Oral cavity, lip, tongue & taste buds

Dr.Iman Nabil

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Oral cavity, lip, tongue&taste buds

1- Classification of GIT.

2- Oral cavity: contents & structure.

3- Lip: structure.

4- Tongue: structure.

5- Taste buds: structure& function.

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Why?
tell me
why!


Gastrointestinal tract (GIT)

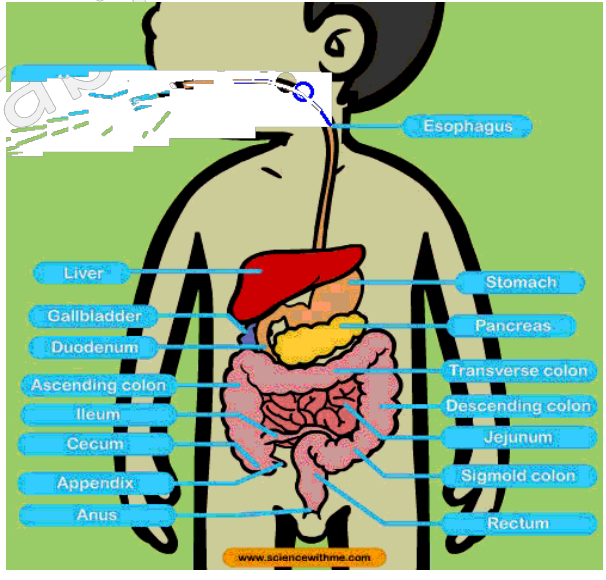
1- Oral cavity: lip, tongue& salivary glands.

2- Alimentary canal:

- Esophagus.
- Stomach.
- Small intestine.
- Large intestine.
- Appendix.
- Junctions.

3- Associated glands: liver, gall bladder& pancreas.

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Oral cavity

It consists of:

1- Vestibule.

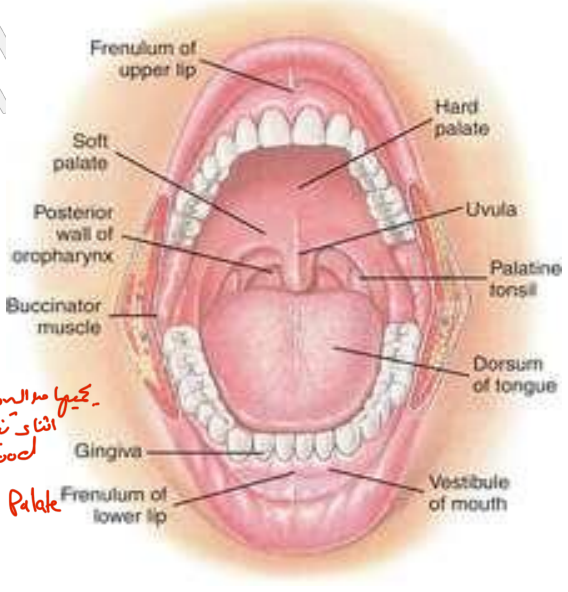
2- Oral cavity proper.

Types of oral mucosa:

A- *Masticatory*: covers gum, hard palate & dorsum of tongue, thick, firmly attached to underlying tissues, stratified squamous epithelium with variable degree of keratinization.

B- *Lining mucosa*: elsewhere in oral cavity, non keratinized stratified squamous epithelium.

C- *Specialized mucosa*: taste buds.



Lip

Dr Imad Kabil

Structure of the lip

It consists of three surfaces:

1- Skin surface: thin skin.

2- Red margin: → الجزء الاحمر

- Transitional zone between the skin and the mucous surface.
- Rich in sensory nerve endings.
- Lined by *thin* keratinized stratified squamous epithelium which is indented by long connective tissue papillae, rich in blood capillaries.
  - *The red color of the lip* is due to reflection of *the numerous blood capillaries* in the underlying connective tissue papillae.

3- The mucous surface: → الجزء المقابل للاسنان

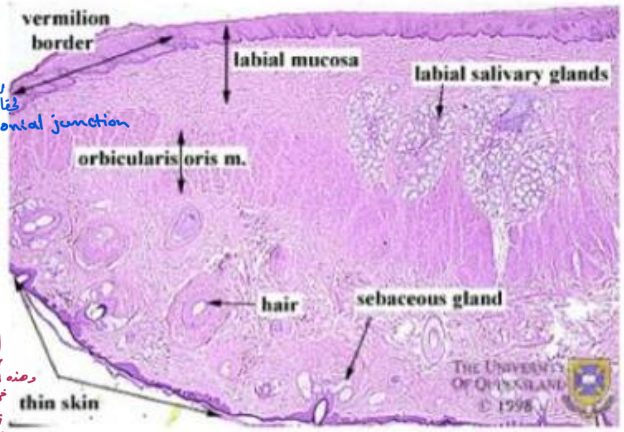
- Epithelium: non keratinized stratified squamous epithelium.
- Lamina propria: contains *labial salivary glands* (mucous acini).

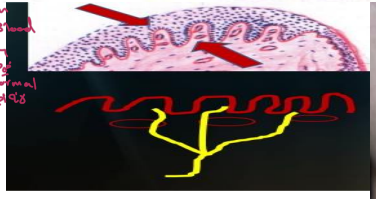
The main bulk of the lip: is formed *the orbicularis oris muscle* embedded in fibro elastic connective tissue rich in fat cells.

types of Salivary gland

major — 90 - 95% from saliva

minor — 5-10% from saliva







2 مستقلة بنفسها gland

عضو مستقل organs

or tissue نسيج

Tongue

Dr Ima[illegible]bil

Tongue

Functions:

1- Food manipulation.

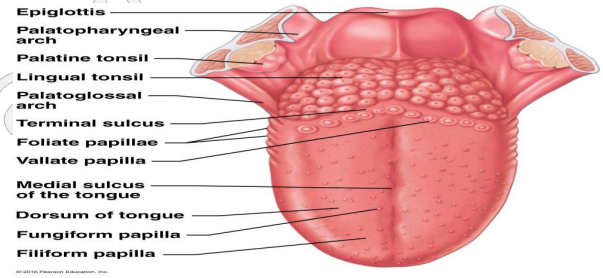
2- Speech.

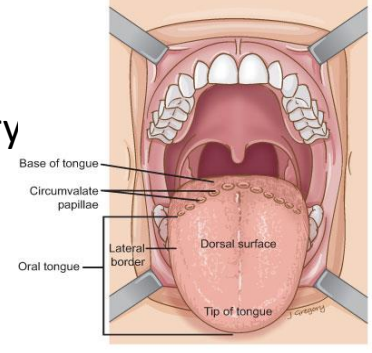
3- General sensory perception & the special sensation of taste.

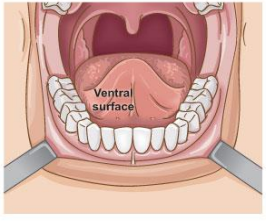
Anatomically:

It has 2 surfaces: dorsal & ventral.

The dorsal surface: is divided by the gustatory line (sulcus terminalis) into anterior 2/3 and posterior 1/3.







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How does the tongue adapt to its functions?

1- Dorsal surface:

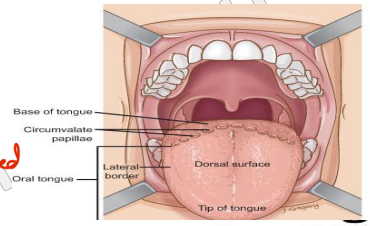
- The mucosa of the anterior 2/3 is firmly attached to the underlying tissue.
- It is modified to form *lingual papillae*.

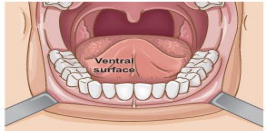
2- Ventral surface:

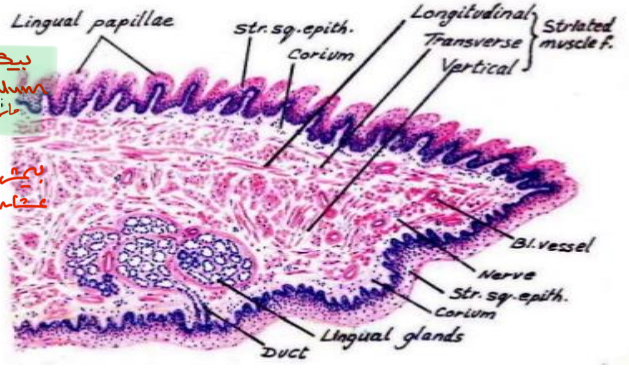
- Covered by the lining mucosa.
- Loosely attached to the underlying tissue to permit free bending and mobility of the tongue.

3- The main bulk: of the tongue is formed of:

- *Striated muscle fibers*: run in three directions: longitudinal, transverse & vertical.
- They are embedded in loose areolar &adipose CT to allow maximal mobility of the tongue.





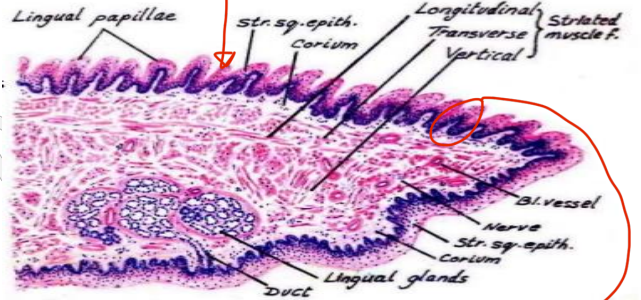


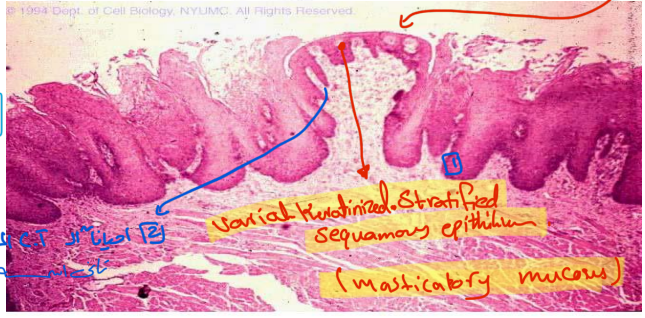
The lingual papillae

Definition: elevations on the anterior 2/3 of the dorsal surface of the tongue.

Function: increase the surface area of the mucosa coming in contact with the food.

Structure: Each papilla has *a core of connective* tissue covered by *stratified squamous epithelium*(with variable degree of keratinization). This core may projects to indent the epithelium to form *secondary papillae*.





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types of Papillae

1-Filiform papillae

Number: most numerous.

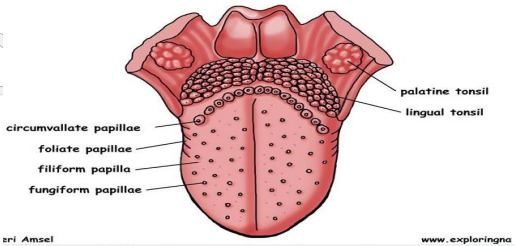
Distribution: arranged in rows, parallel to the gustatory line over the anterior 2/3 of the dorsal surface of the tongue.

Shape: conical with antero posterior inclination.

Epithelium: Lightly keratinized stratified squamous epithelium.

Taste buds: absent.

Secondary papillae: short or absent.





2- Fungiform papillae

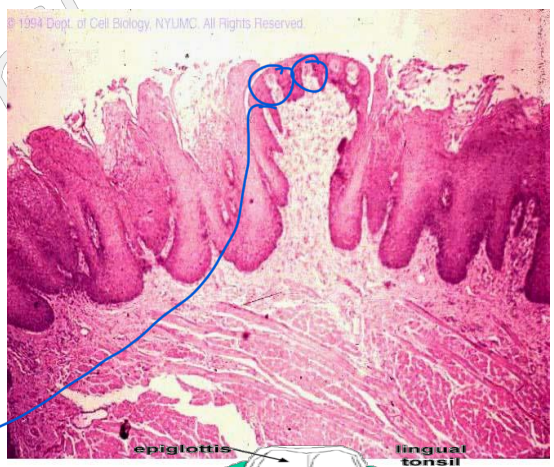
Number: few.

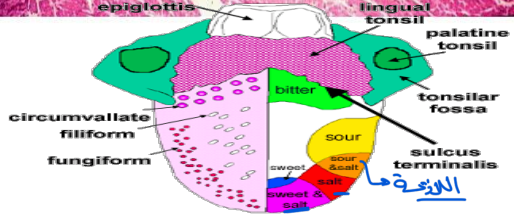
Distribution: scattered among the filiform papillae especially on the tip & edges of the tongue .

Shape: mushroom shaped, have vascular connective tissue core(seen as red spots in the fresh state).

Taste buds: few, present in the apical part of the papilla.

Secondary papillae: short.





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3- Circumvallate (vallate) papillae

Number: 8-12.

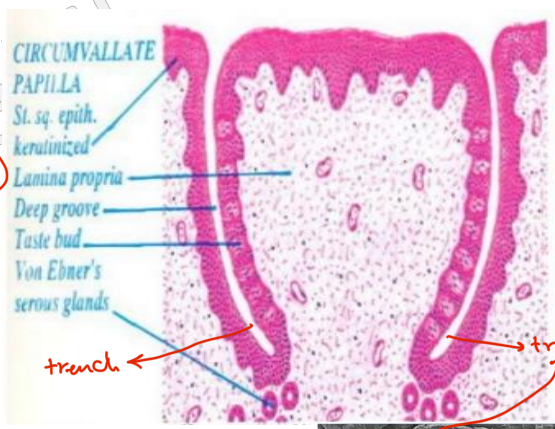
Distribution: just in front of the gustatory line.

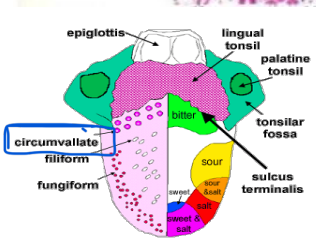
Shape:

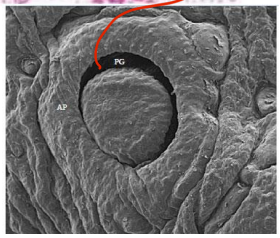
- The largest, seen by the naked eye.
- Triangular in shape.
- Embedded within the substance of the tongue and project for a short distance above the surface.
- Each papilla is surrounded by a trench where ducts of *VonEbner's glands* open into its bottom.

Taste buds: numerous, present along the sides of the papillae.

Secondary papillae: short.







Von Ebner's glands

minor salivary gland

Definition: serous lingual salivary glands.

Site: in the connective tissue encircling each circumvallate papilla.

Ducts: open at the bottom of the trenches surrounding these papillae.

Functions:

1- Their secretion *dissolves* the food particles to facilitate perception of taste.

2- The flow of secretion *washes away* food particles around the taste buds so, they can receive new taste stimulus.

3- The secretion contains *lipase enzyme* which prevents formation of hydrophobic layer.



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4- Foliate papillae

لحم يشبه ورده الشجر العريض .

Number: not recognized in adult human but developed in rabbit. لحم بيكون موجود في

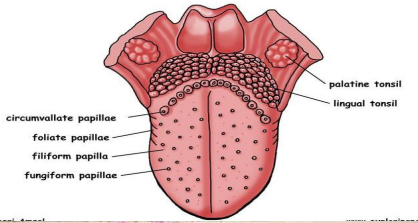
Distribution: arranged in rows, on the lateral sides of the tongue. ثم يختفي Child و embryo الـ

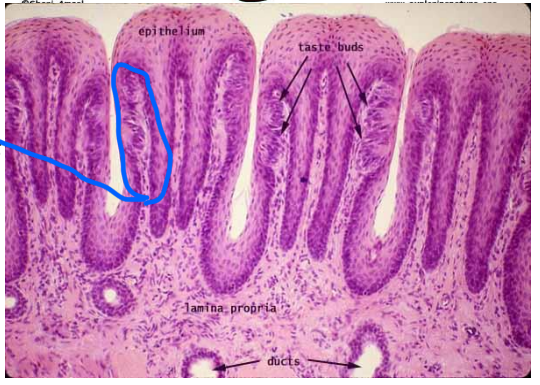
Shape: rectangular.

Secondary papillae: long.

لحم عاملة زي شكل الأنابيب

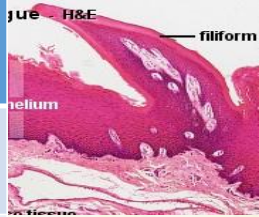
Taste buds: numerous, present along the sides of the papillae.



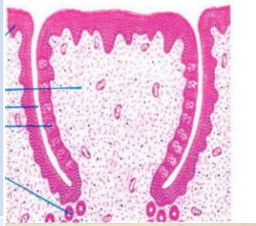


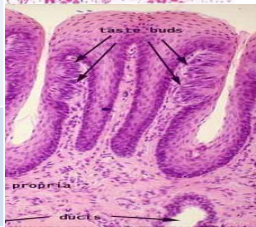
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Types of papillae	Filiform	Fungiform	Circumvallate	Foliate
1-Number	Most numerous.	Few	8-12	Not in adult human, but un rabbits.
2-Distribution	In rows parallel to gustatory line.	On tip & edges of the tongue.	In front of gustatory line.	In rows on posterior part of the lateral sides.
3-shape	Elongated, conical with anteroposterior inclination.	Mushroom shaped with vascular CT.	Largest, triangular, embedded within tongue substance, surrounded by trenches into which open the ducts of Von Ebner's glands.	Rectangular.
4-Secondary papillae	Short ; absent.	Short	Short	Long
5-Taste duds	Absent	Few& apical.	Numerous &on the sides.	Numerous& on the sides.





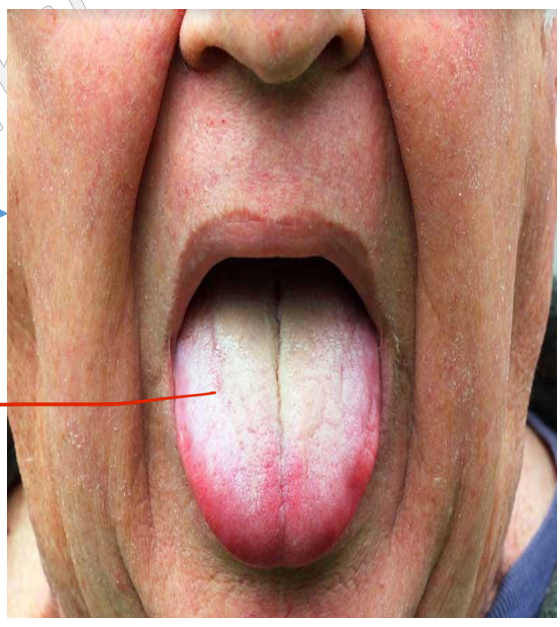




Coated tongue

The keratinized epithelium of the filiform papillae is continuously shed in saliva.

In gastrointestinal disturbances and in fever the shedding of the epithelium is delayed → accumulation of the epithelium mixed with bacteria → formation of a grey coat over the surface of the tongue.



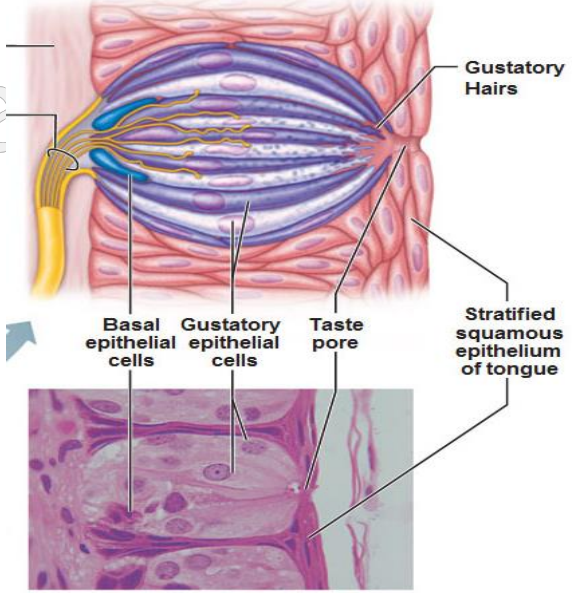
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The taste buds

Definition: neuroepithelial structures specialized for perception of taste sensation.

Sites: embedded within the epithelium of the lingual papillae (few is present within the epithelium of the palate and epiglottis).

Structure: pale & oval structures, connected to the surface of the epithelium by a small opening called the taste pore (gustatory pore).



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Types of cells in taste bud

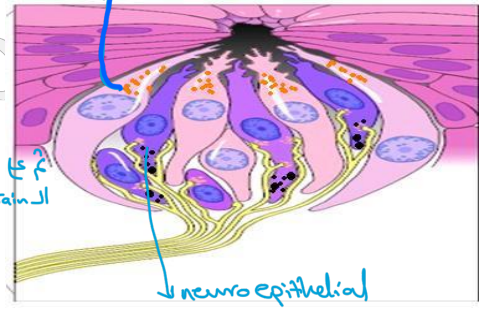
1- Supporting cells.

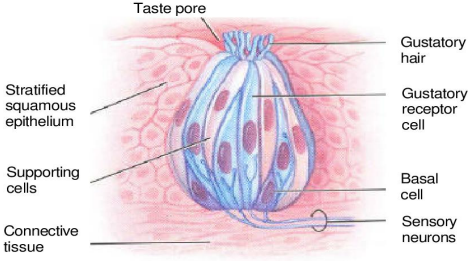
2- Neuroepithelial (gustatory) cells or receptor cell

- Spindle in shape, with apical microvilli (gustatory hairs).
- Their bases are associated with the afferent nerve fibers.
- Food dissolved in saliva stimulates the gustatory hairs.

3- Basal cells:

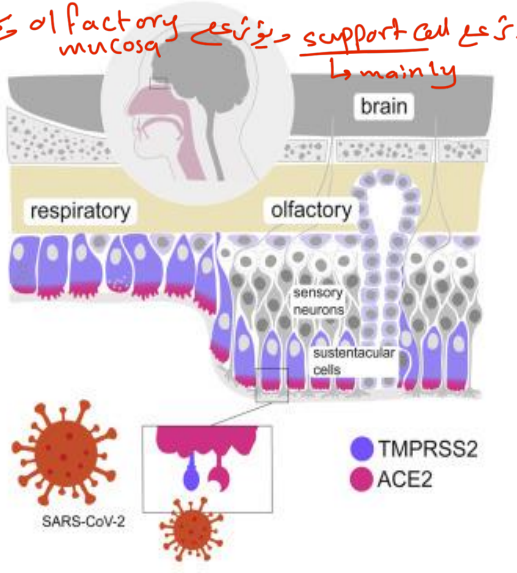
- Small& pyramidal cells, found between the bases of the other cells.
- Function: stem cells which can divide and differentiate to renew the gustatory cells every 10 days.

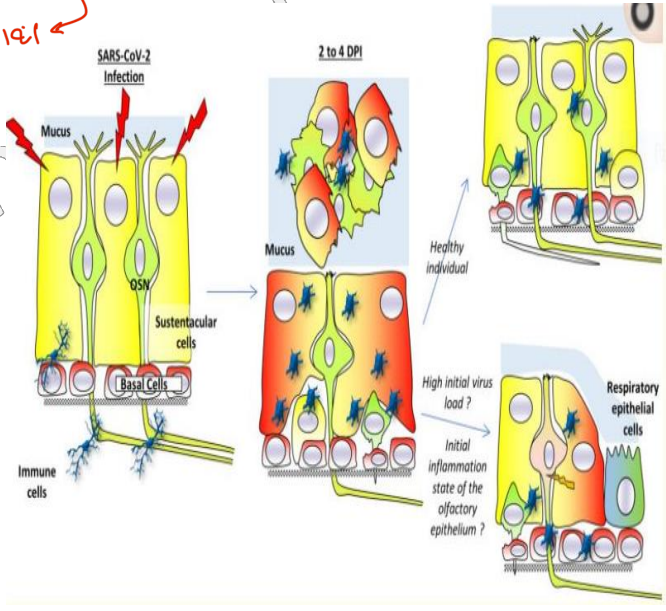




COVID-19 & Anosmia

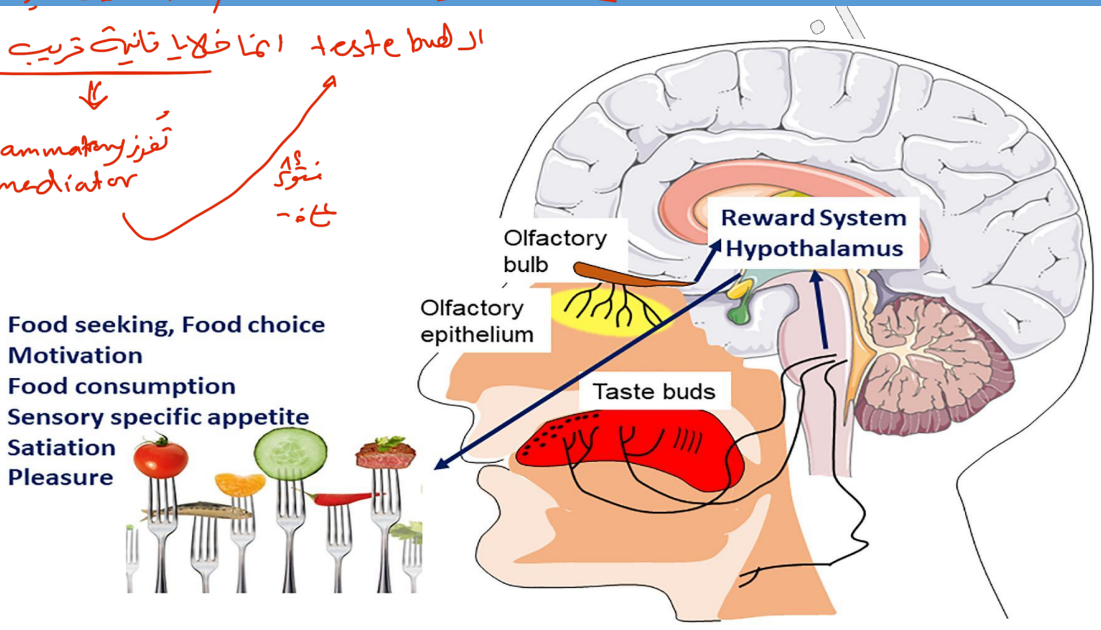
لـ فقدان حاسة الشم بسبب فيروس كورونا تختلف عن الانفلونزا التي يتصير
عشان افقد حاسة التذوق ؟-
انا الفيروس سيؤثر على support cell mainly
damage يحصل ال olfactory mucosa يؤثر على
يؤثر بشكل secondary على neurons epithilium





COVID-19 & Aguesia

لي سبب فقد حساسة التذوق هو ليس تأثير الفيروس على
الـ taste bud انما خلايا قاعدية قريب منها .
↓
تفرز inflammatory mediator
تؤثر على الـ taste bud





Which statement is correct regarding the pointed cell?

