Chapter 1 Outline

I. INTRODUCTION

A. The purpose of the chapter is to

1. Introduce anatomy and physiology as specific disciplines.
2. Consider how living things are organized.
3. Reveal shared properties of all living things.

B. Homeostasis is the major theme in every chapter of the book.

II. ANATOMY AND PHYSIOLOGY DEFINED

A. Through a study of *anatomy* and its subdivisions, the body may be examined at different levels of structural organization.

1. Anatomy may be defined as the study of structure and the relationships among structures.

B. A study of *physiology* deals with how body parts function: the structure of a part determines its function.

1. Physiology is the study of how body structures function.

III. LEVELS OF ORGANIZATION

A. The human body consists of several levels of structural organization.

1. The *chemical* level includes atoms, the smallest units of matter that participate in chemical reactions, and molecules, two or more atoms joined together.
2. *Cells* are the basic structural and functional units of an organism.
3. *Tissues* consist of groups of similarly specialized cells and the substances surrounding them that usually arise from a common ancestor and perform certain special functions.
4. *Organs* are structures of definite form that are composed of two or more different tissues and have specific functions.
5. *Systems* consist of related organs that have a common function.

6. The human *organism* is a collection of structurally and functionally integrated systems; any living individual.

B. The systems of the human body are the integumentary, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, respiratory, urinary, and reproductive.

IV. CHARACTERISTICS of the LIVING HUMAN ORGANISM

A. Basic Life Processes

1. All living things have certain characteristics that distinguish them from nonliving things.
2. Among the life processes in humans are metabolism, responsiveness, movement, growth, differentiation, and reproduction.
    a. *Metabolism* is the sum of all chemical processes that occur in the body, including catabolism and anabolism.
    b. *Responsiveness* is the ability to detect and respond to changes in the external or internal environment.
    c. *(Movement* includes motion of the whole body, individual organs, single cells, or even organelles inside cells.) Please remember our class discussion on this!!
    c. *Growth* refers to an increase in size and complexity, due to an increase in the number of cells, size of cells, or both.
    e. *Differentiation* is the change in a cell from an unspecialized state to a specialized state.
    f. *Reproductio*n refers either to the formation of new cells for growth, repair, or replacement, or the production of a new individual.

C. *Homeostasis* is the maintenance of a constant internal environment within specific physiological parameters.

D. Body Fluids

1. For the body's cells to survive, the composition of the surrounding fluids must be precisely maintained at all times.
    a. Fluid inside body cells is called *intracellular fluid.*
    b. Fluid outside body cells is called *extracellular fluid* (ECF)
        1) ECF filling the narrow spaces between cells of tissues is called interstitial fluid.
        2) ECF in blood vessels is termed plasma; in lymph vessels is termed lymph; in the subarachnoid space is termed cerebrospinal fluid, etc.

2. Since homeostasis depends on the balance between the interstitial fluid and the blood which in turn is in balance with the other fluids, <u>interstitial fluid is considered the internal environment of the body</u>.

V. CONTROL OF HOMEOSTASIS

A. Homeostatic imbalances occur because of disruptions from the external or internal environments.

B. Homeostasis is regulated by the nervous system and endocrine system, acting together or independently.
    1. The nervous system detects changes and sends nerve impulses to counteract the disruption.
    2. The endocrine system regulates homeostasis by secreting hormones.
    3. Whereas nerve impulses cause rapid changes, hormones usually work more slowly.

C. Feedback Systems
    1. General Principles
        a. A *feedback system* is a cycle of events in which information about the status of a condition is continually monitored and fed back (reported) to a central control region.
        b. Any disruption that changes a controlled condition is called a stimulus.

c. A feedback system consists of three basic components.
    1) A *receptor* monitors changes in a controlled condition and sends input in the form of nerve impulses or chemical signals to a control center.
    2) The *control center* sets the range of values within which a controlled condition should be maintained, evaluates the input it receives from the receptors, and generates output commands when they are needed.
    3) An *effector* is a body structure that receives output from the control center and produces a response or effect that changes the controlled condition.
d. If a response reverses a change in a controlled condition, the system is a *negative feedback system.*
e. If a response reinforces or strengthens a change in a controlled condition, the system is *a positive feedback system.*

D. Negative Feedback Systems
1. A negative feedback system reverses a change in a controlled condition.
2. Homeostasis of Blood Pressure (BP): Negative Feedback
    a. If a stimulus (stress) causes blood pressure (controlled condition) to rise, pressure-sensitive cells (baroreceptors) in certain arteries send impulses (input) to the brain (control center). The brain sends impulses (output) to the heart (effector), causing the heart rate to decrease (response) and return of blood pressure to normal (restoration of homeostasis).
    b. The activity of the effector produces a result, a drop in blood pressure, that opposes the stimulus, an increase in blood pressure.

