**ANSWERS TO PRACTICE QUESTIONS**

**Hole’s Human Anatomy & Physiology, 16e**

**Chapter 1**

**Practice 1.1**

**1. What factors probably stimulated an early interest in the human body?**

Factors include attempting to understand the causes of various injuries, illnesses, and the loss of function of body parts, and trying to treat these conditions.

**2. What types of activities helped promote the development of modern medical science?**

Activities include dissection of cadavers, the production of prosthetic body parts, experimentation to improve medical knowledge and techniques, and the discovery of certain chemicals in nature as treatments for specific conditions.

**3. What is the role of a hypothesis in the scientific method?**

The hypothesis is the idea or proposition being evaluated, or tested. It is formulated based on observations, and tested through experiments.

**Practice 1.2**

**1. What are the differences between anatomy and physiology?**

Anatomy is the study of body structures and relies on examination of those structures. Physiology is the study of the functions of body parts, and relies more on experimentation.

**2. Why is it difficult to separate the topics of anatomy and physiology?**

Structure is closely related to function; body parts are shaped and arranged (anatomy) in such a way that they are able to perform their functions (physiology)

**3. List several examples that illustrate how the structure of a body part makes possible its function.**

The arrangement of bones and muscles in the hand allow grasping; the heart’s muscular walls pump blood, and heart valves keep blood flowing in the proper direction; the mouth is shaped to receive food and the shapes of the teeth allow them to break down food into pieces; the tongue mixes food with saliva and prepares food particles for swallowing.

**4. How are anatomy and physiology both old and new fields?**

The fields of anatomy and physiology are ancient, but new discoveries continue in both, especially at the molecular level.

**Practice 1.3**

**1. How does the human body illustrate levels of organization?**

Larger structures are composed of smaller and smaller components. For example, the body consists of several systems, such as the cardiovascular system. The cardiovascular system consists of organs, such as the heart and blood vessels. The heart is composed of tissues, such as muscle tissue and connective tissue. Tissues consist of layers of cells, such as muscle cells and nerve cells. Cells are composed of organelles, which consist of molecules, and finally atoms.

**2. What is an organism?**

An organism is a complete unit of life. Organisms range in size from a single cell to a complex living thing like a human, which is composed of trillions of cells. Humans, as complex organisms, are composed of organ systems, organs, tissues, cells, molecules and atoms.

**3. How do body parts at different levels of organization vary in complexity?**

Typically, the higher the level of organization a structure is part of, the more complex it is. For example, a molecule is composed of 2 or more atoms; therefore a molecule is more complex than an atom. An organ system, such as the cardiovascular system, is composed of organs, such as the heart and blood vessels. Therefore, an organ system is more complex than any of its organs.

**Practice 1.4**

**1. How are cells interdependent on each other?**

Cells are specialized to make unique contributions to maintaining homeostasis. They work together as tissues, which form organs, which in turn form organ systems. Some cells detect changes in the internal environment and communicate with other cells, which then initiate responses to correct the changes. Cells that defend an organism against infection or disease, for example, contribute to the health of other cells in the organism, and of the entire organism.

**2. How is balance related to the internal environment?**

For the internal environment to be maintained constant, input must be balanced by output. Substances or conditions that are in excess (such as extra heat production) must be matched by increased elimination (such as increased heat loss). Shortages must be matched by increased intake or production.

**Practice 1.5**

**1. What is the function of metabolism in the body?**

Metabolism includes all of the physiological events that obtain, release, and use energy. It includes all of the chemical reactions that occur in cells to support life. Metabolism consists of the processes of respiration, digestion, circulation, and excretion. Respiration, for example, supplies oxygen to break down nutrients, and gets rid of carbon dioxide, a byproduct of nutrient breakdown.

**2. Which requirements of organisms does the external environment provide?**

The external environment provides water, nutrients, some heat (some is produced during metabolic reactions too), oxygen, and pressure. Atmospheric pressure is provided for humans. External hydrostatic pressure is mainly provided to water-dwelling organisms.

**3. Why is homeostasis so important to survival?**

Survival of the human organism depends on the survival of its cells. Homeostasis maintains the internal environment, in which those cells live.

**4. Describe three homeostatic mechanisms.**

Negative feedback is a common homeostatic mechanism. When a variable deviates from its set point, this mechanism activates effectors that return the variable toward its normal range. Body temperature and the level of blood glucose are body regulated by negative feedback. For example, if a person is too hot, sweating and increased blood flow to the skin return the body temperature to its normal range. A less common mechanism is positive feedback, in which a change in a variable leads to further deviation from the set point. During blood clotting, certain chemicals stimulate further blood clotting, to stop the bleeding.

**Practice 1.6**

**1. What are the viscera?**

Viscera are the organs within the thoracic and abdominopelvic cavities.

**2. Which organs occupy the thoracic cavity?**

Heart, lungs, trachea, esophagus, thymus

**The abdominal cavity?**

Stomach, liver, spleen, gallbladder, kidneys, small intestine, most of the large intestine

**The pelvic cavity?**

Terminal end of the large intestine, urinary bladder, internal reproductive organs

**3. Name the cavities of the head.**

Cranial cavity, oral cavity, nasal cavity, orbital cavities, middle ear cavities

**4. Describe the membranes associated with the thoracic cavity.**

Double-layered serous membranes line the walls of the thoracic and abdominopelvic cavities and surround each organ. The parietal layer lines the wall of the cavity, and the visceral layer surrounds an organ. Between the layers is a potential space, or cavity, filled with lubricating fluid. The pleural membranes surround the lungs, the pericardial membrane surrounds the heart, and the peritoneal membrane surrounds the abdominopelvic organs.