1- They renew the other cells regularly. → خلية الـ Basal cell
2- They support the receptor cells. → خلية الدعم support cells
3- They found in the epithelium of the filiform papillae. → not contain on taste bud
They are the taste receptive cell.





Salivary glands

Dr.Iman Nabil

DrImanNabil

Salivary glands

1- Functions of saliva.

2- Types of salivary glands.

3- Myoepithelial cells.

4- Types of salivary acini.

5- Types and structure of major salivary glands.

Dr Iman Nabil


Why?
tell me
why!


Functions of saliva

* وظيفة الـ Salivary gland : انها تنتج وتفرز الـ Saliva

1- Moisten the oral cavity. → عشان ما يكون dry

2- Moisten the dry food to aid swallowing. → يرطب الأكل اللي ناشف عشان يسهل عملية البلع

3- Dissolve the food materials to stimulate the taste buds. → بيذوب الـ Food

4- Buffer the contents of the oral cavity by the high concentration of the bicarbonate ions. → PH = neutral يكون oral cavity لانه بيبني تركيز الـ bicarbonate ions

5- Digest the carbohydrates by amylase enzymes. → عشان الـ digestive enzyme تشتغل

- Bacterial flora الـ عشان تحافظ على الـ Bacterial flora بتشتغل في الـ mouth وتعمل acids لـ glucose الـ
- ↓ PH لتقليل الـ
- وهادا بيخلي الـ digestive enzyme ما تشتغل

- يبدأ في عملية الـ digestion لـ carbohydrate وباقي عملية الـ digestion بتكمل في small intestine
- لكل انواع الـ digestive enzyme

عشان كمية لازم احافظ عليها من الـ PH

لانه غرب العائلة حط تراكيز عالية من bicarbonite ions

عشان اعادل الـ acids اللي تكونت من الـ Bacterial flora

Dr Iman Habil

Salivary glands

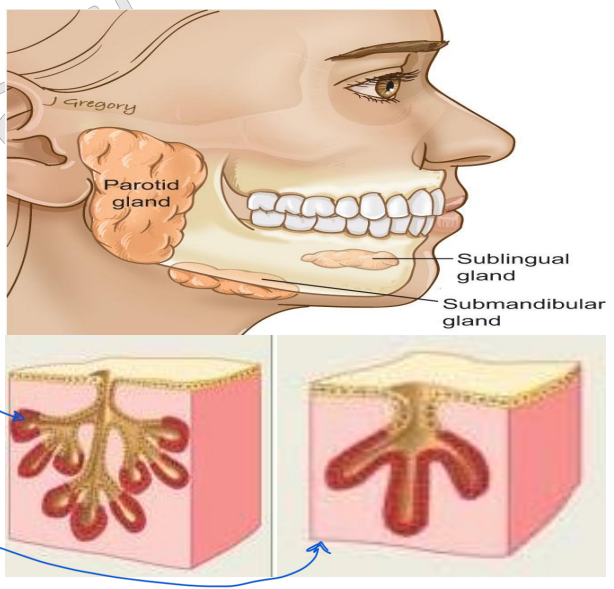
- Salivary glands are two groups:

1- The major salivary glands: (90-95)%

- Parotids, sublingual and submandibular glands.
- They are compound tubuloalveolar glands.
- Their secretion is regulated by nervous reflexes.

2- The minor salivary glands: (5-10)%

- The buccal, labial, lingual&palatine glands.
- They are simple branched tubuloalveolar glands.
- They secrete continuously to moisten and lubricate the oral cavity.



Dr. Iman Nasr

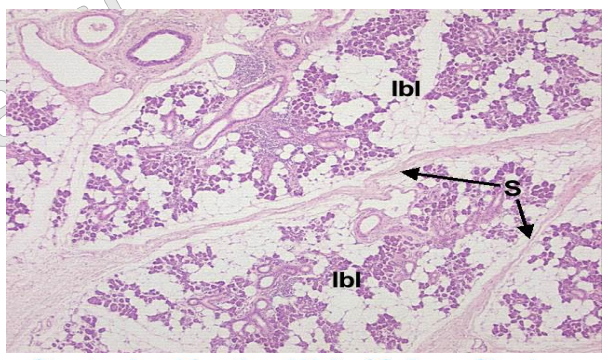
Structure of the major salivary glands

I- Stroma:

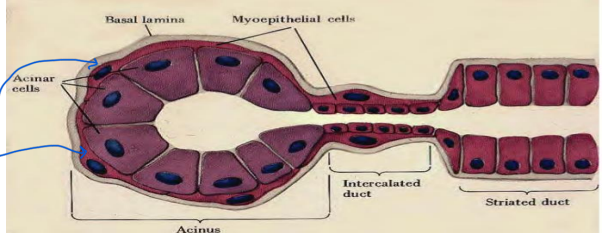
- *CT capsule.*
- *CT septa:* that divide the gland into lobes and lobules.
- *Reticular fibers:* form a network supports the parenchyma.

II- Parenchyma:

- *Secretory acini:* 3 types; serous, mucous& mixed acini.
- *Duct system.*



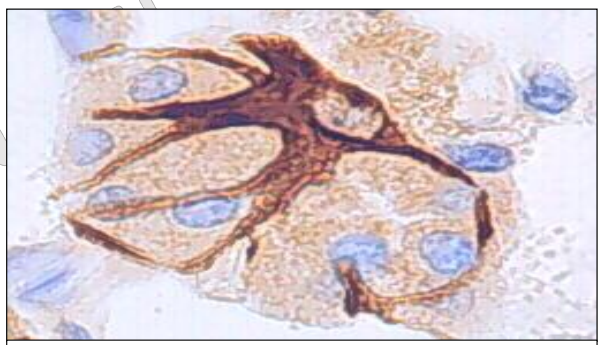
Structural and functional Unit of Salivary Gland

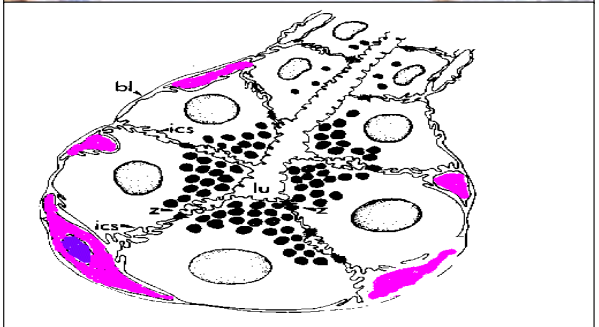


Dr Iman Nabil

Myoepithelial cells=basket cells

- **Shape:** stellate cells with many processes containing actin & myosin.
- **Site:** around the acini *especially mucous* one & along the proximal portions of the ducts.
- **Function:** They contract to squeeze the secretion from the acini into the lumen of their ducts.

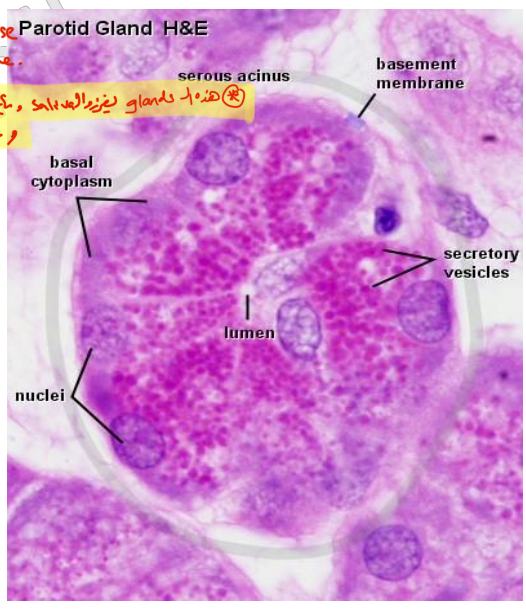




Dr Iman N

1- Serous acini

- **Secretion:** watery, rich in salts and digestive enzymes.
- **Sites:** in the parotid, submandibular and the Von Ebner's glands.
- **Structure:**
  - *Shape:* small, rounded with a narrow lumen & darkly stained.
  - *Lining cells:* pyramidal.
  - *Nucleus:* rounded & situated nearer to the base (WHY).
  - *Cytoplasm:* basal basophilic cytoplasm (rich in rER) with apical acidophilic secretory granules (zymogen granules).
  - *Myoepithelial cells:* few basket cells surround the acini (because their secretion is watery and flow easily).



How the serous acinus adapt to its function?

كيف تتكيف ؟!

- EM: *protein secreting cells.*

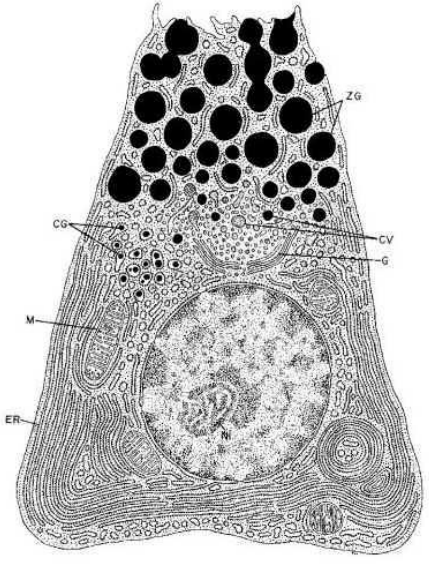
1- Basally: rER. ← حيصنع الـ Protein

2- Supranuclear Golgi. ← وظيفته تصنيع الـ Protein في الـ granule

3-Apically: secretory granules.

لما بتطلع الـ granule في المكان المناسب
عشان تُناسب عملية secretion.

Dr Iman Nabil

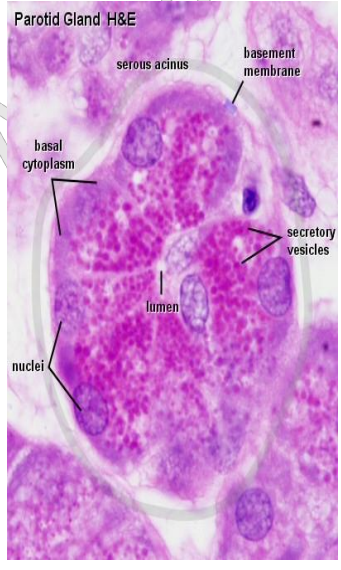


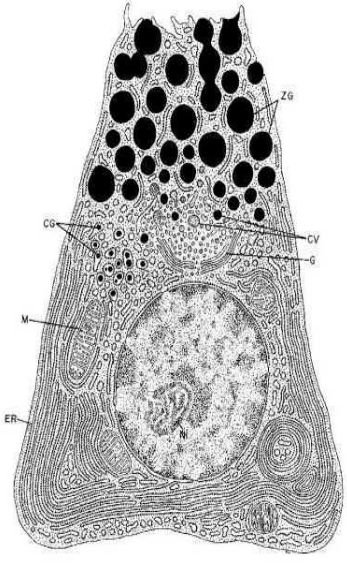
Correlate LM to EM

1- *Nucleus near to the base:* pushed by apical secretory granules.

2- *Basal basophilia:* numerous rER.

3- *Apical acidophilia:* secretory granules.

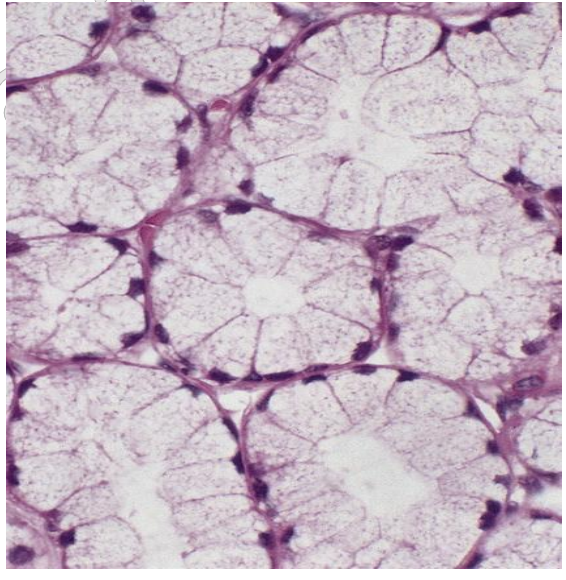




Dr Iman

2-Mucous acini

- **Secretion:** mucus (glycoprotein) to lubricate the food bolus to facilitate its swallowing
- **Sites:** in the sublingual, submandibular, buccal, labial & palatine glands.
- **Structure:**
  - *Shape:* large, pale, oval with a wide lumen.
  - *Lining cells:* cuboidal.
  - *Nuclei:* flattened & basal.
  - *Cytoplasm:* pale vacuolated cytoplasm(as the content of the granules dissolve during preparation of the H&E).
  - *Myoepithelial cells:* numerous basket cells surround the acini (as the secretion is thick).



EM: glycoprotein secreting cells

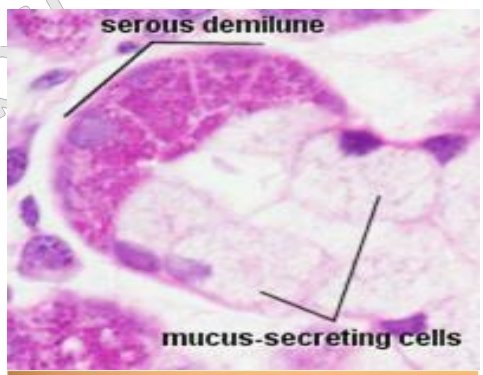
Dr Iman Nail

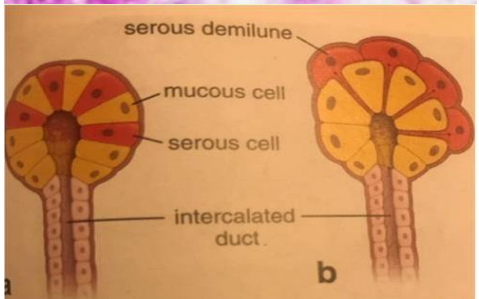
Types of Salivary acini	Serous salivary acini	Mucous salivary acini
1- Size	Smaller	Larger
2- Shape	Rounded	Oval
3- Lumen	Narrow	Wide
4- Cells	Pyramidal.	cuboidal
5- Nuclei	Rounded & near to base.	Flattened & basal
6- Cytoplasm	Dark, basal basophilic & apical acidophilic.	Pale & vacuolated.
7- EM	Basal rER, supranuclear Golgi, apical zymogen granules.	Basal rER, supranuclear Golgi, apical mucinogen granules.
8- Myoepithelial cells	Few	Numerous
9- Function	secrete watery secretion rich in digestive enzymes & salts	secrete mucous.
10- Sites	Parotid, submandibular & Von Ebner ، s glands.	Sublingual, submandibular, buccal, labial, & palatine.

3-Mixed (seromucous) acini

mucous & serous secretion لـ

- **Sites:** in the submandibular and few in the sublingual glands. (i.e. mixed acini)
- **Shape:** it appears as a mucous acinus with a cap of serous cells (*serous demilunes*). ← cap او pad
- **Structure:** each acinus is formed of mucous cells with some serous cells interspersed among them. Both cells pour their secretion into the lumen of the acinus.





Dr. Iman Nabil

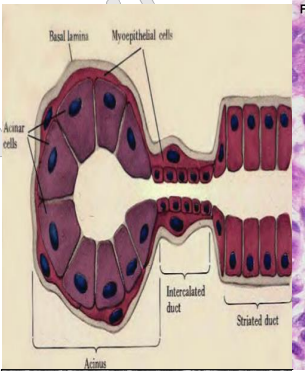
Duct system

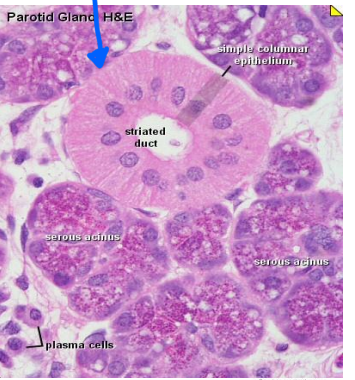
1- The intralobular ducts: consists of 2 parts:

A- The intercalated ducts: drain the secretory acinus& lined by low cuboidal cells.

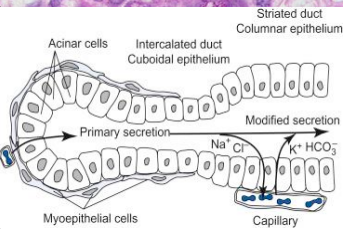
B- The secretory striated ducts:

- Shape: They have a wide lumen.
- Lining cells: cuboidal.
- Nucleus: central& rounded.
- Cytoplasm: acidophilic (numerous mitochondria) with basal striations (basal infoldings).
- Function: They modify the composition of saliva by active ion pump making the saliva hypotonic solution.









Dr Iman Wali

Duct system

cuboidal كانت intralobular في

2- The interlobular ducts: They are lined by columnar epithelium.

بين الـ lobule وبعض

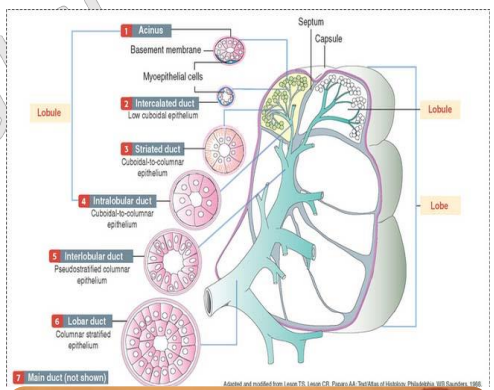
3- The interlobar ducts: They are lined by pseudostratified columnar epithelium.

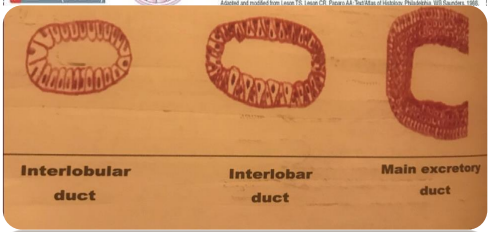
بين الـ lobes وبعضها

4- The main duct: It is lined at its beginning by stratified columnar epithelium then it becomes non keratinized stratified squamous epithelium as it opens into the oral cavity.

تصير

ما تفتح في oral cavity





فايدة هذا التدريج: حماية رطانية من Cancer

ان نظهر من simple بباحثية لـ stratified بتكون معرضة لـ Cancer

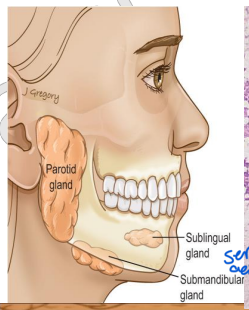
Dr. Iman Nabil

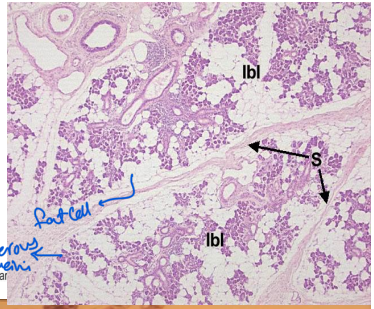
A-The parotid gland

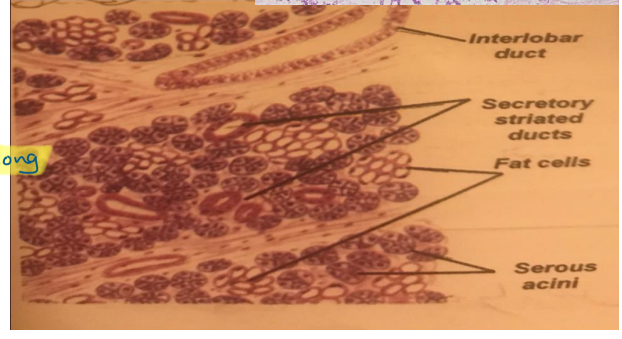
(30% from saliva)

- **Capsule &septa:** thick. facial nerve — superficial
- **Fat cells:** large number. → acini حول & septa.
- **Secretory acini:** 100 % serous acini.
- **Myoepithelial cells:** few.
- **The intralobular ducts:** long, secretory striated ducts form 50% of the length of the intralobular duct.

* serous → modification ← intralobular duct → long
  ↓
  & reabsorption بين secretion.
* mucous → modification







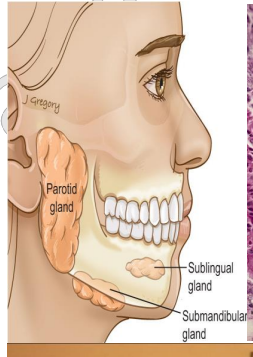
Dr Iman Nabil

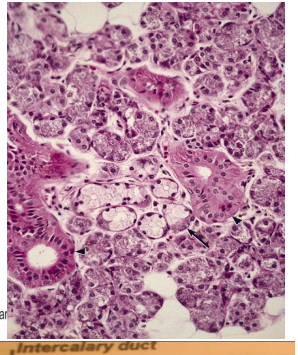
B-The submandibular gland

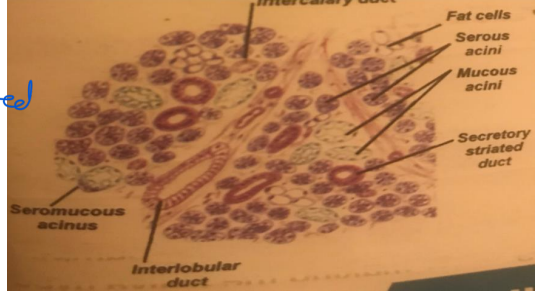
Floor of the mouth لـ في

serous mucous .

- **Capsule &septa:** moderately thick. متوسطية
- **Fat cells:** less numerous. كونه عندها جزء صغير وجزء
- **Secretory acini:** 80% serous acini, 20% mucous acini.
- **Myoepithelial cells:** frequent. → mucous acini حول ال
- **The intralobular ducts:** moderately long, secretory striated ducts form 80% of the length of the intralobular duct. serous اخلاني العلوك بشوق كونه شي عن 20% intercalated







serous secretion لـ في تقل ال

لذلك هي تقل في الدور عندها بكونه اغلبية

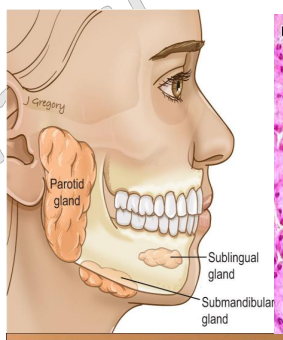
الافراز هو mucous عشان كدة ال striated duct بتاخد كل الانبوبة بتكون ضعيفة وقصيرة.

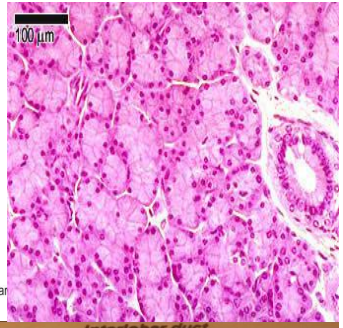
Dr Iman Nasr

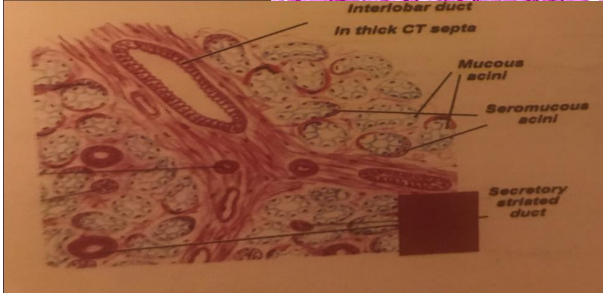
C-The sublingual gland

↳ floor of the tongue.

