



لجان الدُفعات

# ANATOMY

MORPHINE ACADEMY

MORPHINE  
ACADEMY

# Tissues

هي عبارة عن مجموعة من الخلايا cells لهم نفس المصدر origin من الجنين embryology وحكينا انه الخلايا ما يكونوا لحالهم وانه لازم يكون محيط فيهم extracellular matrix

1

Dr. Mustafa Saad  
(2021)



*A tissue is a collection of cells with a common embryologic origin that work together to perform specialized activity. In addition to the cells, a tissue contains the extracellular matrix (ECM) which's found between the cells.*

- Body tissues can be generally divided into 4 main types according to the *type of cells* and the *amount and content of the ECM* they possess.

ExtraCelluolar Matrix

- The main types of body tissues are:

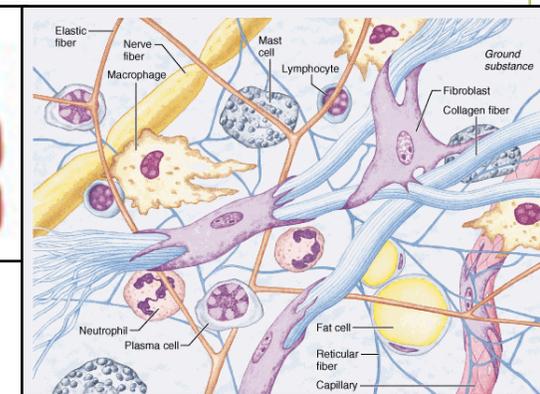
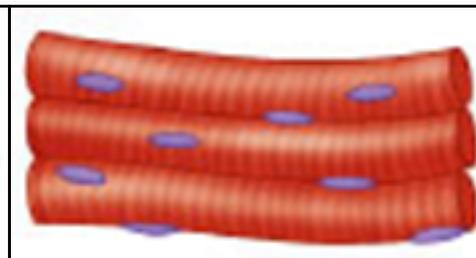
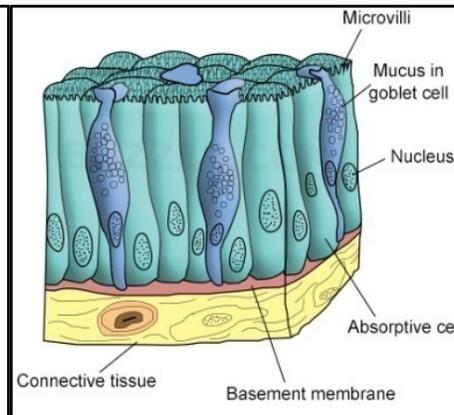
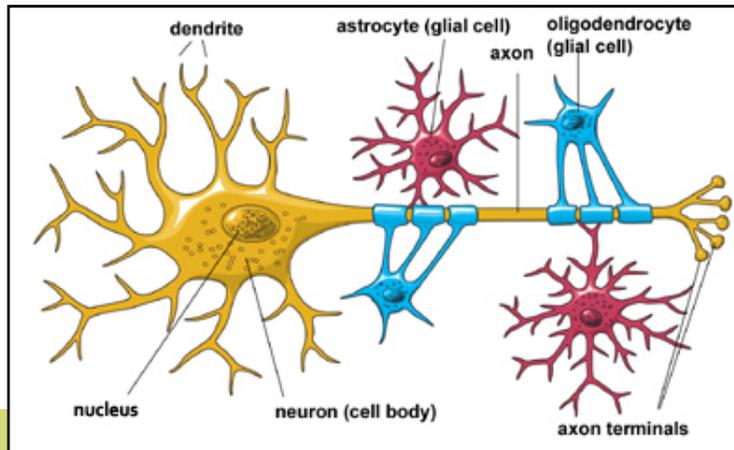
1. Epithelial tissue
2. Connective tissue
3. Muscular tissue
4. Nervous tissue

بيختلفوا في  
نوع الخلايا المكونة  
وكمية ECM  
ومحتويات ECM

Table 1: Types of tissues and their characteristics

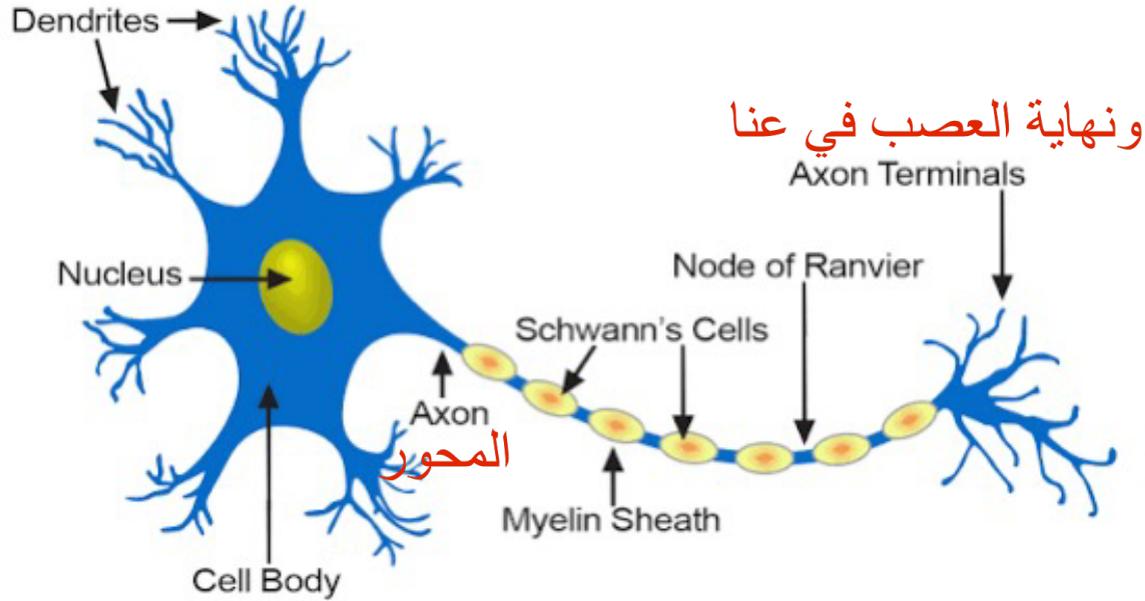
لازم كل epithelial tissue تحتيه  
conecteive tissue

<i>Tissue</i>	<i>Nervous</i>	<i>Epithelial</i>	<i>Muscular</i>	<i>Connective</i>
<i>Cells</i>	Have intertwining متشابكة elongated ممتدة processes عمليات	Aggregated polyhedral cells خلايا متعددة السطوح	ممتدة Elongated منكمشة contractile cells	Several types of fixed and wandering cells
<i>Amount of ECM</i>	كثير كثير قليلة Very small	Small	Moderate	كثير Abundant
<i>Main Function</i>	Transmission of nerve impulse	بطانة Lining, افرازات Secretion تغطي covering	Movement	Support, protection



في البداية يكون عنا  
التشعبات

## Structure of a Typical Neuron



## Nervous tissue

هو اكيد عبارة عن خلايا عصبية  
عن عمليات متشعبة ومتشابكة **interwining**  
**processes**

اطول عمليه **processes** في العصب هي  
**axon** وهو يعتبر محور العصب

وعلى مستوى **axon** في انواع من  
الاعصاب تسمى **myelinated** و

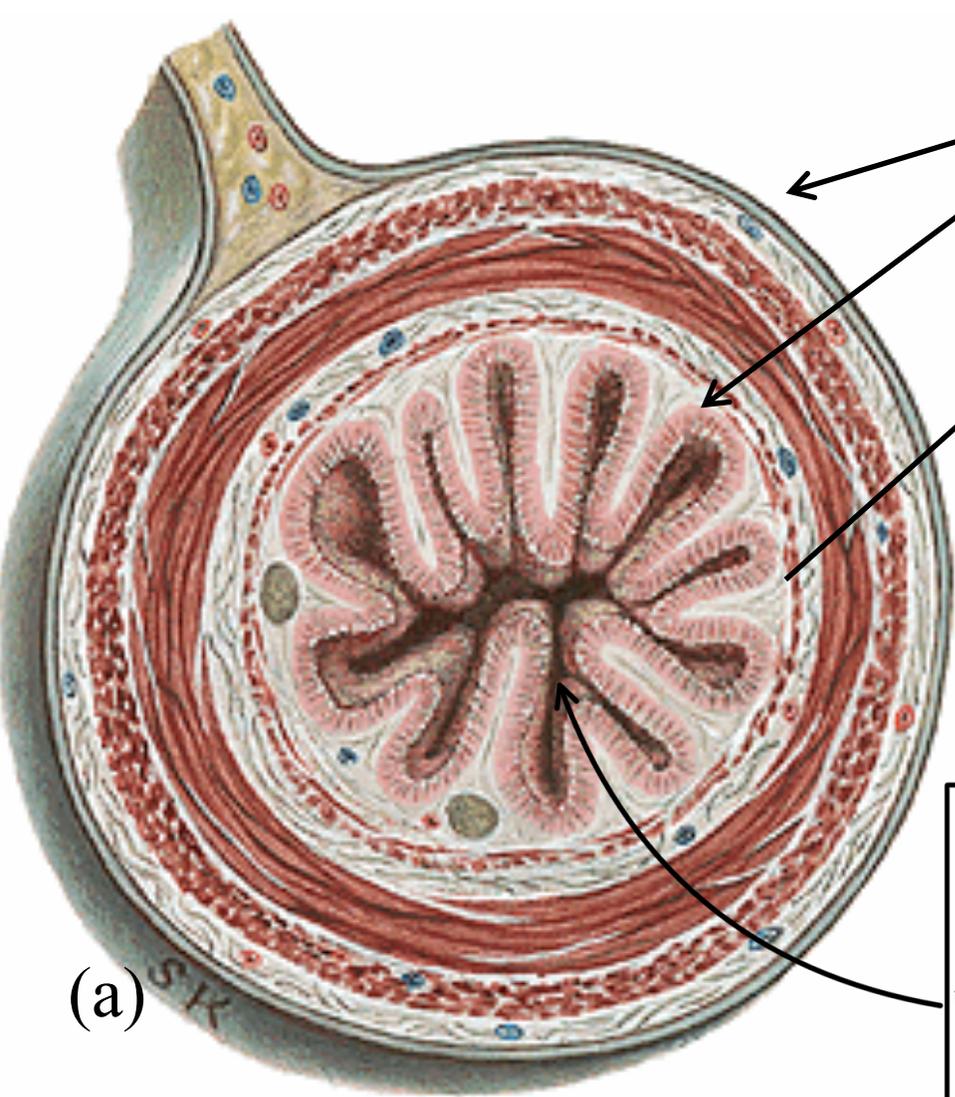
**unmyelinated** انه يكون المحور تبعت  
العصب محاطة بغلاف يسمى الغمد الميني  
**myelin sheath** وظيفته انه يكون السيالان  
العصبي **nerve impulse** اسرع ويكون  
على شكل قفزات **jumps**

