HISTOLOGY

بسم الله الرحمن الرحيم

FINAL | Lecture 1

Histology of the Liver, Gallbladder and Pancreas

Written by: Ghena Nusair
Nour Elzogheir

Reviewed by: Leen Mamoon

﴿ وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم ﴾

اللهم استعملنا ولا تستبدلنا

GI Histology 3

“اللهم افتح عليّ فتوح العارفين، وعلّمني ما ينفعني، وانفعني بما علّمتني، وزدني علماً، واجعلني من عبادك المتقين”

1- Histological Features of the Large Intestine

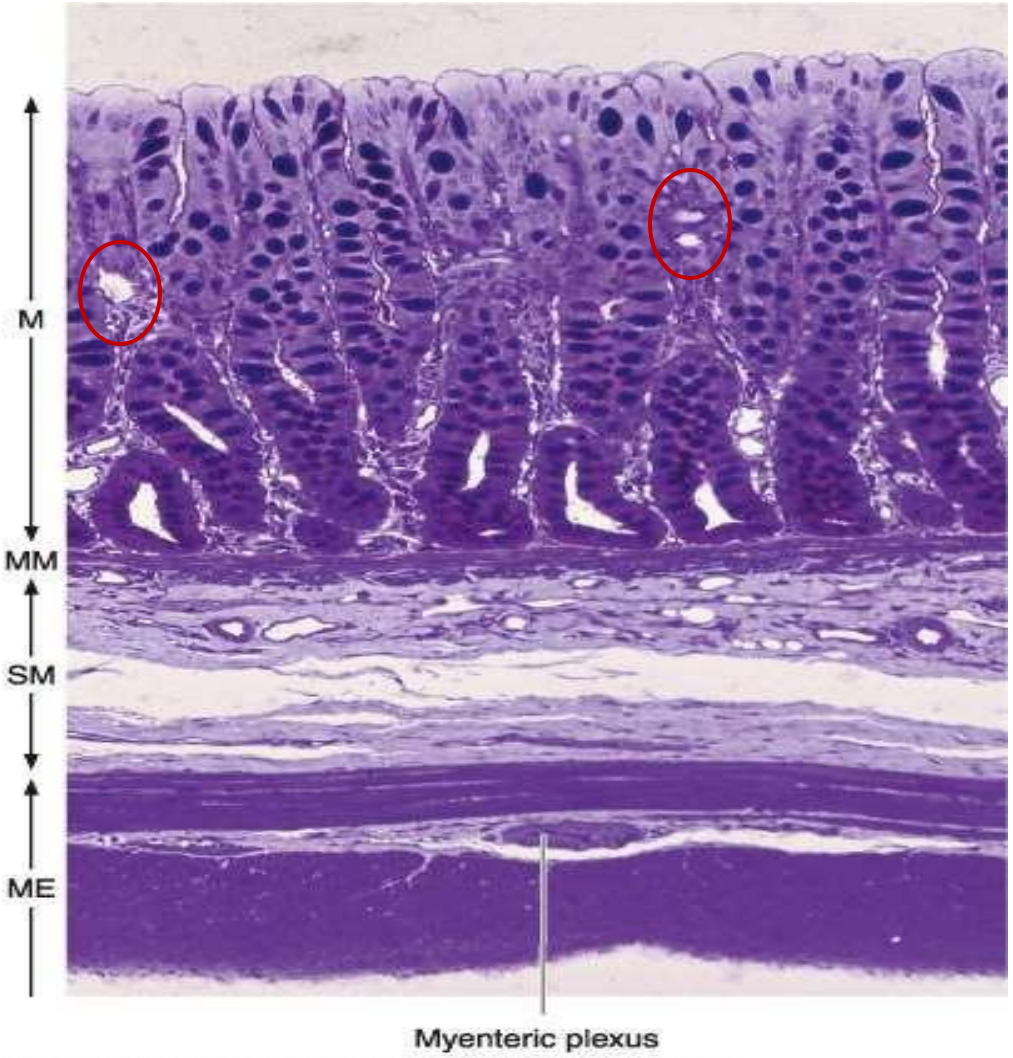
- ✓ Throughout the colon and rectum, the lining epithelium is **simple columnar with numerous goblet cells.**

- ✓ **Goblet cells** are **numerous** to aid in **water absorption** and **feces formation**. Since feces are initially hard and require **lubrication**, mucus secretion is increased.

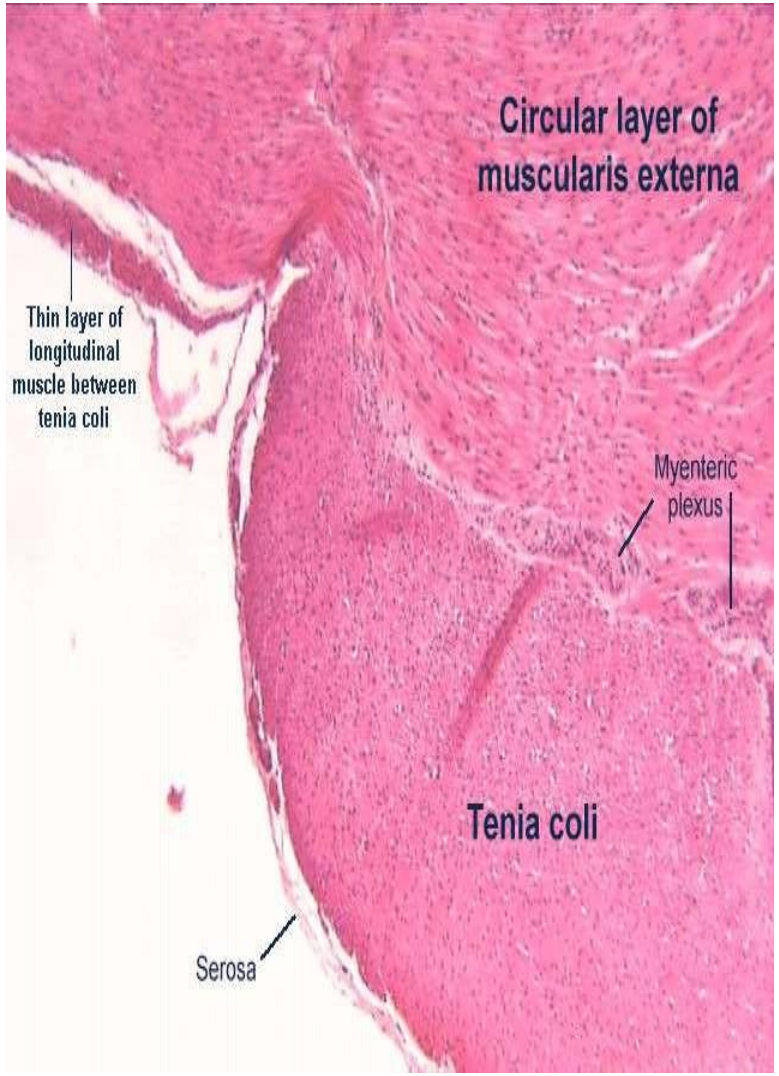
- ✓ **Mucus** is a **highly hydrated gel** that not only lubricates the intestinal surface but also **covers bacteria and particulate matter.**

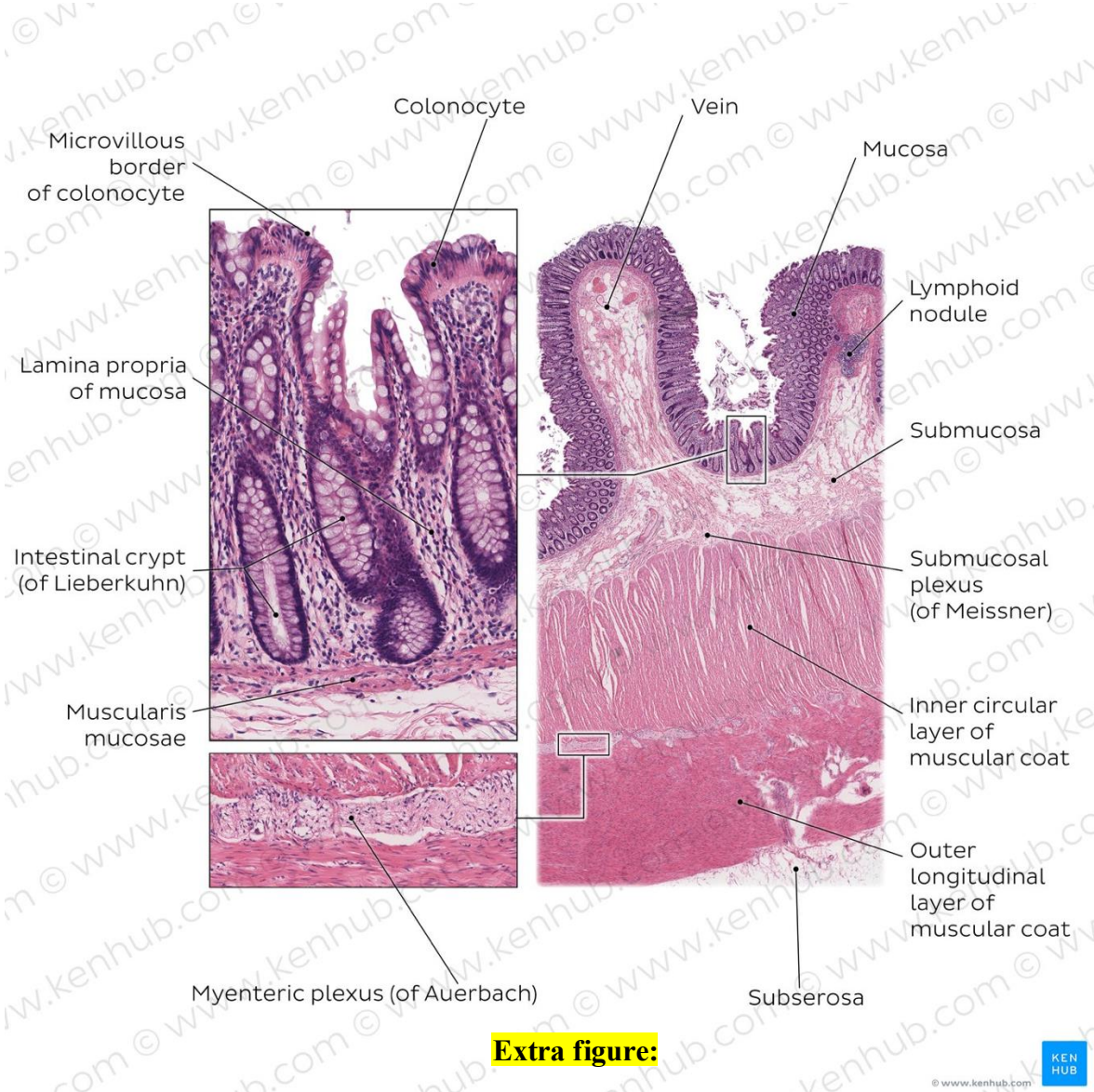
- ✓ **Muscularis externa layer** is divided into **outer longitudinal** (which forms **3 bands of tinea coli**) and **inner circular.** *slide (5)*

- ✓ **Appendices epiploicae** are fat-filled tags found on the **outer surface of the colon.**



- M = Mucosa
- MM = Muscularis Mucosae
- SM = Submucosa
- ME = Muscularis External
- The red circle is the goblet cells.



