

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



HISTOLOGY

MID | Lecture 6

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ وَنَعَلَهُمَّا تَوْسُوسًا بِهِ نَفْسُهُ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

Epithelium pt.4

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Stratified Epithelium

Recall: Epithelium is classified based on number of layers into:

1- Simple (one layer)

2- Stratified (two or more layers)

Stratified Epithelium

- Classified based on the shape of the most superficial layer.
 - Stratified squamous epithelium: Keratinized and non-keratinized
 - Stratified cuboidal epithelium
 - Stratified columnar epithelium
 - Transitional epithelium

The first three **are typical** and the last one is **atypical**.

Stratified squamous epithelium is common, whereas stratified cuboidal and stratified columnar epithelia are rare. They are found only in specific locations and usually not on the surface. For example, Stratified columnar epithelium can be seen in the conjunctive of the eye, that makes it a good location to study it.

Stratified squamous non-keratinized

- Apical layers are squamous but the basal is polyhedral.

Stratified means two or more layers, but in stratified squamous epithelium we usually have many layers.

- Protection

- Location:

➤ Oral cavity

➤ Pharynx

➤ Esophagus

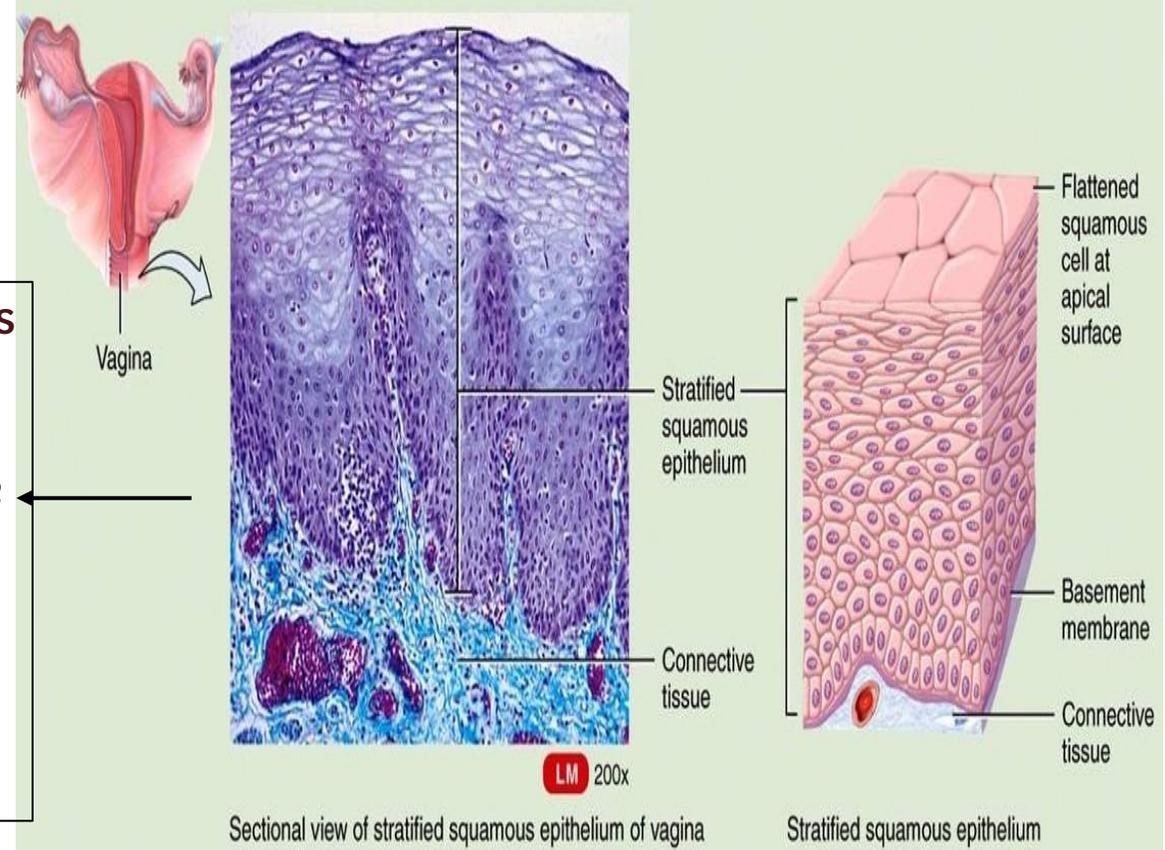
➤ Anal canal

➤ Uterine cervix

➤ Vagina

➤ Cornea.

