

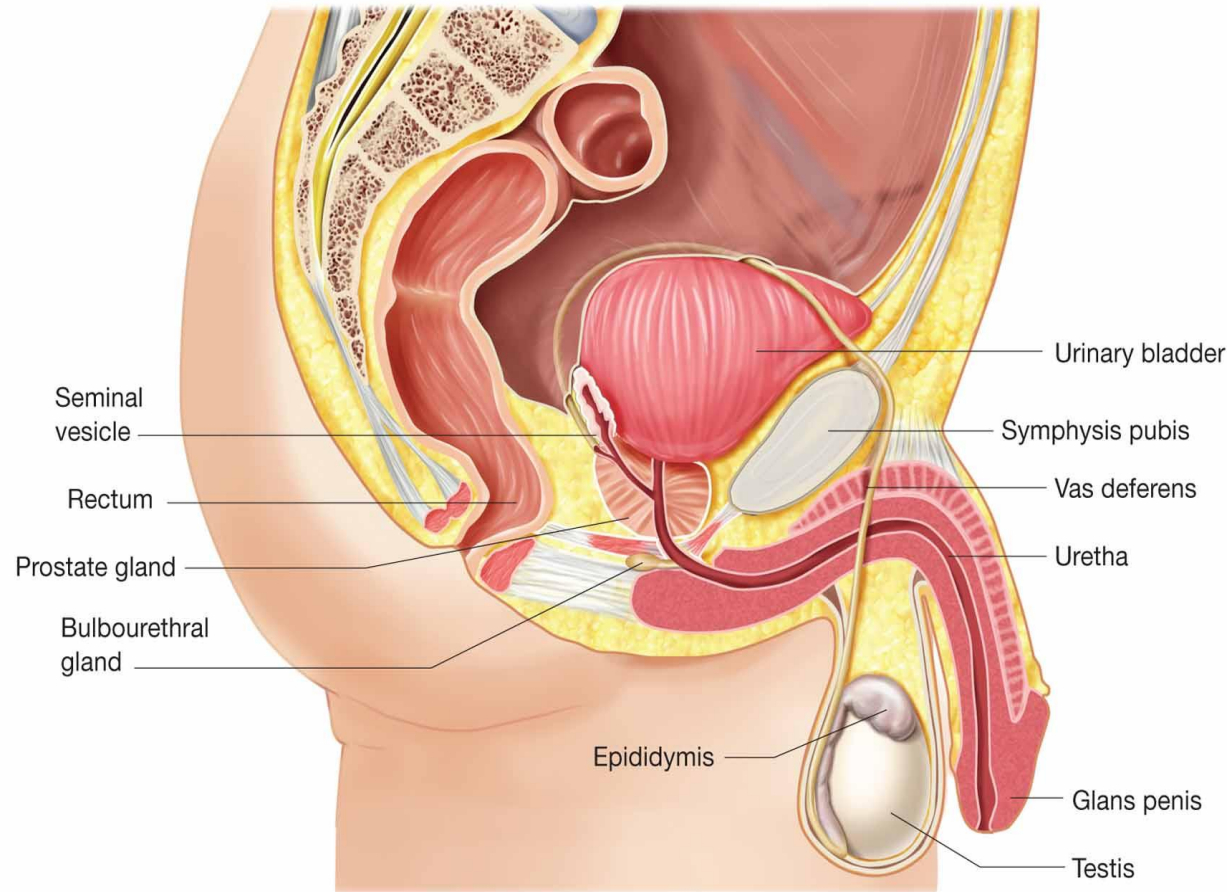
ANATOMY OF MALE GENITAL SYSTEM

By

Hassan Ibrahim

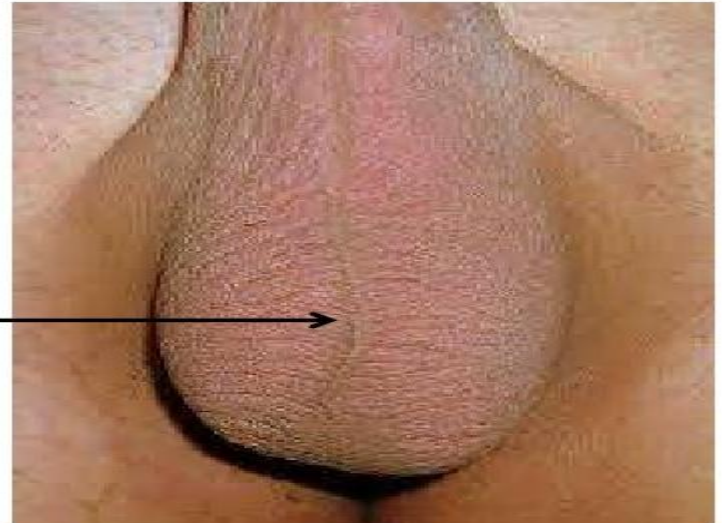
The main components of male genital system are :

- Scrotum
- Testes
- Spermatic cord
- Epididymis
- Vas deferens
- seminal vesicles
- Prostate gland
- Bulbourethral gland
- Penis



The scrotum

- ❑ Scrotum is a dual-chambered protuberance of skin and muscle, which contains the testes, epididymis and lower end of the spermatic cords. It can be considered as an out pouching of the lower part of anterior abdominal wall containing the above structures .
- ❑ Its external positioning keeps the testes 3°C lower than core body temperature.
- ❑ It is divided on its surface into two lateral portions by a raphé which is continued forward to the under surface of the penis and backward along the middle line of the perineum to the anus.



Layers of scrotum :

1- Skin

- ❑ It is very thin, pigmented and generally wrinkled, provided with sebaceous follicles and thin scattered hair. It also contains many sweat glands, thermo sensitive receptors and sympathetic nerves.
- ❑ As a result of cold, the skin covering the scrotum wrinkled and thrown into folds called rougé to lower the surface area and thus lower the heat loss , at other times of hot temperature or exercise the skin become smooth and stretched .

2- Dartos tunic

- ❑ Thin layer of non-striated smooth muscular fibers continuous around the base of the scrotum with the superficial fascia of the groin and the perineum.
- ❑ It sends inward a septum which divides the scrotal pouch into two cavities and extends between the raphé and the under surface of the penis .
- ❑ The dartos tunic is closely attached to the skin externally, but the layer beneath it is loose and easily stretched areolar connective tissue .

3- Spermatic Fascia

It has three layers lying beneath the superficial fascia derived from the layers of anterior abdominal wall :

❑ **External spermatic fascia (intercolumnar or intercrural fascia) :**

The most superficial of the three sheaths and its derived from the aponeurosis of external oblique muscle with which it is continuous round the superficial inguinal ring .It is thin membrane, prolonged downward around the surface of the cord and testis .It is separated from the dartos tunic by loose areolar tissue.