وفي مرض انه الجهاز المناعي **Immune system**  
بكون بهاجم هذا الغمد الميني ويسمى التصلب اللويحي  
**multiple sclerosis** وبتصير العمليه ابطأ



# Epithelial Tissue

- Epithelial tissues have the following characteristics:
  - 1) Cover surfaces or line cavities. دورة حياة سريعة للخليه عشان أكثر الخلايا تتعرض للبيئة وتموت
  - 2) Rapid turn-over (time from the birth of a cell till its death), because it's exposed to the external environment.
  - 3) Formed of sheets of closely packed cells.
  - 4) The cells are polar.
  - 5) The epithelium rests upon a sheet of extracellular matrix called the *Basal Lamina*. The epithelium, also, have a connective tissue layer under it.
  - 6) ***Epithelial tissues lack blood vessels.*** They receive their nutrients from the underlying vascular connective tissue.



Epithelium

Lamina propria  
(connective tissue)

Fig.1: Characteristics of Epithelial tissue. (a) Cross section of small intestine. (b) Section through the skin.

من أكثر الطبقات التي تتعرض الى البيئة enviroment من البيئة الداخلية أو الخارجية رح تتجدد بشكل متكرر وكمان هذه الخلايا poler يعني مش قطبية يعني انه كل جهة من الخلية الها تركيب structure مختلف ووظائف function مختلفة

هذه الانسجة ما فيها دم blood supply طيب الخلايا بدها مغذيات nutrients من وين؟ من conective tisse الي تحتها

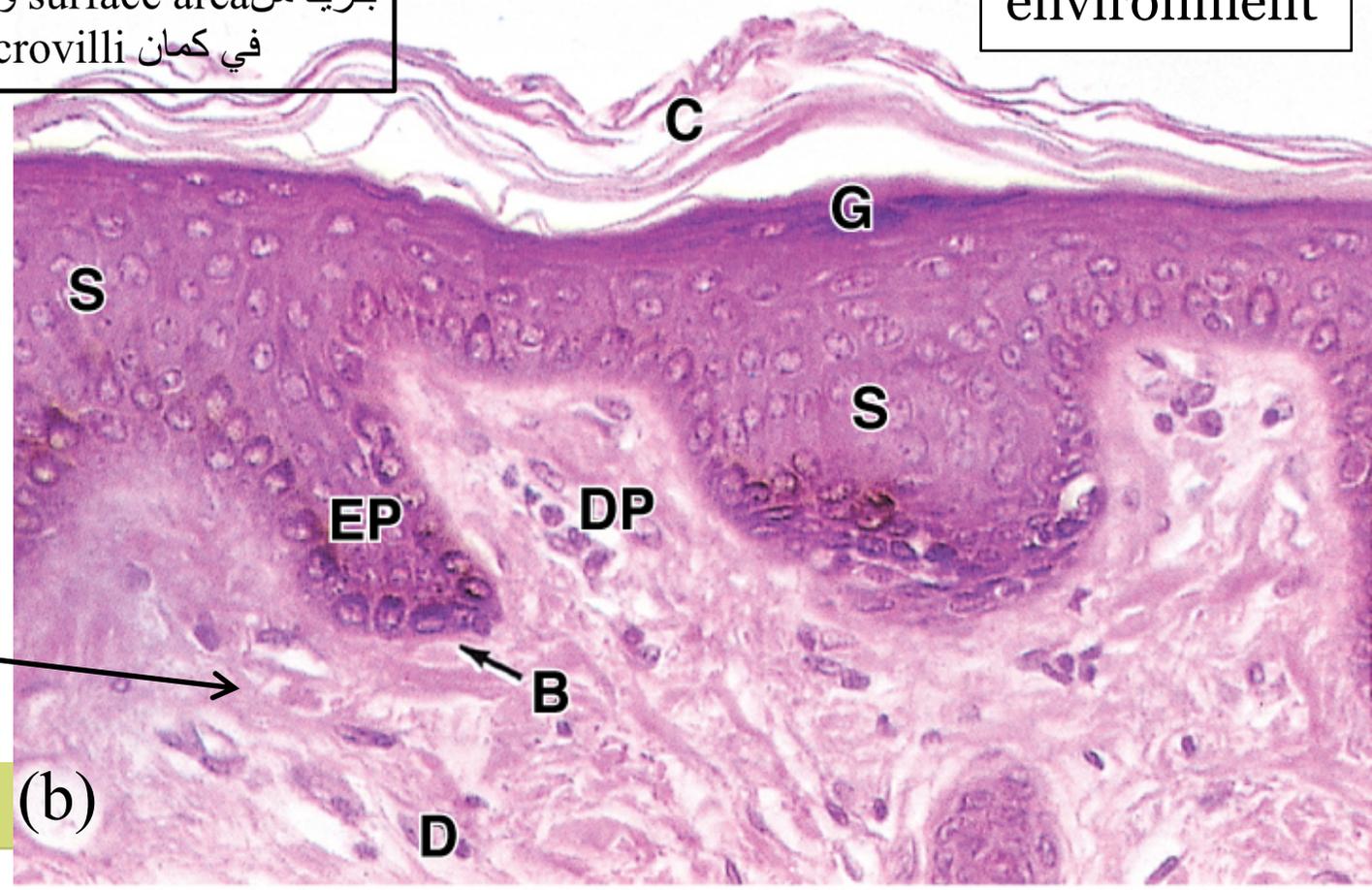
هذا يسمى lumen المجرى الي يمر فيه الاكل قبل ما يصير له امتصاص villi وفيها الاعراف absorption بتزيد من surface area وحتى جواتها microvilli في كمان

External environment

(a)

Epithelium = epidermis

Dermis (connective tissue)



(b)

# Basement Membrane

وهي عبارة عن طبقة عازلة من ألياف fibers

- Basement membrane is formed of the basal lamina and the reticular lamina. The reticular lamina is the upper part of the connective tissue that's usually located under the epithelium which is rich in reticular fibers.

- It supports the epithelium.

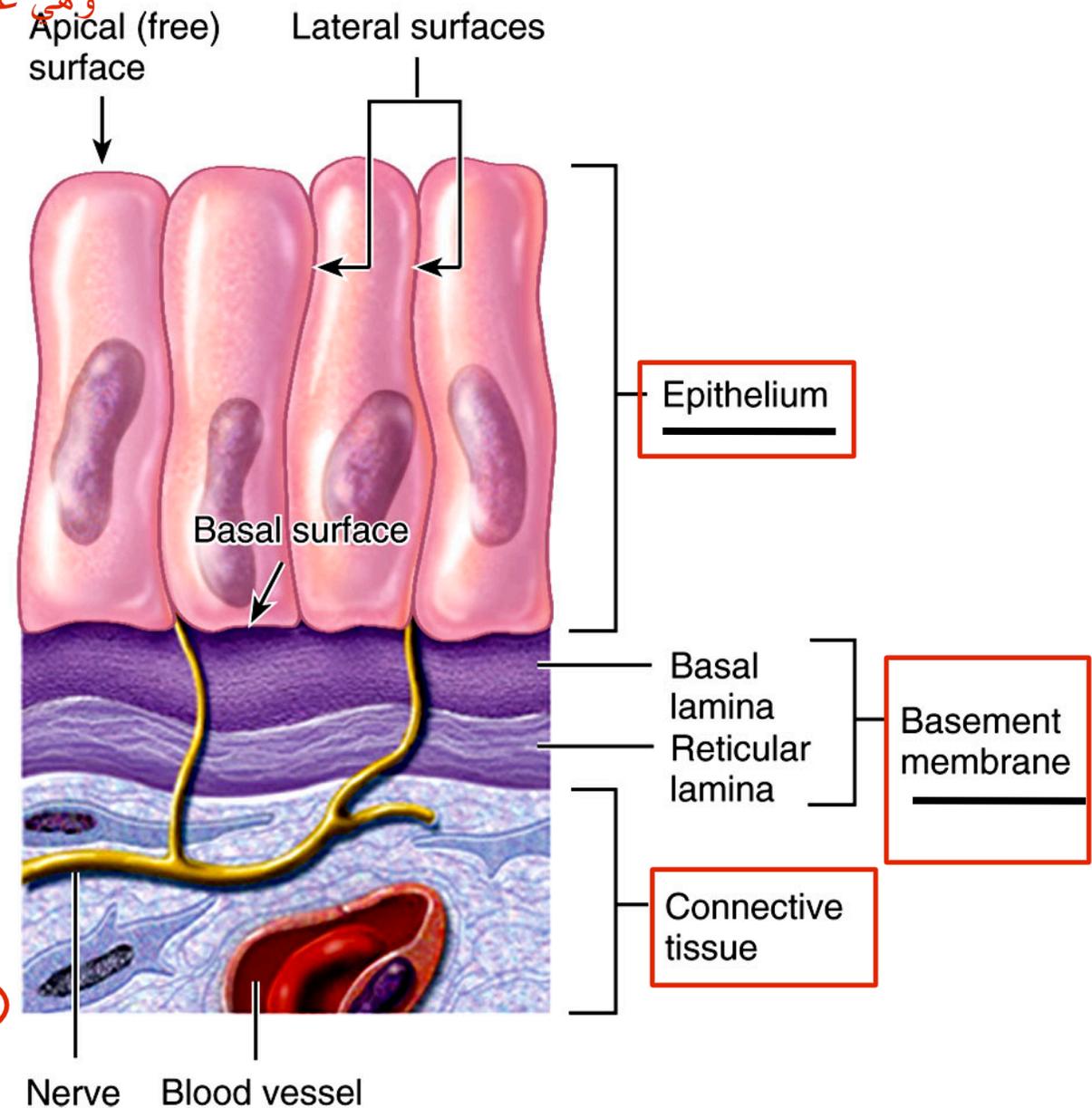


Fig.2: Difference between basal lamina and basement membrane.

