

Histology

faculty of medicine - JU2015

LECTURE#3

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*Now we will complete talking about the cell:

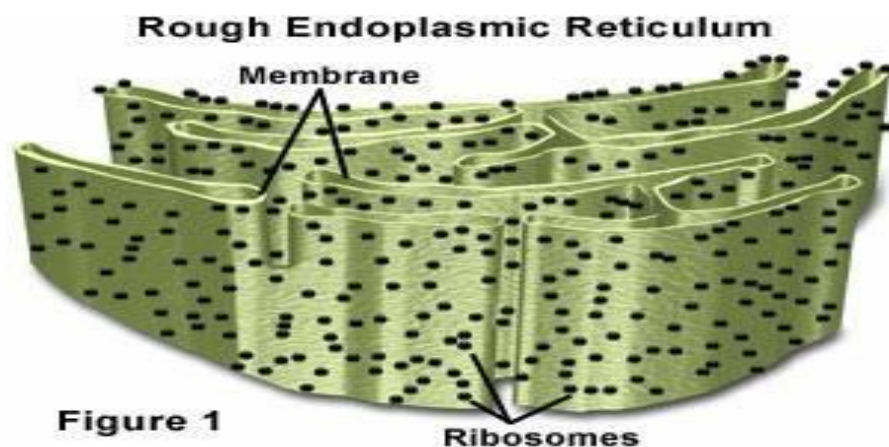
-**Ribosome**: is an organelle that is not surrounded with a membrane and it's composed of two subunits: 1- large subunit

2-small subunit

-The ribosome contains ribosomal RNA and different types of proteins, that's why ribosome is a basophilic structure. (Due to the presence of nucleic acids which will eventually make the net charge negative.)

*We have two types of ribosomes :

1-Ribosomes attached to the rough endoplasmic reticulum: this type synthesizes the proteins for export outside the cell.



2-Free ribosomes: they are freely located within the cytoplasm (not attached to the rough endoplasmic reticulum) and usually they form clusters (group of ribosomes) because they are connected to mRNA.

-We usually see these free ribosomes as polysomes or polyribosomes (poly=many) because of the attachment of ribosomes on the RNA Chain.

-The proteins that will be synthesized by these polyribosomes are going to be used within the cell itself. (inside the cell))

-**Cytoskeleton** : the cytoskeleton elements are 3 types of proteins according to their diameters they are subdivided into :

1-microtubules (largest)

2-intermediate filaments

3-actin filaments (smallest)

*The cytoskeleton elements can't be visualized under the light microscope because they are so thin, while under electron microscope they appear as filamentous shape structure .



-Functions of the cytoskeleton elements:

1-they give support and shape to the cell.

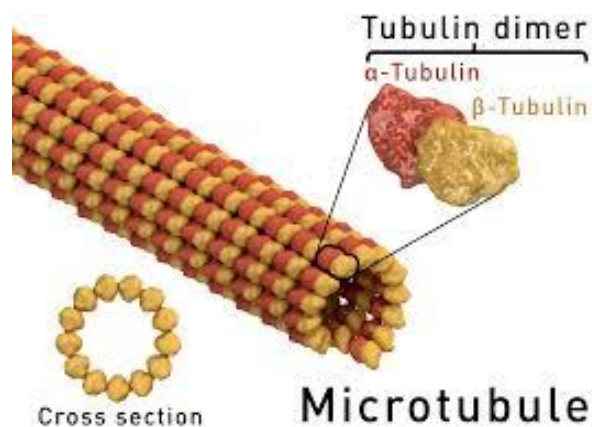
2-important for the movement of the cell and the organelles within the cell .(secretory vesicles use microtubules as a highway tract for transport of proteins.)

-microtubules contain two subunits:

1-alpha subunit 2-beta subunit

-these subunits polymerize to form dimers (structures containing alpha and beta subunits), these dimers polymerize again to form long chain of structure called **Protofilament**.

- 13 protofilament twist around each others to form microtubules



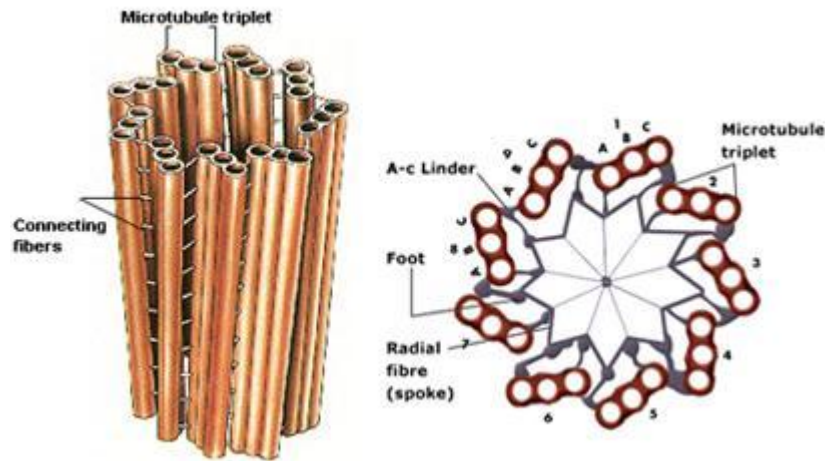
-**Centrioles**: they are important for cell divisions and they are usually two in number:

1-is located vertically

2-is located horizontally

Which mean they are perpendicular to each others.

-Centrioles are composed of 9 triplets of microtubules packed together .



-**Cell inclusions:** are non-living materials which are located in the cytoplasm and they are not important for the vitality of the cell.