❑ **Cremastric fascia**

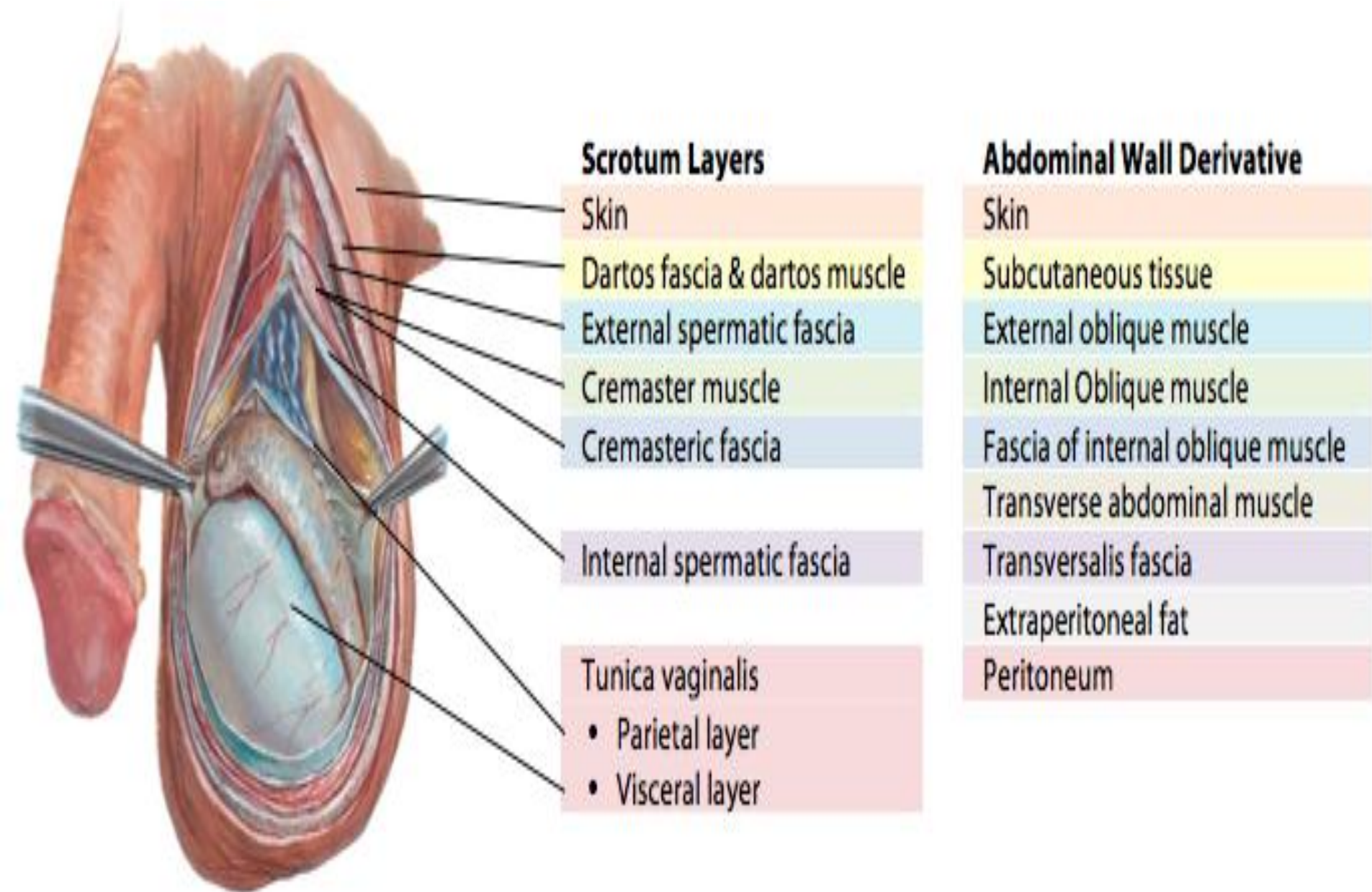
It consists mainly of muscular fibers derived from the inferior portion of the internal oblique muscle and partly of delicate connective tissue . The muscular fibers constitute the cremaster muscle passing down over the cord.

❑ **Internal spermatic fascia (infundibuliform fascia)**

It is derived from the fascia transversalis of the abdomen, it passes downward as a continuous sheath over the cord and encloses its various structures together with a certain amount of areolar tissue derived from the sub peritoneal tissue of the abdominal wall.

4- Tunica vaginalis

With its parietal and visceral parts (it will be described later)



Arterial supply of the scrotum :

1- The superficial and deep external pudendal branches

of the femoral artery supplying the upper and anterior part .

2- The superficial perineal branch

of the internal pudendal artery supplying it from behind .

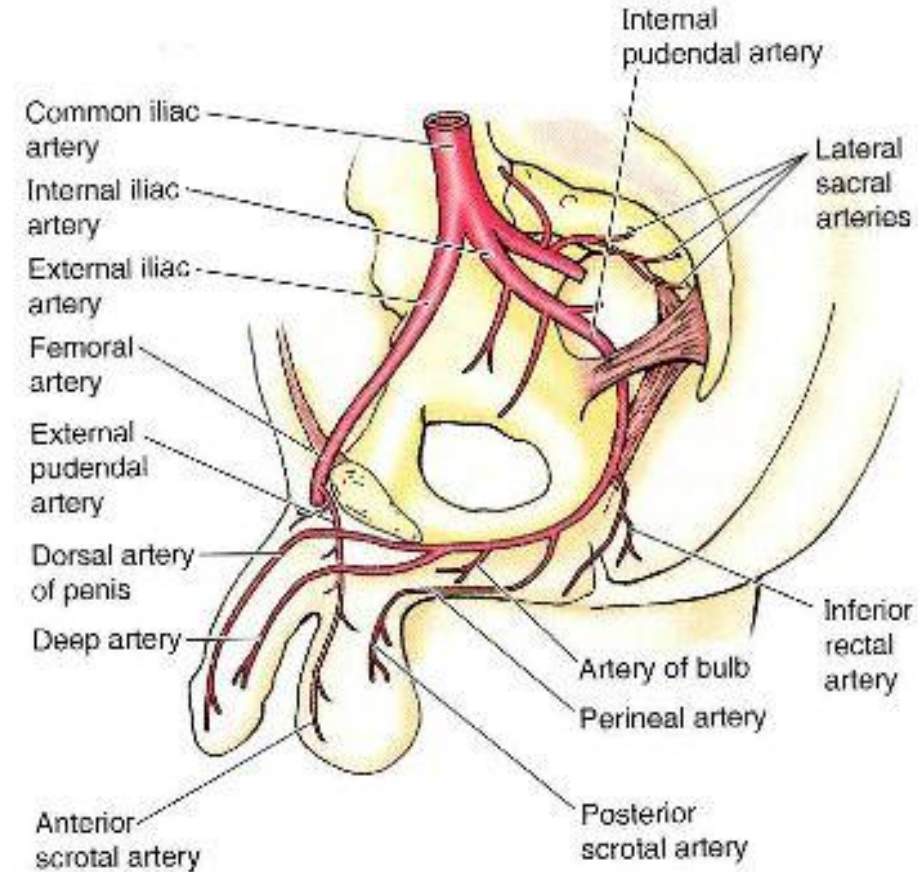
3- The cremasteric branch

from the inferior epigastric artery.

Venous drainage :

❑ The veins draining the anterior scrotum accompany the external pudendal arteries to the great saphenous vein.

❑ Veins from the posterior scrotum follow the internal pudendal artery to become tributaries to the internal iliac V.



Lymphatic drainage of the scrotum :

Lymphatics from skin , fascia and tunica vaginalis drain into superficial inguinal lymph nodes .

Nerve supply of the scrotum :

❑ Anterior scrotal branches of the ilioinguinal nerve:

Supplying the skin of the anterior scrotum .

❑ External spermatic branch of the genitofemoral nerve

Supplying the cremaster muscle.

❑ Posterior scrotal nerves from the perineal branch of the pudendal nerve and perineal branches of the posterior femoral cutaneous nerve.

Supplying the posterior scrotum.

❑ The nerve fibers to dartos muscle are believed to have their origin from the hypogastric plexus .

