Levels of Organization

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Introduction to Human Anatomy and Physiology

OUTLINE

Anatomy and Physiology Overview Organization Levels of the Body Essentials for Life Homeostasis Positive and Negative Feedback Organization of the Body **Body Cavities and Membranes Organ Systems** Anatomic Planes **Directional Terms Abdominal Regions Body Regions** Summary Learning Goals **Critical Thinking Questions** Websites **Review Questions**

OBJECTIVES

After studying this chapter, readers should be able to:

- 1. Define anatomy and physiology.
- 2. Name the components that make up the organization levels of the body.
- **3.** Describe the major essentials of life.
- **4.** Define *homeostasis* and describe its importance to survival.
- 5. Describe the major body cavities.
- 6. List the systems of the body and give the organs in each system.
- 7. Describe directions and planes of the body.
- 8. Discuss the membranes near the heart, lungs, and abdominal cavity.
- 9. List the nine abdominal regions.

10. Compare positive and negative feedback mechanisms.

KEY TERMS

Anatomists: Experts or students in the study of anatomy. **Anatomy:** The study of body parts, forms, and structures. **Appendicular:** Relating to the upper and lower limbs (the arms and legs).

Atoms: The smallest particles of an element that have the element's properties.

Axial: Relating to the head, neck, and trunk.

Cell: The functional and structural unit of life.

Homeostasis: The maintenance of a relatively constant internal environment in the body.

Homeostatic mechanisms: Effectors, receptors, and the body's set point, which act together to maintain homeostasis.

Mediastinum: The organs and tissues of the thoracic cavity that form a septum between the lungs.

Metabolism: The cellular chemical reactions that break down and build up substances.

Molecules: Particles made up of two or more joined atoms.

Organ systems: Groups of organs coordinated to carry out specialized functions.

Organelles: Structures within cells that have specialized functions.

Organism: An individual living thing.

Organs: Structures consisting of groups of tissues with specialized functions.

Parietal: Relating to the wall of a cavity.

Peritoneal membranes: Smooth, transparent membranes that line the abdominal cavity and contain the internal organs of the abdomen.

KEY TERMS CONTINUED

Physiology: The study of body functions.
Tissues: Groups of similar cells that perform specialized functions.
Viscera: Organs in the body cavities, especially in the abdomen.
Visceral: Relating to the membranous covering of an organ.

The study of anatomy and physiology is vital for all health professionals. It involves many different areas of science to understand how the human body works as well as how it is structured. The study of anatomy and physiology provides answers to many questions about the functions of the body in both health and disease. As a result of this understanding, it is possible to see what happens to the body when it is injured, stressed, or contracts a disease or infection. It is important that all allied health students become familiar with the terminology used in anatomy and physiology. In this chapter, the focus is on a complete introduction to anatomy and physiology.

Anatomy and Physiology Overview

The structures and functions of the human body are closely related. **Anatomy** is the study of the structure of body parts and how they are organized. **Physiology** is the study of how body parts work. Every body part functions to assist the human body in different ways. It is not easy to separate the topics of anatomy and physiology because the structures of body parts are so closely associated with their functions. Each part has its own unique substructures that allow it to perform its needed functions.

The human body has been studied for hundreds of years. Even though its inner workings are well understood, new discoveries are still being made even today. As recently as 2003, the human genome (instructions that allow the body to operate) was deciphered for the first time. There are more than 20,000 genes in the human body, so this substantial discovery took many years to complete. Researchers frequently discover new information about physiology, particularly at the molecular level, but basic human anatomy changes very slowly as time progresses.

Organization Levels of the Body

Every body structure is made up of smaller structures, which are, likewise, made up of even smaller components. Chemicals compose every material found in the human body. They contain microscopic **atoms** combined into structures known as **molecules**. Many molecules may be combined into macromolecules. These macromolecules, in turn, form **organelles**, which help to complete the intended functions of a **cell**, the basic unit of both structure and function in the human body.





Source: Adapted from Shier, D. N., Butler, J. L., and Lewis, R. Hole's Essentials of Human Anatomy & Physiology, Tenth edition. McGraw Hill Higher Education, 2009.

