

Histology:- is The Study of Tissues. Tissues are composed of cells and the products of cells.

There are four type of tissue :-

I-Epithelial Tissues : Tissue that covers and lines organs and organisms, found on the surface separated from the connective tissue by basal lamina.

II- connective tissue : Tissue that supports and connects , not found on the surface.

III-Muscle Tissue : Tissue that contracts and produces motion and/or locomotion .

V-Nerve Tissue : Tissue that response to stimuli and conducts impulses ,communication of information.

1-Epithelial Tissue

Major Tissue components :

1-Cells 2- Fibers 3-molecules of extracellular Matrix (ground substance) .

Classification of epithelia based on cellular component

A-Cell shape

1-Squamous cells .

Flat or thin cytoplasm, the nuclei bulge above the cytoplasmic thickness

Functional characteristic: Thin cytoplasmic adaptation for diffusion .

2-Cuboidal cells:- Square cells with round centrally located nuclei.

Functional characteristic: Organelles for energy production and secretory activity.

3-Columnar cells

Tall or "column like" cells, normally oval shaped nuclei located near the attached surface.

Functional characteristic: Organelles for energy production and secretory activity .

B-Cell layer

1-Simple Epithelium = Single layer

2-Stratified Epithelium = Two or more layers of cells Basal layer: generative (mitosis), Surface layer: mature cell type .

C-Specializations of Epithelial cells

Cilia: contain microtubules, used to move materials across the surface of a cell

Microvilli: increase surface area for absorption.

Cellular junctions :several membrane associated structures contribute to cohesion and communication between cells .

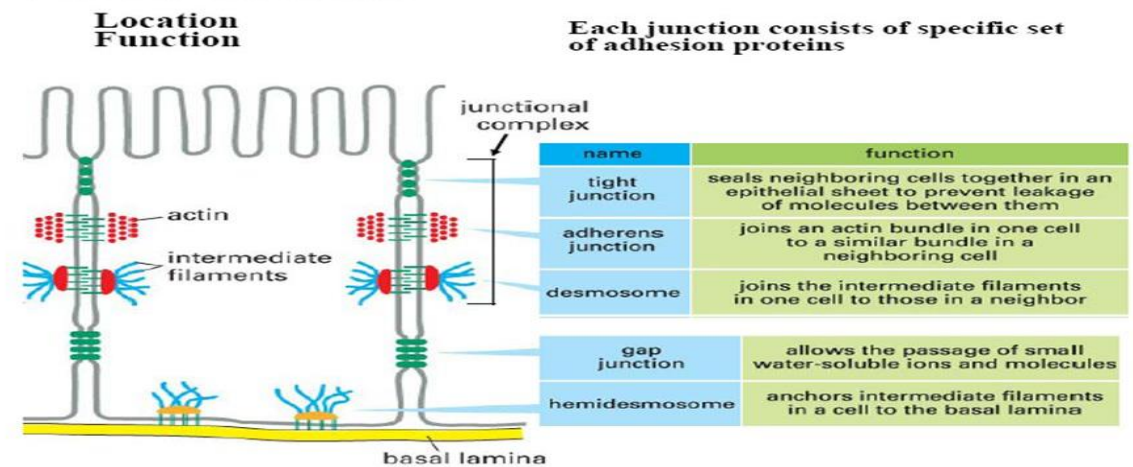
-Gap or communicating junctions :-A **gap junction** connects adjacent cells via protein channels, allowing the direct movement of small molecules and ions from the cytoplasm of one cell to the cytoplasm of the next cell. Gap junctions can also open and close in response to electrical or metabolic signals from nearby cells, which coordinates the functions of tissues. For example, gap junctions in the intercalated discs of cardiac muscle facilitate the rapid movement of ions between cells, allowing heart cells to contract almost simultaneously.

-Desmosomes:- A **desmosome** is a strong cell junction that reduces mechanical stress by connecting cells via specialized proteins at anchoring junctions and helping maintain tissue strength. These junctions penetrate the cell membrane and attach to the cell's [cytoskeleton](#), a network of protein filaments throughout the cytoplasm that gives the cell its shape. Desmosomes are particularly important in epithelial and cardiac muscle tissues where stress is encountered regularly.

-Tight junctions, most apical ,forming a band completely encircling each cell. Tight junctions block the flow of fluids between epithelial cells. This tight adherence prevents materials from leaking between the cells; tight junctions are typically found in epithelial tissues that line internal organs and cavities, and comprise most of the skin. For example, the tight junctions of the epithelial cells lining your urinary bladder prevent urine from leaking out into the extracellular space.

Functions of cell junctions

Cellular Junctions



In epithelial tissue fibers reduced , cells attached to basement membrane, fibers secreted by epithelial cells at their attached surface Matrix Extremely reduced.

