

Pseudostratified

- ✓ Gives you the impression that it is stratified...where it is **a simple epithelium**.

Why ??

Because all cells are reaching the basement membrane.

It is called → Ciliated Pseudostratified Columnar Epithelium with goblet cells.

- ✓ It is found that these cells are appear in respiratory epithelium. so, we use **respiratory epithelium** as an abbreviated name.
- ✓ As they are **goblet cells** they produce **mucus**.

Note that the apical domain in respiratory cells is **cilia**.

★ Apical domain of epithelium cells

- ✓ Are either:
 - microvilli
 - cilia
 - stereocilia

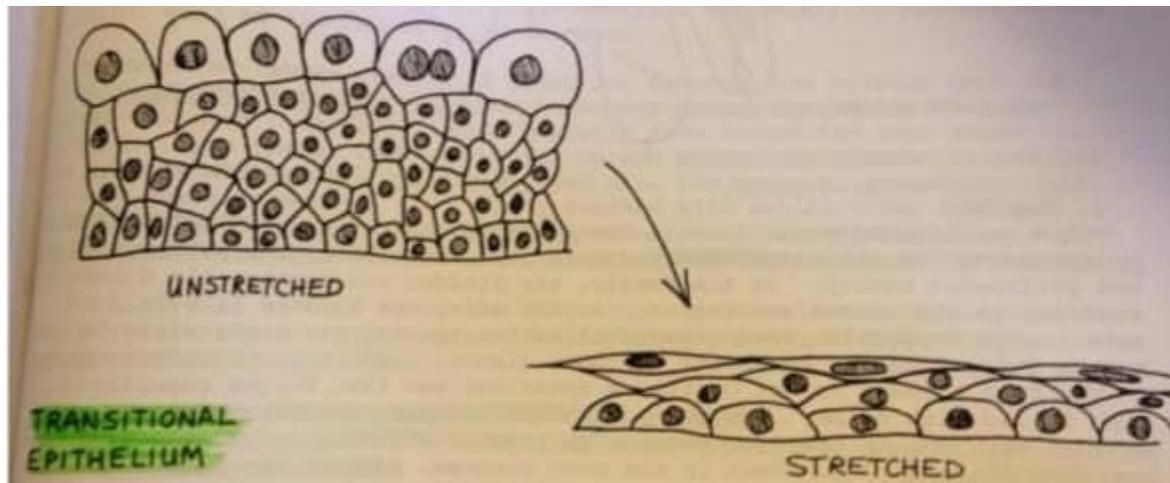
Remember:

It is rich in ion channels, carrier proteins and hydrolytic enzymes.

★ Now let's talk about **transitional epithelium (Urothelium)**

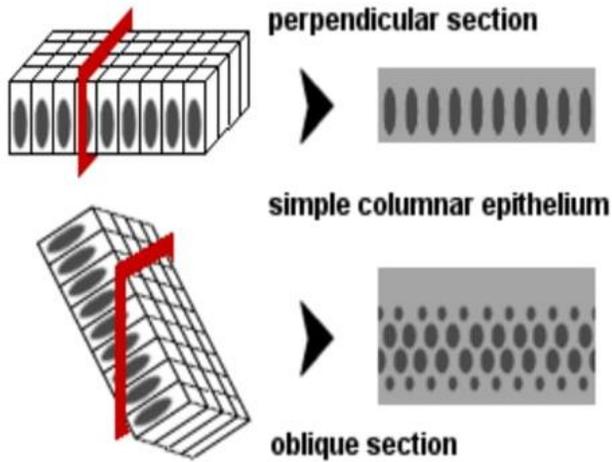
- ✓ some of them have two nucleuses.
- ✓ Lining ureters, urinary bladder and part of urethra.
- ✓ **Its function** → they stretch and permit destination of urinary bladder.

- ✚ Their **basal** cells are usually cuboidal and squamous.
- ✚ **Superficial** cells are **dome shaped** (when unstretched) and **squamous** (when stretched).



Practical note:

➤ When we make a section we are looking at 2D image..
 If we use simple columnar (perpendicular) → nuclei are side by side. But when we use oblique section, they appear not side by side (as for stratified cells).



- Again
- The apical domain of epithelium cells are:
- microvilli
 - cilia
 - stereocilia

Microvilli

- ✓ Microvilli are thicker and shorter than cilia.
- ✓ Microvilli (plural of microvillus) **increase** the surface area. So, we find them in cells responsible for absorption (intestine for example).
- ✓ Their number and size differ according to the **activity** of cells.
 - The more active the cell is → the larger size of microvilli and the larger number of them.
 - In **intestine** they form the straited border.
 - In **kidney** they form brush border.