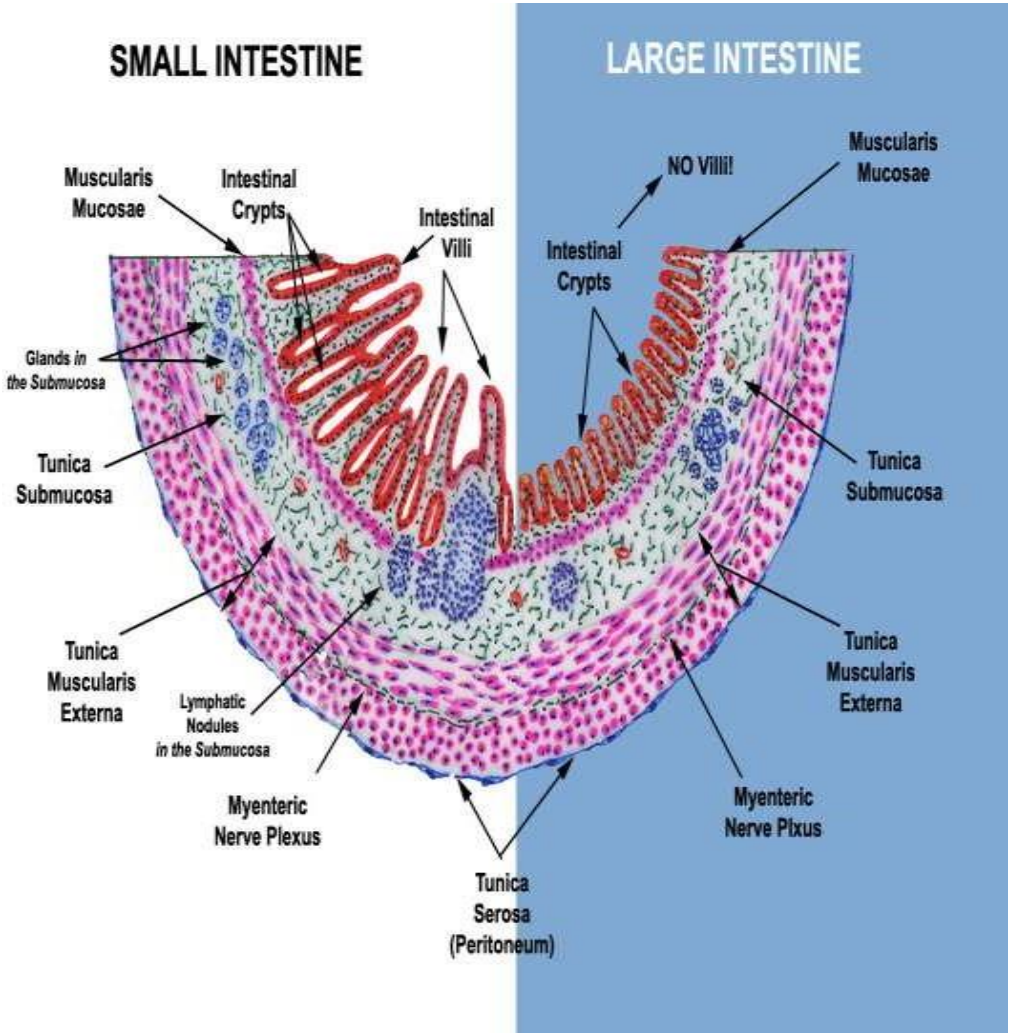


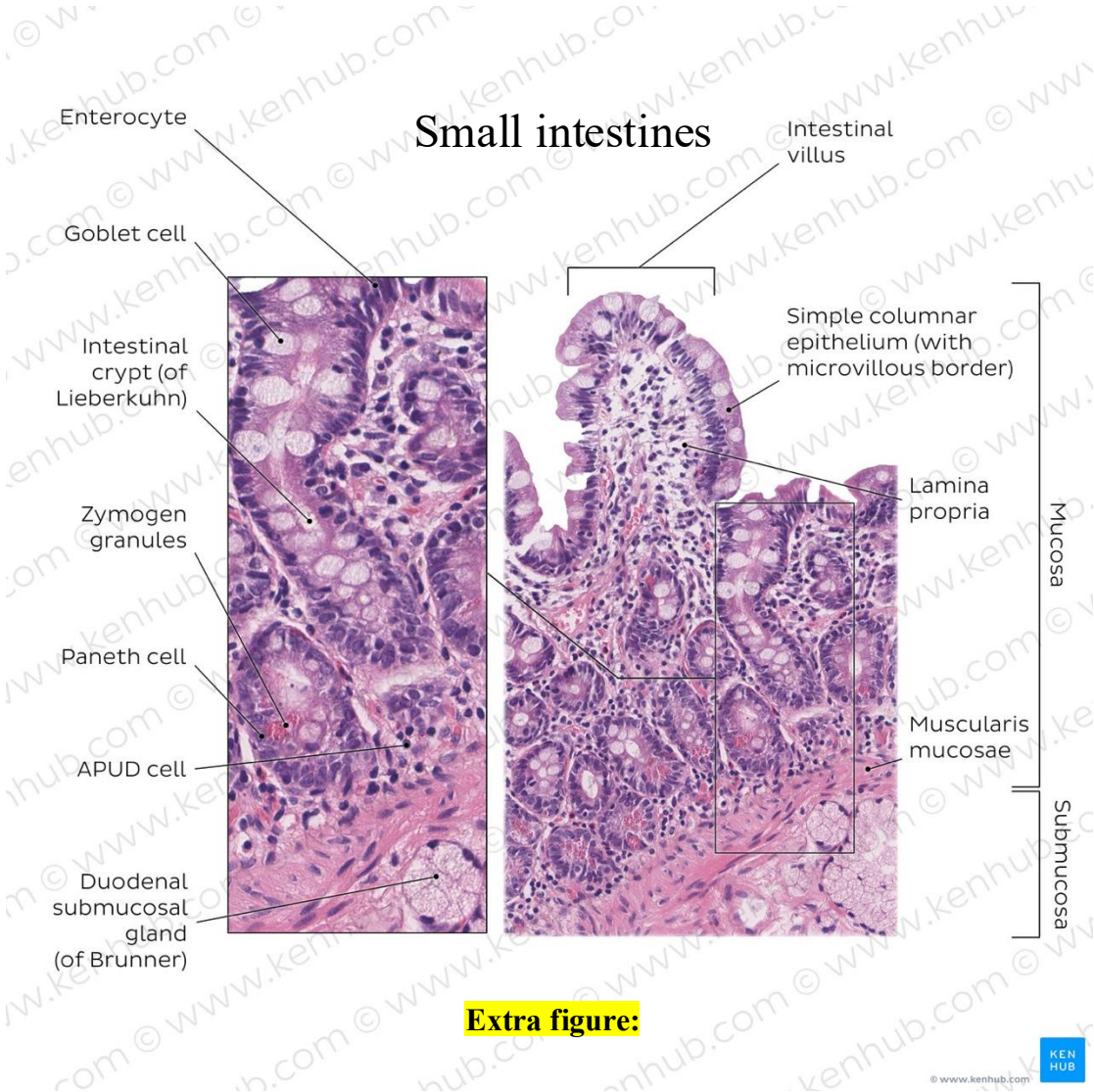
Extra figure:

✓ **Myenteric plexus** of large intestines are **parasympathetic ganglia.**

2- Comparison between small and large intestines

Features	Small intestine	Large intestine
Gland type	**Compound** and **tubular**	**Simple** and **tubular**
Villi	**Present** on surface	**Absent**, but microvilli may be found
Panenth cells	**Present**	**Absent**
Muscularis mucosa	**Ill defined**	**Well defined**
Submucosa gland	**Present , brunners glands**	**Absent**, but the submucosa **contain solitary lymph nodules**





Extra figure:

3- Histological Features of the Anal Region

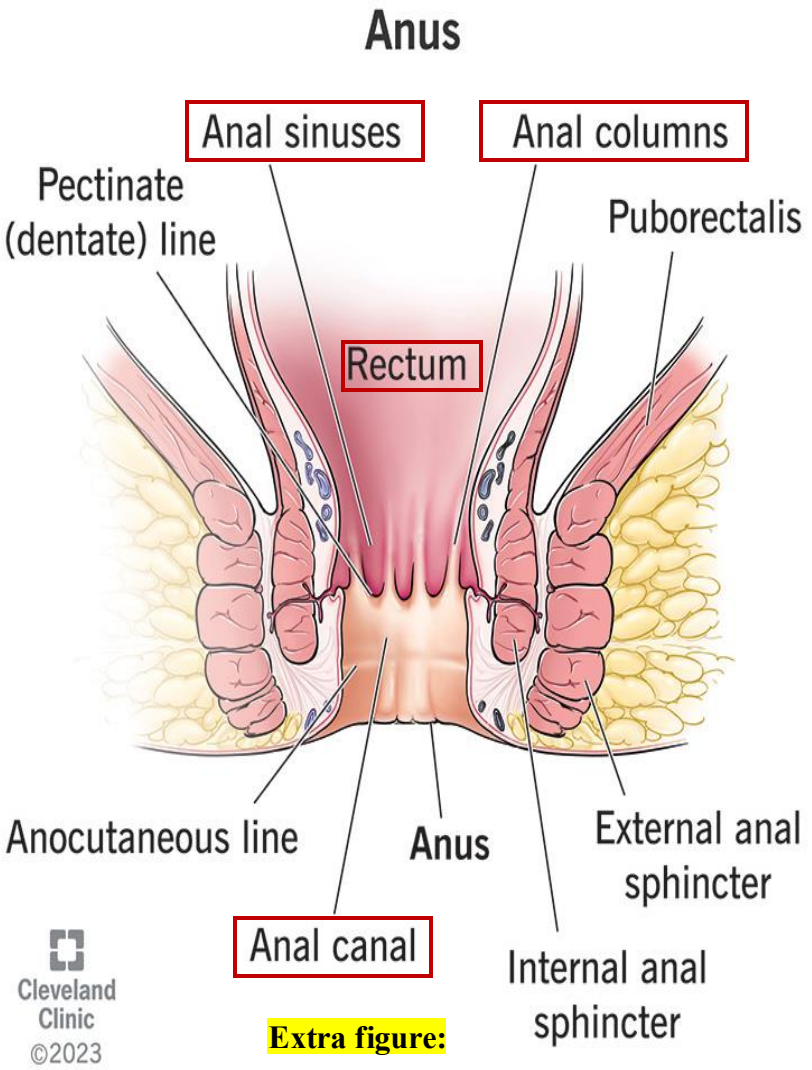
➢ **Relate to Anatomy**

✓ **Rectal Columns of Morgagni**

• In the anal region, the mucous membrane forms a series of **longitudinal folds** known as the **rectal columns of Morgagni.**

• These columns connect to the anal orifice and form the **anal valves** and **anal sinuses.**

• The **rectal columns** extend from **the rectum to the anal canal** and serve as a **landmark** for the transition between regions.



Extra figure:

3- Histological Features of the Anal Region

✓ Anal Canal Structure:

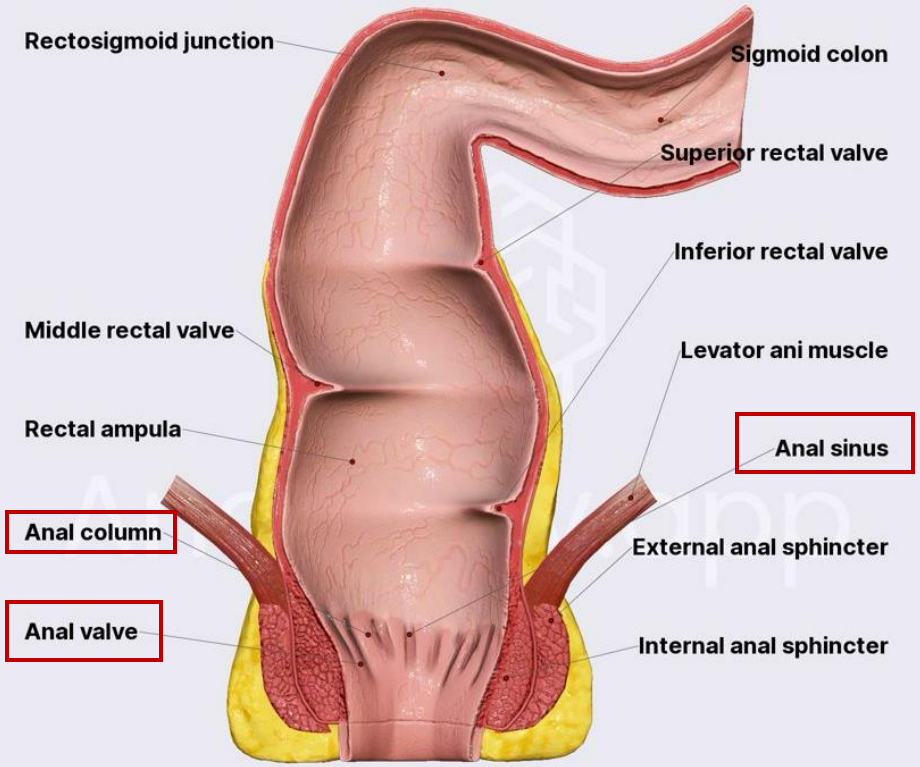
The **anal canal** is approximately **4 cm long** and is divided as follows:

- The **upper 2 cm** continues from the **rectum** and is lined by **simple columnar epithelium.**
- The **3rd cm** is lined by **stratified squamous non-keratinized epithelium**.
- The **4th cm** is lined by **stratified squamous keratinized epithelium.**

2 cm above the anal opening.

- The **transition zone** at the level of the **anal columns** separates the **upper 2 cm** from the **lower 2 cm** of the anal canal.