-Types of cell inclusions:

1-storing metabolic products such as :

a-carbohydrates (glycogen particles)

Glycogen granules

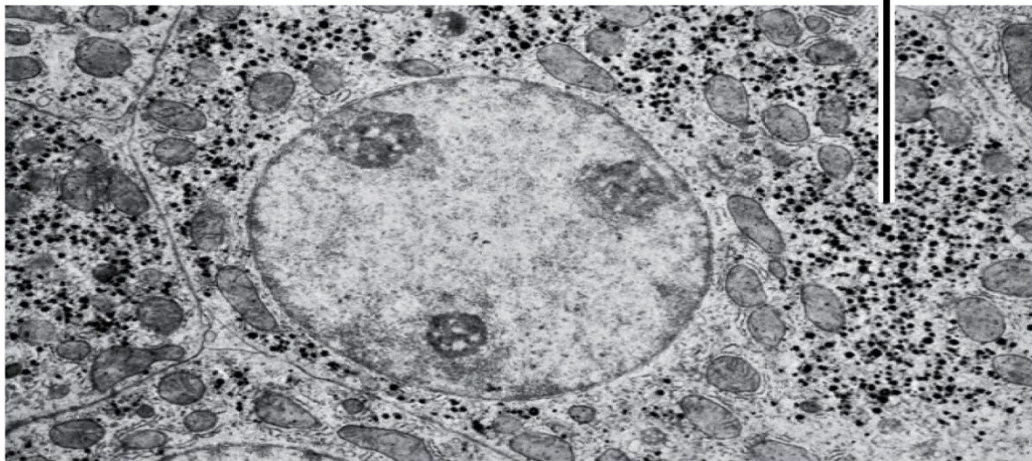
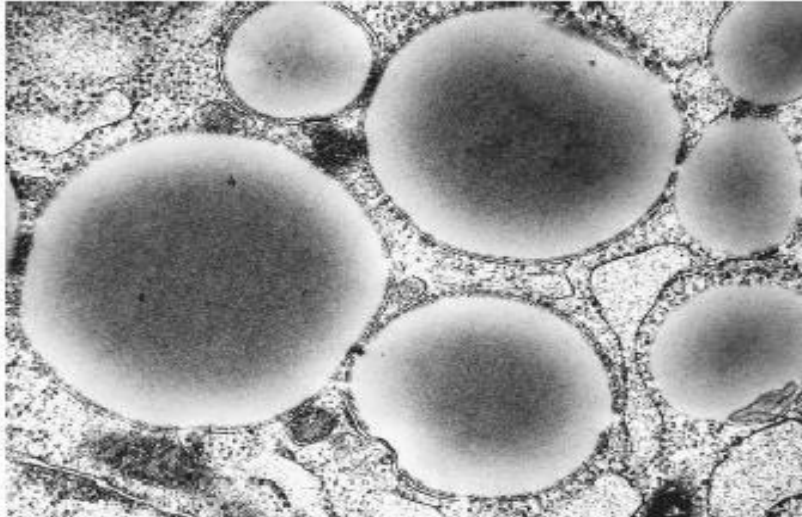


Figure 21.3
Biochemistry, Seventh Edition
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b-lipids (in case of deficiency or needing of energy)



2-storing pigments such as:

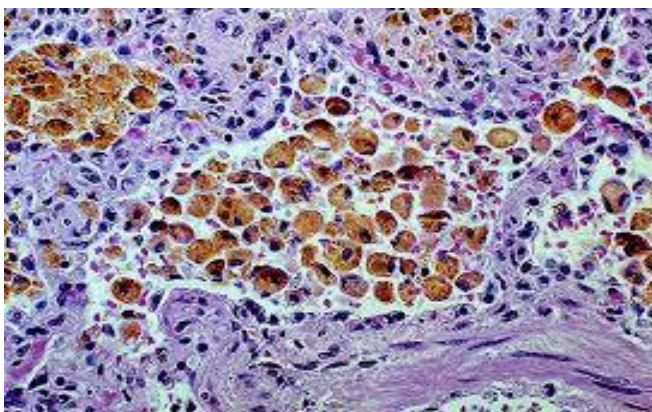
a-Melanin (the skin stores melanin which is responsible for the coloration of the cell)

b-Lipofuscin (this pigment is related to the age and it appears yellowish or brownish in color)

*what do we mean by "this pigment is related to the age"?

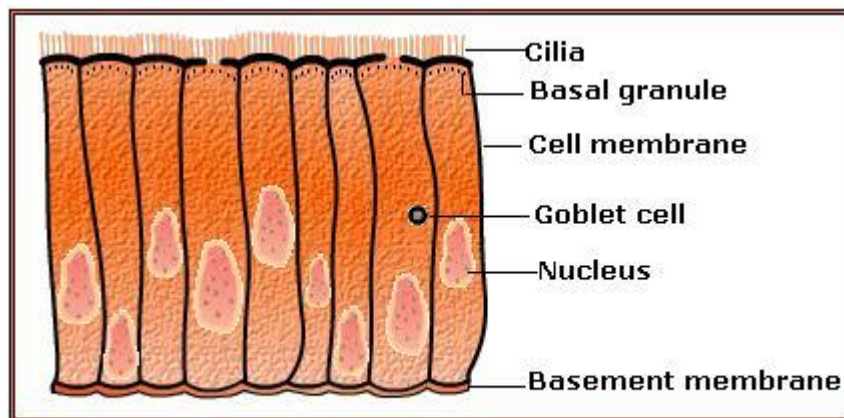
Answer: we said before that primary lysosome will fuse with the phagosome to produce secondary lysosome which will make digestion for the material, the remaining undigested material will accumulate in the cell cytoplasm and this accumulation is called tertiary lysosome or residual bodies. Now in long-living cells ,they accumulate high amount of this material (lipofuscin or age pigment) .So that when you look under the microscope and notice the lipofuscin pigment in the cell, this cell should be a long-living cell.

c-Hemosiderin pigment: it appears golden in color (we will talk about more through the course)



***EPITHELIUM TISSUE**

- The epithelium lines, covers and forms glands ; it lines the internal cavities of our bodies ,it covers the outer surface of our bodies and it has the ability to secrete (glands).
- The epithelium is the first barrier in our bodies.
- The epithelium is composed of closely packed epithelial cells with minimal or no extracellular material in between as you will notice in this figure.



