

I. Levels of organization

- A. The human body has many levels of structural organization. Beginning with the smallest:
1. Chemical level: Examines atoms and how they combine to form the molecules of the human body (water, sugar, protein, DNA).
 2. Cellular level: Examines **cells** (the most basic structural and functional unit of any living thing).
 3. Tissue level: Examines the 4 types of **tissues** (group of two or more cells of similar function or origin).
 - a. **Epithelia**
 - b. **Connective**
 - c. **Nervous**
 - d. **Muscle**
 4. Organ level: Examines **organs** (a structure composed of at least 2 major tissue types) and their specific function for the body.
 5. System level: Examines how 2 or more organs work together, each with a specific function, to accomplish a common purpose (ex. Cardiovascular system, Digestive system).
 6. Organismal level: Examines how all of the organ systems function together to promote life.

II. Tissues:

A. Epithelia

1. Location:
 - a. **Covers** body surfaces and organs
 - b. **Lines** closed body cavities and hollow organs
 - c. Forms **glands**
 - i. Usually associated with cuboid (sometimes columnar) epithelia.
 - ii. Supported by reticular C.T.
 - iii. Classified as **endocrine** or **exocrine**.
 - (a) Endocrine glands:
 - (i) Consist of **ductless** glands that secrete hormones into the circulatory system.
 - (ii) Includes the pituitary gland, adrenal gland, ovary, etc.
 - (b) Exocrine glands:
 - (i) Consist of glands **with a duct** that secrete onto a free surface of the body (skin) or into the lumen (interior space) of a hollow organ (stomach, mouth, etc.).
 - (ii) Includes sweat glands, salivary glands, mammary glands, etc.
2. Functions:
 - a. Protection
 - b. Secretion
 - c. Absorption
3. Characteristics:
 - a. Cells are very simple, 6-sided, and closely packed together. There are 3 types of epithelial cells:
 - (i) **squamous**: flat cells with a disc shaped nucleus
 - (ii) **cuboid**: cube shaped with a spherical nucleus

- (iii)**columnar**: rectangular cells with an elongate nucleus
 - b. Tissue has an **apical** (free) surface which is exposed to a body cavity or the exterior of the body; and a **basal** surface which is attached to an underlying **basement membrane** (connective tissue).
 - c. Typically highly mitotic
 - d. No blood vessels are present (**avascular**).
 - e. Nerves may be present.
4. Tissue arrangements:
- a. **Simple**: a single layer of cells found in areas where diffusion, filtration, secretion and absorption occur. Found in areas of low wear and tear.
 - i. simple squamous:
 - (a) Has a fried-egg appearance.
 - (b) Helps in forming membranes that line closed cavities and cover organs within those cavities; forms walls of capillaries and alveoli within the lungs.
 - ii. simple cuboidal:
 - (c) Primarily associated with glands and their ducts. Also covers the ovary and lines ducts of the kidney.
 - iii. simple columnar:
 - (d) Lines open tracts , i.e. digestive and reproductive tracts.
 - (e) May be specialized with **microvilli** for absorption.
 - (f) Has **goblet cells** for mucous production.
 - b. **Stratified**: contains 2 or more layers of cells. Found in areas of high wear and tear.
 - i. Stratified squamous:
 - (a) Forms outer layer of skin and lines body openings (mouth, esophagus, vagina (nonkeratinized), anal canal (keratinized)).
 - (b) Sloughs easily to reduce friction.
 - ii. Stratified cuboidal:
 - (a) Fairly rare.
 - (b) Forms ducts of sweat glands and lines male urethra.
 - iii. Stratified columnar:
 - (a) Fairly rare.
 - (b) Lines part of the male urethra and forms part of the conjunctiva of the eye.
 - c. **Transitional**:
 - i. Specialized to undergo changes in tension.
 - ii. Looks similar to stratified cuboidal with larger, rounded cells at the apical surface.
 - iii. Cells flatten as tissue is stretched. Lines the ureters and urinary bladder.
 - d. **Pseudostratified**: A single layer of cells where some cells do not reach the surface. This causes the tissue to appear to be multilayered.
 - i. Pseudostratified ciliated columnar: Lines the airway of most of the respiratory system and some ducts in the reproductive system.
5. Cancer
- a. 90% of all cancers are associated with epithelial cells.
 - b. Most cases develop on surfaces exposed to the external environment.