If you look at the list of where we see this type of epithelium, you'll notice that these are regions experiencing a lot of mechanical stress on its tissues. Because of this, **it requires a strong, thick, and highly protective type of epithelium.** Stratified squamous epithelium provides this protection effectively.



Basal layer is the only layer which rests on basal membrane.

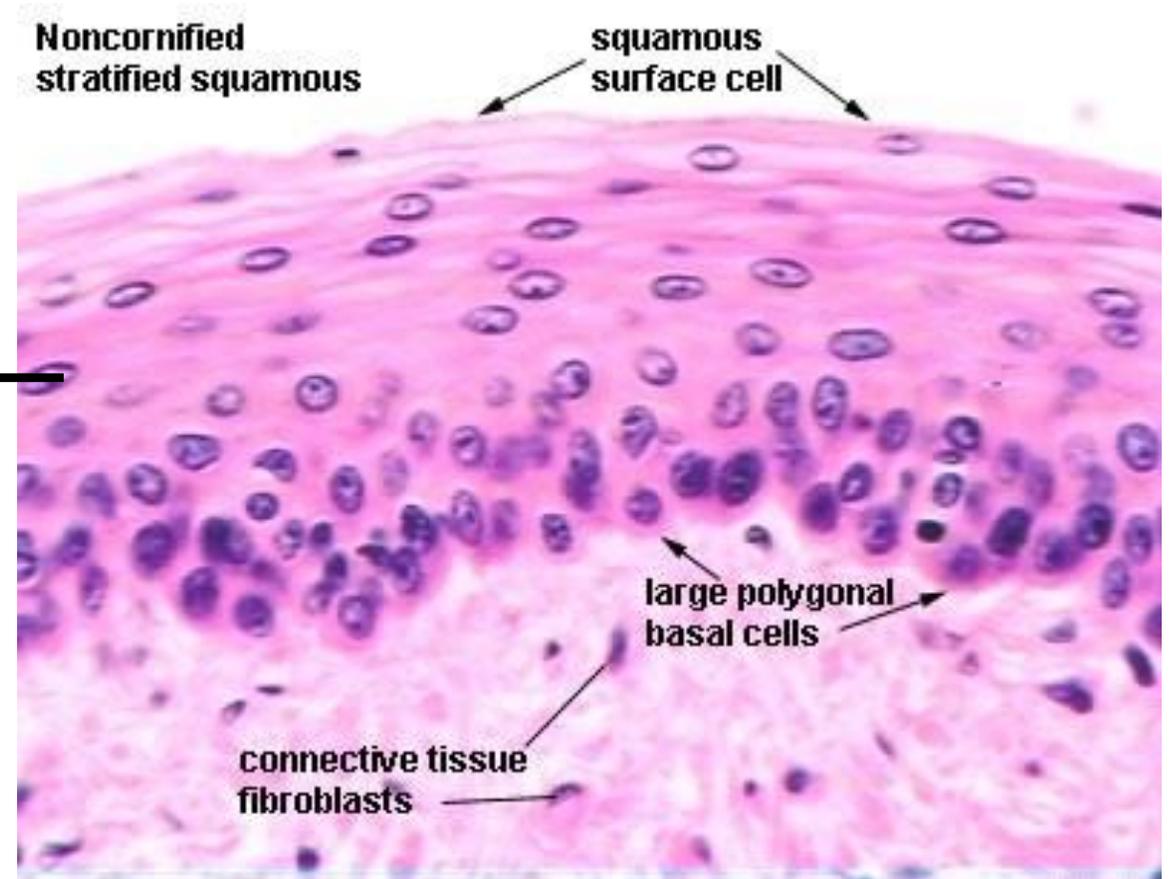
Other layers don't come into direct contact with connective tissue

The thickness of epithelial tissue **varies between different locations.**

For example, the epithelium of the cornea is thinner than that of the oral cavity. The oral cavity requires a thicker epithelium to provide protection against stress and substances entering the mouth, whereas the cornea needs to remain transparent to allow light to pass through the eye. Therefore, its epithelium is thinner while still providing some level of protection.