# Types of Epithelium

- Epithelium can be divided into two general groups:
  - 1) Lining or covering epithelium
  - 2) Glandular epithelium → Main function is secretion
- However, some lining epithelial cells secrete (like those in the stomach) and some glandular cells are present between lining cells (like goblet cells of small intestine)

وفي كمان goblet cell هي مسؤولة عن secretion بس بيجي مكانهم من الطبقات الي بعملوا lining وموجودين في الجهاز التنفسي respiratory system و الامعاء الدقيقة small intestine

بس بحكيك انه لكل قاعدة شواذ انه الخلايا المسؤولين من lining يعملوا secretion او خلايا العكس فمثلا المعدة stomach الطبقة المبطنه من الداخل لازم تكون الخلايا epithelium مسؤولة عن lining بس بنفس الوقت مسؤولة عن افراز الحمض acid

# Lining or covering epithelium

According to number of layers

Simple  
(1 layer)

Stratified  
( $\geq 2$  layers)

Pseudostratified  
epithelium

According to shape of cell

Squamous

شكلها  
مسطحة  
flat

Cuboidal

شكلها  
مكعب

Columnar

شكلها  
عامودي  
بالطول

According to shape of cell in upper layer

Squamous

شكلها  
مسطحة

Keratinized

Cuboidal

شكلها  
مكعب

Non-  
keratinized

Columnar

شكلها  
عامودي

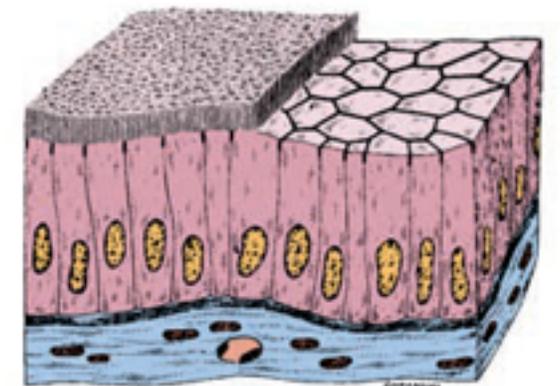
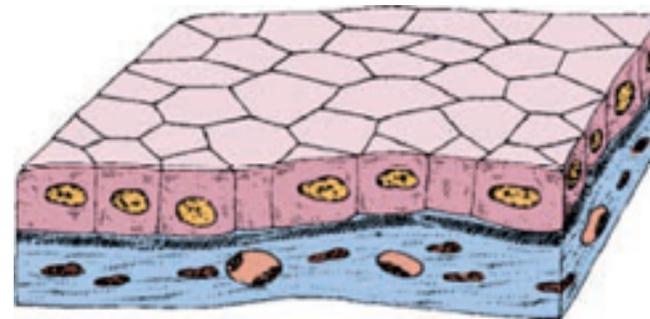
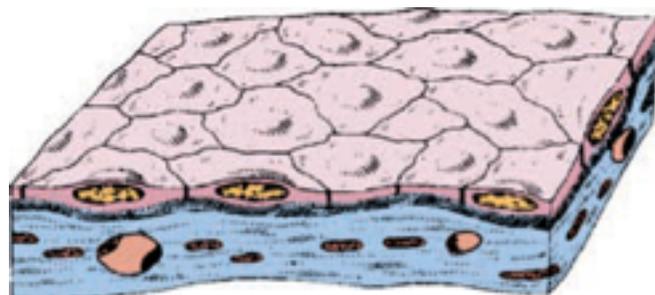
Transitional

شكلها مش معروف  
بنحطها بهذه القائمة

# Simple Epithelium

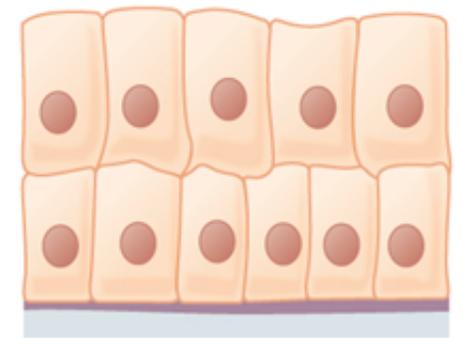
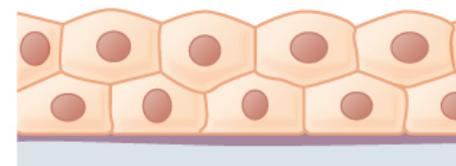
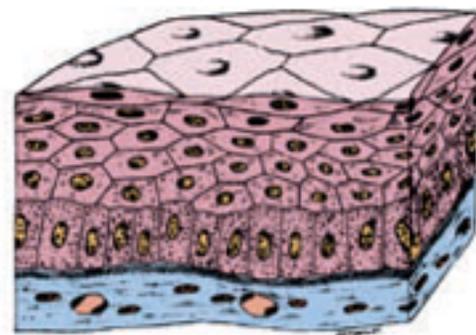
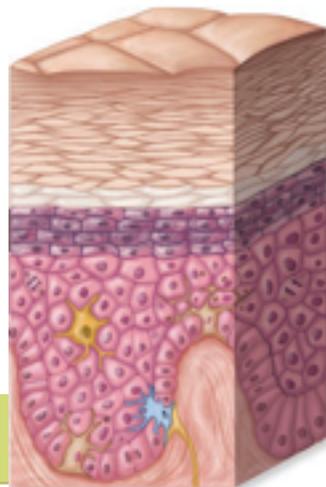
بحكيك انه شو فائدة معرفة هذه المعلومات ولشو تصنيف الانسجة وهيك انه لما يفوت سرطان على الجسم بنروح بنوخذ عينة من الكبد مثلا واحنا اكيد بنعرف شو الانسجة الموجودة في الكبد فاذا شفنا نسيج مختلف بنعرف انه في سرطان

	Simple Squamous	Simple Cuboidal	Simple Columnar
Number of Layers	Single	Single	Single
Cells	Flattened squamous	Cuboidal	Tall columnar
Location	<ul style="list-style-type: none"> <li>Line blood vessel الأكثر انتشارًا</li> <li>Line body cavities تجاوب</li> </ul>	<ul style="list-style-type: none"> <li>Line renal tubules الانابيب الكلوية</li> <li>Cover ovaries المبايض</li> </ul>	<ul style="list-style-type: none"> <li><i>Ciliated</i>: عليهم شعيرات قناة فالوب</li> <li>Uterine tube</li> <li><i>Non-ciliated</i>: ما عليهم شعيرات</li> <li>Stomach</li> </ul>
Function	<ul style="list-style-type: none"> <li>Easy passage of substances مرور المواد بسهولة</li> <li>Secretion</li> </ul>	<ul style="list-style-type: none"> <li>Active transport</li> <li>Cover organs</li> </ul>	<ul style="list-style-type: none"> <li>Secretion إفراز</li> <li>Absorption</li> </ul>



# Stratified Epithelium

	Stratified Squamous		Stratified Cuboidal	Stratified Columnar
	Keratinized	Non-keratinized		
<b>Number of layers</b>	Multiple	Multiple	Multiple	Multiple
<b>Top-most layer</b>	Squamous cells covered by <u>keratin</u> layer	Squamous cells not covered by keratin layer	Cuboidal	Columnar
<b>Location</b>	يُحافظ على رطوبة الجلد <i>skin</i> Skin	المريء Esophagus	Large ducts of salivary glands الغدد اللعابية	الملتحمة Conjunctiva
<b>Function</b>	<ul style="list-style-type: none"> <li>Protection</li> <li>Prevent water loss</li> </ul>	<ul style="list-style-type: none"> <li>Protection</li> </ul>	<ul style="list-style-type: none"> <li>Protection</li> <li>Secretion</li> </ul>	<ul style="list-style-type: none"> <li>Protection</li> <li>Secretion</li> </ul>



# Transitional epithelium (Urothelium):

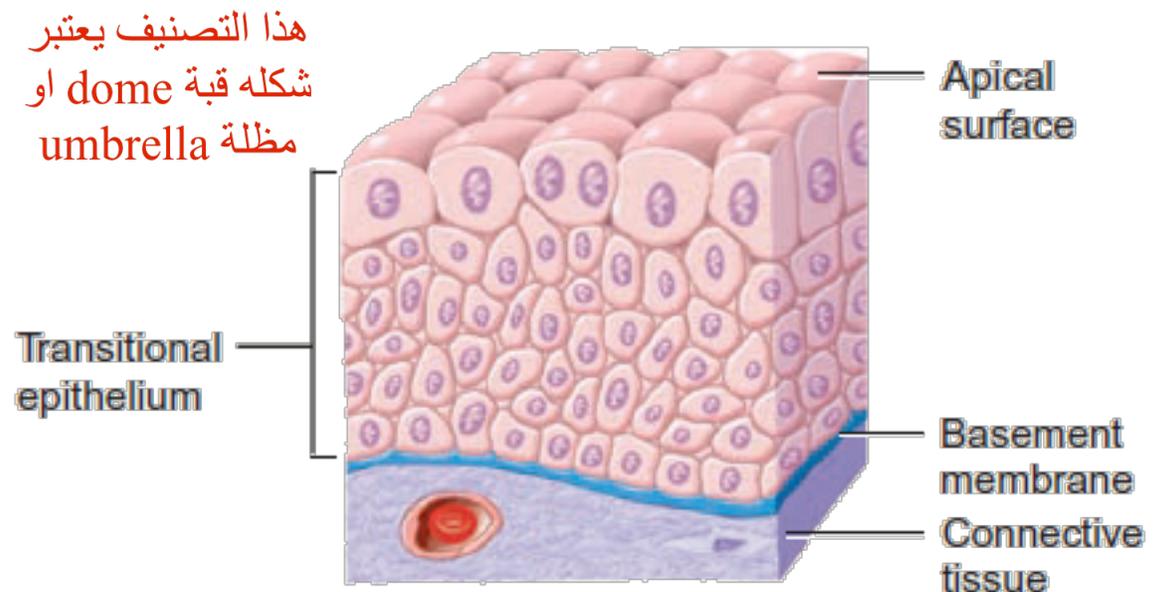
❖ The topmost cells of this stratified epithelium are dome-like (called *Umbrella Cells*).

