Human Anatomy and Physiology

Anatomy - the study of the form or structure and arrangement of body parts and their relationships

Physiology - the study of the functions of the body parts or structures and their relationships in maintaining life processes.

Levels of Structural Organization

The human body consists of levels of structural organization that are associated with one another.

There are six levels of structural organization:

1. chemical level - It is the simplest level and it includes all of the chemical substances essential for maintaining life. These substances are made up of atoms. An atom is the smallest unit of matter. Matter is anything that takes up space and has mass. Atoms combine to form molecules, which may be simple or complex. Different types of molecules combine to form organelles ("little organs"). Organelles are specific structures that carry out specific functions.

2. cellular level - The cell is the basic unit of structure and function and of life. Cells vary in size, shape, and function and may contain many types of organelles.

3. tissue level - Tissues are groups of similar cells that perform a specific function.

There are four major types of tissues in the human body:

   a. epithelial tissue - It is found lining body cavities and covers the surface of the body. It functions in protection, secretion, and excretion.

   b. connective tissue - It is found on the surfaces of and in organs and tissues and functions in protection, support, and attaching organs and tissues to each other and to the walls of body cavities.

   c. muscle tissue - It functions in the movement of body parts and organs, and in the movement of substances throughout the body.
There are three major types of muscle tissue:

(1) **skeletal muscle** - It is found attached to and covering bones and it functions in body movement.

(2) **cardiac muscle** - It is located in the heart wall and functions in the contraction and relaxation of the heart as it beats.

(3) **smooth muscle** - It is located in the walls of internal or visceral organs and it functions in moving substances throughout the body.

d. **nervous tissue** - It is located in the brain and spinal cord, and extends to various tissues and organs. It functions in transmitting electrical or nerve impulses from the external and internal environments to the brain and spinal cord where it is interpreted and a response occurs.

4. **organ level** - Organs are groups of two or more types of tissue working together to perform a specific function.

5. **organ system level** - Organ systems are groups of organs that work closely together to perform a common function.

There are eleven organ systems in the human body:

a. **integumentary system**
b. **muscular system**
c. **skeletal system**
d. **nervous system**
e. **endocrine system**
f. **cardiovascular system**
g. **lymphatic system**
h. **respiratory system**
i. **digestive system**
j. **urinary system**
k. **reproductive system**

6. **organismal level** - It is the highest level of structural organization and it consists of groups of organ systems working together to maintain body structure and function. Organ systems work together to maintain an internal environment that is fairly constant, stable, or balanced. This is referred to as **homeostasis** ("to stay the same"). Changes do occur, but within very narrow ranges or limits.
Homeostasis

Body parts or structures function efficiently in maintaining metabolic processes and when the survival needs are within certain limits or optimum levels. The survival needs include: water, oxygen, nutrients, an appropriate body temperature, and atmospheric pressure. Water is necessary for chemical reactions, excretion, and secretion. Oxygen is required for many of the metabolic reactions that break down nutrients and provide energy. Nutrients provide energy for cells and cell processes. Body temperature must be maintained within a certain range for chemical reactions and cell processes to perform efficiently. If the body temperature falls too low or increases too high, chemical reactions will slow down or may stop. Atmospheric pressure is the force of air on the body surface by the weight of air. It is important in breathing and in the exchange of oxygen and carbon dioxide in the lungs.

To maintain homeostasis there are control mechanisms. Control mechanisms consist of three parts:

1. receptor - It responds to sensory stimuli from the internal and external environments. The information is sent along afferent pathways to the control center.

2. control center - It consists of the brain and spinal cord which interpret and analyze the information and determine an appropriate response. Information is then sent along efferent pathways to the effector.

3. effector - It consists of tissues, organs, or glands that perform a motor response to the original stimulus that was received by the receptor. The response involves a feedback mechanism. If the response slows down or inhibits the stimulus it is a negative feedback mechanism. If the response speeds up or enhances the stimulus, it is a positive feedback mechanism. Most control mechanisms for homeostasis in the human body are negative feedback mechanisms.