

HISTOLOGY

- BY: CHILL MEDICOS



1. Histology of stomach

⇒ J-shape, Hollow organ

⇒ Present b/w esophagus & Duodenum

⇒ 4 layers

① Mucosa

→ simple columnar epith. (gastric pit)
→ Lamina propria → connective tissue
→ blood vessels
→ pyloric gland
→ Muscularis mucosae → Layer of smooth layer

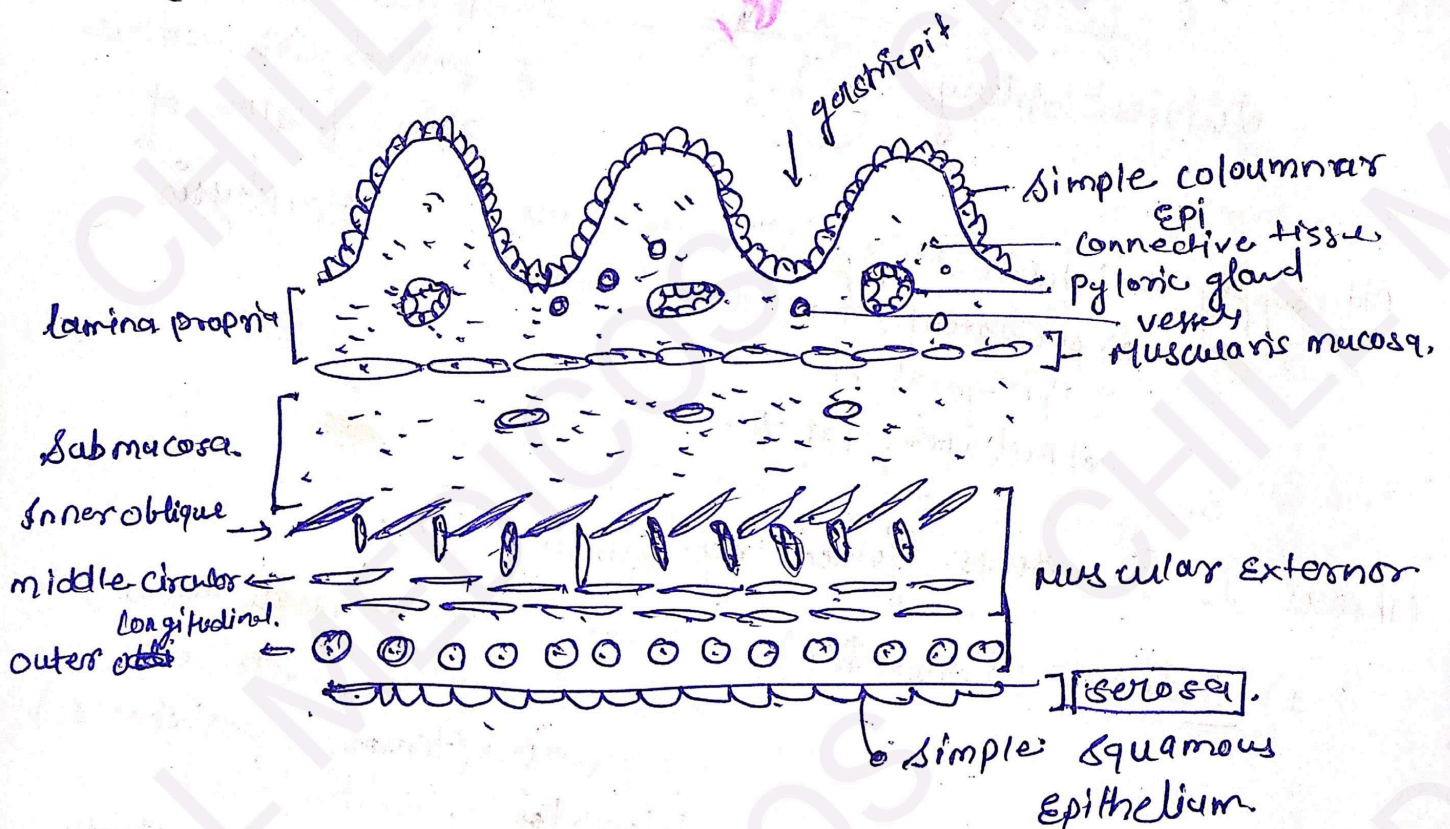
② Submucosa → connective tissue + Blood vessels.

③ Muscular coat / muscular externa.

→ Inner oblique
→ middle circular
→ outer longitudinal.

④ Serosa:-
(cover peritoneum)

Simple Squamous Epithelium.



2. Histology of Duodenum

- ⇒ 1st segment of small intestine
- ⇒ small, shortest, widest and fixed part
- ⇒ Approx 25cm length. (10 inch)
- ⇒ pyloric part → duodenojejunal flexure.
- ⇒ 4-layers

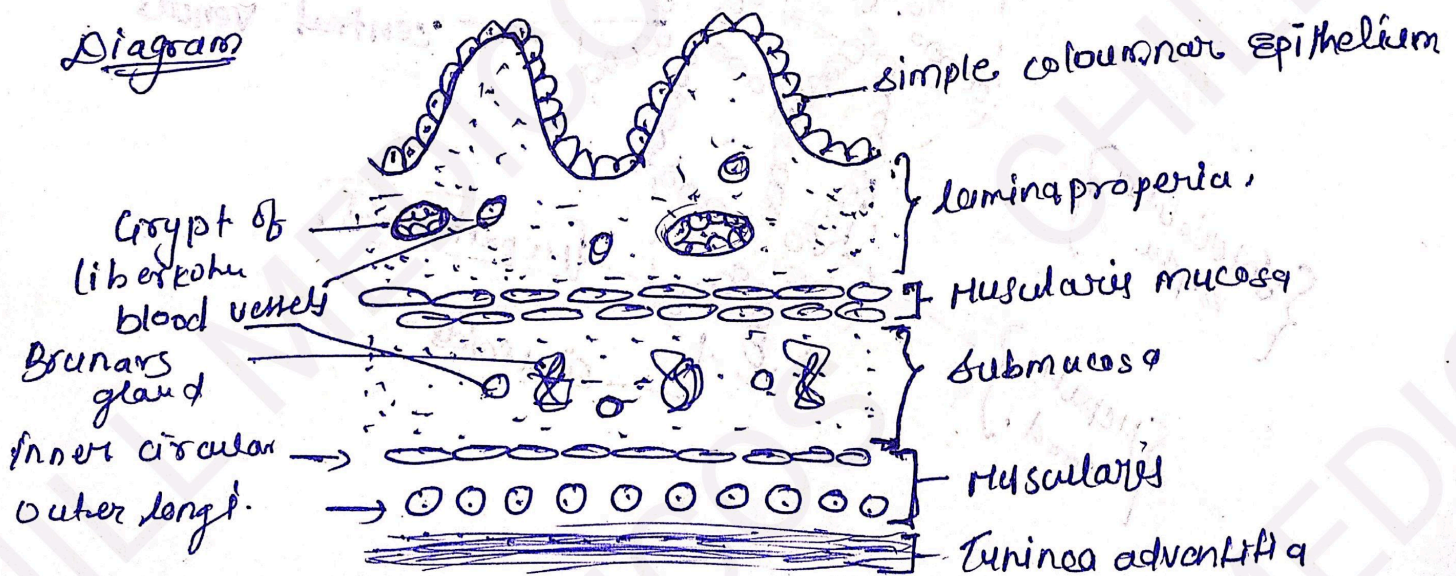
① Mucosa ⇒ modified like finger projection or villi
└─> simple columnar epi
└─> lamina propria ⇒ crypt of Lieberkuhn:
Connective tissue + Blood vessel
└─> Muscularis mucosa ⇒ smooth muscle layer (1, 2, 3)

② Submucosa ⇒ Bruner's gland (identification)

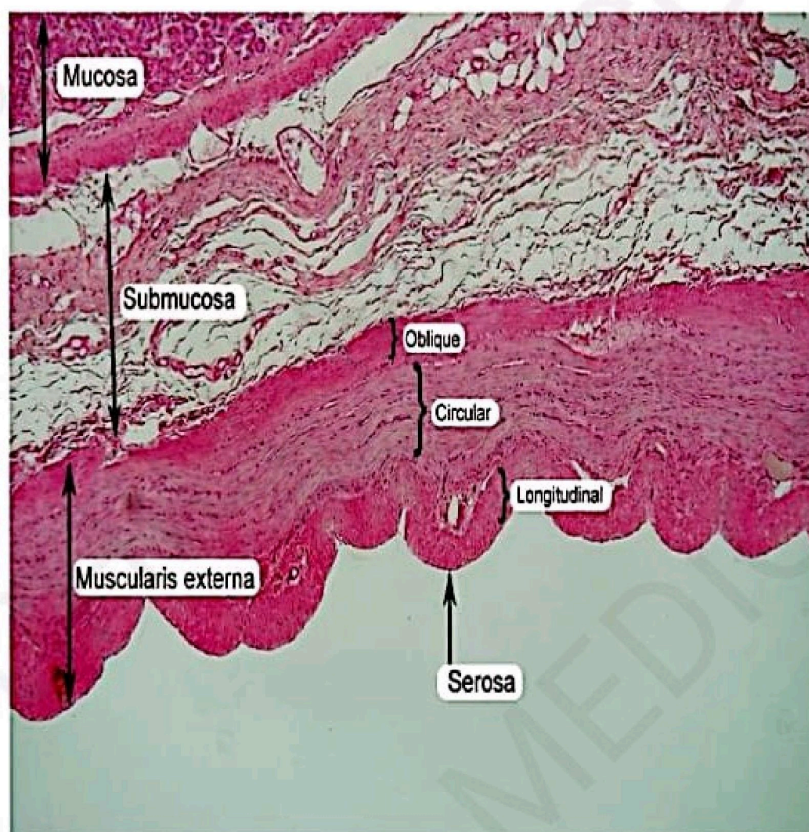
③ Muscular coat / Muscular externa
└─> inner circularis
└─> outer longitudinal

④ Adventitia / Serosa
└─> peritonium
No, peritonium

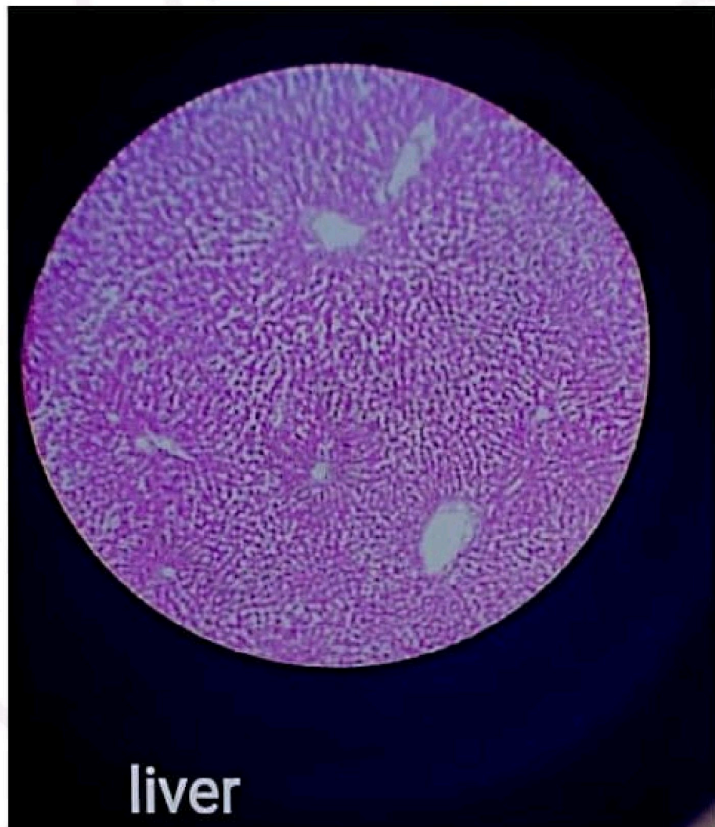
Diagram



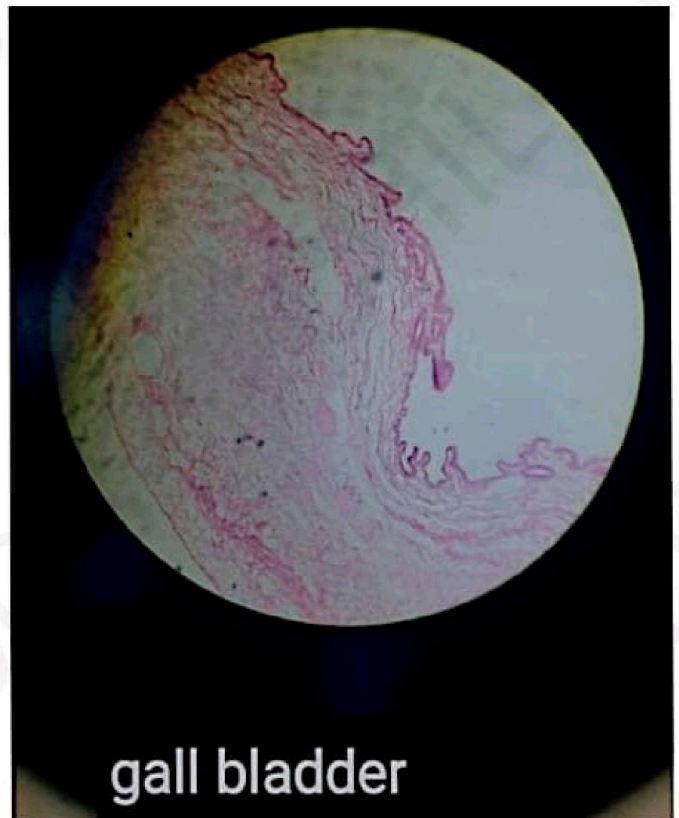
Stomach



duodenum



liver



gall bladder

③ Histology of liver

- ⇒ largest exocrine gland. → enzyme Release
- ⇒ covered by connective tissue.

