The Human Body: An Orientation Outline

1.1 Form (anatomy) determines function (physiology) (pp. 1–3; Fig. 1.3)

A. Anatomy is the study of the structure of body parts and their relationships to each other, and physiology is the study of the function of body parts. (p. 1)

B. Topics of Anatomy (p. 2)

1. Gross (macroscopic) anatomy is the study of structures large enough to be seen with the naked eye.
   a. Regional anatomy is the study of all body structures in a given body region.
   b. Systemic anatomy is the study of all structures in a body system.
   c. Surface anatomy is the study of internal body structures as they relate to the overlying skin.
2. Microscopic anatomy is the study of structures that are too small to be seen with the naked eye.
   a. Cytology is the study of individual cells.
   b. Histology is the study of tissues.
3. Developmental anatomy is the study of the change in body structures over the course of a lifetime; embryology focuses on development that occurs before birth.
4. Specialized Branches of Anatomy
   a. Pathological anatomy is the study of structural changes associated with disease.
   b. Radiographic anatomy is the study of internal structures using specialized visualization techniques.
   c. Molecular biology is the study of biological molecules.

C. Topics of Physiology (pp. 2–3)

1. There are several subdivisions of physiology, most of which consider the function of specific organ systems, and often focus on cellular and molecular events.

D. Complementarity of Structure and Function (p. 3)

1. The principle of complementarity of structure and function is based on the fact that what a structure can do is related to its form.

1.2 The body's organization ranges from atoms to the entire organism (pp. 3–4; Fig. 1.1)

A. The chemical level is the simplest level of organization. (p. 3; Fig. 1.1)

1. Atoms, tiny building blocks of matter, combine to form molecules.
2. Molecules combine in specific ways to form organelles, which are the basic unit of living cells.

B. The cellular level is the smallest unit of life, and varies widely in size and shape according to the cells' function. (p. 3; Fig. 1.1)

C. The tissue level is groups of cells having a common function. (p. 3; Fig. 1.1)

D. The organ level is made up of discrete structures that are composed of at least two groups of tissues that work together to perform a specific function in the body. (p. 4; Fig. 1.1)

E. The organ system level is a group of organs that work closely together to accomplish a specific purpose (p. 4; Fig. 1.1).
F. The organismal level is the total of all structures working together to promote life (p. 4; Fig. 1.1).

1.3 What are the requirements for life? (pp. 4–8; Figs. 1.2–3)

A. Necessary Life Functions (p. 5; Fig. 1.2)
1. Maintaining boundaries allows an organism to maintain separate internal and external environments or separate internal chemical environments.
2. Movement allows the organism to travel through the environment, and allows transport of molecules within the organism.
3. Responsiveness, or irritability, is the ability to detect changes in the internal or external environment and respond to them.
4. Digestion is the process of breaking down food into molecules that are usable by the body.
5. Metabolism includes all chemical reactions that occur in the body.
6. Excretion is the process of removing wastes.
7. Reproduction is the process of producing more cells or organisms.
8. Growth is an increase in size in body parts or the whole organism.

B. Survival Needs (p. 8)
1. Nutrients are consumed chemical substances that are used for energy and cell building.
2. Oxygen is required by the chemical reactions that release energy from foods.
3. Water, the most abundant chemical substance in the body, provides an environment for chemical reactions and a fluid medium for secretions and excretions.
4. Normal body temperature is required for the chemical reactions of the body to occur at the proper rate.
5. Atmospheric pressure must be within an appropriate range so that proper gas exchange occurs in the lungs.

1.4 Homeostasis is maintained by negative feedback (pp. 8–11; Figs. 1.4–1.6)

A. Homeostasis is the ability of the body to maintain a relatively constant internal environment, regardless of environmental changes (pp. 8–9).

B. Homeostatic Control (pp. 9–11; Figs. 1.4–1.6)
1. Homeostasis is controlled through communication systems involving various components:
a. The regulated factor or event is called the variable.
b. Receptors monitor changes in the environment and send some kind of signal to a control center.
c. The control center is a structure that determines the set point for a variable, analyzes input, and coordinates an appropriate response by signaling an effector.
d. An effector is a structure that carries out the response directed by the control center.
e. The response from the effector feeds back to either reduce or amplify the effect of the stimulus.
2. Negative Feedback Mechanisms

a. Most homeostatic control mechanisms are negative feedback mechanisms that reduce or stop the effect of the stimulus, preventing severe changes within the body.

