The objectives of this lecture 1:

1. **What is the function of Epithelial Tissue ?**
2. **How Many Types of Epithelial Tissue?**
3. **Define lamina propria? What is the function of its?**
4. **What is a papillae?**
5. **What is basal lamina? Numerate the layers of it?**
6. **What are the main functions of basal lamina?**
7. **How is tissues associated with each other?**
8. **Classify the junctions types?**
9. **Explain the apical cells?**
10. **Classify the epithelial tissue according to the number of layers?**
11. **Classify the epithelial tissue according to the cells shape?**
12. **What are the functions of each type? Where it's found give an example?**

TISSUES

Cells come together with extracellular matrix (a jelly-like fluid) to form the four types of tissues found in the human body: :1-***Epithelial tissue 2- Connective tissue 3- Muscle tissue 4- Nervous tissue***. Tissues join together in different arrangements to form our body organs. Organs work together in systems.

Epithelial Tissue

A. Structure. Epithelia are specialized layers that line the internal and cover the external surfaces of the body. An epithelium consists of a sheet of cells lying close together with little matrix (ECM). The cells are located on top of dense irregular connective tissue, the basement membrane (BM).

1. The basement membrane separates the epithelium from underlying connective tissue and blood vessels.

2. Epithelia are avascular and receive nourishment by diffusion of molecules through the basal lamina.

B. Classification Epithelia are classified into various types on the basis of the number of cell layers (one cell layer is simple; more than one is stratified) and the shape of the superficial cells. Pseudostratified epithelia appear to have multiple cell layers, but all cells are in contact with the basal lamina .

C. Function

1. Transcellular transport of molecules from one epithelial surface to another occurs by various processes, including the following:

a. Diffusion of oxygen and carbon dioxide across the epithelial cells of lung alveoli and capillaries

b. Carrier protein–mediated transport of amino acids and glucose across intestinal epithelia c. Vesicle-mediated transport of immunoglobulin A (IgA) and other molecules

2. Absorption occurs via endocytosis or pinocytosis in various organs (e.g., the proximal convoluted tubule of the kidney).

3. Secretion of various molecules (e.g., hormones, mucus, proteins) occurs by exocytosis.

4. Selective permeability results from the presence of tight junctions between epithelial cells and permits fluids with different compositions and concentrations to exist on separate sides of an epithelial layer (e.g., intestinal epithelium).

5. Protection from abrasion and injury is provided by the epidermis, the epithelial layer of the skin.

All **epithelial tissues** have these common characteristics:

1. They form sheets of tightly bound cells or roll into tubes.
2. Epithelial cells lie on the basement membrane.
3. Epithelial cells have two different "sides"—apical and basolateral.
4. The apical side always faces out of the body

Characteristic Features of Epithelial Cells

The forms and dimensions of epithelial cells range from high **columnar** to **cuboidal** to low **squamous** cells. Epithelial cell nuclei have a distinctive shape, varying from spherical to elongated or elliptic. The nuclear form often corresponds roughly to the cell shape; thus, cuboidal cells have spherical nuclei, and squamous cells have flattened nuclei. The long axis of the nucleus is always parallel to the main axis of the cell.

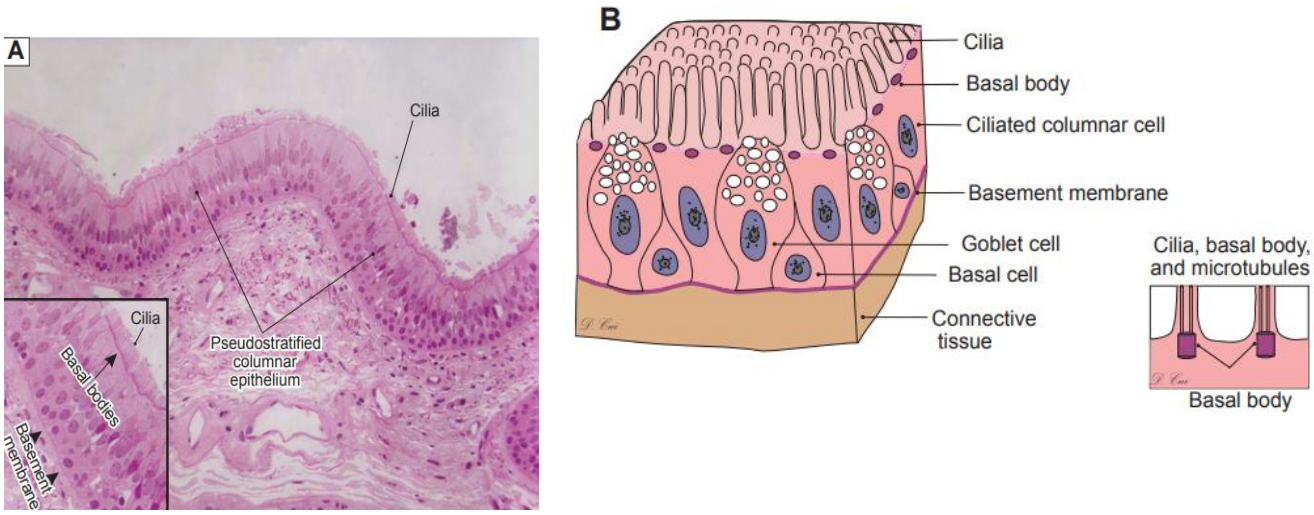
Because the lipid-rich membranes between cells are frequently indistinguishable with the light microscope, the stained cell nucleus is a clue to the shape and number of cells. Nuclear form is also useful to determine whether the cells are arranged in layers, a primary morphologic criterion for classifying epithelia.

