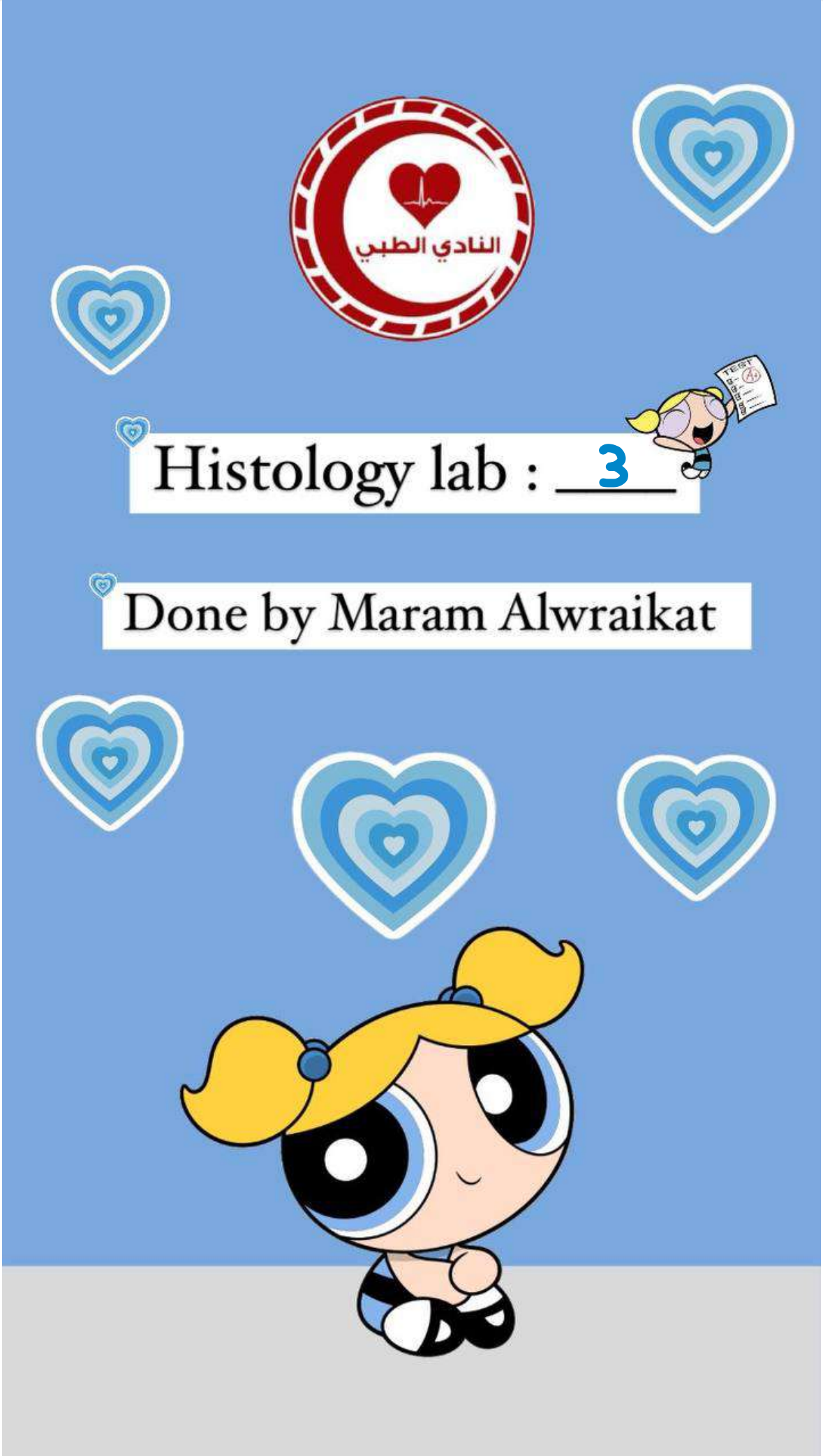

النادي الطبي
Histology lab : 3
Done by Maram Alwraikat

Histology Lab 3

Questions will be ??

الدكتور ح يجيب صورة tissue

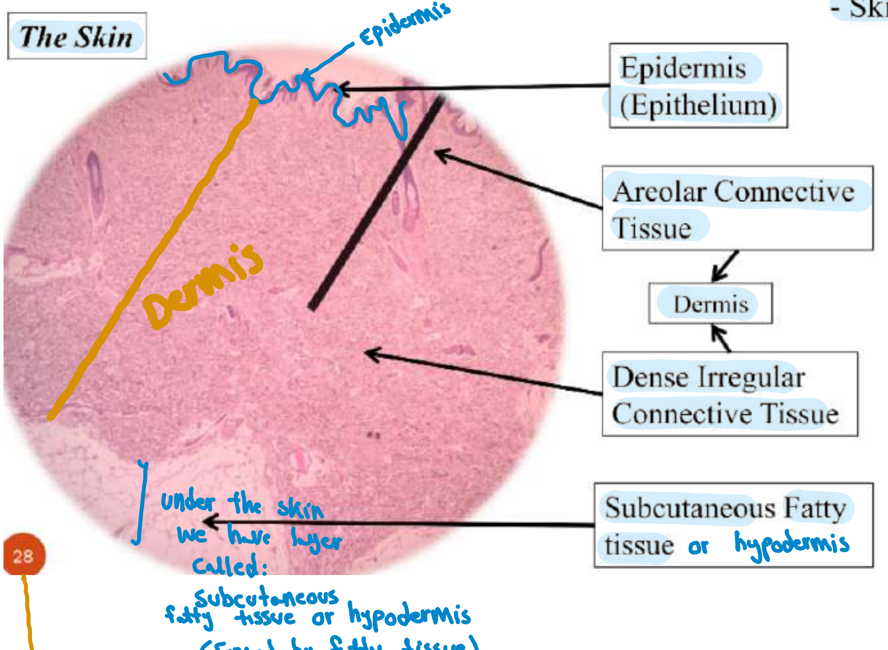
- Identify the tissue (نوع tissue ؟)
- نوعد الجزء من tissue ؟
  - Basal lamina
  - Reticular lamina . . . . . .
  - (Identify the part)
- possible location (labs+ lectures)
  where this tissue could be located ?

other type of (lining or covering Epithilium) According to number of layers

(4) Stratified Squamous Keratinized Epithelium

It's found in areas that require great protection:
- Skin → Epidermis

The Skin

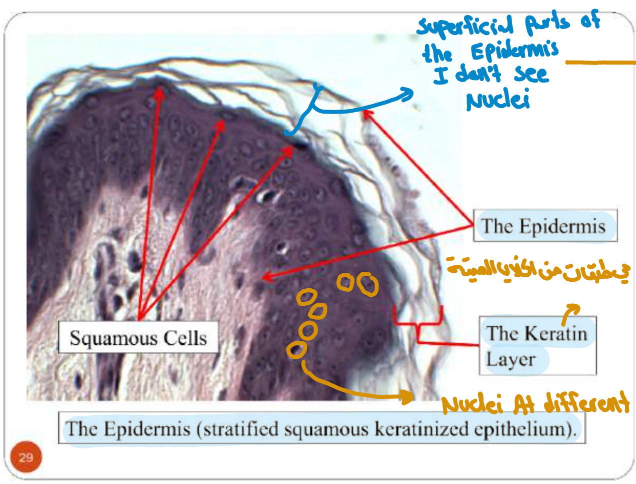


This is a General view of the slide of low magnification (we can see a several layers)

skin ← تتكون من طبقتين
- superficial layer called the Epidermis (طبقة سطحية)
- A Deep layer called Dermis (طبقة عميقة)

* the Epidermis of the skin is an (Epithelial layer) Formed of stratified Squamous keratinized Epithelium

* The Dermis is a connective tissue layer And Actually contains two types of connective tissues
  - Areolar connective tissue
  - Dense Irregular connective tissue



The Epidermis (stratified squamous keratinized epithelium).

superficial parts of the Epidermis I don't see Nuclei → Because these layers Are formed of died cells (Keratin)

→ Epidermis (Epithelium)

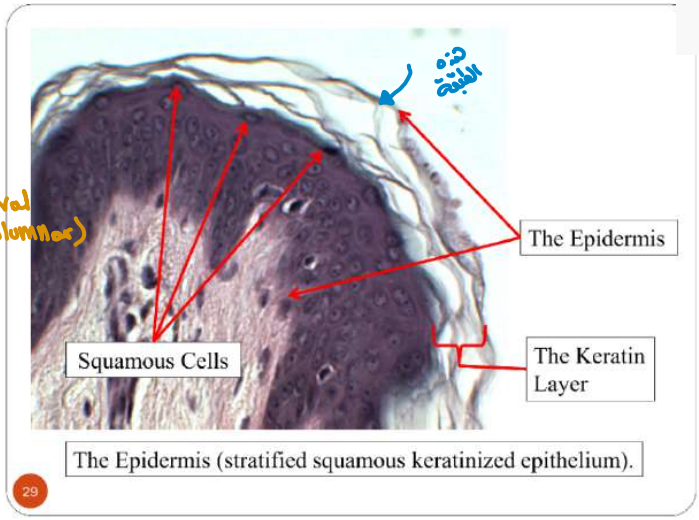
Nuclei At different levels → مابكون بينهم spaces

* when we classified stratified Epithilium

↳ we must look at the shape of cells in the top most layer

under the microscope we don't see the cell membrane so to identify the shape of the cell we must look at the Nuclei

- oval (columnar)
- flat (squamous)
- Round (cuboidal)



But here the Nuclei Are died

(There are no Nuclei)

So how can I identify the shape of the cells?

