EXPERIMENT NO.: 1 **DATE:**

AIM: INTRODUCTION AND SCOPE OF ANATOMY AND PHYSIOLOGY

INTRODUCTION:

- Anatomy and physiology concern with the structures and functions of the human body.
- **Anatomy describes the structures of the body** -- their scientific names, composition, location, and associated structures. Anatomy ("a cutting open") is a plan or map of the body.
- **Physiology studies the function of each structure**, individually and in combination with other structures.
- Anatomy and physiology always work together. As we examine each part of the body, always consider both its structure and its function.

➢ **The study of anatomy is divided into 2 major fields:**

1. **Gross anatomy** is the study of large visible structures
2. **Microscopic anatomy** is the study of structures that are too small to see, such as cells and molecules.

1. **Gross anatomy**, also called macroscopic anatomy, is separated into 5 major divisions:
   A. **Surface anatomy** describes surface forms and marks.
   B. **Regional anatomy** describes the organization of specific areas of the body such as the head or hand. This approach is used mostly in professional schools: medical, dental, physical therapy.
   C. **Systemic anatomy** describes groups of organs that function together for a single purpose.
   D. **Developmental anatomy** describes the structural changes in an organism from fertilized egg to maturity. Embryology is the anatomical study of early development.
   E. **Clinical anatomy** describes various medical specialties, including medical anatomy (changes that occur during illness), and radiographic anatomy.
2. **Microscopic anatomy** is divided into two major divisions:
   A. **Cytology,** the study of cells and their structures.
   B. **Histology,** the study of tissues and their structures.

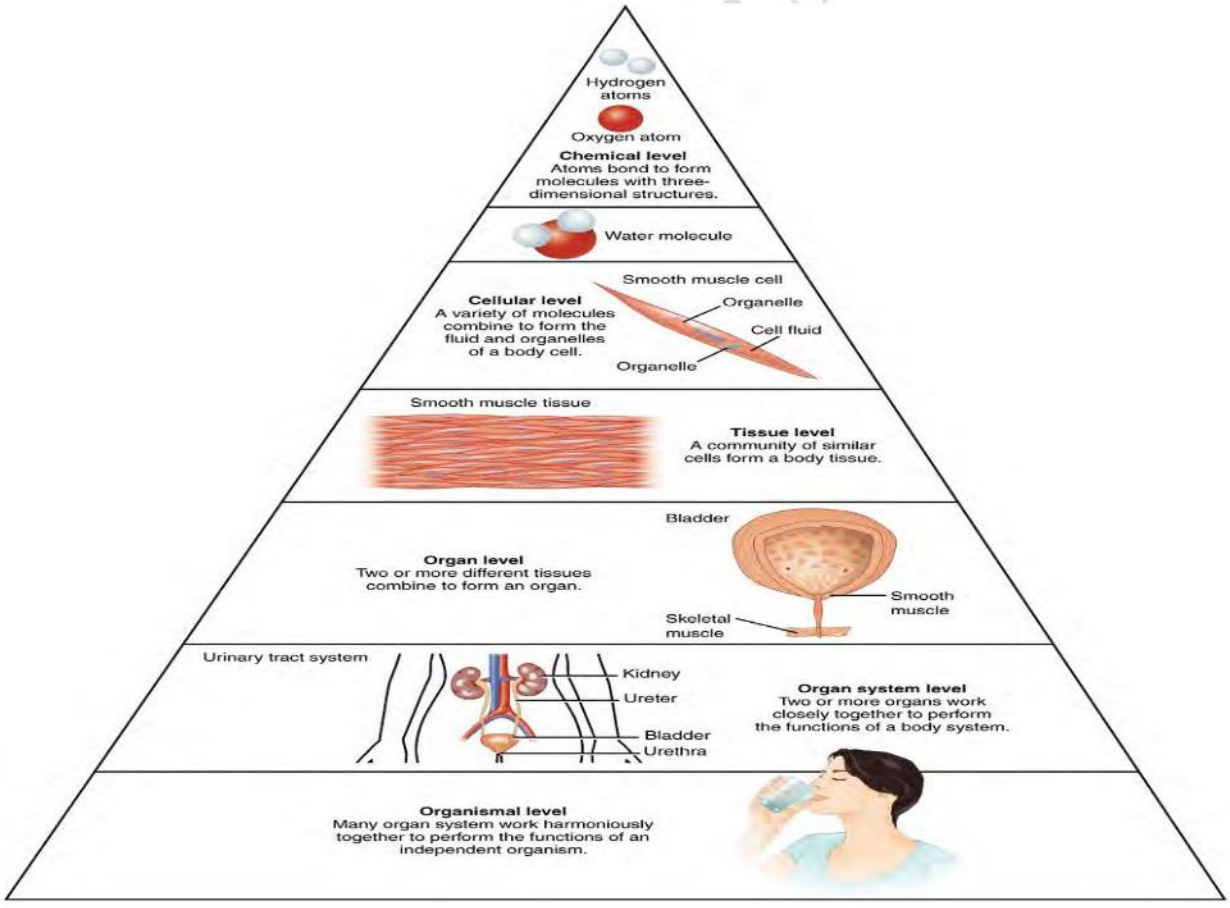
➢ **Physiology has many specialties. The 4 basic divisions are:**