Stratified squamous non-keratinized

- **A lot of layers of cells → feature of stratified squamous epithelium**, unlike stratified columnar or cuboidal epithelium.
- The basal cells are rounded polyhedral; **however**, by approaching superficial layer, cells start to acquire squamous shape.



Stained by haematoxylin and eosin and taken by bright field light microscope.

Non-keratinized epithelium → non-cornified epithelium.

Stratified squamous keratinized epithelium (dry)

Skin is composed of:

1- Epidermis (epithelial covering)

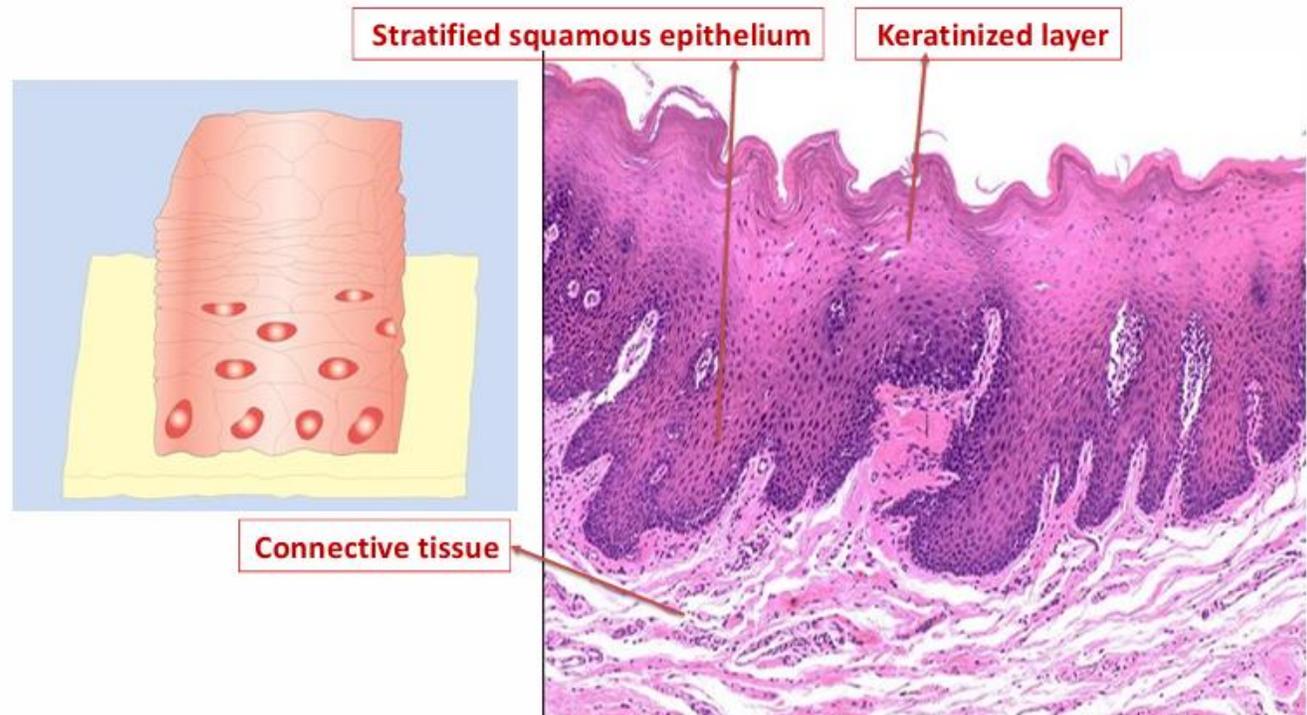
2- Dermis (Two layers of connective tissue, loose layer underneath the epithelium and dense connective tissue deeper in the skin)