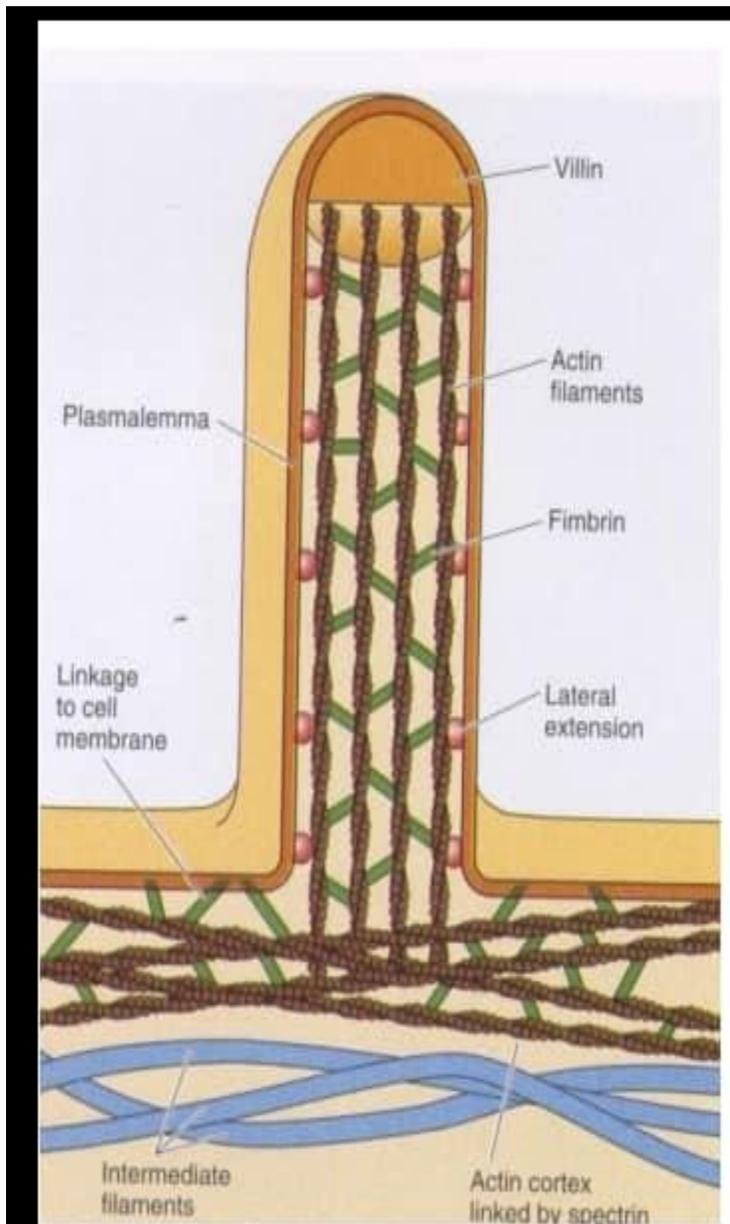
Brush border and straited border are the same but differ in the name.

✚ Due to the **resolution** of Light microscopy we **cannot** see microvillus **individually** → we see them as a **brush or straited border**, but we can distinguish cilia via **LM**.

Structure :