❖ Location:

– Urinary bladder and ureters.  
That's why it's also called *Urothelium*.

❖ The umbrella cells are dome-shaped when the bladder is empty. Once it's full, these cells will become flattened (hence the name transitional).

❖ Functions: Protection against the adverse effects of urine. Allows the bladder to change size.



بس ليش ما خرينا اسمها dome epithelium على حسب شكلها مثلاً يعني؟ بحيكلك انه هذه الانسجة في ظروف معينة رح يتغير شكلها من القبة يعني في الجهاز البولي urinary system يكون شكل الحالبان ureters أو المثانة bladder يكون مثلث tringle ولما تتمدد يتغير شكلها وتمتلئ وتصبح الخلايا مسطحة

# Pseudostratified columnar ciliated epithelium:

هي عبارة عن طبقة واحدة ولكن من اختلاف اماكن النواة  
بارتفاعات مختلفة للخلايا بتفكرها اكثر من طبقة

- In this epithelium, the cells have different heights. All cells rest on the same basal lamina, but not all of them reach the surface. This makes the nuclei occupy different levels giving the epithelium a false stratified appearance, but this epithelium is, actually, simple.

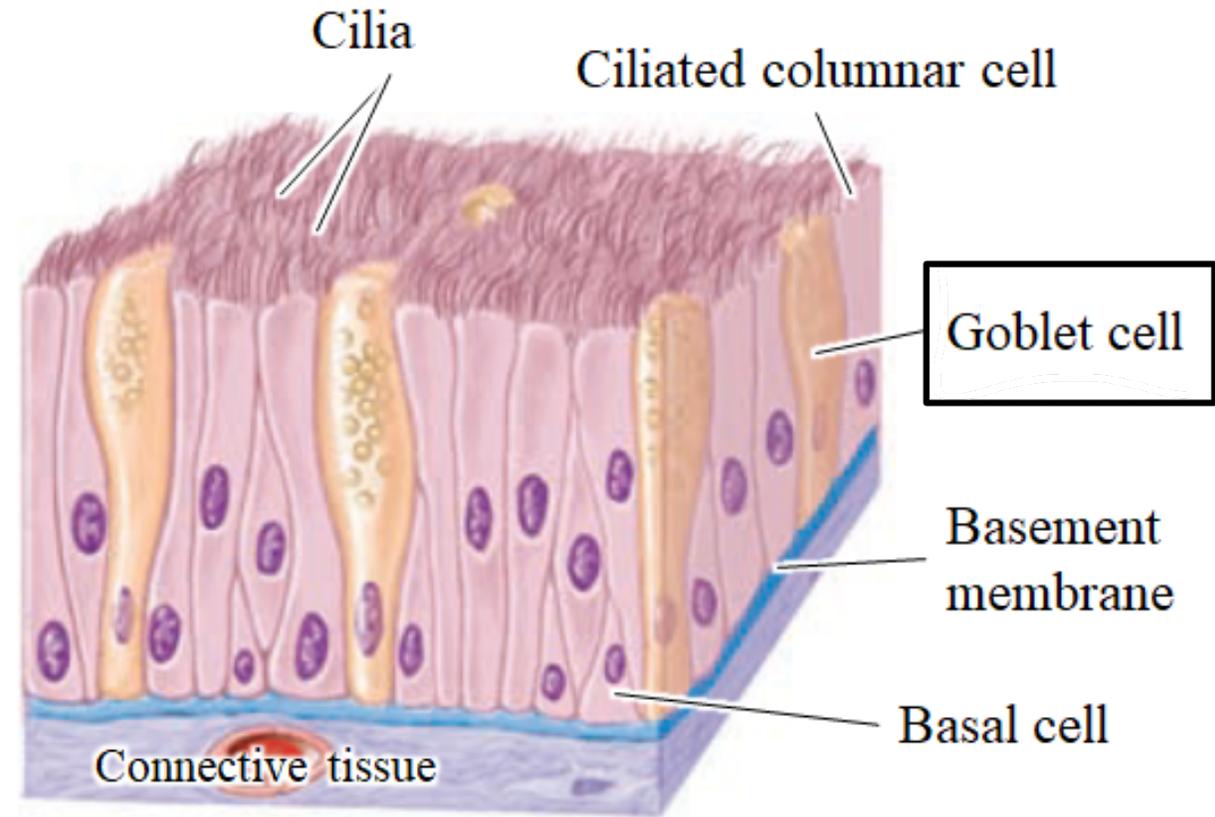


Fig.4: Pseudostratified columnar ciliated epithelium.

- **Location:** <sup>القصبية الهوائية</sup> Trachea, <sup>الشعب الهوائية</sup> bronchi, and <sup>التجويف الانفي</sup> nasal cavity (that's why it's also called *Respiratory Epithelium*).
- **Functions:** Protection, secretion. Ciliary movement removes particles from the airway passages.

# Glandular Epithelium

- Is an epithelium specialized for secretion.

## Classification of glandular epithelium:

### 1) According to number of cells:

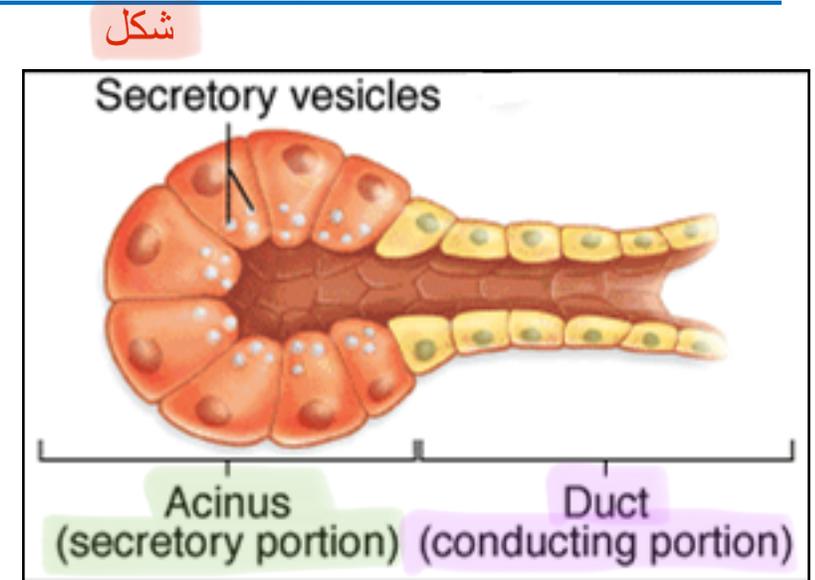
- ❑ **Unicellular** glands: formed of a single cell, like Goblet cells of digestive and respiratory tracts.
- ❑ **Multicellular** glands: formed of clusters of cells, like: salivary and sweat glands.

## 2) According to presence of ducts:

- ❑ **Exocrine glands:** possess ducts that transfer the secretion to the outside of the body, like: salivary glands. *الغدد اللعابية*
- ❑ **Endocrine glands:** they lack ducts. Their secretions are transferred to the target organs, usually, by blood. Example: Pancreatic Islets, Pituitary gland. *من الامثلة على هذه الغدد : الكظرية ، الدرقيه ، الزعترية ، البنكرياس ، النخامية ، تحت المهاد*

## 3) Exocrine glands classified according to morphology of duct and secretory portion:

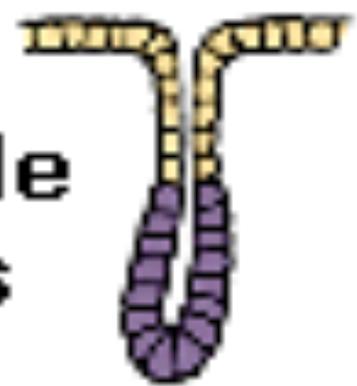
- ❑ Each exocrine gland has a secretory portion that produces the secretion and a duct that carries this secretion.
- ❑ The duct and the secretory portion could be branched or unbranched.
- ❑ The secretory portion could acinar (ball-shaped), tubular, or coiled.