Cells are actually microscopic structures that may be quite different in size, shape and function. Cells are grouped together to form **tissues**, which in turn, are grouped together to form **organs**. Groups of similarly functioning organs form **organ systems**, which then combine to form a living **organism** (see **Figure 1–1**). Body parts are organized into different levels of complexity, including the atomic level, molecular level, and cellular level. Atoms are the most simple in structure, with complexity increasing in molecules, organelles, tissues, and organs.

CHECK YOUR KNOWLEDGE

- 1. What is an organism?
- Explain the organization levels of the body.

Essentials for Life

Humans and other animals share many similar traits. We require specific nutrients in order to remain healthy, and to grow and develop normally. Energy is gained from the breakdown, digestion, absorption, and assimilation of food. Absorbed nutrients move throughout the body's circulation. Respiration brings in oxygen that works with nutrients to grow and repair body parts. The unusable parts of these processes are then excreted as waste. The body's **metabolism** controls all of these processes.

Human beings need several substances for survival: food, water, oxygen, pressure, and heat in specific quantities and with specific qualities. Food provides nutrients for energy, growth, and regulation of the chemical reactions in the body. Some of these chemicals are used as energy sources or supply the raw materials needed for building new living matter. Others help to regulate vital chemical reactions. Water is required for metabolic processes and makes up most of the body's actual structure, transporting substances and regulating temperature.

Oxygen is a gas that drives metabolic processes by releasing energy from food that is consumed and bringing nutrients to cells throughout the body. Pressure, specifically atmospheric pressure, is essential for breathing. Blood pressure is a form of hydrostatic pressure that forces the blood through the veins and arteries. Heat is produced as energy from metabolic reactions, influencing their speed. Body heat is measured as temperature.

Vital signs are observable measurements taken to determine the condition of a patient. They include temperature, blood pressure, pulse rate, and respiration rate. Other measurements that are taken to verify



FIGURE 1-2 Homeostatic mechanism

the patient's condition include reflexes, the pupils of the eyes, and brain waves.

Homeostasis

The internal environment of the human body must stay relatively stable in order for the person to survive. **Homeostasis** is a term that describes a stable internal body environment. It requires concentrations of nutrients, oxygen, and water to be normal and balanced, and for heat and pressure to be regulated at tolerable levels. **Homeostatic mechanisms** regulate the body, and include:

- *Effectors* (which cause responses that alter conditions)
- *Receptors* (which provide information about internal stimuli)
- Set point (which gives particular values for specific functions [see Figure 1-2]). The set point for body temperature, for example, is 98.6 degrees Fahrenheit (37 degrees Celsius). Another set point is the one for normal adult blood pressure, which is ideally below 120 (systolic) over 80 (diastolic).

CHECK YOUR KNOWLEDGE

- 1. Why is homeostasis essential to survival?
- 2. Describe two homeostatic mechanisms.

Positive and Negative Feedback

The body utilizes positive and negative feedback systems to regulate various activities. A positive feedback mechanism is one that makes conditions move away from the normal state to stimulate further changes. They are usually short-lived and extremely specific actions. A negative feedback mechanism is one that prevents the correction of deviations from doing too much (which could possibly harm the body). Most of the feedback mechanisms of the human body use negative feedback. Examples of positive feedback include: the onset of contractions prior to childbirth, the process of blood clotting, lactation, the secretion of estrogen during the follicular phase of menstruation, and the generation of nerve signals. Examples of negative feedback include: blood pressure regulation, erythropoiesis (the production of red blood cells), body temperature regulation, and control of blood glucose levels.

Organization of the Body

The human body is composed of distinct body parts, cavities, membranes, and organ systems. These include various body systems, which will be discussed in greater detail in the following sections.

Body Cavities and Membranes

The human body contains several cavities, and can be divided into the axial portion and the appendicular

portion. The **axial** portion of the human body includes the head, neck, and trunk. The **appendicular** portion of the human body includes the upper and lower limbs. The axial portion includes the brain (housed inside the cranial cavity), spinal cord (housed within the vertebrae, inside the vertebral canal), thoracic cavity (inside the chest), and abdominopelvic cavity (inside the abdomen and pelvic areas).