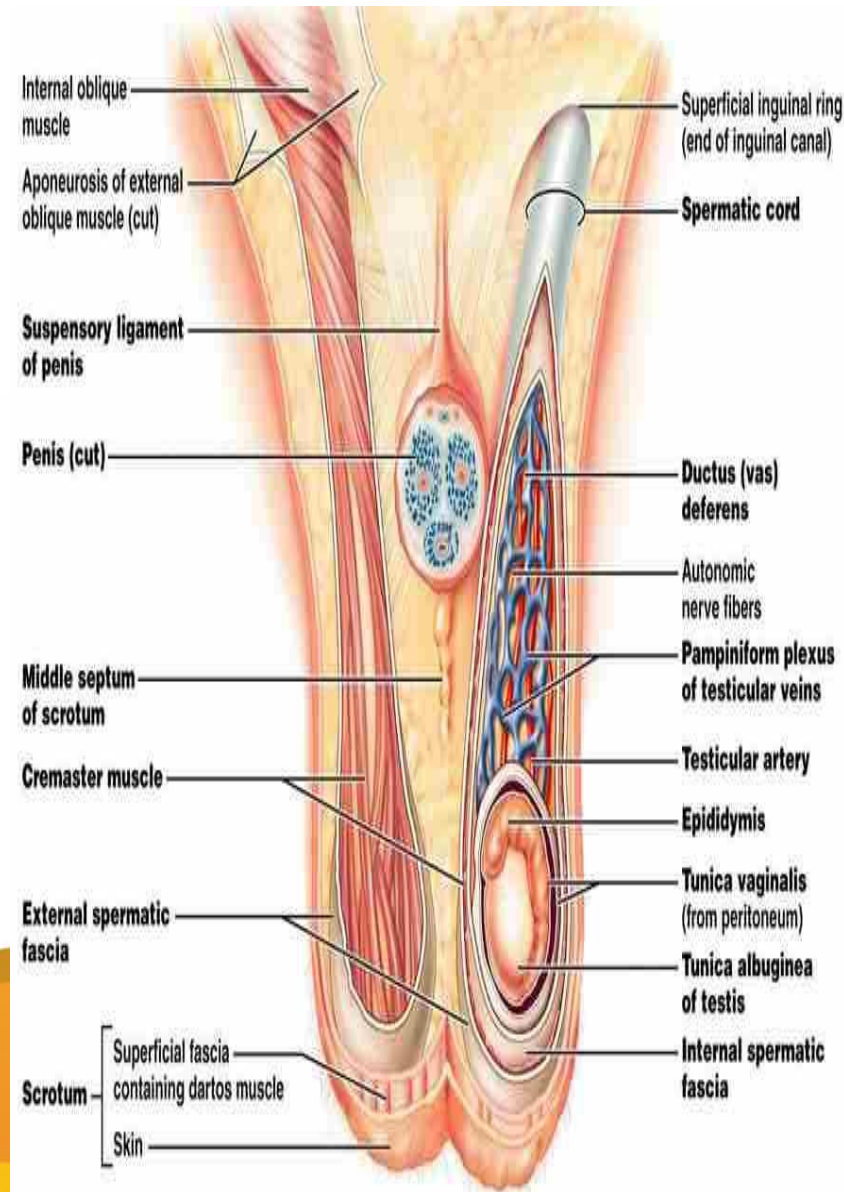
Spermatic Cord

Course of the cord :

- ❑ The Spermatic Cord extends from the deep inguinal ring to the back of the testis.
- ❑ In the abdominal wall the cord passes obliquely along the inguinal canal, lying at first beneath the internal oblique and upon the fascia transversalis, having the aponeurosis of the external oblique in front of it nearer the pubis .
- ❑ It then escapes at the superficial ring, and descends nearly vertically into the scrotum to the posterior of the testis.

Covers of the cord :

The coverings of the cord derived from the abdominal wall are the same three layers of spermatic fascia of scrotum



Structures of the Spermatic Cord:

The spermatic cord is composed of arteries, veins, lymphatics, nerves, ductus deferens. These structures are connected together by areolar tissue.

The arteries within the cord :

They are three : internal and external spermatic arteries and the artery to the ductus deferens.

The internal spermatic artery (testicular artery)

a branch of the abdominal aorta, escapes from the abdomen at the deep inguinal ring and through the superficial inguinal ring into the scrotum. It then descends to the testis.

The external spermatic artery (cremasteric artery)

a branch of the inferior epigastric artery supplies the coverings of the cord, anastomosing with the internal spermatic artery.

The artery of the ductus deferens

a branch of the superior vesical artery accompanies the ductus deferens and anastomosing with the internal spermatic artery near the testis.

The veins of the cord :

Venous drainage coming from the testis and epididymis joins to form the **pampiniform plexus of veins** which forms the chief mass of the cord

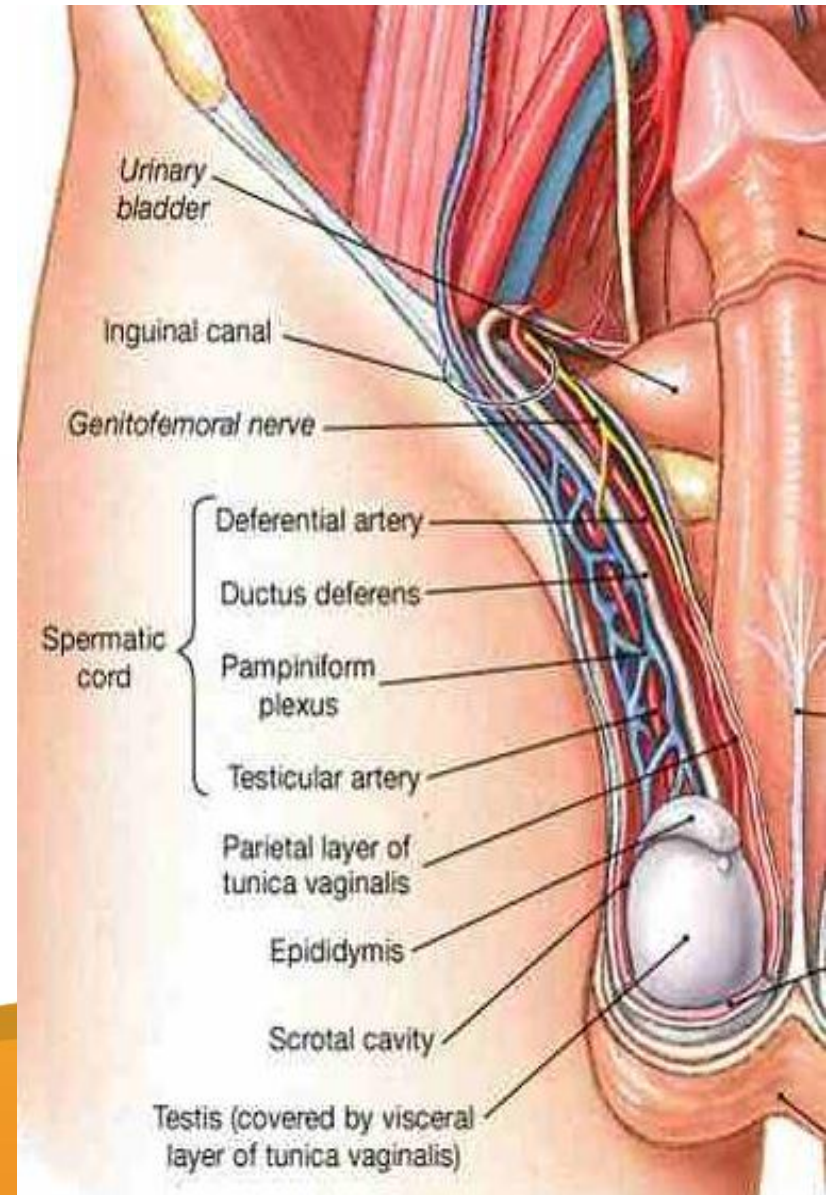
Cremasteric vein and Deferential vein

The lymphatic vessels of the cord

A superficial plexus and a deep plexus of lymph vessels drain the testis and the epididymis upward through the spermatic cord to the lateral and preaortic lymph nodes.

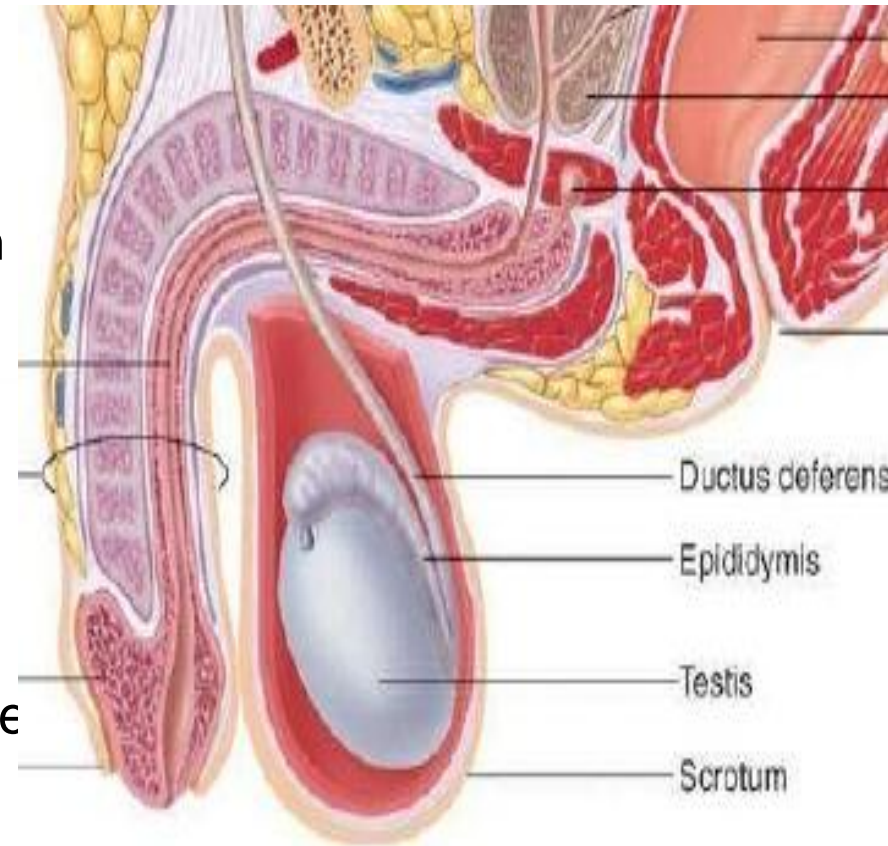
The nerves of the cord :

