

TOPIC 1: CONCEPTS AND THEMES OF HUMAN PHYSIOLOGY

I. What is human physiology?

- A. Study of *function* of human body
- B. Function closely related to structure
 - 1. For example, to understand heart function, need to understand heart structure

II. Major Theme 1: Organization of the body: Structure & Function

- A. Overview
 - 1. Let's break a person into the smallest functional pieces and then...
 - 2. Put the pieces back together again in a way that helps understand function
 - 3. We will do this in detail for different parts of the body repeatedly this semester!
- B. Cells: 75 trillion in human body
 - 1. Basic cell functions
 - a) obtain nutrients & oxygen
 - b) make energy
 - c) eliminate wastes
 - d) synthesize proteins & other compounds
 - e) sense/respond to environment
 - f) control exchange of material with environment
 - g) move materials
 - h) reproduce (only some cells can do this; nerves and muscles generally cannot)
 - 2. Specialized cell functions
 - a) Each cell also performs specialized function, which is usually a modification of basic cell function
 - b) Examples:
 - (1) gland cells of digestive system secrete digestive enzymes (d above)
 - (2) kidney cells selective retain some substances & eliminate others (f)
- C. Primary Tissues: composed of cells of a single type + extracellular material (Fig 1.2)
 - 1. Nervous tissue (Fig 1.2a)
 - a) Cells specialized for initiation and transmission of electrical impulses
 - b) Found in:
 - (1) brain
 - (2) spinal cord
 - (3) nerves
 - 2. Muscle tissue (Fig 1.2b)
 - a) Cells specialized for contraction & force generation
 - b) Three types
 - (1) skeletal
 - (2) cardiac
 - (3) smooth (e.g., used in digestive)
 - 3. Epithelial tissue
 - a) Cells specialized in exchange of material with environment
 - b) Two general types of structures
 - (1) sheets (e.g., skin, digestive tract lining) (Fig 1.2c)
 - (2) secretory glands (sweat glands, endocrine glands (fig 1.3)
 - 4. Connective tissue (Fig 1.2d)
 - a) Cells that connect, support & anchor body parts

- b) examples: tendons, bone, blood

D. Organs

1. Composed of two or more primary tissues organized to perform a specific function
2. Example: Stomach is composed of
 - a) epithelial tissue (restricts transfer of digestive enzymes to blood; exocrine glands secrete digestive enzymes; endocrine glands that secrete hormones that regulate muscle contraction & exocrine secretion)
 - b) smooth muscles tissue (mixes & propels food)
 - c) nervous tissue (controls contraction & secretion)
 - d) connective tissue (holds all together)

E. Body Systems

1. Collection of organs that perform related functions and interact to accomplish a common activity essential to survival of body.
2. Example: Digestive system composed of: mouth, pharynx, esophagus, stomach, small & large intestines, salivary glands, pancreas, liver, and gallbladder.

III. Theme 2: Organization of the Body: Compartments and Function

- A. Let's see how the overall body plan is divided into different fluid compartments (Fig 1.4); interactions between these compartments drives much of the function we will study (e.g., how nerves generate electrical signals; overall cardiac function)

B. Fluid Compartments within Body (Fig 1.5)

1. Intracellular Fluid (ICF)
 - a) Fluid within cells
2. Extracellular Fluid (ECF)
 - a) Fluid outside cells
 - b) Further compartmentalized into
 - (1) Plasma (liquid portion of blood)
 - (2) Interstitial fluid (fluid that surrounds cells)
 - (3) Boundry between the 2 is capillary walls
 - (4) Water and small molecules can move freely across capillaries
3. Boundry between ECF and ICF are cell membranes

IV. Theme 3: Homeostasis

A. Definition & Concepts:

1. Keeping the internal environment constant (Fig 1.4)
 - a) This must be done to maintain cell function
2. Environment of Cell is the ECF (blood plasma, interstitial fluid).

B. Factors that must be homeostatically maintained: ECF volume, composition and temperature.

C. For every body system that we study, we will examine how that system is regulated to maintain homeostasis (e.g., the urinary system producing urine with the needed balance of water and salts)

D. Regulation of Homeostasis

1. Negative feedback control (Figs 1.6 and 1.7) is most common
2. Positive feedback control does occur sometimes (Fig 1.8)