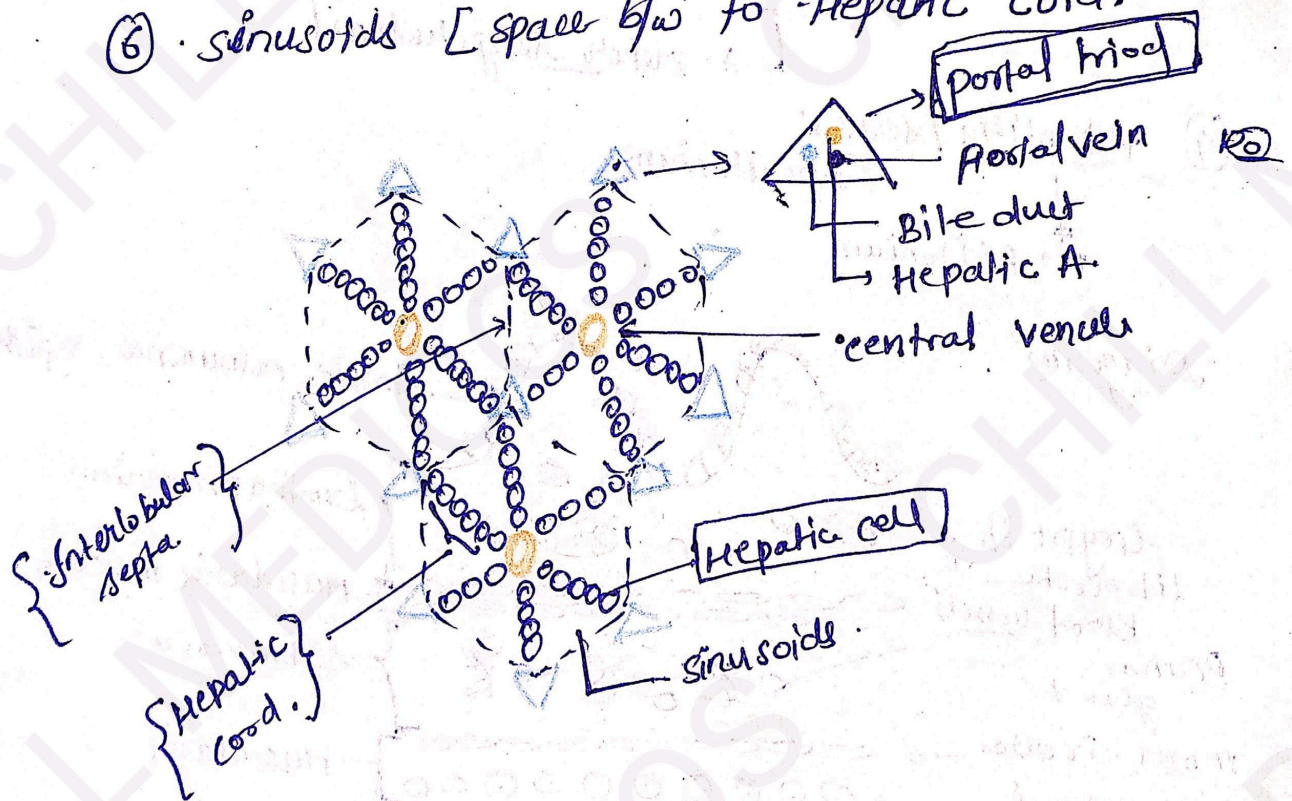
Histology

- 1) Hepatic lobules [hexagonal] functional unit
- 2) central venule (center)
- 3) portal triad
 - ↳ Hepatic A. & its branches
 - ↳ portal vein & its branches
 - ↳ Bile duct
 - [Anterior → posterior]
 - Duct → Artery → vein.

④ Hepatocytes / hepatic cells.

⑤ Hepatic cord.

⑥ sinusoids [space b/w to hepatic cord.]



4. Histology of Gall bladder (Xtra submucosa)

⇒ small pouch & exocrine gland - Enzyme

muscularis
mucosa

Location ⇒ RT lobe of liver.
Inferior surface

⇒ store & concentrate Bile.

Histology :-

1) Mucosa ⇒ mucosal fold {honeycomb}

→ simple columnar epithelium

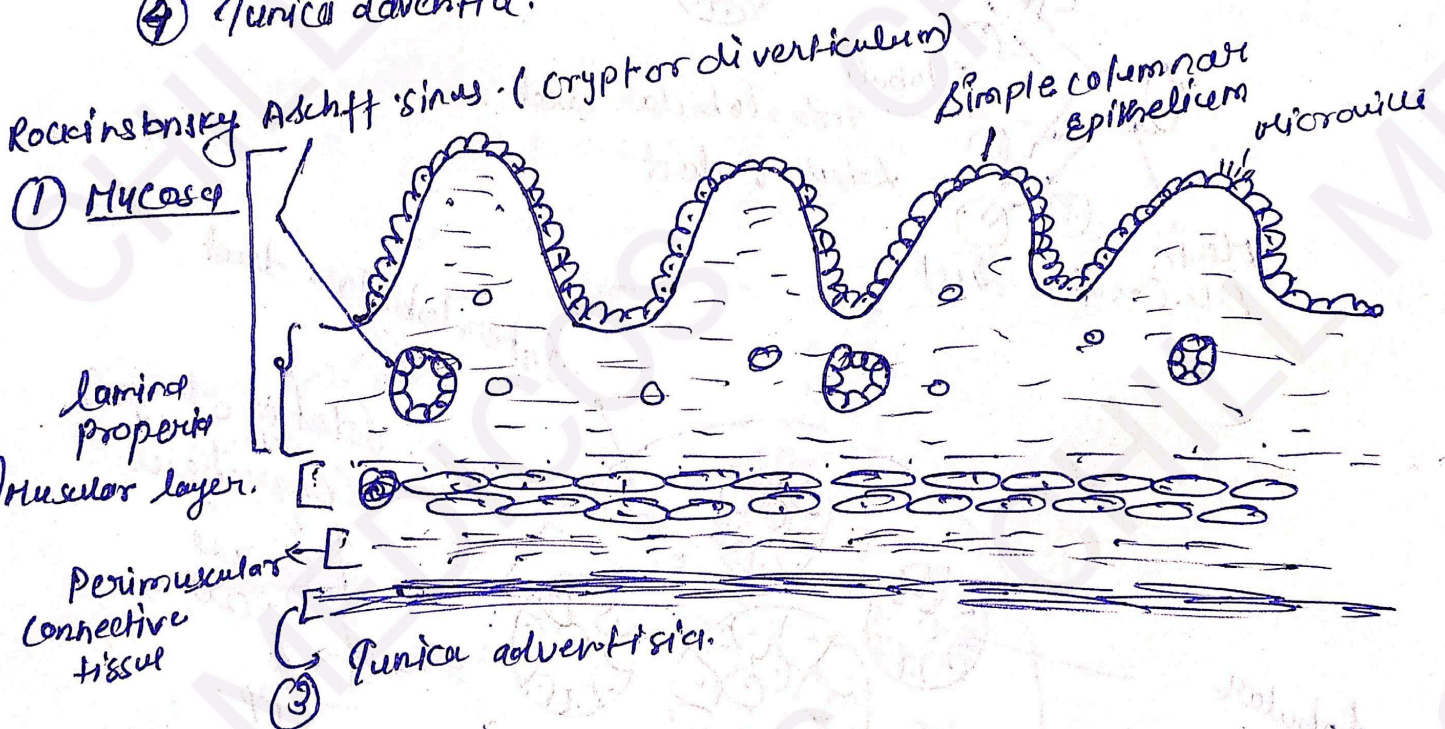
→ lamina propria → connective tissue + blood vessels
+ Rockin's glands
→ Aschoff's sinus (mucous secret)

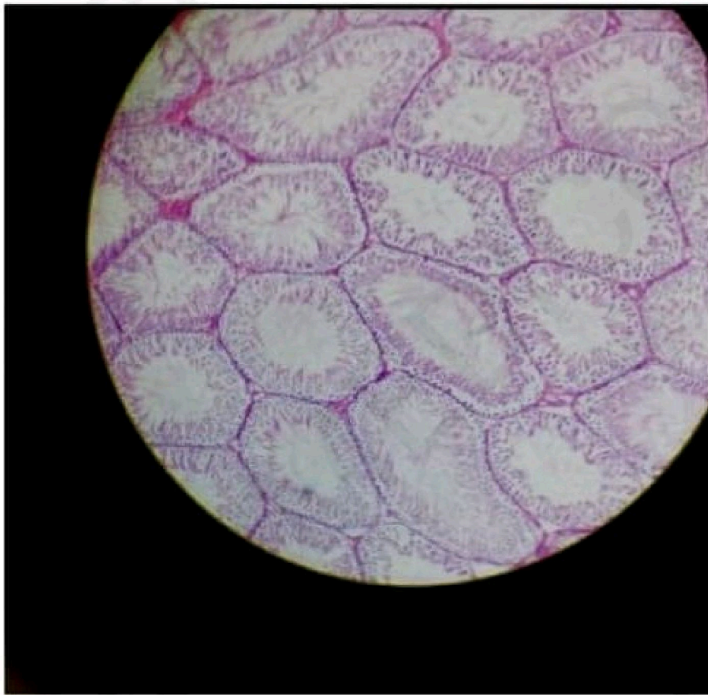
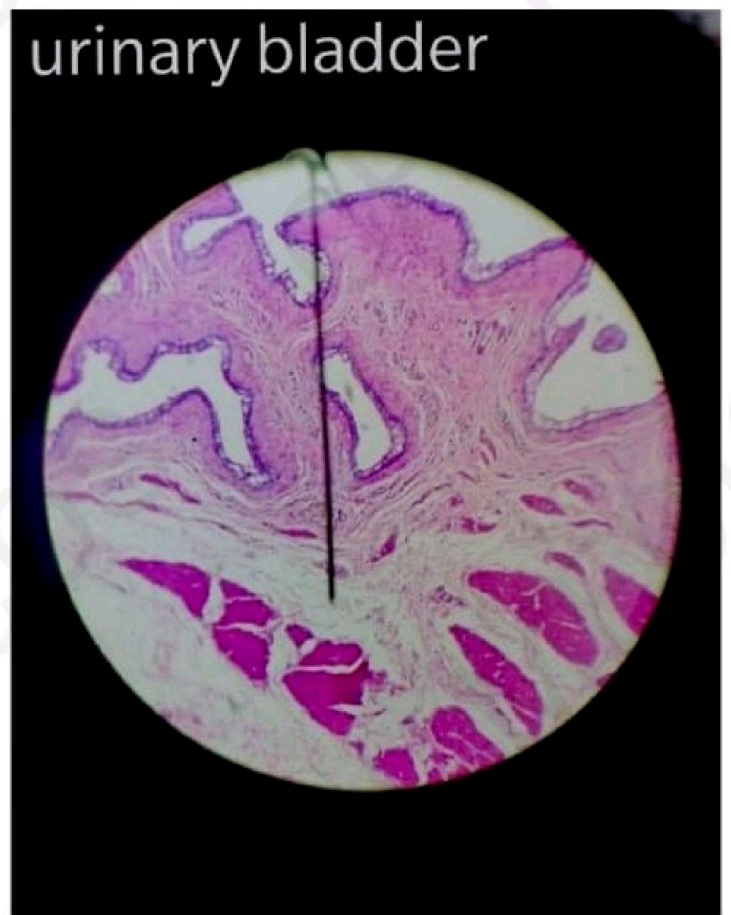
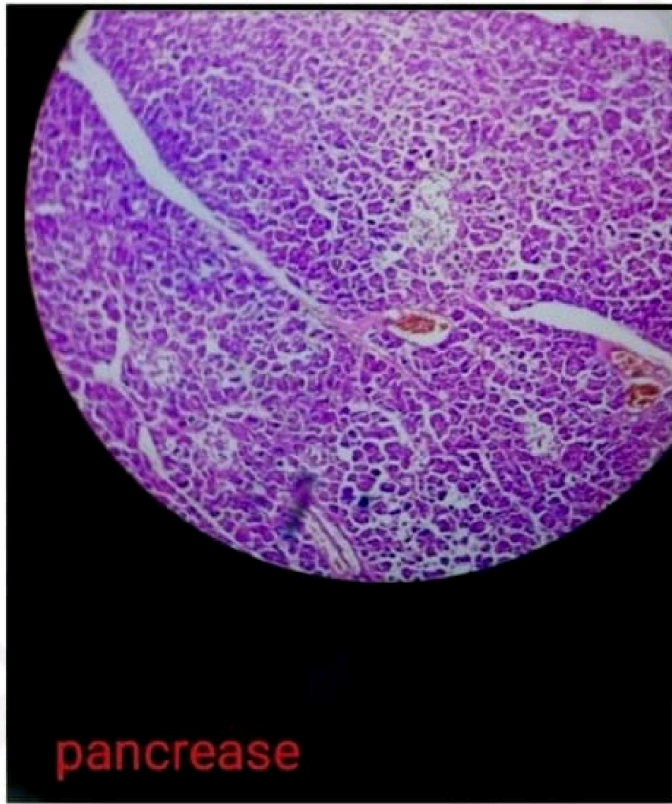
2) Submucosa