The head contains the oral cavity (housing the teeth and tongue), nasal cavity (inside the nose, divided into right and left portions), sinuses, orbital cavities (housing the eyes and related structures), and middle ear cavities (housing the middle ear bones).

The **viscera** are the internal organs within the thoracic and abdominopelvic cavities. These cavities are separated by the diaphragm, a muscle essential for breathing. Above them, the **mediastinum** separates the thoracic cavity into right and left halves, and contains the heart, trachea, esophagus, and thymus gland. The lungs lie outside the mediastinum.

The viscera of the abdominal cavity include the liver, stomach, gallbladder, spleen, kidneys, and the majority of the small and large intestines. The pelvic cavity is bordered by the hipbones, and contains the lower part of the large intestine, the urinary bladder, and internal reproductive organs. The major cavities of the body are shown in **Figures 1–3A and 1–3B**.

The inner thoracic and abdominopelvic cavities are lined with connective membranes. For example,







FIGURE 1–4 Transverse section through the thorax of the serous membranes associated with the lungs and heart (superior view)

the heart is surrounded by pericardial membranes, including a thin visceral pericardium over the heart's surface. This is separated by a small amount of watery, serous pericardial fluid from the parietal pericardium, which has a lubricating function. All of these structures are housed in the pericardial cavity. The lungs are lined with the **parietal** pleura, and actually covered by the **visceral** pleura.

There is no actual space between these pleural membranes, but the region between them is still referred to as the pleural cavity. The abdominopelvic cavity is lined with **peritoneal membranes**, including the parietal peritoneum lining the walls and the visceral peritoneum covering each organ. Between these membranes, the potential space is called the peritoneal cavity (see **Figures 1–4 and 1–5**).

CHECK YOUR KNOWLEDGE

- 1. List the cavities of the head.
- 2. Which body cavity will be opened if an incision is made just inferior to the diaphragm?

Organ Systems

In each organ system of the human body, organs work together to maintain homeostasis. These organ systems include the integumentary, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, digestive, respiratory, urinary, and reproductive systems (see **Figure 1–6**).

FIGURE 1–5 Transverse section through the abdomen (superior view)

Integumentary System

The integumentary system includes the skin, hair, nails, sebaceous (oil) glands, and sweat glands. It functions to protect the underlying tissues of the body, assist in the regulation of body temperature, contain various sensory receptors, and manufacture certain substances.

Skeletal System

The skeletal system supports and protects the soft tissues of the body, and helps the body move. It consists of bones, which are bound together by ligaments and cartilages. The skeletal system shields soft tissues and attaches to the muscles. The bones also help in blood formation and provide storage of mineral salts.

Muscular System

The muscular system works with the skeletal system in helping the body to move. Body parts are moved by muscle contraction. Posture and body heat are maintained by the muscular system. The muscular system also includes the tendons.

Nervous System

The nervous and endocrine systems control and coordinate various organ functions, helping to maintain homeostasis. The nervous system consists of the brain, spinal cord, nerves, and sensory organs. *Nerve impulses* are electrochemical signals used by



FIGURE 1-6 Systems of the body

nerve cells to communicate with each other and with the glands and muscles of the body. Certain nerve cells (called *sensory receptors*) detect internal and external changes that affect the body. Other nerve cells interpret and respond to these stimuli. Additional nerve cells carry impulses from the brain or spinal cord to the glands and muscles. These nerves are able to stimulate the muscles to contract and cause the glands to secrete their products.

Endocrine System

The endocrine system consists of hormonesecreting glands. Hormones affect specific target cells, altering their metabolism. Hormones have a relatively long duration of action compared to nerve impulses. The organs of the endocrine system include the hypothalamus (in the brain), pituitary gland, pineal gland, thyroid gland, parathyroid glands, adrenal glands, pancreas, and thymus. Other organs with endocrine function include the ovaries and testes, which also are part of the reproductive system.

Cardiovascular System

The cardiovascular system includes the heart, blood, arteries, veins, and capillaries. The heart muscle pumps blood through the arteries, transporting gases, hormones, nutrients, and wastes. Blood returns to the heart via the veins. Oxygen is carried from the lungs to the body, and nutrients are carried from the digestive system. The blood also transports biochemicals required for metabolism. Wastes are carried in the blood from body cells to the excretory organs.