1. **Cell physiology**, including chemical and molecular processes within and between cells.
2. **Special physiology**, the study of specific organs such as the heart.

3. **Systemic physiology,** the cooperative functions of all the organs in an organ system. We will use a systemic physiology approach in this class.
4. **Pathological physiology**, the effects of diseases on organs and organ systems.

➢ Levels of Organization

- Our bodies are organized at many different levels.
- The levels of organization of living things, from smallest to largest, are:
  1. **Atoms,** the smallest functional units of matter.
  2. **Molecules,** active chemicals.
  3. **Organelles**, specialized structures within a cell.
  4. **Cells,** the smallest living units.
  5. **Tissues,** a group of similar cells that work together.
  6. **Organs,** two or more tissue types working together.
  7. **Organ systems,** two or more organs working together.
  8. **Organism,** a single individual, including all of the above.



The human body is divided into 11 interconnected organ systems. All organ systems work together, and many organs function in more than 1 organ system.

1. **The Integumentary System:** includes the skin & derived structures, it protects internal organs & helps maintain body temperature.

2. **The Skeletal System:** includes the bones & joints, it provides support & protection to internal organs.
3. **The Muscular System:** includes skeletal muscle and it provides movement.
4. **The Nervous System:** includes the brain, spinal cord, and nerves. It provides regulation of body functions & sensory perception.
5. **The Endocrine System:** includes hormone-producing cells & glands. It regulates homeostasis, growth & development.
6. **The Cardiovascular System:** includes blood, heart, & blood vessels. It is responsible for delivery of oxygen & nutrients to the tissues.
7. **The Lymphatics & Immune System:** includes lymphatic vessels & fluid. It is involved in the defense against infection.
8. **The Respiratory System:** includes lungs & airways. It is involved in the absorption of oxygen & release of carbon dioxide.
9. **The Digestive System:** includes organs of the gastrointestinal tract. It is responsible for the absorption of nutrients.
10. **The Urinary System:** includes the kidneys, ureters, and bladder. It is responsible for electrolyte balance & waste removal.
11. **The Reproductive System:** includes the reproductive organs in males and females. It controls the biological process by which new individuals are produced.

HOMEOSTASIS:

- Ability to maintain relatively stable internal conditions despite a changing external environment. Dynamic state of equilibrium, or balance.
- The body is said to be in homeostasis when its cellular needs are adequately met and functional activities are occurring smoothly.
- Virtually every organ system plays a role in maintaining the internal environment.

A homeostatic regulatory mechanism consists of 5 parts:

1. **Receptors:** It act as a sensors/receiver that respond to a stimulus. It monitors change in control condition.
2. **Sensory Neurons:** It send the input information/message to control center, means information from cell/tissue/organ etc to integrated system i.e brain and spinal cord.
3. **Integrated System:** It analyze the incoming message received from the sensory neurons and sends out commands/messages. In the body there are hundred controlled

conditions. A few examples are heart rate, blood pressure, temperature and breathing rate.