② Muscularis externa ⇒ circular smooth muscle layer.

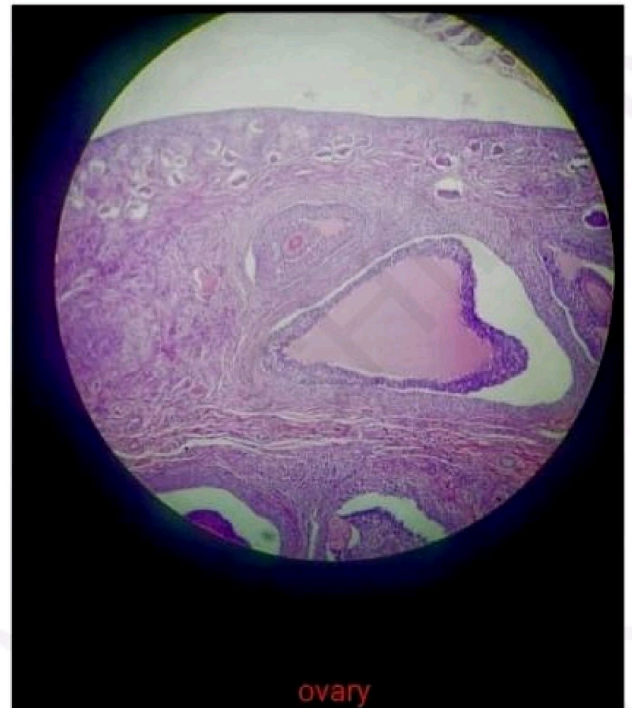
③ → perimuscular connective tissue

④ Tunica adventitia.





Testes



⑦ Histology of testes

⇒ Male reproductive organ

⇒ Location ⇒ Extra Abdominal Region
↳ Scrotum

⇒ Shape ⇒ oval shape & 1 pair

⇒ production of sperm.

Histology

1.) Tunica vaginalis (outer) ⇒ Double layer serous sac
parietal & visceral

2.) Tunica albuginea (middle) ⇒ fibro-connective tissue
↳ testicular lobules = 200-250

3.) Tunica vasculosa (inner) ⇒ highly vascular layer

1 Testicular lobule = 2-3 seminiferous tubules

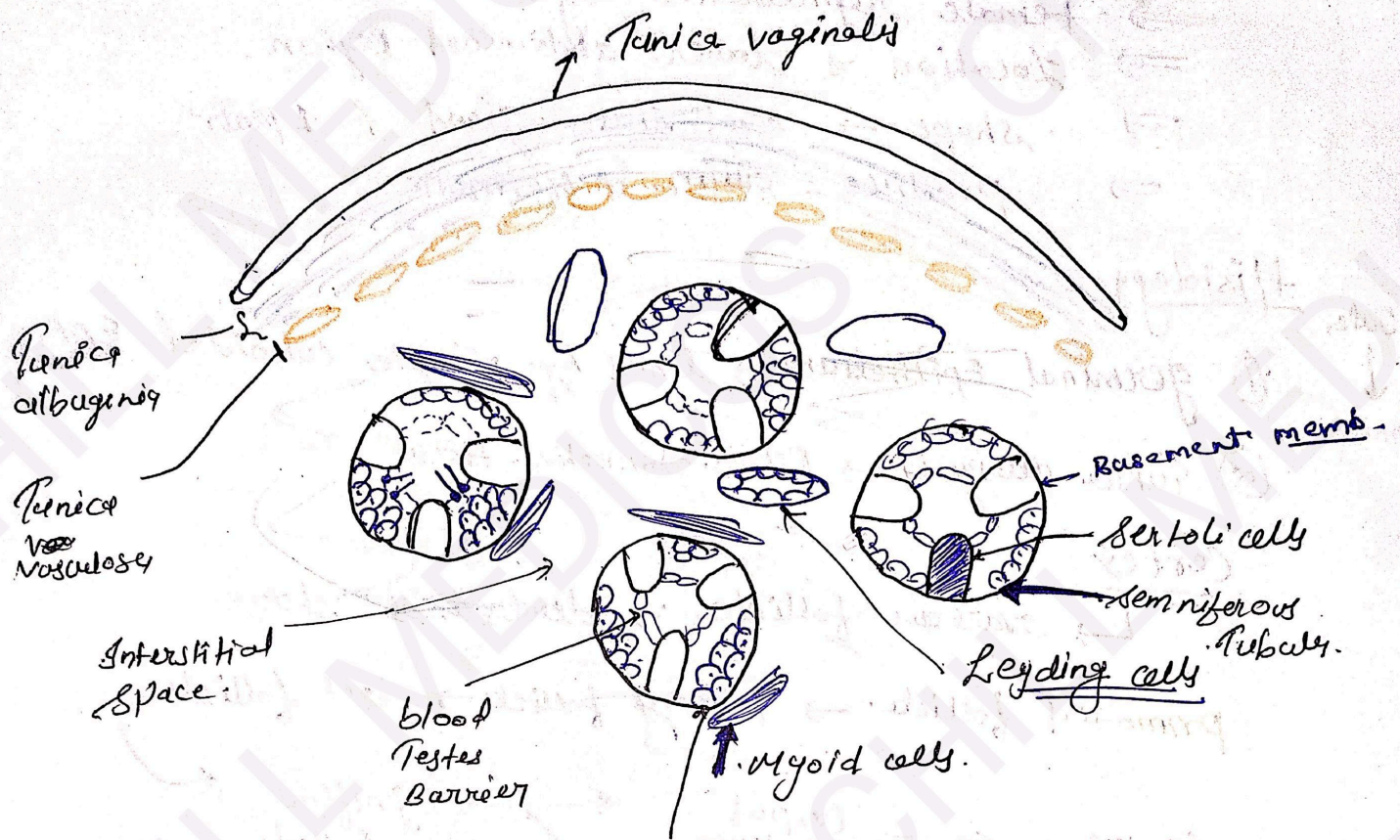
* Seminiferous tubules

→ Sertoli cell / sustentacular cells [provide nutrition]
↳ Blood testis barrier

→ Developing stage of spermatogenic cell.

⇒ Leydig cells (interstitial space)
↳ secrete (testosterone)

⇒ Myoid cells



Spermatogenic cells -

1. spermatogenic cell
2. " " "
3. spermatid
4. sperm.

⑧. Histology of ovary

- ⇒ female reproductive organ
- ⇒ Location → lower abdominal region.
- ⇒ shape → oval shape gland & pair
- ⇒ produce. ovm. & Hormone.

Histology:-
Outer
↓
Inner.

① germinal epithelium → lined by simple cuboidal Epi.

② Tunica albuginea → fibro-connective tissue

Cortex

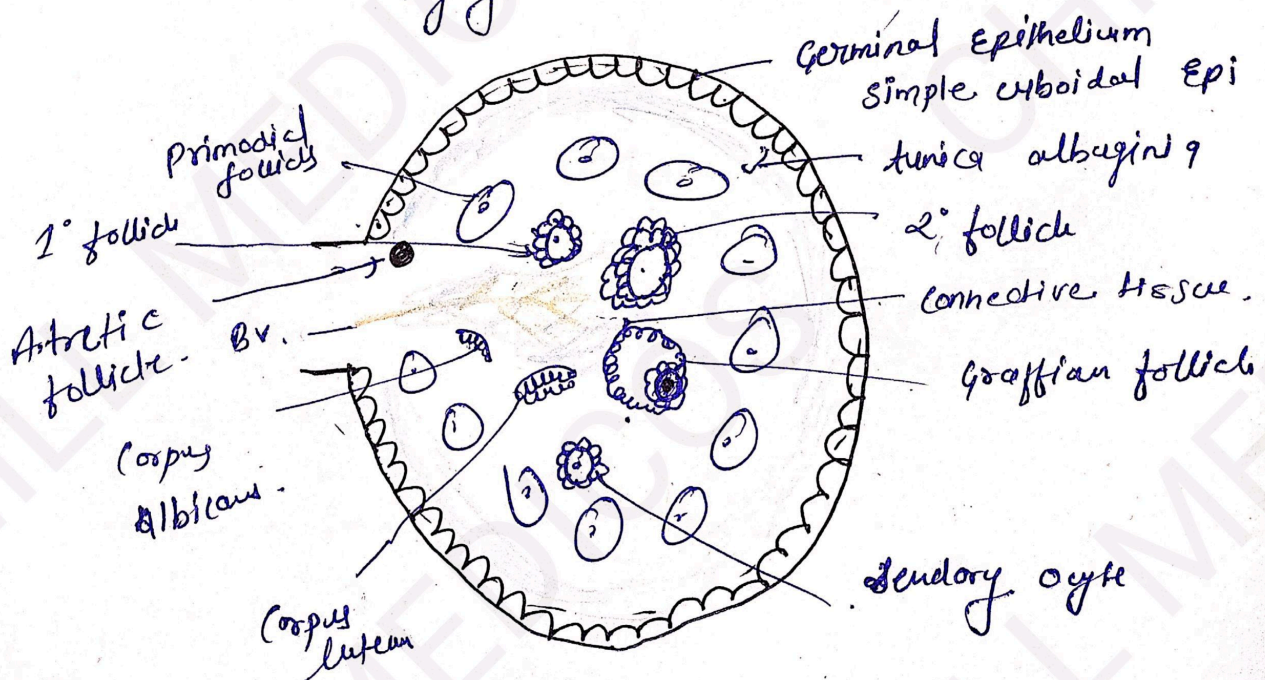
↳ ovarian follicle → development stage

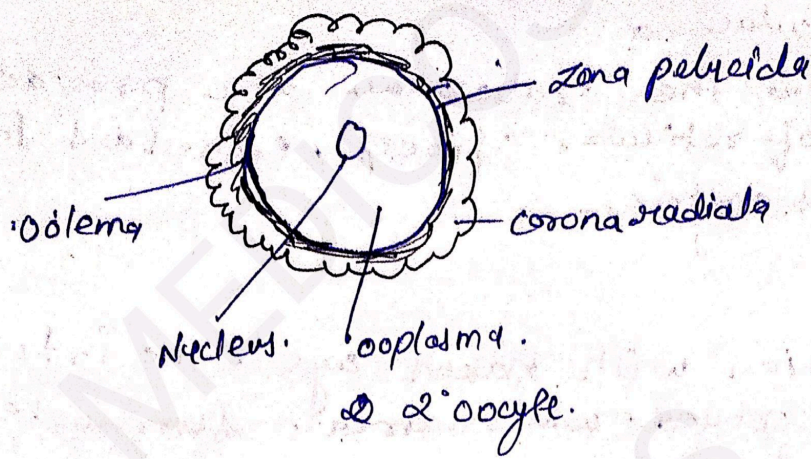
primordial follicle → primary follicle → 2nd follicle

Corpus albicans. ← Corpus luteum ← Graafian follicle
2nd ry. oocyte

• Atretic follicle (remains follicle after menopause)

Medulla → connective tissue.
Highly blood vessels.