- **Capsule &septa:** thin capsule, relatively thick septa.
- **Fat cells:** absent.
- **Secretory acini:** 99% mucous, 1% serous, represented by the serous demilunes.
- **Myoepithelial cells:** numerous.
- **The intralobular ducts:** very short, secretory striated ducts form 99% of the length of the intralobular duct.







Dr Iman Nail

Types of major salivary glands	Capsule& septa	Fat cells	Acini	Myoepithelial cells	Intralobular ducts
Parotid	Thick	Numerous.	100% serous.	Few.	Long. 50% secretory striated.
Submandibular	Moderately thick	Less numerous.	80% serous, 20% mucous.	Frequent.	Moderately long. 80% SS.
Sublingual	Thin capsule& relatively thick septa	Absent.	99% mucous, 1% serous.	Numerous.	Very short. 99% SS.



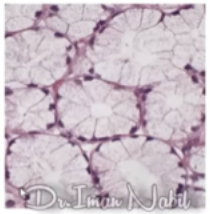
What is the best statement describing these histological structures?

1- They are present in the parotid gland.

2- Their secretion is rich in digestive enzymes.

3- They are glycoprotein secreting cells.

4- They contain numerous basal mitochondria.





Pharynx, general plan of GIT& esophagus

Dr.Iman Nabil

DrIman

Pharynx, general plan of GIT& esophagus

1- Pharynx: parts & structure.

2- General plan of GIT.

3- Esophagus: structure& function.

Dr Iman Nabil


Why?
tell me
why!


Pharynx

Dr Imam Mobil

Pharynx

- **Anatomically:** It is a muscular tube that extends behind the nasal cavities (nasopharynx), the mouth (oropharynx) and the larynx (laryngopharynx= hypopharynx).
- **Histologically:**

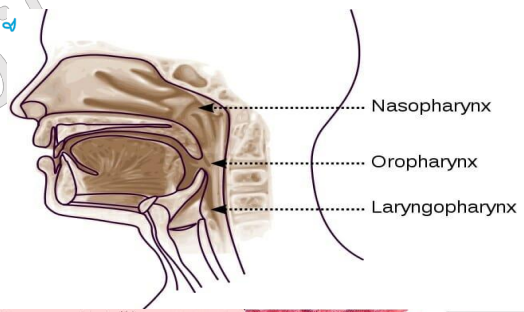
1- **Mucosa:**

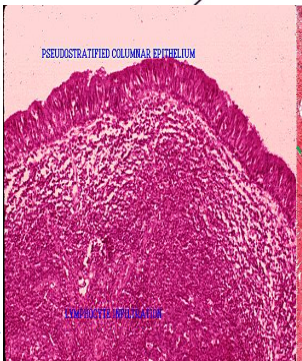
A-Epithelium:

- The nasopharynx: lined by pseudostratified ciliated columnar epithelium with goblet cells.
- The oropharynx: lined by non keratinized stratified squamous epithelium. It is a common passage for air and food
- The laryngopharynx: lined by non keratinized stratified squamous epithelium.

B- Lamina propria: contains seromucous.

2- **Striated muscles** of the pharynx.







Dr Iman Nabil

General plan of alimentary canal

From esophagus into anal canal

1- Mucosa: consists of 3 parts:

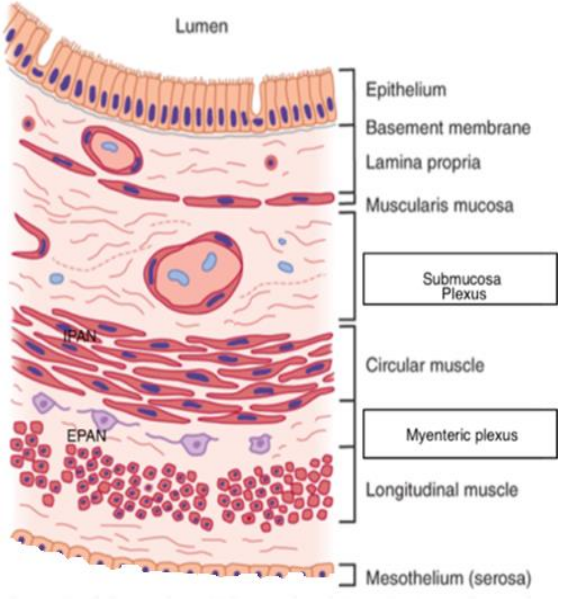
A- Epithelium: varies according to the function of the part.

B- Lamina propria:

- Loose connective tissue rich in blood and lymph vessels.
- It may contain glands and lymphoid tissue.

C- Muscularis mucosae:

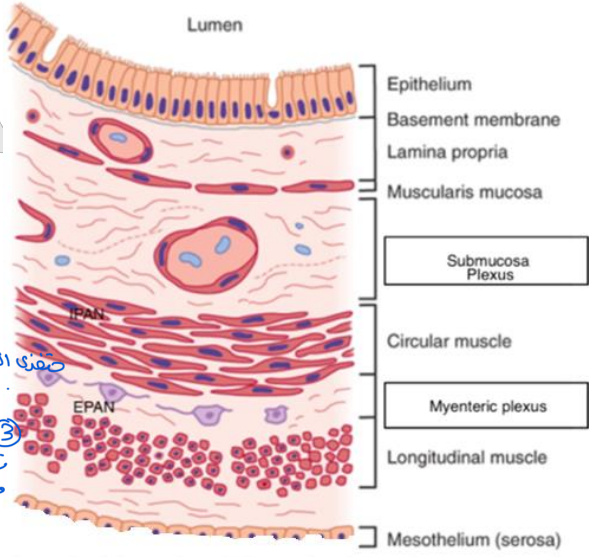
- A thin layer of smooth muscle fibers usually arranged in an inner circular and an outer longitudinal directions.
- Function: It allows movement of the mucosa independently from the other movements of the digestive tract to increase its contact with food



General plan of alimentary canal

2- Submucosa:

- Formed of dense fibro elastic connective tissue rich in blood and lymph vessels.
- It contains *the submucosal autonomic nerve plexus* (Meissner's plexus).
- It may contain glands and lymphoid tissue (mucosa associated lymphoid tissue which protects against infection).

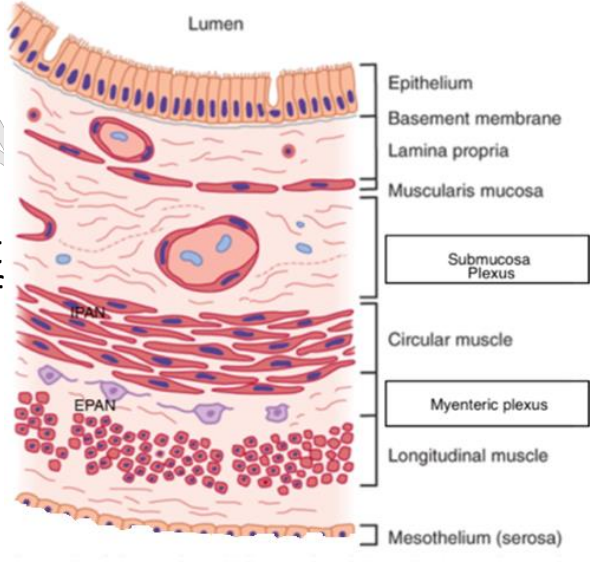


Dr. Iman N

General plan of alimentary canal

3- Musculosa (muscularis externa):

- Smooth muscle fibers, spirally arranged into an inner circular layer and outer longitudinal layer.
- Function: produces peristaltic movement which move the food within the lumen of the GIT.
- It contains *the myenteric nerve plexus (Auerbach's plexus)* situated in between the two layers of the smooth muscle fibers.



Dr Iman N

General plan of alimentary canal

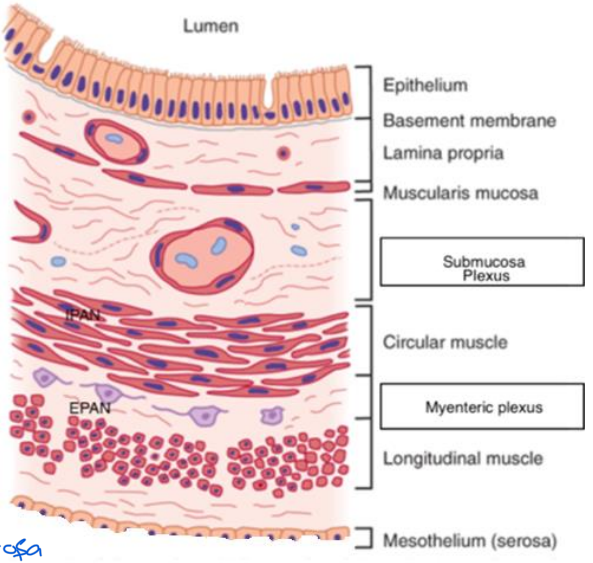
4- Adventitia/ Serosa:

- Loose connective tissue (if covered externally by mesothelium of simple squamous epithelium, so it is called serosa).
- It may contains blood and lymph vessels. It may contains adipose tissue.

- Function:

1- *Adventitia:* Protection & fixation to the surrounding walls.

2- *Serosa:* provides smooth surface covering the organ to allow their free movement.



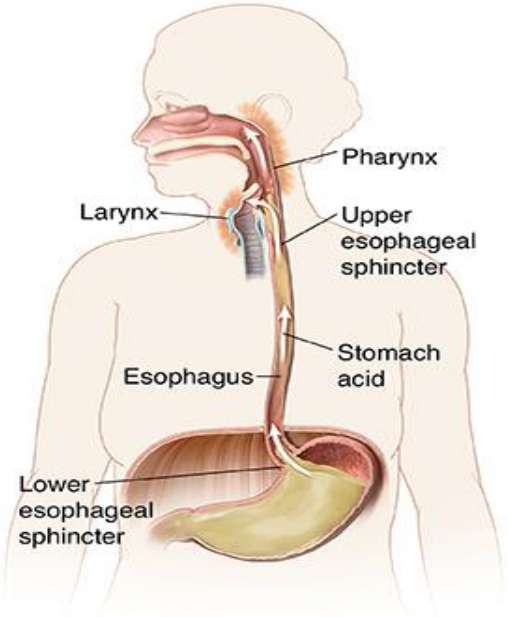
Esophagus

Dr Imad Iqbal

Esophagus

- **Function:** transport of the food from the mouth down to the stomach.
- **Anatomically:** Most of the esophagus lies in the thorax except for the terminal part which passes through the diaphragm to lie in the abdomen.

Dr Iman Na



Structure of esophagus
1- Mucosa

1- Epithelium:

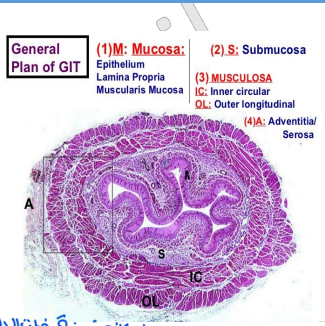
- Non keratinized stratified squamous epithelium to resist the friction by the food.
- It is continuously renew by mitosis of the basal cell layer.

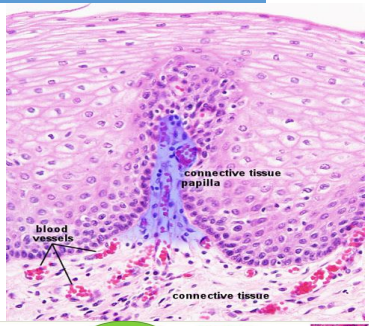
2- Lamina propria: contains *mucosal esophageal glands*

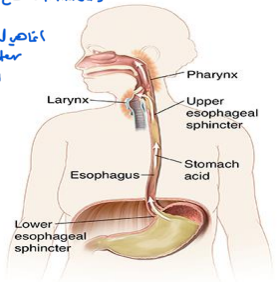
- Site: near the junction with the stomach.
- Function: secret neutral mucus that protects esophageal mucosa against regurgitated stomach contents.

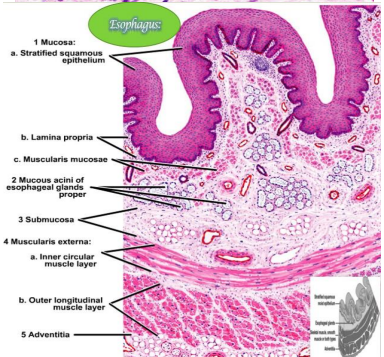
3- Muscularis mucosae:

- longitudinal smooth muscle fibers.
- In the lower part of the esophagus: it becomes differentiated into inner circular and outer longitudinal layers.





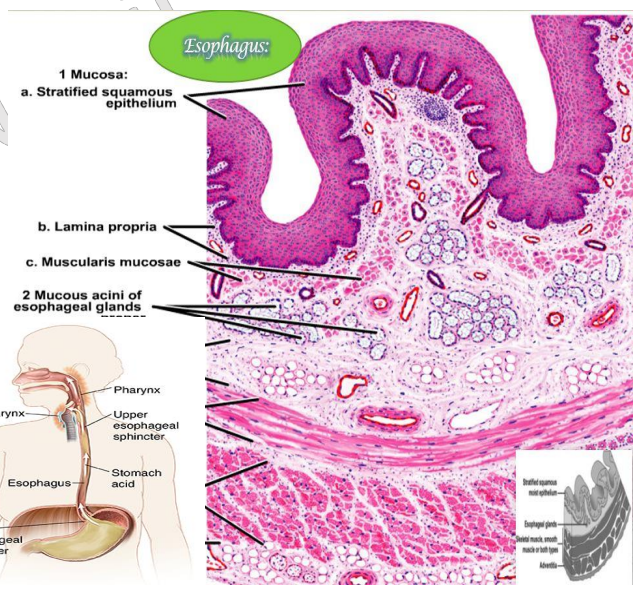




2- Submucosa

Ly dense fiber CT

- It *contains the submucosal esophageal glands*:
- Site: along the entire esophageal length..
- Function: secret mucus to lubricate the mucosa.

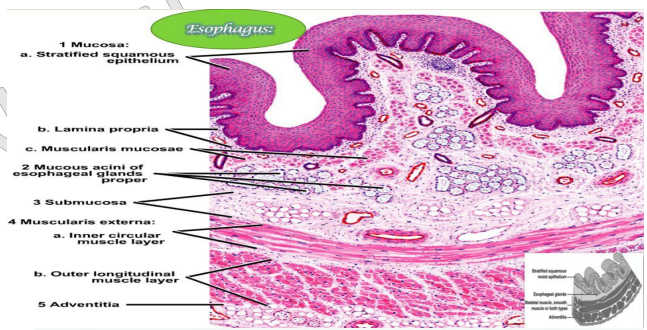


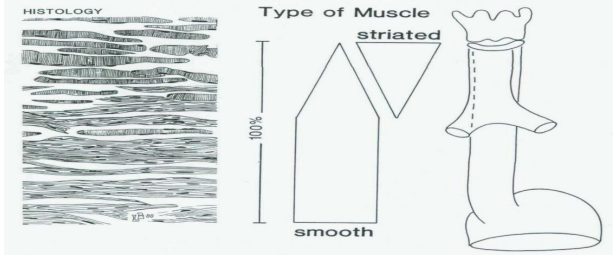
Dr Iman N

Types of esophageal glands	Mucosal esophageal glands	Submucosal esophageal glands
1- site	In the lamina propria, near the junction with the stomach.	In the submucosa, along entire length.
2- Function	Secrete neutral mucous to protect against regurgitated stomach contents.	Secrete mucous to lubricate the mucosa.

3- Musculosa

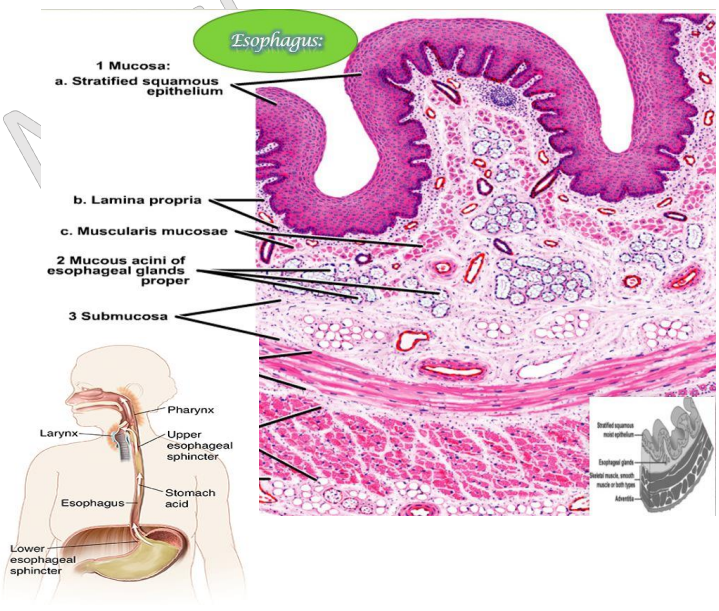
- *In the upper third:* it is formed of striated muscles fibers.
- *In the middle third:* it is formed of a mixture of both striated and smooth muscles.
- *In the lower third:* it is formed of smooth muscle fibers(arranged in an inner circular and an outer longitudinal muscle layers).





4- Adventitia/Serosa

- It is covered by adventitia in its thoracic part.
- The abdominal part is covered by serosa. (peritonium covering).



Dr Iman



What is the correct statement regarding the mucosal esophageal glands?

1- They are present along the entire length of the esophagus.
2- They secrete protective mucous against gastric reflux.
3- They secrete lubricating mucous for the esophageal wall.
4- They are present at the upper third of the esophagus.



Stomach

Dr.Iman Nabil

DrImanNabil

Stomach

1- Function of the stomach.

2- Adaptation of the stomach to its function.

3- Parts of the stomach: structural variations.

Dr Iman Nabil


Why?
tell me
why!


Stomach

- **Functions**:

1- Add HCL to ingested food. → acidic environment يعمل → digestive enzyme

2- Transform food into chyme. → digestive enzyme مع in contact تزيد surface area

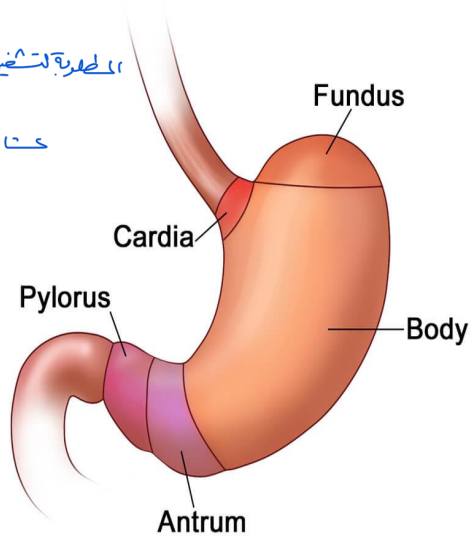
3- Digestive of the food by secretion of digestive enzyme (pepsin). → Protein الذي يكسر ال peptid ل

- **It is divided into 3 regions:** most dilated part.

1- *The cardia:* surrounds the esophagus.

2- *The fundic region:* is the largest part, including the fundus and the body of the stomach.

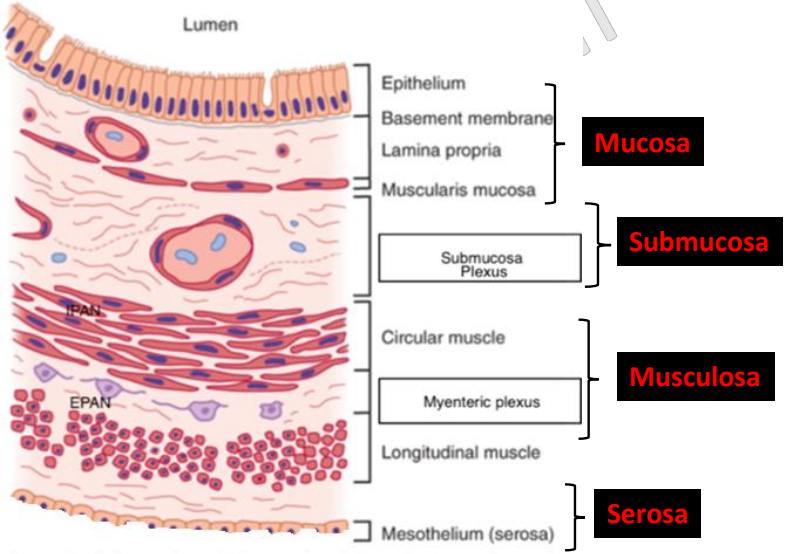
3- *The pylorus.*



Dr Iman A...

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General plan of GIT tubes



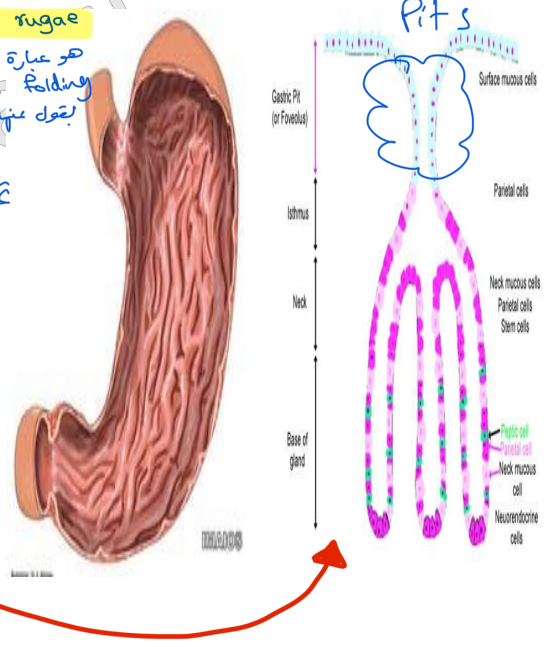
Source: Ganong's Review of Medical Physiology

How does the stomach adapt to its functions?

1- The mucosa and the submucosa of the empty stomach show longitudinal folds (***gastric rugae***) which disappear in the distended state → expansion of the stomach when it is filled with food.

2- The mucosal surface of the stomach is invaginated into the lamina propria forming ***gastric pits***.

3- The lamina propria contains large number of simple branched tubular glands (***gastric glands***) which open into the bottoms of the pits.



1- Mucosa

Dr Imad Sabil

I- Fundic mucosa

- It is characterized by *short and narrow gastric pits* (occupy 1/5 of the length of the mucosa).
- It consists of:

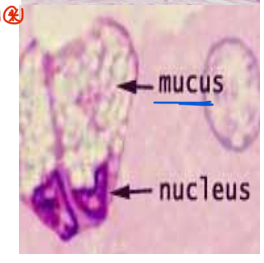
A- The surface epithelium: lined by *the surface mucous cells* (which also cover the pits):

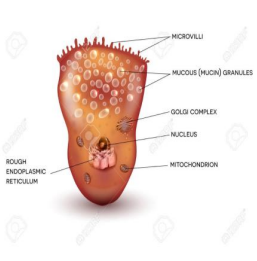
- Shape: tall columnar cells with pale apical parts.
- Function: secrete *visible thick mucus* (protects epithelium from abrasion by food) with neutral or slightly alkaline pH which protects the epithelium from auto digestion & erosion by acids.

B- The lamina propria: contains large number of *fundic glands* that secrete the gastric juice. The glands are surrounded by little amount of connective tissue.

C- Muscularis mucosae.





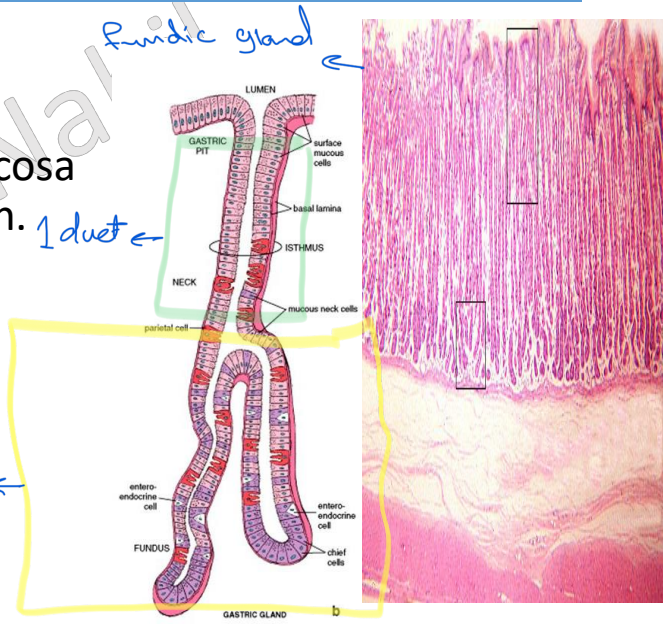


The fundic glands of the stomach

- **Type:** simple branched tubular glands.
- **Appearance:** closely packed, extending throughout the full thickness of the mucosa with minimum amount of CT in between.
- **Lining cells:** 5 types.