4. **Motor Neurons:** The output information/message from integrated center (brain and spinal cord) to cell/tissue/organ etc are travelled by motor neurons.
5. **Effectors:** The cell/tissue/organ etc act as effector that responds according to output command of the control/integrated center.

Receptors, control center and effectors maintain the homeostasis by two mechanisms:

1. **Negative feedback:**

- When the response of effectors opposes the original stimulus, it is called negative feedback because it negates the stimulus.
- An example of negative feedback is the temperature thermostat in your home.
- Temperature sensors turn the air conditioner off and on to maintain air temperature within a specific, limited range.
- In the same way, the brain controls normal body-temperature homeostasis by negative feedback.
  - Some stimulus (Stress) disrupts homeostasis (control condition) by an increase in body temperature.
  - Due to this condition thermoreceptors (temperature sensitive receptors) in the skin and brain activate and send input message via nerve impulse to control center.
  - Control center analyze the input message and send output message to effectors (skin).
  - Effectors according to output message of control center increases sweating from sweat glands causes increased heat loss by evaporation.
  - Finally, decreases the temperature in the form of response and normalize the body temperature (control condition).

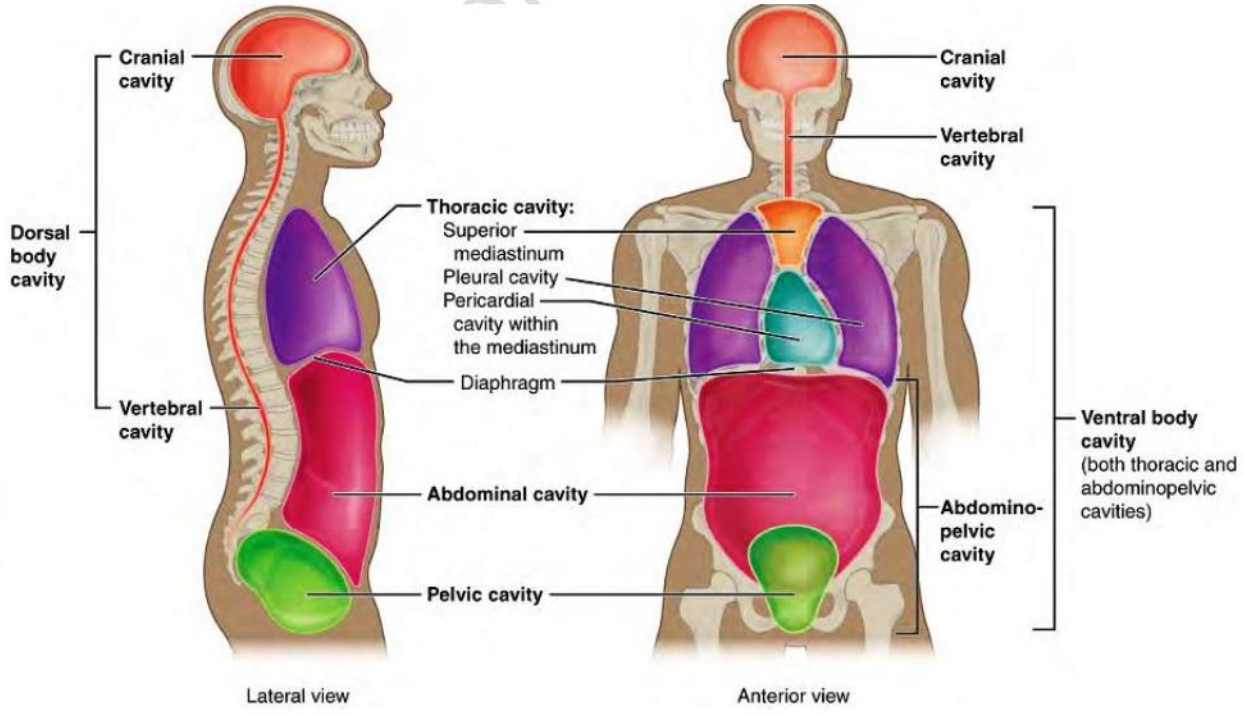
2. **Positive feedback:**

- The effector adds to the initial stimulus instead of negating it, speeding up the process.
  - Labor contraction is the example of positive feedback system.
  - Labor contractions force baby's head or body into birth canal.
  - It produces effect on control condition and increases distention of cervix of uterus.