Lymphatic System

The lymphatic system is composed of the lymphatic vessels, lymph nodes, thymus, spleen, and lymph fluid. It works with the cardiovascular system, transporting tissue fluid back into the bloodstream. It also carries specific fats from digestive organs into the bloodstream. Lymphatic cells (lymphocytes) defend the body against infection.

Digestive System

The digestive system takes in food from outside the body, breaking down and absorbing nutrients. It then excretes wastes from its various processes. The digestive system also produces certain hormones and works in conjunction with the endocrine system. The structures of the digestive system include the mouth, teeth, salivary glands, tongue, esophagus, stomach, liver, gallbladder, pancreas, small intestine, large intestine, rectum, and anus. The pharynx is part of both the digestive and respiratory systems.

Respiratory System

The respiratory system takes in and expels air, exchanging oxygen and carbon dioxide via the lungs and bloodstream. The structures of the respiratory system include the nose, nasal cavity, larynx, trachea, bronchi, and lungs. Again, the pharynx is part of both the respiratory and digestive systems.

Urinary System

The urinary system functions to remove liquid wastes from the body. It consists of the kidneys, ureters, urinary bladder, and urethra – it is through the urethra that urine is expelled. In females, the urethra is located just above the vagina, and in males, it runs through the penis. The kidneys filter wastes from the blood and maintain electrolyte concentrations. The urinary bladder stores urine and the urethra carries it outside of the body.

Reproductive System

The reproductive system in females consists of the ovaries, uterine tubes, uterus, vagina, clitoris, and vulva. The female sex cells are called *oocytes* or *eggs*. They are fertilized by male sex cells (*sperm* or *spermatozoa*). When a female is impregnated, the embryo normally develops within the uterus.

The male reproductive system includes the scrotum, testes, epididymides, ductus deferentia, seminal vesicles, prostate gland, bulbourethral glands, penis, and urethra.

Reproduction is the process of producing offspring. As embryonic cells divide, they grow and produce new cells, which continue the process.

CHECK YOUR KNOWLEDGE

- **1.** Describe the general functions of the digestive system.
- 2. List the organs of the respiratory system.

Anatomic Planes

The body can be visually divided into specific areas, called *planes*. They "divide" the body at particular angles, in particular directions (see **Figure 1–7 and Table 1–1**).



FIGURE 1-7 Anatomic planes

Directional Terms

Directional terms used in the study of anatomy include words that describe relative positions of body parts as well as imaginary anatomical divisions. The term *anatomical position* describes the body standing erect, facing forward, with the arms held to the sides of the body, palms of the hands facing forward. When the terms *right* and *left* are used, they refer to those specific sides of the body when it is in the anatomical position. Important directional terms used in anatomy are listed in **Table 1–2**.

Abdominal Regions

Anatomists have divided the abdomen and pelvis into nine imaginary regions. These regions are helpful in identifying the location of particular abdominal organs. They are also useful for describing the location of abdominal pain. **Figure 1–8**A shows the nine abdominal regions, identified from the left to the right, and moving from top to bottom one row at a time. The abdomen may also be divided into four quadrants, as shown in **Figure 1–8**B. **Table 1–3** explains each abdominal region in greater detail.

Table 1–1 Anatomic Planes		
Anatomic Plane	Meaning	
Coronal (frontal)	A plane dividing the body into anterior and posterior portions.	
Sagittal	A plane dividing the body lengthwise into right and left portions. A median (midsagittal) plane passes along the midline, dividing the body into equal parts. A parasagittal plane divides the body similarly, but is lateral to the midline.	
Transverse (horizontal)	A plane that divides the body into superior and inferior portions.	