- ① Ureter ✗
- ② kidney ✗
- ③ Appendix ✗
- ④ Intestine ✗
- ⑤ spleen ✗

⑨ histology of spleen

• General features

- spleen is the largest lymphoid organ of the body.
- It is a blood forming organ in foetal life and blood destroying organ in postnatal life.

• Connective Tissue framework

- Except at the hilum - the surface of the spleen is covered by layer of peritoneum.
- Deep to peritoneum organ is covered completely by capsule.
- Trabeculae - arising from the capsule extend into the substance of the spleen.
- Trabeculae divided into smaller division that form network.
- Capsule and Trabeculae are made up of fibrous tissue in which elastic fibers are abundant.

→ Capsule & trabeculae are

→ The spaces b/w the trabeculae are pervaded by network of reticular fibers embedded in an amorphous matrix.

Parenchyma

⇒ On examination with naked eye, the interior of spleen shows round white area surrounded by red matrix.

The white pulp

- Made up of aggregation of lymphocytes that surround a small artery or arterioles
- It forms cord-like aggregations of lymphocytes
- Cords are thicker at white pulp than elsewhere and contain lymphatic nodules similar to those seen in lymph node
- These nodules called Malpighian body
- ⇒ Each nodule has a germinal center
- ⇒ These nodules are easily distinguished from those lymph node because of the presence of arteriole, each of them
- ⇒ Lymphatic nodules of white pulp are aggregation of B-lymphocytes
- ⇒ germinal centre are areas where B-lymphocytes are dividing

The Red pulp

- Modified lymphoid tissue infiltrated with all the cells of circulating blood
- It is sponge like permeated by spaces (splenic sinusoids) lined by reticular cells
- The intervals b/w the spaces are filled by B-lymphocytes as well as T-lymphocytes, macrophages and blood cells.

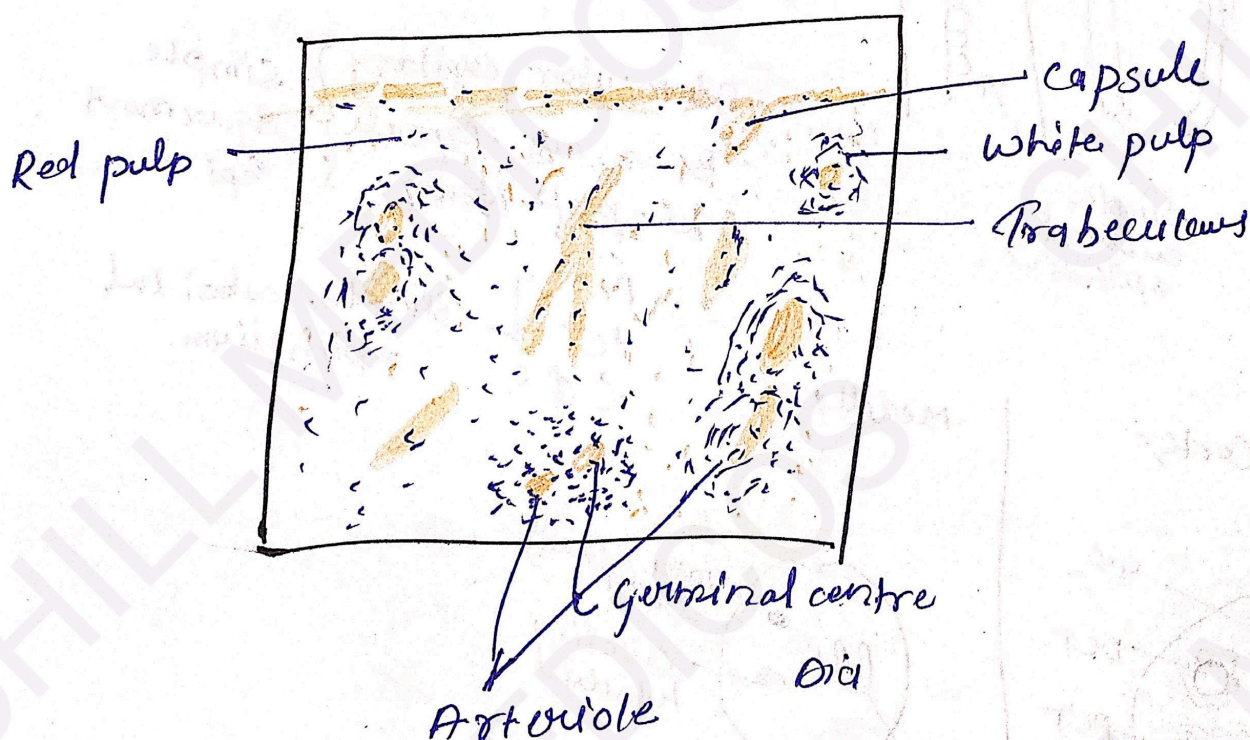
* functions:-

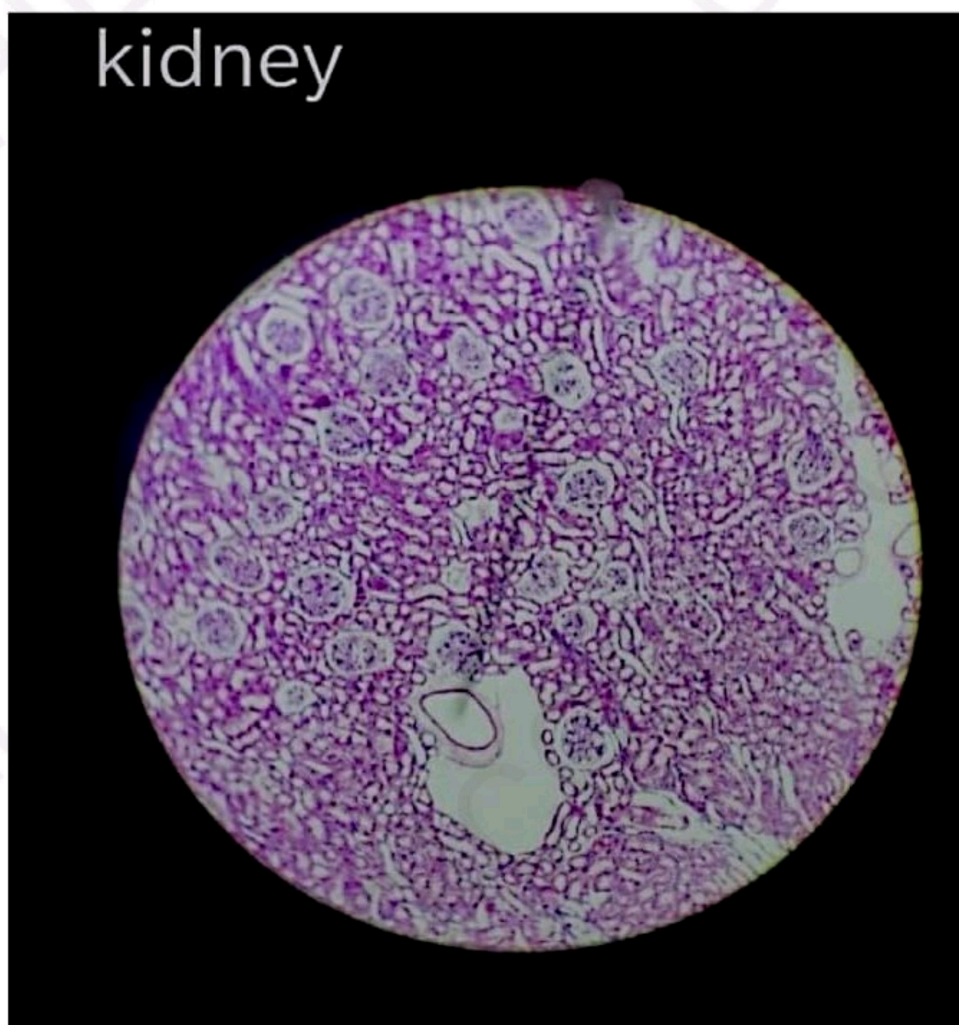
- Multiply of B, T-lymphocytes
- Immune response
- Only site an immune system response can be started against antigens.
- Spleen contains the large aggregations of macrophages, mononuclear phagocyte system.
- In fetal life spleen is a centre for production of all blood cells.
- In later life only lymphocytes are produced.
- Spleen is often regarded as a store of blood that can be required in circulation.

◦ Clinical correlation

- ① splenomegaly:- Enlargement of spleen
- Its cellularity and vascularity of organ
 - Many cause exaggerated form of normal splenic function

Causes : Infection - Malaria





10. Histology of Kidney

⇒ Compound tubular structure.

Histology

Stroma

↳ Capsule

↳ Connective tissue

↳ Reticular

↳ collagen fiber

parenchyma

↳ outer cortex

• Brown Red glandular
contained spherical
glomerular capillaries

↳ PCT

↳ DCT

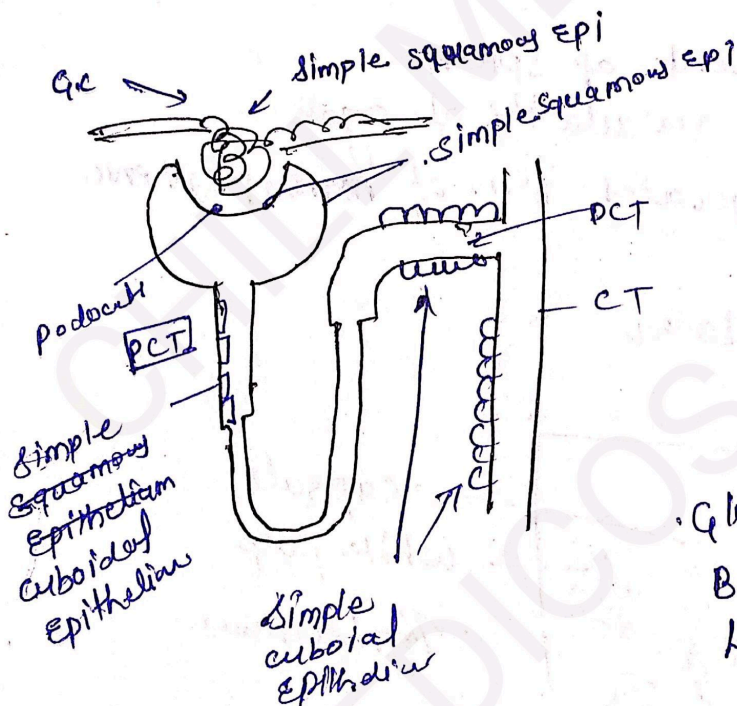
↳ Inner medulla.

lighted region

Tubular structure

↳ loop of Henle.