Lining cells 5 انواع محفظة بـ Fundic gland

Dr Iman Nabil



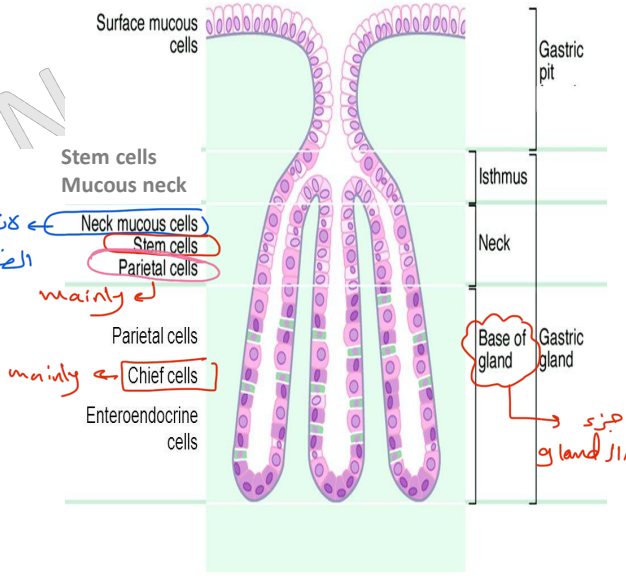
The fundic glands of the stomach

Each gland is divided into:

A- Upper part: lined by mucous neck & stem cells (2 cells).

B- Middle part: lined mainly by parietal cells.

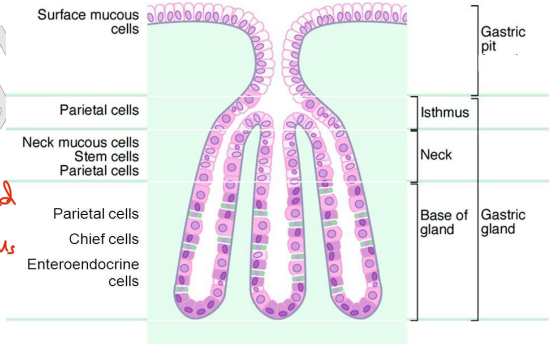
C- Base: lined mainly by peptic, enteroendocrine. (2 cells).

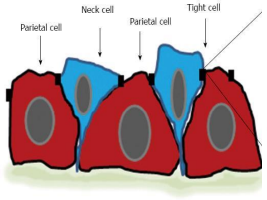


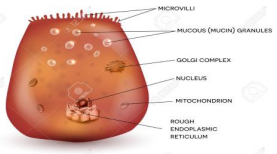
Dr Iman N

1- The mucous neck cells

- **Site:** in the upper part of the fundic gland.
- **Shape:** low columnar.
- **Function:** secrete *soluble mucus* to lubricate the gastric content.







Dr Iman Na

2- Oxyntic cells = parietal cells

- **Site:** mainly in the middle part of the gland.
- **Functions:**

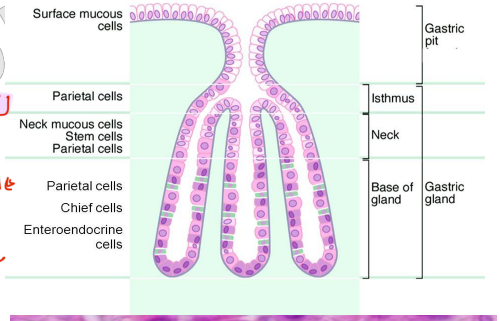
1- Secrete HCL

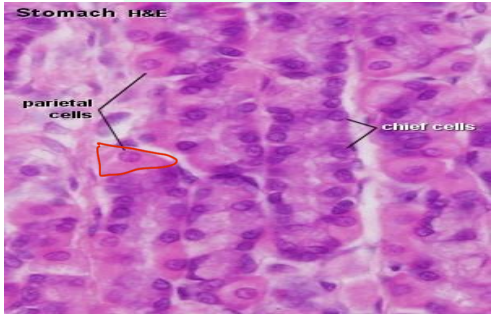
2- Secrete the intrinsic factor for vitamin B12 absorption.

- **Structure:**

LM:

- Shape: pyramidal.
- Nucleus: rounded.
- Cytoplasm: deep acidophilic.





Dr Iman Nabil

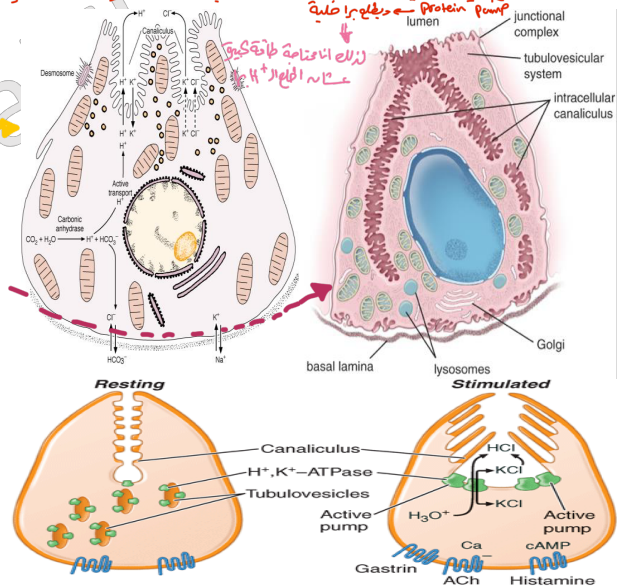
How does the oxyntic cell adapt to its function?

1- They have **intracellular canaliculi**: deep invaginations of the apical plasma membrane into the cytoplasm, connected with the lumen of the gastric gland & bear **numerous microvilli** → increase surface area for an active ion pump.

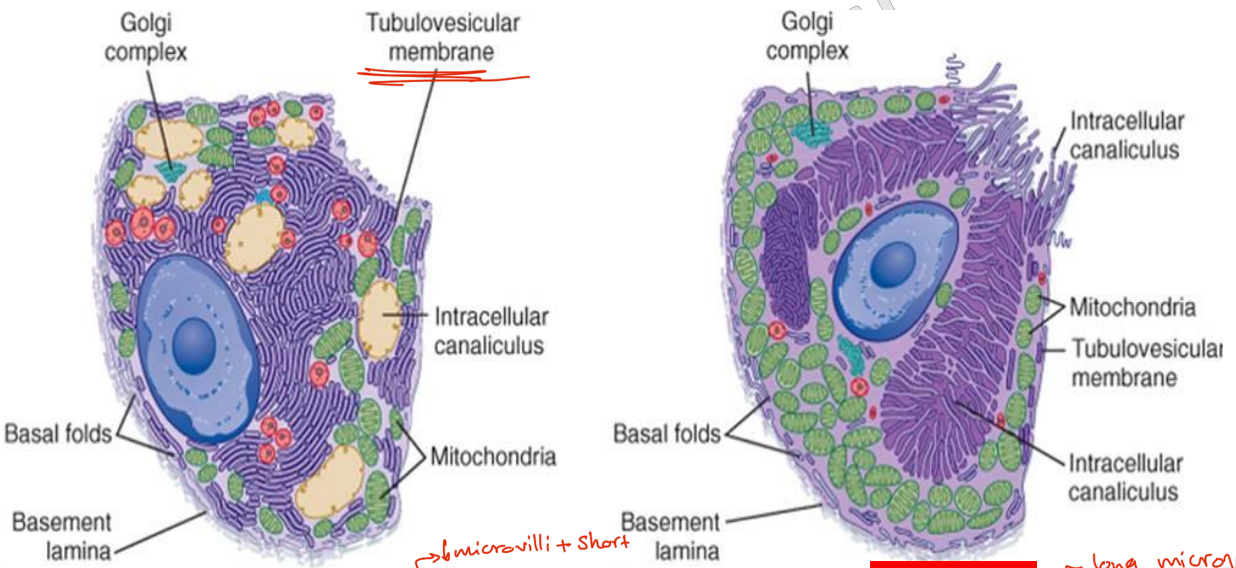
2- **Tubulovesicular system**: it is a reservoir of plasma membranes contain proton pump:

- *In active state:* membranes of the tubulovesicular system decrease(inserted into the wall of the canaliculi forming numerous microvilli).
- *In resting state:* membranes increase, microvilli decrease.

3- **Numerous mitochondria** → energy for active ion pump.



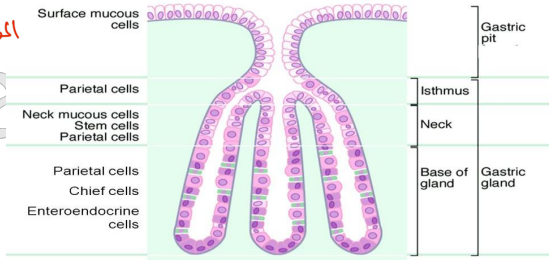
2- Oxyntic cells = parietal cells

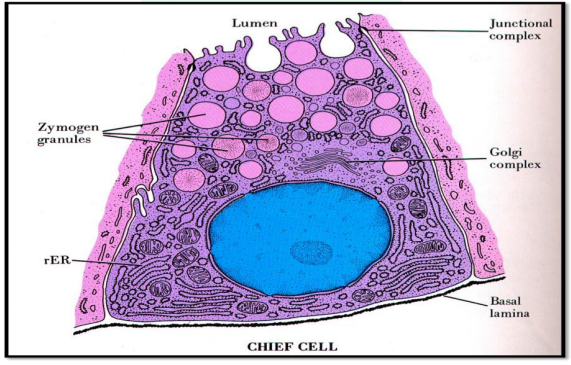


3- Peptic cells =chief cells= zymogenic cells

- **Number:** the most numerous cells.
- **Function:** secrete pepsin & gastric lipase.
- **Site:** present mainly in the base of the gland.
- **Structure:**

LM: pyramidal cells with a basal basophilic cytoplasm & apical acidophilic granules(zymogen granules).





Dr Iman Na

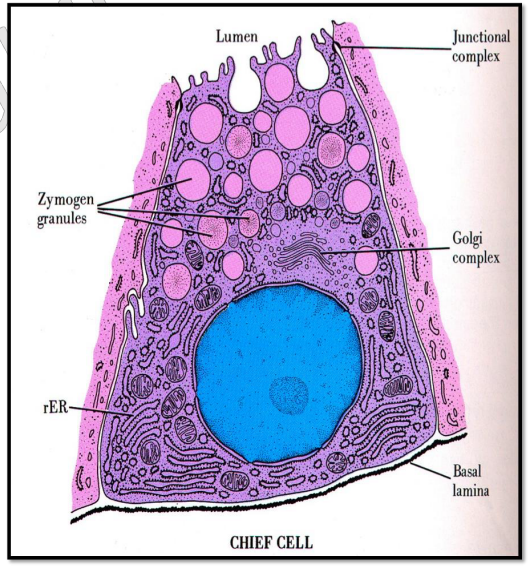
How does the peptic cell adapt to its function?

EM: *protein secreting cells:*

1- Basal rER.

2- Supranuclear Golgi complex.

2- Apical secretory granules.



Dr Iman Nabil

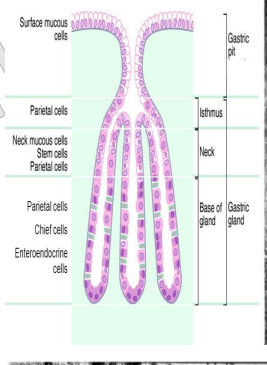
4- Enteroendocrine cells

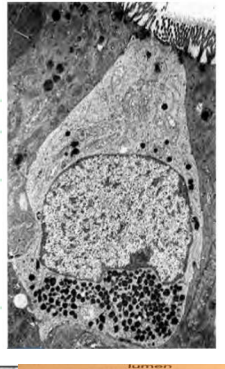
- **Site:** mainly in the base of the gland.
- **Function:** They belong to the diffuse neuroendocrine system; secrete peptide hormones e.g. gastrin.
- **Structure:**

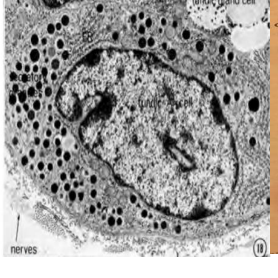
LM: pale, they are best visualized by immunohistochemical staining for their peptide hormones.

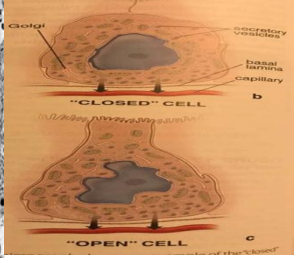
EM:

- Of 2 types : either *closed type* (do not reach the lumen) or *open type* (reach the lumen by their microvilli).
- Pyramidal cells with basal secretory granules (WHY).



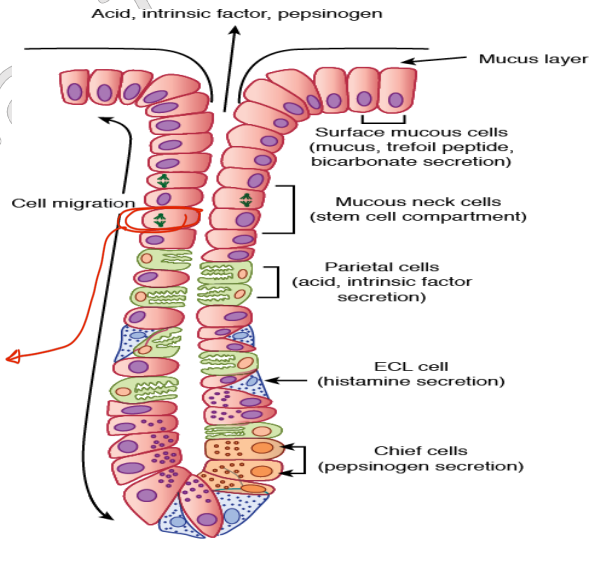






5- Stem cells

- **Site:** mainly in the upper part of the gland.
- **Function:** They proliferate and move upward to differentiate into the surface mucous cells or downward to differentiate into all other cells lining the gastric glands.
- **Structure:** low columnar cells with mitotic figures.



Dr Iman Nail

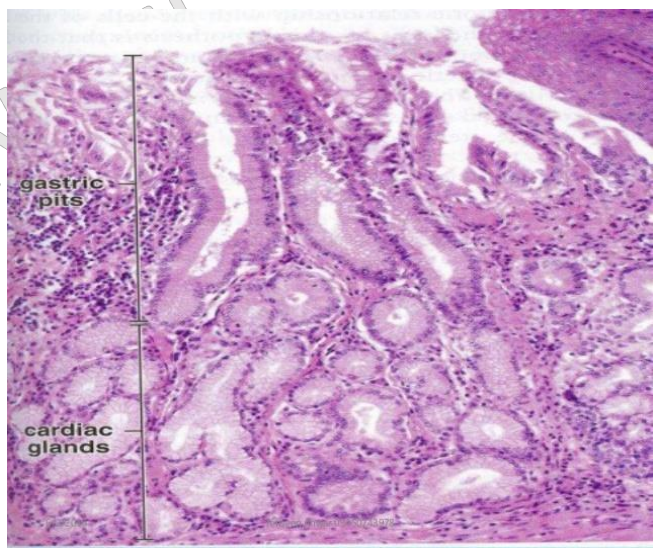
Types of Fundic gland cells	1-Mucous neck cell	2- Oxyntic cell=Parietal cell	3- Peptic cell=Chief cell	4- Entero-endocrine cell	5- Stem cell
1- LM	Low columnar.	Pyramidal, rounded nucleus, deep acidophilic cytoplasm	Pyramidal, apical eosinophilia & basal basophilia.	Small pyramidal, pale, visualized by immuno-histochemical stain.	Low columnar, usually in mitosis.
2- EM	Glycoprotein secreting cells (apical mucin granules, Golgi, basal part contains rER)	• Intracellular canaliculi with microvilli, • Tubulo-vesicular system, • mitochondria,	Protein secreting cells	Basal secretory granules, 2 types: closed & open.	Free ribosomes & polysomes.
3- Function	Secretes soluble *mucous* for lubrication of gastric content.	Secretes HCl& intrinsic factor for vitamin B12 absorption.	Secretes pepsin & gastric lipase.	Secretes peptide hormones.	Proliferates& differentiates to replace other types of cells.
4- Site	Upper part of glands.	Middle part of glands.	Base of the glands.	Base of the glands.	Upper part of glands.

II-Mucosa of the cardia

1- Shallow gastric pits, lined by surface mucous cells.

2- The lamina propria contains simple branched coiled tubular glands lined mainly by mucus secreting cells.

Function :Together with mucosal esophageal glands, they protect epithelium against gastric reflux.

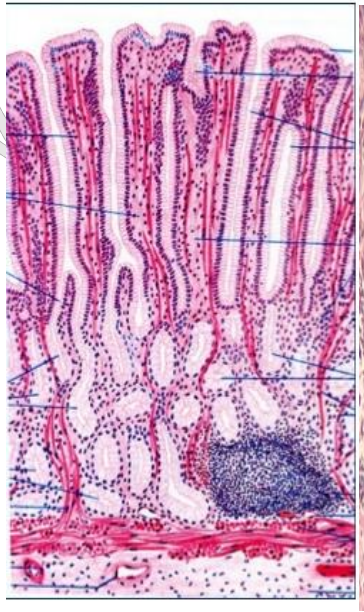


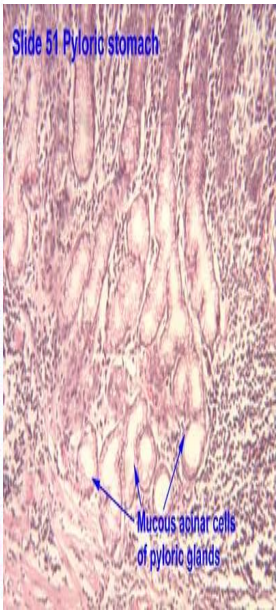
Dr Iman

III- Pyloric mucosa

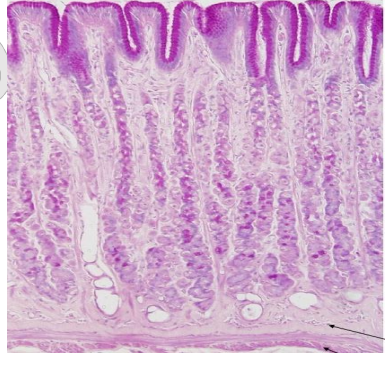
1- Wide and deep gastric pits (occupying more than ½ of the length of the mucosa).

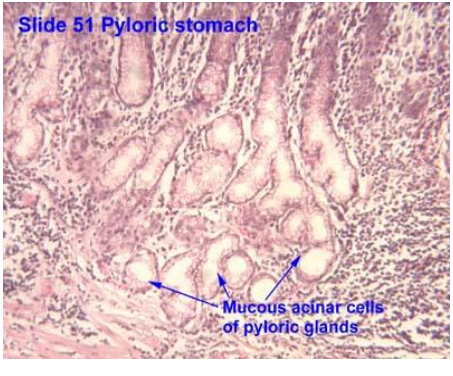
2- The lamina propria contains the *simple branched coiled tubular glands* which are lined by mucus secreting cells and some enteroendocrine cells (especially those secreting gastrin).





	Fundic mucosa	Pyloric mucosa
1- Gastric pits	Narrow& shallow Occupy 1/5 of mucosa.	Deep & wide Occupy ½ of mucosa.
2- Gastric glands ❖ Type	Simple branched tubular.	Simple branched coiled tubular.
❖ Appearance	Darker	Paler
❖ Lining cells	5 types	2 types
❖ Main lining cell	Peptic cells	Mucous secreting cells.
❖ Amount of CT in between	Little amount of CT.	Large amount of CT.





2-3&4- Submucosa, musculosa& serosa

فش عندي اختلاف عن اي organ تاني موجود في GIT

الحامة المميزة

Dr Ima

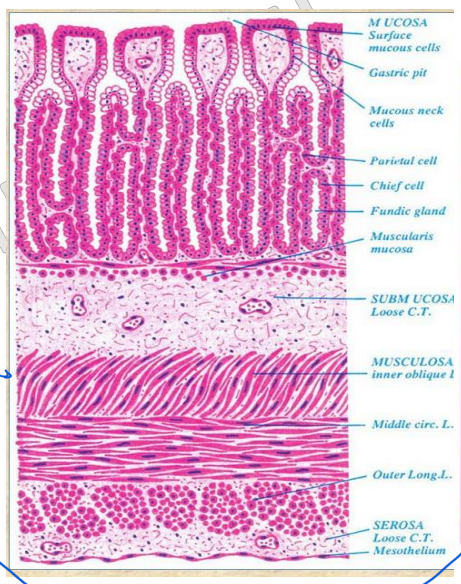
Musculosa& serosa

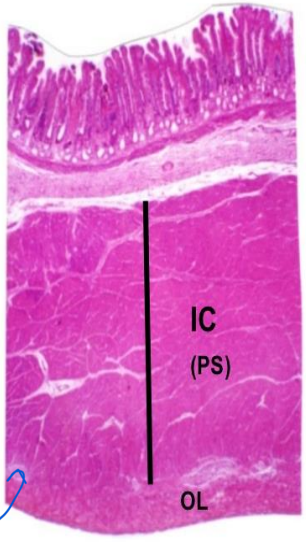
- **Musculosa:**

➢ It is formed of smooth muscle fibers, arranged in inner oblique, middle circular and outer longitudinal layers ⟶ mixing gastric chyme during the digestion.

➢ In the pylorus: the circular smooth muscle layer is thickened to form the *pyloric sphincter*.

- **Serosa:** the whole stomach is covered by serosa.







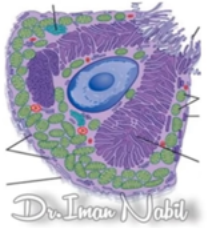
What is the true statement regarding this cell type?

1- It secretes the pepsinogen.

2- It is present mainly in the base of the gland.

3- Its microvilli increase in the resting state.

4- It is distinguished by its deep acidophilic cytoplasm.





Small intestine

Dr.Iman Nabil

DrImanNabil

Small intestine

1- Function of the small intestine.

2- Adaptation of small intestine to its function.

3- Parts of the small intestine: structural variations.

Dr Iman Nabil


Why?
tell me
why!

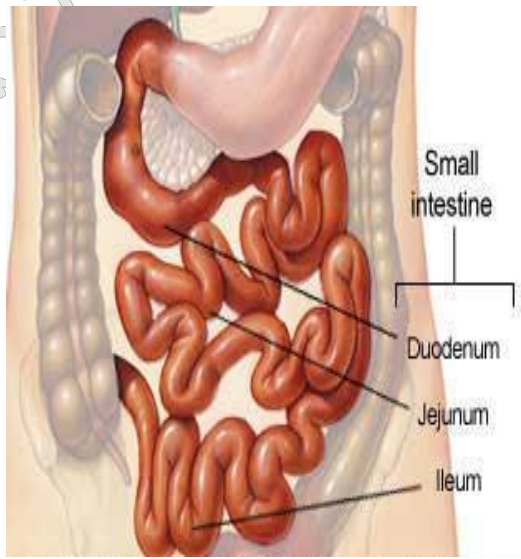

Small intestine

- **Functions:**

1- Complete the process of digestion.

2- Absorption of the digested products.

- **Anatomically:** divided into 3 parts; duodenum, jejunum and ileum



amylase التي تفرز ال salivary gland بسبب وجود ال oral cavity هي تبدأ في ال

disaccharides ال Carbohydrate التي يبدأ في تكسير ال stomach في ال

lipid تكسير ال gastric lipase و Pepsin بواسطة ال peptid إلى Protein

carbohydrate مسئول digestion تحتاج على ال small intestin هنا في

amino acid يصير protein و ال glucose يصير ال lipid تتحول ل

absorption لها small molecule سوف يكون هذه ال fatty acid و glycerol

Blood و ثم توزع على ال

Dr Iman Nabil

How does the small intestine adapt to its function?

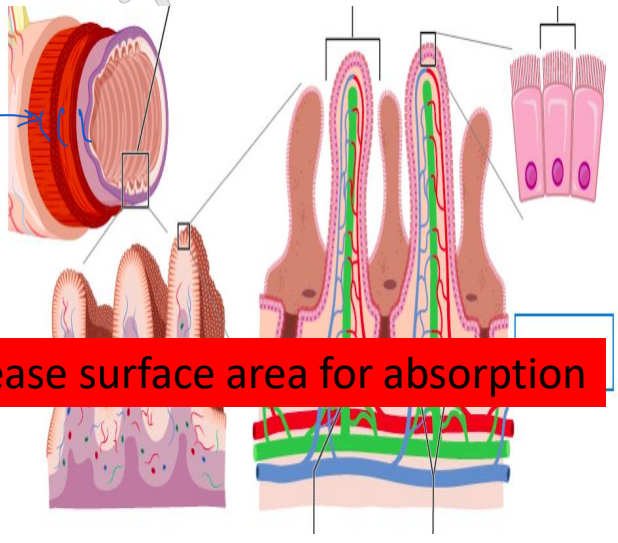
1- It is the longest segment of the digestive tube → prolonged contact between food and digestive enzymes.

2- Modifications of the luminal surface:

A- *Plicae circulares (valves of Kerckring):* permanent circular folds formed by the mucosa and submucosa especially in the jejunum.

B- *Villi:* outgrowth of the mucosa.

C- *Microvilli:* modification of the apical cell membrane of the enterocytes.