↳ we will able to identify the shape of the cells exactly and percisely by using other methods

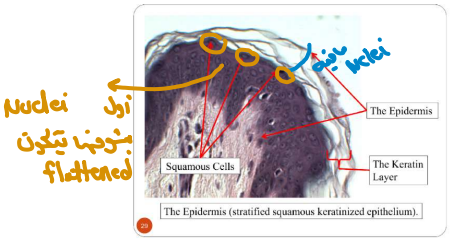
1- Electrone microscope

عن طريقه منشوف الكونيا الموجودة في top-most layer

Squamous cells في عبارة عن

2- Light microscope

The Nuclei that I first see Are flattened



Nuclei اول شي منشوفها بتكون flattened

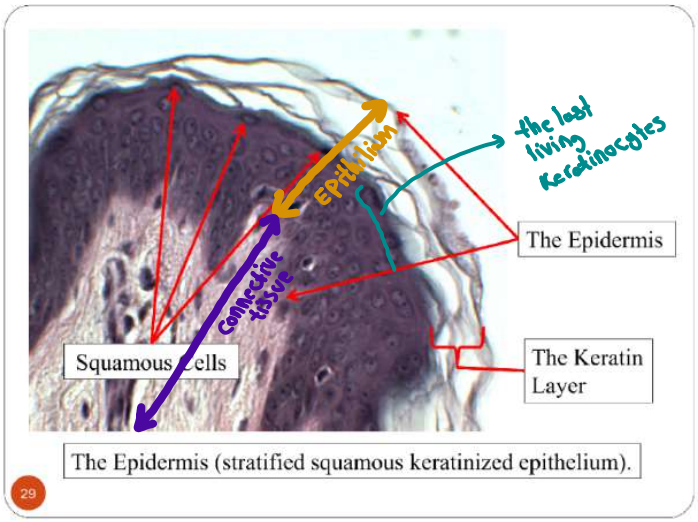
Flattened ← Nuclei وبما انه هاي

Squamous ← cells فهذه

(more superficial) ← و نستنتج ان الكونيا Are Also Squamous

↳ دقة: Electrone microscope أدق

we Are Actually see them As Squamous cells



Epithilium → Epithelial cells يتكون من

Epidermis ← Skin لكن في

↳ Epithelial cells بالاسم خاص

(Keratinocytes)

↳ Another Name for the Epithilial cells

It is not a different type of cell

It is just a special name

Function (For Stratified Squamous Keratinized Epithelium) ⟶ prevent water loss

How ? by many ways

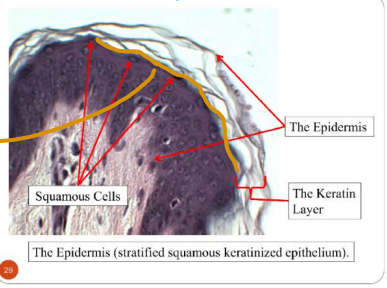
السبب الرئيسي

Close proximity between cells (القرب بين الخلايا)

Tight Junctions بين الخلايا

هو وجود كمية من الدهون بين الخلايا في هذه الطبقة

ليس معناه بعض الماء يدخل من خلاله



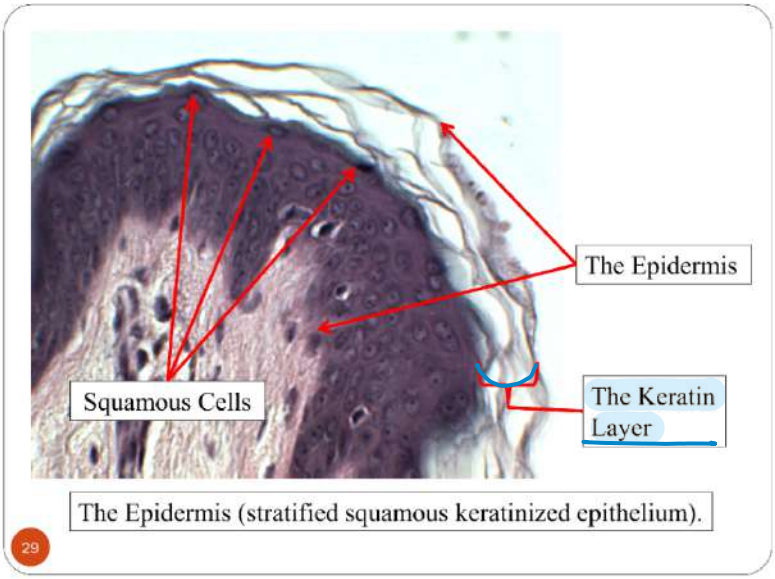
هذه المنطقة الخلايا الموجودة بين هذه الطبقات تفرز مادة دهنية

هذه المادة الدهنية تتجمع بين الخلايا

So small spaces between cells is filled with fat

الماء والدهون ← مش محبة

بسبب وجود هذه الطبقة من fats ← يقل فقدان الماء



* Important :

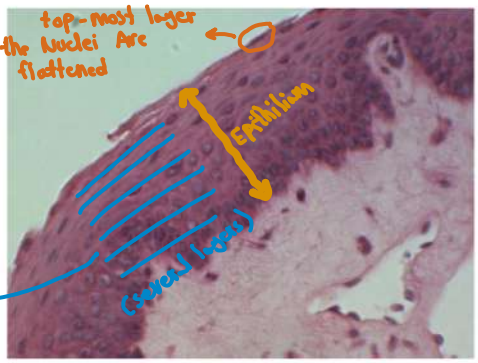
I look at the slide under the microscope And I see top layers that have no nuclei

I have only one type of Epithilium with this feature

↳ Stratified Squamous Keratinized Epithelium

- It's found in areas that require protection and water loss is not a big problem:
  - Mouth, esophagus, anal canal
  - Vagina

(5) Stratified Squamous Non-Keratinized Epithelium



lined by ← الموي

⟶ Top most layer is formed of squamous cells

multiple layers (stratified)

So Stratified Squamous

Epithilium يطلع Nuclei وبعاين منشوف من اختفى نقطة كلو نقطة (Nuclei كلها تحتوي على)

This epithilium is non-Keratinized : معناه

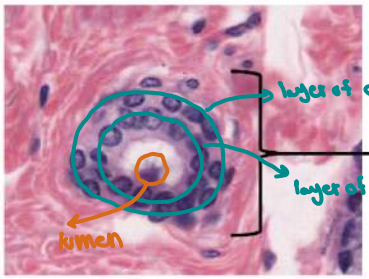
↳ So stratified Squamous Not-Keratinized Epithelium

closly packed cells (No Spaces)

* Stratified cuboidal And columnar Epithelium → Are Not common in the body (ما منشوفهن بأماكن كثيرة)

→ Formed by several layers with the top most layer formed of: Cuboidal cells / Columnar cells

(6) Stratified Cuboidal Epithelium



→ location : Large excretary ducts of salivary and sweat glands

→ usually but not necessary

↓

Stratified cuboidal : عادة وليس بشرط
بتكون من طبقتين فقط
(Cuboidal cells) والطبقتين بتكونوا من

(2 layer (usually)) Stratified cuboidal epithelium lining a duct of a gland. (Example)

→ في الطبقتين ، الخلايا تحتوي على Round Nuclei
So it contains cuboidal cells

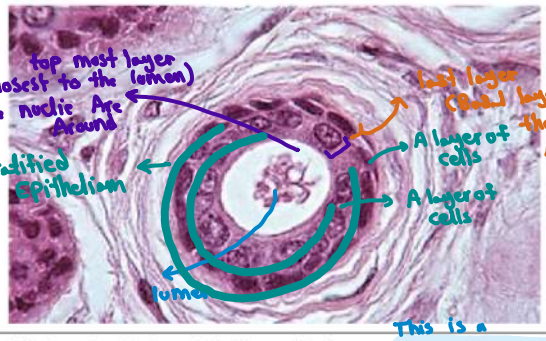
31

* multiple layers (stratified)

* Top most layer is formed of cuboidal cells

لكن مابيجي شكل الخلايا في باقي الطبقات (تتغير حسب)

So Stratified cuboidal Epithilium



This is a Stratified cuboidal epithelium lining a duct of a salivary gland. Note how the cells in the basal layer appear to have flattened nuclei and the cells in the apical layer have round nuclei. Remember, in the classification of stratified epithelium, we only look at the shape of cells (nuclei) in the apical layer.