Table 1–2 Directional Terms				
Directional Term	Meaning	Example		
Inferior	A body part is below another body part, or is located toward the feet	The neck is inferior to the head.		
Superior	A body part is above another body part, or is located toward the head	The thoracic cavity is superior to the abdominopelvic cavity.		
Anterior (ventral)	Toward the front	The eyes are anterior to the brain.		
Posterior (dorsal)	Toward the back	The pharynx is posterior to the mouth.		
Lateral	Toward the side as related to the midline of the body	The ears are lateral to the eyes.		
Bilateral	Refers to paired structures, with one on each side of the body	The lungs are bilateral.		
Contralateral	Refers to structures on the opposite side	If the right leg is injured, the patient may have to put most of his or her weight on the contralateral leg instead of using both equally.		
lpsilateral	Refers to structures on the same side	The right kidney and right lung are ipsilateral.		
Medial	Refers to an imaginary midline that divides the body into left and right halves	The nose is medial (closer to the body's midline) to the eyes.		
Distal	A body part is <i>farther</i> from the point of attachment to the trunk than another part	The fingers are distal to the wrist.		
Proximal	A body part is <i>closer</i> to the point of attachment to the trunk than another part	The elbow is proximal to the wrist.		
Deep	A body part is more <i>internal</i> than another part	The dermis is the deep layer of the skin.		
Superficial	A body part is more <i>external</i> than another part	The epidermis is the superficial layer of the skin.		



FIGURE 1–8A Abdominal regions

Source: Adapted from Shier, D. N., Butler, J. L., and Lewis, R. Hole's Essentials of Human Anatomy & Physiology, Tenth edition. McGraw Hill Higher Education, 2009.



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Table 1–3 Abdominopelvic Regions		
Region	Meaning	
Left hypochondriac	The upper left abdominal region, under the angle of the ribs and diaphragm; this region contains a small portion of the stomach, a portion of the large intestine, and the spleen.	
Epigastric	The upper middle abdominal region, between the left and right hypochondriac regions and under the cartilage of the lower ribs; this region contains parts of the liver and most of the stomach.	
Right hypochondriac	The upper right abdominal region, under the angle of the ribs and diaphragm; this region contains the right lobe of the liver and the gallbladder.	
Left lumbar	The middle left abdominal region, beneath the left hypochondriac region; this region contains part of the small intestine and part of the colon.	
Umbilical	The middle center portion of the abdomen, where the naval is located; it lies between the left and right lumbar regions and contains part of the transverse colon, small intestine, and pancreas.	
Right lumbar	The middle right abdominal region, beneath the right hypochondriac region; this region contains parts of the small and large intestines.	
Left iliac (inguinal)	The lower left abdominal region, beneath the left lumbar region; this region contains parts of the colon, small intestine, and left ovary (in women).	
Hypogastric	The lower middle abdominal region, between the left and right iliac regions; this region contains the urinary bladder, parts of the small intestine, and uterus (in women).	
Right iliac (inguinal)	The lower right abdominal region, beneath the right lumbar region; this region contains parts of the small intestine, cecum, appendix, and right ovary (in women).	

Body Regions

The remainder of the body is classified into various regions that clinically describe them. For example, carpal tunnel syndrome refers to the carpal areathe wrist-where acute pain can occur from the development of this syndrome. The most common body regions are listed in Table 1–4.



- 1. Name the nine abdominopelvic regions.
- 2. Describe the anatomic planes of the body.

Summary

Anatomy is the science of body structures and the relationships among these structures. Physiology is the science of body functions. The human body consists of six levels of structural organization, the chemical, cellular, tissue, organ, system, and organism levels. Certain processes that distinguish life processes from nonliving things include metabolism, responsiveness, movement, growth, differentiation, and reproduction.

The abdomen and pelvis are divided into nine abdominopelvic regions as follows: left hypochondriac, epigastric, right hypochondriac, left lumbar, umbilical, right lumbar, left iliac, hypogastric, and right iliac. Body cavities are mainly divided into two sections: the dorsal and ventral cavities. The dorsal cavity is subdivided into the cranial cavity (which contains the brain) and the vertebral canal (which contains the spinal cord). The meninges are protective tissues that line the dorsal body cavity.

The ventral body cavity is subdivided by the diaphragm into a superior thoracic cavity and an inferior abdominopelvic cavity. The viscera are organs within the ventral cavity. A serous membrane lines the wall of the cavity and adheres to the viscera. The thoracic cavity is subdivided into three smaller cavities, the pericardial cavity, the mediastinum, and the pleural cavity. The body's organ systems work together to maintain homeostasis. These systems include the integumentary, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, digestive, respiratory, urinary, and reproductive systems.