Ciliated epithelium

***The main function for epithelium according to its structure and location is protection from biological samples, viruses, dehydration ,...etc.**

-Burns are considered as medical emergencies because the patient may lose high amount of water (dehydration) .

***The epithelium is avascular (no blood vessels are presented in the epithelium) and tightly packed , unlike the connective tissue(that lays under the epithelial tissue) which is vascular and loosely packed.**

***There are nerve endings between epithelial cells.**

***Characteristics of epithelium:**

1-it is derived from any embryonic layers

-The three layers of the embryo that the epithelium could be derived from are:

a-ectoderm : the epithelium lining the outer surface of the skin.

b-mesoderm : the epithelium lining the blood vessels and the heart.

c-endoderm : the epithelium lining the GI tract or the stomach.

*In order to find the epithelium, you have to look for a space (external surface or the cavity of an organ) and the epithelium will be directly lining it.

2-it rests on the basal lamina or basement membrane: this membrane separates the epithelial cells from the underlying connective tissue.

-Basement membrane: is a non-cellular structure and it's composed of:

a-Extracellular material

b-Proteins

c-Glycoproteins

d-protoglycans

-The basement membrane is produced by the epithelial cells and the underlying connective tissue.

3- Closely packed cells.

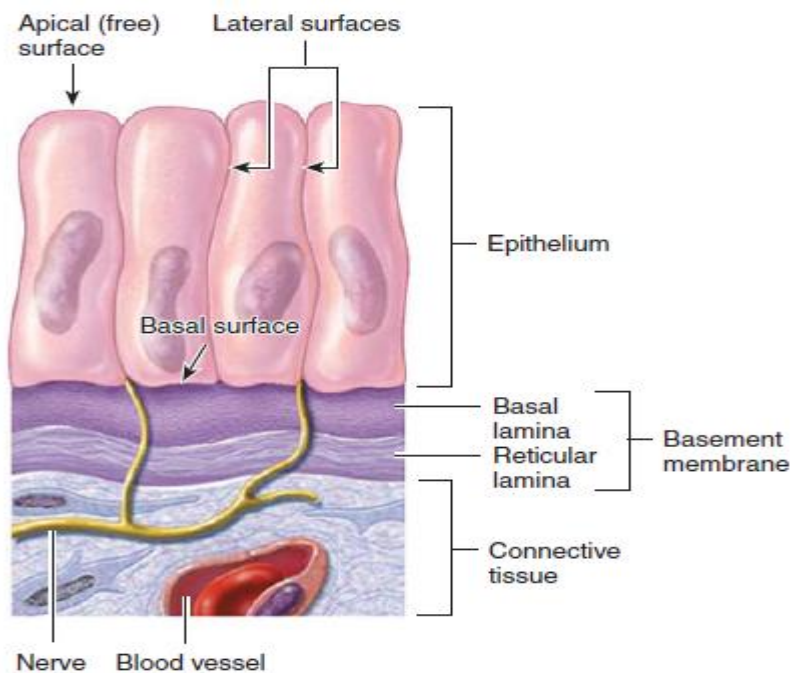
4- Avascular cells.

5- Richly innervated .

6-high regenerative power: it means that the epithelial cells can undergo mitosis to replace the keratinized dead skin cells (when the outer cells of the skin are lost by scratching, new ones are made instead.)

7-The cells of epithelium are polarized: it means that they have two domains (poles) :

- a- Apical free surface (towards the apex) facing the lumen or the external environment .**
- b- Basal surface faces the basal membrane .**



***Lateral surfaces: surfaces adjacent to the neighboring cells.**

8-modified to perform special functions:

***Functions of Epithelium:**

- a-Protection according to its location.**
- b-trans-cellular transport .**
- c-secretion.**
- d-absorption : the epithelium lining the GI tract or the stomach or the intestine .**
- e-selective permeability: since the epithelial cells are the first barrier of our bodies and they are tightly packed cells , they can control what substances can come in and what substances should stay out.**

f-detection of sensation .

***Classification of epithelium :**

1-according to the number of layers:

a-simple epithelium (one layer of cells)(all the cells are in direct contact with basement membrane)

**b-stratified epithelium: skin is made of it and its function is protection .
(more than one layer of cells) (not all the cells in direct contact with the basement membrane)**