**5. Distinguish between the parietal and visceral peritoneum.**

The parietal peritoneum lines the inner surface of the wall of the abdominopelvic cavity, and the visceral peritoneum covers the surfaces of most abdominopelvic organs.

**6. Name the major organ systems and list the organs of each system.**

Integumentary system: skin, hair, nails, sweat and sebaceous glands

Skeletal system: bones, ligaments, cartilages

Muscular system: muscles

Nervous system: brain, spinal cord, nerves, and sense organs

Endocrine system: endocrine glands: pituitary gland, thyroid gland, parathyroid glands, adrenal glands, pancreas, ovaries, testes, pineal gland and thymus

Cardiovascular system: heart, arteries, veins, capillaries

Lymphatic system: lymph nodes, thymus, and spleen

Digestive system: mouth, teeth, tongue, pharynx, esophagus, stomach, small intestine, large intestine, salivary glands, liver, pancreas, and gallbladder

Respiratory system: nasal cavity, pharynx, larynx, trachea, bronchi, and lungs

Urinary system: kidneys, ureters, urinary bladder, and urethra

Reproductive system of male: scrotum, testes, epididymides, ductus deferentia, seminal vesicles, prostate gland, bulbourethral glands, penis, and urethra

Reproductive system of female: ovaries, uterine tubes, uterus, vagina, clitoris, and vulva

**7. Describe the general functions of each organ system.**

Integumentary system: Protects tissues, regulates body temperature, detects changes in environment via sensory receptors, and synthesizes specific chemicals, such as vitamin D

Skeletal system: Provides a framework for the body, supports and protects internal organs and soft tissues, helps with body movements, produces blood cells, and stores inorganic salts, such as calcium salts

Muscular system: Provides force to move body parts, maintains posture, and produces most of the body heat

Nervous system: Regulates and adjusts organ function for homeostasis; detects changes in the environment, receives and interprets sensory information, and responds to this information by stimulating muscles and glands

Endocrine system: Regulates and adjusts organ function for homeostasis, and communicates via hormone secretion into body fluids; each hormone alters metabolism of specific target cells

Cardiovascular system: Transports red and white blood cells, platelets, respiratory gases, nutrients, hormones, and wastes throughout the body

Lymphatic system: Defends the body against infection and disease, transports some tissue fluid back to the bloodstream, and carries large fats from the digestive system to the general circulation

Digestive system: Receives nutrients from the environment, breaks down food particles into smaller molecules that can be absorbed across cell membranes and enter body fluids, eliminates wastes, and produces hormones to regulate digestive processes

Respiratory system: Moves air into and out of the lungs, and exchanges oxygen and carbon dioxide between the lungs and the blood

Urinary system: Removes blood wastes, helps maintain water, electrolyte, and acid-base balance, produces urine, and transports urine to the outside of the body

Reproductive system of male: Produces and maintains sperm, produces hormones that develop male body type, and transfers sperm to the female reproductive tract

Reproductive system of female: Produces and maintains oocytes (eggs), produces hormones that develop female body type, receives sperm for fertilization, supports development of the embryo and fetus, functions in birth process, and nourishes infant

**Practice 1.7**

**1. Define aging.**

Aging refers to the changes in the body that occur with the passage of time.

**2. List some aging-related changes at the microscopic and whole-body levels.**

Changes at the microscopic level include decreased production of elastin and collagen proteins, diminished subcutaneous fat, which leads to skin wrinkling, increased percentage of body fat, which alters the rate of drug metabolism, decreased efficiency of DNA repair mechanisms, and decreased efficiency of energy extraction from nutrients. Whole-body changes include fading hair color, wrinkling skin, loss of effectiveness of the immune system, increased blood pressure, and slightly elevated blood glucose, which may become clinically significant.

**Practice 1.8**

**1. Describe the anatomical position.**

A person in anatomical position is standing up straight, facing forward, has upper limbs at the sides, and the palms are facing forward.

**2. Using the appropriate terms, describe the relative positions of several body parts.**

The head is superior to the neck.

The foot is inferior to the knee.

The toes are anterior to the heel.

The brain is posterior to the nose.

The great toe is medial to the smallest toe.

The thumb is lateral to the smallest finger.

The kidneys are bilateral.

The left kidney and the spleen are ipsilateral.

The left kidney and the right kidney are contralateral.

The knee is proximal to the foot.

The knee is distal to the thigh.

The skin is superficial to the subcutaneous layer.

The lens of the eye is deep to the cornea.

**3. Describe three types of body sections.**

A sagittal section divides the body into left and right portions. If the portions are equal, it is called a median or midsagittal plane. If the portions are unequal, it is called a parasagittal plane. A transverse or horizontal plane divides the body into top and bottom portions. A frontal or coronal section divides the body into front and back portions.

**4. Describe the nine regions of the abdomen.**

The epigastric region is the upper middle part of the abdominal area. The left and right hypochondriac regions lie on both sides of the epigastric region. The umbilical region is in the central part of the abdominal area. The left and right lateral (lumbar) regions lies on both sides of the umbilical region. The pubic (hypogastric) region occupies the lower middle part of the abdominal region. The left and right inguinal (iliac) regions lie along both sides of the pubic region.

**5. Explain how the names of the abdominal quadrants describe their locations.**

The umbilicus is the reference point for the abdominal quadrants. Above the umbilicus is termed “upper,” and below is termed “lower.” The sides are named anatomically as left or right.