3- Both layers are supported by hypodermis

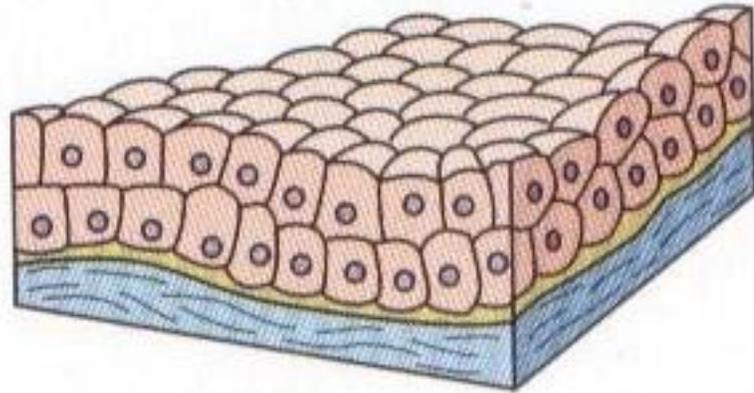
Will be discussed later.

The basal layer of the epithelium has smaller cells with closer nuclei, causing more intense basophilia at the base where they rest. The intermediate and upper layers have larger cells with more cytoplasm, leading to less basophilia when staining.

- **Location: Epidermis of skin.**
- The superficial layers, which distinguish this type from the non-keratinized epithelium, are composed of dead cells filled with keratin filaments. You don't see the nucleus usually .
- These layers provide an extra layer of protection to the skin, locking in moisture and preventing the underlying living cells from dying due to direct exposure to the environment. It is an important feature that humans have as they don't live in water, in this way the tissues are kept hydrated.