Most epithelia rest on connective tissue. In the case of epithelia lining the cavity of internal organs (especially in the digestive, respiratory, and urinary systems) this layer of connective tissue is often called the **lamina propria**. The lamina propria not only serves to **support the epithelium but also provides nutrition and binds it to underlying structures.** The area of contact between epithelium and lamina propria is increased by irregularities in the connective tissue surface in the form of small

evaginatons called **papillae**. Papillae occur most frequently in epithelial tissues subject to friction, such as the covering of the skin or tongue.

Specializations of the Apical cell Surface

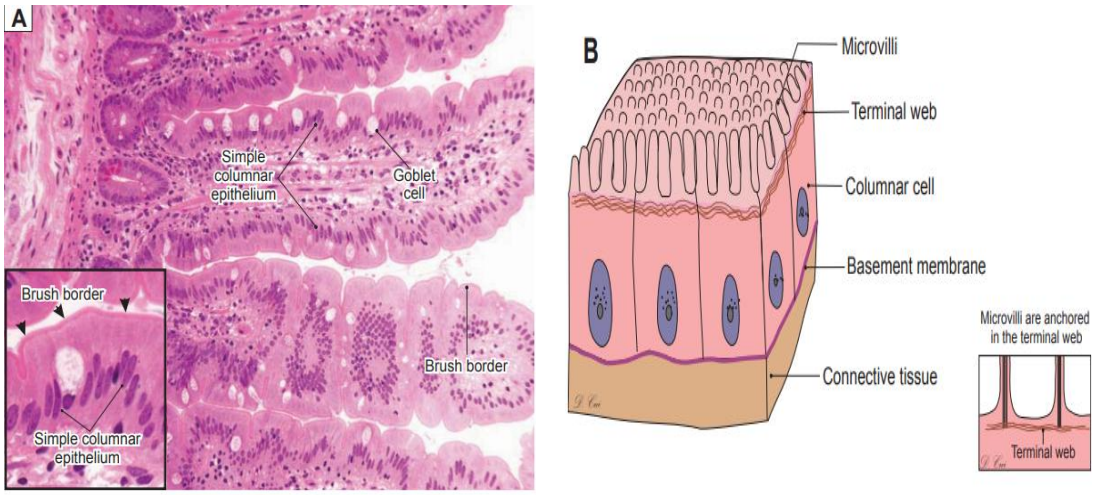
1-Cilia : hair-like appendages elongated, motile structures that have a greater diameter and length than microvilli and attached to the apical surface of cells Cilia arise from electrondense, cylindrical structures, called basal bodies, in the apical cytoplasm just below the cell membrane. Cilia are 0.2 µm in diameter and 5 to 10 µm long, so they can be seen as individual structures with the light microscope. The function of cilia is to aid in the transport of material along the surface of epithelial cells and act as sensory structures to produce movement. Cilia are present in the pseudostratified ciliated columnar epithelium in the respiratory tract and ciliated simple columnar epithelium in the oviduct (fallopian tube)



2-Microvilli:

Microvilli are smaller than cilia. Microvilli are anchored to a network structure called the terminal web, which contains actinfilaments to stabilize the microvillus. These specialized structures increase apical surface area to aid in absorption. Microvilli are commonly seen in simple columnar epithelium lining the small intestine and simple cuboidal

epithelium lining the proximal tubules in the kidney. Microvilli of the intestinal epithelium are about 0.08 µm in diameter and 1 µm long, so they cannot be distinguished as individual structures with the light microscope, but the row of tightly packed microvilli can be seen as a brush border.