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(7) Stratified Columnar Epithelium

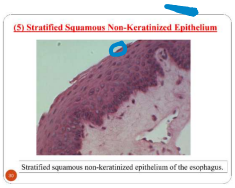
→ location: Conjunctiva , duct of salivary glands

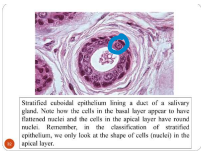
Stratified columnar epithelium lining a duct of a salivary gland. (Also)

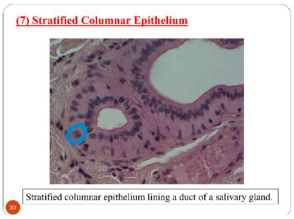
33

* How can I differentiate between the shape of Nuclei ?

Flattened — Round — oval (بتكون طويلة نوعي)







* Glands
- Secretic portion
- Duct secretic portion ⟶ contains of Glandular Epithilium

Ducts of the glands are formed of Lining Epithilium

Lining Epithilium of the Glands (Ducts)

Duct يختلف حسب حجم

- small ducts Are lined by simple cuboidal Epithilium
- many small ducts together formed a bigger duct ⟶ this lined by simple columnar Epitheliam
  - together formed bigger duct These become lined by stratified cubodial Epithilium
- بالنهاية رح تتكون القنوات الرئيسية (the main ducts of the Glands) And these Are lined by stratified columnar Epithilium

stratified columnar / simple cuboidal

that lines the ducts of Exocrine Glands ← Epithilium في أنواع مختلفة من ←

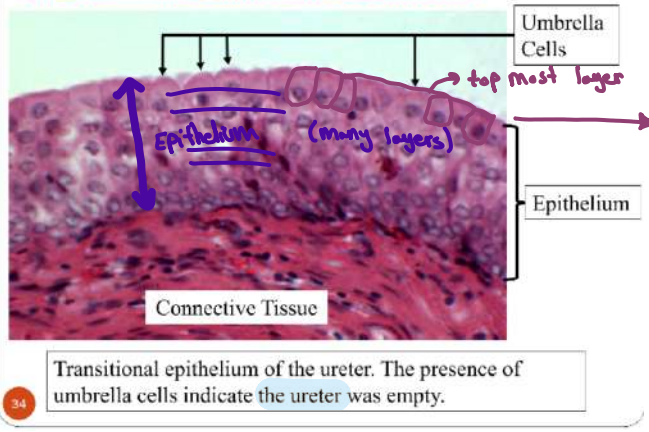
depending on the size of the duct

Epithelium من أنواع مختلفة ← ويحتوي على أنواع مختلفة ← ducts وفيه ← (slide of the gland) ← ضمن أنسوف

or

(8) Transitional Epithelium (Urothelium)

❖ Found in: Urinary bladder, ureters and renal calyces.



→ urothelium ⟶ urinary system في موجود انتقالي نسيج

cell-membrane تكون منتظمة تكون

* Cells of the top most layer (umbrella shape) لها سميت إنها

umbrella مثل convex يكون ← upper surface

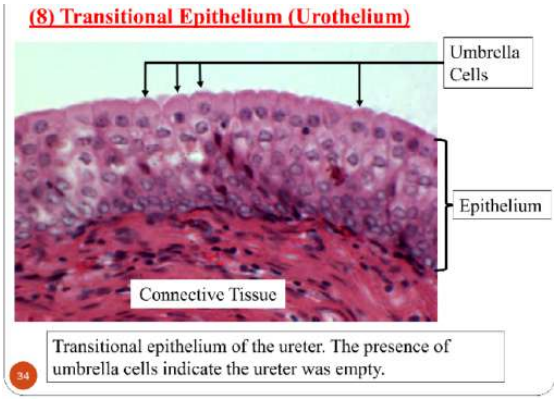
umbrella/ doom shap cells : عندما تمتد الخلايا يظهر لها ← يعني معناها مثل القبة

Nuclie (Around) → but it is not cuboidal

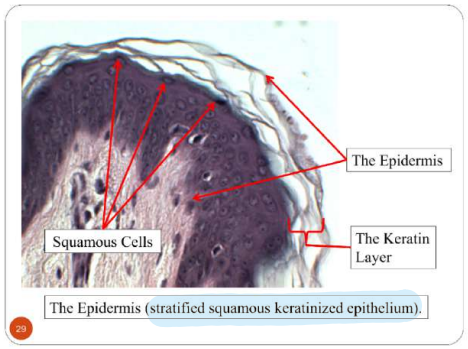
more straight ← مسطحة يكون

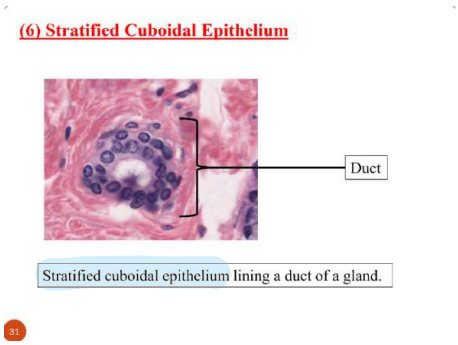
umbrella تكون أعمق حجمًا من cuboidal و

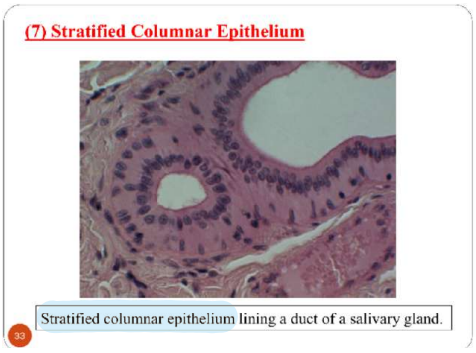
(umbrella / Doom shape cells) ← فمعروف عن طريق

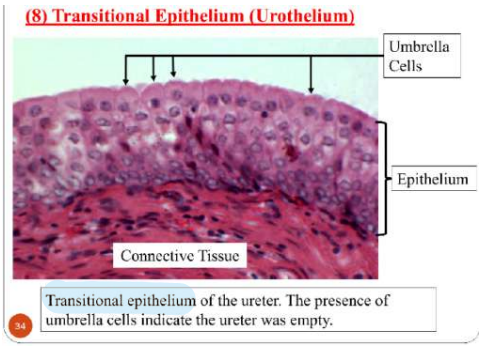


Stratified Epithilium









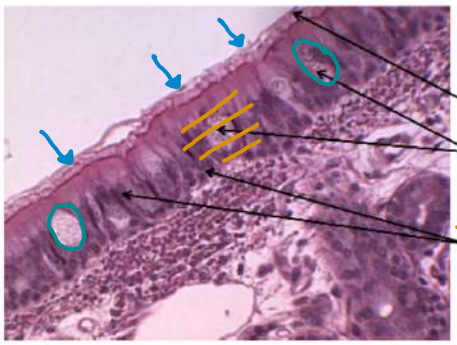
(9) Pseudostratified Columnar Ciliated Epithelium (Respiratory Epithelium)

The *Respiratory epithelium* is a pseudostratified columnar ciliated epithelium found in the trachea, bronchi, and nasal cavity.

