

AN INTRODUCTION TO THE HUMAN BODY

Chapter 1

Anatomy and Physiology Lecture

AN INTRODUCTION TO THE HUMAN BODY

Why Study Anatomy and Physiology:

1. Knowledge of the Structure and Function of the human body provides the basis for understanding disease.
2. Knowledge of the Structure and Function of the human body is essential for those planning a career in the health sciences.
3. Knowledge of the Structure and Function of the human body is beneficial to nonprofessional because it helps with understanding overall health and disease, with evaluating, recommended treatment, and with critically reviewing advertisements and articles.

Anatomy and **Physiology** are two branches of science that will help us understand our body parts and their functions.

Anatomy – Is the scientific discipline that investigates the body's structure.

LEVELS OF ANATOMY

1. Developmental Anatomy – Is the study of the structural changes that occur between conception and adulthood.
2. Embryology – Is a subspecialty of developmental anatomy, considers changes from conception to the end of the eighth week of development.
3. Cytology – Examines the structural features of cells.
4. Histology – Examines the tissues, which are cells and the materials surrounding them.
5. Gross (Macroscopic) Anatomy – Is the study of structures that can be examined without the aid of a microscope, can be approached from either a systemic or regional perspective.

6. Systemic Anatomy – Is the study of specific systems of the body, such as, the nervous system, respiratory system, etc.
7. Regional Anatomy – Is the study of a specific region of the body, such as, the head, the chest, abdomen, arm, etc.
8. Surface Anatomy – Is the study of the external form of the body and its relationship to deeper structures.
9. Anatomic imaging – Uses radiographs (x-rays), ultrasound, magnetic resonance imaging (MRI), and other technologies to create pictures of internal structures.

Physiology:

Physiology – Is the scientific investigation of the processes or functions of living things.

1. Cell Physiology – Examines the processes occurring in cells.
2. Systems Physiology – Considers the functions of organs systems.
3. Pathophysiology - study of functional changes associated with disease and aging.
4. Neurophysiology – Focuses on the nervous system.
5. Cardiovascular Physiology - study of functions of the heart and blood vessels.
6. Pathology – Is the medical science dealing with all aspects of disease, with an emphasis on the cause and development of abnormal conditions as well as the structural changes resulting from disease.
7. Exercise Physiology – Focuses on changes in function, but also structure, caused by exercise.

LEVELS OF STRUCTURAL ORGANIZATION

(Fig. 1.1, page 3)

(Several levels of structural organization that associated with one another in various ways):

A. **CHEMICAL LEVEL** (the lowest level of organization)

-Contains atoms, such as Carbon (C), hydrogen (H), oxygen (O), Nitrogen (N), Calcium (Ca), Potassium (K), and Sodium (Na).

(1) Atoms - smallest unit of matter (anything that occupies space and has mass.)

(2) Molecules - combination of two or more atoms e.g. proteins, carbohydrates, fats, and vitamins.

B. **CELLULAR LEVEL**

1. Cells – Are the basic structural and functional units of all living things.

2. Organelles – Formed by the combination of molecules. Are the small structures that make up cells.

C. **TISSUE LEVEL**

1. Tissue – Is group of similar cells and the substances surrounding them.

Four Basic Types of Tissue in the human body:

(a) **Epithelial Tissue** - Lines/Covers

Functions:

-Absorption (e.g.; the lining of the small intestine)

-Transport (e.g.; kidney tubules)

-Excretion (e.g.; sweat gland)

-Protection (e.g.; the skin)

-Sensor reception (e.g.; the taste buds in the tongue)

Classified on the basis of shape and number of layers:

On Layers

Simple epithelium - only one layer of cell

Stratified epithelium - two or more layers stacked on top of the other.

On Shapes

Squamous epithelium - flat

Cuboidal epithelium - cube shaped

Columnar epithelium - column like

(b) **Connective Tissue** - Connection and support.

Adipose

Cartilage

Bone

Blood

(c) **Muscle Tissue** - Movement

(d) **Nervous Tissue** - Communication

****(Each type of cell in the tissue has a specific function)****

D. **ORGAN LEVEL**

Organ: Is composed of two or more tissues types that perform one or more common functions.