- Genital branch of the genitofemoral nerve (L1/2)
- Ilioinguinal nerve (though outside spermatic cord but travels next to it).
- Sympathetic nerves (testicular plexus)



The Testes

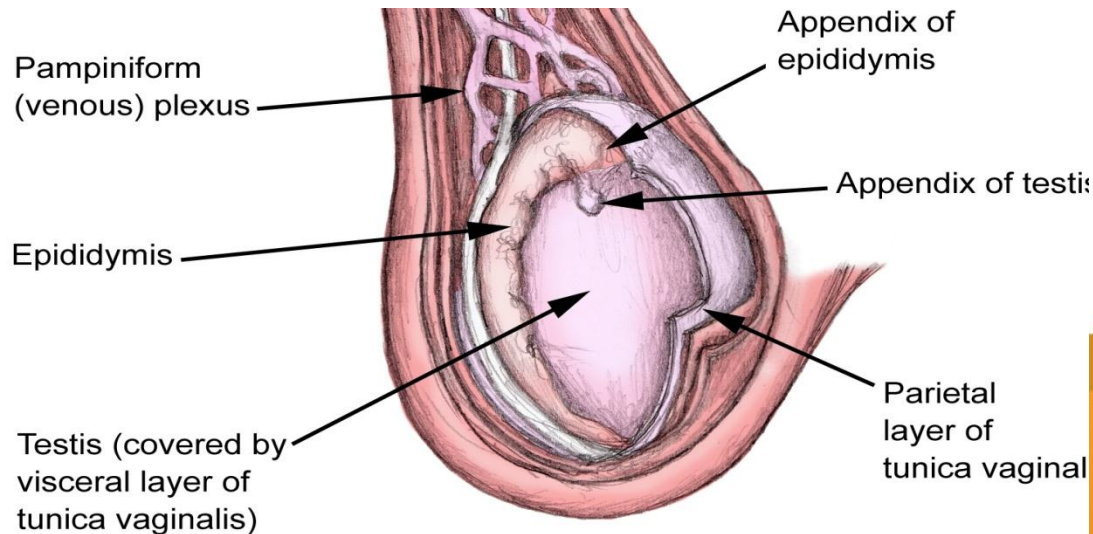
- ❑ Testes are suspended in the scrotum by the spermatic cords, the left testis hanging somewhat lower than its fellow .
- ❑ **Dimensions** of the testis are from 4 to 5 cm in length, 2.5 cm in breadth and 3 cm in anteroposterior diameter , its weight varies from 10.5 to 14g .
- ❑ It has two poles upper and lower, two borders anterior and posterior and two surfaces lateral and medial .
- ❑ Each testis is of an oval form compressed laterally, and having an oblique position in the scrotum; the upper pole is directed forward and laterally ; the lower pole backward medially .
- ❑ The anterior convex border looks forward and downward, the posterior is straight border looks backward and upward where the cord is attached.



❑ The anterior border and lateral surfaces, as well as both poles of the organ, are convex, free, smooth, and invested by the visceral layer of the tunica vaginalis. The posterior border to which the cord is attached, receives only a partial investment from that membrane.

❑ Lying upon the lateral edge of this posterior border is a long, narrow, flattened body, the **epididymis**.

❑ On the upper pole of the testis, just beneath the head of the epididymis is a minute oval sessile body the **appendix of the testis** (hydatid of Morgagni); it is the remnant of the upper end of the Müllerian duct



The testes are invested in 3 tunics :

Tunica Vaginalis :

- ❑ Is the serous covering of the testis, epididymis and spermatic cord , derived from the peritoneum during descent of the testis into the scrotum.
- ❑ After descent it becomes obliterated; the lower portion remains as a shut sac which invests the surface of the testis
- ❑ It has two laminae :

1- visceral lamina

- The visceral lamina covers the greater part of the testis and epididymis .
- From the posterior border of the gland it is reflected on to the internal surface of the scrotum.

2- parietal lamina

- Is far more extensive than the visceral extending upward for some distance in front and on the medial side of the cord and reaching below the testis.
- ❑ The inner surface of the tunica vaginalis is smooth and covered by a layer of endothelial cells.
- ❑ The interval between the visceral and parietal lamina constitutes the cavity of the tunica vaginalis .

Tunica Albugenia:

- ❑ Is the fibrous covering of the testis. It is a dense membrane of a bluish-white color composed of bundles or septa of white fibrous tissue which interlace in every direction and dip into the gland.
- ❑ These septa imperfectly divide the gland into wedge shaped parts called lobules .
- ❑ Tunica albugenia is covered by the tunica vaginalis, except at the points of attachment of the epididymis to the testis and along its posterior border where the spermatic vessels enter the gland.
- ❑ It is applied to the tunica vasculosa over the glandular substance of the testis and at its posterior border is reflected into the interior of the gland, forming an incomplete vertical septum called the **mediastinum testis**.

Mediastinum Testis

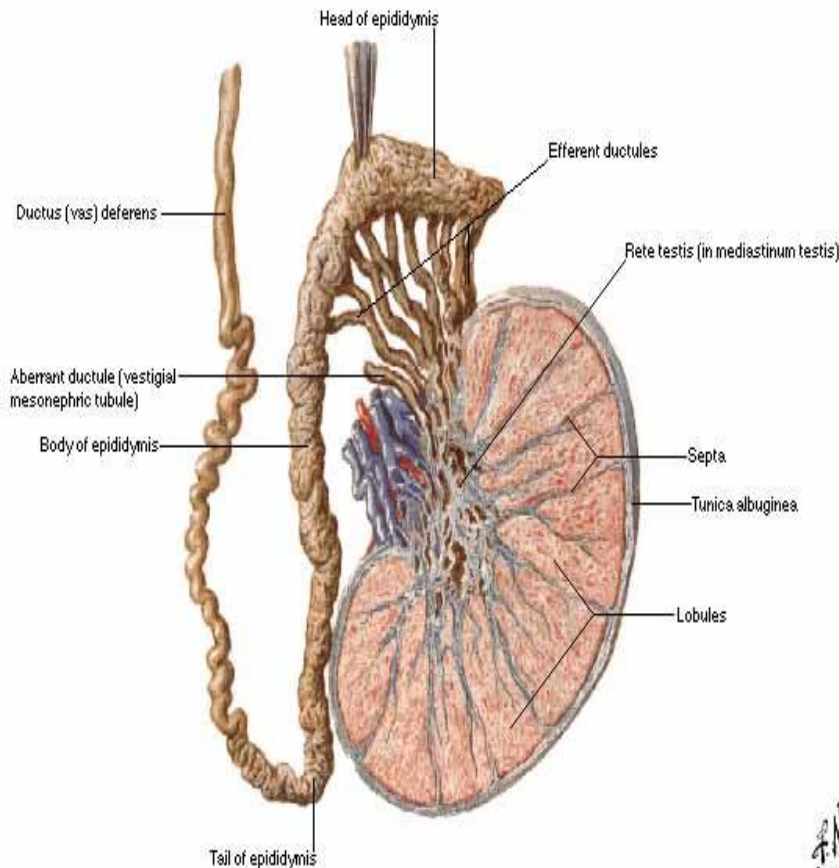
- ❑ The tunica albugenia thickens posteriorly to form the mediastinum testis which is an area where ducts, blood vessels and nerves leave or enter.
- ❑ From the mediastinum, thin, incomplete, and branching fibrous septa and associated blood vessels radiate into the gland .