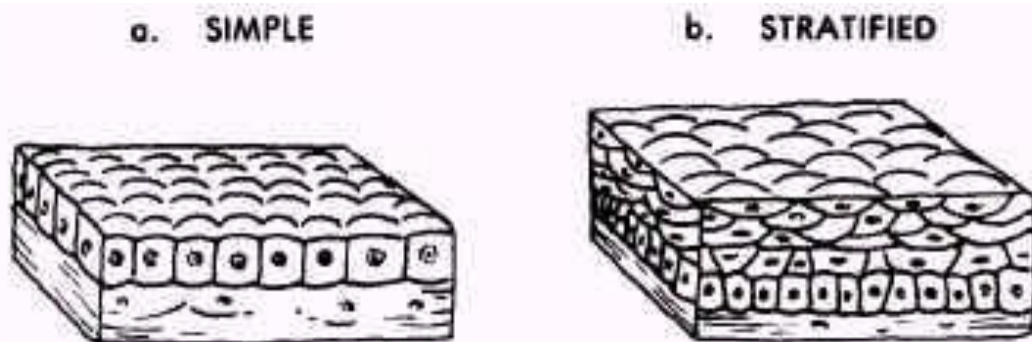


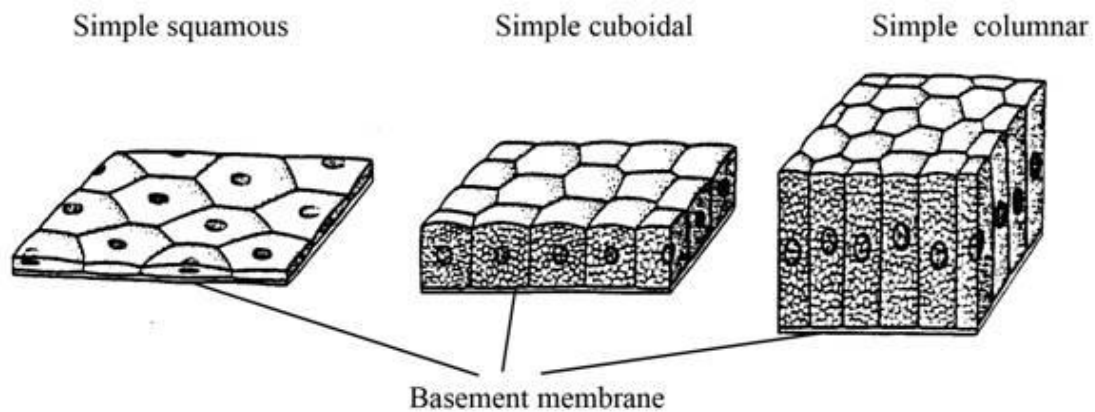
Figure 2-2. Types of epithelial tissues.

2-according to the shape of the cell :

a-squamous: flat and wide cells

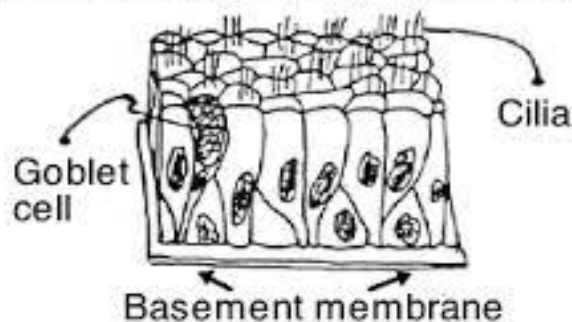
b-cuboidal : cube like cells (height=width)

c-columnar (height>width)

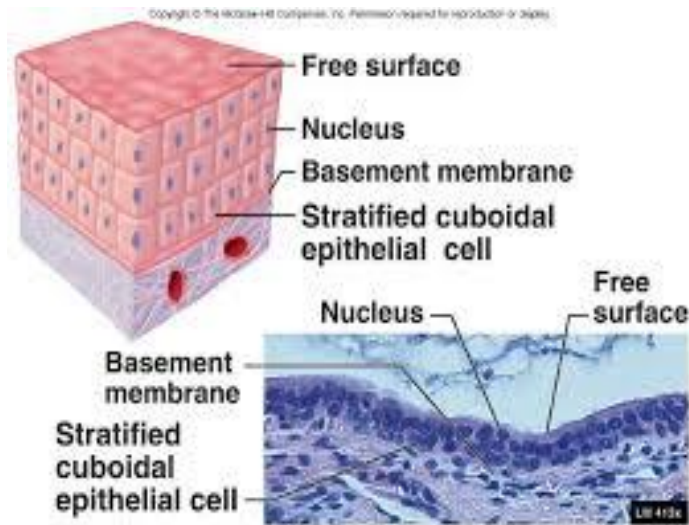


***** Pseudostratified columnar : A type of the simple epithelium**
"usually" ciliated ,the tissue is composed of tall columnar cells , but
between these tall cells , we find short cells that don't reach the apical
surface, but they are attached to the basement membrane (one layer
of cells , but because of the differences in heights of the cells , they
appear as more than one layer) , so it gives you a false appearance of
stratified tissue (pseudo = false) ex : the epithelial cells that live in the
blood vessels " the endothelium" are flat an composed "simple
squamous" of one layer. Notice the figure :

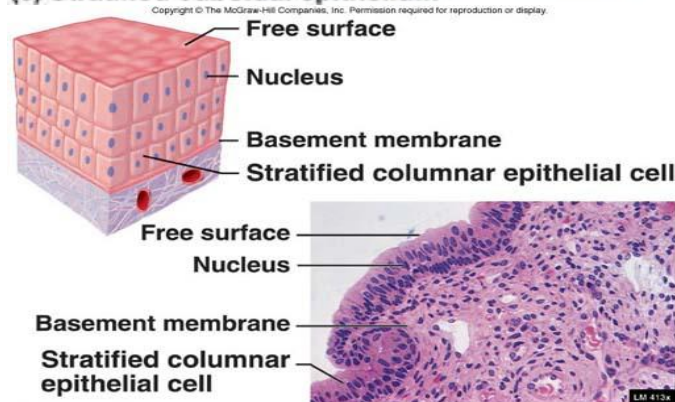
Pseudostratified (ciliated) columnar



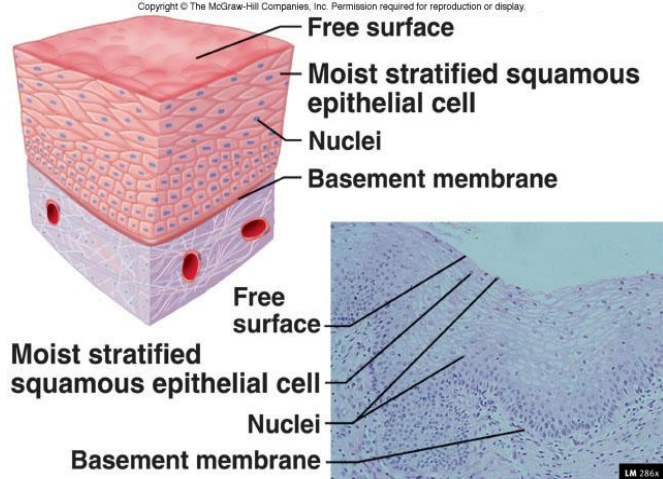
*The alveoli of the lungs are made of simple squamous epithelium