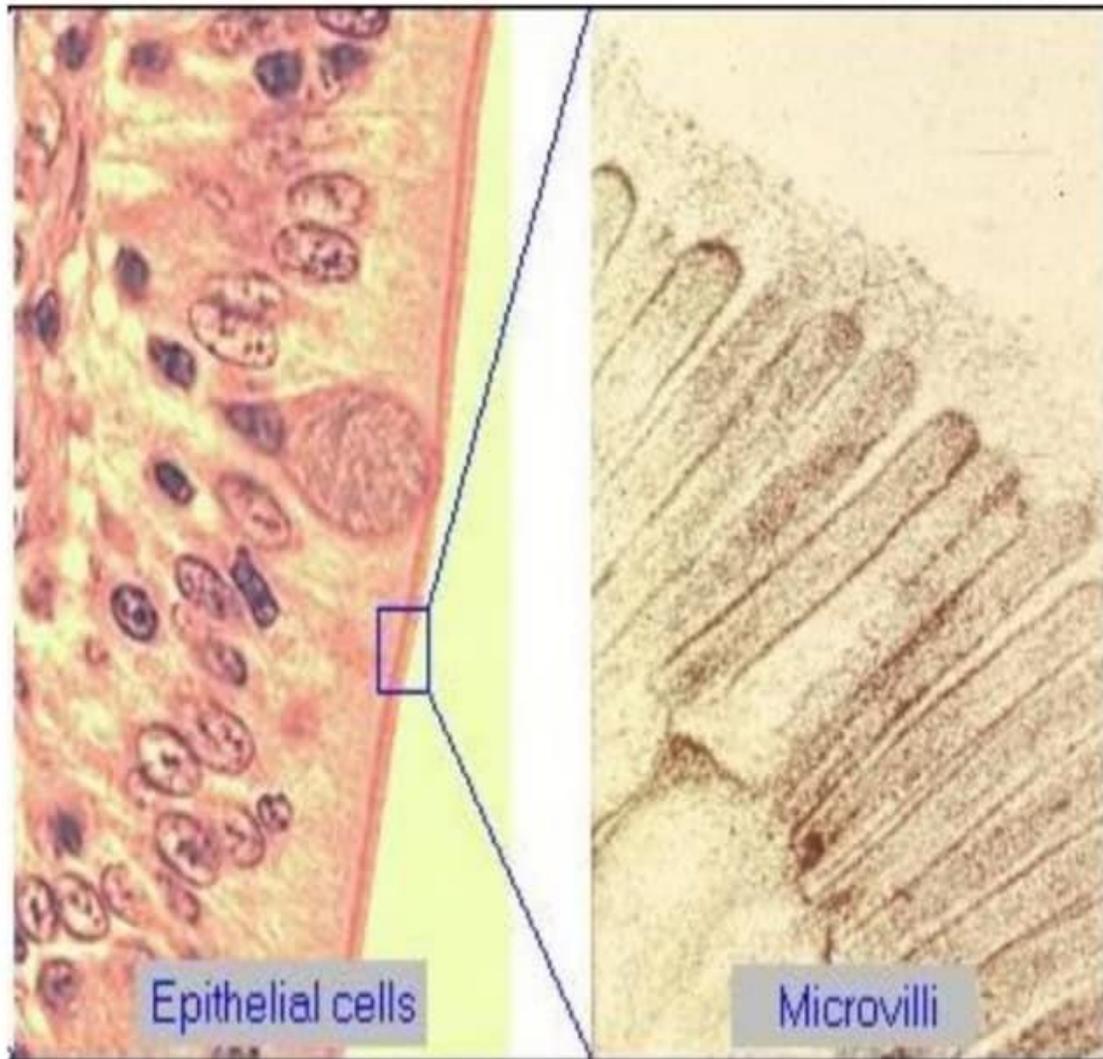
- ✓ The microvillus is 1μ in length and 1μ in width.
 - ✓ Contains a core of 25-30 actin filaments (micro Filaments).
 - ✓ Actin filaments are cross linked with villin.
 - ✓ They are inserted in the **terminal web** and intermediate filament to anchor themselves
 - ✓ Microvilli are covered by glycocalyx.
- ✚ **The terminal web** is a network of actin and sceptrin supported by myosin and IF. It is a cytoskeletal feature at the apical pole in many epithelial cells

In the picture bellow villin and proteins of web are required other proteins are not.



Microfilaments are attached together by villin protein

Microvilli under LM and EM



cilia

- ✓ Motile and **hair** like projection.
- ✓ It is found in places where we need to transport fluid and particles (such as mucus) → we find it in **respiratory cells(to move mucus)** and **fallopian tube (to move the ovum)**.
- ✓ their length is $2-5\mu$ with a diameter of 2μ (**taller than microvilli**).
- ✓ Their number ranges from 1-300 cilium per cell.
- ✓ They move rhythmically and rapidly in one direction.



Structure

- ✚ The core of cilium is called **axoneme**.
- Each axoneme contains longitudinal microtubules arrange as :
 - **9 doublets microtubules (double circles) to the outside(peripheral)**
 - **2 singlets microtubules (single) at the center(central)**.

So, we can say that they are (9+2) in structure. Each doublet is composed of two circles-their structural unit is **protofilament**.

- if we assume that the two circles are A and B
A and B are in common of **3 protofilaments**.
- A contains **13** protofilament and B contains **10**.

✚ Neighboring **doublets** are connected by nexin (in purple).
****doublets** are connected to the **singlets** by radial spokes (in yellow).

✚ Cilia is anchored within the cell by **basal body** → which is also a microtubule similar to centrioles (9+0)

Dynein protein:

- The motor protein which is responsible for the movement of cilia. In general, it is responsible for the movement.
- It is ATPase molecule

How it is work ?

When it takes ATP there is a conformational changes occurs to its shape.