↳ collecting duct

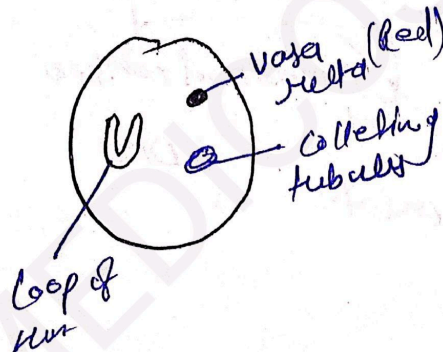
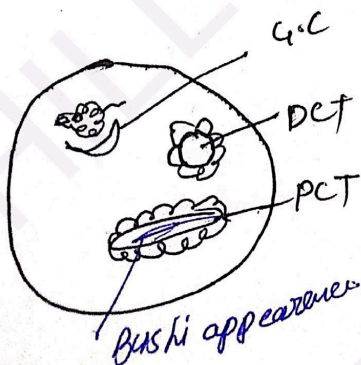


Glomerular capillary }
Bowman's capsule } Simple
Loop of Henle } Squamous
Epi

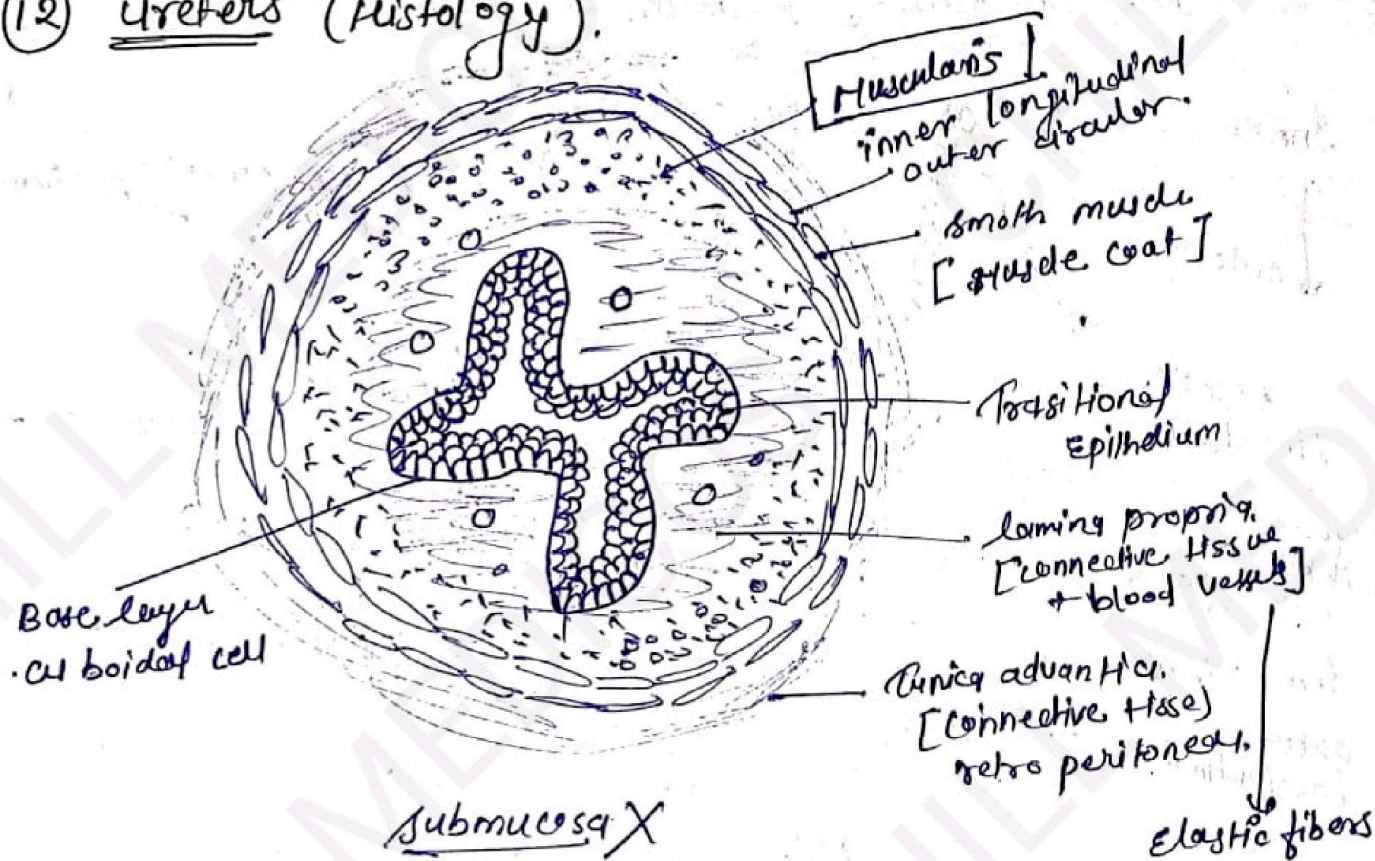
PCT }
DCT } Simple cuboidal
CT } epithelium.

Cortex

Medulla



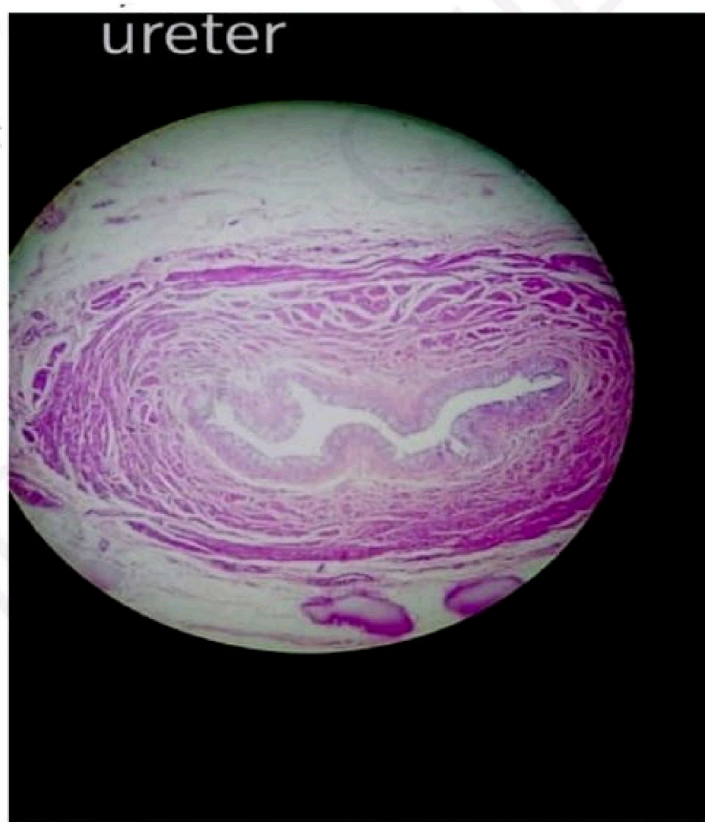
⑫ ureters (histology).



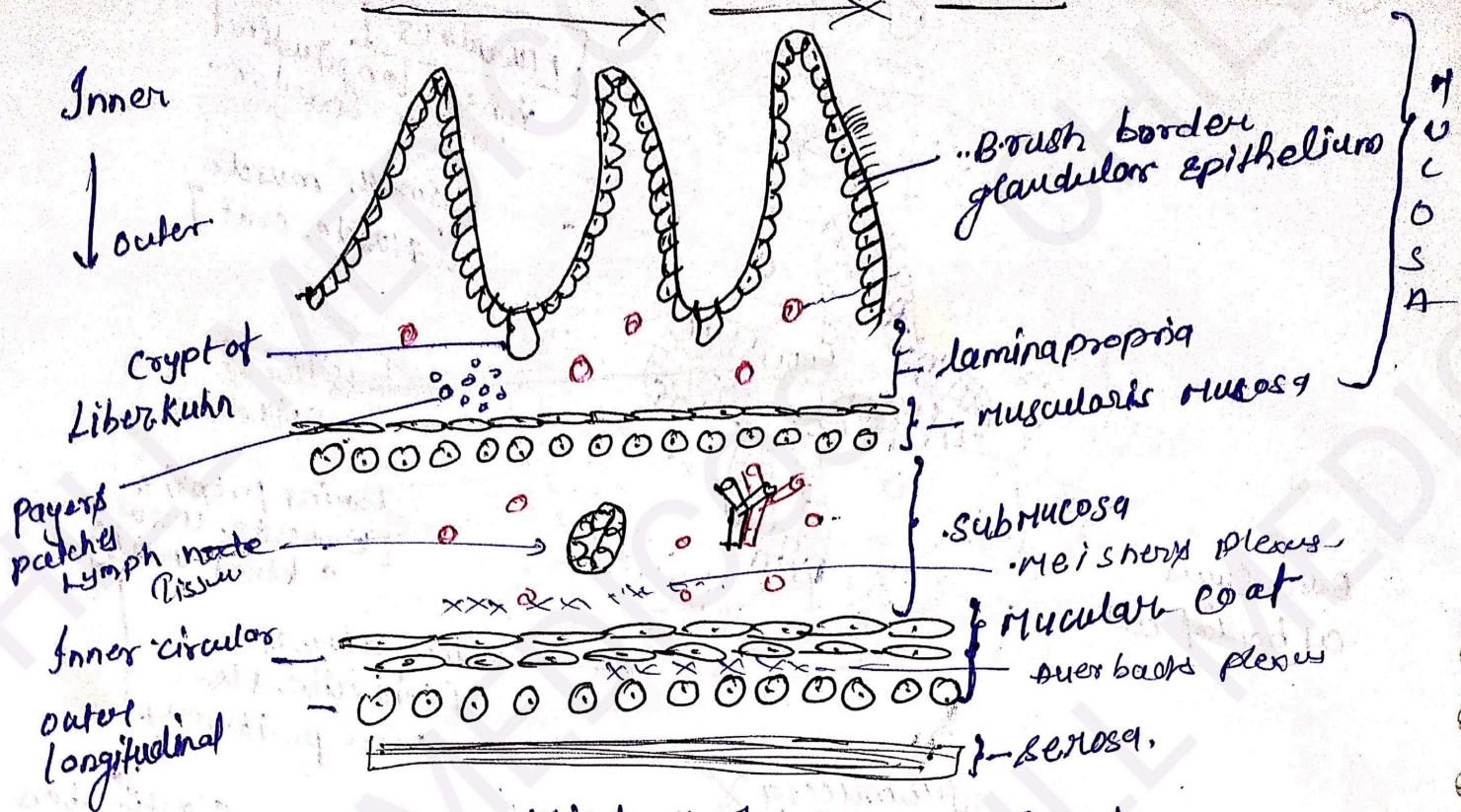
Submucosa X

Inner longitudinal
outer circular layer } muscular coat.

- 3-5 longitudinal fold gives lumen of star shape
- 3-6 layers of transitional layer
- Intermediate pear shape
- Basal layer - cuboidal cell.