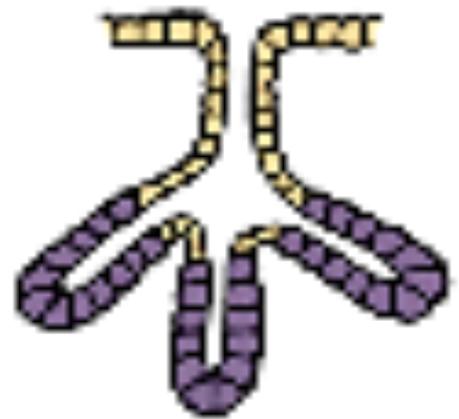
اشكال acinus

# Exocrine Gland Types

simple types



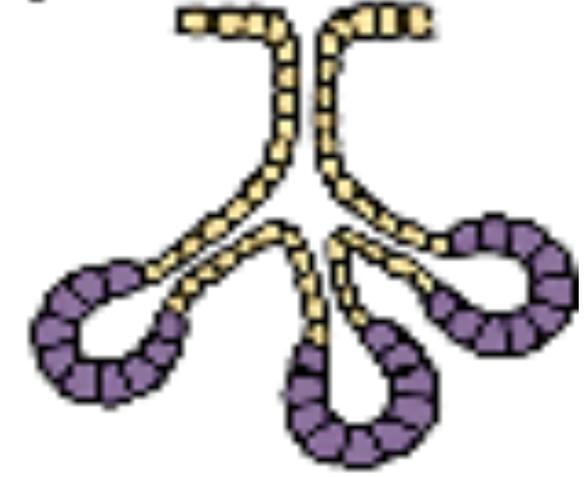
tubular



branched tubular

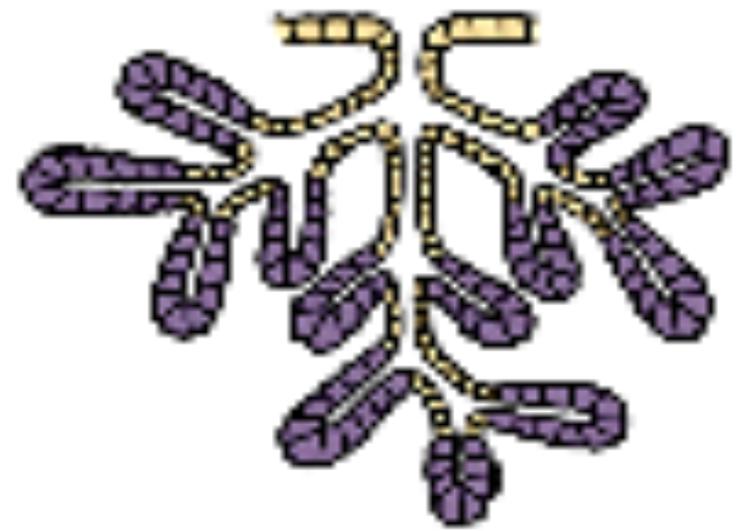


coiled tubular

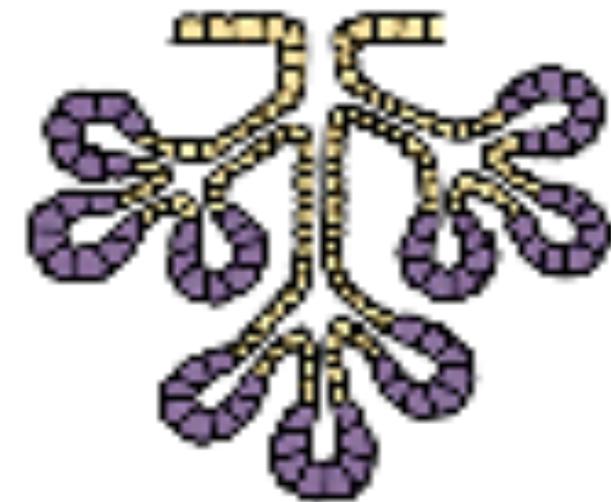


branched alveolar

compound types



tubular

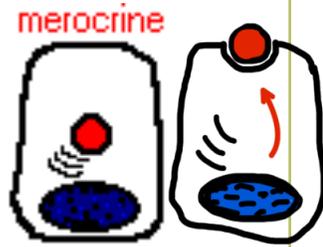


alveolar

## 4) Exocrine glands classified according to method of secretion:

الغدد الصماء

☐ **Merocrine**: only the product is secreted by exocytosis. As in salivary glands.

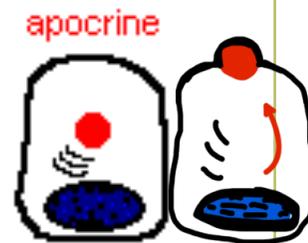


❖ Merocrine glands are either **serous** (excrete a watery solution) or **mucous** (excrete a thick solution).

تفرز محلول مائي

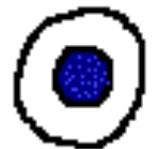
تفرز محلول سميك

☐ **Apocrine**: the product and the apical part of the cell is shed. As in mammary gland.



بتشيل الجزء العلوي من الخلية معها

☐ **Holocrine**: the whole cell disintegrates and is shed with the secretion. As in sebaceous glands of the skin.



# Epithelial Cell Polarity

حكينا عنها قبل هيك انه polarity يعني مش قطبية يعني انه كل جهة من الخلية لها وظيفة معينة

- ❖ Polarity means that various regions of a cell have specialized structural features because they perform different functions.
- ❖ Epithelial cells can be generally divided into 3 regions:
  1. **Apical (Luminal) region:** close to the lumen of the organ.
  2. **Lateral regions:** adjacent to other cells.
  3. **Basal region:** lying on the basal lamina.

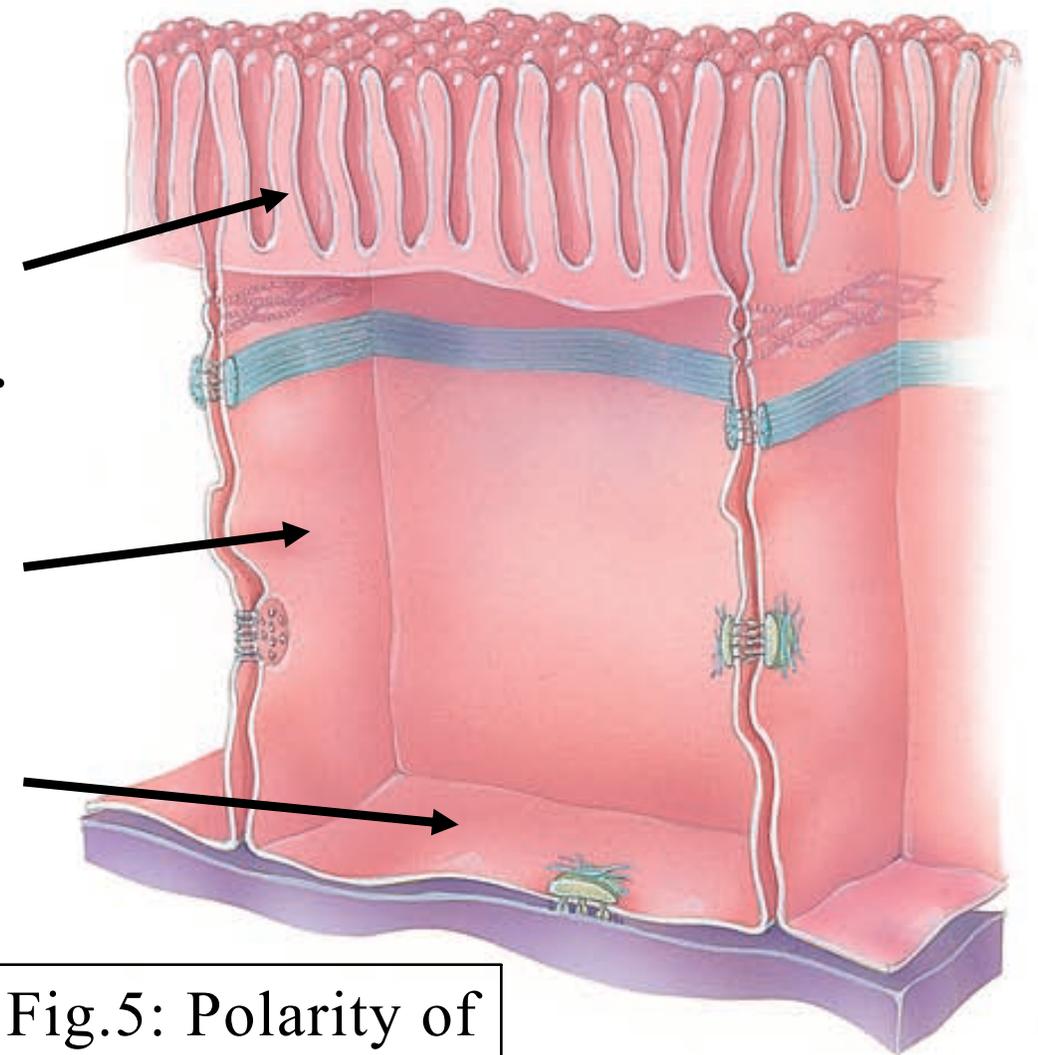
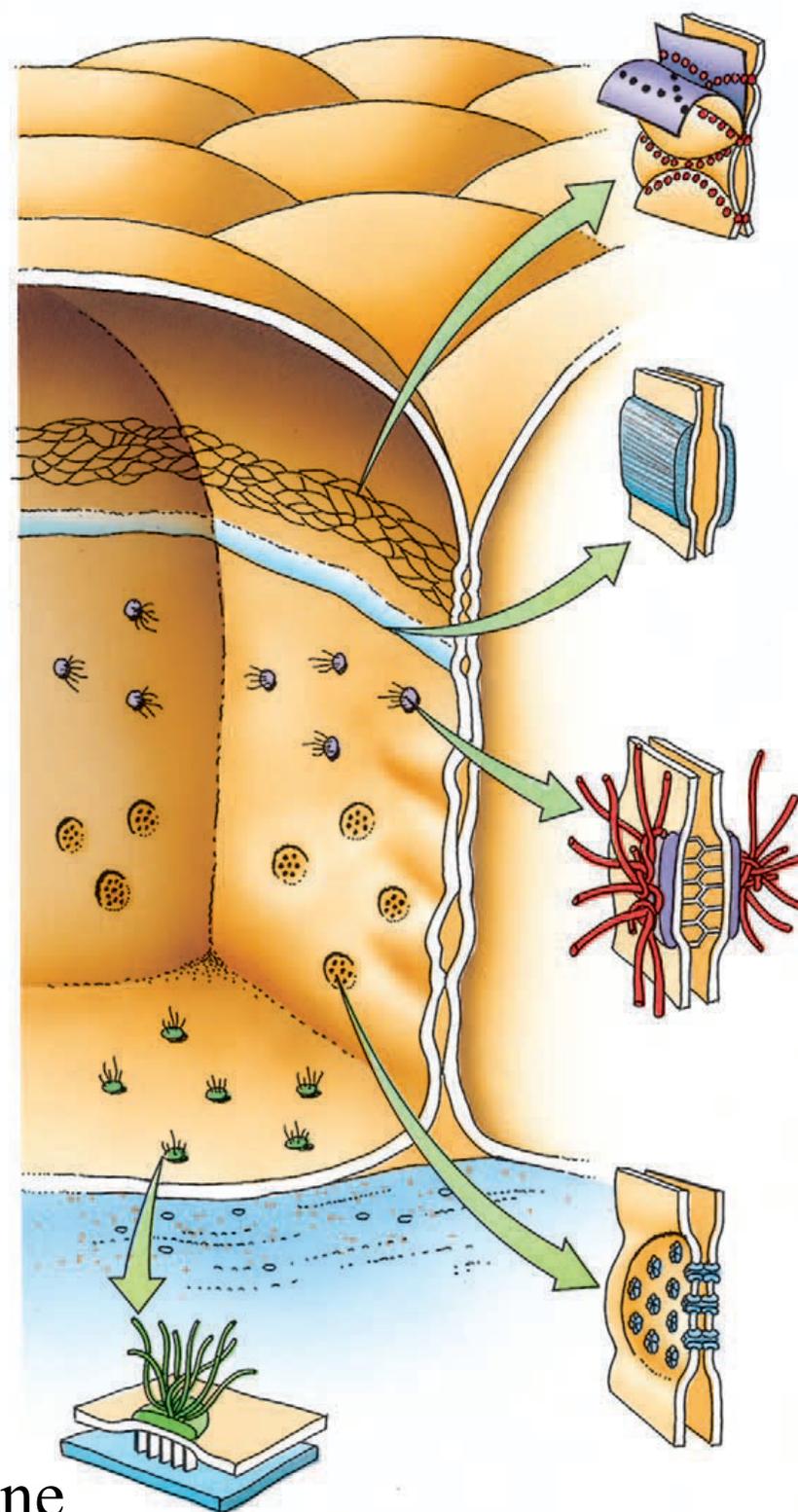


Fig.5: Polarity of epithelial cells.