3. Positive Feedback Mechanisms
   a. Positive feedback mechanisms enhance the effect of the stimulus, resulting in an amplifying effect of the stimulus, creating cascades that are used to control events that do not require continuous adjustment.
4. Homeostatic imbalances often result in disease.

1.5 Anatomical terms describe body directions, regions, and planes (pp. 11–17; Figs. 1.7–1.8; Table 1.1)

A. Anatomical Position and Directional Terms (pp. 12; Table 1.1)
   1. Anatomical position is a position in which the body is erect, palms face forward, and thumbs point away from the body.
      a. Anatomical position is always assumed, regardless of the actual body position and, in anatomical position, right and left refer to the right and left sides of the person viewed.
   2. Directional terms are used to explain exactly where one body part is in relation to another.

B. Regional Terms (pp. 12–13,16; Fig. 1.7)
   1. There are two fundamental divisions of the body: the axial region, consisting of the head, neck, and trunk, and the appendicular region, consisting of the appendages—the upper and lower limbs.
   2. Regional terms designate specific areas within the axial and appendicular divisions.

C. Body Planes and Sections (p. 16; Fig. 1.8)
   1. Body planes are flat surfaces that lie at right angles to each other.
      a. Sagittal planes are vertical planes that separate the body into right and left parts.
         i. A sagittal plane lying directly on the midline of the body is midsagittal, while any sagittal plane off the midline is parasagittal.
      b. Frontal planes are vertical planes that separate the body into anterior and posterior parts.
      c. Transverse, or horizontal, planes are planes that run horizontally from right to left, and divide the body into superior and inferior parts.
   2. Sections are cuts made along or between specific planes, and are used to show different aspects of anatomy.

1.6 Many internal organs lie in membrane-lined body cavities (pp. 17–20; Figs. 1.9–1.12)

A. Body cavities are spaces within the body that are closed to the outside and protect the internal organs.

B. The dorsal body cavity is the space that houses the central nervous system, and has two subdivisions: the cranial cavity, which houses the brain, and the vertebral cavity, which houses the spinal cord.

C. The ventral body cavity is anterior to and larger than the dorsal cavity and has two main subdivisions: the thoracic cavity and the abdominopelvic cavity. (pp. 18–19; Figs. 1.9–12)
   1. The thoracic cavity is a superior division of the ventral cavity that is subdivided into the pleural cavities that surround each lung, and the medial mediastinum, which

includes the pericardial cavity surrounding the heart, and other midline thoracic structures.

2. The abdominopelvic cavity is separated from the thoracic cavity by the diaphragm and consists of two regions: the superior abdominal region contains digestive structures, spleen, and other organs; and the inferior pelvic cavity contains urinary and reproductive structures, and the rectum.
3. Serous membranes within the ventral body cavity are double-layered membranes that cover the inner walls of the ventral cavity and the outer surfaces of organs.
    a. Serous membranes within the ventral body cavity are double-layered membranes that cover the inner walls of the ventral cavity and the outer surfaces of organs.
    b. The parietal serosa lines the body cavity walls and folds in on itself to form the visceral serosa, which covers the outer surfaces of organs.
    c. Serous membranes secrete and are separated by a thin layer of lubrication fluid called serous fluid, which allows organs to slide without friction along cavity walls and between each other.
    d. Serous membranes are named for the specific cavity or organs with which they are associated.
4. The abdominopelvic region is divided into either four quadrants or nine abdominopelvic regions (see p. 19 for a complete list of quadrants and regions).
    a. The abdominopelvic region is divided into either four quadrants or nine abdominopelvic regions (see p. 19 for a complete list of quadrants and regions).

D. Other Body Cavities (p. 20)

1. There are several smaller body cavities, mostly in the head, and most open to the body exterior (see complete list on p. 20).