LEARNING GOALS

The following learning goals correspond to the objectives at the beginning of this chapter:

- **1.** Anatomy is defined as the study of body parts, forms, and structures. Physiology is defined as the study of body functions.
- 2. The organization levels of the body include the atoms, molecules, macromolecules, organelles, cells, tissues, organs, organ systems, and the living organism.

Table 1-4 Bo	ay Regions
Region	Meaning
Abdominal	Between the thorax and pelvis
Acromial	The point of the shoulder
Antebrachial	The forearm
Antecubital	The space in front of the elbow
Axillary	The armpit
Brachial	The arm
Buccal	The cheek
Carpal	The wrist
Celiac	The abdomen
Cephalic	The head
Cervical	The neck
Costal	The ribs
Coxal	The hip
Crural	The leg
Cubital	The elbow
Digital	The finger or toe
Dorsal	The back
Femoral	The thigh
Frontal	The forehead
Genital	The reproductive organs
Gluteal	The buttocks
Inguinal	The groin (depressions of abdominal wall near thighs)

Lumbar	The loin (lower back, between ribs and pelvis)
Mammary	The breast
Mental	The chin
Nasal	The nose
Occipital	The lower posterior region of the head
Oral	The mouth
Orbital	The eye cavity
Otic	The ear
Palmar	The palm of the hand
Patellar	The front of the knee (kneecap)
Pectoral	The chest
Pedal	The foot
Pelvic	The pelvis
Perineal	The perineum; between the anus and external reproductive organs
Plantar	The sole of the foot
Popliteal	The area behind the knee
Sacral	The posterior region between the hipbones
Sternal	The anterior middle of the thorax
Sural	The calf of the leg
Tarsal	The instep of the foot
Umbilical	The naval
Vertebral	The spinal column

- **5.** The major body cavities are the cranial cavity (housing the brain), thoracic cavity (inside the chest), and abdominopelvic cavity (inside the abdomen and pelvic areas).
 - 6. The systems of the body and their organs are as follows:

Integumentary: Skin, hair, nails, sebaceous (oil) glands, sweat glands Skeletal: Bones, ligaments, cartilages Muscular: Muscles, tendons

- **3.** Essentials for life include specific nutrients such as food, water, and oxygen, as well as pressure and heat.
- **4.** Homeostasis is defined as a stable internal body environment. It requires concentrations of nutrients, oxygen, and water, as well as heat and pressure. Homeostatic mechanisms regulate the body.

Nervous: Brain, spinal cord, nerves, sensory organs

- *Endocrine:* Hypothalamus, pituitary, thyroid, parathyroid glands, pancreas, pineal gland, adrenal glands, thymus
- *Cardiovascular:* Heart, blood, arteries, veins, capillaries
- *Lymphatic:* Lymphatic vessels, lymph nodes, thymus, spleen, lymph fluid
- *Digestive:* Mouth, teeth, salivary glands, tongue, pharynx, esophagus, stomach, liver, gallbladder, pancreas, small intestine, large intestine, rectum, anus
- *Respiratory:* Nose, nasal cavity, pharynx, larynx, trachea, bronchi, lungs
- *Urinary:* Kidneys, ureters, urinary bladder, urethra, penis
- *Reproductive:* Female: ovaries, uterine tubes, uterus, vagina, clitoris, vulva; male: scrotum, testes, epididymides, ductus deferentia, seminal vesicles, prostate gland, bulbourethral glands, penis, urethra
- 7. Inferior, below another body part; superior, above another body part; anterior (ventral), toward the front; posterior (dorsal), toward the back; lateral, toward the side; bilateral, refers to paired structures; contralateral, refers to structures on opposite sides; ipsilateral, refers to structures on the same side; medial, refers to an imaginary body midline; distal, farther from the point of attachment to the trunk; proximal, closer to the point of attachment to the trunk; deep, more internal; superficial, more external. Body planes include coronal (frontal), dividing the body into anterior and posterior portions; sagittal, dividing the body lengthwise into right and left portions; and transverse (horizontal), dividing the body into superior and inferior portions.
- 8. The heart is surrounded by pericardial membranes including the visceral pericardium over the heart's surface. The lungs are lined with a membrane called the parietal pleura, and covered by a membrane called the visceral pleura. The abdominopelvic cavity is lined with peritoneal membranes. The parietal peritoneum lines its walls, and the visceral peritoneum covers each organ.
- 9. The nine abdominal regions are the left hypochondriac, epigastric, right hypochondriac, left lumbar, umbilical, right lumbar, left

iliac (inguinal), hypogastric, and right iliac (inguinal) regions.