- It activates the stretch receptors of cervix and send input message to control center via sensory nerve impulse.
- Control center activates the hypothalamus and pituitary gland and send the output message to increase oxytocin secretion in blood.
- Oxytocin produces their effect on to the effector (cervix of uterus) and cause distention of cervix of uterus than the normal value to push the baby further into birth canal.
- Birth of the baby decreases distention of cervix of uterus and interrupts positive feedback cycle.

BODY CAVITIES AND SEROUS MEMBRANES

- The body maintains its internal organization by means of membranes, sheaths, and other structures that separate compartments.
- The dorsal (posterior) cavity and the ventral (anterior) cavity are the largest body compartments.
- These cavities contain and protect delicate internal organs, and the ventral cavity allows for significant changes in the size and shape of the organs as they perform their functions. The lungs, heart, stomach, and intestines, for example, can expand and contract without distorting other tissues or disrupting the activity of nearby organs.



Subdivisions of the Posterior (Dorsal) and Anterior (Ventral) Cavities

- The posterior (dorsal) and anterior (ventral) cavities are each subdivided into smaller cavities.
- In the posterior (dorsal) cavity, the cranial cavity houses the brain, and the spinal cavity (or vertebral cavity) encloses the spinal cord.

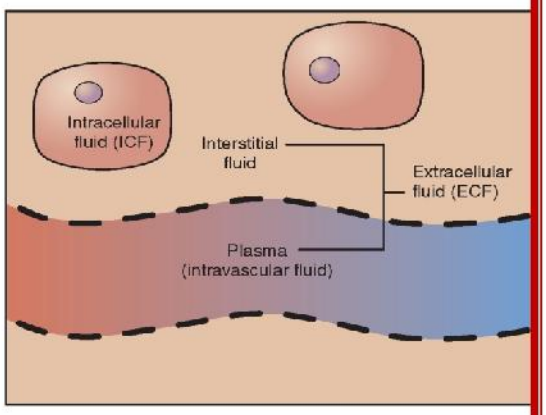
The anterior (ventral) cavity has divided by the diaphragm muscle into 2 parts:

1. **A superior thoracic cavity,** containing the
   A. **Pleural cavity (left and right, divided by the mediastinum) organs:** lungs membranes: visceral and parietal pleura
   B. **Pericardial cavity organs: heart membranes:** visceral and parietal pericardium
2. **Inferior abdominopelvic cavity**, containing the
   A. **Peritoneal cavity membranes:** visceral and parietal peritoneum
   B. **Abdominal cavity (superior peritoneal) organs:** liver, stomach, spleen, intestine
   C. **Pelvic cavity (inferior peritoneal) organs:** intestine, bladder, reproductive organs

Membranes of the Anterior (Ventral) Body Cavity:

- The walls of the ventral body cavity and the outer surfaces of the organs are covered with a thin, double layered membrane – serosa or serous membranes.
- Part of the membrane lining the cavity walls - parietal serosa -folds on itself to form the visceral serosa which covers the organs in the cavity.
  - Parietal - "paric"- means wall
  - Visceral - "viscus"- means an organ in a body cavity

BODY FLUIDS:



Water content of the body is divided into:

1. Intracellular compartment (67%) - Inside the cell
2. Extracellular compartment (33%) - Outside the cell

1. Intracellular Fluid (ICF)

- Comprises, 2/3 of the body water.
- If body has 60% water, ICF is about 40% of your weight.
- The ICF is primarily a solution of potassium and organic anions, proteins etc.
- The cell membranes and cellular metabolism control the constituents of this ICF.

2. Extracellular compartment (ECF):

- It is the remaining 1/3 of your body's water.