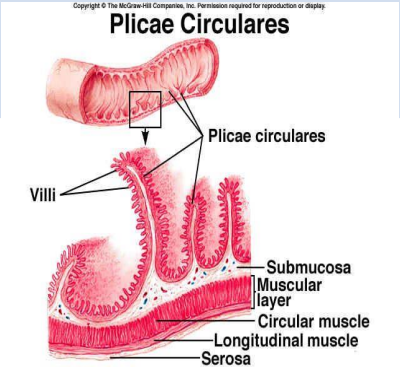


Increase surface area for absorption

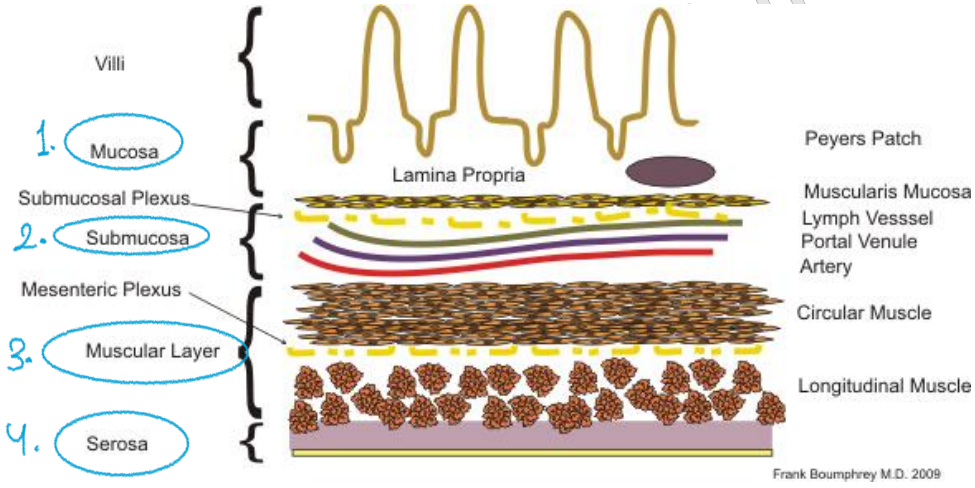
Dr Iman Ali

	Gastric rugae	Plicae circularis
1- Site	Stomach	Small intestine especially Jejenum.
2- Structure	• Longitudinal folds of mucosa & submucosa. • Disappear in distended state.	• Circular folds of mucosa & submucosa. • Permanent
3- Function	Permit expansion of stomach by food.	Increase surface area for absorption of food.





General structure of the small intestine



1- Mucosa

- It consists of:

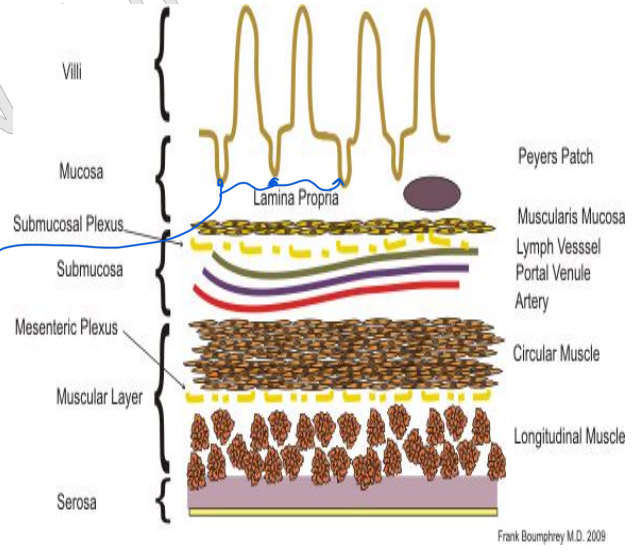
A- Intestinal villi.

B- Lamina propria: contains:

➢ *The intestinal glands (crypts of Lieberkuhn):* open between bases of villi.

➢ *Collection of immune cells.*

C- Muscularis mucosae.



Dr Iman N

I-Intestinal villi

= Projection in mucosa

- **Definition:** outgrowths of the mucosa into the intestinal lumen.
- **Structure:**

A- Epithelium: 4 types of cells.

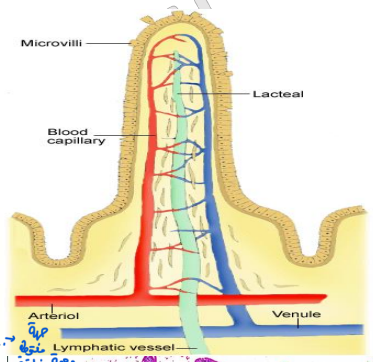
B- A core of connective tissue: contains:

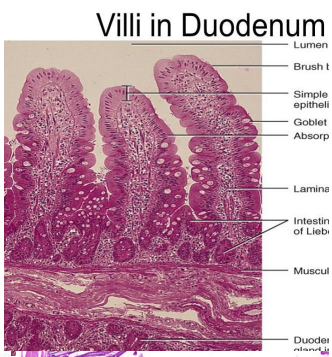
➢Fenestrated capillaries.

➢A central lymphatic channel (lacteal).

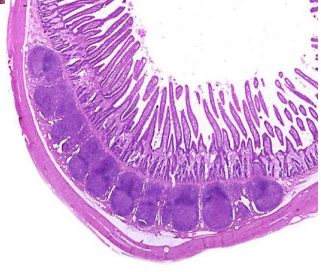
➢Smooth muscle fibers.

- In the duodenum, the villi are broad and leaf-like. In the jejunum, they are the longest and finger like; while in the ileum they are short and finger like.









Food absorption is maximal in the jejunum and is the least in the ileum.

Types of cells covering the villi

Dr Imad Iqbil

1- The columnar absorptive cells=enterocytes

(absorption & complete digestion بتم هي المسؤولة عن) intestin هي الخلية الاكثر في

- **Functions:**

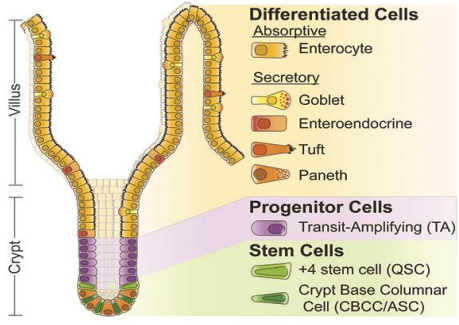
A- Terminal digestion(proteins,CHO,Fat).

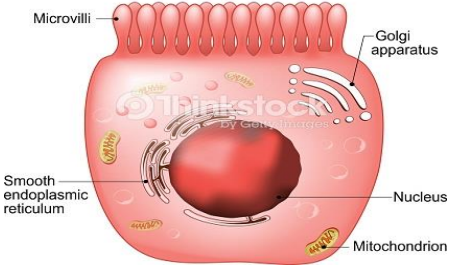
B- Absorption: amino acids, monosacharides, chylomicrons.(fat)

- **Site:** villi, superficial part of the glands.
- **Structure:**

LM: tall columnar cells with brush border.

microvili حتكون EM دليل ع انه لو شفتيها في





Dr Iman Nabil

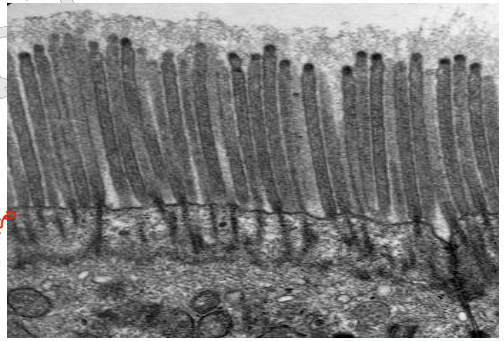
How does the enterocyte adapt to its function?

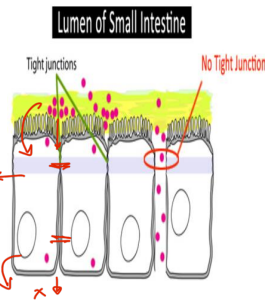
EM:

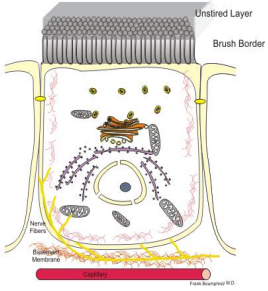
1- Their luminal surface has a well developed *microvilli* with well-developed cell coat → the site of activity of disaccharidase & peptidase secreted by the cells

2- The enterocytes are held together by *junctional complexes* → seal the intestinal lumen from the lamina propria.

3- Cytoplasm contains sER& Golgi → Formation of chylomicron

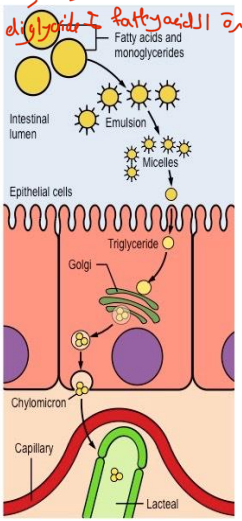






Dr. Iman Nabil

How does the enterocyte adapt to its function?

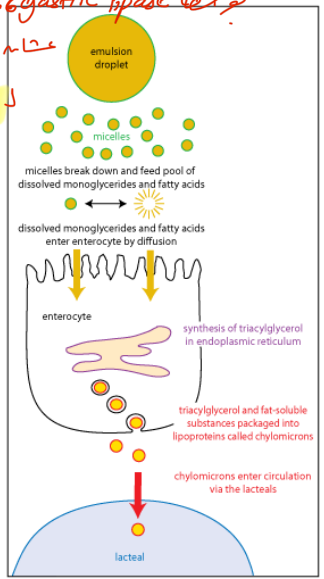


Fatty acids and monoglycerides are emulsified by bile salts to form micelles

Fatty acids enter the epithelial cells and link to form triglycerides

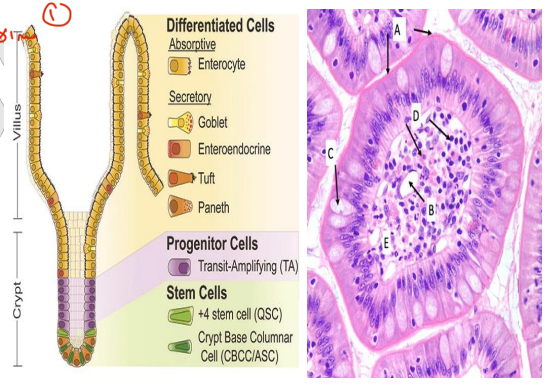
Triglycerides combine with proteins inside the Golgi body to form chylomicrons

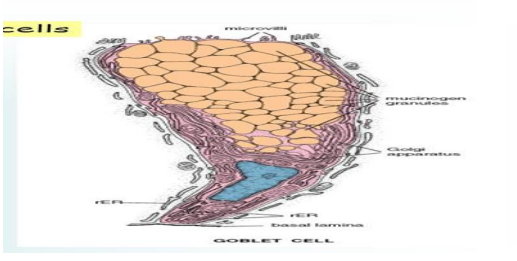
Chylomicrons enter the lacteal and are transported away from the intestine



2- Goblet cells

- **Function:** secretes mucous that protects epithelium from abrasion and invasion by pathogens.
- **Site:** covering the villi& the superficial part of the glands, increase toward ileum.
- **LM:** cup shaped, pale apical part, narrow basophilic base contains dense flattened nucleus.
- **EM:** *glycoprotein secreting cells*
  - ➢Basal rER.
  - ➢supranuclear Golgi.
  - ➢Apically: mucinogen granules.

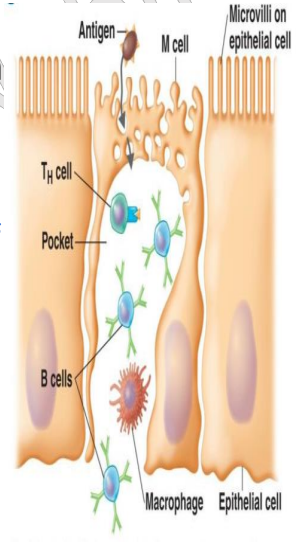


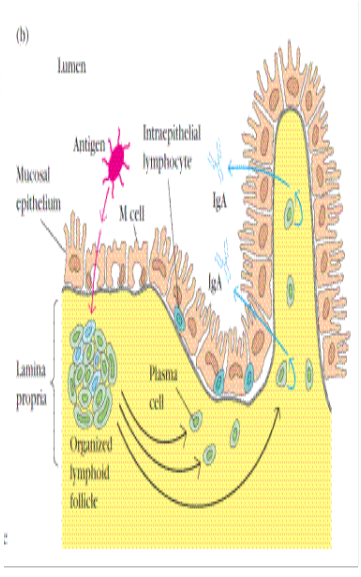


Dr. Iman Nafea

3- M cells=microfold cells

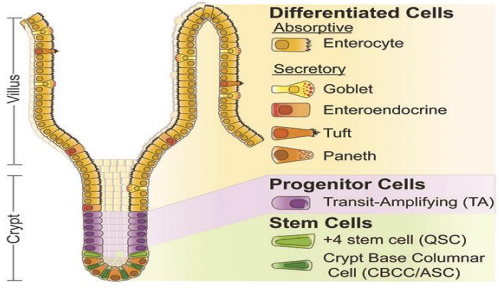
- **Site:** among the intestinal epithelium of the ileum overlying the Peyer's patches.
- **Function:** antigen sampling cells that play an important role in the intestinal immunological function.
- **Structure:**
  - Broad cell.
  - Has few& short microvilli (microfolds).
  - The basal cell membrane shows deep pockets that are occupied by the lymphocytes and the processes of macrophages extending from the lymphatic aggregations.

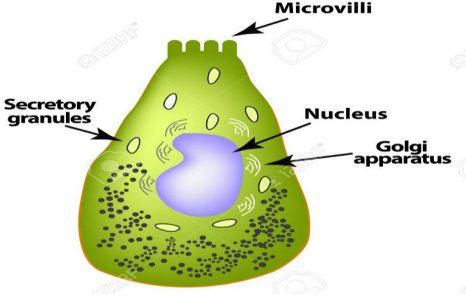




4- Enteroendocrine cells

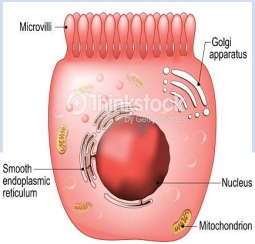
- **Function:** secrete peptide hormones (such as S cells secreting secretin and Mo cells secreting motilin).
- **Site:** few, more in base of intestinal glands.
- **Structure:** similar to gastric one.

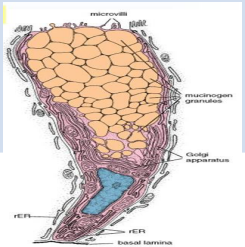


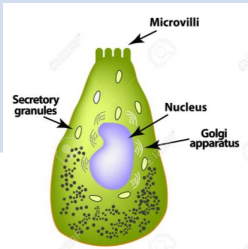


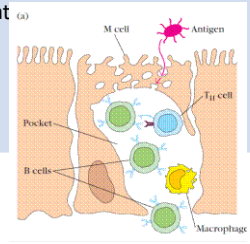
Dr Iman Nabil

Cell lining of surface epithelium&villi	1- Enterocytes	2- Goblet cell	3- Entero- endocrine cell	4- M cells
1- Histological features	1-Columnar, with brush border. 2- Closely packed microvilli with prominent cell coat. 3- Junctional complex esp tight junction.	1-Cup shaped, pale apical part, narrow basophilic base contains dense flattened nucleus. 2- EM: glycoprotein secreting cells(rER, Golgi& secretory granules)	1-Pale pyramidal, either open(with long microvilli) or closed type. 2-Basal secretory granules.	1- Broad cell with few microvilli (microfolds). 2- Basally: deep pocket occupied by lymphocytes & macrophages.
2- Function	A- Terminal digestion (proteins,CHO, lipid). B- Absorption: aminoacids, monosacharide, chylomicrons).	Secretes mucous that protects epithelium from abrasion and invasion by pathogens.	Secrete peptide hormones.	Antigen- sampling cell (immune function).
3- Site	Villi, superficial part of the glands.	Villi, superficial part of the glands, increase toward ileum	More in base of intestinal glands.	Among intestinal epithelium of ileum overlying payers pat









II- Lamina propria → CT and contain on Blood vessels
A-Intestinal glands = crypts of Lieberkuhn

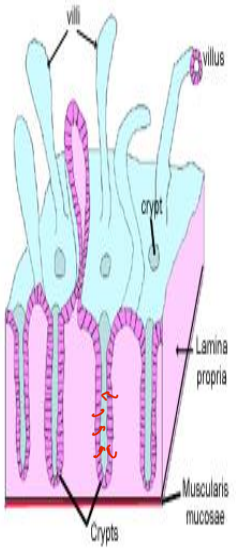
- **Type:** simple tubular glands that extend deep through the full thickness of the lamina propria& open between the bases of the villi. = one duct

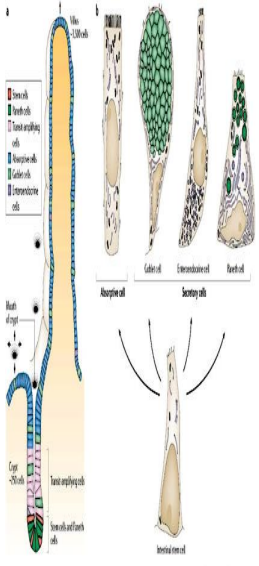
- **The gland is lined by 5 types of cells:**

1- Few absorptive columnar cells.
2- Goblet cells.
3- Enteroendocrine cells.
4- Stem cells.
5- Paneth cells.

surface of gland → villi التي تغطي ال

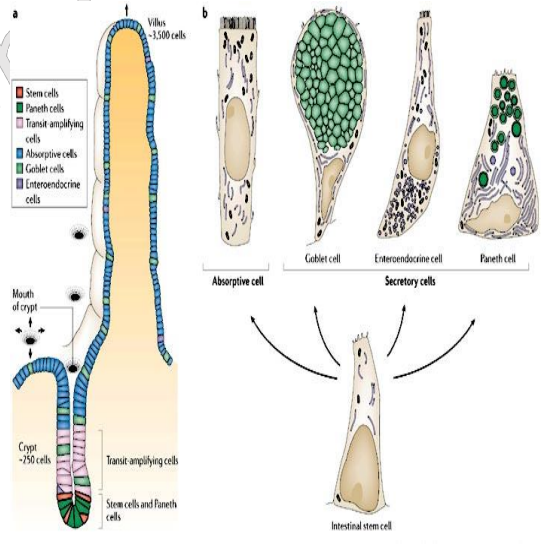
Dr Iman Na





Stem cells

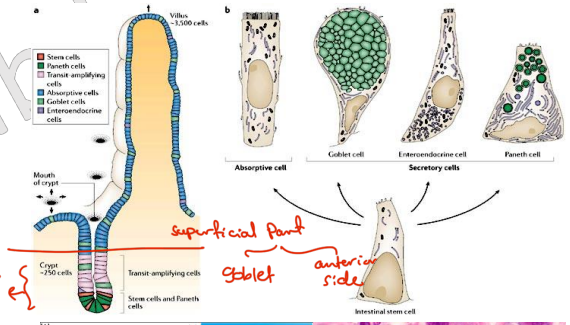
- **Site:** Basal half of glands.
- **Function:** Proliferate & move either upward or downward to differentiate into all other types of cells.
- **Structure:** similar to gastric one (low columnar cells usually seen in mitosis).

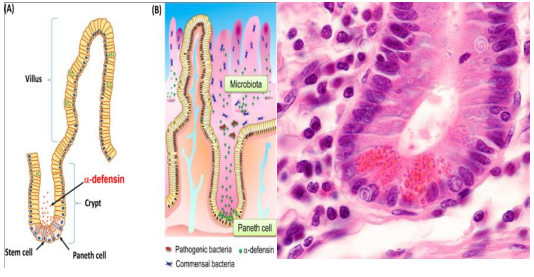


Dr Iman Nabil

Paneth cells

- **Site:** in the base of the intestinal glands.
- **Function:** secrete the antibacterial *lysozyme* which break the bacterial cell wall(playing an important role in controlling the microbial flora in the intestines).
- **Structure:** they are similar to peptic cells of the fundic glands(deep basal basophilic cytoplasm and apical acidophilic granules).





Dr Iman Nabil

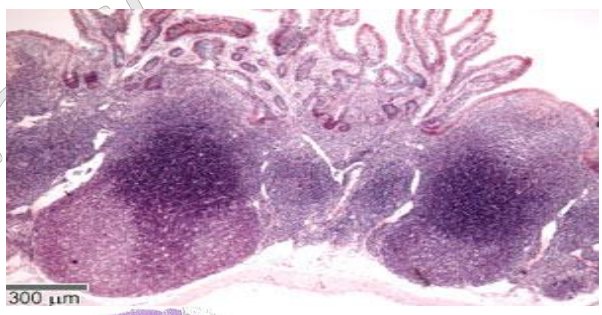
II-Lamina propria
B- Peyer's patches

- **Definition:** aggregations of lymphoid nodules (a part of the mucosa associated lymphoid tissue), found in the wall of *the ileum*.
- **Site:**

➢ In the lamina propria, extending through the muscularis mucosa and appear in the submucosa.

➢ They are present opposite to the mesenteric attachment (anti mesenteric).

- The epithelium over the patches is *usually lacking the villi* (ironed mucosa) and contains the M cells.
- **Function:** They serve as immunological barrier against the antigens in the lumen(the plasma cells secrete IgA which released across the epithelial cells into the intestinal lumen).

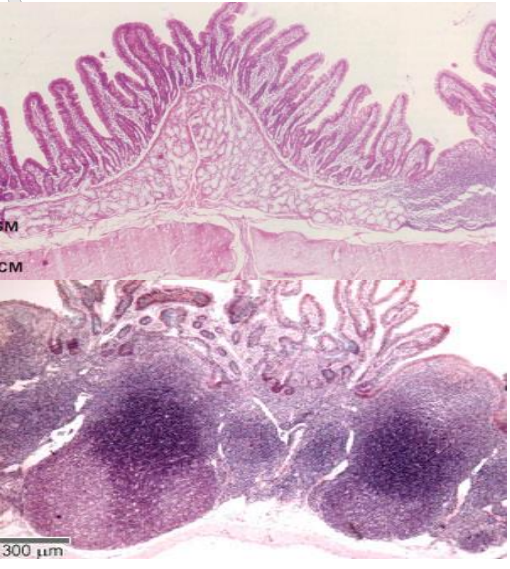


2- Submucosa

A- In the duodenum: it contains *Brunner's glands*:

- Site: proximal part of the duodenum.
- Structure: mucous glands with their ducts open into the bottom of the intestinal crypts.
- Function: secrete thick alkaline mucus that neutralize the gastric chyme, thus, protect the mucosa.

B- In the ileum: extensions of the Peyer's patches.



Dimnah Nabil

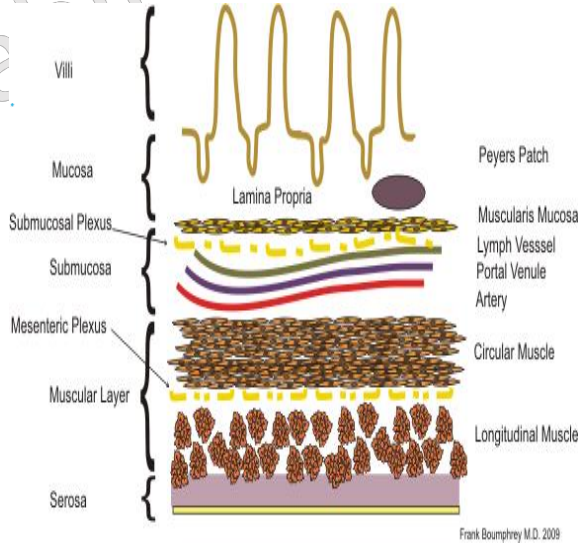
3&4-Musculosa& Serosa

- **Musculosa:** smooth muscle fibers, arranged in an inner circular and outer longitudinal layers. → Paristaltic movment.
- **Serosa.**

A histological section in the mucosa of the small intestine, reveals numerous cell types, what is the function of the pointed cell?

1- Secrete mucous for protection of the intestinal mucosa.
2- Absorption of the digested nutrients.
3- Secretion of motilin hormone.
4) Secretion of antibacterial agents.










Thank You

Large intestine, appendix & junctions

Dr.Iman Nabil

Dr.Iman Nabil

Large intestine, appendix& junctions

1- Large intestine: structure.

2- Appendix: structure.

3- GIT junctions: types & changes.

Dr Iman Nabil


Why?
tell me
why!


Large intestine

- **Functions:**

1- Absorption of water & electrolytes.

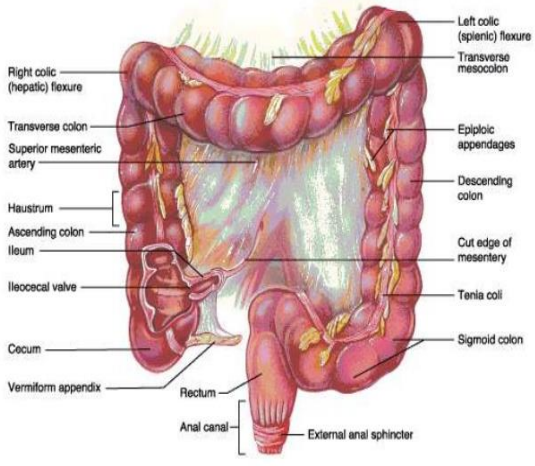
2- Elimination of undigested materials in the form of feces.