→ Pseudostratified Epithilium

↓

موجود بجسم الإنسان لكن بشكل قليل



* How to recognize the rispiratory Epithilium ? (3 features)

- Nuclei at different levels — كاحظ موجودة على عدة طبقات
- Goblet cells — لونها فاتح أبيض
- presence of cilia on the surface of the Epithilium

منشوف cilia (على شكل شعيرات) "شعيرات صغيرة على سطح Epithelium بشكل واضح"
I can even see individual cilia
(light microscope بنشوفها تحت cilia الواحدة)

← إذا جبت هذه النقاط 3 ← بعرف إنه : Respiratory Epithelium
or Pseudostratified
columnar ciliated Epithelium

Nuclie At different levels Is this A simple or stratified Epithelium ? Simple

why ؟

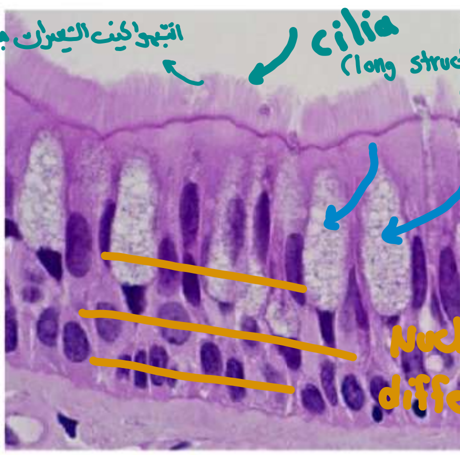
بال stratified ← عندي طبقة من Basal lamina عليها طبقة من الخلايا وأكل هذه الطبقة يوجد طبقة أخرى

Stratified

بال Pseudostratifie عندي طبقة من Basal lamina وعندي خلايا ذات ارتفاعات مختلفة

عشان هيك كل الخلايا تلامس the same basal lamina

لكن بسبب ارتفاعاتها المختلفة ← Nuclie صارت على طبقات مختلفة



Pseudostratified columnar ciliated epithelium. Try to identify the different structures in this epithelium.

لازم 3 شروط معاً

Cilia (Are clearly seen) منشوفها بوضوح

Compare the brush border of the small intestine with the cilia of the trachea (both images are at the same magnification).

Cilia are much more easily seen than the brush border because cilia are larger than microvilli.

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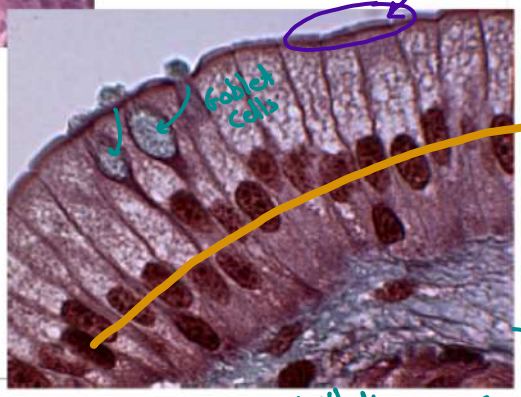


on the surface brush border (microvilli) ← microscope تحت يظهر يا دوب خط رفيع

يسمى خط معلم Nuclie in this line Nuclie لكن ليس بعض (up And down)

Simple columnar Epithelium of the small intestine

At Same Magnification

Cilia

* Are clearly seen منشوفها بوضوح

I can even see individual Cilia

Brush Border

* بسين كخط

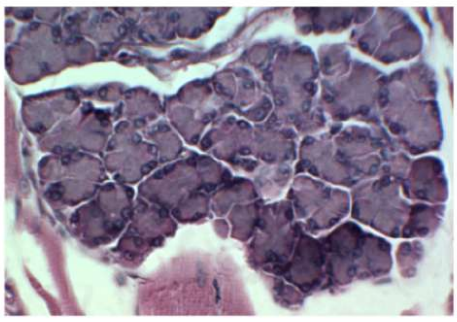
Cilia لكن ماعليه Goblet cells معاه Stratified Epithil عشان يكون بعض الأحيان ممكن

Goblet Cells بين Cilia وعليه simple Epithilium

Respiratory Epithilium حتى تكون ← 3 features لازم يكون في

ملاحظات: المقارنة بين أي صورتين لازم يكونوا (At the Same magnification)

(10) Glandular Epithelium



Serous Gland Example: Parotid salivary gland

Mucous Gland 5. Example: Sublingual salivary gland and Goblet cells.

* Mucous, Serous → Exocrine, Merocrine

* عشان Apocrine تكون ← Serous, Mucous بنفس الوقت

Serous glands of the tongue. Note the round nuclei and the stained cytoplasm.

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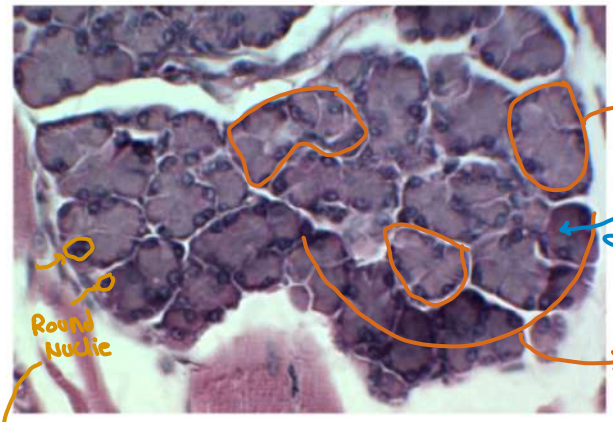
(10) Glandular Epithelium



Serous glands of the tongue. Note the round nuclei and the stained cytoplasm.

38

Nuclie حول Basophilia عشان why ? Nucleus كانت ترب عشان Rough Endoplasmic Reticulum بكون لونين أزرق/بنفسجي غامق

Cytoplasm for serous glands :بجيبوا عشان

Basophilic ← بكون

Acidophilic وفي حالات نادرة قد يكون

why ? Mucous فتتزوم mucous glands كانت وعند استخدام الطريقة الاعتيادية بالتحضير حتى mucous يختفي empty وتكون بتبين كانها cytoplasm (white in color, empty)

Mucous salivary gland. Note the nucleus in the bottom of the cell, the basal basophilia, and the unstained cytoplasm.

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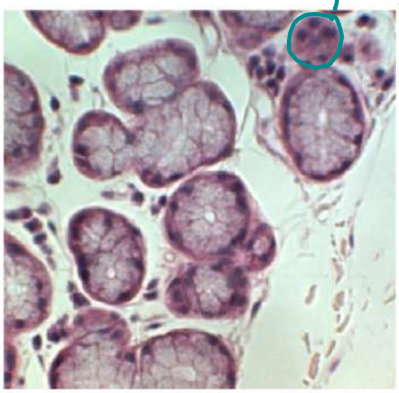

Mucous salivary gland. Note the nucleus in the bottom of the cell, the basal basophilia, and the unstained cytoplasm.

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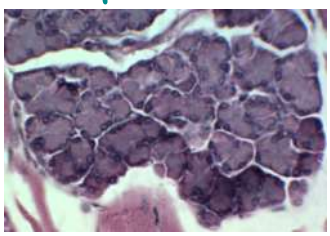
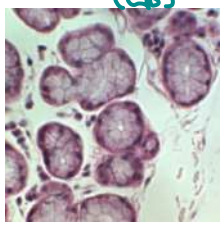
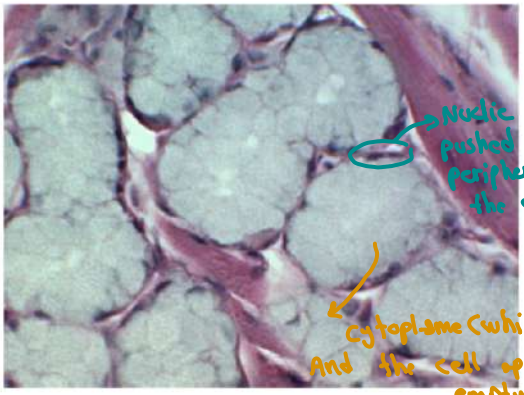
Salivary Glands

Minor:
Small Salivary Glands found with in other structures
Example:

Major 3
- Parotid Gland: Are Serous Gland (كلهم)
- Submandibular Gland
- Sublingual
- Mixed (serous, mucous)

الغدد اللعابية هم عبارة عن (Salivary Glands found within (داخل) tongue



Mucous glands of the tongue.