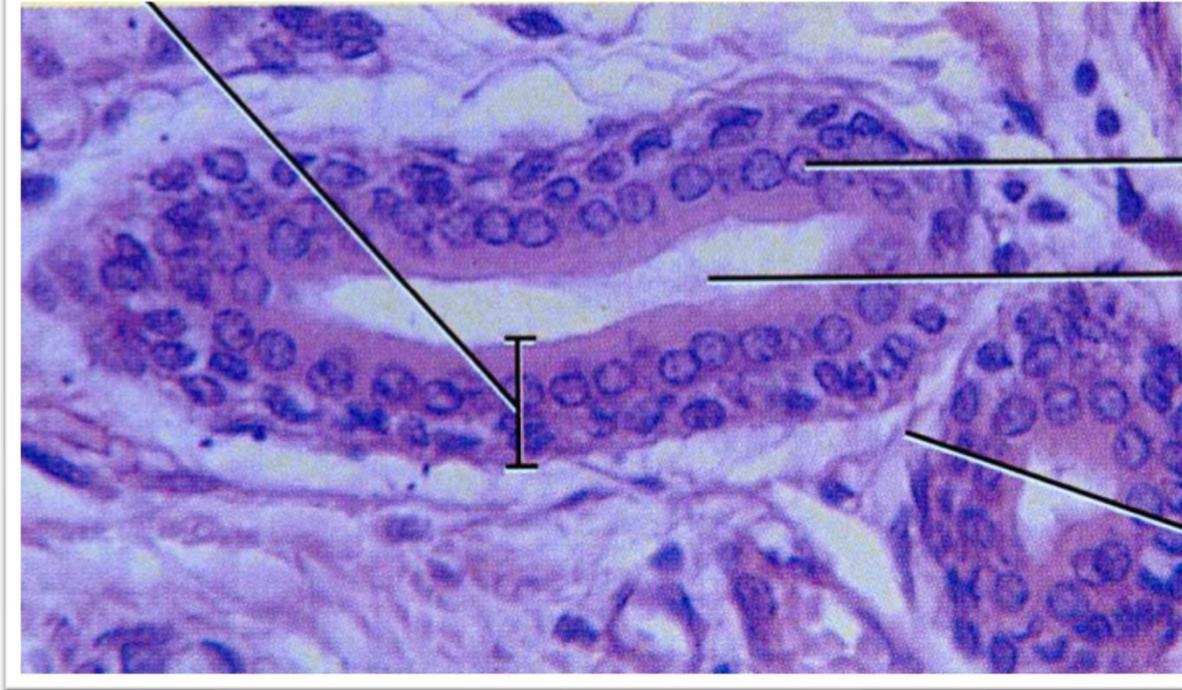


Stratified cuboidal epithelium



Cuboidal

Stratified cuboidal epithelium



lumen

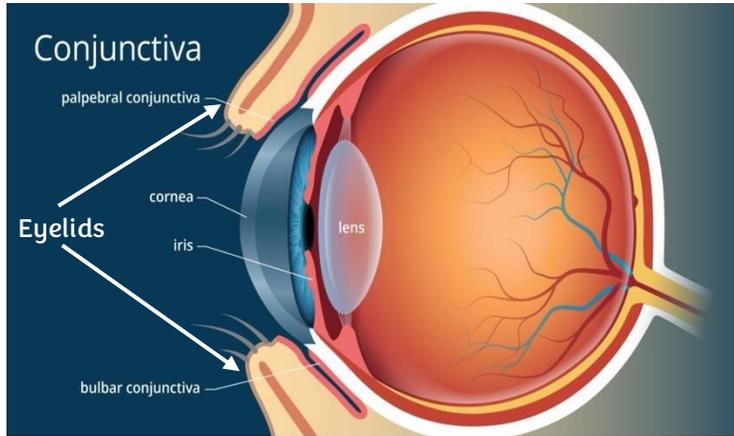
Connective tissue

The apical surface is contact with the lumen and the basal layer rest on the basal lamina

- Rare type.
- Superficial layer is cuboidal.
- Location : larger ducts of exocrine glands such as salivary glands
- **The smaller the duct, the more likely it is to be lined with simple cuboidal.**

Stratified columnar epithelium

It's a rare type we could see it in a certain ducts but the very famous and good example of columnar is the conjunctiva lining the eyelids .

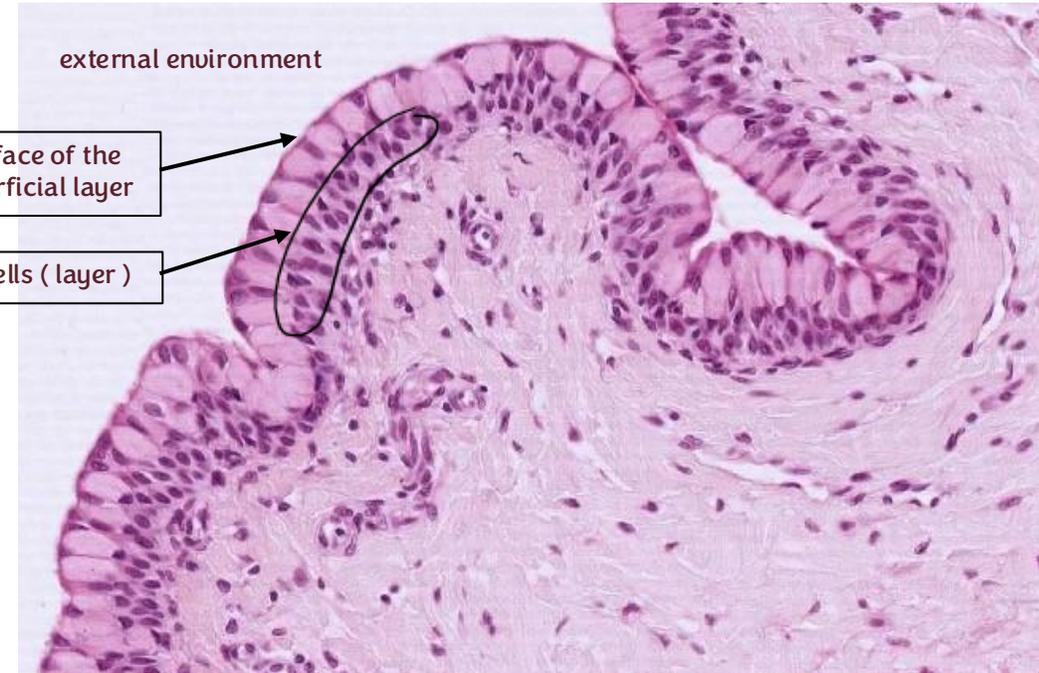
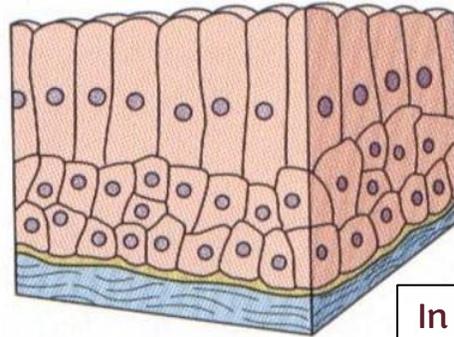