3- Histological Features of the Anal Region



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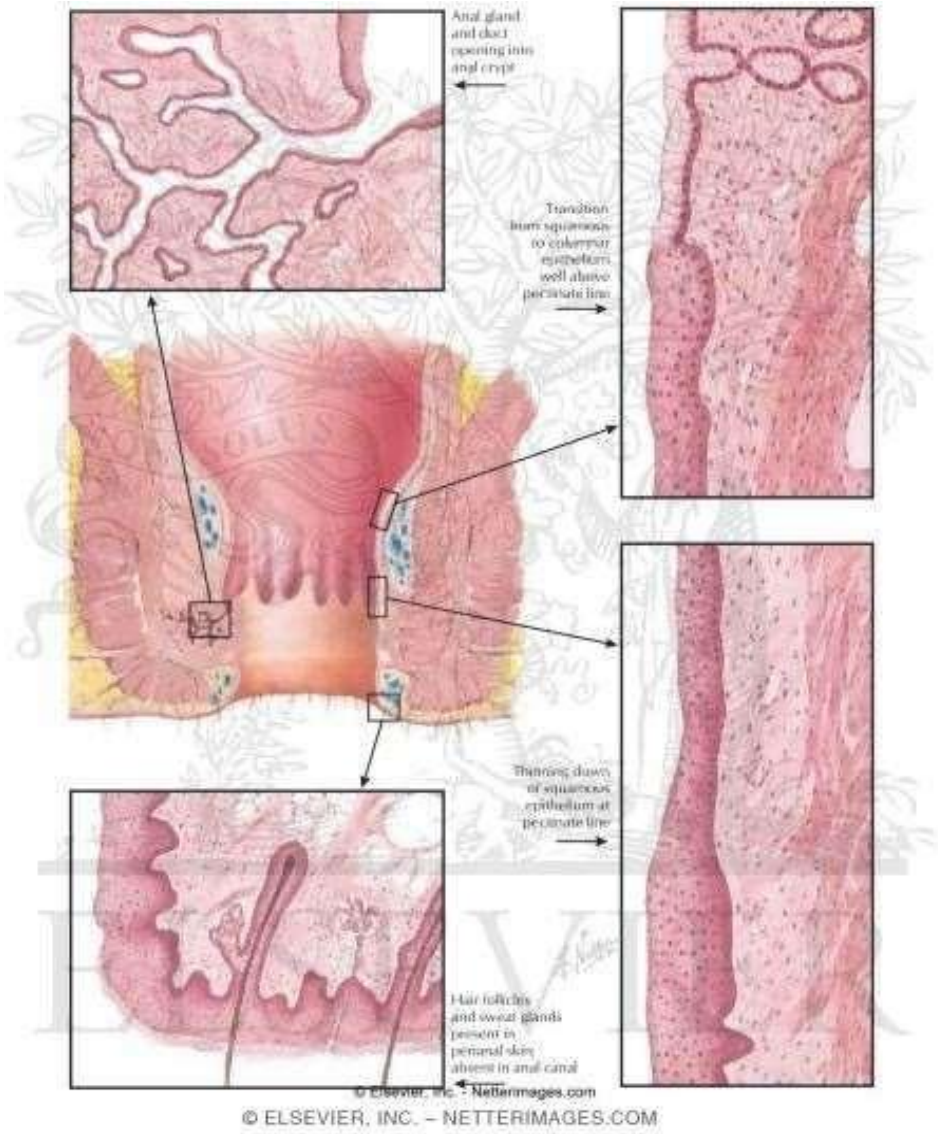
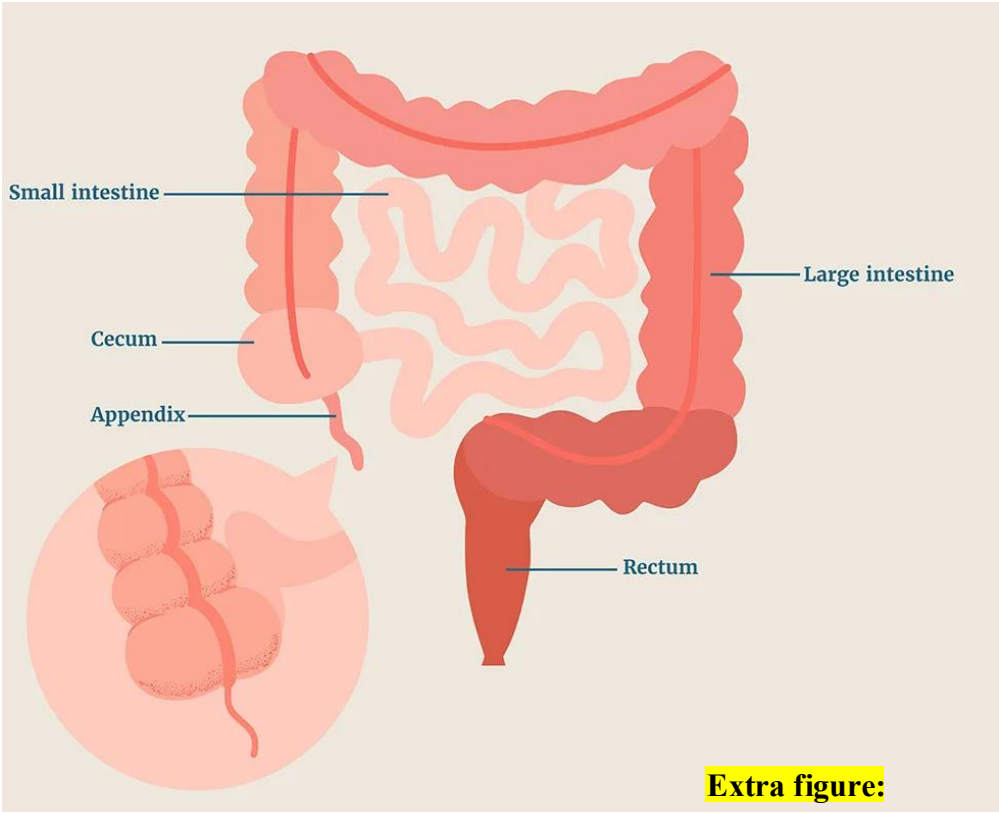


4- Histological Features of the Appendix

➢ Relate to Anatomy

- ✓ The **appendix** is an **evagination of the cecum.**
- ✓ It has a **small, narrow, and irregular** lumen, primarily due to the presence of **abundant lymphoid follicles** in its wall.
- ✓ The appendix is considered a **lymphatic organ**, similar to the **spleen**, and plays a role in **immunity** especially during early life.
- ✓ It is **entirely** covered by **serosa**, specifically the **mesoappendix** (a fold of mesentery made of two layers of peritoneum).



Extra figure:

4- Histological Features of the Appendix

➢ **Relate to Pathology**

Clinical Significance – Appendicitis:

- The **narrow lumen** of the appendix makes it prone to **obstruction**.
- **Inflammation** (appendicitis) can lead to:

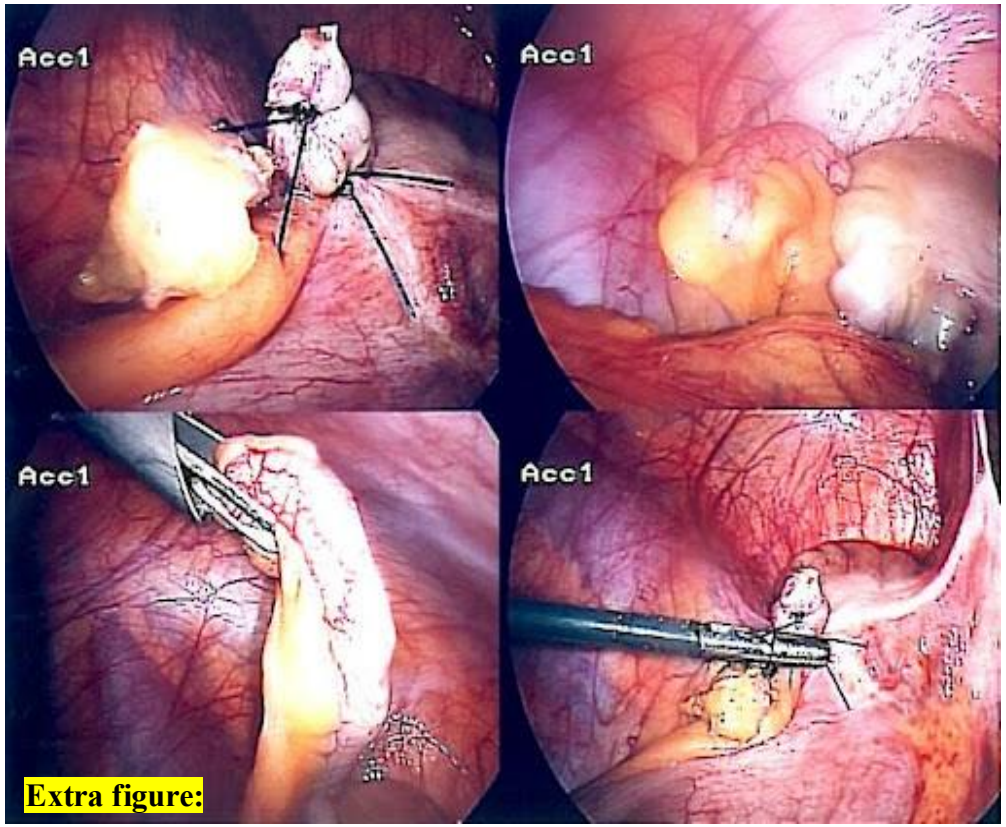
✓ **Engorgement** of blood vessels

✓ **Expansion** & **rupture**

✓ **peritonitis**

- **Treatment**:

Appendectomy is typically performed even with 50% clinical suspicion of appendicitis.



4- Histological Features of the Appendix

✓ **Epithelium:**

•Lined by **simple columnar epithelium with few goblet cells.**

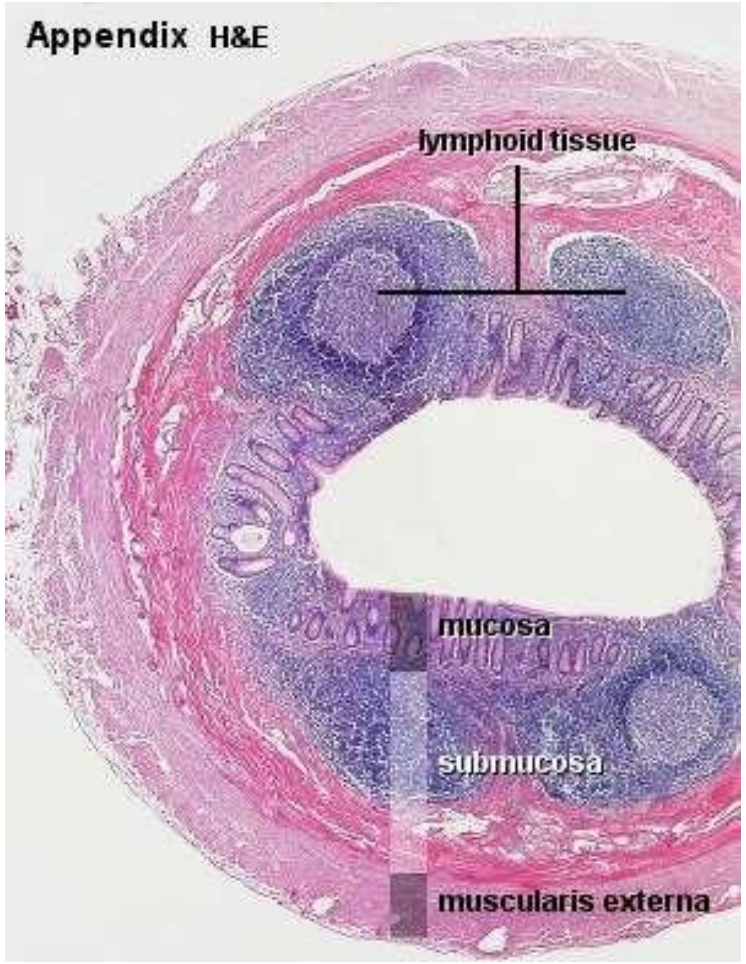
✓ **Lamina Propria and Submucosa:**

•The lamina propria is filled with **lymphatic nodules** instead of **glands**.

•These **lymphoid follicles** form a **circular layer** in the **mucosa** and **may infiltrate** the **submucosa**.

✓ **Intestinal Glands:**

•The appendix has **fewer** and **shorter intestinal glands** compared to the **large intestine**.



4- Histological Features of the Appendix

✓ **Teniae Coli**

Absent in the appendix (unlike in the rest of the colon)

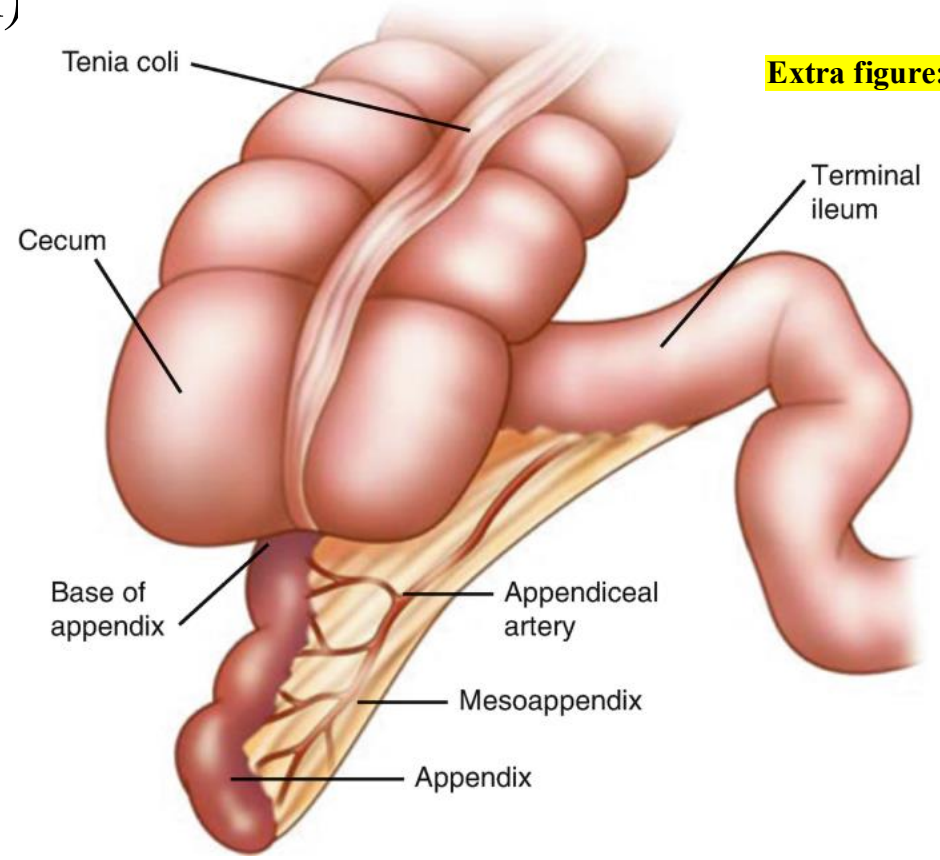
✓ **Serosal Covering:**

The appendix is completely covered by **serosa** (**mesoappendix**).