→ Serous (Nucleus Round , cytopham usually basophilic)

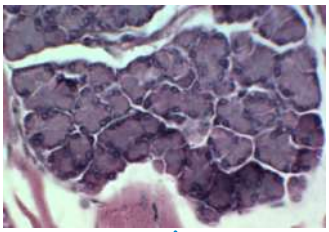
→ Mucous (" flattened , " white)

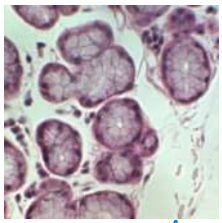
← لكن ببساطة :

* Serous Glands Are stained (ملونة)

* Mucos " Are not stained (غير ملونة)

حلف من دون ما تروح بافي features كتفريق سريع


Stained

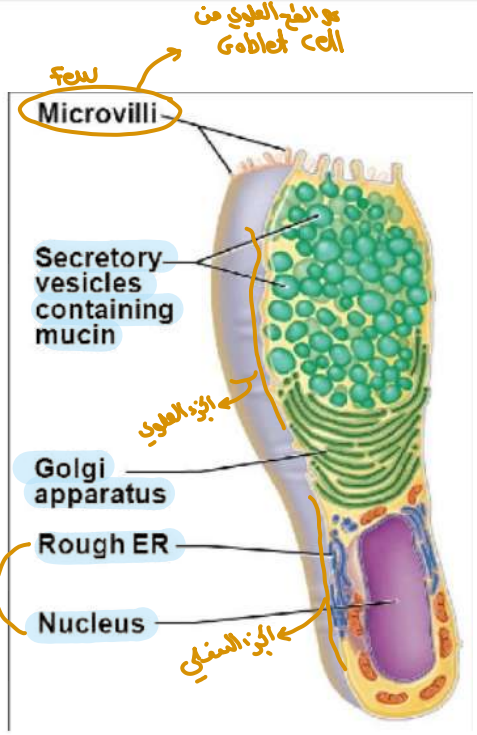

Not Stained

Are usually pink in color ← Lining Epithilium الي تتكون من Ducts

* للتفريق بين
- Secretary portion
  - إذا كانت serous عادة يكون لونها بنفسجي
  - إذا كانت mucous يكون لونها أبيض

Goblet cell: (classification)
- Unicellular
- Exocrine
- Merocrine
- Mucous Glands
- Located within epithelium

كتكون لوحدها
Epithelium دائماً مع
tissues من نوع آخر كتكون معي
Epithelium بسمع



جزء من الطرف العلوي من Goblet cell

بالجزء العلوي

موجودين بالجزء السفلي

بالجزء السفلي

Goblet cell

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→ Goblet cells :

Is A type of mucous Glands

microscope ← حتى تبين قدنا لما نفحصها تحت

(it appears empty)

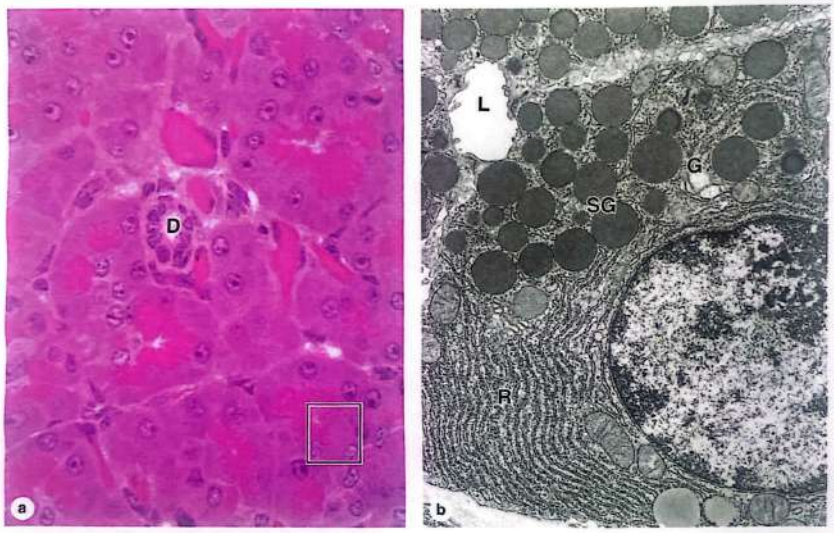
↳ They Are Goblet shap

يعني

يعني جزئها العلوي واسع

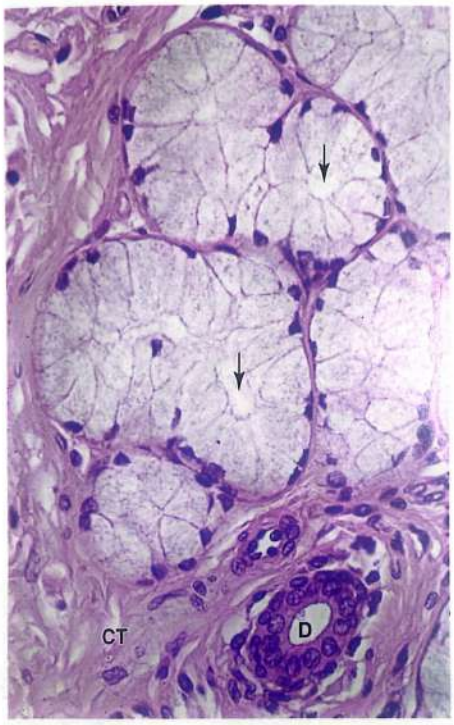
(Secretory vesicles بالي، يعني
اللي مخزون فيها mucin
Golgi Apparatus وفيها
والجزء السفلي ضيق

FIGURE 4–24 Serous cells.

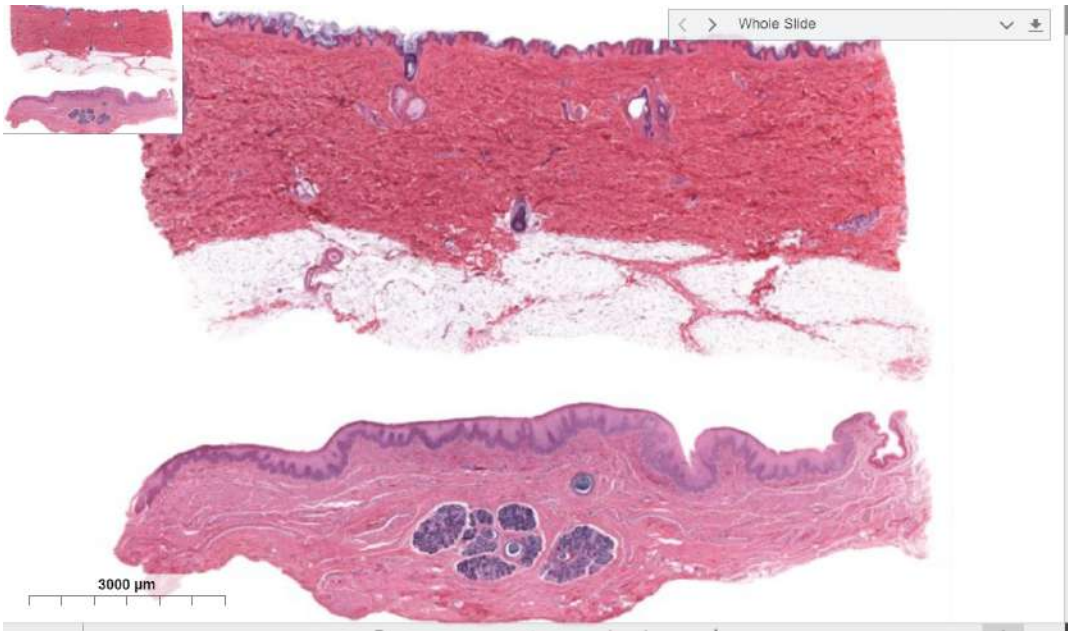


The small serous acini of the exocrine pancreas each have 5-10 cells facing a very small central lumen. Each acinar cell is roughly pyramidal, with its apex at the lumen. **(a)** As seen by light microscopy, the apical ends are very eosinophilic due to the abundant secretory granules present there. The cells' basal ends contain the nuclei and an abundance of RER, making this area basophilic. A small duct **(D)** is seen, but lumens of acini are too small to be readily visible. The enclosed area is comparable to that shown in part **b**. (X300; H&E) **(b)** A portion of one acinar cell is shown ultrastructurally, indicating the abundant RER **(R)**, a Golgi complex **(G)**, apical secretory granules **(SG)**, and the small acinar lumen **(L)**. (X13,000)

FIGURE 4–25 Mucous cells.