# Cellular Junctions

- ❖ Cell-membrane structures.
- ❖ Located on the lateral and basal surfaces.

**Hemidesmosomes:** area of adhesion between cell membrane and basal lamina.



1 التحام  
**Tight Junction:** area of fusion of cell membrane. Seals the space between two cells.

3  
**Adherent Junction:** area of adhesion between two cell membrane.

2  
**Desmosomes:** area of stronger adhesion between two cell membrane.

4  
**Gap Junction:** porous area in the cell membrane of two cells that allow passage of substances between them.

مرتبين  
حسب  
قوة  
التصاق

# Features of the apical surface of the cell

- **1) Microvilli (single = microvillus):**
- Finger-like cytoplasmic projections that are present in absorptive epithelium, most prominently in the small intestine. They increase the surface area.

شكل الخلية عامودي columnar

Fig.6a: Microvilli of small intestinal cells



- **2) Stereocilia**

- They're similar in structure to microvilli; however, they're longer and less motile. They may act as mechanoreceptors as in the inner ear hair cells.

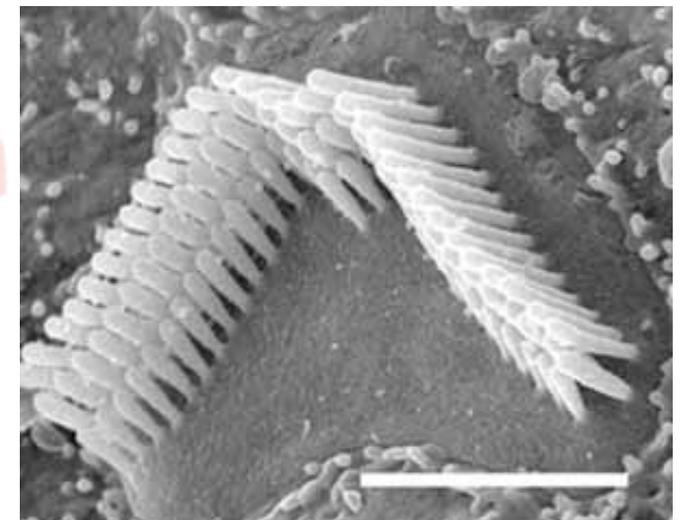


Fig.6b: Stereocilia of a hair cell

### • 3) Cilia

- Thick, elongated, motile structures on the surface of some epithelial cells, like those of the trachea. There are, usually, many cilia on the surface of a single cell. They move in rhythmic fashion backwards and forwards removing fluids and debris in a certain direction.

وظيفتها تحريك المخاط mucus او ازالة  
المواد العالقة على الخلايا

### • 4) Flagella

- They're similar to cilia in structure but are much longer and, usually, only one flagellum is present on a cell. The movement of the flagellum is rotational. In humans, only sperms possess a flagellum.

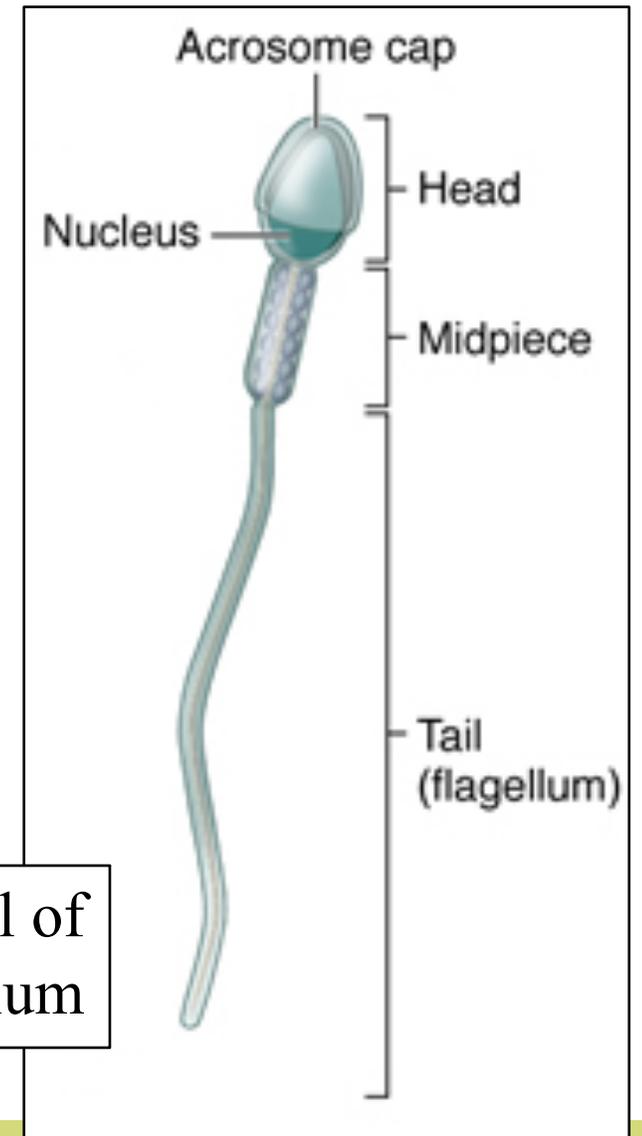
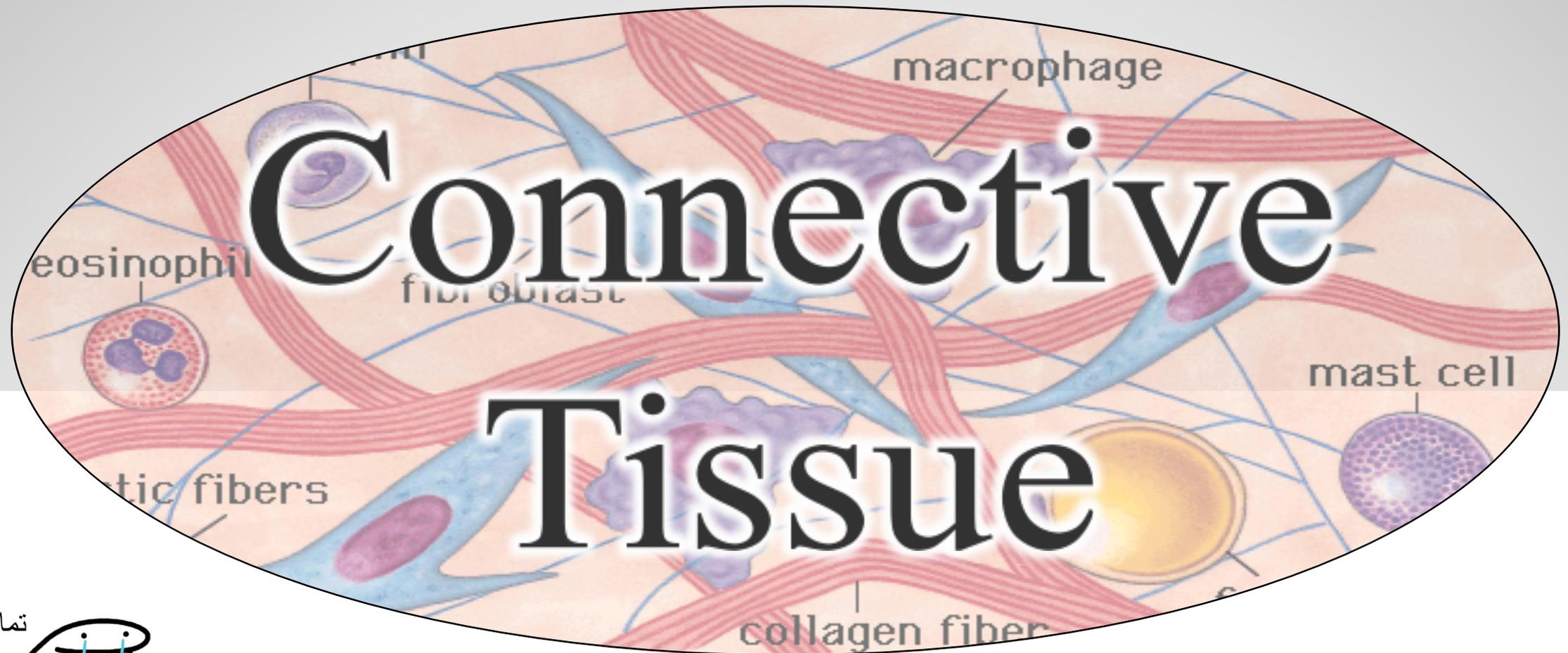


Fig.6c: Sperm. The tail of the sperm is a flagellum



اي نشيج غير مسؤول عن secretion او lining او covering او movment او electrical empulses بكون  
 connective tissue زي الدم blood مثلاً والخلايا الدم البيضاء والحمراء تعتبر خلايا طوافة wandering بتسبح  
 في البلازما وزي السائل اللمفاوي lymph او حتى العظم bone

**Connective tissue (CT) is a type of body tissue characterized by the presence of an abundant extracellular matrix within which are dispersed different types of cells and fibers.**