10. A positive feedback mechanism is one that makes conditions move away from the normal state, stimulating further changes. They are usually short-lived and extremely specific actions. A negative feedback mechanism is one that prevents the correction of deviations from doing too much, which could potentially harm the body. Most of the feedback mechanisms of the human body use negative feedback.

CRITICAL THINKING QUESTIONS

- **1.** An 8-year-old boy fell off of some playground equipment and later complained of pain in his upper left abdomen, below the ribs. Which organs are located in this region?
- 2. A pregnant woman sitting in her physician's waiting room is experiencing extreme sweating. She feels very warm, as if she has a fever. Which body response system will work to reduce her symptoms?

WEBSITES

- http://home.comcast.net/~wnor/terminologyanat planes.htm
- http://web.jjay.cuny.edu/%7Eacarpi/NSC/ 14-anatomy.htm
- http://www.biology-online.org/4/1_physiological_ homeostasis.htm
- http://www.innerbody.com/htm/body.html
- http://www.merck.com/mmhe/sec01/ch001/ ch001d.html
- http://www.wisc-online.com/objects/index_tj.asp? objID=AP15505

REVIEW QUESTIONS

- **1.** The maintenance of a relatively constant internal environment in the human body is termed:
 - A. positive feedback
 - B. negative feedback
 - C. homeostasis
 - D. effector control
- 2. The lungs are to the respiratory system as the spleen is to the:
 - A. lymphatic system
 - B. cardiovascular system

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- C. digestive system
- D. urinary system
- **3**. The pituitary and thyroid glands are components of the:
 - A. respiratory system
 - B. endocrine system
 - C. lymphatic system
 - D. cardiovascular system
- **4.** Support, protection of soft tissue, mineral storage, and blood formation are functions of which system?
 - A. nervous
 - B. muscular
 - C. skeletal
 - D. integumentary
- 5. The chemical or molecular level of organization begins with _____ and forms ?
 - A. cells: tissues
 - B. molecules: atoms
 - C. organs; systems
 - D. atoms; molecules
- **6**. Which sectional plane divides the body so that the face remains intact?
 - A. midsagittal plane
 - B. coronal plane
 - C. sagittal plane
 - D. transverse plane
- **7.** Which of the following portions of the body contains the arms and legs?
 - A. ventral
 - B. appendicular
 - C. thoracic
 - D. axial
- 8. Which of the following terms indicates the front of the body?
 - A. ventral
 - B. dorsal
 - C. posterior
 - D. proximal
- **9.** Which of the following portions of the body contains the head, neck, and trunk?
 - A. thoracic
 - B. axial
 - C. ventral
 - D. appendicular

- **10.** The state in which an organism maintains a constant internal environment is called:
 - A. growth
 - B. reproduction
 - C. homeostasis
 - D. responsiveness
- **11.** A cut passing through the midline of the body that divides it into equal left and right halves is referred to as which of the following planes?
 - A. coronal
 - B. midsagittal
 - C. transverse
 - D. frontal
- **12.** Skin, hair, and nails are associated with the:
 - A. digestive system
 - B. endocrine system
 - C. lymphatic system
 - D. integumentary system
- **13.** Which of the following is lateral to the nose?
 - A. forehead
 - B. chin
 - C. eyes
 - D. chest
- **14.** The chest is ______ to the mouth.
 - A. inferior
 - B. posterior
 - C. superior
 - D. anterior
- **15**. The thoracic cavity contains the:
 - A. cranium
 - B. pelvic cavity
 - C. abdominal cavity
 - D. pericardial cavity

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