(For example, Heart, Liver, Lungs, Brain, Stomach)

E. **ORGAN SYSTEM LEVEL**

Organ System – Is a group of organs that have a common function or set of functions and are therefore viewed as a unit.

(For example: Urinary system, Digestive system, Respiratory system, Reproductive system, Integumentary system, Skeletal system,

- Muscular system, Nervous system, Cardiovascular system, etc.)
F. **ORNISMISM LEVEL** (The highest level)

Organism – Is any living thing considered as a whole, whether composed of one cell such as a bacterium or trillions of cells such as human.

CHARACTERISTICS OF THE LIVING HUMAN ORGANISM

Characteristics of Life:

Humans are organism and share common characteristics with other organisms.

Life is the most important common feature of all organisms.

Six Life's Essential Characteristics:

1. **Organization** - Is the condition in which the parts of an organism have specific relationship to each other and the parts interact to perform specific function.
2. **Metabolism** – Is all of the chemical reactions taking place in an organism.
3. **Responsiveness** – Is the ability of an organism to sense changes in its external or internal environment and adjust to those changes.
4. **Growth** – Happens when cells increase in size or number, which produces an overall enlargement of all or part of an organism.
5. **Development** - Changes an organism undergoes through time; it begins with fertilization and ends at death.

Involves Growth, Differentiation, and Morphogenesis.

Differentiation: Is changes in cell structure and function from

generalized to specialized.

Morphogenesis – Is changes in shape of tissues, organs and the entire organism.

6. Reproduction – Is the formation of new cells or new organisms.

CONTROL OF HOMEOSTASIS

Homeostasis - Is the existence and maintenance of a relatively constant environment within the body.

Cells need relatively stable conditions (fluids surrounding the cell) to function effectively and contribute to the survival of the body as a whole.

Variable Condition: For cell to function normally, the volume, temperature, and chemical content of the body fluid must remain within a narrow margin.

Set Point: The ideal normal value.

Normal range: Slightly around the set point values.

(Note: If the cell fluid surrounding cells deviate from homeostasis, they do not function normally and can die. Disruption of homeostasis results in disease and sometimes death).

Negative-Feedback

Negative means that any deviation from the set point is made smaller or is resisted.

Note: Most feedback systems in the body are negative.

Three Basic Components of a Negative Feedback Mechanism

1. Control center
2. Receptor
3. Effector

1. **Control Center** determines the point at which some aspect of the body, called controlled condition, should be maintained.

(Control center receives information about the status of a controlled condition from a receptor and then determines an appropriate course of action.)

Hundred of Controlled Conditions exist in the body:

(Heart rate, blood pressure, acidity of the blood, blood sugar level, body temperature, breathing rate, etc.)

2. **Receptor** monitors changes in the controlled condition and then sends the information, called inputs, to the control center.

Stimulus is any stress that changes a controlled condition.

(Example: A stimulus such as exercise raise the body temperature (the controlled condition), and thermal (heat) receptors send input to the control center, which in this case is in the brain.)

3. **Effector** receives information, called the output, from the control center and produces a response (effect).

(So while you are exercising, your brain (control center) signals for increased secretions by your sweat glands (effectors); as sweat evaporates from the skin, body temperature drops back to normal.)

*The response that occurs is continually monitored by the receptor and feed back to the control center.

Note: The maintenance of normal blood pressure is an example of a

negative-feedback mechanism that maintains homeostasis.

Positive-Feedback

Positive-feedback responses are not homeostatic and are rare in healthy individuals.

Positive: Implies that when a deviation from the normal value occurs, the response of the system is to make the deviation even greater.

Note: Positive-feedback usually creates a cycle that leads away from homeostasis and, in some cases results to death.

Some Good Examples of Negative-Feedback : Blood clotting which helps stop loss of blood from a cut. Labor contractions during birth of a baby.

ANATOMICAL TERMINOLOGY

BODY POSITIONS

(In anatomy, descriptions of any region or part of the human body assume that the body is in a specific position - anatomical position)

Anatomic Position - Four characteristics of the anatomical position: (1) the subject stands erect (upright position) facing the observer, (2) with feet flat on the floor, (3) arms placed at the sides and (4) the palms of the hand turned forward.