The cornea covered with the stratified squamous non-keratinized.
The whitish part of the eye ,which is called sclera, is covered by conjunctiva.
The pinkish line is a conjunctiva , it lines the inner aspect of the eyelids.

Rare type.

Protection.

Location: Conjunctiva with Goblet cells



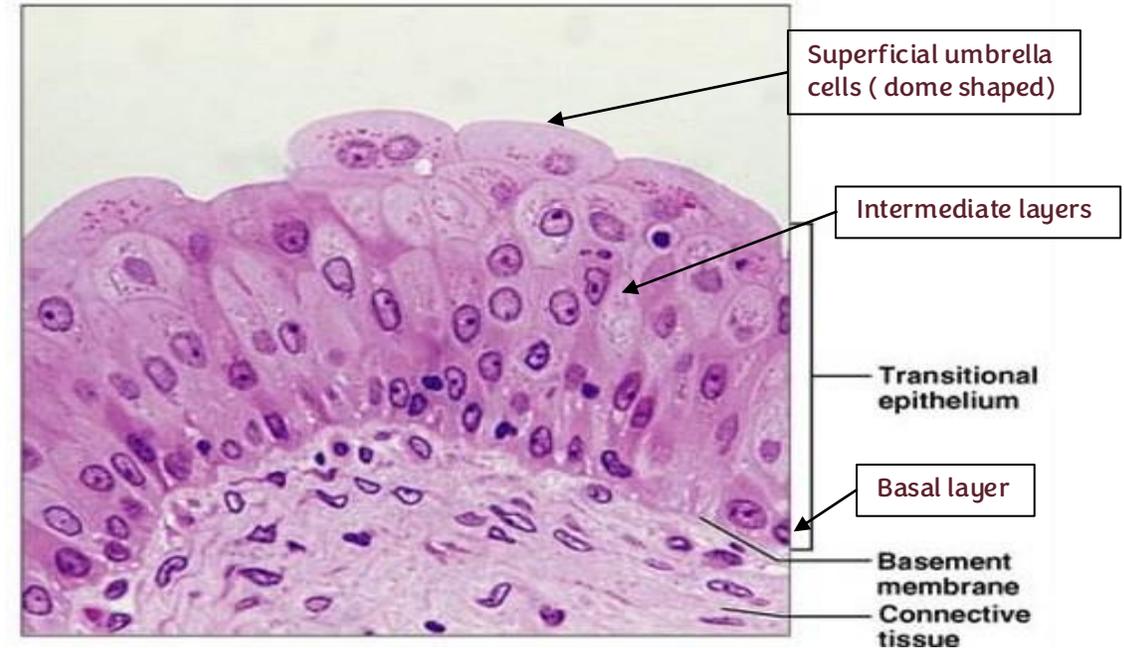
In the conjunctiva we have goblet cells to secrete mucus that participate in covering and protecting the outer surface of cornea and sclera , it has to do with complexity of the tear fell .
Tears have 3 composition : lipid , mucus and water .
Goblet cells participate in the mucous part of our tear fell.

This is a H&E section and this image acquired using the Bright field microscope.

Transitional epithelium

- Appears cuboidal when relaxed and squamous when stretched.
- Also called urothelium.
- Location: most of the urinary tract.
- Function: allows stretching, protection and distension

That how the epithelium would look like when the urinary bladder was empty .



It is the atypical type, because it transit from one form to another.