(e) Stratified cuboidal epithelium

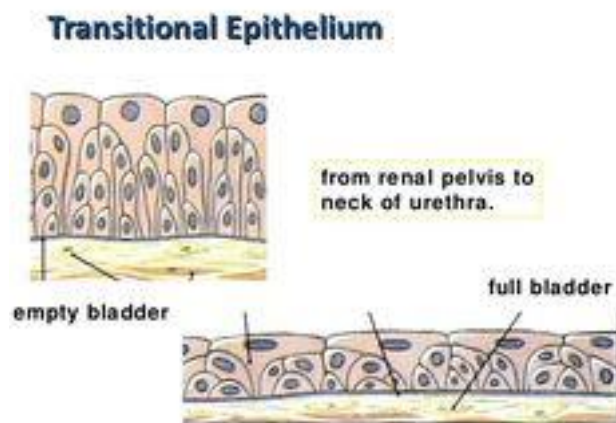


(f) Stratified columnar epithelium



(d) Stratified squamous epithelium

*****Transitional epithelium : is a type of stratified epithelium . It lines the urinary bladder , when the urinary bladder is empty , the epithelium is relaxed(dome-shaped or cuboidal in shape).On the other hand , when the urinary bladder is full of urine , the epithelium will be continuously stretching (flat-shaped or squamous in shape), that's why it's called transitional epithelium.**



***Stratified squamous epithelium has two special types:**

1-keratinized: like the skin or the upper part of the tongue (because it's exposed to mechanical forces).

****How is Keratin formed?**

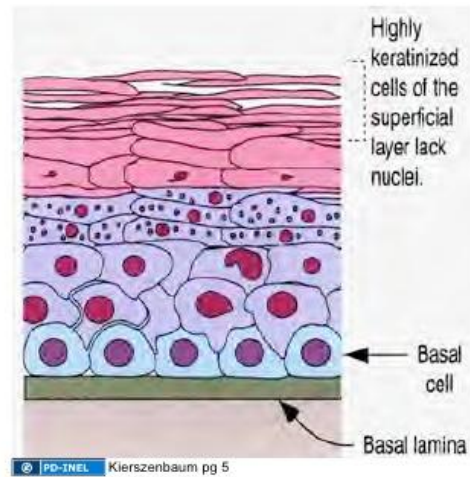
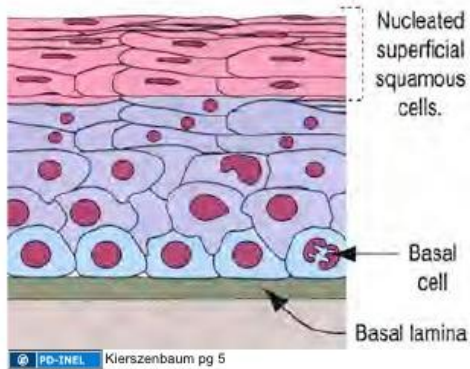
Answer: The cells of the epithelium build-inside their cytoplasm this keratin, and as they move upward towards the surface cells, these surface cells start to die (nucleus and organelles disappear) and what remains is keratin, that's why keratin accumulates over the surface cells, the layer of the keratin is considered a protective layer.

2-non-keratinized: like the lower part of the tongue (because it's not exposed to mechanical forces).

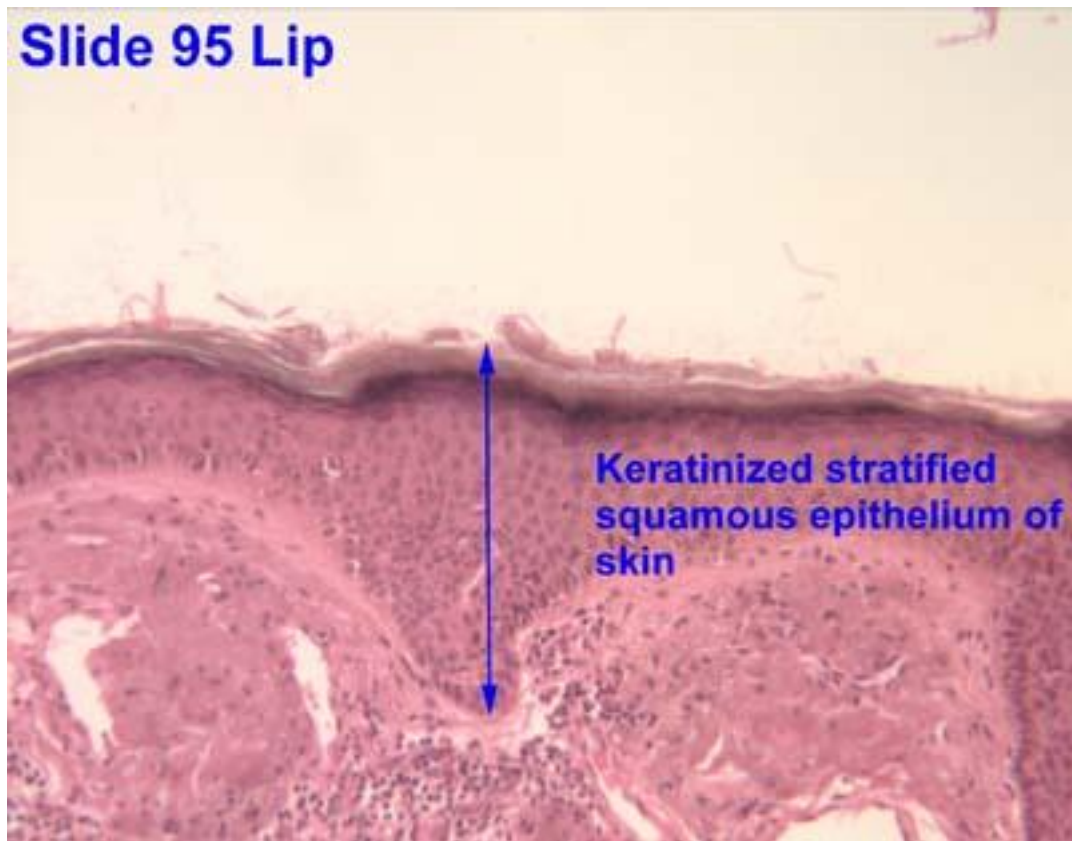
***In general, the beginnings of opening start as keratinized stratified squamous epithelium and end up as non-keratinized stratified squamous epithelium .**