Mucous cells of salivary glands are typically larger than serous cells, with flattened basal nuclei. Most of the cytoplasm is filled with secretory granules containing mucinogen like that of goblet cells. The RER and Golgi complexes of mucous cells produce heavily glycosylated glycoproteins with water-binding properties. The lumens (arrows) of mucous tubules are larger than those of serous acini. Much connective tissue surrounds the mucous tubules and ducts **(D)**. (X200; PT)



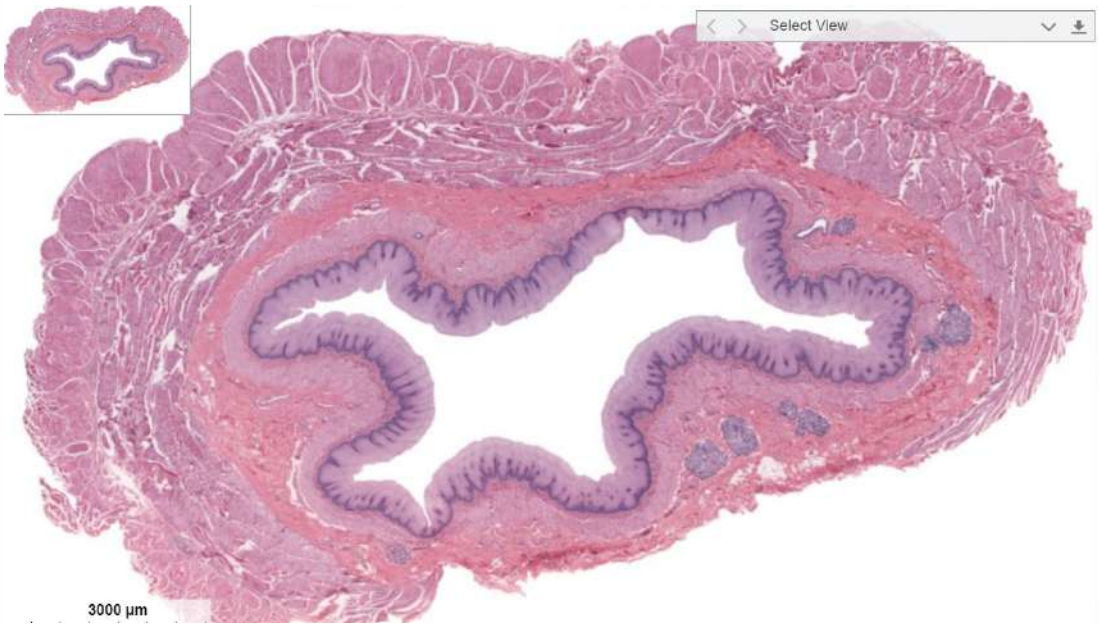
MH 017 Stratified Epithelia

Stratified Squamous Epithelia

A stratified squamous epithelium has multiple layers of cells. It is continuously replacing itself by division of the basal layer of cells. These cells change shaped as they move toward the surface and are eventually shed. Its name arises from the squamous appearance of the outermost layer of cells.

Stratified squamous epithelium is further classified by the presence or absence of keratin, a tough protective protein, at its apical surface.

- Thin Skin - covered by a stratified squamous keratinized epithelium.
  - Number of cell layers in skin ranges from a few (thin skin) to many (thick skin)
  - Because skin is exposed to air, it is keratinized to protect the surface from abrasion and is lubricated by glycolipids to avoid desiccation
- Esophagus - lined by a



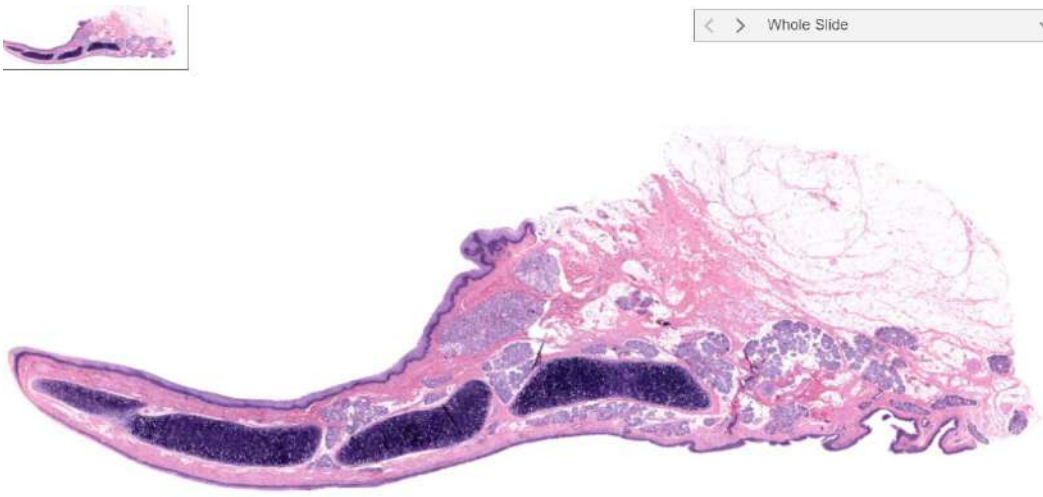
MH 109 Esophagus

Stratified Squamous Non-Keratinized Epithelium

This esophagus is lined by a stratified squamous non-keratinized epithelium.

Features of this epithelium:

- This epithelium has 40 to 50 layers of cells. They change shape as they migrate from the basal layer to surface: cuboidal cells in the basal layers, round cells in the middle layers, and flattened (squamous) in the upper layers.
- The epithelium is separated from the underlying connective tissue by a thin basement membrane. It is seen as a dark band beneath the epithelium.
- Keratin is not necessary because this epithelium is not exposed to the desiccating effects of air and is constantly kept moist.



MH 038 Epiglottis

Stratified Squamous Epithelium

The entire anterior surface (the part facing the tongue) and apical portion of the posterior surface (the part facing the larynx) of the epiglottis is covered by a stratified squamous epithelium. These areas are vulnerable to abrasion due to the passage food.

The rest of the posterior surface is covered by respiratory epithelium. The epithelium abruptly transitions from a stratified squamous epithelium to a pseudostratified columnar epithelium (respiratory epithelium).

Respiratory epithelium is a pseudostratified columnar epithelium with ciliated columnar cells and goblet cells.

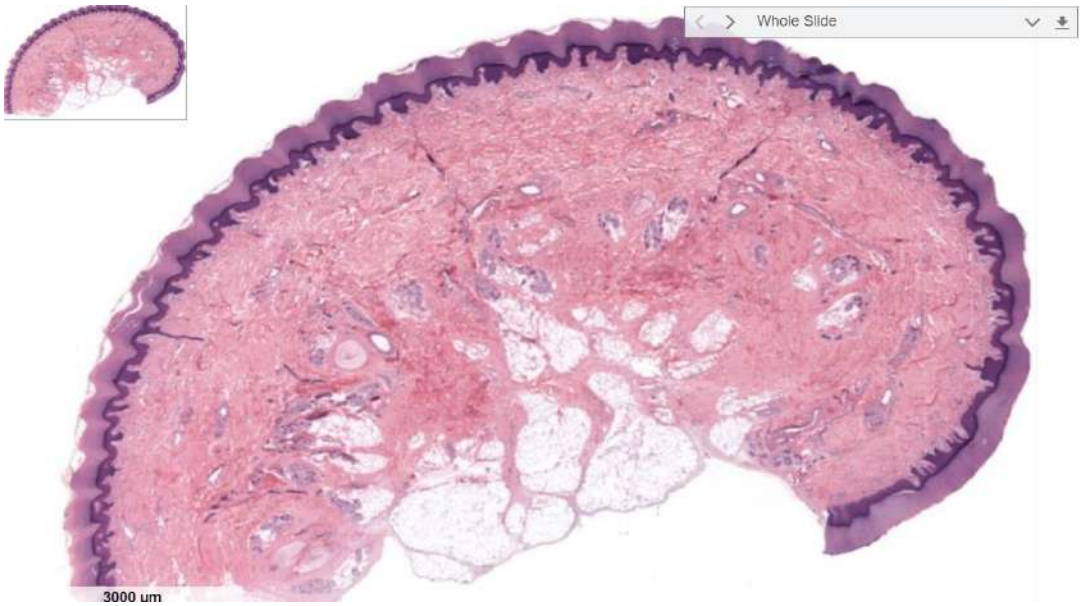
MH 090 Thin Skin

Stratified Squamous Keratinized Epithelium

There are two types of skin - thin and thick. Thick skin only occurs on the palmar and plantar surfaces of hands and feet, whereas thin skin occurs on all other parts of the body.

Thin skin is covered by a stratified squamous keratinized epithelium.

- Only a few layers of epithelial cells.
- The keratin layer has become dislodged (filamentous) from the cells during preparation of the specimen. In its natural state, it would be only a few microns thick. Consequently, the keratin layer is less thick than the cellular layer in thin skin.
- Because skin is exposed to air, it is keratinized to protect the surface from abrasion and is lubricated by glycolipids to protect it from dehydration.
- The basement membrane is too thin to be identified in this specimen.