Tunica Vasculosa:

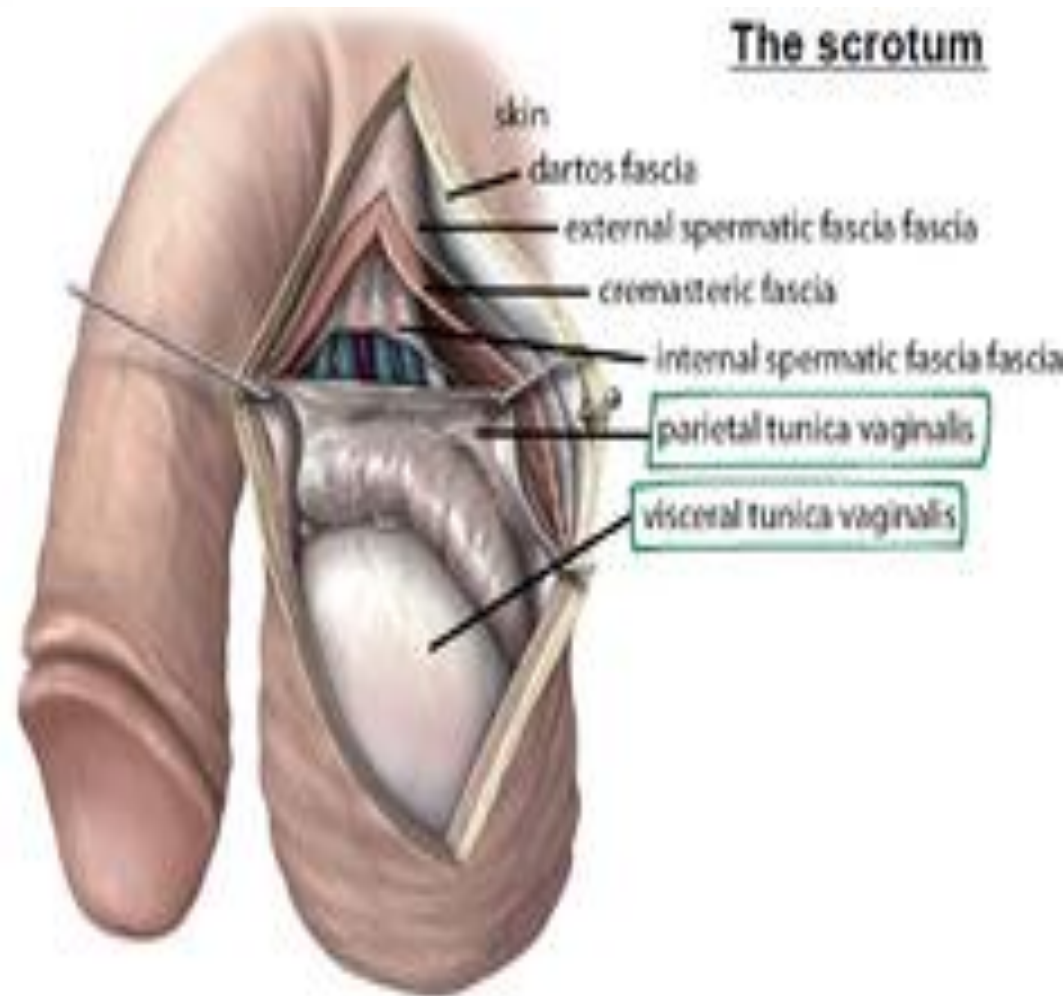
- ❑ The Tunica Vasculosa is the vascular layer of the testis consisting of a plexus of blood vessels held together by delicate areolar tissue.
- ❑ It clothes the inner surface of the tunica albuginea and the different septa in the interior of the gland.