-Having one standard anatomical position allows directional terms to be clear; any part or region can be described relative to any other part.

*Note: Know the common names and anatomical terms, in parentheses.

REGIONAL NAMES

Regional names are terms given to specific region of the body for reference.

Examples: Cranial (skull), thoracic (chest), brachial (arm) patellar (knee), cephalic (head), and gluteal (buttock).

DIRECTIONAL TERMS

Direction terms indicate the relationship of one part of the body to another.

-Like regional names, used for uniformity all over the world.

PLANES AND SECTIONS

Planes are imaginary flat surfaces that are used to divide the body or organs into definite areas.

1. Sagittal Plane is a vertical plane that divides the body or an organ into right and left sides.
2. Midsagittal (median) Plane is a vertical plane that passes through the midline of the body or organs and divides it into equal right and left sides.
3. Parasagittal Plane is a sagittal plane that does not pass through the midline but instead divides the body or an organ into unequal right

and left sides.

4. Frontal (coronal) Plane divides the body or organ into anterior (front) and posterior (back) portions.
5. Transverse (cross-sectional or Horizontal) Plane divides the body or organ superior (top) or inferior (bottom) portions.

*Above planes are all at right angles to one another.

6. Oblique Plane passes through the body or organ at an angle between the transverse plane and either the midsagittal, parasagittal, or frontal plane.

BODY CAVITIES

Body Cavities are confined spaces within the body that contain internal organs.

-Cavities separated from each other by structure such as muscles, bones, or ligaments, help to protect, separate, and support the organs.

Two Principal Body Cavities:

1. Dorsal body cavity
2. Ventral body cavity

1. **Dorsal Body Cavity** is located near the dorsal (back) surface of the body.

Two principal subdivisions of Dorsal Body Cavity

- a. Cranial Cavity - formed by the cranial (skull) bones and containing the brain.
- b. Vertebral (spinal) canal - formed by the vertebrae of the backbone

and contains the spinal cord and the beginnings (roots) of spinal nerves.

2. **Ventral Body Cavity** is located on the ventral (front) aspect of the body.

*Serous membrane, a thin, slippery tissue, lines the wall of the ventral body cavity and covers the organs within it.

*Viscera are organs inside the ventral body cavity.

Two Principal Subdivisions of the Ventral Body Cavity

- A. **Thoracic Cavity (Chest Cavity)** - an upper portion.

*Thoracic Cavity has three compartments:

1. Two Pleural cavities - each of the two surrounds a lung.

Pleura is the serous membrane associated with the lungs.

2. Pericardial Cavity - between the lungs.

Pericardium is the serous membrane associated with the heart.

Mediastinum is a region between the lungs, extending from the sternum (breastbone) to the vertebral column or backbone.

Diaphragm is the structure (anatomical landmark) that divides the ventral body cavity into the thoracic and abdominopelvic cavities.

- B. **Abdominopelvic Cavity** - the lower portion of ventral body cavity

*As the name suggests, is divided into two portions, although no wall separates them--abdominal and pelvic cavities.

*Peritoneum is the serous membrane that lines the abdominopelvic cavity and covers the organs within.

(1) Abdominal Cavity contains the stomach, spleen, liver, gallbladder, pancreas, small intestine, and most of the large intestine.

(2) Pelvic Cavity contains the urinary bladder, portions of the large intestine, and the internal organs of reproduction.

ABDOMINOPELVIC REGIONS AND QUADRANTS

Maybe divided into nine regions:

1. Right Hypochondriac region
2. Epigastric region
3. Left Hypochondriac region
4. Right lumbar region
5. Umbilical region
6. Left lumbar region
7. right iliac (Inguinal) region
8. Hypogastric (pubic) region
9. Left iliac (inguinal) region

*Examine Fig determine organs in different regions.

Maybe divided into four quadrants:

1. Right upper quadrant (RUQ)
2. Left upper quadrant (LUQ)
3. Right lower quadrant (RLQ)
4. Left lower quadrant (LLQ)