Stratified Squamous Epithelium

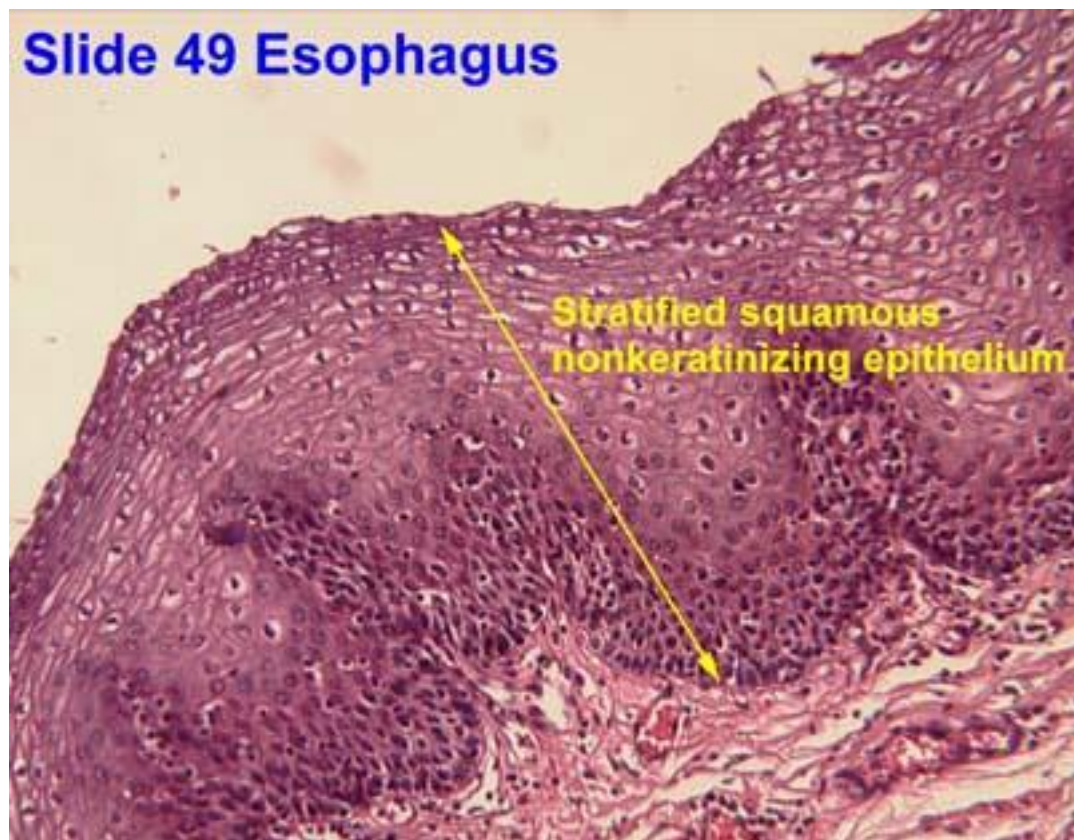
non-keratinized keratinized



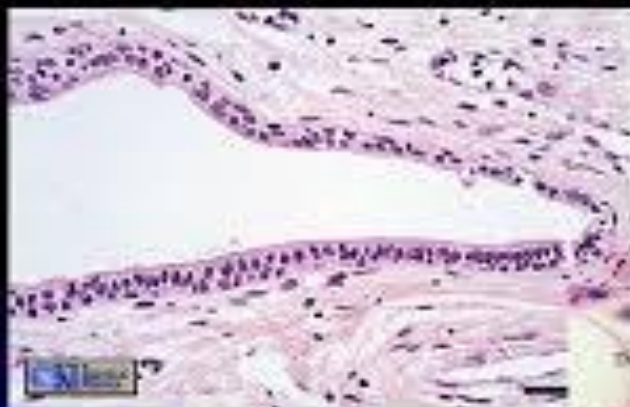
Slide 95 Lip

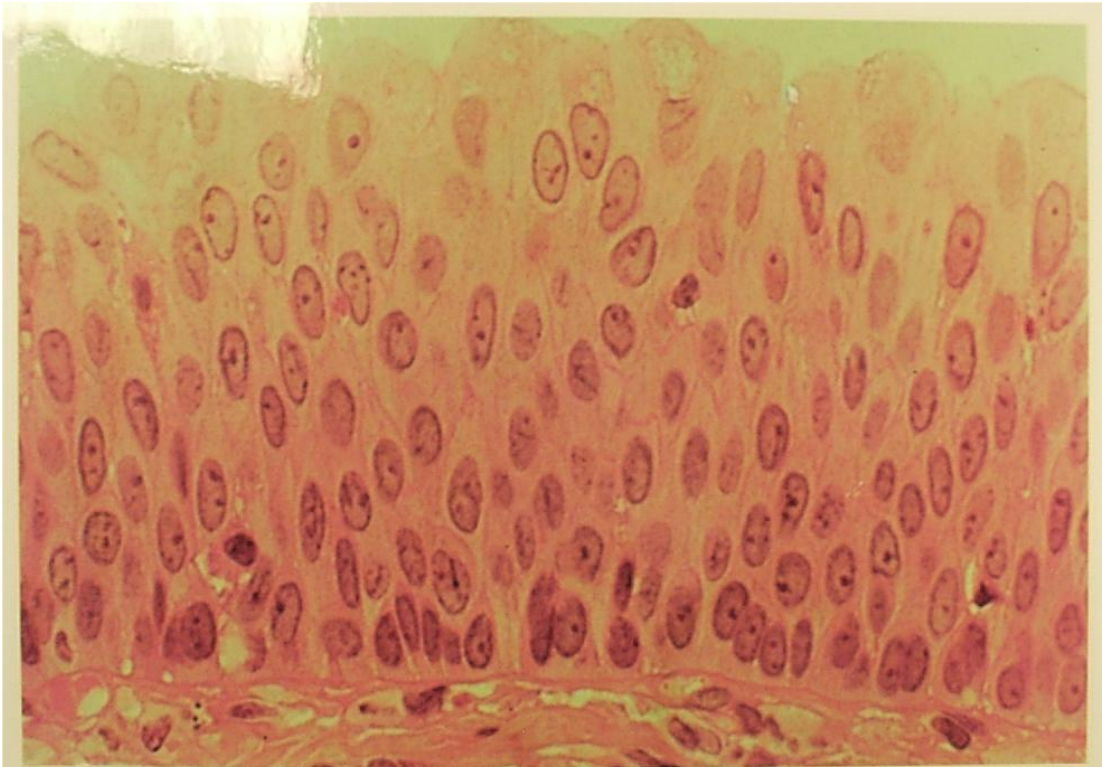


Slide 49 Esophagus

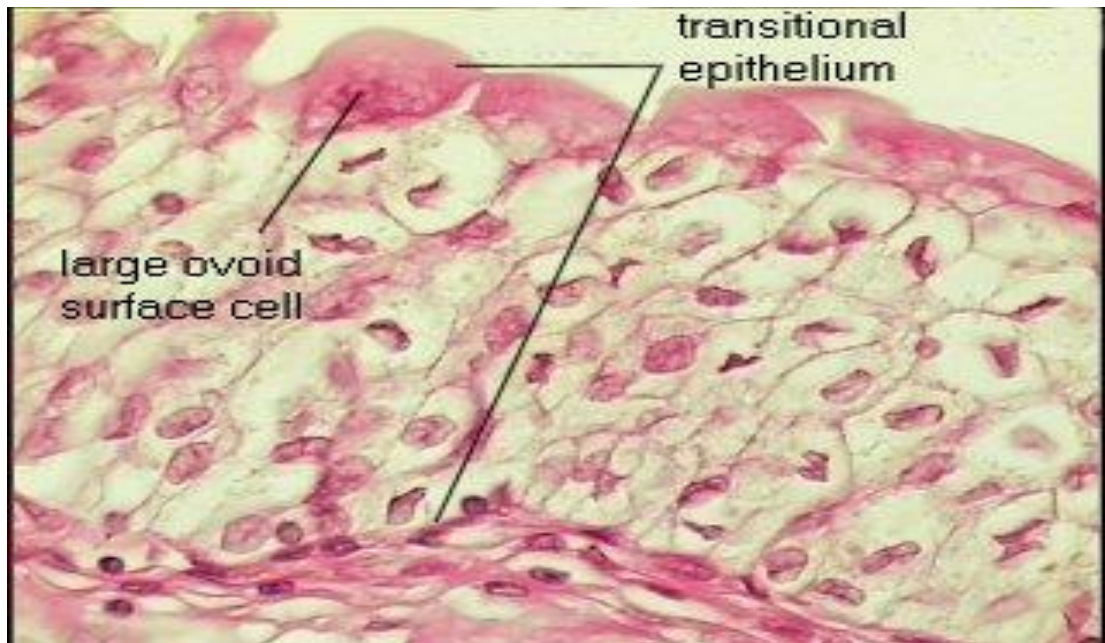


Stratified Cuboidal Epithelial Tissue

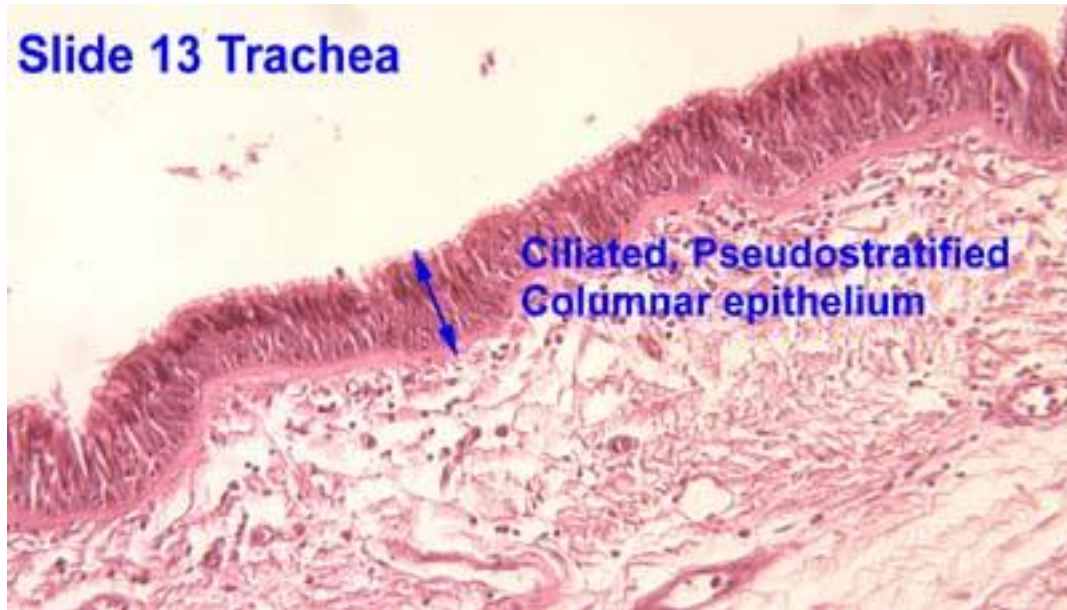




STRATIFIED COLUMNAR This tissue contains one or more layers of columnar cells and a basal layer of cuboidal cells. Found in few places (epiglottis, urethra and some glands). *Human epiglottis* 820 X



Slide 13 Trachea



Simple Cuboidal Epithelium

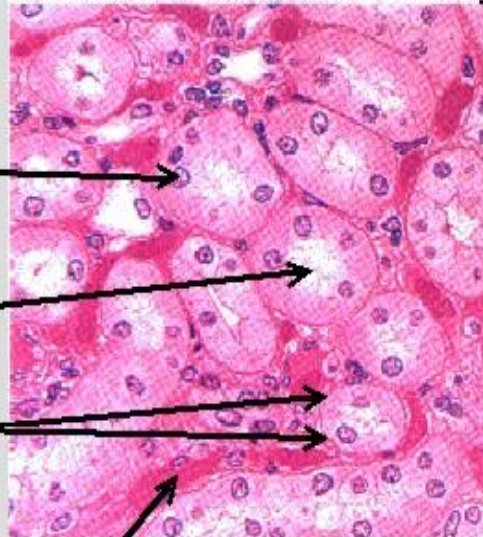
Convolved tubules of the kidney

Nucleus of
cuboidal cell

Lumen of
tubule

Cuboidal
epithelial cells

Connective tissue



Simple Columnar Epithelium

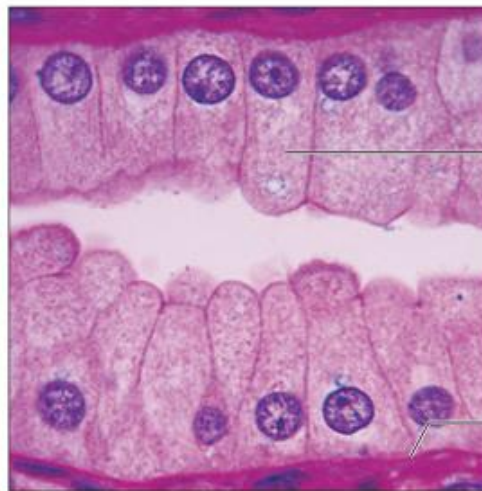
(c) Simple columnar epithelium