The principal functions of epithelial tissues are:

- 1-the covering and lining of surfaces (skin ,intestines)
- 2-absorption (intestines)
- 3-secretion (glands)
- 4-sensation(gustative and olfactory neuepithelium)
- 5-contractility (myoepithelial cells).

Basal lamina structure :It appears as dense layer 20-100 nm thick consisting of a delicate network .of very fine fibrils (lamina densa) and an electron –lucent layer on one or both sides of the lamina densa called lamina lucida, the function of BM are

Functions of B.M.

- 1-structural functions as supporting the cells and attach cells to the underlying connective tissue .
- 2- filter substances entering epithelium from below .
- 3- concentrate mitogenic growth factors .
- 4-form a base for epithelial repair and regeneration

Classification of simple Epithelial tissue

Epithelia are divided into two main groups according to their structure and function .

1- covering or lining epithelia

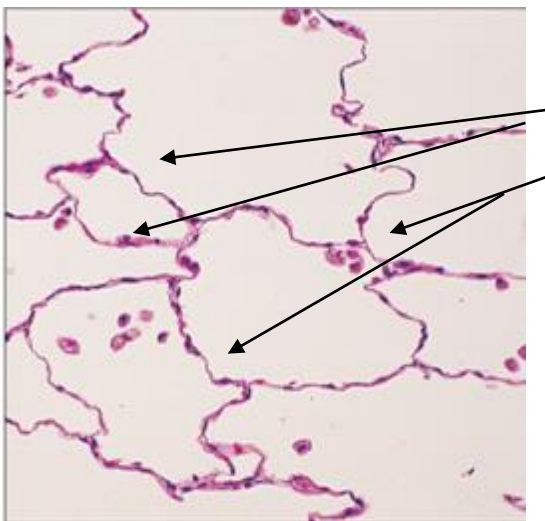
2-secretory or glandular epithelia

1- covering or lining epithelia

1-Simple Squamous Epithelium (S.S.E),

Single layer of cells, flattened cells with disc –shaped central nuclei and sparse cytoplasm mesothelium lining body cavities, endothelium lining blood vessels.

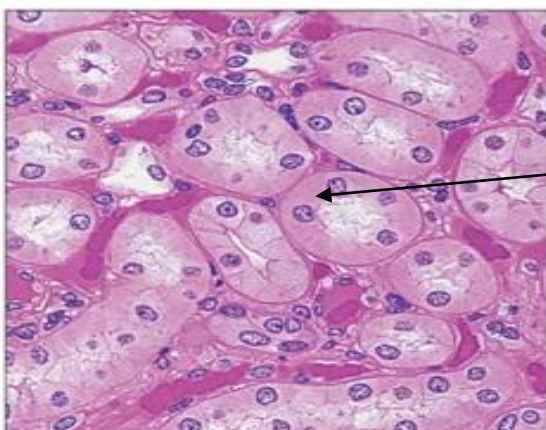
Simple Squamous epithelium can be found in the renal corpuscle in the kidney cortex and Henli's loop. All capillaries are S. S. E. as well as the lining of the heart and blood vessels. and alveolar sacs of the lung.



.Air sacs of lung tissue

Nuclei of squamous epithelial cells

Simple squamous epithelial tissue 125 X



Simple cuboidal Epithelial cells

in kidney tube 430 X

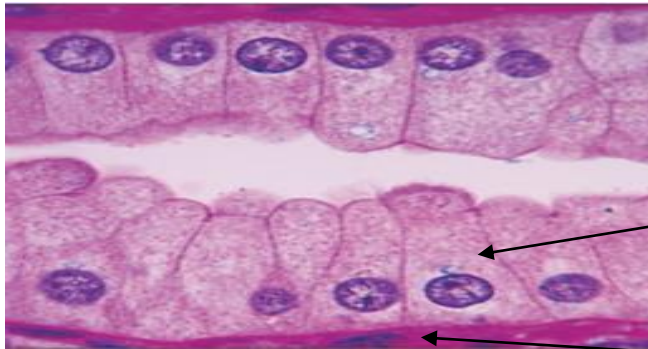
2-Simple Cuboidal Epithelium

Single layers of "cube like" cells can be found in the follicles in the thyroid gland, tubules of the nephrons in the kidney. They form the secretory epithelium and ducts of many glands such as the salivary glands, kidney tube and the thyroid gland . Function Absorption ,secretion of mucus ,enzymes and other substances ,ciliated type propels mucus (or reproductive cells) by ciliary action.

3-Simple Columnar epithelium.

Single layer of tall, column like cells. oval shape of nuclei. some cells bear cilia;

layer may contain mucus secreting unicellular glands (goblet cells)



simple columnar epithelial cell

basement membrane

simple columnar epithelial cell of the stomach mucosa 860 X

4-Pseudostratified Ciliated Columnar

Columnar cells appear to be in layers but are not. All cells are attached to the basement membrane.

The layered appearance is due to the different positions of the nuclei of these cells.

