Describe the general functions of each organ system.

1. Lecture Suggestions and Guidelines
2. Discuss how each system includes a set of interrelated organs that work together.
3. Describe the organ system involved with each of the following functions: body covering, support and movement, transport, absorption, excretion, and reproduction.
4. Application Question(s)
5. Pick a body system and explain how malnourishment could affect its function.

Answer: Answers will vary. An example would be not getting the required nutrients in the diet could result in muscle weakness because there would be less proteins to enable the muscle to contract. Another example would be that malnourishment would result in less hemoglobin in red blood cells, so less oxygen being carried to the body’s cells.

1. Critical Thinking Issue(s)
2. Which major body functions are served by more than one organ system? Name the functions that they serve.

Answer: Support and movement - skeletal and muscular systems; integration and coordination - nervous and endocrine systems; transport - cardiovascular and lymphatic systems; absorption and excretion - digestive, respiratory, and urinary systems.

## 1.7 Anatomical Terminology

Learning Outcome 1: Properly use the terms that describe relative positions, body sections, and body regions.

1. Lecture Suggestions and Guidelines
2. Introduce students to the correct anatomical position.
3. Discuss terms of relative position to describe the location of one body part with respect to another.
4. Describe the three major body sections or planes.
5. Describe the anterior and posterior body regions, and give examples using an anatomical term as well as a common term. For example, arm = brachial region; carpal = wrist region, etc.
6. Application Question(s)
7. Apply the student’s knowledge of directional terms learned in this chapter to situations outside the human body.

Answer: Responses will vary, but attempt to describe relative positions of items in a cupboard, relative positions of student seating in the classroom, relative positions of the working parts found inside a clock, etc.

1. Ask students to apply their knowledge of the major body cavities by drawing and identifying, on an illustration of the human body, the nine abdominal regions.

Answer: Responses should include drawings and identification of the right hypochondriac region, epigastric region, left hypochondriac region, right lumbar region, umbilical region, left lumbar region, right iliac region, hypogastric region, and left iliac region.

1. Critical Thinking Issue(s)
2. By utilizing the directional terms learned in this chapter, ask students to choose a body part and to describe its relative position.

Answer: Students may use relative directional terms, body planes, abdominal regions, and terms used to describe body regions. Remind them of the importance of maintaining the correct anatomical position before they begin to use directional terms.

1. If a patient enters the emergency room with a gunshot wound to the epigastric region, which visceral organs may have been traumatized?

Answer: Damage to the liver, stomach, transverse colon, gall bladder, pancreas, kidneys, and associated blood vessels would be of major concern.