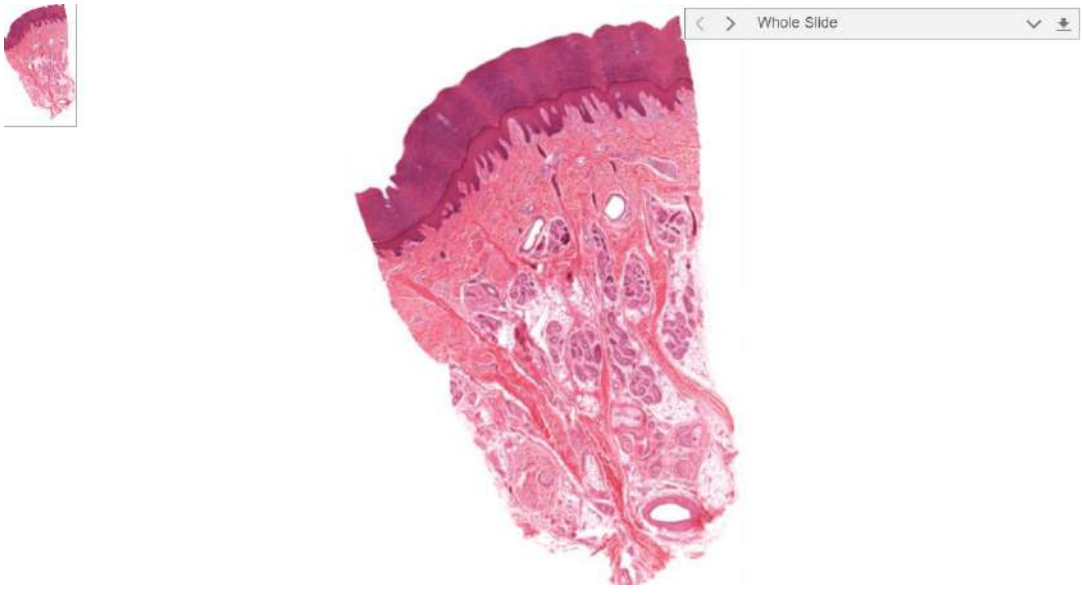
MH 091 Thick Skin

Stratified Squamous Keratinized Epithelium

There are two types of skin - thin and thick. Thick skin only occurs on the palmar and plantar surfaces hands and feet, whereas thin skin occurs on all other parts of the body.

Thick skin is covered by a stratified squamous keratinized epithelium.

- The epithelial cells form between 10 and 20 layers.
- The keratin layer is thicker than the cellular layer (which is the opposite of thin skin.)
- Because skin is exposed to air, it is keratinized to protect the surface from abrasion and is lubricated by glycolipids to protect it from dehydration.
- The basement membrane is too thin to be identified in this specimen.



MHS 235 Thick Skin

Stratified Squamous Keratinized Epithelium

This specimen has a well preserved epithelium with excellent cellular definition.

Thick skin is covered by a stratified squamous keratinized epithelium.

- The epithelial cells form between 10 and 20 layers.
- The keratin layer is much thicker than the cellular layer. A closer examination reveals the outlines of cells within the keratin. This reflects the cellular origins of the keratin. These cells are dead and do not have nuclei.
- Because skin is exposed to air, it is keratinized to protect the surface from abrasion and is lubricated by glycolipids to protect it from dehydration.
- The basement membrane is too thin to be identified in this specimen.

MHS 227a Eye

Stratified Squamous Epithelium

The anterior surface of the cornea is covered by a very thin stratified squamous non-keratinized epithelium.

Because this surface is exposed to air and is non-keratinized, the epithelium must be kept constantly moist with tears.

Irregularity or edema of the corneal epithelium disrupts the smoothness of the air-tear film interface reducing visual acuity.

MH 109 Esophagus

Stratified Cuboidal Epithelium

Stratified cuboidal epithelium has a limited distribution. It is most often found in large ducts from exocrine glands. Typically, it has only two layers of cuboidal cells.

This esophagus has an example of a large duct with a stratified cuboidal epithelium.

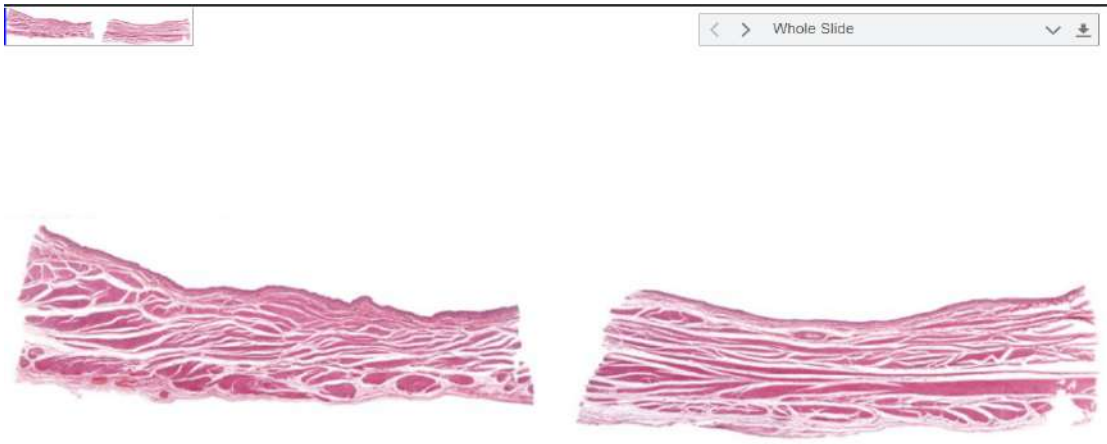
Smaller ducts with a stratified cuboidal epithelium are also present.

MHS 234 Esophagus

Cuboidal and Columnar Epithelia

Cuboidal epithelium has a limited distribution. It is most often found in the ducts from exocrine glands. These ducts range from simple cuboidal, simple columnar, to stratified cuboidal epithelia.

- Simple cuboidal epithelium - often found in small ducts.
- Simple columnar epithelium - found in intermediate size ducts.
- Stratified cuboidal epithelium - usually found in both small and large ducts. It most often has only two layers of cuboidal cells.



MH 018 Transitional Epithelia

Transitional Epithelium

Transitional epithelium (urothelium) is a specialized stratified epithelium found in the lower urinary tract. It rapidly adapts to distention and contraction by changing from a taller to thinner epithelium. Umbrella cells are highly dynamic cells at the luminal surface.

- Relaxed (non-stretched)

  The transitional epithelium has several layers of cells and large, dome-shaped umbrella cells on its surface. (They are called umbrella cells because they cover several underlying epithelia cells.)

- Extended (stretched)

  The transitional epithelium has become thinner. The umbrella cells have become elongated and flattened.

MHS 214 Bladder

Transitional Epithelia

The bladder is lined with a transitional epithelium (urothelium).

This empty bladder contains umbrella cells that are elongated and flattened and others that are round and dome shaped. Their conformation depends on their location within the folds of the bladder.

- Flattened Umbrella Cells - stretch over several underlying epithelial cells (#1 and #2).
- Dome-Shaped Umbrella Cells - are rounded and bulge from the surface of the epithelium (#1 and #2).
  - Bi-Nucleated Cells - have two nuclei.

MH 016 Simple Epithelia

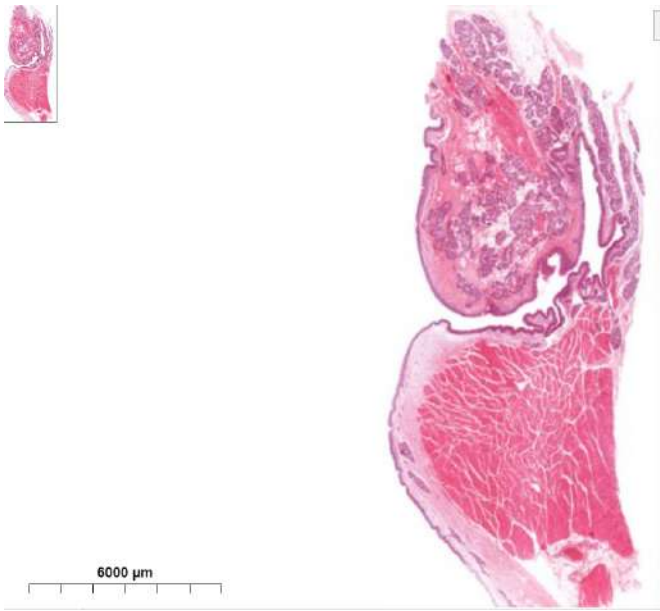
Pseudostratified Columnar Epithelium

The trachea is a tube that connects the larynx to the lungs allowing the passage of air. It is lined with a pseudostratified columnar epithelium.