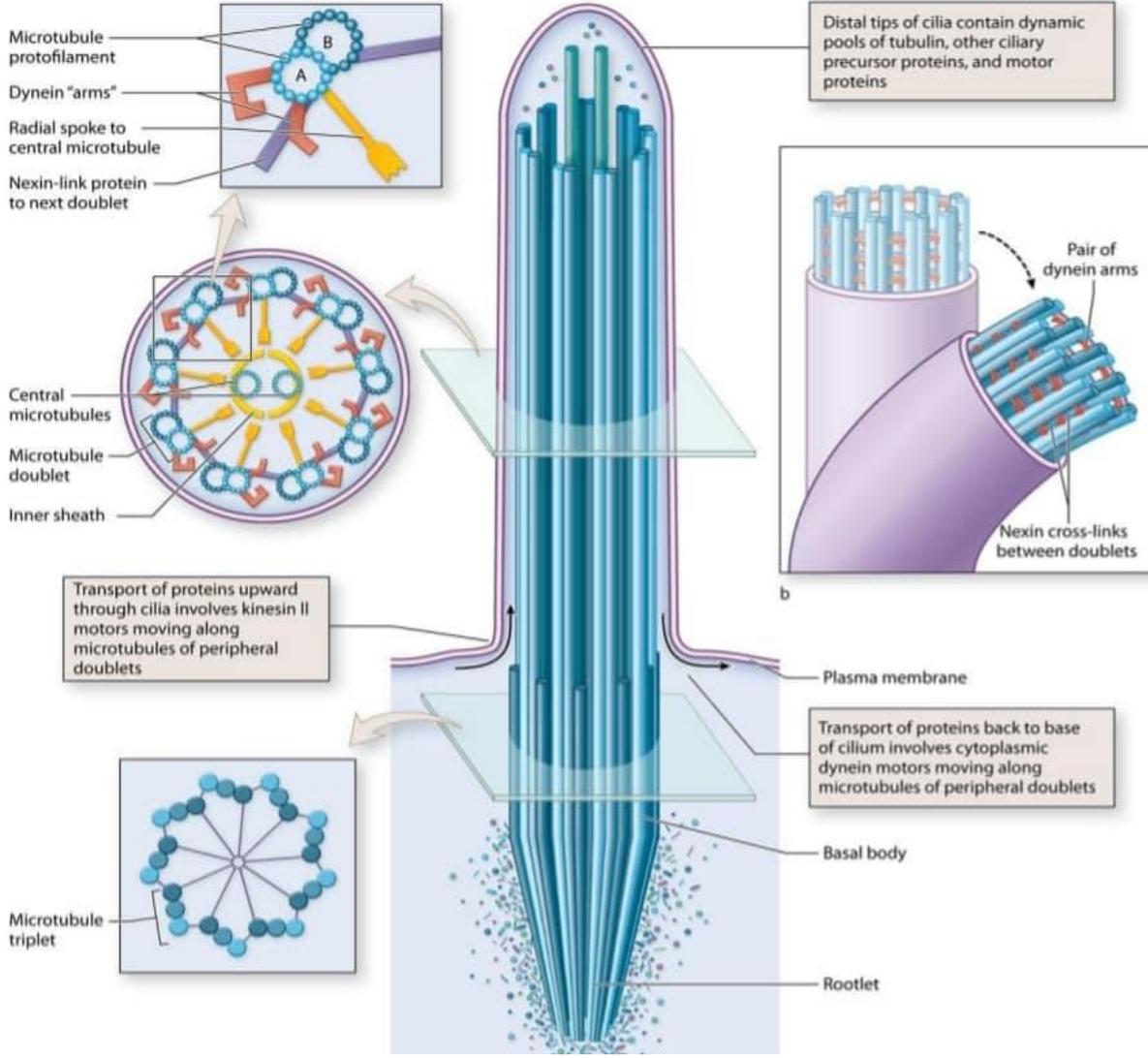
Each dynein of first doublet (A) will attach to its neighbor (B) and pull it .

This happen only to half of it and the other half does not work (alternately) .

Then when ATP is hydrolysed it returns to its original shape.

You can see the video in elearning for further information

See the picture below



Not required just for reading.



Stereocilia:

- ✓ They are long immotile microvilli present in the epididymis (part of male reproductive system) and inner ear. They have special functions in these places.....will be discussed later.
- ✓ They are longer than typical microvilli, more widely separated and branched.
- ✓ Its core made of actin filament.
- ✓ They appear branch and tall.

فكابدوا المجد حتى مل أكثرهم**وعانق المجد من أوفى ومن صبيرا
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