1-Basal cells are short and irregular with their nuclei near the basement membrane.

2-Pyramidal cells have their nuclei about in the center of the cell, midway between the base and the free epithelial surface.

3-Columnar cells extend from the basement membrane to the free surface. Only cells that reach the free surface have cilia.

Some Pseudostratified epithelia have only 2 layers of cells.

In Respiratory epithelium there are all three types of cells.

Single mucous secreting gland cells are found scattered among respiratory epithelium the free surface contains stereo cilia (branched microvilli, not true cilia).

-Stratified Epithilium, 2 or more layers of cells, protection for surfaces exposed to chemical attack .

Many cell shapes may be found. Superficial layer of the epithelium contains the distinguishing cell type that gives the name to the epithelium.

1-Stratified Squamous Epithilium Thick membrane composed of several cell layer ; basal cells are cuboidal or columnar and metabolically active ;surface cells are flattened (Squamous) basal cells are active in mitosis and the cells of the more superficial layer . Protects underlying tissue in areas subjected to abrasion .

Squamous cells on the free surface found in Epidermis of the skin, esophagus, vagina, rectum.

a-Non-Keratinized epithelium, (Internal, esophagus etc)

b-Keratinized epithelium , dry (Skin) the surface cells are full of keratin and dead .

2- **StratifiedCuboidal Epithilium** Cuboidal cells on the free surface found in sweat glands ,developing ovarian follicles .

3-Stratified Columnar Epithilium Columnar cells on the free surface found rarely .

4- Pseudostratified

Single layer of cells but looks stratified (2or more layers) all cells rest on the basement membrane , nuclei at different levels .

5-Transitional (Urinary) Epithelium

-Found in urinary bladder ,urethra ,calyx of kidney .

A- basal layer is made up of cuboidal cells.

B-Intermediate layer of pear – shaped ,, balloon ,, cells .

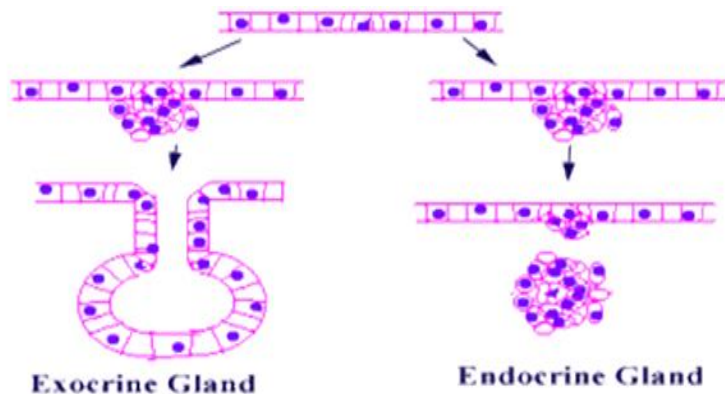
C- Superficial layer cells are larger than the others .

Relaxed (contracted) state . cells cuboidal to columnar in appearance . 6 layers of cells .

Stretched state . cells stretched and flattened 2-3 layers of cells . In extreme distension these cells may appear almost squamous .

2-secretory or glandular epithelia

Glands –All glands (exocrine and endocrine) are produces by epithelial tissue .



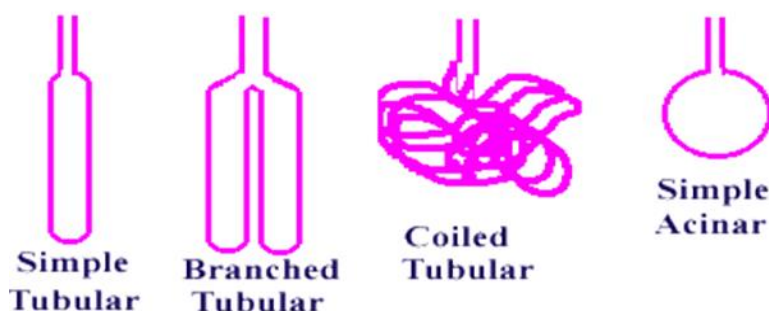
Exocrine Glands secrete onto epithelial surfaces, ducts: carry exocrine secretions to surfaces.

Endocrine Glands secrete into tissue spaces & blood vessels, ductless glands, secrete hormones into the bloodstream.

Simple unicelinar glands

These are found scattered among the epithelial cells. The goblet cells in intestinal epithelia and the mucous cells in the respiratory tract are simple Unicellular Glands.

Multicellular Glands These glands result from the in growth of the epithelium into the underlying connective tissue and are connected to the epithelial surface by a duct. The cells in the lower portion of the gland become secretory in nature, producing either mucus or a watery secretion(serous). The secretory portion may be tubular or acinar, simple or branched, or a combination of these.



Reference:- From Cells to Organs: A Histology Textbook and Atlas .2003, 1st edition.