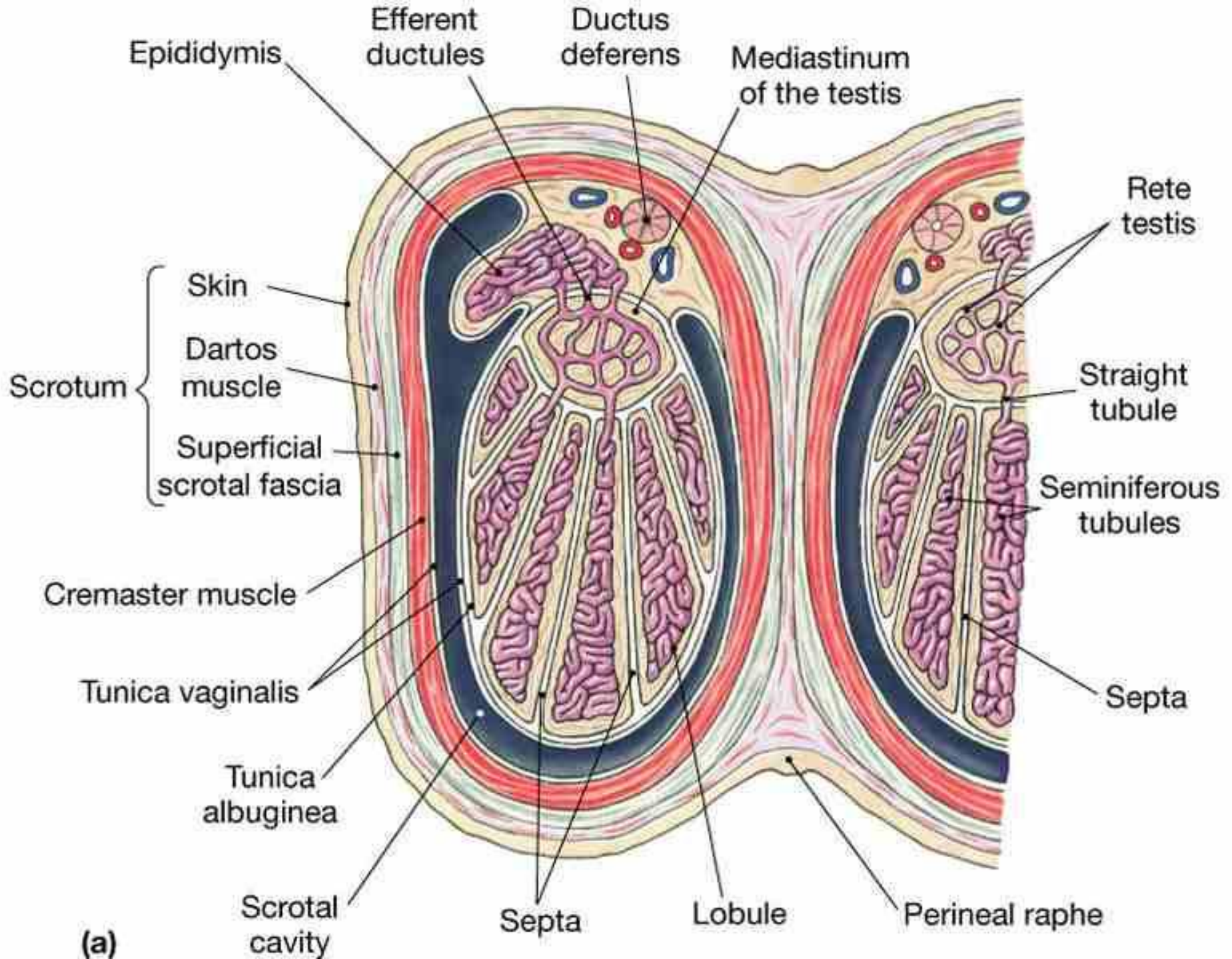
Testis, Epididymis and Ductus Deferens

Frontal Section



The scrotum





Gross anatomy

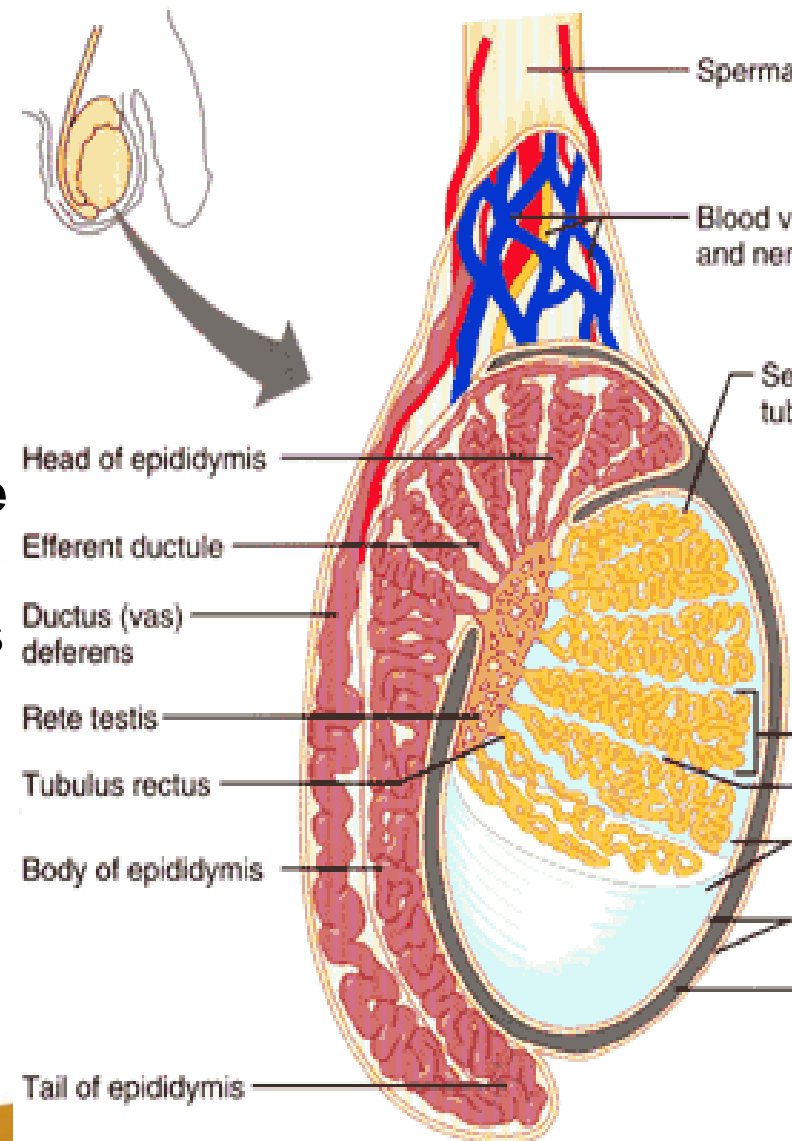
- ❑ Beneath the serous tunica vaginalis the testis is invested by an external coat the tunica albugenia from the deep surface of which number of slender fibrous bands or septa dip into the gland .
- ❑ These septa imperfectly divide the organ into number of wedge shaped parts called lobules about 200 to 300 in number . all the septa end posteriorly in the mediastinum and traversed by complicated network of canals into which the minute tubules open .
- ❑ The mediastinum, the septa, and the tunica albugenia form a framework enclosing a number of imperfectly isolated spaces which are filled by parenchyma testis composed of enormous numbers of much-convoluted seminiferous tubules completely fill up the intervals between the septa.
- ❑ The minute tubules look like fine threads but loosely held together by a small amount of connective tissue. Usually three or four tubules are found in each lobule and the total number in the testis is about 600

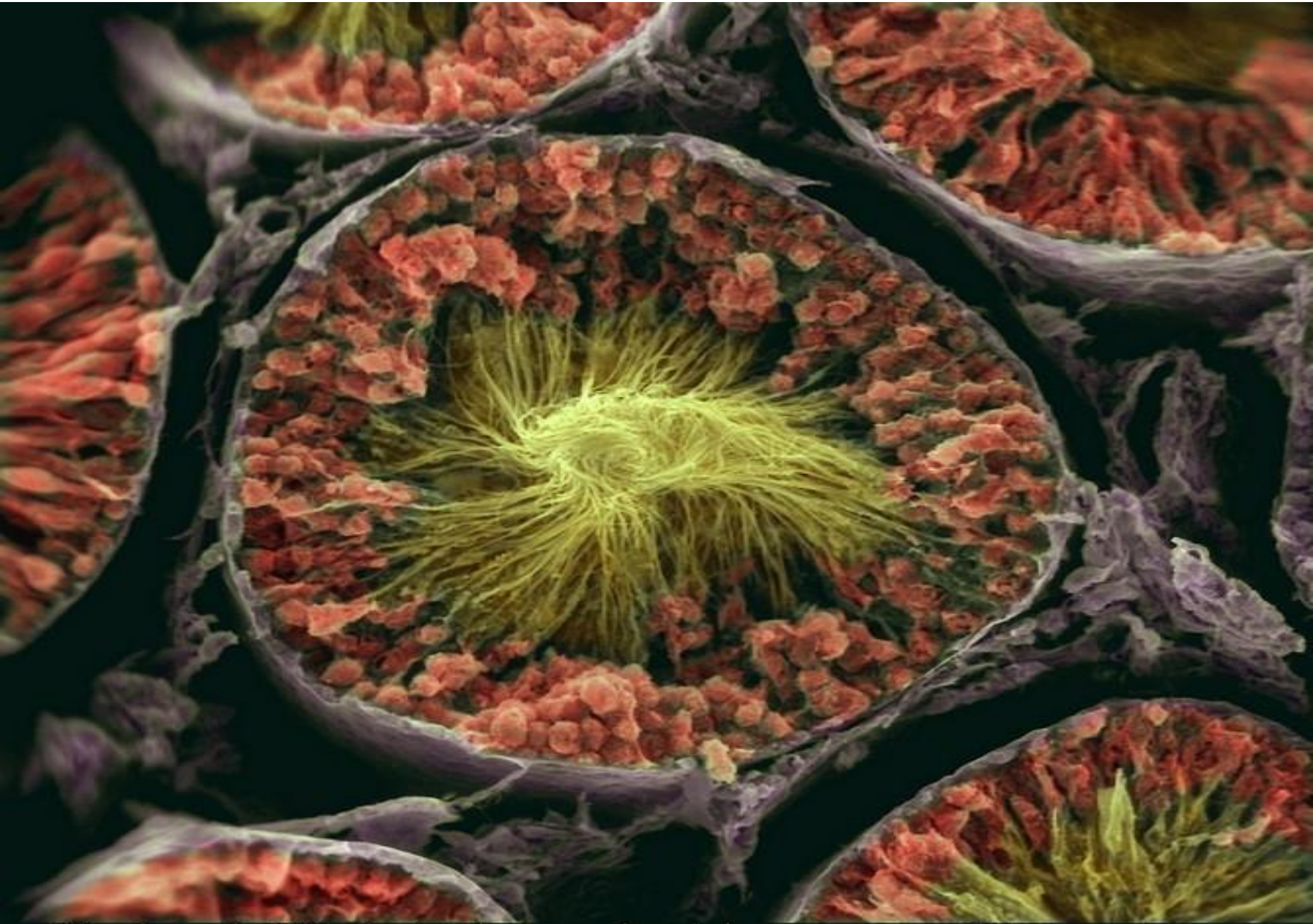
❑ The **seminiferous tubules** pass towards the mediastinum testis and unite at acute angles to form a smaller number of slender tubes which run a straight course called **tubuli recti** .

❑ **Tubuli recti** open into a complicated network of fine canals situated in the substance of the mediastinum called the **rete testis**.

❑ The secretion of the seminiferous tubules is carried through the tubuli recti into the rete testis and leaves to reach the canal of the epididymis through from fifteen to twenty minute tubules called **efferent ductules**.

❑ **Efferent ductules** pierce the tunica albugenia and enter the caput epididymidis . Each efferent ductule is at first straight but soon becomes much convoluted and forms a little conical mass of twisted tubule called a lobule Of the epididymis (conus vasculosa).