✓ **Mesoappendix Contents:**

- **Appendicular artery**
- **Appendicular vein**
- **Lymph nodes**

Extra figure:



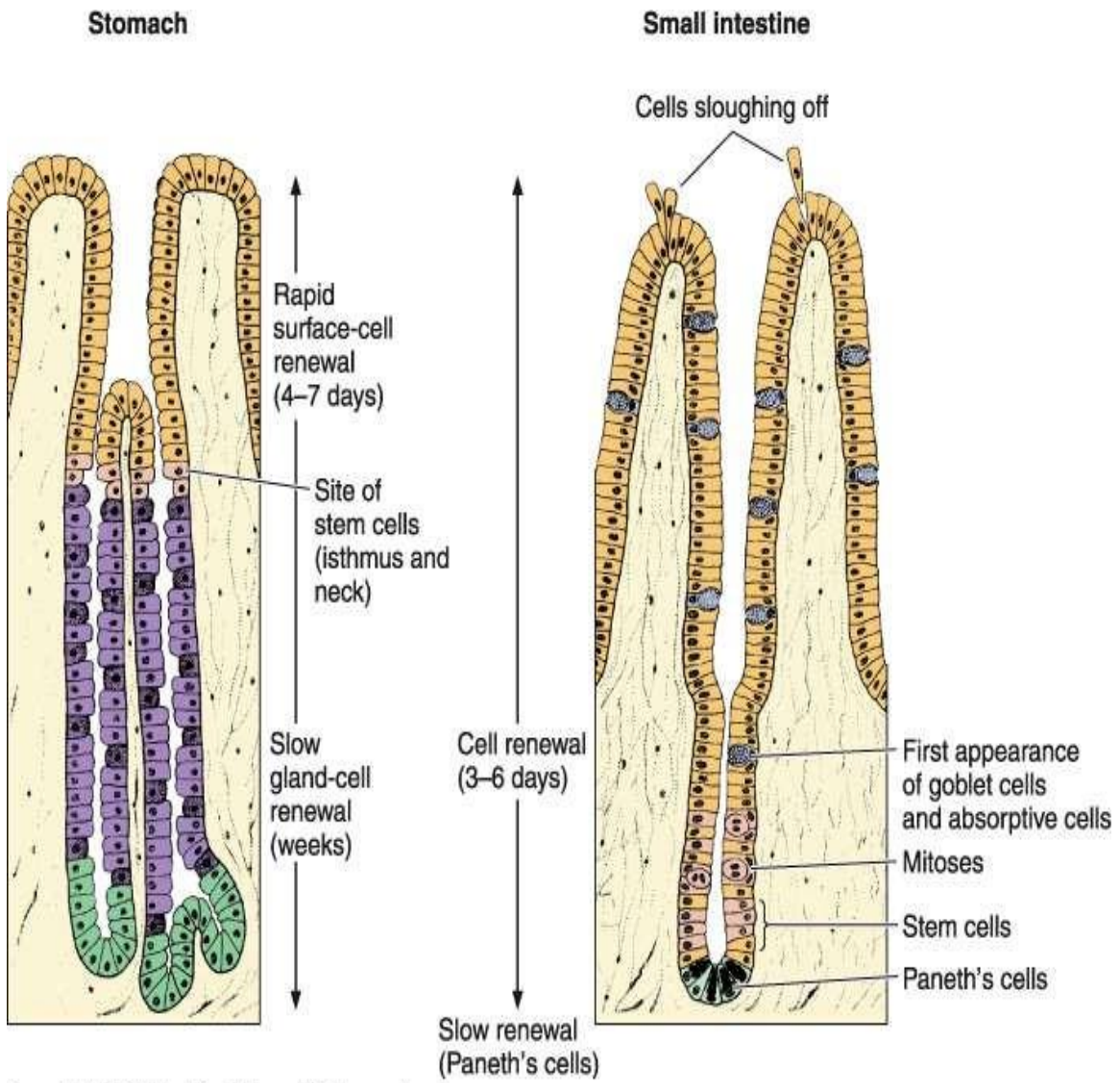
5- Cell Renewal in the (GIT)

- ✓ The **epithelial cells** of the **entire GIT** are continuously **cast off** and **replaced** by new cells.
- ✓ This renewal occurs through **mitosis of stem cells**, ensuring the functional integrity of the epithelium.

Region	**Stem Cell Location**	**Migration Direction**	**Renewal Time**
Esophagus	Basal layer of the epithelium	Upward	-
Stomach	Neck of the gastric glands	Upward to surface and downward to base	4-7 days
Small Intestine	Base of the intestinal glands	Upward	3–6 days
Large Intestine	Bottom **third** of the crypts	Upward	-

Migration direction refers to where the new cells move after they divide.

5- Cell Renewal in the (GIT)



6- Histological Features of the liver

➢ Relate to Anatomy

✓ Liver's secretions

The liver is a **mixed large gland** with both:

- **Endocrine** functions (e.g., producing albumin, clotting proteins, and growth factors)
- **Exocrine** functions (e.g., bile salt secretion)

✓ Blood Supply:

Blood sinusoids in the liver receive blood from two main sources:

- **The portal vein** (60–70%) — carries **nutrient-rich** blood.
- **The hepatic artery** (20–30%) — carries **oxygenated** blood.

This mixed blood flows through the sinusoids, where hepatocytes absorb it.

✓ Venous Drainage

•Central vein is responsible for venous drainage of hepatocytes, Waste products and blood from:

Hepatocytes

↓

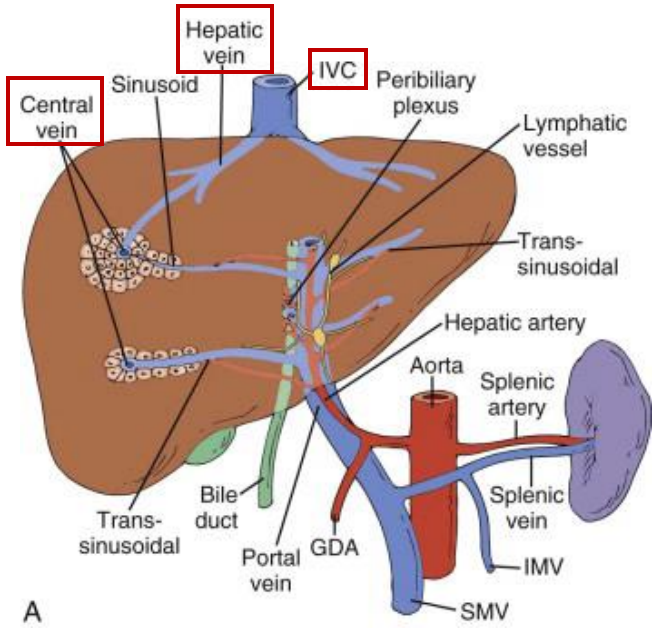
Central vein

↓

Hepatic vein

↓

Inferior vena cava



Extra figure:

7- Liver capsule & Lobule structure

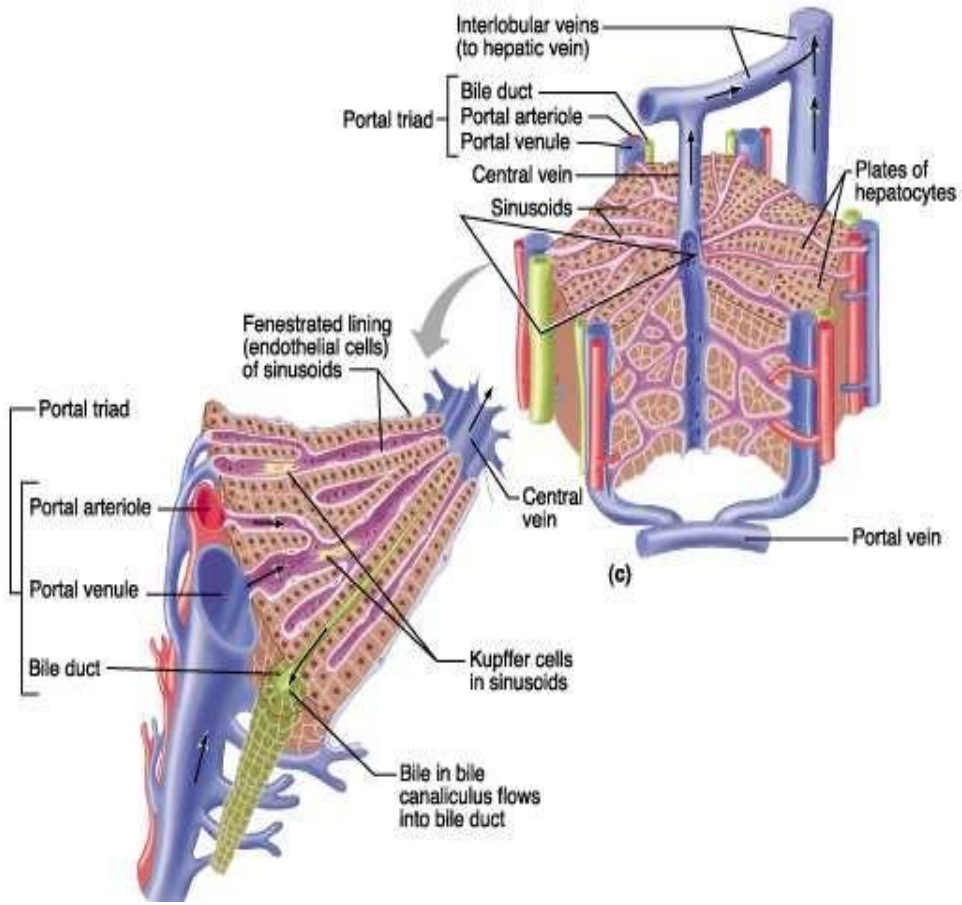
✓ Liver Capsule

- The liver is surrounded by a capsule called the **Glisson's capsule**.
- The importance of this capsule lies in it's role in **separating** and **organizing** the liver into **lobules** and **lobules.**

✓ Liver Lobule

- The liver is structurally divided into **hexagonal lobules**, sometimes described as heptahexagonal lobules due to their six-sided shape.

- A key feature of each lobule **is the arrangement of hepatocytes: Radially oriented,** extending from the **periphery** toward the **central vein.** *Refer to slide (22)*



7- Liver capsule & Lobule structure

✓ At **the edges** of the hexagonal liver lobule, there is a structure called the **portal triad.**

✓ The **portal triad** consists of:

•A branch of the **portal vein**, which acts like a **venule**.

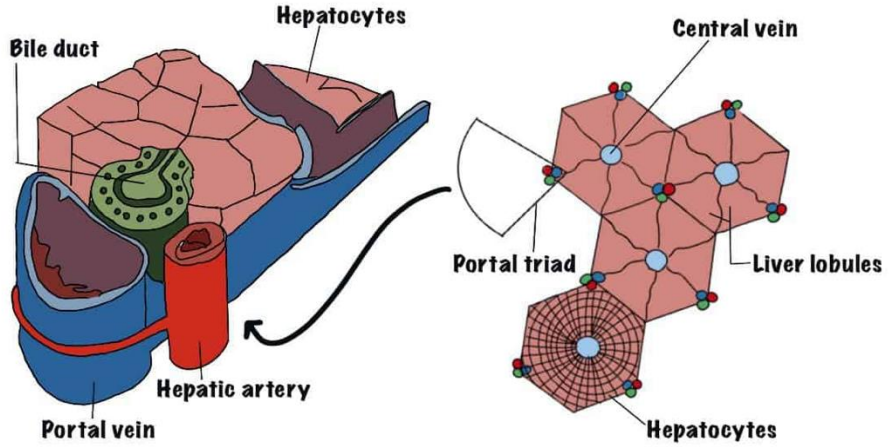
•A branch of the **hepatic artery,** which functions as an **arteriole**.