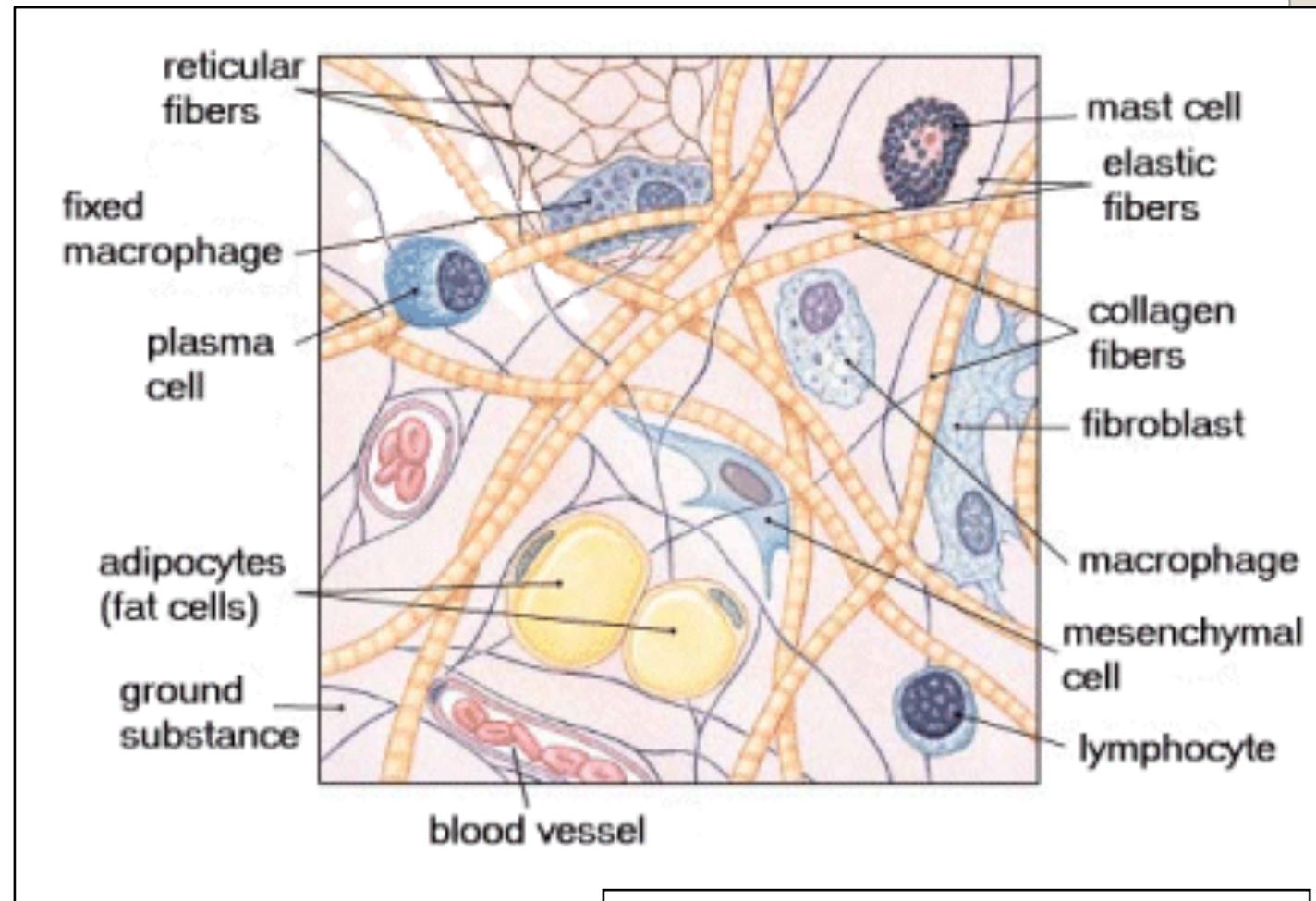


Fig.7: Components of CT.

### **Functions:**

1. Provide form of organs.
2. Support of different organs → fatty tissue.
3. Connect and bind different structures → cartilage, bone. <sup>الغضاريف</sup>
4. Provide a medium for diffusion of nutrients and waste products → connective tissue proper, blood.

# The Cells Of The Connective Tissue

**Fibroblasts** – *most common type of cell in the CT*

- **Function:** *Synthesizes fibers and produces components of extracellular matrix.* تصنع كمية كبيرة من البروتينات الي هي اصلا fibers

- **Main Features:**

- ✓ Abundant irregularly branched cytoplasm.
- ✓ Large, pale-staining nucleus with a prominent nucleolus and a well developed rough endoplasmic reticulum and Golgi apparatus (*features of protein producing cells*).

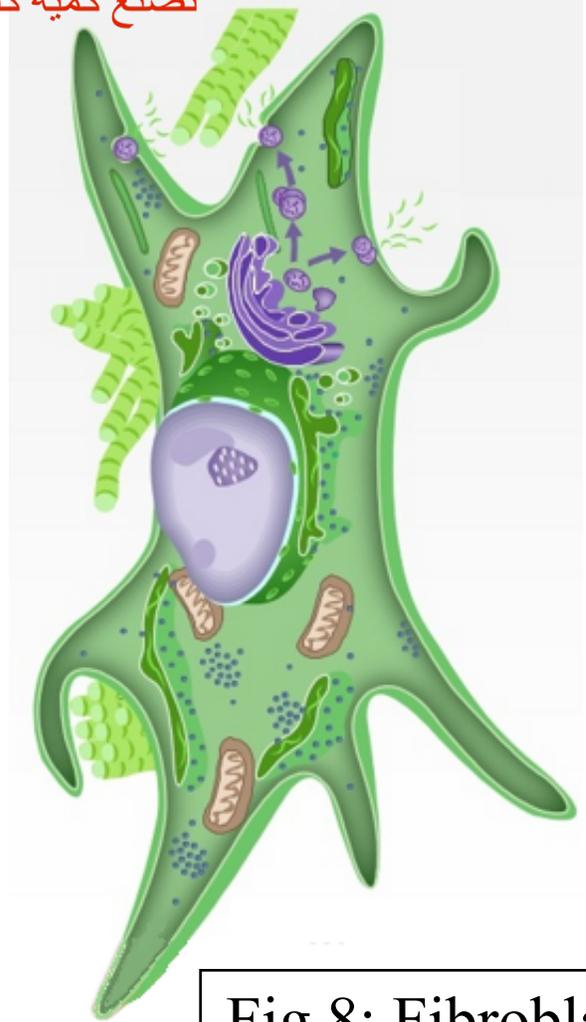


Fig.8: Fibroblast.

## Cell

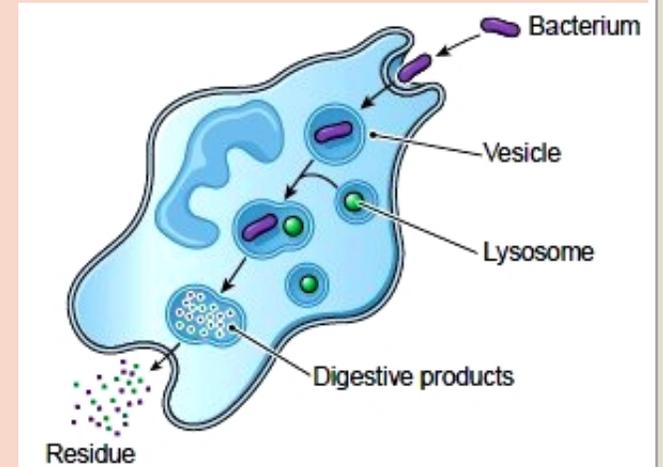
## Important feature

## Function

Macrophages

Cell surface has indentations and protrusions  
انبعاث للداخل بروز للخارج

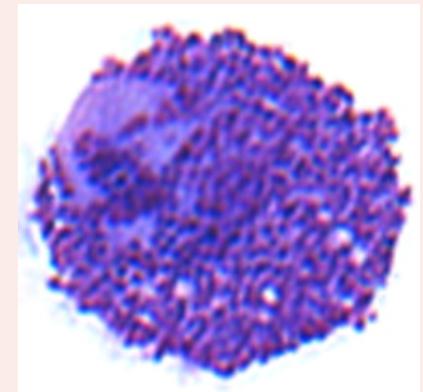
البلعمة  
Phagocytosis



Mast cells

Cytoplasm filled with dark staining secretory granules

Secretion of histamine (allergy), heparin, and others

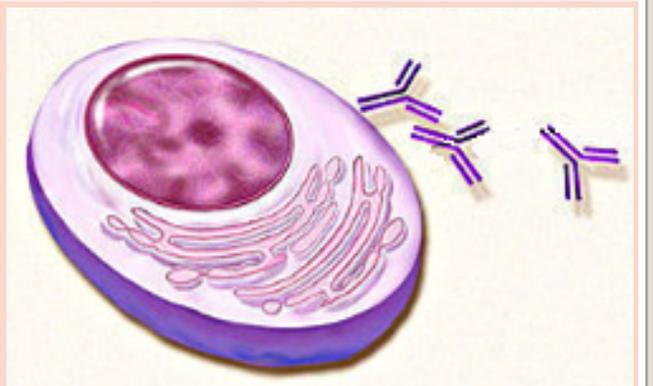


Plasma cells

Nucleus has alternating dark and light regions (clock-face appearance)

Production of antibodies

داخلة في Immune system



# Extracellular Matrix

Formed of:

هي عبارة عن ماء مع هذول الاشياء



**A. Fibers:** these are elongated protein structures and they include:

①) *Collagen fibers*: give strength to the tissue.

②) *Elastic fibers*: give elasticity to the tissue.