E. Positive Feedback System
1. A positive feedback system tends to strengthen or reinforce a change in one of the body's controlled conditions.

2. Normal childbirth provides a good example of a positive feedback system.
    a. When labor begins, the uterus is stretched (stimulus) and stretch-sensitive nerve cells in the cervix of the uterus (receptors) send impulses (input) to the hypothalamus (control center). The hypothalamus causes the release of oxytocin (output) which stimulates the uterus (effector) to contract more forcefully (response). Movement of the baby's head down the birth canal causes further stretching, the release of more oxytocin, and even more forceful contractions. The cycle is broken with the birth of the baby.
    b. The positive feedback system reinforces a change in a controlled condition.

VI. BASIC ANATOMICAL TERMINOLOGY

A. Body Positions
    1. Anatomical Position
        a. The *anatomical position* is a standardized method of observing or imaging the body that allows precise and consistent anatomical references.
        b. When in the anatomical position, the subject stands erect facing the observer, the upper extremities are placed at the sides, the palms of the hands are turned forward, and the feet are flat on the floor.
    2. Reclining Position
        a. If the body is lying face down, it is in the *prone* position.
        b. If the body is lying face up, it is in the *supine* position.
B. Regional Names
    1. Regional names are names given to specific regions of the body for reference.
C. Directional Terms
    1. Directional terms are used to precisely locate one part of the body relative to another and to reduce length of explanations.
D. Planes and Sections

1. Planes are imaginary flat surfaces that are used to divide the body or organs into definite areas. Principal planes include: midsagittal (medial) and parasagittal, frontal (coronal), transverse (cross-sectional or horizontal) and oblique.

E. Sections are flat surfaces resulting from cuts through body structures. They are named according to the plane on which the cut is made and include transverse, frontal, and midsagittal sections

F. Body Cavities

1. Body cavities are spaces within the body that help protect, separate, and support internal organs.
2. Dorsal Body Cavity
    a. The dorsal body cavity is located near the dorsal surface of the body and has two subdivisions, the cranial cavity and the vertebral canal.
        1) The cranial cavity is formed by the cranial bones and contains the brain.
        2) The vertebral (spinal) canal is formed by the bones of the vertebral column and contains the spinal cord.
    b. Three layers of protective tissue, called meninges, line the dorsal body cavity.
3. Ventral Body Cavity
    a. The ventral body cavity is subdivided by the diaphragm into a superior thoracic cavity and an inferior abdominopelvic cavity.
    b. The thoracic cavity contains two pleural cavities, the mediastinum, and the pericardial cavity.
        1) The pleural cavities enclose the lungs, while the pericardial cavity surrounds the heart.
        2) The pericardial cavity surrounds the heart.

2) The mediastinum is a broad, median partition between the lungs that extends from the sternum to the vertebral column; it contains all contents of the thoracic cavity except the lungs.

c. The abdominopelvic cavity is divided into a superior abdominal and an inferior pelvic cavity

1) Viscera of the abdominal cavity include the stomach, spleen, pancreas, liver, gallbladder, small intestine, and most of the large intestine.

2) Viscera of the pelvic cavity include the urinary bladder, portions of the large intestine and internal female and male reproductive structures.

4. Thoracic and Abdominal Cavity Membranes

a. A thin, slippery serous membrane covers the viscera within the thoracic and abdominal cavities and also lines the walls of the thorax and abdomen.

b. Parts of the serous membrane are the parietal layer which lines the walls of the cavities and the visceral layer which covers and adheres to the viscera within the cavities.

c. Serous fluid between the two layers reduces friction and allows the viscera to slide somewhat during movements.

d. The serous membranes include the pleura, pericardium and peritoneum.

1) The pleural membrane surrounds the lungs, with the visceral pleura clinging to the surface of the lungs and the parietal pleura lining the chest wall.

2) The serous membrane of the pericardial cavity is the pericardium, with visceral pericardium covering the surface of the heart and the parietal pericardium lining the chest wall.

3) The peritoneum is the serous membrane of the abdominal cavity, with the visceral peritoneum covering the abdominal viscera and the parietal peritoneum lining the abdominal wall.

5. Abdominopelvic Regions and Quadrants
    a. To describe the location of organs easily, the abdominopelvic cavity may be divided into nine regions by drawing four imaginary lines.
    b. To locate the site of an abdominopelvic abnormality in clinical studies, the abdominopelvic cavity may be divided into quadrants by passing imaginary horizontal and vertical lines through the umbilicus.