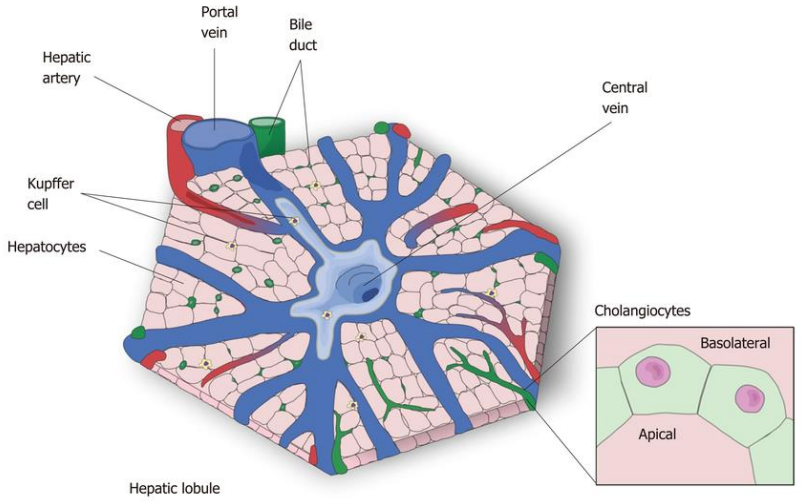
•A **bile duct** (also referred to as the **hepatic duct**).

✓ In addition to these three main components, the portal triad region also contains:

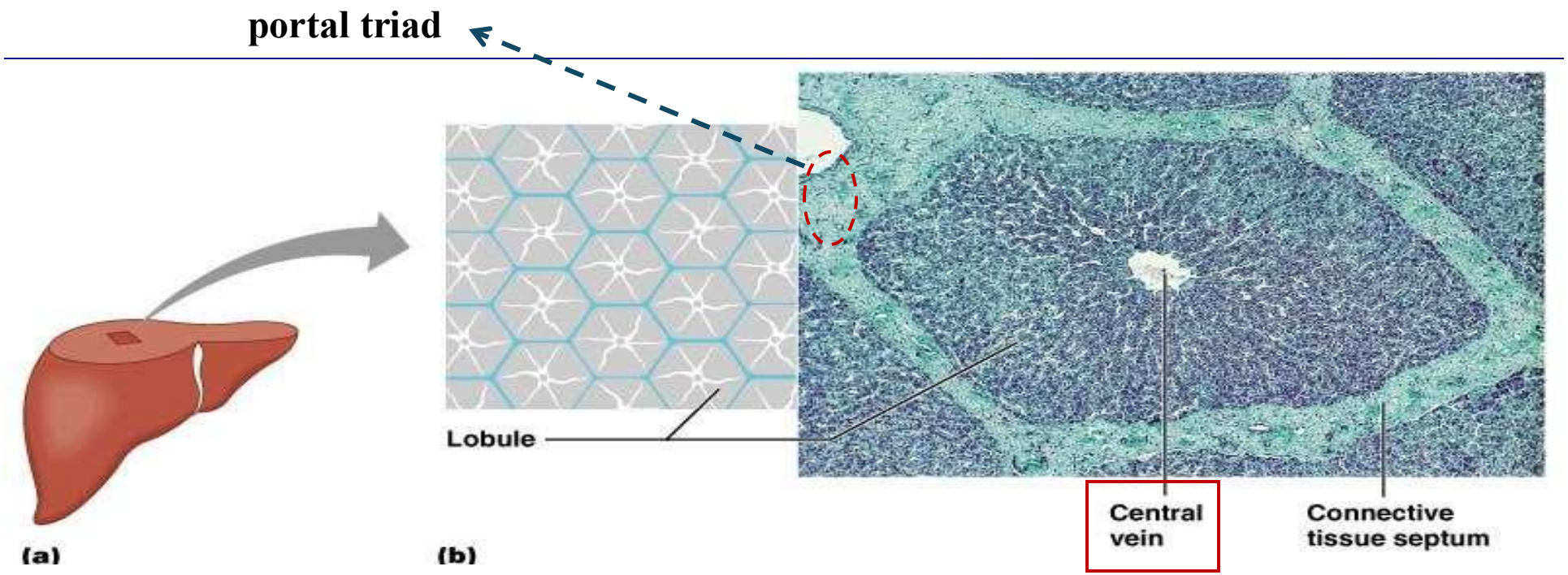
•**Reticular fibers**

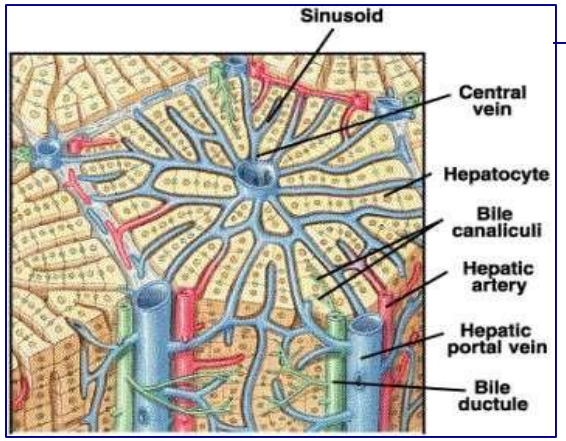
•**Lymphatic vessels**





7- Liver capsule & Lobule structure

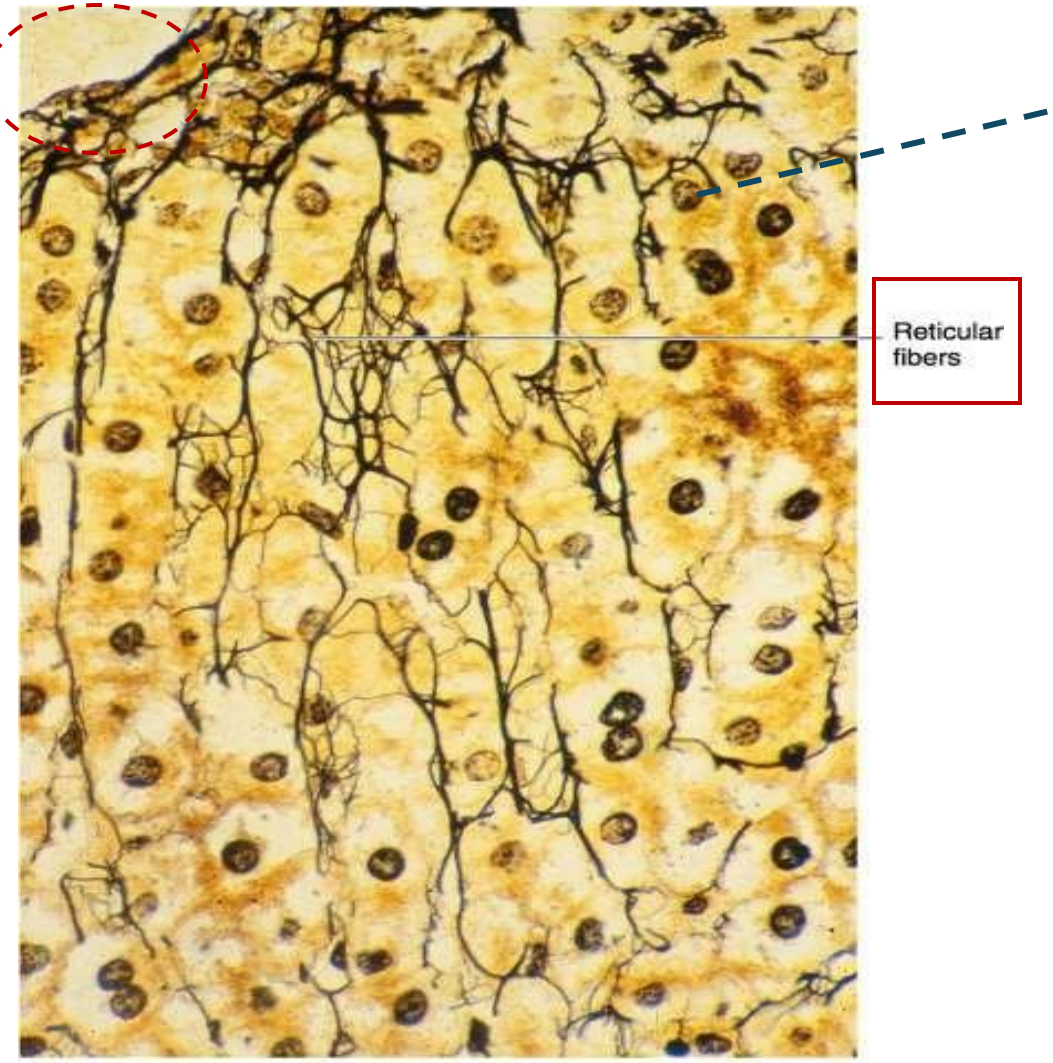




- ✓ The Glisson's capsule sends **connective tissue** extensions called **septa** into the liver parenchyma, These septa connect he **blood vessels** and other structures, such as those found in the portal triad (e.g., bile ducts, lymphatics)