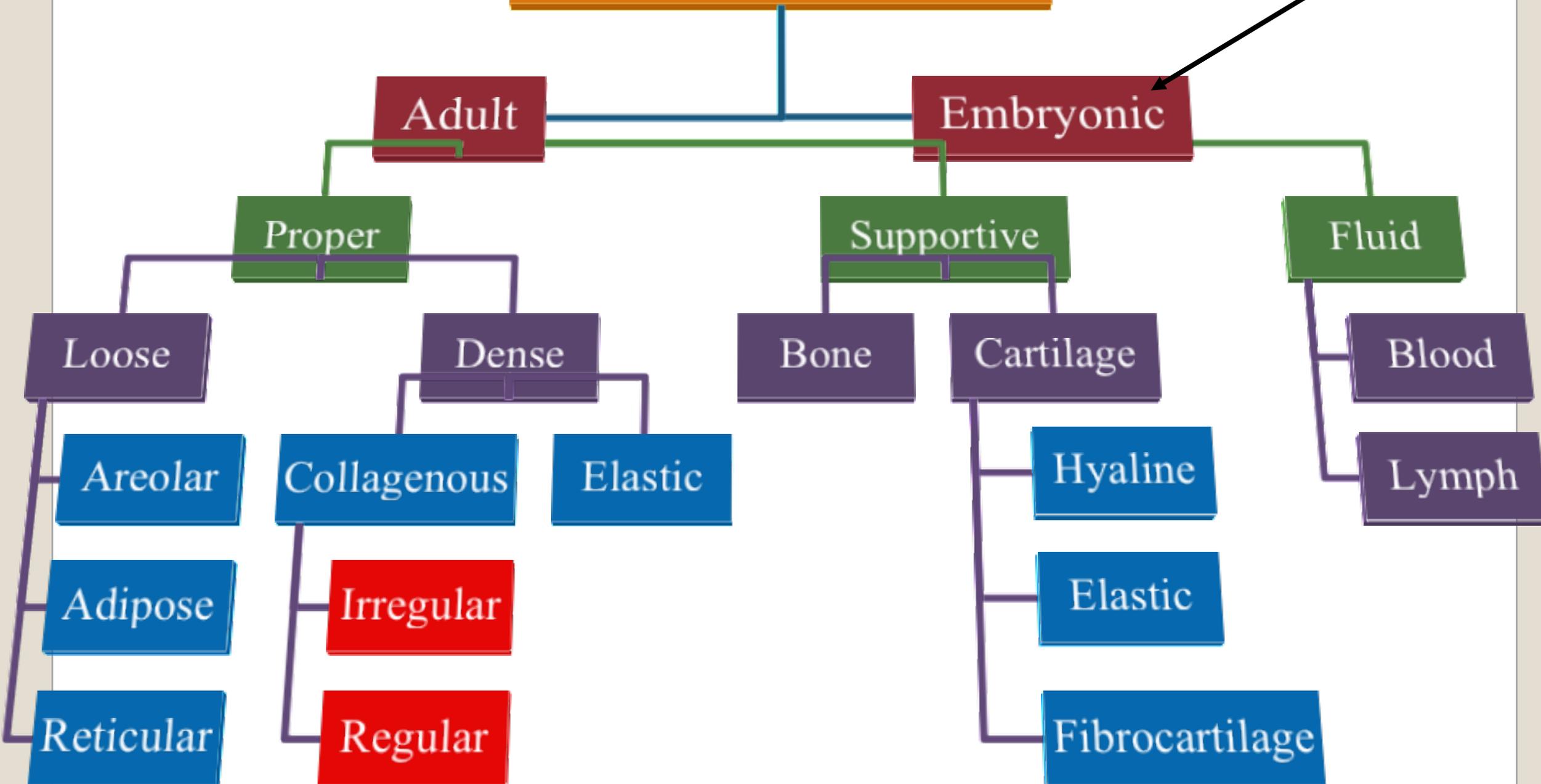
③) *Reticular fibers*: form a net that surrounds the different parts of the tissue holding them together.

**B. Ground substance:** formed of various large molecules with water.

# Classification

## Connective Tissue

Mainly in embryos



- ❑ ***Proper connective tissue*** is the connective tissue in which the cells that form the ECM is the fibroblast or cells derived from fibroblasts.

والفرق بينهم انه اذا loose او dense هو ترتيب الخيوط fibers وعددهم

- ❑ ***Loose connective tissue***: the fibers are loosely arranged forming a network.

بكونوا بشكل متباعد وفضفاض

وعلى شكل شبكة

- ❑ ***Dense connective tissue***: the fibers are numerous and densely packed.

اعدادها كبيرة

متراسة بكثافة عالية

# Loose Areolar Connective Tissue:

الأكثر وجودًا في الجسم

- ❑ A very common type of connective tissue. It gives some support to organs and tissues.

- ❑ Features:

- Contain all three types of fibers arranged loosely.
- All types of connective tissue cells (especially fibroblasts and macrophages) are present here.
- All these components are embedded in an abundant semi-fluid ground substance.
- It's highly vascular.

Collagen fibers      Elastic fibers      Reticular fibers

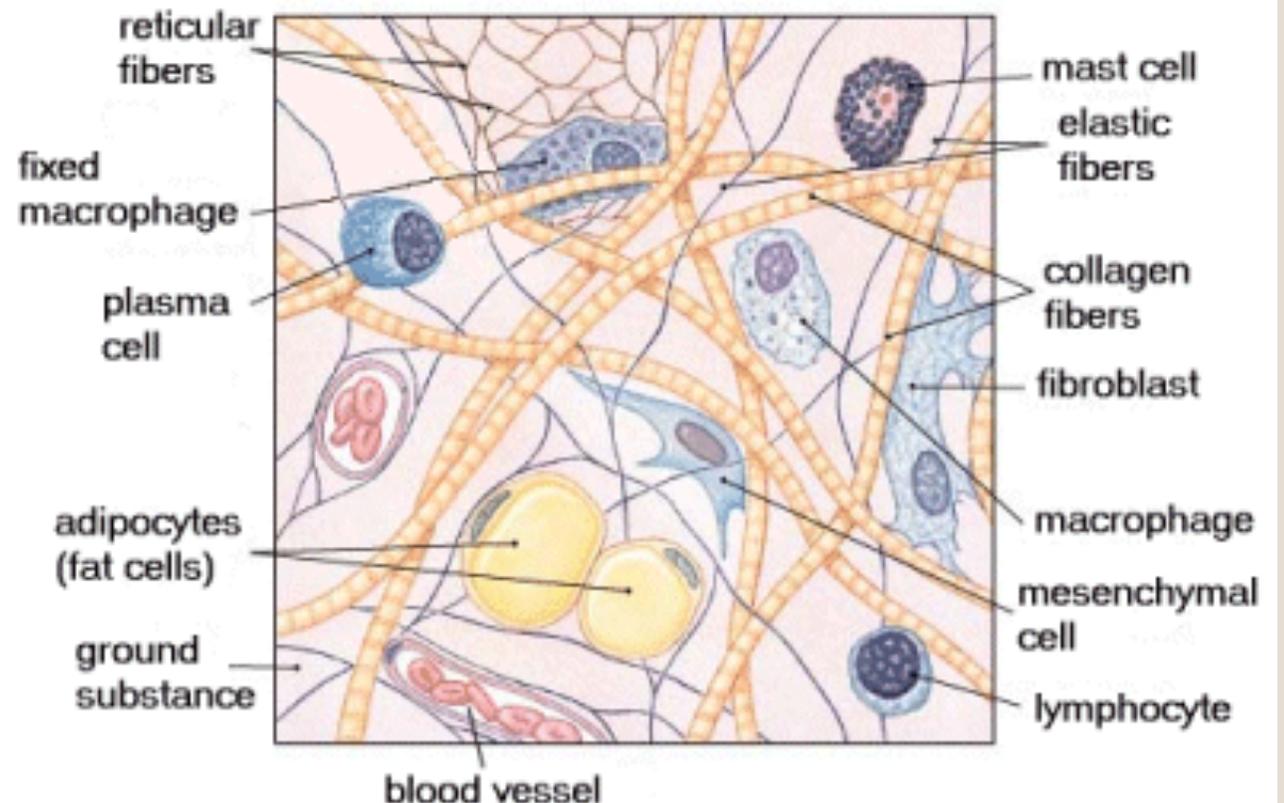


Fig.9: Areolar connective tissue.

## □ Found:

1. Under epithelia.
2. Around glands.
3. In the spaces between muscle and nerve fibers.
4. Around blood and lymphatic vessels.
5. It fills many small spaces making it the '*packing material*' of our body.

يعني حشوة اي مكان فاضي بنحط فيه هذا النسيج

## □ Functions:

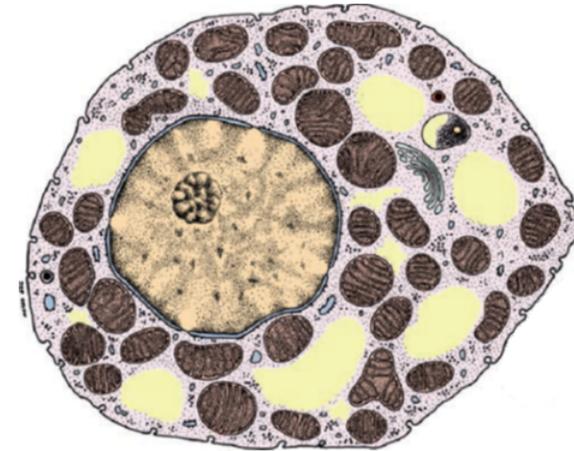
1. It gives organs their shape.
2. It is a medium for the diffusion of gases, nutrients, and waste product.
3. It is usually the first tissue where microorganisms and foreign particles enter the body; therefore, it's an important site for immune and inflammatory responses.

# Adipose Tissue

- ❑ Is a type of loose connective tissue characterized by the abundance of a specific type of cells called adipocytes.
- ❑ It is of two types:

	<i>White Adipose Tissue</i>	<i>Brown Adipose Tissue</i>
<b>Type of adipocyte</b>	White	Brown
<b>Gross color</b>	White to yellow (due to presence of fat)	Brown due to abundance of blood vessels
<b>Main function</b>	Storage of energy	Production of heat
<b>Location</b>	<ul style="list-style-type: none"> <li>• Present throughout life</li> <li>• All over the body</li> </ul>	<ul style="list-style-type: none"> <li>• Abundant in <u>infants</u> الاطفال الرضع</li> <li>• Decrease with age</li> <li>• In adults found in few areas</li> </ul>

	White Adipocyte	Brown Adipocyte
<b>Shape</b>	Spherical دائري	Polygonal مُضلع
<b>Size</b>	Larger	Smaller
<b>Fat droplet</b>	Single (unilocular)	Multiple (multilocular)
<b>Nucleus</b>	Peripheral	Central
<b>Mitochondria</b>	Numerous	Numerous



هرمون الاشباع

- White adipocytes secrete the hormone Leptin, which is a satiety factor.



انه اذا اكلت بعد ثلث ساعة يفرز هذه الهرمون وبتشبع

# Other types of connective tissue proper:

Type	<i>Loose</i>		<i>Dense</i>	
	<i>Reticular</i>	<i>Collagenous</i>	<i>Collagenous</i>	<i>Elastic</i>
<b>Fibers</b>	Reticular	<i>Irregular</i> ترتيب fibers بطريقة غير منظمة Collagen, passing in all directions	<i>Regular</i> ترتيب fibers بطريقة منظمة Collagen, passing in one direction	Elastic
<b>Function</b>	Holds parts of organs together	Resists forces from all directions	Resists traction forces	Provides elasticity
<b>Location</b>	Lymph node, spleen	Dermis of skin	Tendons, ligaments	Aorta, vocal cords