3- Stereocilia are long microvilli which consist of actin microfilaments and help with absorption like ordinary microvilli, stereocilia are less than 0.1 µm in diameter, but they can attain lengths of 10 µm or more. Stereocilia are characteristic of the pseudostratified columnar epithelium of the ductus epididymis and vas deferens of the male reproductive system.

Specializations of the Basal Surface

(Basal Domain)

Epithelial cells rest on a basement membrane, consisting of a basal lamina and a reticular lamina, which provide an underlying foundation for the cells. The term "basement membrane" is used in light microscopy observation. The terms "basal lamina" and "reticular lamina" are ultrastructural terms and refer to features that require electron microscopy to be seen. Cells are anchored to the basement membrane by hemidesmosomes, junctions that connect the cells to the underlying basement membrane.

Basal Laminae & Basement Membranes

All epithelial cells in contact with subjacent connective tissue have at their basal surfaces a felt-like sheet of extracellular material called the basal lamina. This structure is visible only with the electron microscope, where it appears as an electron-dense layer, 20–100 nm thick, consisting of a network of fine fibrils, the dense layer or lamina densa .In addition, basal laminae may have electron-lucent layers on one or both sides of the dense layer, called clear layers or laminae lucida. Basal laminae are found not only in epithelial tissues but also where other cell types come into contact with connective tissue. Basal laminae have many functions. Such as ***regulate cell proliferation and differentiation by binding and concentrating growth factors; influence cell metabolism and survival; organize the proteins in the adjacent plasma membrane (affecting signal transduction); and serve as pathways for cell migration***. An extracellular basal lamina always lies at the interface of epithelial cells and connective tissue. Nutrients for epithelial cells must diffuse across the basal lamina. Nerve fibers normally penetrate this structure, but small blood capillaries (being epithelial themselves) never enter an epithelium

across a basal lamina. When components of a basal lamina are resolved with the light microscope, the structure is often called a basement membrane.

Specializations of Lateral surface (domain): Contains junctional complexes that connect cells to neighboring cells.

Lateral surfaces of epithelial cells exhibit several specialized intercellular junctions these are:

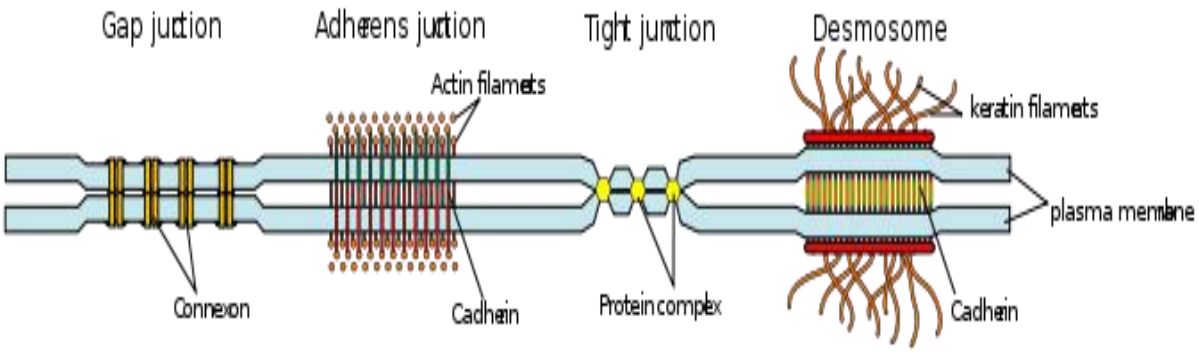
■■ **Tight or occluding junctions**: the closely associated areas between two adjacent cells.

■■ **Adherent or anchoring junctions** share the characteristic of anchoring cells through their cytoplasmic actin filaments.

■■ **Gap junctions** are channels for communication between adjacent cells.

■■ **Desmosome** also known as a macula adherents is a cell structure specialized **for cell-to-cell** adhesion. A type of junctional complex, they are localized spot-like adhesions randomly arranged on the lateral sides of plasma membrane

■■ **Hemidesmosomes:** are specialized junctions that resemble half of a desmosome. They mediate adhesion of epithelial cells to the underlying extracellular matrix. These junctions are present on the basal surface of basal cells in certain epithelia (e.g., tracheal epithelium and stratified squamous epithelium) and on myoepithelial cells, where they **lie adjacent to the basal lamina (**adherence of epithelial **cells to the underlying basal lamina)**



Types of Junctions in Epithelial cells