

Chapter 1 - Introduction to Human Anatomy and Physiology

1.1 Introduction (Fig. 1.1)

- A. The earliest studies of anatomy and physiology probably dealt with treating illnesses and injuries.
- B. Early healers relied on superstitions and magic.
- C. Later, herbs were used to treat certain ailments.
- D. Eventually, the stage was set for the development of medicine with standardized terms in Greek and Latin.

1.2 Anatomy and Physiology (Fig. 1.2)

- A. Anatomy deals with the structure (morphology) of the body and its parts.
- B. Physiology studies the functions of these parts.
- C. The two disciplines are closely interrelated because the functional role of a part depends on how it is constructed.
- D. Anatomists rely on observation while physiologists employ experimentation.
- E. It is more common to discover new information about physiology but anatomical discoveries are being made as well.

1.3 Levels of Organization (Fig. 1.3)

- A. The human body is the sum of its parts and these parts can be studied at a variety of levels of organization.
 - 1. Atoms are the simplest level.
 - 2. Two or more atoms comprise a molecule.
 - 3. Macromolecules are large, biologically important molecules inside cells.
 - 4. Organelles are aggregates of macromolecules used to carry out a specific function in the cell.
 - 5. Cells are the basic living unit.
 - 6. Tissues are groups of cells functioning together.
 - 7. Groups of tissues form organs.
 - 8. Groups of organs function together as organ systems.
 - 9. Organ systems functioning together make up an organism.
- B. The chapters that follow consider human structure and function at these various levels.

1.4 Characteristics of Life (Table 1.1)

- A. Fundamental characteristics of life are traits shared by all organisms.
- B. Characteristics of life include:
 - 1. Movement (internal or gross)
 - 2. Responsiveness (reaction to internal or external change)
 - 3. Growth (increase in size without change in shape)
 - 4. Reproduction (new organisms or new cells)
 - 5. Respiration (use of oxygen; removal of CO₂)
 - 6. Digestion (breakdown of food into simpler forms)
 - 7. Absorption (movement of substances through membranes and into fluids)
 - 8. Circulation (movement within body fluids)
 - 9. Assimilation (changing nutrients into chemically different forms)
 - 10. Excretion (removal of metabolic wastes)
- C. The total of all the chemical reactions occurring within the body to maintain these characteristics constitutes metabolism.

1.5 Maintenance of Life

- A. Requirements of Organisms
 - 1. Life depends on the availability of the following:
 - a. Water (required for metabolic reactions, for transport of substances, for temperature regulation)

- b. Food (nutrients needed to supply energy and raw materials for building new living matter)
 - c. Oxygen (used in releasing energy from nutrients)
 - d. Heat (a byproduct of metabolism; its presence governs the rate at which reactions occur)
 - e. Pressure (force required to facilitate movement of air or fluids)
 - 2. Both the quality and quantity of these factors are important.
- B. Homeostasis (Figs. 1.4 -1.7)
 - 1. Maintenance of a stable internal environment is called homeostasis.
 - 2. Homeostasis is regulated through control systems, which have receptors, a set point and effectors in common. Examples include:
 - a. Homeostatic mechanisms regulate body temperature in a manner similar to the functioning of a home heating thermostat. (Fig. 1.6 – 1.7)
 - b. Another homeostatic mechanism employs pressure-sensitive receptors to regulate blood pressure.
 - 3. Most of the body's homeostatic controls involve negative feedback mechanisms, but there a few examples of positive feed back systems that operate for short periods of time in the human body.
 - 4. Each individual uses homeostatic mechanisms to keep body levels within a normal range; normal ranges can vary from one individual to the next.

1.6 Organization of the Human Body

- A. Major features of the human body include its cavities, membranes, and organ systems.
- B. Body Cavities (Figs. 1.8-1.9)
 - 1. The body can be divided into an appendicular portion (upper and lower limbs) and an axial portion (head, neck, and trunk), which includes a dorsal and a ventral cavity. Organs within these cavities are called viscera.
 - a. The dorsal cavity can be divided into the cranial cavity and vertebral canal.
 - b. The ventral cavity is made up of a thoracic cavity and an abdominopelvic cavity, separated by the diaphragm.
 - i. The mediastinum divides the thorax into right and left halves.
 - ii. The abdominopelvic cavity can be divided into the abdominal cavity and the pelvic cavity.
 - c. Smaller cavities within the head include the oral cavity, nasal cavity, orbital cavities, and middle ear cavities.
- C. Thoracic and Abdominopelvic Membranes (Figs. 1.10-1.11)
 - 1. The thoracic cavity is lined with pleura; the parietal pleura lines the cavities while the visceral pleura covers the lungs. A thin layer of serous fluid separates the two layers.
 - 2. The heart is surrounded by pericardium. The visceral pericardium covers the heart and the parietal pericardium makes up an outer sac. Serous fluid separates the two layers.
 - 3. Peritoneum lines the abdominopelvic cavity; a parietal peritoneum lines the wall while visceral peritoneum covers the organs.
- D. Organ Systems (Fig. 1.12)
 - 1. Body Covering
 - a. The integumentary system, including skin, hair, nails, and various glands, covers the body, senses changes outside the body, and helps regulate body temperature.
 - 2. Support and Movement
 - a. The skeletal system, made up of bones and ligaments, supports, protects, provides frameworks, stores inorganic salts, and houses blood-forming

- tissues.
- b. The muscular system consists of the muscles that provide body movement, posture, and body heat.
- 3. Integration and Coordination
 - a. The nervous system consists of the brain, spinal cord, nerves, and sense organs. It integrates information incoming from receptors and sends impulses to muscles and glands.
 - b. The endocrine system, including all of the glands that secrete hormones. Hormones circulate in the body fluids and act on specific target cells to help to integrate and control metabolic functions.
- 4. Transport
 - a. The cardiovascular system, made up of the heart and blood vessels, distributes oxygen and nutrients throughout the body while removing wastes from the cells.
 - b. The lymphatic system, consisting of lymphatic vessels, lymph nodes, thymus, and spleen, drains excess tissue fluid and includes cells of immunity.
- 5. Absorption and Excretion
 - a. The digestive system, made up of the mouth, esophagus, stomach, intestines and accessory organs, receives, breaks down, and absorbs nutrients.
 - b. The respiratory system exchanges gases between the blood and air and is made up of the lungs and passageways for air.
 - c. The urinary system, consisting of the kidneys, ureters, bladder, and urethra, removes wastes from the blood and helps to maintain water and electrolyte balance.
- 6. Reproduction
 - a. The reproductive system produces new organisms.
 - i. The male reproductive system consists of the testes, accessory organs, and vessels that conduct sperm to the penis.
 - ii. The female reproductive system consists of ovaries, uterine tubes, uterus, vagina, and external genitalia. The female reproductive system also houses the developing offspring.

1.7 Anatomical Terminology

- A. Relative Positions (Fig. 1.13)
 - 1. Terms of relative position are used to describe the location of a part relative to another part.
 - 2. Terms of relative position include: superior, inferior, anterior, posterior, medial, lateral, bilateral, ipsilateral, contralateral, proximal, distal, superficial (peripheral), and deep.
- B. Body Sections (Figs. 1.14-1.15)
 - 1. A sagittal section divides the body into right and left portions.
 - 2. A transverse section divides the body into superior and inferior portions.
 - 3. A coronal section divides the body into anterior and posterior sections.
 - 4. Sometimes a cross section, oblique section, or longitudinal section will be made through a cylindrical organ.
- C. Body Regions (Figs. 1.16-1.17)
 - 1. The abdominal area can be divided into nine regions.