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Microscopic anatomy of the testis :

1- Wall of seminiferous tubule :

Each seminiferous tubule has a **central lumen lined the germinal epithelium** and is surrounded by **a well defined basement membrane** (formed of laminated connective tissue containing numerous elastic fibers)

The seminiferous epithelium is composed of two cell types:

Spermatogenic cells

Somatic cells (sertoli cells)

□Spermatogenic cells

Seminiferous tube wall is formed by a stratified epithelium where cells can be seen in different stages of spermatogenesis With primary cells closest to the basement membrane with those more mature closer to tubule lumen

Spermatogonia: they are the stem cells (diploid) that divide by mitosis. One of the daughter cells start the spermatogenesis, while the other remains as Spermatogonia. These cells are located in the basal part of germinal epithelium, i.e. adjacent to the basal lamina. They are cuboidal shaped and have a round or slightly oval nucleus.

Morphologically there are two types of these cells

type A Spermatogonia (dark nucleus)

type B Spermatogonia (clear nucleus, with small peripheral clumps of chromatin and a central nucleolus)

Spermatocytes: The type B Spermatogonia grows to form primary Spermatocytes which undergo the first meiotic division giving the secondary Spermatocytes which in turn undergo the second meiotic divisions forming the spermatids. so while the first meiotic division takes about three weeks the second meiotic division is very fast. This means it is very difficult to observe secondary Spermatocytes.

The primary Spermatocytes are characterized by having a large cytoplasm, in which can be seen a large nucleus which is characterized by the presence of clumps of heterochromatin chromosomes.

Spermatids: The spermatids are the result of meiotic divisions of Spermatocytes , they perform the spermiogenesis with nucleus becoming more compact and small and by the loss of part of the cytoplasm by the residual bodies.

spermatozoa identified by characteristic structures such as the acrosome, axoneme and mitochondria are arranged around it.

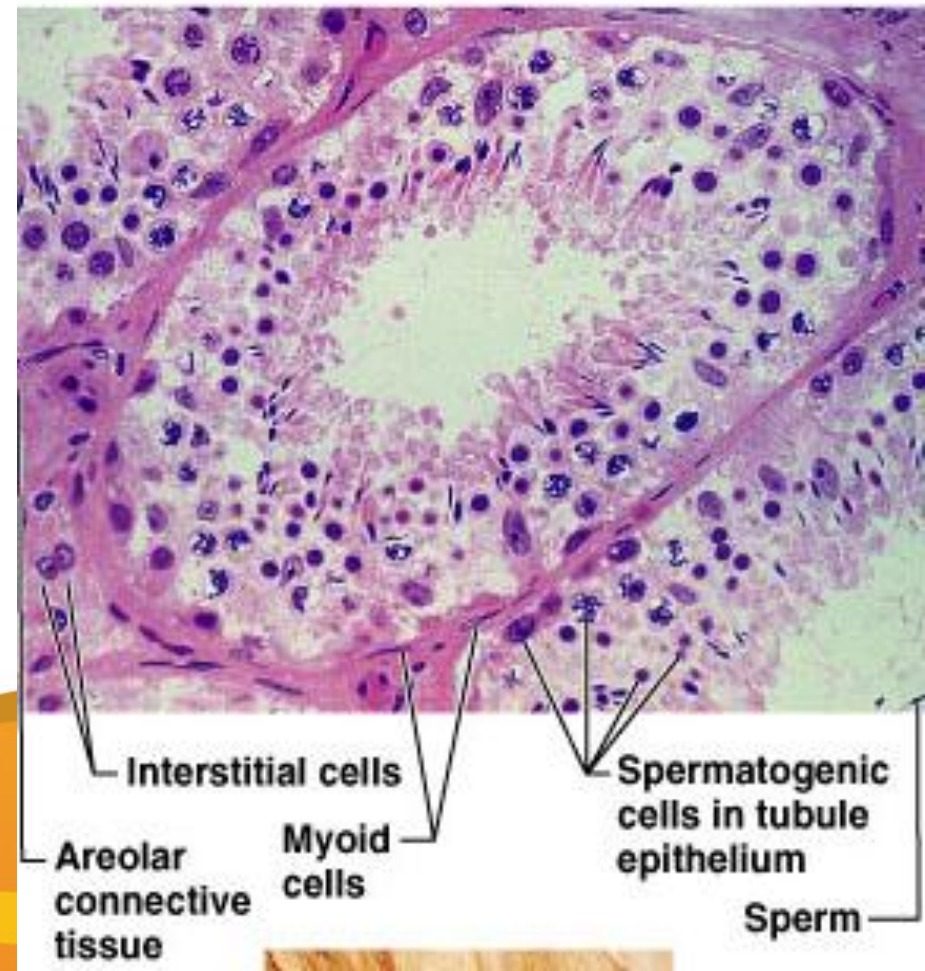
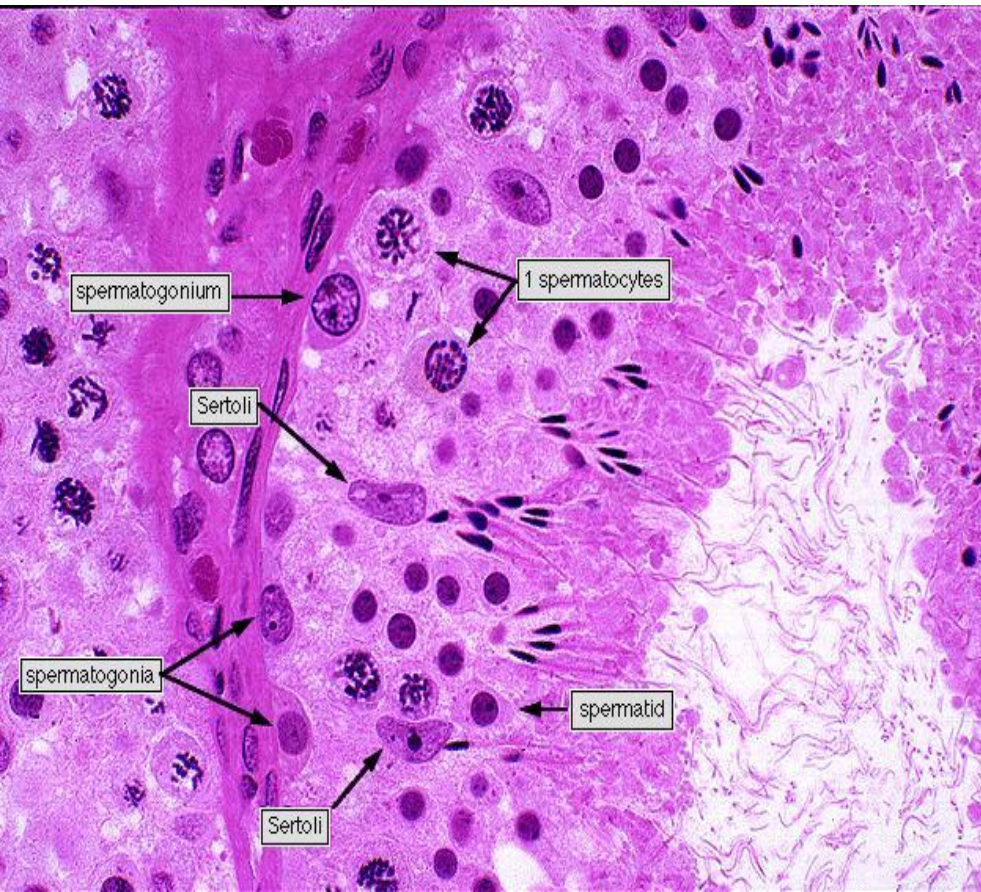
□ Sertoli cells:

- ✓ They form about 35- 40 % of germinal epithelium , they provide support for Spermatogenic cells.
- ✓ Sertoli cells show irregular shape, rest on the basal lamina and its extensions surround the cells of the Spermatogenic series and reach the lumen.
- ✓ Lateral projections of adjacent Sertoli cells are joined by tight junctions, which defines two compartments in the tubular wall. **the basal compartment** (in which are located the Spermatogonia) and **adluminal compartment** (in which are located Spermatocytes and spermatids). This perform the **blood-testis barrier**,
- ✓ **blood-testis barrier** prevents haploid cells contact with the immune system and cause autoimmune reactions.
- ✓ Tight junctions form a continuous circumferential seal above the basal lamina of the seminiferous tubules in the testis. The major proteins of BTB tight junctions are Occludins, Claudins and JAMs (Junctional Adhesion Molecules)
- ✓ Sertoli cells are tall columnar cells with ill defined borders , mainly due to the shape and location of its nucleus, which is pale placed perpendicular to the basal lamina and it shows a deep indentation very characteristic and pale cytoplasm rich in lipid droplets .