- **Anatomically:**

➢Caecum.

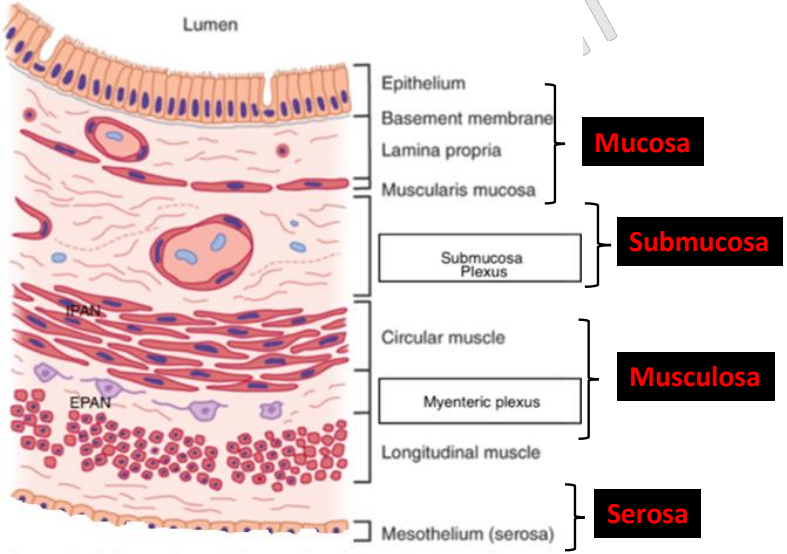
➢Colons (ascending, transverse, descending & sigmoid).

➢Rectum. → resivor of stone



Dr Iman Na

General plan of GIT tubes



Source: Ganong's Review of Medical Physiology

1- Mucosa

1- The surface epithelium: is smooth with no villi.

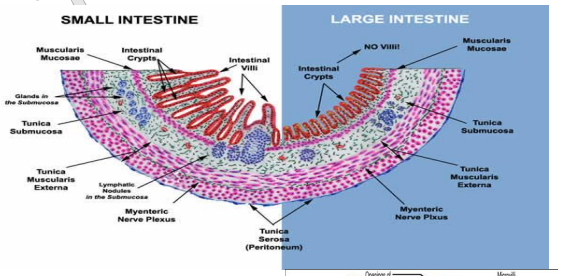
2- Lamina propria: contains:

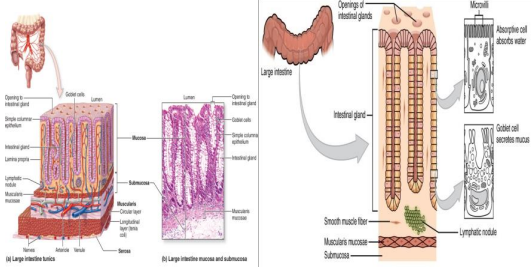
A- A large number of *intestinal glands* (crypts of Lieberkuhn), which characterized by being:

- Simple tubular, straight&parallel to each other.
- Extend throughout the full thickness of mucosa.
- Perpendicular to the muscularis mucosae & open into the lumen.
- Densely packed together with minimal amount of connective tissue in between.

B- *Lymphoid nodules.*

3- Muscularis mucosae.





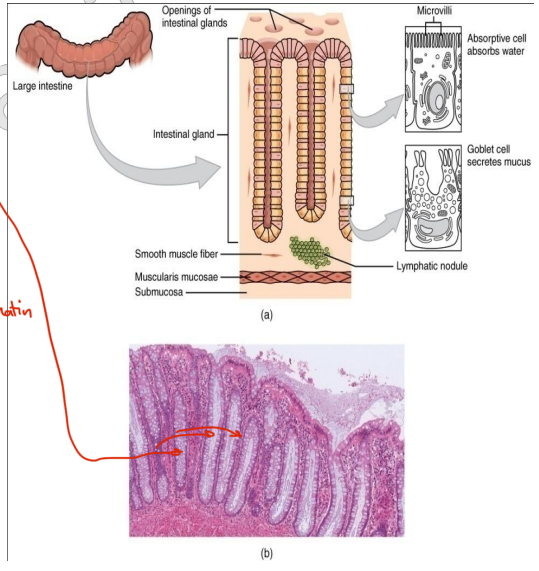
Lining cells of the surface epithelium and the intestinal glands

1- The columnar absorptive cells: have short microvilli for absorption of water from the residuals of the digested food.

2- Goblet cells: present in a huge number.

3- Enteroendocrine cells: few in number(EC cells secreting serotonin and L cells secreting enteroglucagon).

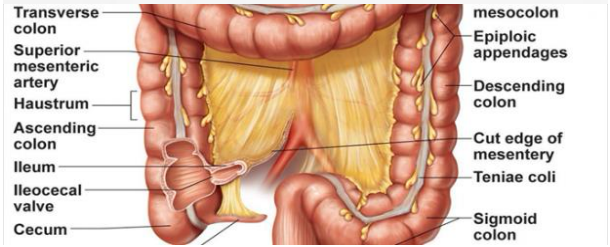
4- Stem cells: at the bases of the glands.



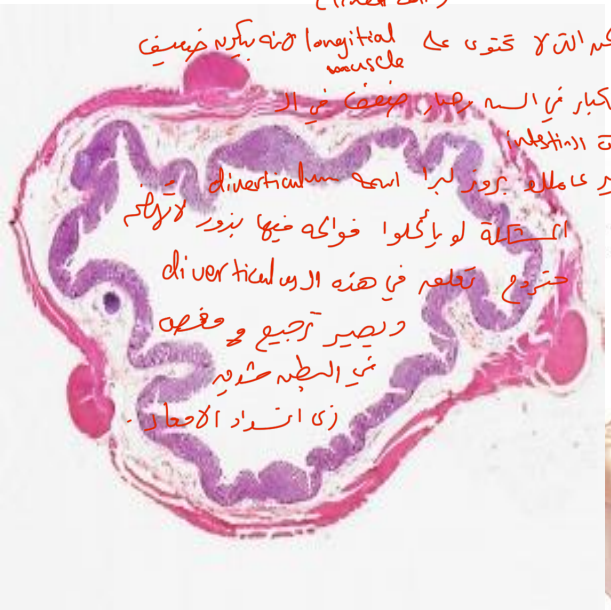
2&3-Submucosa and Musculosa

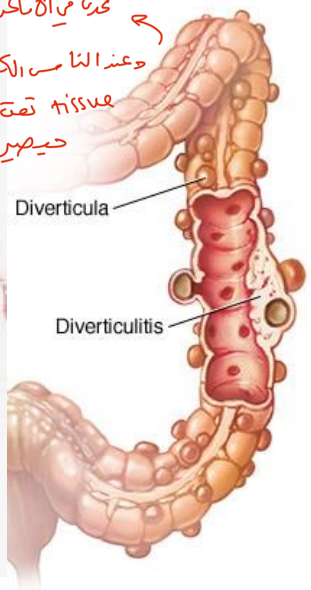
- **Musculosa:** smooth muscle fibers arranged in:
  - A complete inner circular layer.
  - An incomplete outer longitudinal layer, which condensed into three bands of longitudinal smooth muscle fibers called *the teniae coli* (seen by the naked eye on the outer surface of the colon giving its characteristic sacculations =*haustration*).

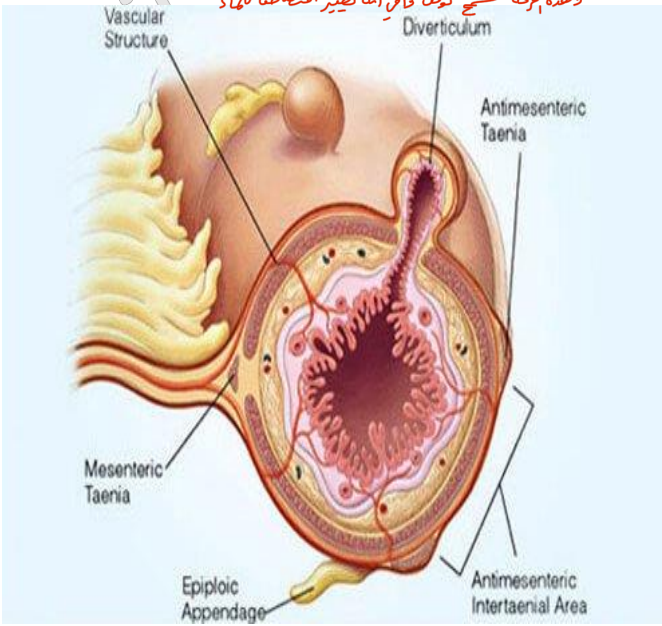




Diverticulosis







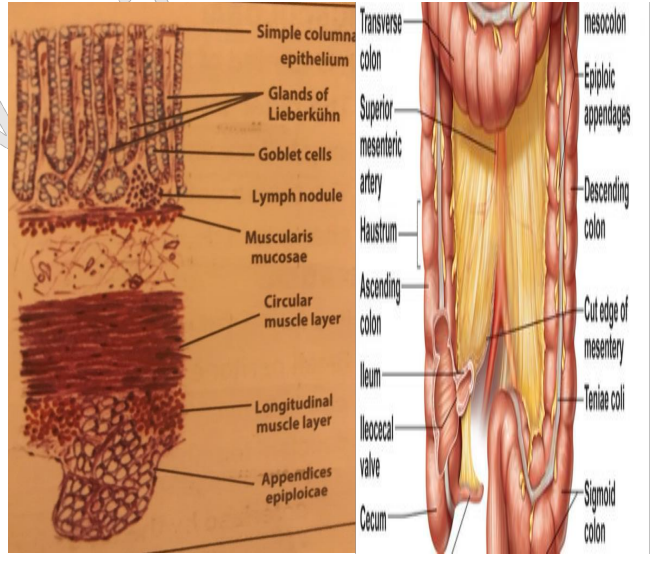
4- Serosa

محيزة هنا.

- *The appendices epiploicae:* are small peritoneal projections filled with adipose tissue, which are seen protruding on the outer surface of the colon at the sites of the deficient longitudinal muscle fibers.

زادتر — Peritonium من

هذه ال appendices من وظائفها انها تحمي الاماكن التي تفتقر عن Tinea coli.
(support of wall) epiploicae



Dr Iman Wali

Appendix

Dr Imam Tabil

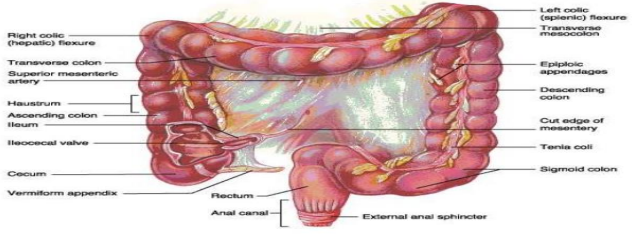
Appendix

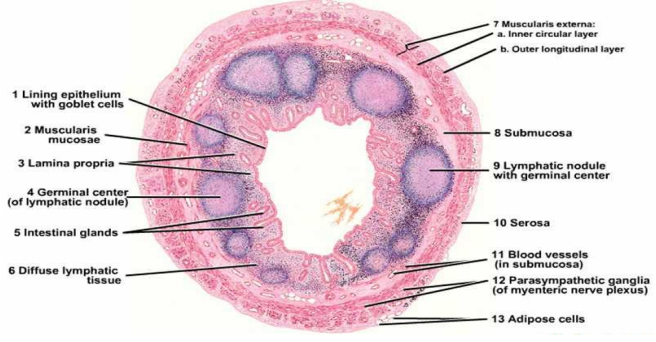
ناصية مغلقة وناصية مسكرة

- **Anatomically:** It is a blind ended narrow evagination of the caecum.
- **Function:** It is a part of the mucosa associated lymphoid tissue. (ileum زي الموجود في)
- **Histologically:** It has a narrow, irregular lumen that may be filled with dead cells & debris. (احيانا ممكن تشوف بداخله خلايا ميتة أو مكسرة)

وهذه مشكلة لانه ممكن اي شغلة من الداخل للورم تفوت فيها

و يتراكم فيه بكتيريا وتحدث infection ويؤدي الى inflammation appexiditis





1- Mucosa

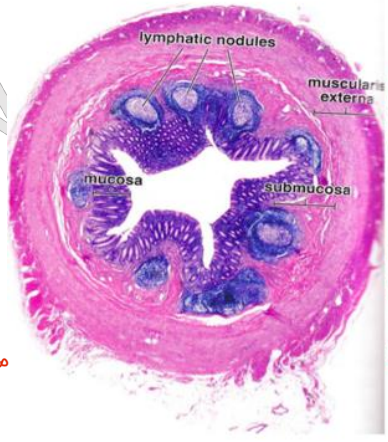
- **It is similar to that of large intestine, but differ in:**

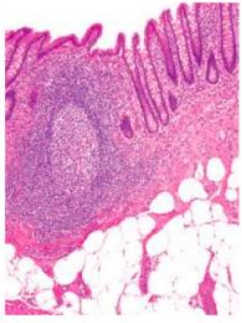
A- Crypts of Liberkuhn:

- Few in number.
- Shorter.
- Widely separated.
- Have no digestive or absorptive functions.
- They are lined by: simple columnar cells, goblet cells & many enteroendocrine cells.

B- Lymphoid nodules: fill the lamina propria, extending around the whole circumference of the appendix.

C- The muscularis mucosae: is usually interrupted by the lymphoid tissue that penetrates into the submucosa.



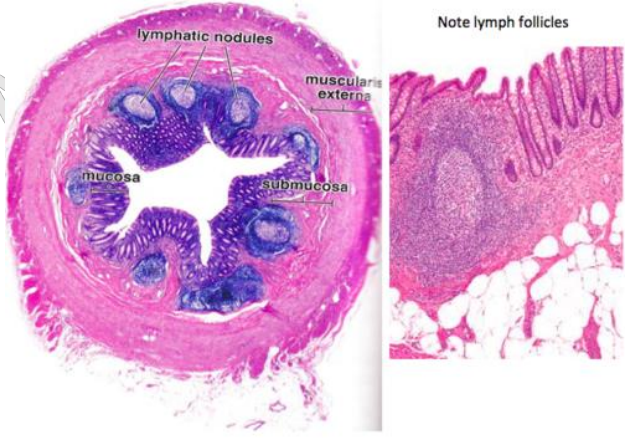


2,3&4-Submucosa, musculosa& serosa

- **Submucosa:** may contains lymphoid nodules.

Serosa :- C.T + simple. squam. epith (mesothelium)

peritonium من جزئين ←



Dr Iman

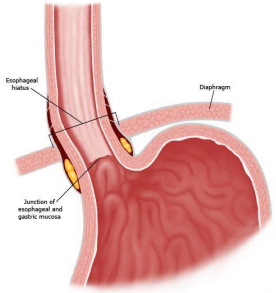
Junctions

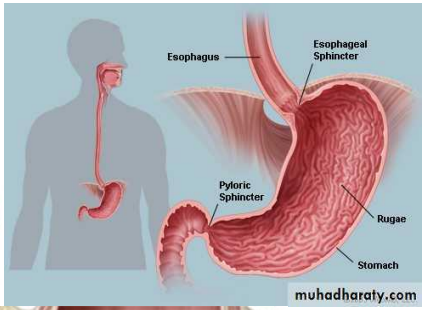
Dr Imam Habil

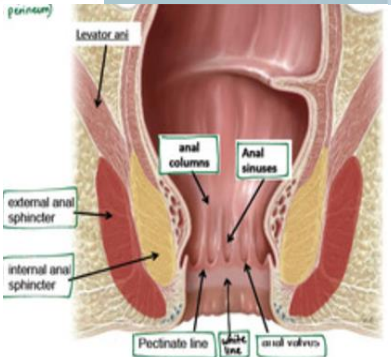
Junctions

- **There are three main junctional sites:**

1- The esophago gastric junction.
2- The pyloro duodenal junction.
3- The recto anal junction.







Dr Iman

I- The esophago gastric junction

1- Mucosa:

A- Epithelium: changes *abruptly* from the non keratinized stratified squamous to the simple columnar epithelium which is interrupted by gastric pits of the cardiac region.

B- Lamina propria: the mucosal esophageal glands change into the branched tubular cardiac glands.

2- Submucosa:

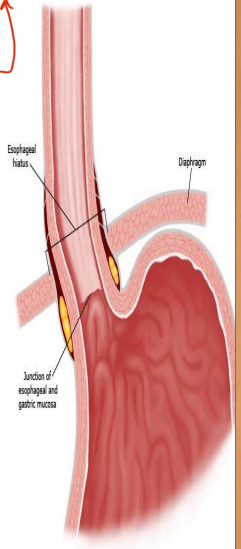
- The submucosal esophageal glands stop or continue for a variable distance into the submucosa of the cardia.

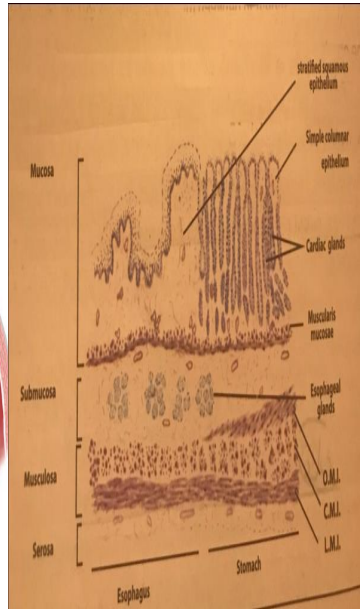
3- Musculosa:

- Thickened at the cardiac region due to the additional inner oblique smooth muscle fibers.

4- Serosa:

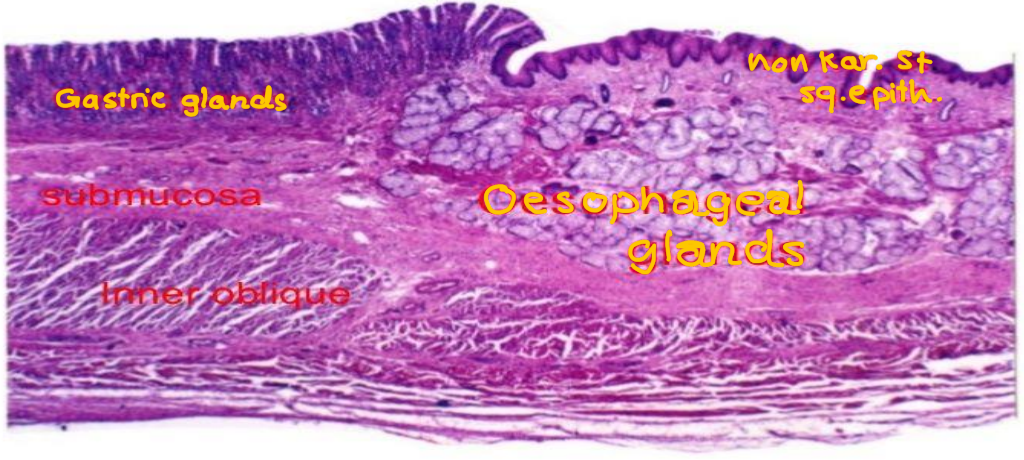
- The abdominal end of the esophagus is continuous with that of the stomach.





Dr Iman Nasr

Gastro-oesophageal junction



II- The pyloro duodenal junction

1- Mucosa:

A- Epithelium: gradually changes; the surface columnar cells acquire a brush border,& the epithelium starts to project into the lumen forming the duodenal villi.

B- Lamina propria: the crypts of Lieberkuhn replace the pyloric glands& the goblet cells start to appear in the lining of the villi & the crypts.

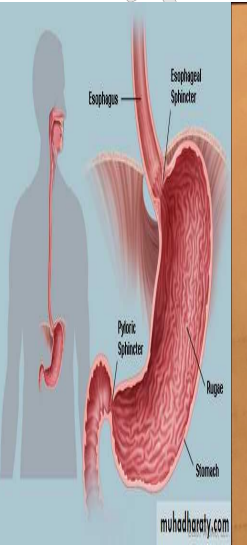
2- Submucosa:

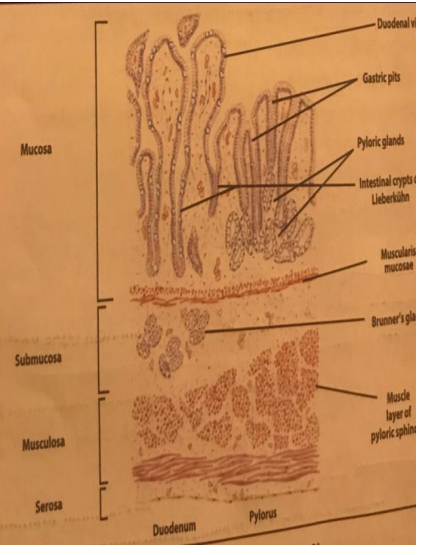
Brunner's glands appear in the duodenal region.

3- Musculosa:

The thick inner circular muscle layer that forms the pyloric sphincter becomes thinner towards the duodenum.

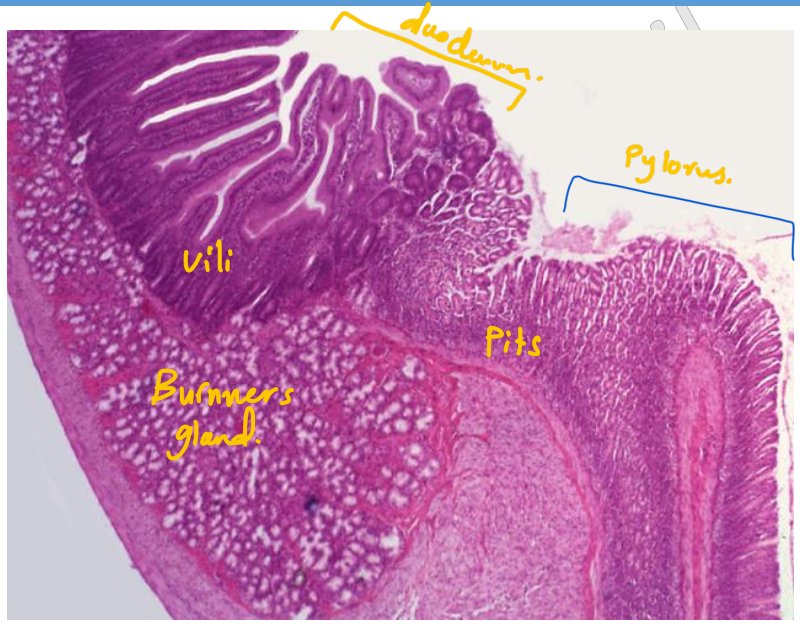
4- Serosa: continues.





Dr Iman N

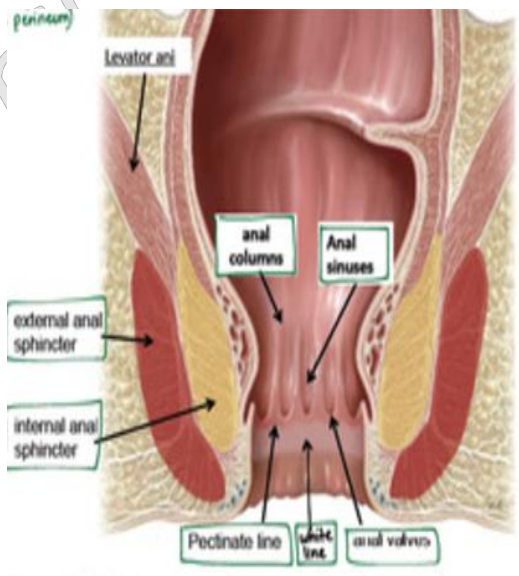
II- The pyloro duodenal junction



III- The recto anal junction

1- Mucosa:

- The upper part of the anal canal shows longitudinal mucosal folds called *the anal columns of Morgagni.*
- The distal ends of these columns are connected by transverse mucosal folds known as *the anal valves* which marking *the pectinate line.*

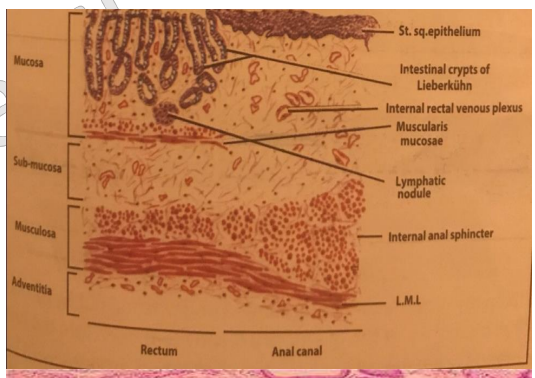


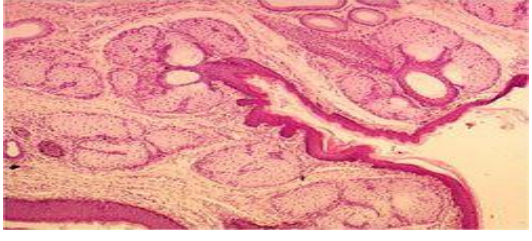
Lower 1/3 & upper 2/3 of anal canal
ectoderm
non-kers. stratified squ. epith.
endoderm
simple cuboidal epith
nerve supply & Blood supply

Dr. Iman Nah

III- The recto anal junction

A- Epithelium: changes gradually from *simple columnar epithelium with goblet cells* → *stratified columnar* epithelium on the anal columns → *non keratinized stratified squamous* epithelium at the level of the anal valves → *keratinized stratified squamous* epithelium about 1cm above the anal orifice with hair follicles, sebaceous glands& the circumanal apocrine sweat glands.