7- Liver capsule & Lobule structure

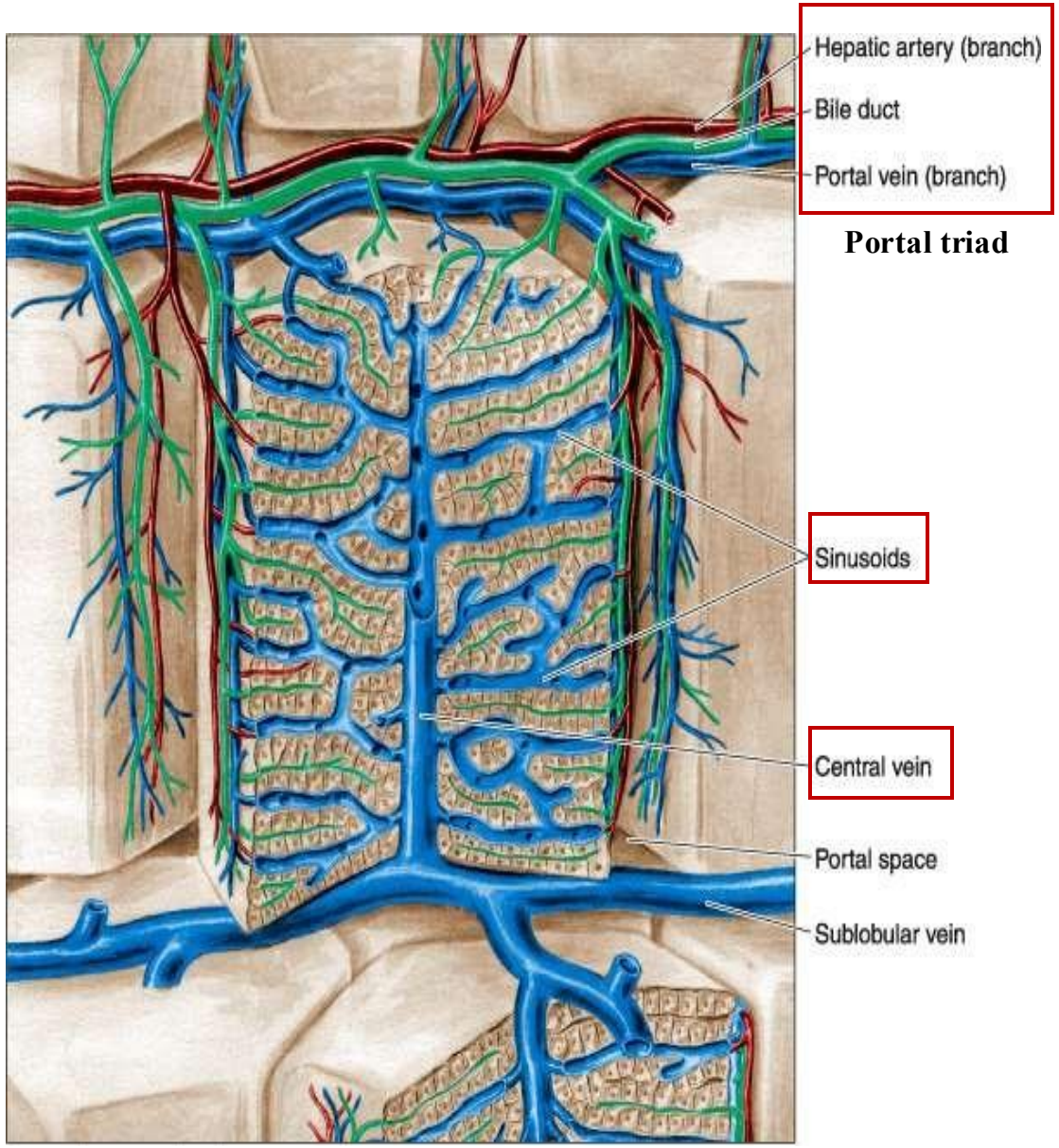
Central vein



Hepatocytes with defined rounded nucleus

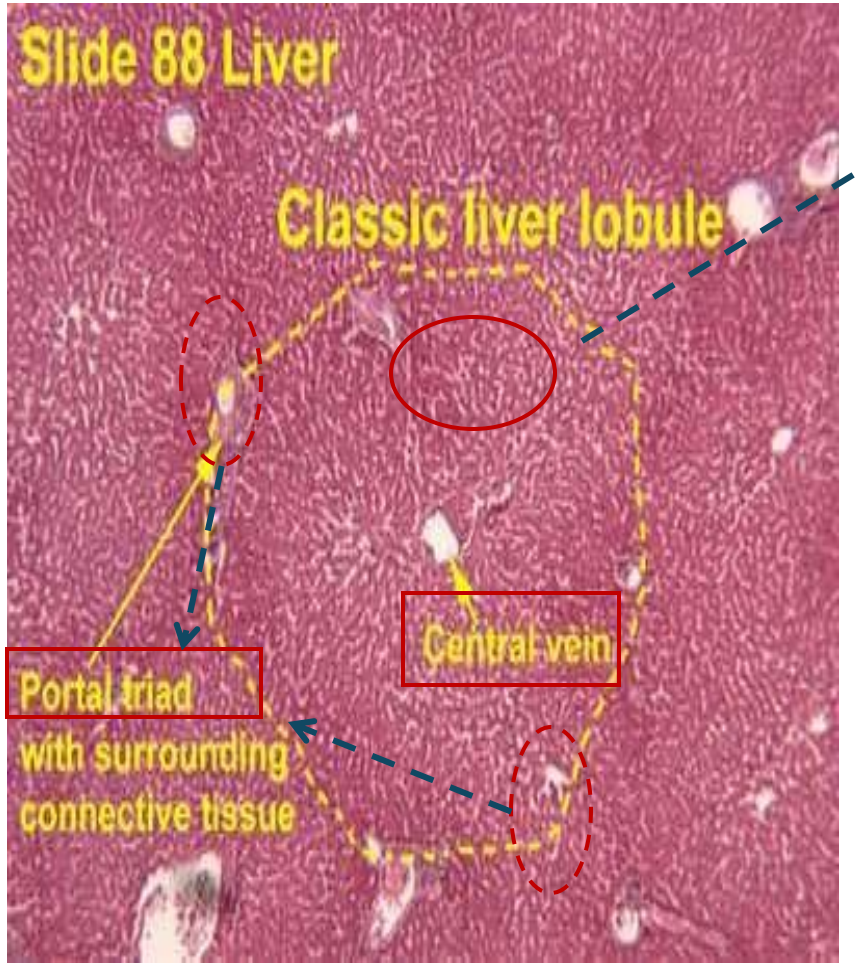
- ✓ Stroma is rich in **Reticular fibers** in which **support hepatocytes and sinusoids**

7- Liver capsule & Lobule structure



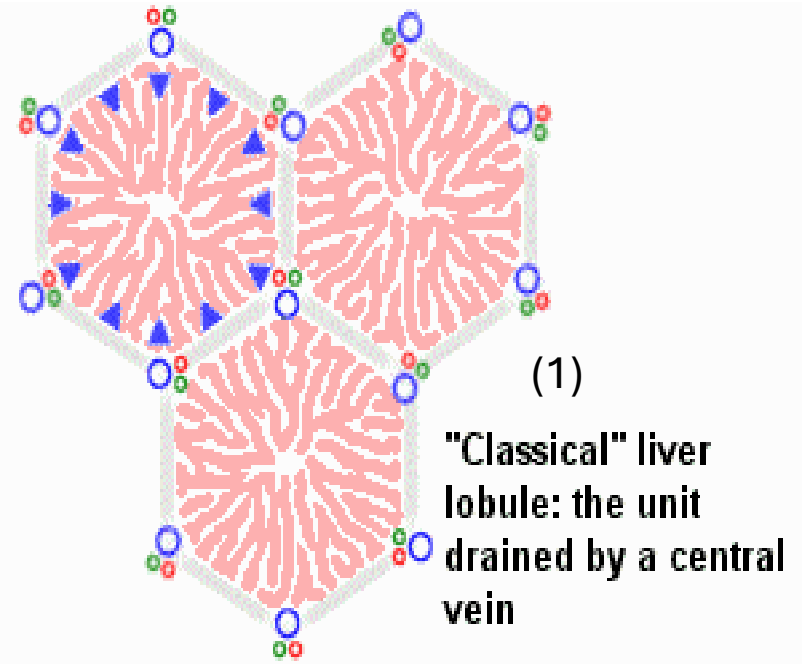
- ✓ Hepatocytes are arranged **radially**, extending from the **periphery** of the lobule toward the **central vein.**
- ✓ They are organized in **pairs** of adjacent columns of cells, between two adjacent hepatocytes, **bile is formed** and flows through structures called **bile canaliculi.**
- ✓ On the **opposite side**, blood flows through sinusoids, allowing hepatocytes to:
  - **Receive oxygen and nutrients**
  - **Support the production of bile**

7- Liver capsule & Lobule structure



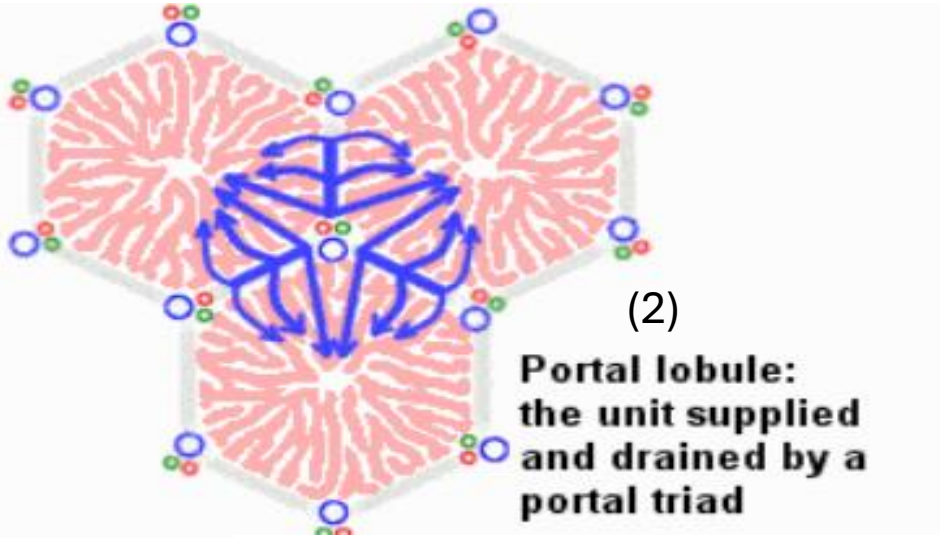
- **All are hepatocytes and the white spaces are blood sinusoids.**

7- Liver capsule & Lobule structure



(1)

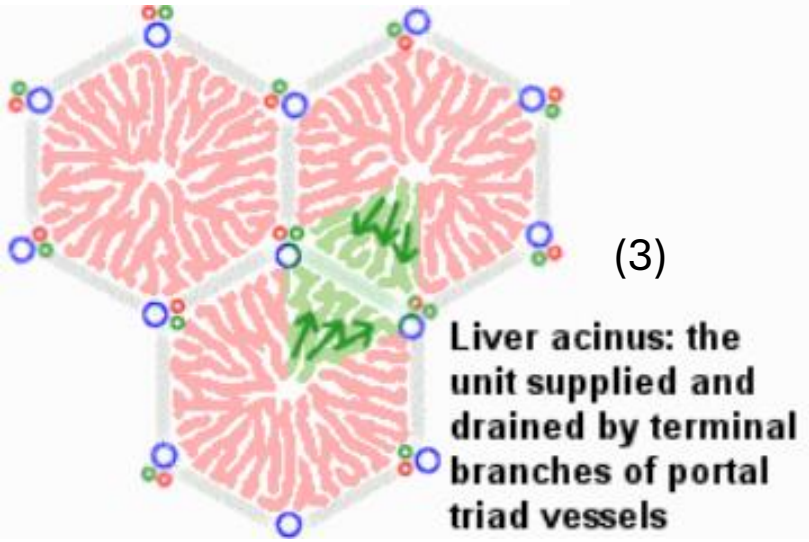
"Classical" liver lobule: the unit drained by a central vein



(2)

Portal lobule: the unit supplied and drained by a portal triad

- Includes portions of three adjacent classic lobules that drain into the same bile duct.



(3)

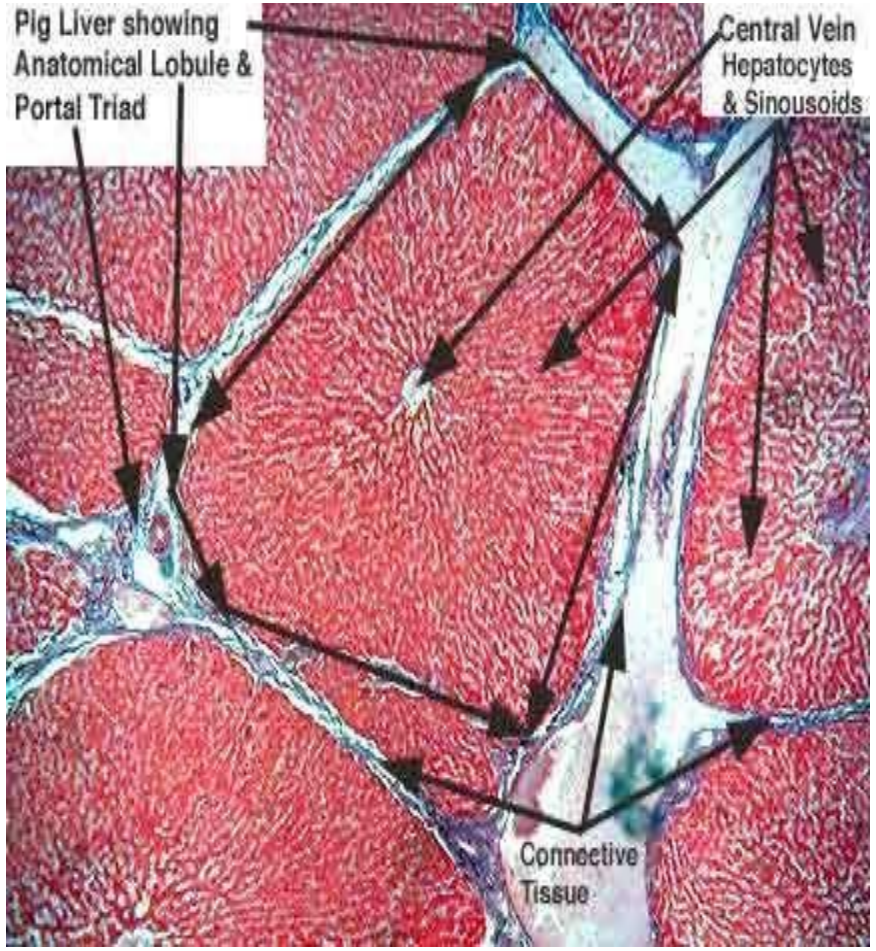
Liver acinus: the unit supplied and drained by terminal branches of portal triad vessels

- Diamond in shape between 2 central and 2 portal triads (cross access)

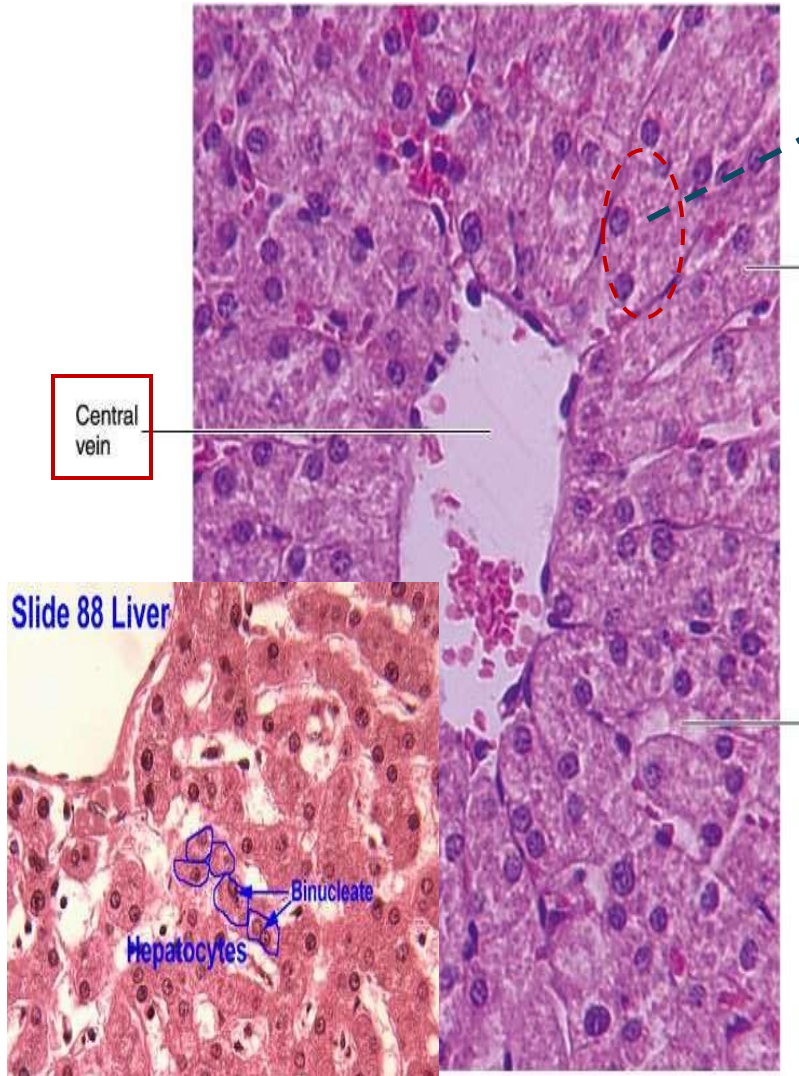
✓ **There are three types of lobules : classical , portal and acinus .**