For example: the urinary bladder is the part of the urinary tract that accumulate the urine. So the kidney will produce the urine, which will descend through the ureters toward the urinary bladder ,So before the urine was dripping into the urinary bladder, the bladder was empty. But the more we have urine in it, this urinary bladder has to stretch. We have smooth muscles in it, so they will relax, and the incoming urine will push against the interior of the urinary bladder, so it will enlarge. The enlargement is actually allowed because this epithelium allows stretching. Those cells will no longer appear rounded. They will try to flatten out. If we looked at a section from a full urinary bladder, those cells will appear squamous, and the empty urinary bladder will appear cuboidal(rounded or dome-shaped). But it is not stratified squamous, not stratified cuboidal, it is stratified transitional epithelium, also known as urothelium.

Transitional epithelium

- A single layer of small basal cells resting on a very thin basement membrane.
- An intermediate region containing from one to several layers of cuboidal or low columnar cells.
- A superficial layer of large bulbous or elliptical **umbrella** cells, sometimes **binucleated**, which are highly differentiated to **protect** the underlying cells against the potentially cytotoxic effects of hypertonic urine.

How we can distinguish transitional epithelium ?

- 1) Some of the superficial cells have binucleation.
- 2) It has around (5-6) layers so it is impossible to be stratified cuboidal which has usually 2 layers and extremely 3 layers.

- This table summarizes the various types of the epithelium tissue :

Major Feature	Cell Form	Examples of Distribution	Main Function
Simple (one layer of cells)	Squamous	Lining of vessels (endothelium); Serous lining of cavities: pericardium, pleura, peritoneum (mesothelium)	Facilitates the movement of the viscera (mesothelium), active transport by pinocytosis (mesothelium and endothelium), secretion of biologically active molecules (mesothelium)
	Cuboidal	Covering the ovary, thyroid	Covering, secretion
	Columnar	Lining of intestine, gallbladder	Protection, lubrication, absorption, secretion
Stratified (two or more layers of cells)	Squamous keratinized (dry)	Epidermis	Protection; prevents water loss
	Squamous nonkeratinized (moist)	Mouth, esophagus, larynx, vagina, anal canal	Protection, secretion; prevents water loss
	Cuboidal	Sweat glands, developing ovarian follicles	Protection, secretion
	Transitional	Bladder, ureters, renal calyces	Protection, distensibility
	Columnar	Conjunctiva	Protection
Pseudostratified (layers of cells with nuclei at different levels; not all cells reach surface but all adhere to basal lamina)		Lining of trachea, bronchi, nasal cavity	Protection, secretion; cilia-mediated transport of particles trapped in mucus out of the air passages

For any feedback, scan the code or click on it



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			

Additional Resources:

رسالة من الفريق العلمي:

عن النبي -ﷺ- قال: قال الله: أعددت لعبادي الصالحين ما لا عين رأت، ولا أذن سمعت، ولا خطر على قلب بشر.
ثم قرأ النبي -ﷺ-: ﴿تَتَجَافَى جُنُوبُهُمْ عَنِ الْمَضَاجِعِ يَدْعُونَ رَبَّهُمْ خَوْفًا وَطَمَعًا وَمِمَّا رَزَقْنَاهُمْ يُنْفِقُونَ * فَلَا تَعْلَمُ نَفْسٌ مَّا أُخْفِيَ لَهُمْ مِّن قُرَّةِ أَعْيُنٍ جَزَاءِ بِمَا كَانُوا يَعْمَلُونَ﴾
قال ابن القيم -رحمه الله-:

تأمل كيف قابل ما أخفوه من قيام الليل بالجزاء الذي أخفاه لهم مما لا تعلمه نفس، وكيف قابل قلقهم وخوفهم واضطرابهم على مضاجعهم حين يقومون إلى صلاة الليل بقرة الأعين في الجنة .

يا ساهر الليل إنَّ الليل مُتَحَلُّ
والعمرُ عمَّا قريبٍ سوف يرتحلُّ
فاجعل نصيبك من ليلٍ تُسامرُهُ
صلاة وترٍ بها تَسْمُو وتَبْتَهَلُ

Reference Used:

(numbered in order as cited in the text)

1. Dr. Gada Abu Al-Ghanem's lecture