12. Intestine (Jejunum & Ileum)

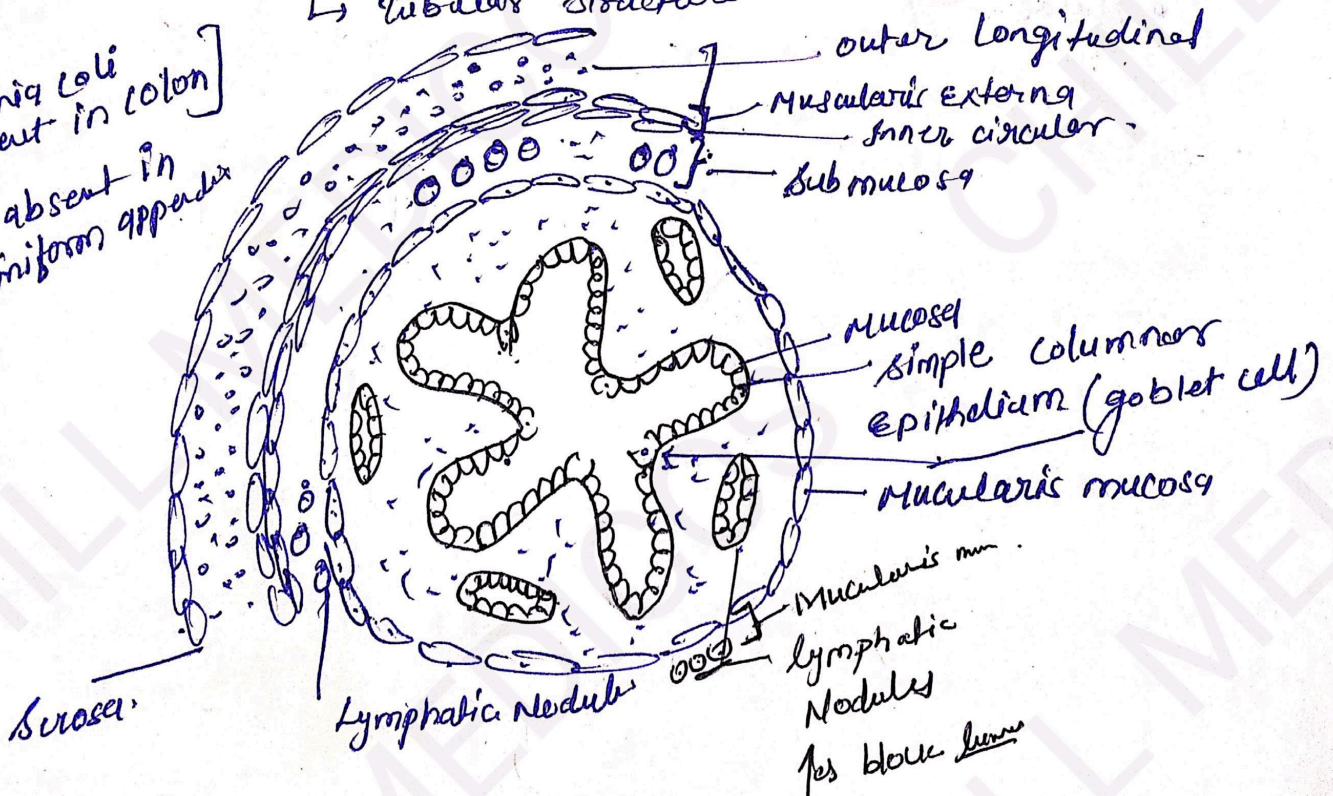


Histology of Jejunum & Ileum

13. Vermiform Appendix

- ↳ crypts - poor
- ↳ narrowest part of cecum
- ✗ L Paenibacillus coli absent (present in muscularis externa)
- ↳ lymphoid tissue not present at birth (increases with age)
- ↳ reduced
- ↳ Tubular structure

[Paenibacillus coli present in colon but absent in vermiform appendix]

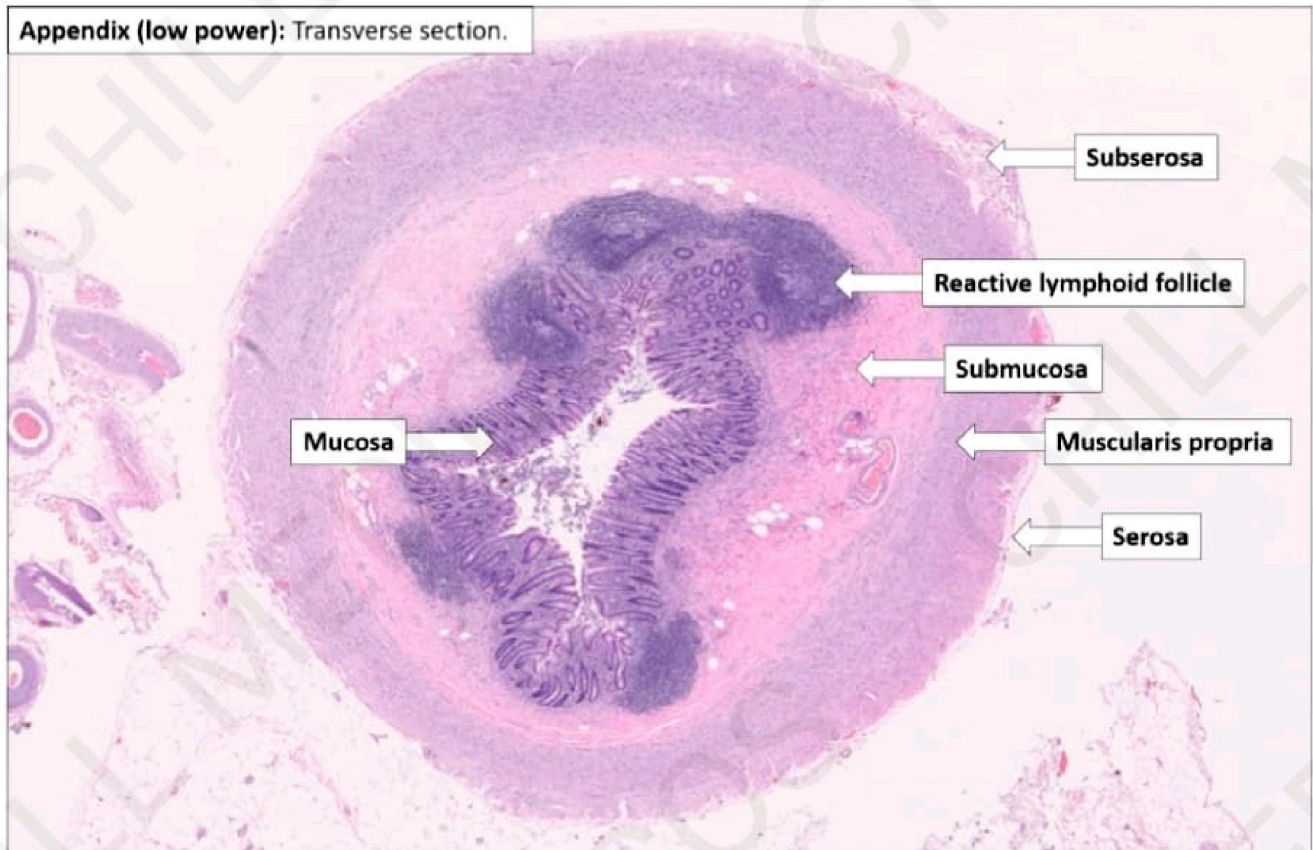


ileum

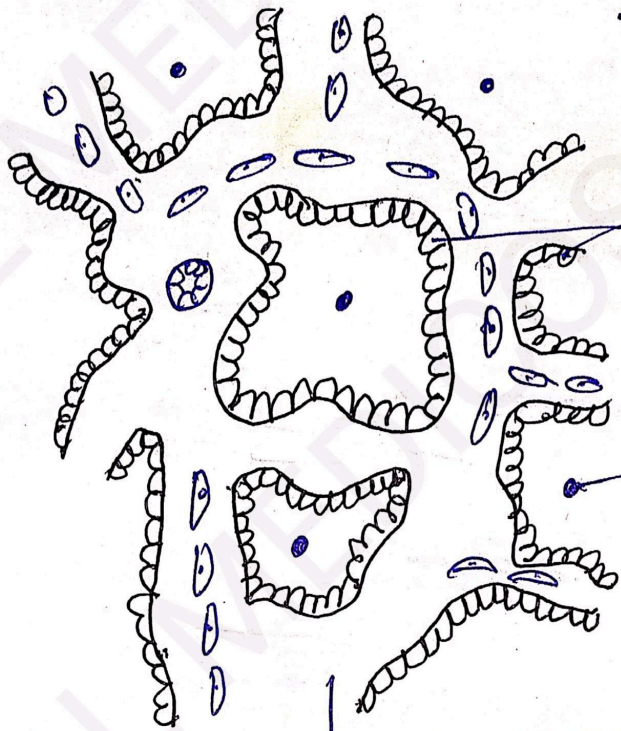
jejunum



Appendix (low power): Transverse section.



- (14). prostate gland → Largest accessory male sex gland
- 'chestnut' shape
 - 30-50 compound - tubulo - alveolar gland
 - follicle open into 12-20 ducts that open into prostatic urethra.

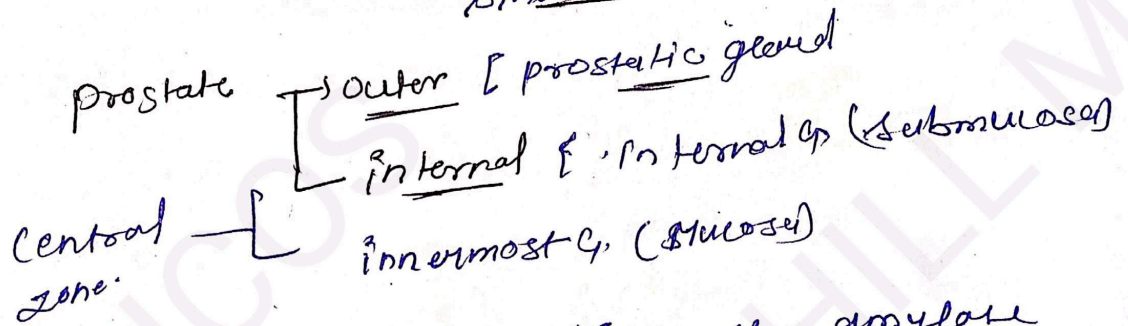


columnar epithelium

amyloid bodies / corpora
 amyloidea → ↑ in old age
 ↑ abundant glycoprotein in condensed form

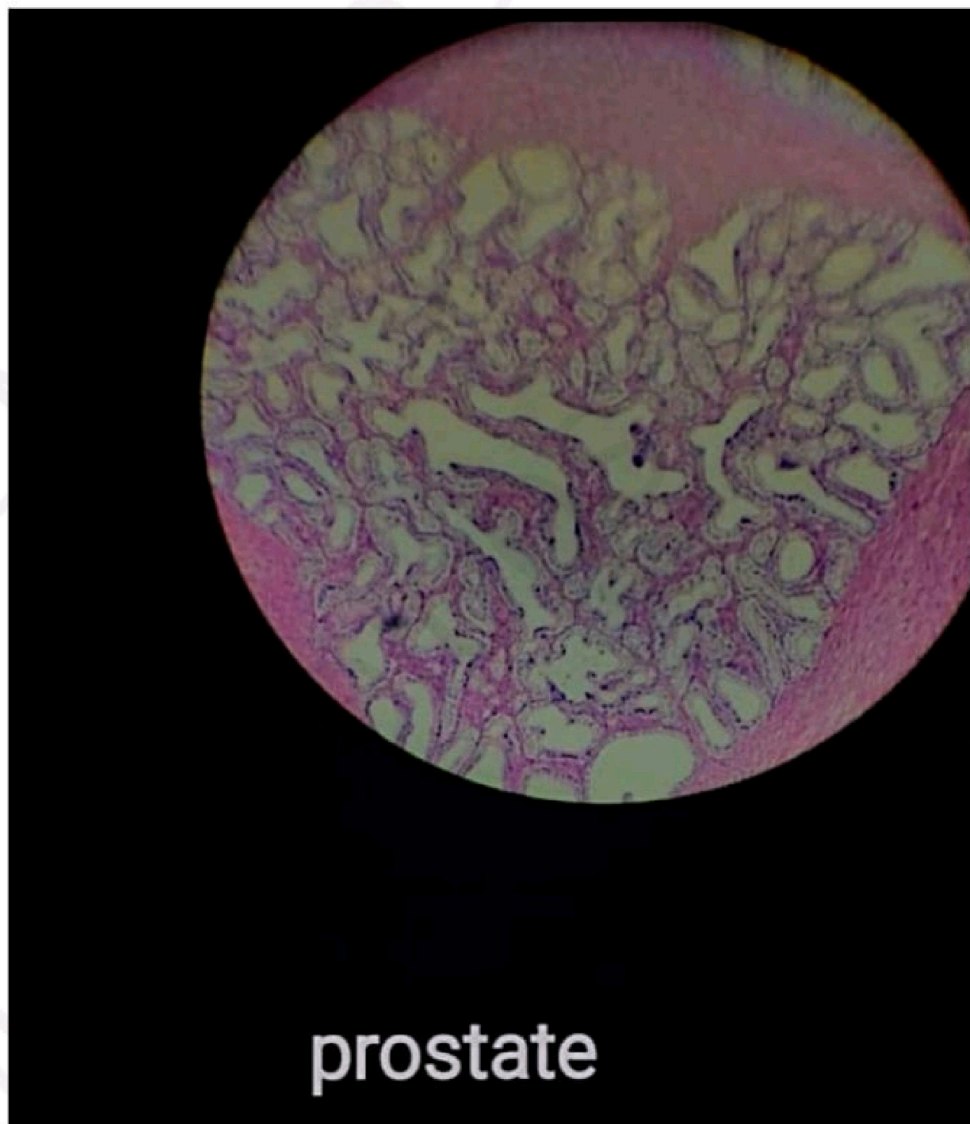
fibromuscular tissue

↳ contains collagen fibers smooth muscle



⇒ function: - secretion: - Enzymes - amylase, protease, acid phosphatase, lipoase
 produce - prostaglandins

⇒ clinical: - Benign nodular hyperplasia
 Cancer of prostate (carcinoma)
hyperplasia



prostate

SPLEEN

The structure of the spleen is **similar to the lymphnode.**

capsule

- It is covered with a **capsule**. That capsule is made of dense connective tissue and elastic fibers.