✓ Click here

8- Hepatocytes & Sinusoids & The Space of Disse

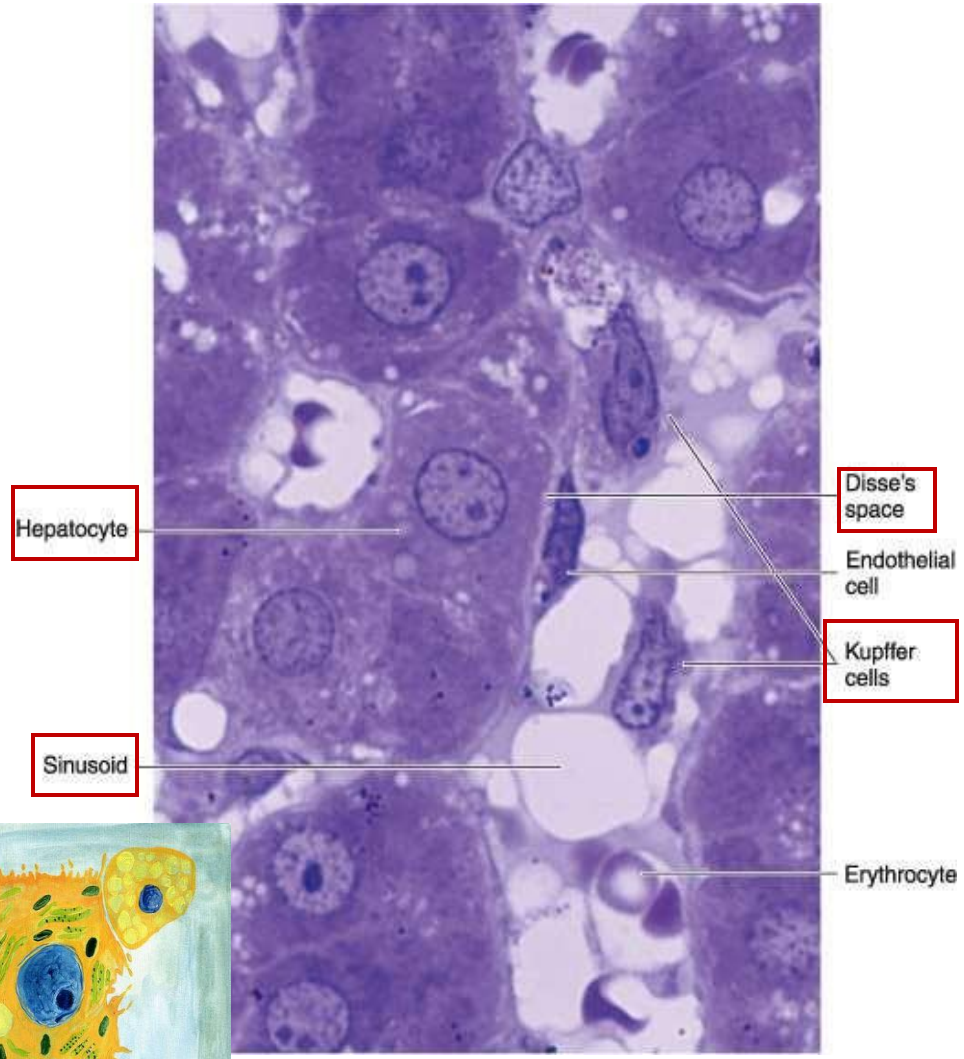


- In **animals** , the boundaries of hexagonal lobules are **well defined** unlike in **humans** where they are **ill defined**.



- **The nucleus of the hepatocyte can be binucleated**
- **White spaces → blood sinusoids → blood from the portal vein (deoxygenated) and hepatic artery (oxygenated) flows into the sinusoids, where it mixes and bathes the hepatocytes.**

8- Hepatocytes & Sinusoids & The Space of Disse



✓ **The Space of Disse** (perisinusoidal space) is a **narrow** space located between **the blood sinusoids** and **the hepatocytes**.

✓ Its **function** is to:

•**Prevent** direct contact between blood and hepatocytes.

•**Allow** only plasma and absorbable materials to enter and reach the hepatocytes.

✓ Key features:

•It does **not** contain **Kupffer cells.**

•There is **no** direct contact with **whole blood.**

✓ May **contain**:

•**Microvilli** from hepatocytes *(to increase absorption).*

•**Ito cells** *(also known as **stellate cells**)* contain vitamin A rich lipids inclusions, snd it's release retinoids.

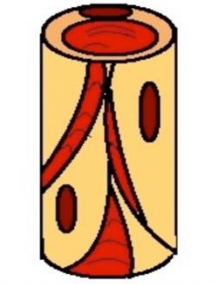
•**Reticular fibers** as supporting structures.

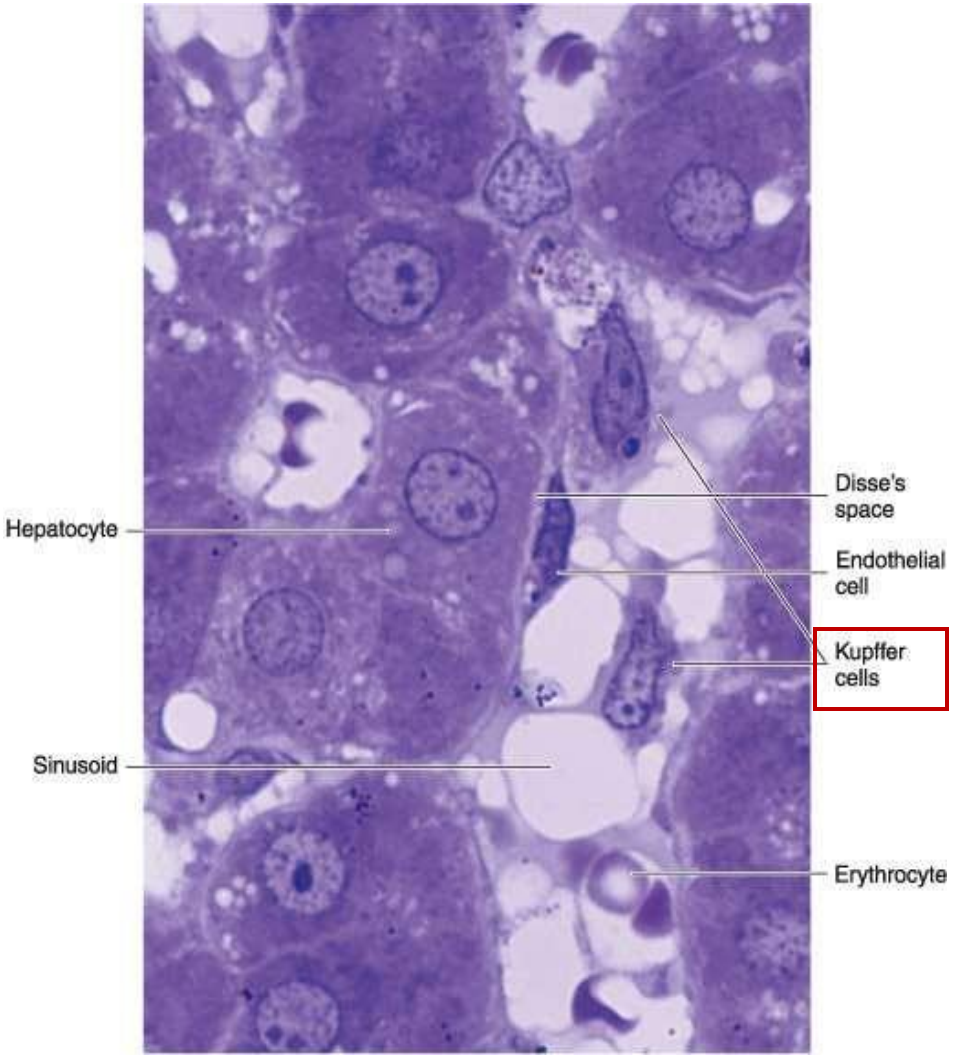
8- Hepatocytes & Sinusoids & The Space of Disse

✓ **Kupffer cells** are macrophage cells located **inside** the blood **sinusoids.**

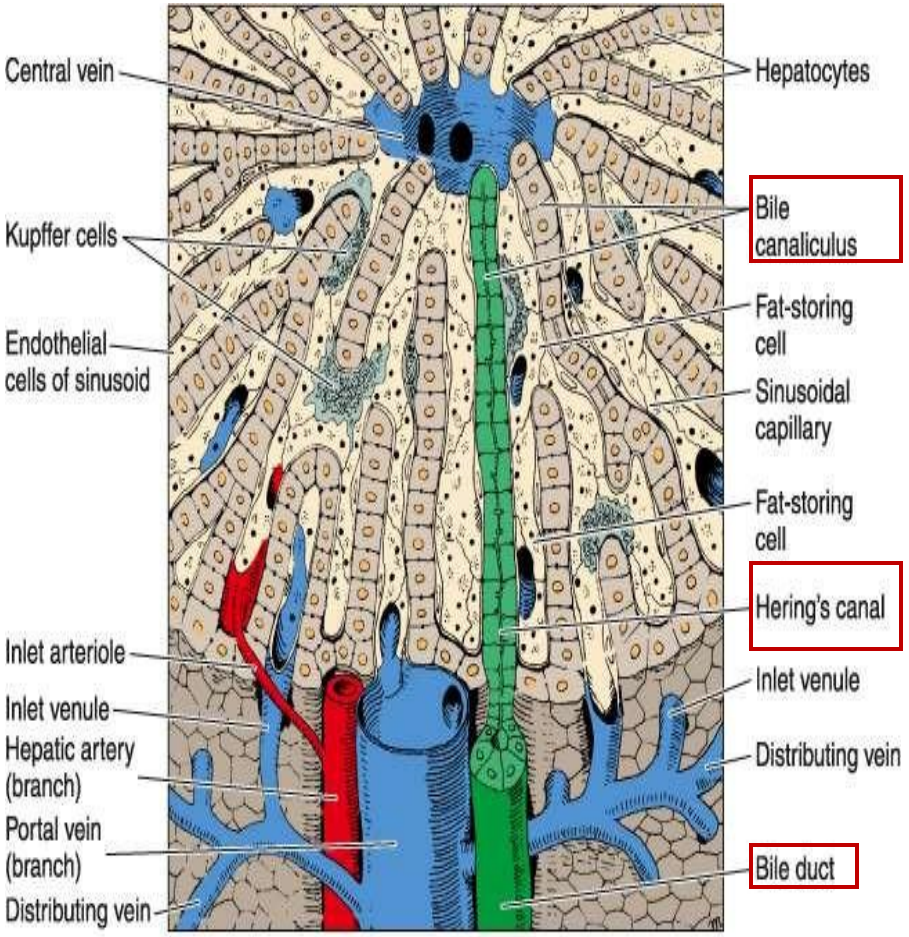
- They appear **dark** in color under the microscope.
- Functions: **Phagocytose** aged blood cells, **Recycle hemoglobin** and iron, **Clear pathogens** from the blood.

The sinusoidal capillaries:
Are **fenestrated** (contain pores) to allow plasma and nutrients to move into the Space of Disse.


Sinusoidal Capillary



8- Hepatocytes & Sinusoids & The Space of Disse



Bile Flow and Hepatic Structure

•**Bile secretion** begins in small spaces called **bile canaliculi,** located between **adjacent hepatocytes.**

•As bile flows outward, the canaliculi continue as **Hering's canals** (ductules).