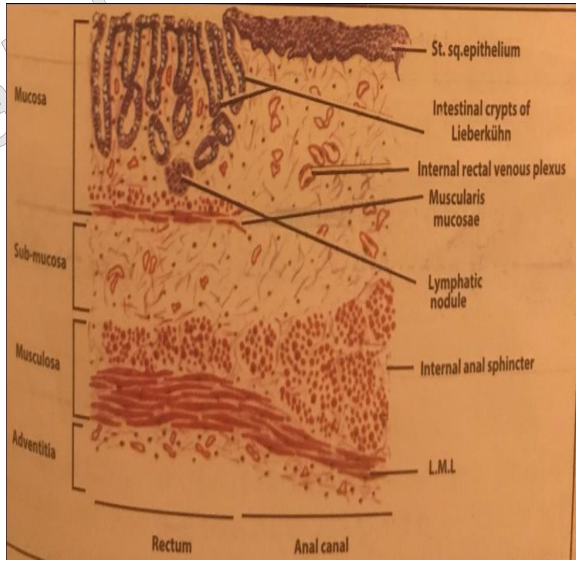




Dr Iman Nafie

III- The recto anal junction

- **Lamina propria:** the short crypts of Lieberhuhn gradually disappear.
- **Muscularis mucosae:** fades out at the level of the anal columns, and the lamina propria blends with **the submucosa** of the anal canal& *contains the internal rectal venous plexus.*



Dr Iman Nabil

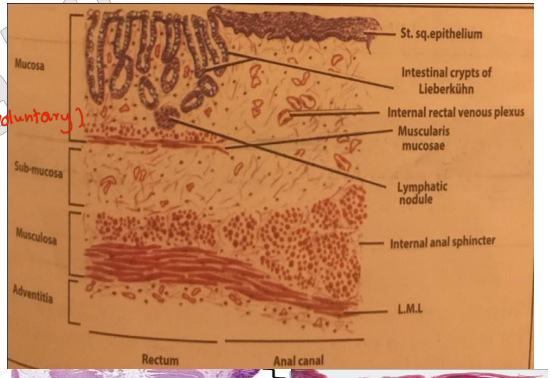
III- The recto anal junction

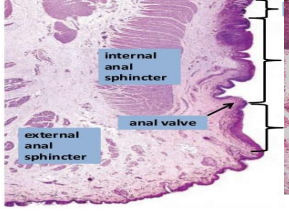
3- Musculosa:

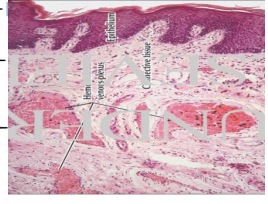
- The inner circular smooth muscle layer is thickened to form *the internal anal sphincter.* (involuntary)
- Distal to internal anal sphincter, there is *the external anal sphincter* (circumferential bundles of skeletal muscles). (voluntary) تتحكم فيها الشخص
- The outer longitudinal layer: fades in between the 2 sphincters.

4- Adventitia: The adventitia of rectum is continuous with the dermis around the anal orifice which contains *the external rectal venous plexus.*

.



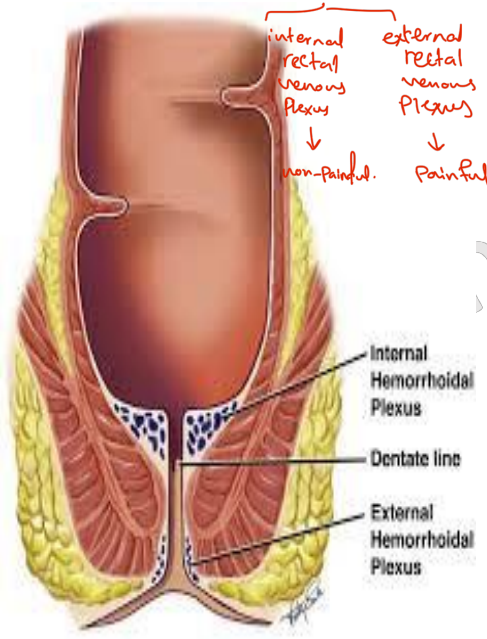


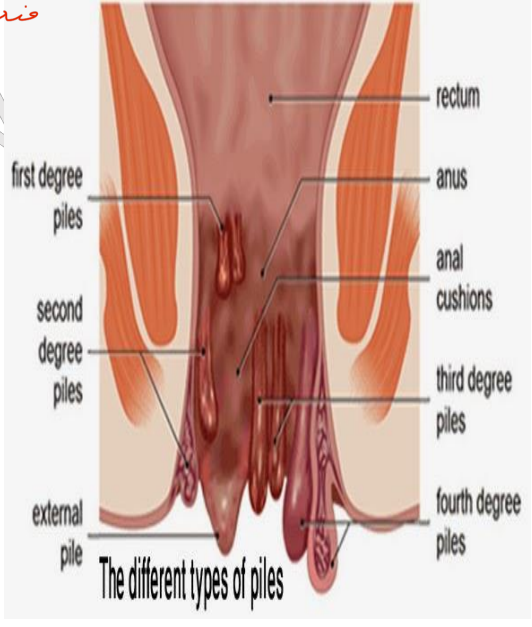


The venous plexuses of the recto anal junction may become dilated and congested causing piles (hemorrhoids).

(*) عكسه يصير في هذا الـ Plexuses ← dilation @ junction (تتمدد وتتوسع وتتقبض دم)

(hemorrhoids) فتتحول الـ





III- The recto anal junction

Which statement is the best describing the histological structure of the large intestine?

1- The taenia coli are incomplete circular smooth muscle layer.
2- Paneth cells are found among the lining epithelium of the intestinal crypts.
3- The appendices epiploicae are present at the serosal surface
4- The sacculations seen by the naked eye represents accumulation of adipose tissue at the outer surface.








Thank You

Liver, gall bladder & pancreas

Dr.Iman Nabil

DrImanNabil

Liver, gall bladder & pancreas

1- Liver: functions, structure, blood supply & lobulation.

2- Biliary system.

3- Gall bladder: function & structure.

4- Exocrine pancreas: structure.

Dr Iman Nabil


Why?
tell me
why!

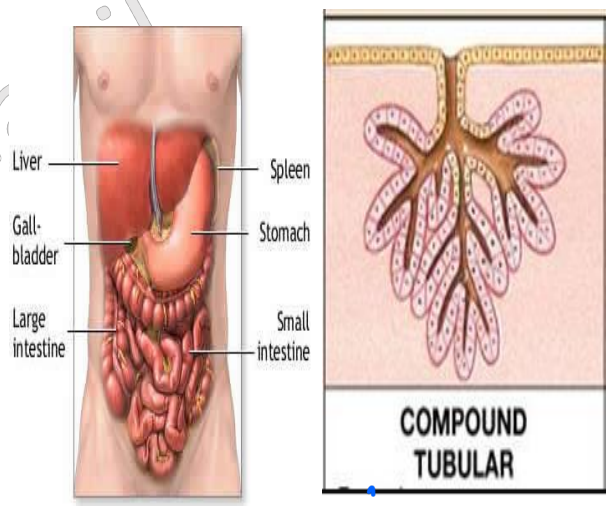

Liver

- **Anatomically:** It is the largest gland in your body, located in the right hypochondria, below the diaphragm.
- **Histologically:** It is a mixed gland, has both endocrine & exocrine function (compound tubular gland).

هناك خلايا تفرز مواد مباشرة من قنوات

branched يعني بتتكون لـ ducts اكثر من secretory unit

هناك خلايا تفرز مواد تصب في قنوات.



سبحان الله

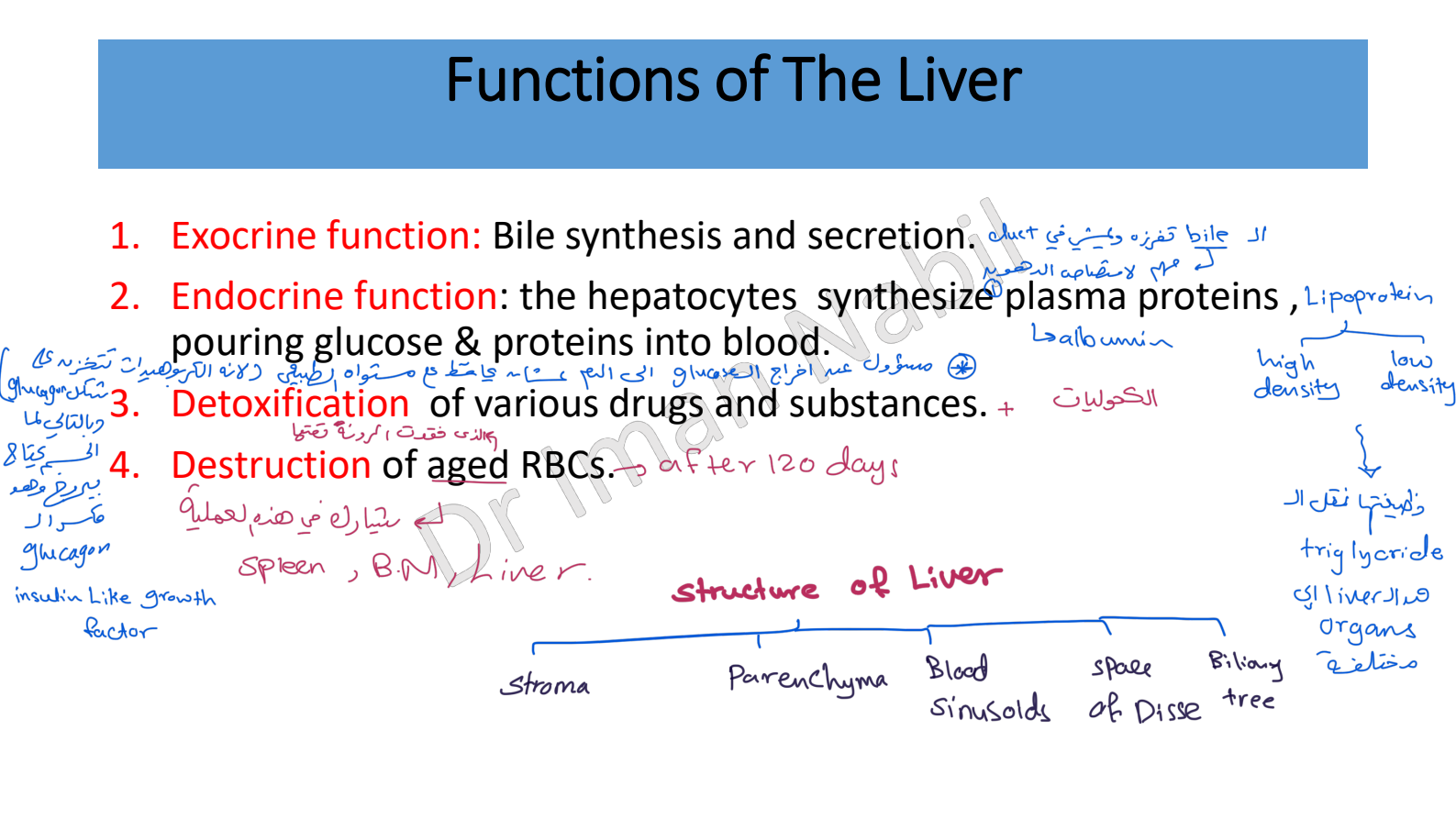
الحمد لله

الله أكبر

لا اله إلا الله

Functions of The Liver

1. Exocrine function: Bile synthesis and secretion.
2. Endocrine function: the hepatocytes synthesize plasma proteins , pouring glucose & proteins into blood.
3. Detoxification of various drugs and substances.
4. Destruction of aged RBCs. → after 120 days

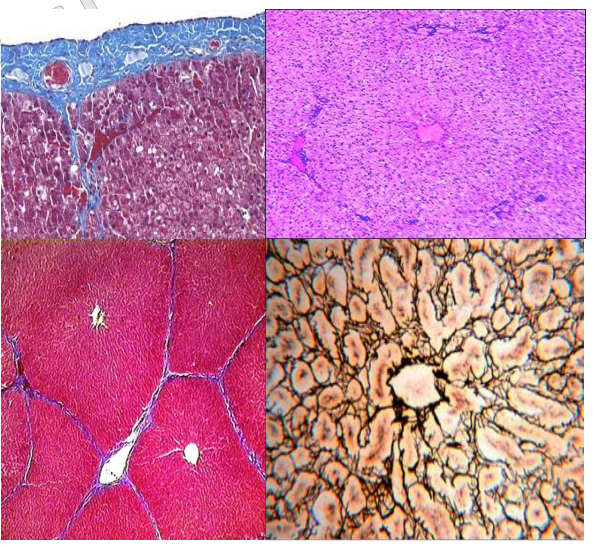


Dr Iman Nabil

Structure of the liver

1- Stroma:

- CT capsule: called *Glisson's capsule* which is partially covered by mesothelium.
- CT septa: arise at the hilum(*the porta hepatis*).
- Reticular fibers: support the parenchyma.



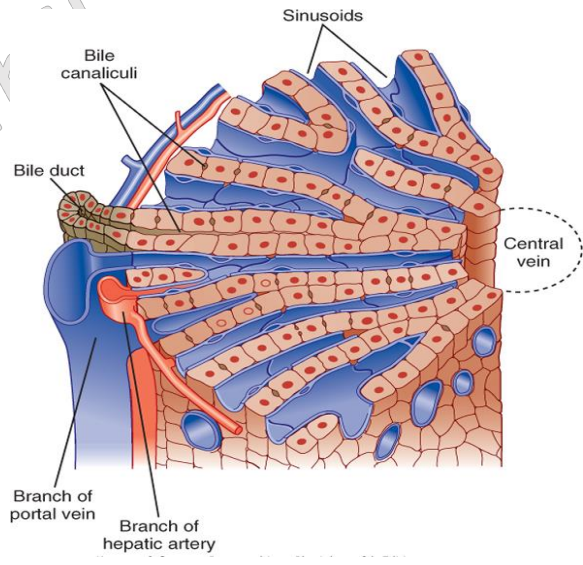
The lobular organization of the liver is not evident in human

Dr Imad Nasr

Structure of the liver

2-Parenchyma:

- **Hepatocytes:** arranged in anastomosing cords, radiating from a central vein. These hepatic cords enclose between them *bile canaliculi* and are separated from each other by *blood sinusoids*.
- **Blood Sinusoids.**



Dr Iman Nab

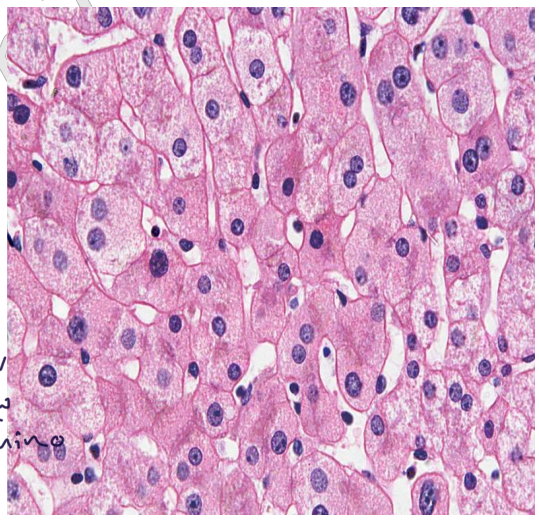
I-Hepatocytes

- **LM:**

➢ *Shape:* polyhedral.

➢ *Nucleus:* rounded, centrally& pale. Some hepatocytes are binucleated.

➢ *Cytoplasm:* acidophilic (due to the presence of large numbers of mitochondria and sER)& pale (due to presence of glycogen and lipid droplets).



Dr Iman Nabil

How does hepatocyte structure adapt to its function?

- **EM:**

1- Abundant *mitochondria* (high metabolic activity).

2-Well developed rER (plasma proteins).

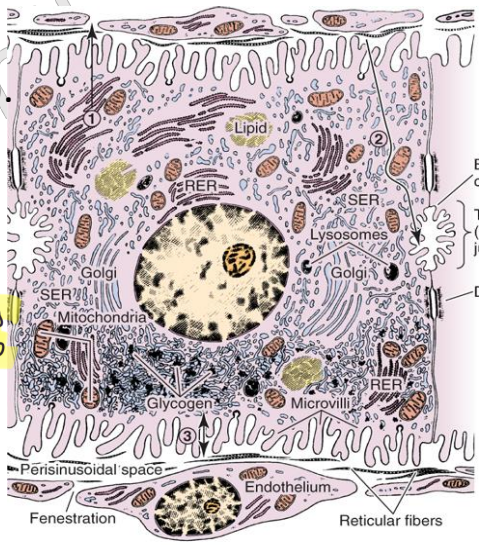
3- Multiple *Golgi* (secretory activity).

4- Abundant *sER* (synthesis of bile & glycogen, detoxification).

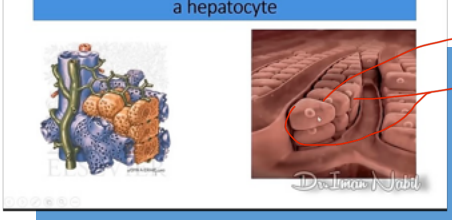
5- Numerous *peroxisomes* (oxidation of FA).

6- *Lysosomes & lipofuscin* pigments (aged cell).

7- *Glycogen & lipid* (energy).



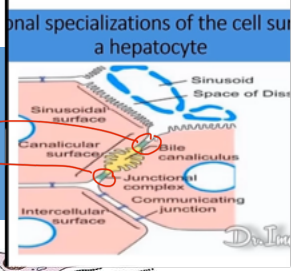
Dr Iman Nabil



intercellular side → bile canaliculi الناحية التي

vascular side

I-Hepatocytes



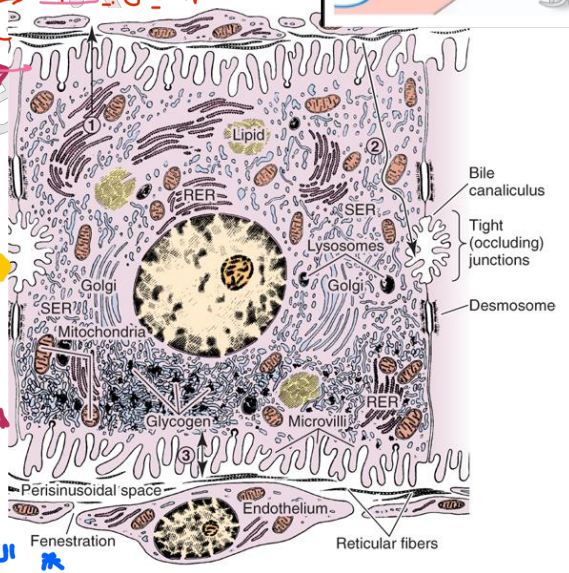
- **The hepatocyte has two functional surfaces:**

1-The vascular side: → Blood الوجه المواجه لـ Sinusoid

- Faces the perisinusoidal space. → هذا الـ space يحيط بالخلايا الكبد حتى يحدث exchange بين الـ plasma الخارجة من الـ Blood sinusoid & خلايا الكبد
- It shows *long microvilli* (WHY). هذا السطح مواجه لـ exchange لوجود خلايا الكبد حتى تزود مساحة السطح طريق

2- The intercellular side: Bile اصغر وجود في الجسم

- Where bile canaliculi are enclosed between adjacent hepatocytes. بين خلايا الكبد المتجاورة يوجد الـ bile canaliculi
- Each bile canaliculus shows *short microvilli* projecting into its lumen & is bounded by *tight junctions and desmosomes.* يزود مساحة السطح لعملية الافراز وتقل الـ bile ① ②



هذا السطح مواجه لـ vascular والسطح الجانبي هذا الـ space يفصل بينه وبين الخلايا

① تفصل الـ intercellular لتشكل كامل سد الأجزاء التي تحيط بالـ canaliculi

② تمنع تسرب الـ bile إلى الـ Blood وتبقى داخل القناة

plasma الدم حتى تحفظ خلايا الكبد شو؟!

لـ حتى يرجع المواد التي يحتاجونها glucose & plasma protein

plasma الدم حتى تحفظ خلايا الكبد شو؟!

① حتى تحفظ الـ nutrition تعتبر

② حتى تحفظ (مواد المغذية تصل) nutrients جاية من الـ GIT

③ حتى تحفظ drugs & substance الي يحتاجها الكبد لـ detoxification يحصل

II-The blood sinusoids

Blood supply of the liver

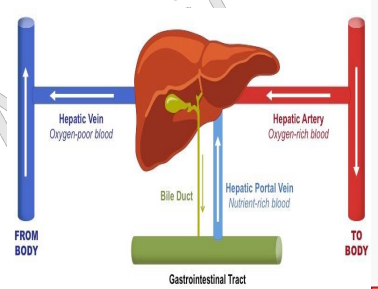
- **The liver has a double blood supply:**

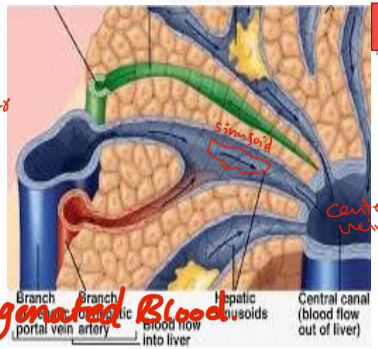
1- 25%: Oxygenated blood from the *hepatic artery.*

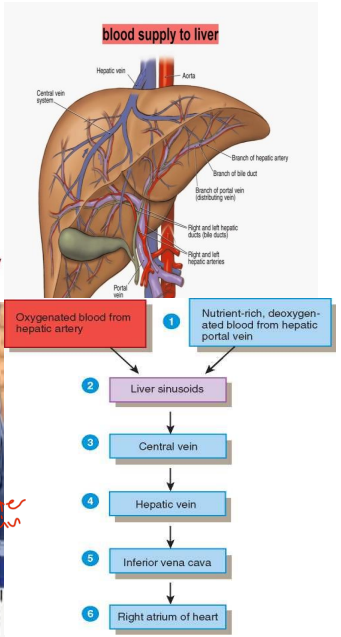
2- 75%: Poorly oxygenated blood from *the portal vein* (rich in nutrients from the GIT)

On entering the porta hepatis, the portal vein and the hepatic artery ⟶ *interlobular branches* (in the portal canals) ⟶ *the sinusoids* ⟶ *the central vein* ⟶ *hepatic veins* ⟶ *the inferior vena cava*.

hepatocytes are never exposed to full oxygenated Blood



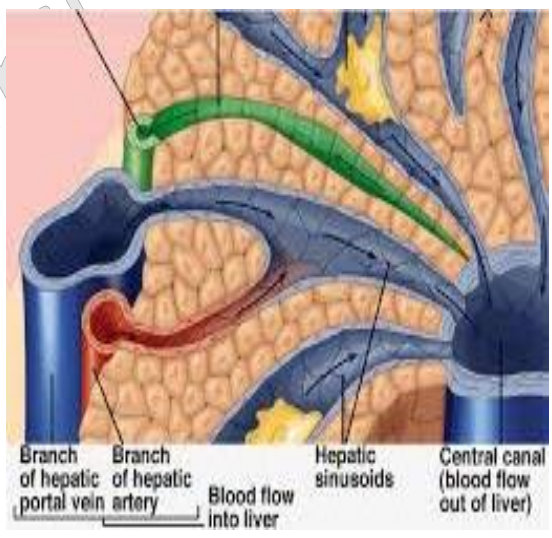




Liver is the first organ to receive nutrients but also the first exposed to toxic substance absorbed from GIT

II-The blood sinusoids

- **Function:** Exchange between blood & hepatocytes.
- **Structure:** lined by 2 types of cells.



Dr Iman Nab

A-Endothelial cells

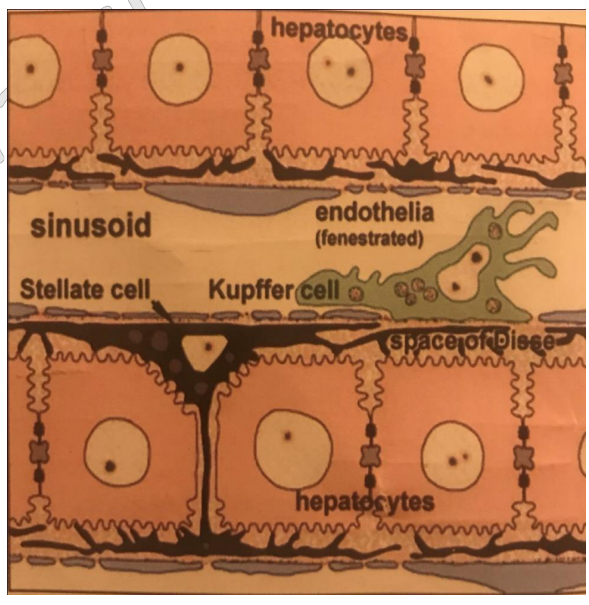
- **Structure:**

➢ Flat cells. عشان تسهل عملية التبادل

➢ Numerous large fenestrations without diaphragm → ما فيش ستارة → الصفيرة اللي كانت تغطي ال Fenestration. ← عشان تسهل عملية ال exchange

➢ Surrounded by discontinuous basal lamina.