A cut section through the spleen shows the substances of **spleen arranged in the form of white pulp and red pulp**

The white pulp

The white pulp appears **basophilic** (bluish) in the **haematoxylin** stained section because it **contains lymphocytes**.

The red pulp

- The red pulp appears red because it **contains many sinuses filled with RBC**.

Circulation of blood through spleen

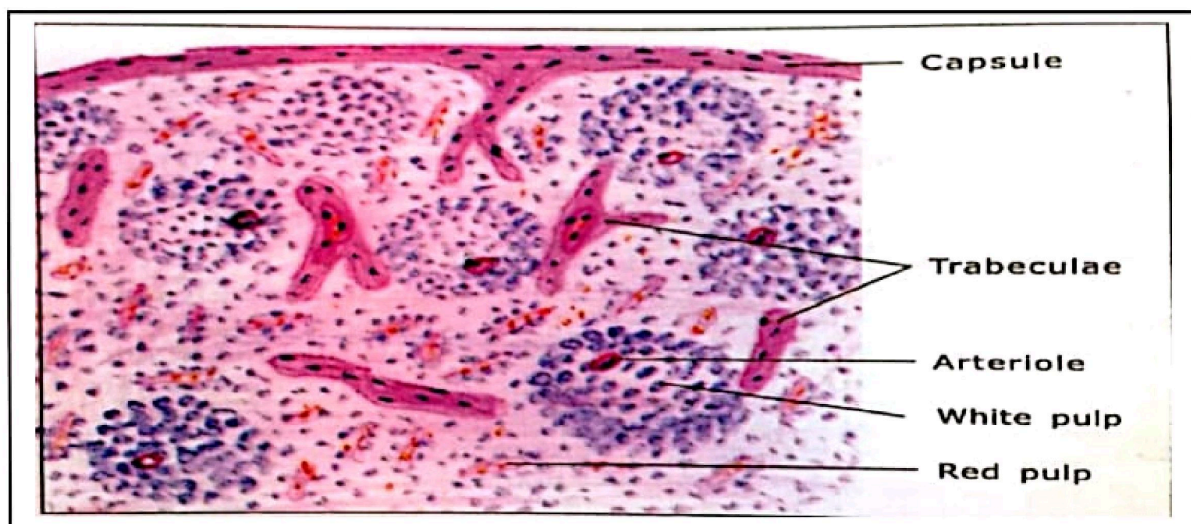
- Splenic artery enters at hilum . It is branched and enters the pulp where it is covered by lymphocytes
- That **periarteriolar lymphatic sheath** is called as **white pulp**.
- At the center of this pulp is the **central artery**
- There are two theories of circulation **open and closed circulation**

Functions of spleen

- Filtration of blood
- Site of production of B and T lymphocytes
- Destruction site for RBC

Applied

- **Splenomegaly**- enlargement of the spleen is called as splenomegaly.
- It occurs in **malaria and leukaemias**.



URETER

Ureter is a tube with star shaped lumen inside

- It conducts urine from renal pelvis to the urinary bladder

It's structure **containing three walls**

Mucosa

- **Epithelium- transistional type of Epithelium** which is 4 to 5 layers thick
- **Lamina propria-** made up of **loose connective tissue** containing blood vessels and lymphatics

Muscle layer

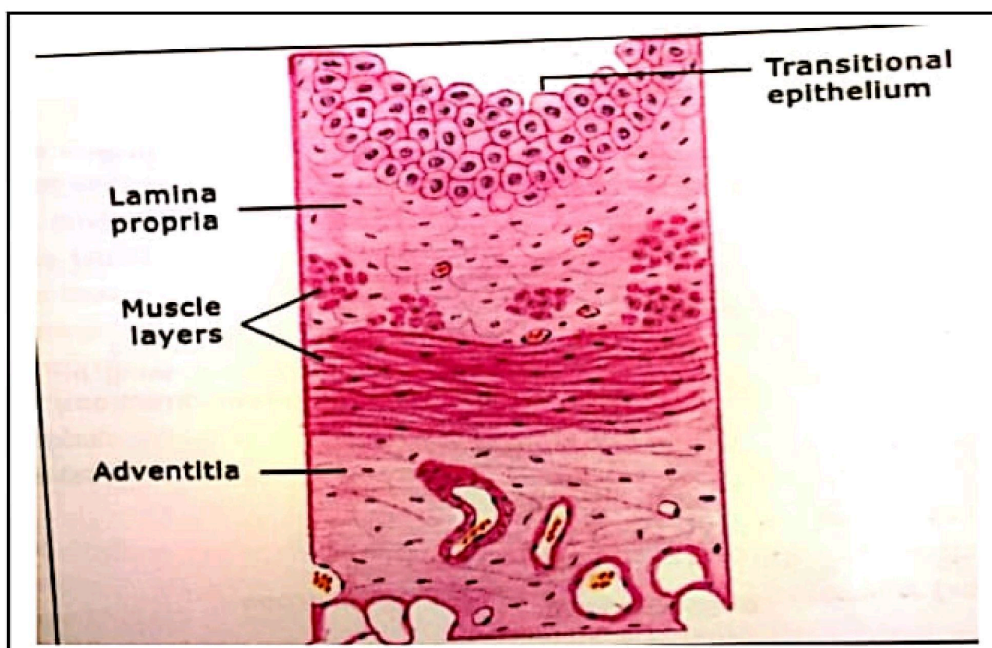
- Inner longitudinal and outer circular layer of smooth muscle

Adventitia

- Outer most layer of ureter made up of loose connective tissue.

Clinical

- **Ureter stone** – Stone in the ureter.
 - Kidney may **dislodge the stone** and **pass into ureter**.
 - It causes **severe pain radiating from back to front side at lower abdomen.**



THYROID GLAND

It is **surrounded** by thin connective tissue **capsule**.

- From the capsule **septa** extend into gland **carrying blood vessels** along with them

Parenchyma

- The **parenchyma** of the gland is arranged in the form of **thyroid follicles**.

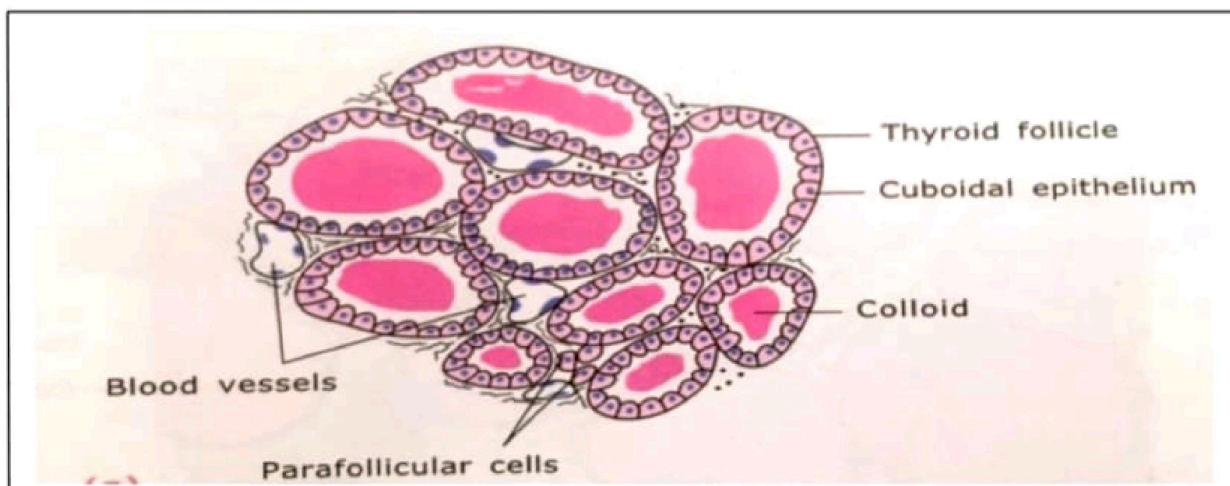
Thyroid follicles

- Follicles are having **central cavity** that **contains gel like** material called **colloid**.
 - **Colloid is containing thyroglobulin.**
 - Thyroglobulin is the **storage form of thyroid hormones**
- Follicles are lined by a **single layer of epithelium**
- Epithelial cells of **follicle vary in size from cuboidal to columnar**
- It depends on the activity of cells
 - **Cuboidal cells** reffered as “**resting stage**”
 - **Coloumnar cells** reffered as “**active**” or “**secratory stage**”

Each follicle is **surrounded** by a network of **reticular fibers, vessels and lymphatics**

Parafollicular cells

- Few cells present **surrounding follicular cells** called as **parafollicular cells**
- **They secrete hormone calcitonin.**



ARTERY

Arteries are vessels which conduct blood from heart to tissue.

The wall of the artery is having three layers.

Tunica intima

- **Innermost layer of artery.**
- It is having **four components**
 - **Endothelium**- made up of **simple squamous epithelium.**
 - **Basal lamina**
 - **Subendothelial connective tissue**
 - **Internal elastic lamina**- made up of a layer of elastic lamina

Tunica media

- Intermediate layer
- It is the thickest layer and **consisting of elastic fibers and smooth muscle cells**
- The **amount of elastic fibers and smooth muscle** is depending upon the **size of artery**
- **They arranged circularly**
- It is **separated from tunica adventitia by external elastic lamina**

Tunica adventitia

- Outermost layer of artery
- Made up of **connective tissue cells and collagen fibers**

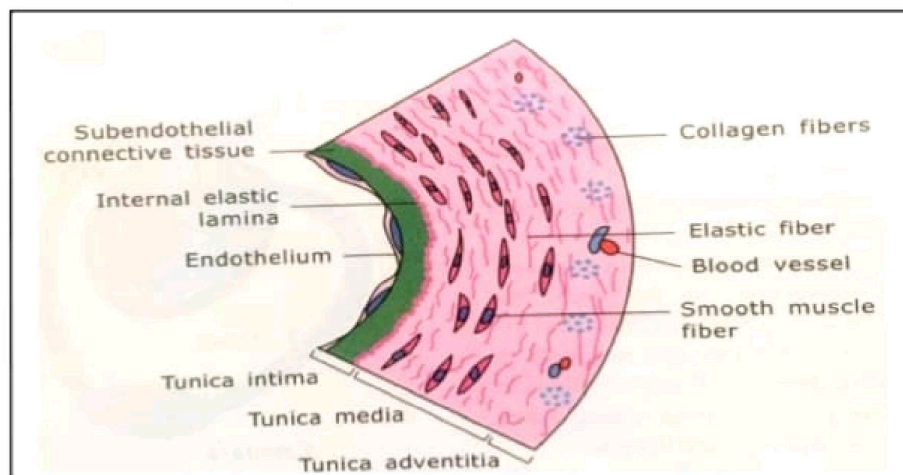
Classification of arteries

Into three types

- **Elastic arteries**- larger arteries ex. Common carotid, subclavian artery
- **Muscular arteries**- medium sized arteries.
- **Arterioles**- Smaller arteries. Terminating into capillaries.

Clinical

Atherosclerosis- deposition of lipid, fibrous tissue in tunica intima



CARDIAC MUSCLE

Cardiac muscle is also **striated** similar to skeletal muscle but its **contraction is involuntary**.

- They are supplied by **autonomic nerves**
- They are **present only in heart**.