•These ductules then empty into the bile ducts, which are lined by **cuboidal epithelial cells** and are located **within** the **portal triad.**

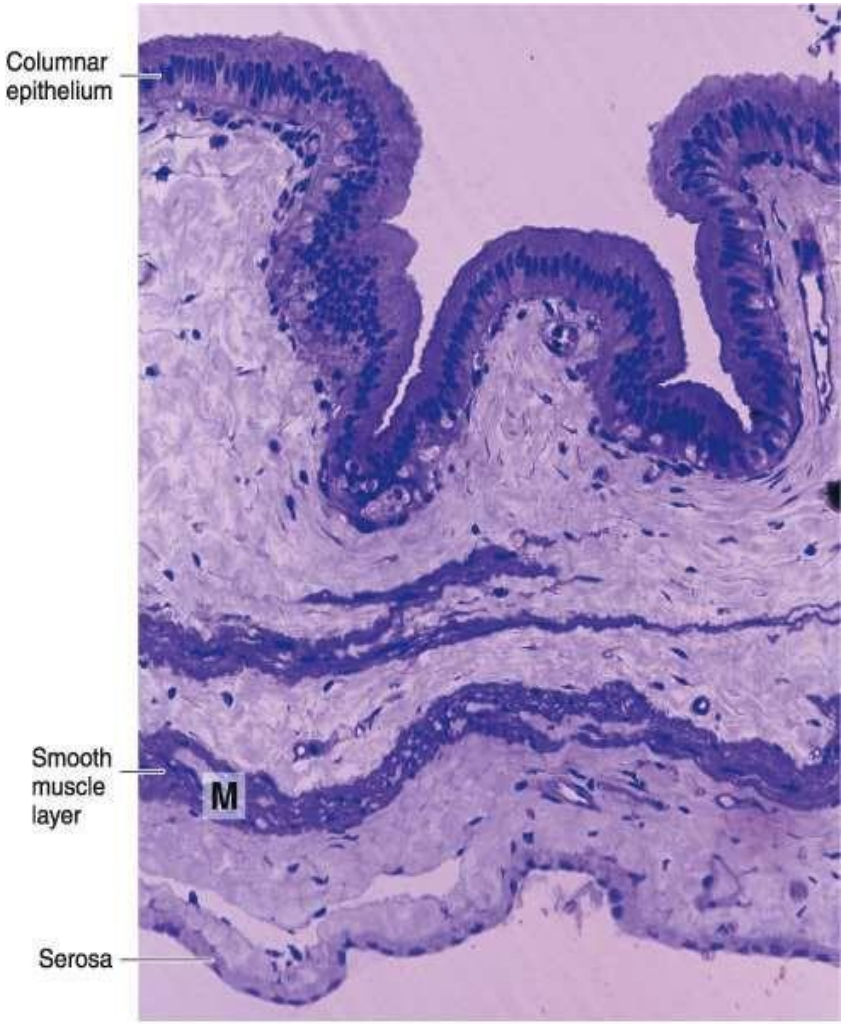
9- Histological Features of the Gallbladder

- ✓ Main role is **the concentration of bile** through water absorption.

- ✓ Capacity is approximately 30–50 mL.

- ✓ Mucosa:
- forms **abundant folds**, giving a **honeycomb** appearance.
- Lined by **simple columnar epithelium.**
- **Goblet cells** are **absent**.
- May contain **microvilli** to aid in **absorption**.

- ✓ **Muscularis mucosa** and **submucosa** are absent.



9- Histological Features of the Gallbladder

- ✓ **Muscularis externa** is made of irregularly arranged **smooth muscle fibers** (mainly **oblique**).
- **Not organized** into inner circular and outer longitudinal layers.

- ✓ **No peristaltic segmentation** occurs in the gallbladder.

- ✓ **Contraction**:

•Stimulated by **cholecystokinin** (CCK) secretion.

10- Histological Features of the Pancreas

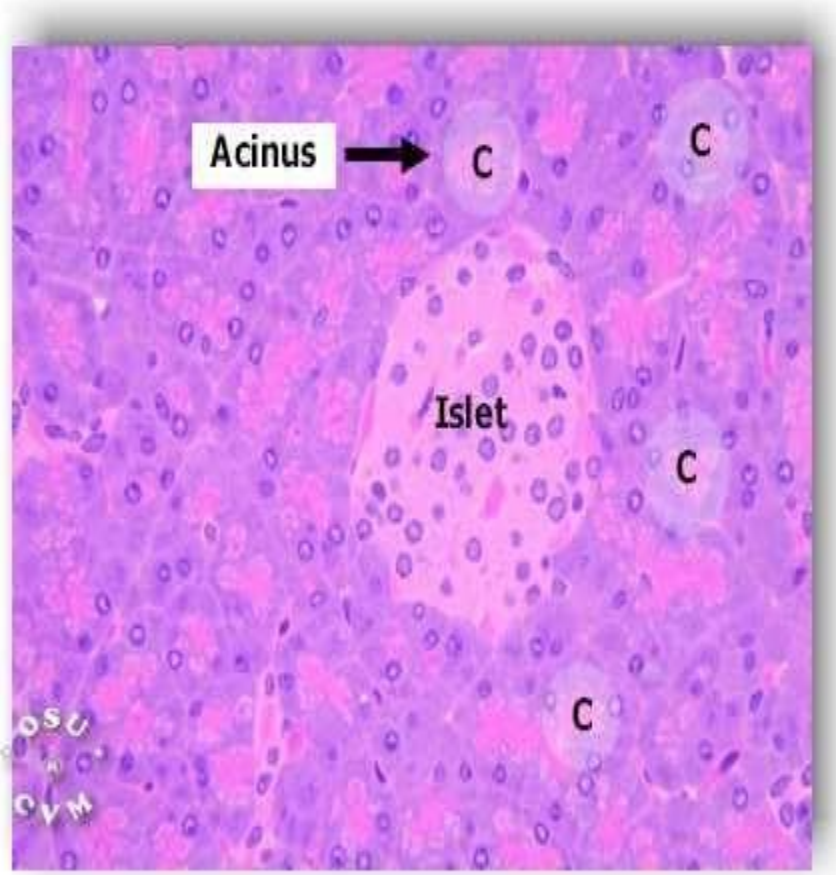
✓ The pancreas is a **mixed gland**, containing both: **Exocrine** components ,**Endocrine** components.

✓ It contains **Islet cells** which include **beta** and **alpha** cells.

✓ It also contains **pancreatic acne:**

•This refers to a group of **secretory cells** which rest on a **basement membrane and** surround a **lumen**.

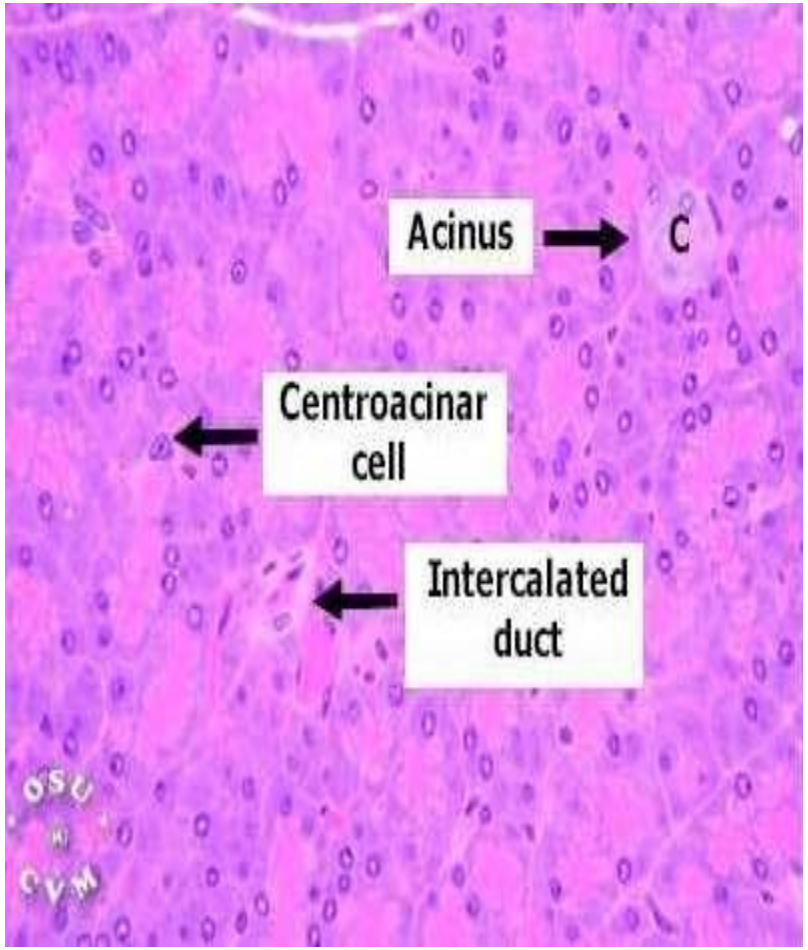
•The cells produce **pancreatic secretion** into the lumen.

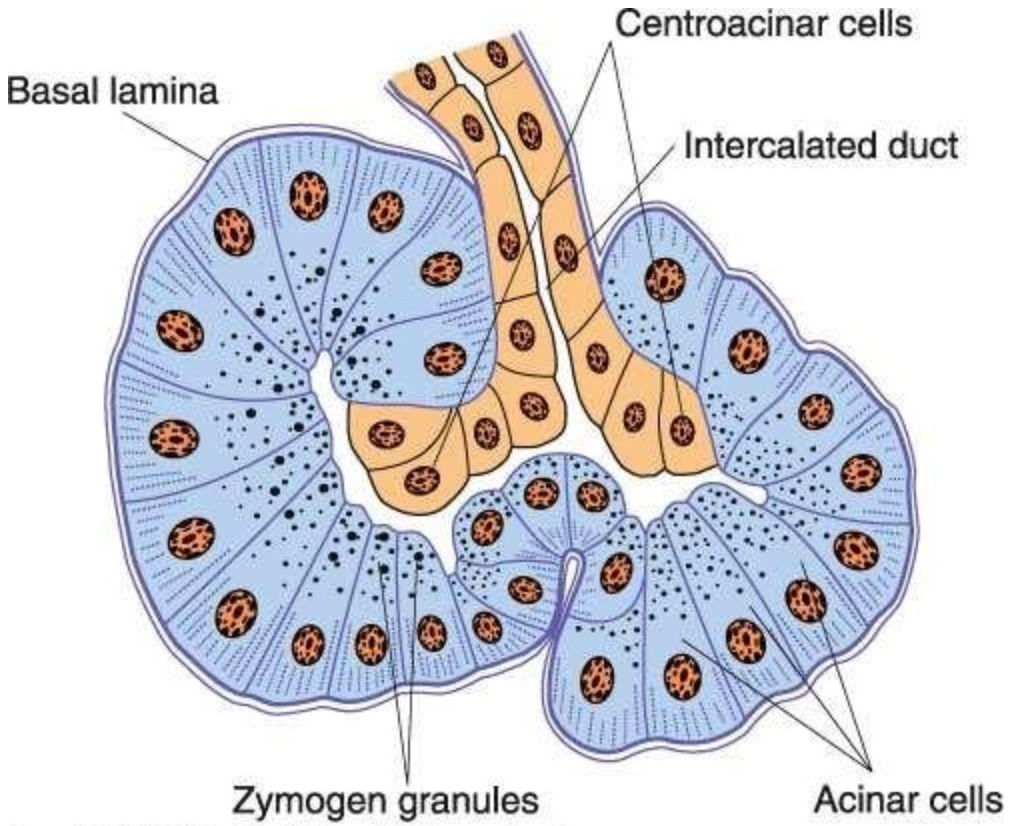


11- Differences between the parotid & the pancreas

Parotid	Pancreas
Series of acini	Series of acini
Intercalated duct	Intercalated duct **with centroacinar cells** (cuboidal cells)
Striated duct	**No** striated duct
Acini **not** polarized	Acini **have** polarity (zymogen granules at apex)
Secretion enzymes not prominent	Secretion enzymes as zymogen granules

✓ **Polarity** : secretions (enzymes) are found as granules **(zymogen granules)** in the apex of cells.





- ✓ **Pancreatic secretions** are drained through a ductal system that begins with **intercalated ducts** containing centroacinar cells. These ducts merge into **interlobular**, then **interlobar ducts,** and finally empty into the main **pancreatic duct.**

- ✓ Unlike **salivary glands,** the pancreatic ductal system **does not contain striated ducts**

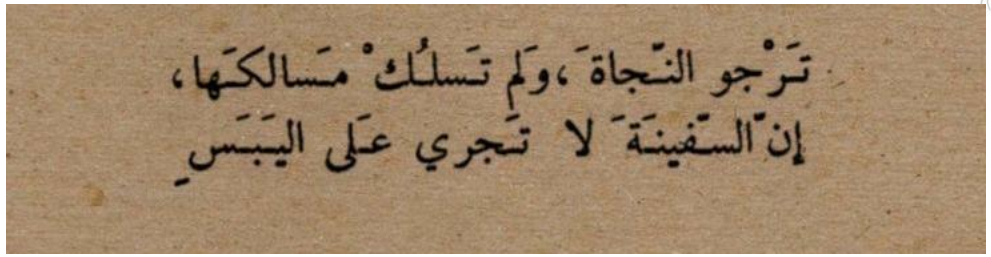
For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	25	**White spaces → blood sinusoids….**	**More clarification**
V1 → V2	15 31	7-10 days Isolate	4-7 days Islet

Additional Resources:

رسالة من الفريق العلمي:



العداوة مع اليهود قائمة منذ زمن بعيد، فهم قتلة الأنبياء، هم الذين نقضوا عهدهم في زمن الرسول عليه الصلاة والسلام والقصص معروفة في السيرة، ولا سبيل لطرد هؤلاء من بلاد المسلمين إلا أن نعود لديننا حق العودة فبه قوتنا وتوفيق الله لنا للنيل من هؤلاء الذين لم يدخروا سلاحًا ولا سبيلًا لقتل إخواننا، وفقنا الله لما يحبه ويرضاه ورزقنا رؤية تحرير البلاد الإسلامية من سطوة هؤلاء، إنه على ما يشاء قدير.

ادعوا لي بالهداية وتيسير الأمور...