- **Function**: This allows free passage of plasma into the perisinusoidal space for the exchange process to occur.



Dr Iman Nabil

B- Kupffer cells

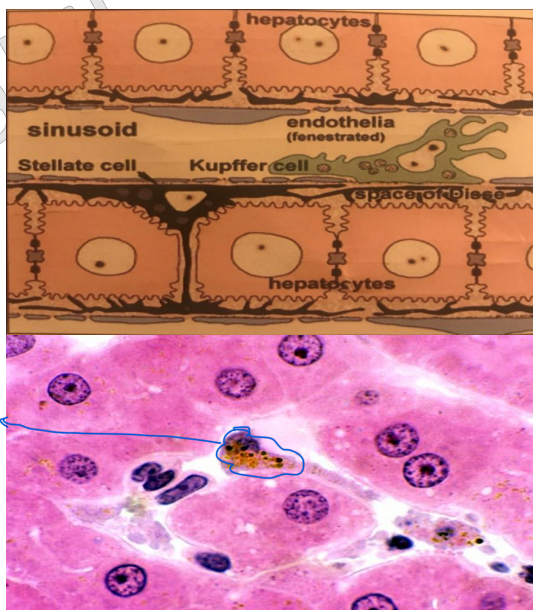
- **Origin:** from blood monocytes. → Blood بتطلع مدار وترجع ع الـ tissue
- **Structure:** Kupffer cells هي ماكروفاجز موجودة ع الـ liver

➢ Large branching cells.

➢ Their pseudopodia are projecting into the lumen of the sinusoids. تكون بارز

➢ The cytoplasm contains many lysosomes containing hemosiderin pigment. لانه خلايا أكلة — Kupffer الصبغة الموجود في — أصفر بني

- **Function:** phagocytosis of aged RBCs. خلايا الـ RBCs لانها اصبحت خلايا عاجزة وهافي عندها مرونة.



هي تكتشف ع hemoglobin حرج وانا مكسره

heme ← iron حزينه جوا الكلية عشان ارجع اكسرها

globin ← amino acid بتفيدهن

bilirubin ← يرجع ع الكبد عشان يطلع ع البايل مرة تانية ك RBC

Dr Iman Nabil

* this function is greatly increases after splenectomy

The space of Disse

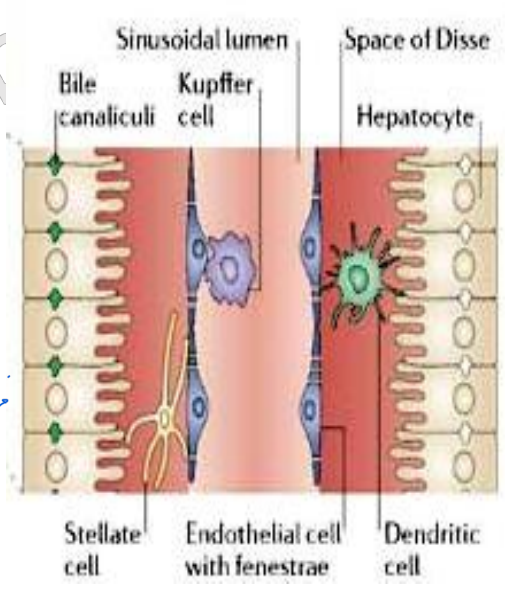
- **Definition:** It is a narrow perisinusoidal space between the endothelial lining of the sinusoids and the hepatocytes.
- **Function:** It allows exchange of metabolites between the plasma and the hepatocytes.
- **Contents:**

1- Plasma filtered from the sinusoids.

2- Microvilli projecting from the hepatocytes.

3- Reticular fibers(support to the wall of sinusoids).

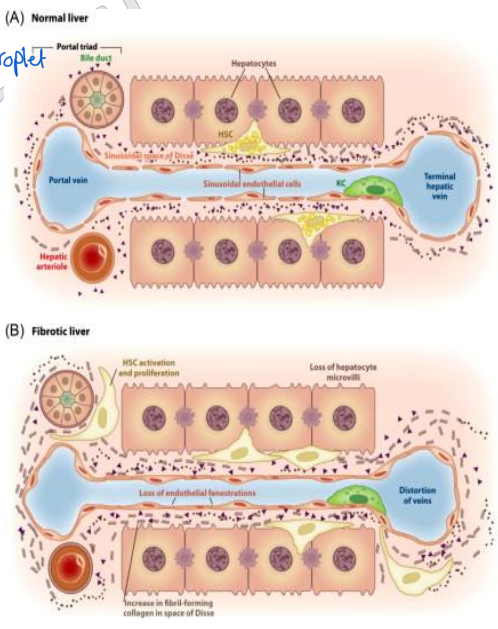
4- Hepatic stellate cells (Ito cells): vitamin A storing cells. (within lipid droplets). it is derived from the mesoderm (endoderm)



Dr Iman Nah

Hepatic stellate cells

- In chronic inflammation of liver, it differentiate into myofibroblasts and deposit excess amount of collagen in the perisinusoidal space causing ***liver fibrosis.***

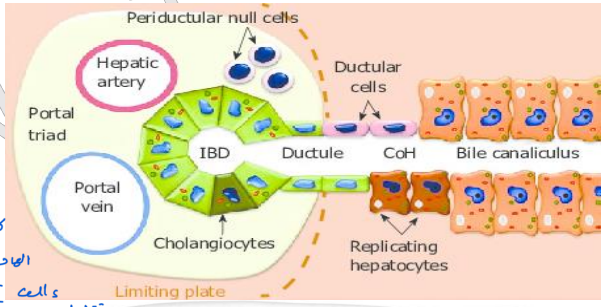


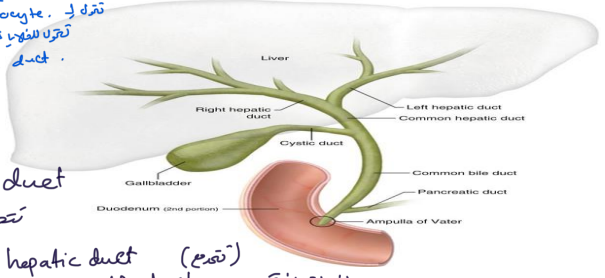
Dr Iman Nasr

The biliary tree

لـ القنوات الي ماشي فيها العصارة الصفراوية

- The hepatocytes → *the bile canaliculi* (lined by the cell membrane of adjacent hepatocytes) → *canals of Hering*(lined by cuboidal cells) → *the interlobular bile ducts*(in the portal canals, lined by cuboidal then columnar cells) → the right and the left *hepatic ducts*.





Common hepatic duct
Cystic duct تتحد مع
Common bile hepatic duct (تتحد)

Cells of the Canal of Hering is considered as stem cells, have a role in liver regeneration

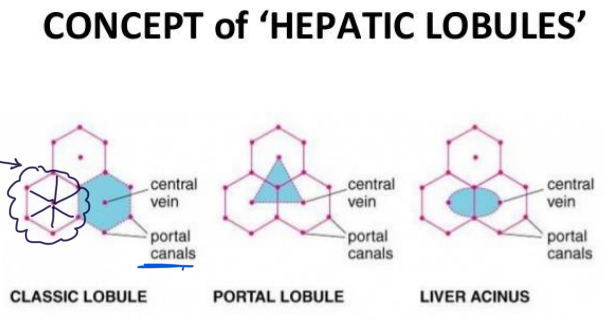
Hepatic lobulation

- Three classifications of liver lobules refer to different aspects of hepatocyte activity:

1-The classic hepatic lobule.

2- Portal lobule.

3- Liver acinus.



Original

The classic hepatic lobule

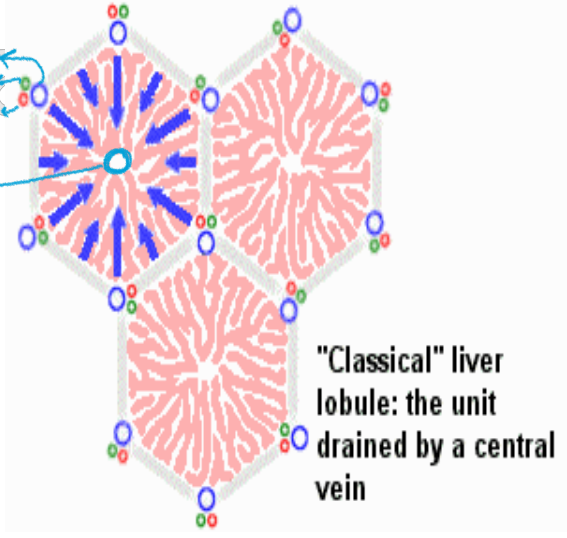
- It is *a hexagonal mass* of hepatocytes radiating around a central vein.
- **Center:** Central vein.
- **Corner:** The portal canals, enclosing the portal triad, contain 3 structures:

1- An interlobular bile duct.

2- An interlobular branch of the portal vein.

3- An interlobular branch of the hepatic artery.

- In the classic hepatic lobule, *blood and bile flow in opposite directions*: the blood flows towards the central vein while the bile flows away from the central vein.

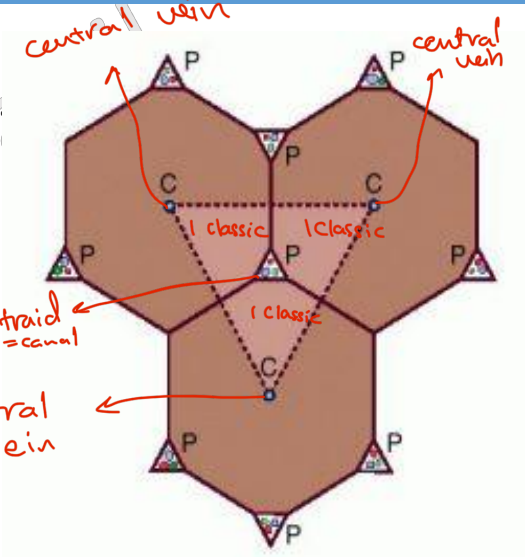


"Classical" liver lobule: the unit drained by a central vein

Dr Iman Nabil

B-The portal lobule

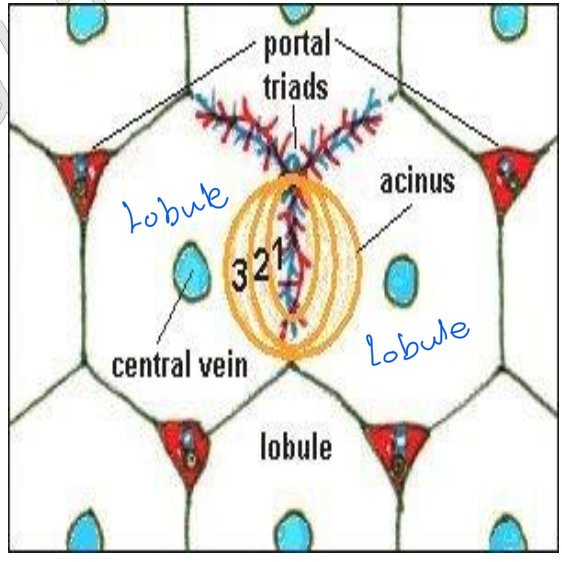
- This is *a triangular mass* of hepatocytes from three adjacent classic hepatic lobules.
  - **Center:** a portal canal.
  - **Angles:** the central vein.
- Each portal lobule drains its bile into the central bile duct.



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C-The liver acinus

- It is the functional unit of the liver(correlate between blood perfusion, metabolic activity & liver pathology).
- It is *a diamond shaped* mass of hepatocytes from two adjacent classic hepatic lobules.
- **Center:** vascular core formed of branches from portal vein and hepatic artery, present along the border between two classic lobules.



C-The liver acinus

لي عشان اهم وظيفتها عشرة لـ 3 مناطق :-

- It is subdivided into three zones according to their blood supply:

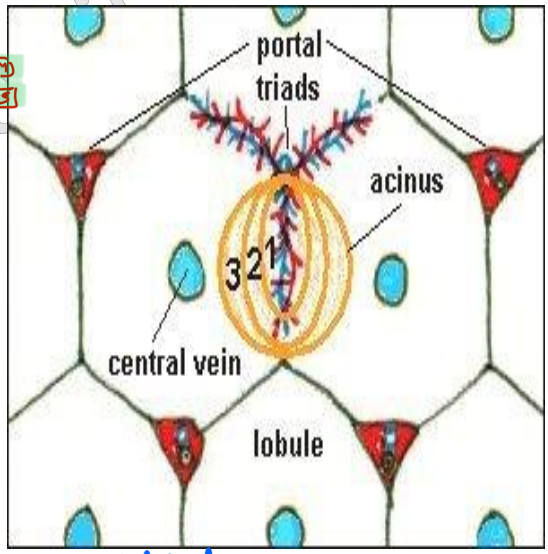
1- Zone I:

- The hepatocytes close to the vascular core.
- It is richly supplied by blood.
- Its hepatocytes carry out oxidative metabolism and protein synthesis.

2- Zone II: hepatocytes intermediate in location & in their blood supply.

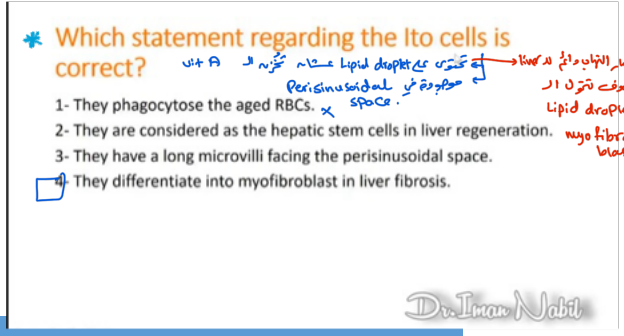
3- Zone III:

- The hepatocytes are farthest from the blood supply & close to the central veins.
- It has the poorest blood supply.
- Its hepatocytes carry out glycolysis.
- Its cells are the first that suffer from degeneration and necrosis.



* Classical lobule → anatomical lobule
* liver acinus → Physiological lobule

Dr Hind Wael

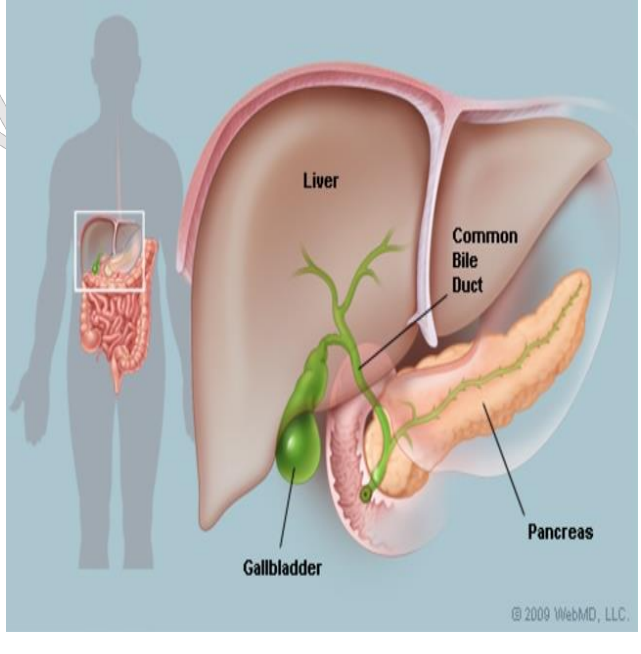


Gall bladder

Dr Ima

Gall bladder

- **Anatomically:** It is a hollow, pear shaped organ attached to the lower surface of the liver.
- **Function:** storage, concentration of bile and its release when needed into the common bile duct.



Dr.Iman N

Structure of gall bladder

3 layers:

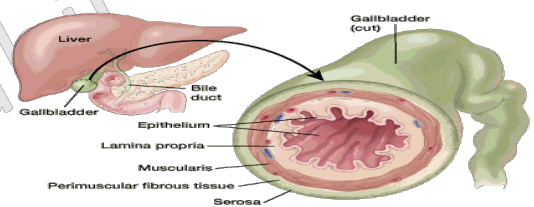
1- Mucosa:

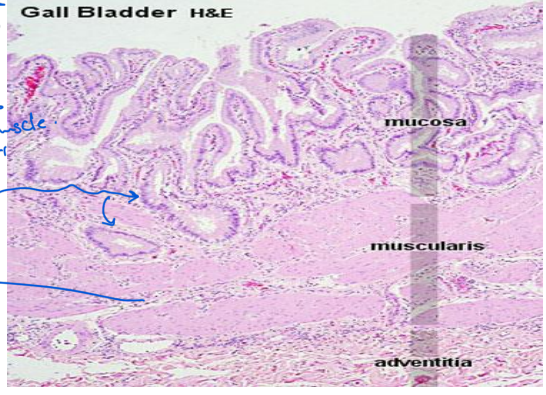
- Highly folded especially when the gallbladder is empty.
  - *Epithelium:* simple columnar epithelium with apical microvilli (for salt and water absorption).
  - *Lamina propria.* (layer From C.T).

2- Musculosa: smooth muscle fibers arranged in several directions and separated by fibro elastic connective tissue.

3- Adventitia/ Serosa: according to anatomical surface.

N submucosa , No muscularis mucosae





Dr Iman Nabil

Rokitansky-Aschoff sinuses

- **Definition:** Deep diverticula of the mucosa, may extend through musculosa.
- They occur due to *hyperplasia of the epithelial cells*, that herniate through the musculosa.
- Bacteria may accumulate in these sinuses causing *chronic inflammation* (a risk factor for formation of gallstones).



{ فأصبر لحكم ربك فإنك بأعيننا }

Pancreas

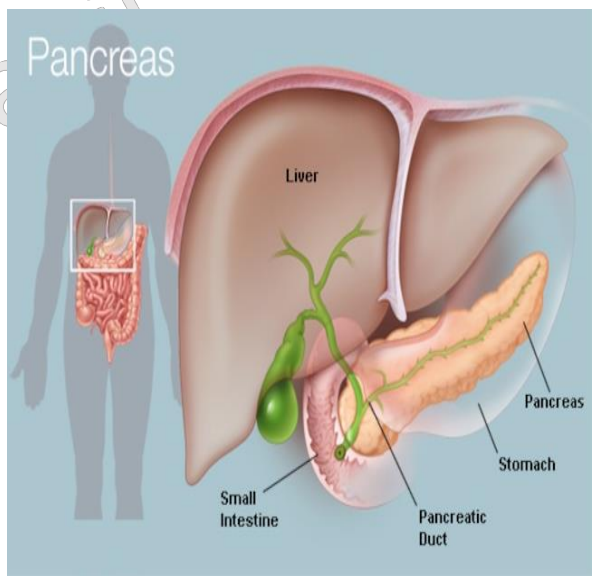
Dr Ima

Pancreas

- **Anatomically:** It lies in the C shaped curvature of the duodenum.
- **Histologically:** It is a *mixed gland*:

➢ Endocrine portion (Islets of Langerhans) : secrete hormones.

➢ Exocrine portion: secrete digestive enzymes. → يترجع على duodenum.



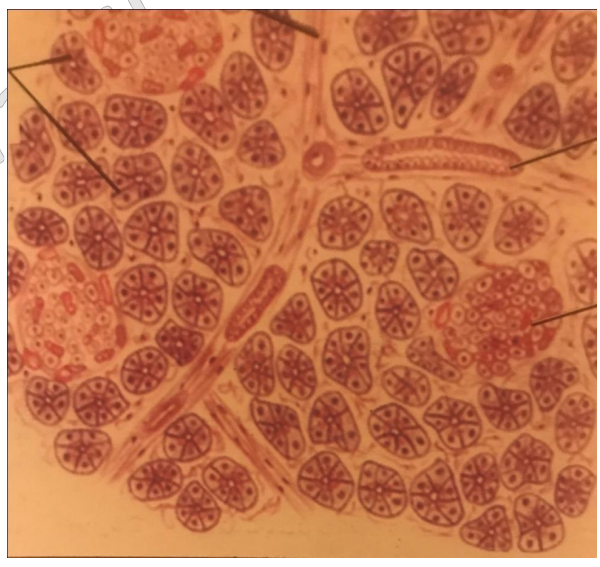
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Structure of the pancreas

1- The stroma:

- *CT capsule.* بيحوطها كبسولة
- *CT septa:* that divide the pancreas into small lobules.
- *Reticular fibers:* support the pancreatic parenchyma.

2- Parenchyma: the exocrine parenchyma.



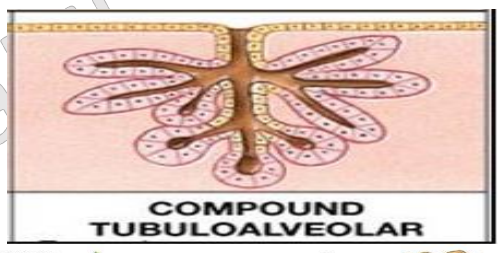
Dr Iman N

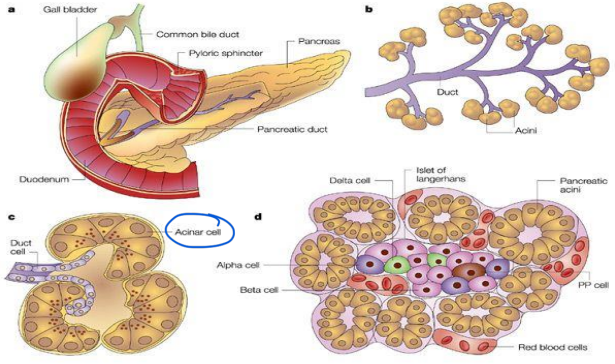
The exocrine parenchyma of the pancreas

- It is a compound tubuloalveolar gland.
- **Composed of:**

1- Pancreatic acini.

2- Duct system.

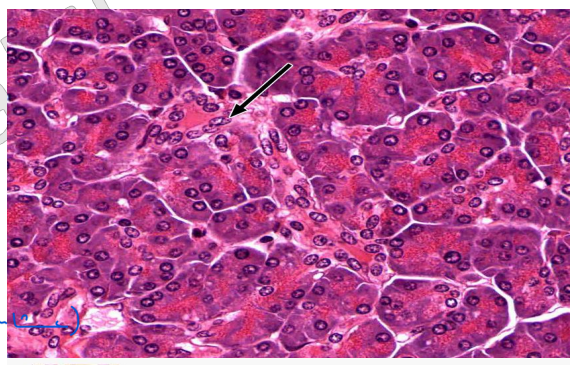


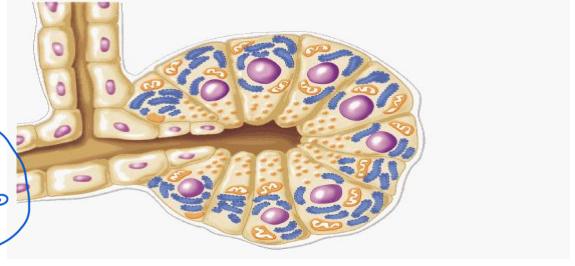


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The pancreatic acini

- *They are serous acini, similar to those of salivary glands* (lined by pyramidal cells, with basal basophilia due to abundant rER & apical acidophilia due to zymogen granules), *but differ in being:*
  - Oval in shape.
  - Larger in size.
  - Without myoepithelial cells.
  - Tightly packed, pressing against one another thus acquiring variable shapes.
  - Their lumen is lined by centroacinar cells, that represent the first part of the intralobular ducts (intercalated ducts), that is telescoped inside the lumen of the acinus.





Dr Iman Nasr

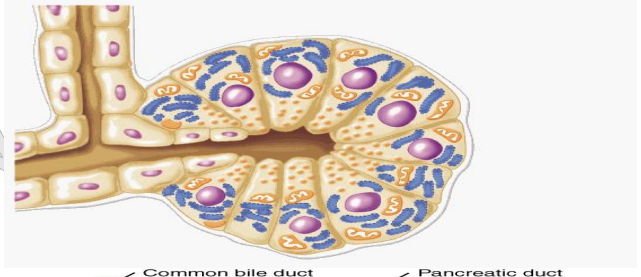
	Salivary serous acini	Pancreatic serous acini
1- Size	Smaller	Larger
2- Shape	Rounded	Oval, may acquire variable shapes.
3- Myoepithelial cells	Few	Absent
4- Centroacinar cells	Absent	Present

The duct system

1- The intralobular ducts (intercalated duct): its proximal part is forming the centroacinar cells. The remaining part is lined by low cuboidal cells.

2- The interlobular ducts: lined by simple cuboidal then simple columnar cells.

3- The main pancreatic duct: lined by simple columnar cells with goblet cells(similar to that of the duodenum where it opens).



Dr Iman N






Thank You