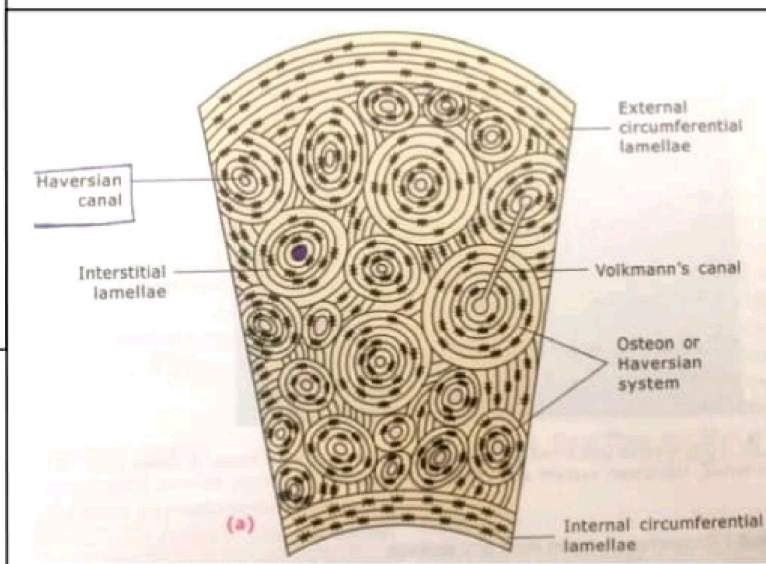
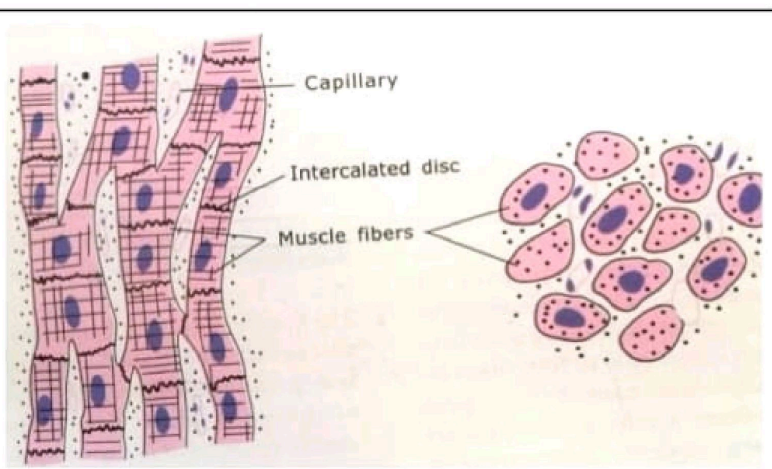
Cardiac muscle is consisting of **long and thick** muscle fibers

- These fibers **show branching**
- So, individual fiber **appears as “Y” shaped**.
- Each fiber is made up of **cardiac myocytes**.
- Each myocyte has a **centrally placed single oval nucleus**.
- They are joined and form a junction known as **intercalated disc**.
- **Gap junctions** are present in the longitudinal or lateral portion of intercalated disc. **It helps in spreading of action potential**

Myofibrils of cardiac muscle have actin and myosin filaments.

Applied

- **Hypertrophy of cardiac muscle** – when cardiac muscle works excessively their size is enlarged.
- **No capacity for regeneration**
- **Damaged part is replaced by fibrous tissue**.



COMPACT BONE

It forms the **bulk of the diaphysis** of long bone

- It forms a **thin layer on the external surface of all other bones.**
- This part of **bone is called compact because no space is visible on naked eye examination**

Bone core is made up of spongy bone

Compact bone covering

Periosteum- the bone on its external surface is covered by a membrane called periosteum

- It consists two layer – outer fibrous layer and inner cellular layer.

Endosteum – It is the **thin lining** of the bone **towards marrow cavity** and spongy bone

Compact bone is made up of Lamella.

Lamellae are present in three different patterns

Haversian system of lamellae

Also known as osteon

Lamellae Arranged around a canal known as **Haversian canal**. This canal is **containing vessels and lymphatics**.

Blood vessels and nerves go inside the compact bone through **volkmann's canal**

Interstitial lamellae

Lamellae seen in areas between osteon is known as interstitial lamellae

Circumferential lamellae

It is two types

Outer circumferential lamellae- present **on the outer surface of bone** just below periosteum.

Inner circumferential lamellae- It **encircle the marrow cavity**

Clinical application

- ❖ **Rickets**- poor mineralization of bone due to **vitamin d deficiency in child** results in bowing of legs known as rickets.

SKELETAL MUSCLE

They are also known as striated or voluntary muscle.

- They are **supplied by somatic nerves**
- Under light microscope it shows alternating dark and light bands
- Skeletal muscle consists numerous muscle fibers

Covering

- Each **individual muscle** fiber is surrounded by a covering known as **endomysium**
- **Many muscle fibers** aggregate to form **bundle** which is surrounded by a layer called as **perimysium**
- **Many bundles** unite to form a muscle which is covered by **epimysium**.

The point of contact between terminal end of axon and muscle fiber is called **motor end plate**.

Basic unit of skeletal muscle is long **cylindrical fiber**. Fiber is **formed by fusion of many myoblast**

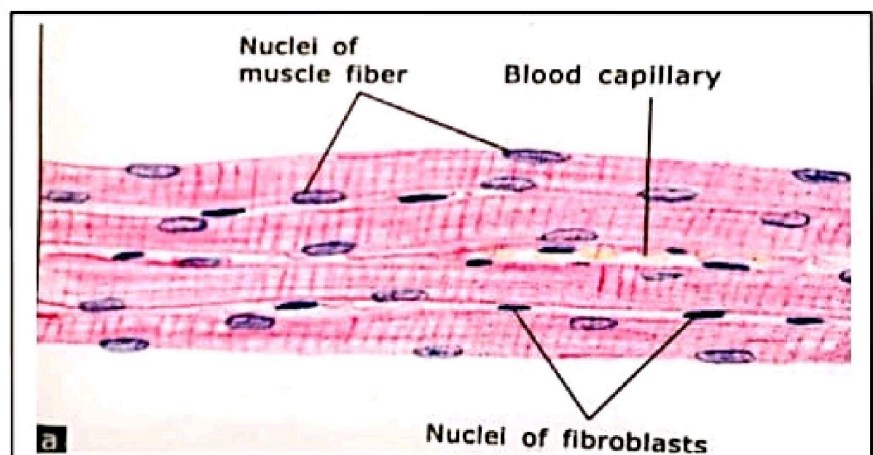
- **Nuclei of cells** are present **towards peripheral** part of cytoplasm

Striations

- The **dark band** is called as "**A**" band and **Light band** is called as "**I**" band
- A thin line is seen in the middle of the light area is called as **Z line**
- The mid region of the dark band is called as **H band**
- In the middle of the H band the line is known as **M line**

The area between two adjacent **Z lines** called as **Sarcomere**.

- A sarcomere is the **contractile unit of muscle**
- It's containing **thick myosin** and **thin actin filaments**



Cartilage

- It is a specialized connective tissue
- It consist of three components
 - Ground substance
 - Fibers and
 - Cells.
- Three types of cartilage are found in the body
 1. Hyaline cartilage
 2. Elastic cartilage
 3. Fibro cartilage
- They differ from each other because of the type and amount of fibers present in them.
 - Cartilage is not supplied with blood vessels
 - It is avascular
 - It is usually surrounded by membrane called as perichondrium.
 - Perichondrium having reach blood supply.
 - Chondrocytes receive nutritive substance by diffusion through the ground substance.

HYALINE CARTILAGE

It is the most abundant type of cartilage in human Body.

Location:

- In fetal skeleton,
- Ends of adult Bones,
- Nose,
- Costal cartilage,
- Trachea, bronchi and larynx.

Description:

- It consist of homogeneous, transparent and amorphous intracellular matrix.
- Matrix consist of collagen fibers and ground substance

- Cartilage cell known as chondrocytes
- Chondrocyte is present in small spaces called as **lacunae**.
- It is surrounded by perichondrium

Fibers

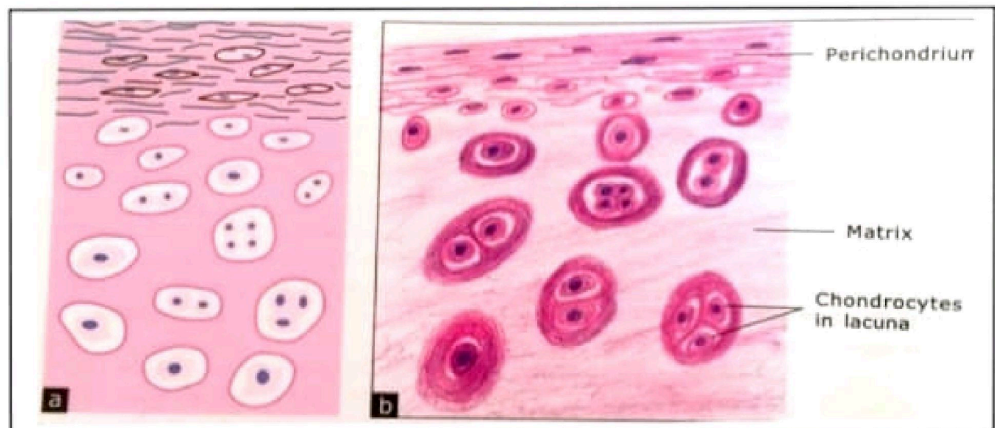
- Its type 2 collagen fibers
- It is provide stability and strength to the cartilage
- They are not seen in the histological section because they have same refractive index as that a ground substance.

Ground substance

- Homogenous, gel like structure.

Chondrocytes

- They occupy lacunae in the matrix.
- They are responsible for the synthesis of collagen fibers and ground substance.



Perichondrium

- Hyaline cartilage on its free surface covered with a fibro vascular membrane called as perichondrium.
- It is absent at the free surface of bone at joint cavity. Known as [articular cartilage]
- It is consist of two layers
 1. Outer fibrous layer.
 2. inner cellular layer

Functions

- Articular cartilage provides smooth surface for movement of joints.
- It is provides support [as in costal cartilage]
- Firmness keeps the lumen of trachea and bronchi patent.

ELASTIC CARTILAGE

Location

- It is present in pinna of the ear.
- Epiglottis
- Corniculate
- Cuneiform cartilage of larynx.
- External auditory meatus and auditory tube.

Description

- Also known as “yellow elastic cartilage”

Fibers

- Elastic cartilage contains branching elastic fibers.
- Contains type 2 collagen fibers.

Ground substance

- Contains proteoglycans.

Cells

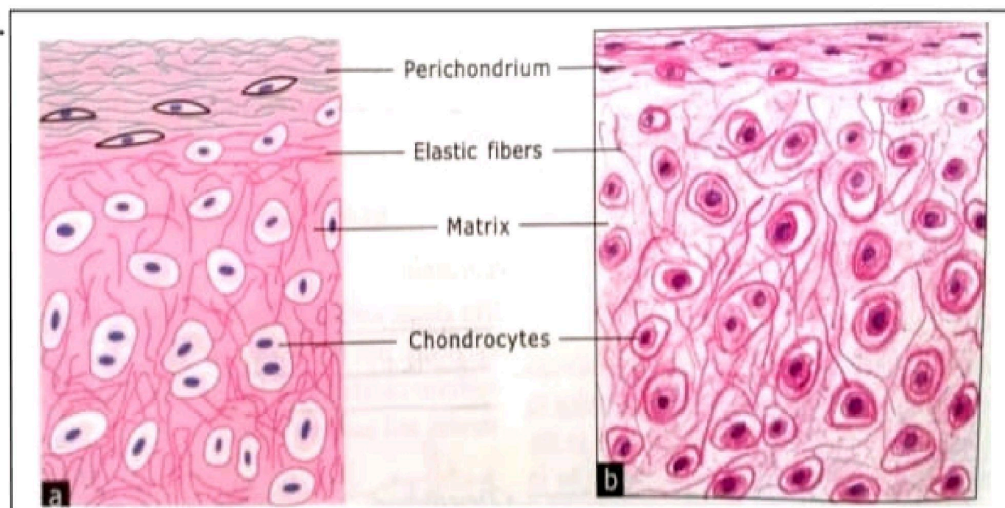
- Chondrocytes are present in lacunae.
- These cells are bigger than cells present in hyaline cartilage.
- They are closely placed.

Perichondrium

- Having two layer
 - (1) Outer fibrous layer
 - (2) Inner cellular layer.

Function.

- It provides shape and support to the organ.



FIBROCARILAGE

- It is also known as “white fibrocartilage”

Location

- Intervertebral discs
- Public symphysis
- Manubriosternal joint
- Menisci of knee joint
- Articular disc of temporomandibular and sternoclavicular joints

Description

Fibers

- Type-1 variety

Ground substance

- Very less variety.

Cells

- Very few chondrocytes are seen
- They are placed between large fiber bundles

Perichondrium

- It's absent in fibrocartilage.

Function

- It is capable of **resisting compressive** and **shear forces**.