- ECF is about 20% of the body weight.
- The ECF is primarily a NaCl and NaHCO3 solution.
- The ECF is further subdivided into three sub-compartments:

A. Interstitial Fluid (ISF). B. Plasma. C. Transcellular fluid

A. Interstitial Fluid (ISF)

- Interstitial Fluid (ISF) surrounds the cells, but does not circulate.
- It is the main component of the extracellular fluid
- It comprises about 3/4 of the ECF.
- Interstitial fluid is found in the interstitial spaces, also known as the tissue spaces.

Composition of interstitial fluid:

- Water solvent amino acids
- Sugars
- Fatty acids
- Coenzymes
- Hormones
- Neurotransmitters
- Salts
- Waste products from the cells.
- Lymph is considered a part of the interstitial fluid

Function of interstitial fluid

- Intercellular communication.
- Interstitial fluid bathes the cells of the tissues.
- Removal of metabolic waste.

B. Plasma:

- It is the yellow liquid component of blood in which the blood cells in whole blood are normally suspended
- 55% of the total blood volume.
- It is the intravascular fluid part of extracellular fluid (all body fluid outside of cells)
- It makes up about 1/4 of the ECF.

Composition of plasma

- Water (90% by volume)
- Dissolved proteins
- Glucose
- Clotting factors
- Mineral ions
- Hormones
- Carbon dioxide.

Function of plasma

- Plasma is the main medium for excretory product transportation.

- Blood serum is blood plasma without fibrinogen or the other clotting factors (i.e., whole blood minus both the cells *and* the clotting factors).

C. Transcellular fluid

- Transcellular fluid is the portion of total body water contained within epithelial lined spaces.
- Smallest compartment.
- It is about 2.5% of the total body water.

  Examples
  - Cerebrospinal fluid
  - Ocular fluid (Aqueous humor)
  - Joint fluid (Synovial fluid)
  - Urine

Composition of transcellular fluid:

1. Cerebrospinal fluid:
   - The CSF is mainly produced by the choroid plexus.
   - The entire nervous system contains between 80-150 ml of CSF.
   - It is a clear colorless liquid that contains White blood cells, glucose, protein, lactic acid, urea, cations (Na^+, K^+, Ca^{++} etc) and anions (Cl^-, and HCO_3^-).
2. Ocular fluid (Aqueous humor):
   - The aqueous humor is a transparent, gelatinous fluid similar to plasma.
   - It is located in the anterior and posterior chambers of the eye, the space between the lens and the cornea.
   - It contains Amino acids (transported by cilliary muscles), 98% water, Electrolytes, Ascorbic acid, Glutathione
3. Joint fluid (Synovial fluid):
   - Synovial fluid is clear, pale yellow, viscid, and does not clot.
   - The principal role of synovial fluid is to reduce friction between the articular cartilage of synovial joints during movement.
   - It contains Normal 3–4 mg/ml hyaluronic acid, a polymer of disaccharides, WBC, RBC and proteins
4. Urine:
   - Urine is a typically sterile liquid by product of the body secreted by the kidneys through a process called urination and excreted through the urethra.

- It contains 95% water, Organic solutes like urea, creatinine, uric acid, and trace amounts of enzymes, carbohydrates, hormones, fatty acids, pigments, and mucins, and inorganic ions such as sodium (Na+), potassium (K+), chloride (Cl-), magnesium (Mg2+), calcium (Ca2+), ammonium (NH4+), sulfates (SO42-), and phosphates (e.g., PO43-).

SOME DEFINITIONS RELATED TO HUMAN ANATOMY AND PHYSIOLOGY SUBJECT:

CELL: It is living structural and functional units of body enclosed by membrane.

CYTOLOGY: It is the branch of science concern with the study of cells.

TISSUE: It is a group of cells that usually have common embryonic origin and function together for special activities.

BLOOD: It is a liquid connective tissue

LYMPH: It is a thin, watery, clear, modified tissue fluid formed by the passage of substance from the blood capillaries into the tissue space (interstitial space) and enters in to the closed system of lymphatic capillaries to lymphatic vessels and lymphatic sinus.

CARDIOVASCULAR SYSTEM: Cardiovascular is the system which includes the study of the heart, blood vessels and blood.

IMMUNE SYSTEM: It is the collection of cells, tissues and molecules that protects the body from numerous pathogenic microbes and toxins in our environment.

SIGNATURE OF TEACHER