As its name implies, this epithelium appears to be stratified (*i.e.*, has multiple layers of cells) but in fact all of the cells are attached to the basement membrane. Therefore, it is a simple epithelium. The stratified appearance is due to the nuclei of individual cells being present at different levels.

Features of this pseudostratified epithelium:

- Cilia - extend 5 to 7 µm from the surface of the epithelial cells. The dark line at their base is from their basal bodies.
- Goblet Cells - scattered cells that secrete mucus. They are difficult to identify in this specimen, but a thick layer of mucus covers some regions of the epithelium.
- Basement Membrane - the epithelium is separated from



MH 135 Larynx

Pseudostratified Columnar Epithelium

The upper fold of the larynx, the false vocal cord, is covered by a pseudostratified columnar epithelium.

Features of this epithelium:

- Cilia - extend 5 to 7 µm from the surface of the epithelial cells. The dark line at their base is from their basal bodies.
- Goblet Cells - scattered cells that secrete mucus. The secretion granules are clustered within the cells. This is seen as a clear circular area due to the mucus being extracted during preparation of the specimen.
- Basement Membrane - the epithelium is separated from the underlying connective tissue by a thick basement membrane. It is seen as an acidophilic band beneath the epithelium.

Since it lines the respiratory tract, a pseudostratified ciliated, columnar epithelium with goblet cells is referred to as the "respiratory epithelium".

MH 136 Trachea

Pseudostratified Columnar Epithelium

Examine the luminal surface of the cross section which is lined with a pseudostratified columnar epithelium.

Features of this epithelium:

- Cilia - extend 5 to 7 µm from the surface of the epithelial cells. The dark line at their base is from their basal bodies.
- Goblet Cells - scattered cells that secrete mucus. They can be identified by their cluster of basophilic secretion granules near their luminal surface.
- Basement Membrane - the epithelium is separated from the underlying connective tissue by a thick basement membrane. It is seen as an eosinophilic band beneath the epithelium.

Since it lines the respiratory tract, a pseudostratified ciliated, columnar epithelium with goblet cells is referred to as the "respiratory epithelium".

The surface of this epithelium is also shown in EM 076

MHS 222 Trachea

Pseudostratified Columnar Epithelium

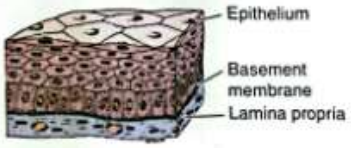
The luminal surface of the trachea is lined with a pseudostratified columnar epithelium. In some areas, individual epithelial cells can be identified in this semi-thin section.

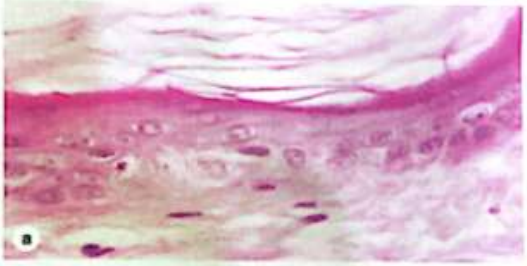
Features of this epithelium:

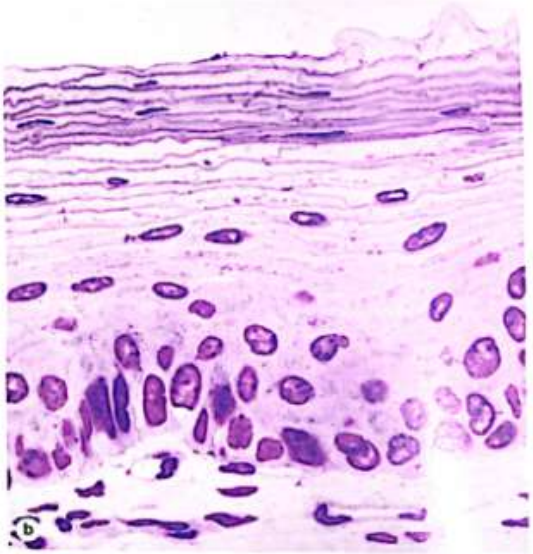
- Cilia - extend 5 to 7 µm from the surface of the epithelial cells. The dark line at their base is from their basal bodies.
- Goblet Cells - scattered cells that secrete mucus. They are difficult to identify in this specimen.
- Basement Membrane - the epithelium is separated from the underlying connective tissue by a thick basement membrane. Difficult to identify in this specimen.

Since it lines the respiratory tract, a pseudostratified ciliated, columnar epithelium with goblet cells is referred to as the "respiratory epithelium".

FIGURE 4–15 Stratified epithelium.





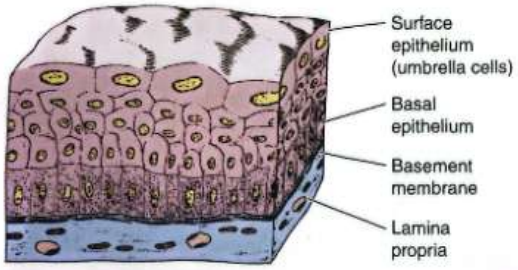


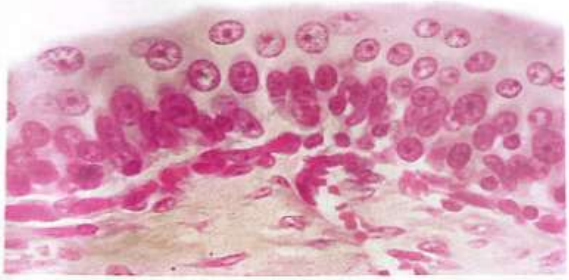
Stratified squamous epithelia usually have protective functions: protection against easy invasion of underlying tissue by microorganisms and protection against water loss. These functions are particularly important in the epidermis **(a)** in which differentiating cells become **keratinized**, that is, filled with keratin and other substances, eventually lose their nuclei and organelles, and form superficial layers flattened squames that impede water loss. Keratinized cells are sloughed off and replaced by new cells from more basal layers, which are discussed fully with the skin in Chapter 18.

Nonkeratinized stratified squamous epithelia occur in many organs, such as the esophageal lining **(b)** or outer covering of the cornea **(c)**. Here cells accumulate much less keratin and retain their nuclei but still provide protection against microorganisms.

Stratified cuboidal or columnar epithelia are fairly rare but occur in excretory ducts of certain glands, such as sweat glands **(d)** where the double layer of cells allows additional functions. All X400; (b) PT, (a, c, and d) H&E.

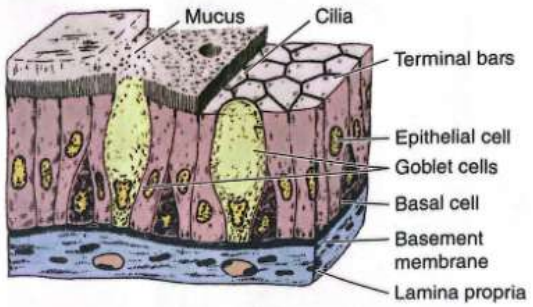
FIGURE 4–16 Transitional epithelium or urothelium.

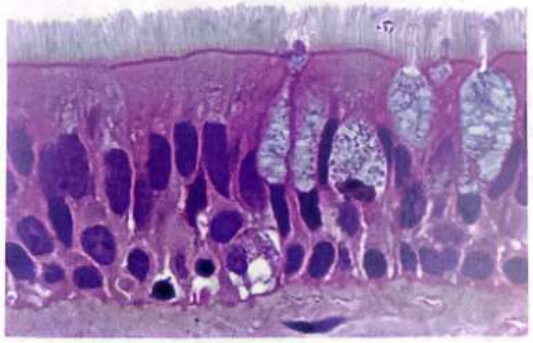




Urothelium is stratified and lines much of the urinary tract. The superficial cells are rounded or dome-shaped, and have specialized membrane features enabling them to withstand the hypertonic effects of urine and protect underlying cells from this toxic solution. Cells of this epithelium are also able to adjust their relationships with one another and undergo a transition in their appearance as the urinary bladder fills and the wall is distended. These unique features of transitional epithelium are discussed more extensively in Chapter 19. (X400; H&E)

FIGURE 4–17 Pseudostratified epithelium.





Cells of pseudostratified epithelia appear to be in several layers, but their basal ends all rest on the basement membrane. The pseudostratified columnar epithelium of the upper respiratory tract shown here contains many ciliated cells, as well as other cells with their nuclei at different levels. (X400; H&E)