Description: Single layer of tall cells with round to oval nuclei; some cells bear cilia; layer may contain mucus-secreting unicellular glands (goblet cells).



Function: Absorption; secretion of mucus, enzymes, and other substances; ciliated type propels mucus (or reproductive cells) by ciliary action.

Location: Nonciliated type lines most of the digestive tract (stomach to anal canal), gallbladder, and excretory ducts of some glands; ciliated variety lines small bronchi, uterine tubes, and some regions of the uterus.

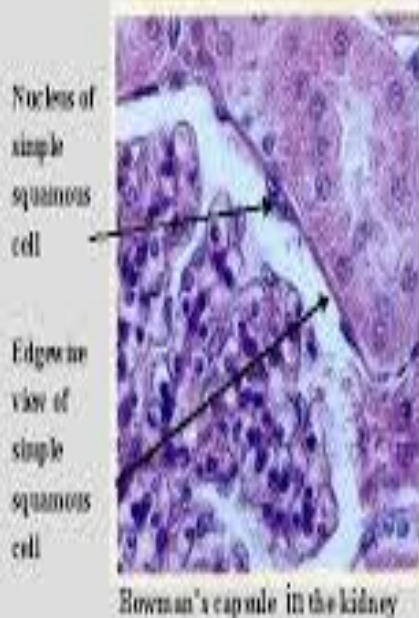


Simple columnar epithelial cell

Basement membrane

Photomicrograph: Simple columnar epithelium of the stomach mucosa (1150 \times).

Simple Squamous Epithelium



Nucleus of simple squamous cell

Edgewise view of simple squamous cell

Bowman's capsule in the kidney

*Cilia: projections from the apical surface of the cell and they are motile structures .Plus , they are found in the respiratory tract .They push the mucus which is produced by the goblet cells out of the respiratory tract.

*Goblet cells : are found in the respiratory tract with the cilia and these goblet cells secrete mucus material in order to lubricate the air passageway and to warm(clean) the air before entering.

***In smokers, the number of goblet cells increases (more mucus production) ,which will decrease the motility of the cilia .For this reason; smokers have to cough heavily in order to get the mucus out of their bodies.**

* Two special types of tissues which do not follow the naming rule:

1-pseudostratified epithelium →simple

2-transitional epithelium → stratified

*The function of the microvilli is to increase the area of absorption.

Always do your best. What you plant now, you will harvest later.

*we all are humans and we all DO make mistakes,forgive me if there are any mistakes.

*This sheet is done by: Omar Al-Sahily