2- Peritubular cells : (lamina propria)

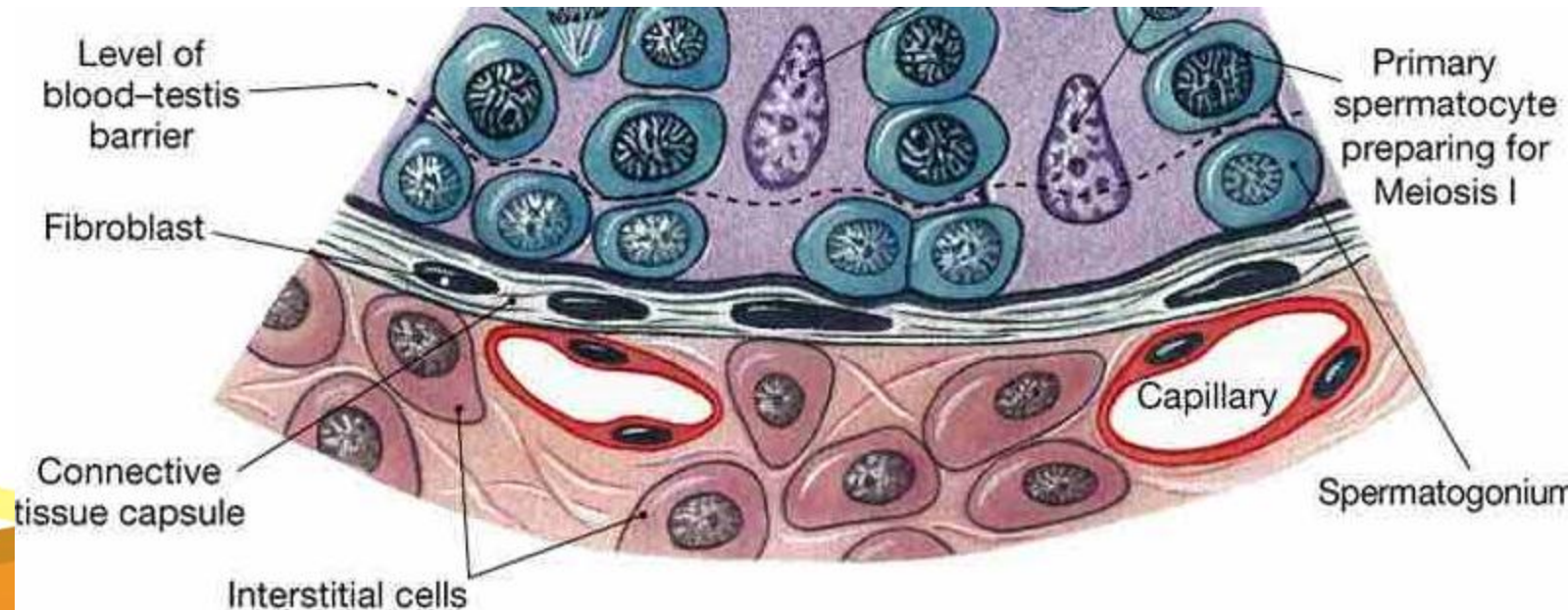
surrounds each seminiferous tubule consists of basal membrane , layer of collagen and Peritubular cells (myofibroblasts)

- Myofibroblasts are poorly differentiated myocytes with the capacity of spontaneous contraction . these cells are stratified around the tubules and form about 6 concentric layers produce gentle peristaltic waves in the tubules



3- Interstitial cells :

- ❑ The interstitial tissue in between the seminiferous tubules is composed of **leydig cells** blood vessels , lymphatics and macrophages .
- ❑ leydig cells are present singly or in clusters . they have rounded nucleus with a prominent nucleolus .
- ❑ Adult leidge cells are rich in smooth endoplasmic reticulum and mitochondria with tubular crists . the cytoplasm contains crystalline structures known as **Reinke crystals** which are probably subunits of globular proteins the function of which is not clearly known .
- ❑ The interstitial tissue also contain macrophages and lymphocytes. There is one macrophage for every 10 – 50 leidge cells..



Tubuli Recti

are lined by simple columnar epithelium which drops to simple cuboidal just before the rete testis.

Rete Testis

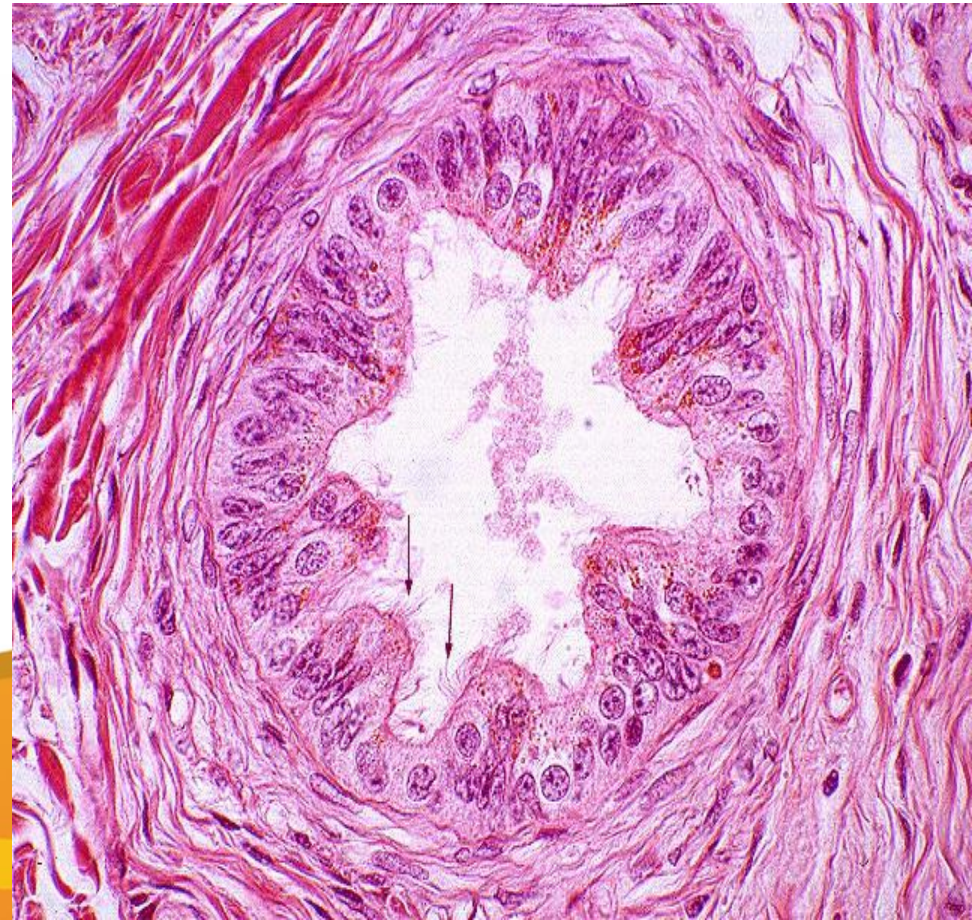
the tubules in the rete testis are lined by simple cuboidal or columnar epithelium (each cell has a single apical cilium) embedded in highly vascular loose interstitial connective tissue

Efferent Ductules.

Efferent ductules are lined by columnar epithelium which is pseudo stratified.

Lining cells may be ciliated (taller cells) or have microvilli (shorter cells).

A thin layer of circular smooth muscle occurs on the distal parts of ductules.



Arterial supply of testis :

1- Testicular artery

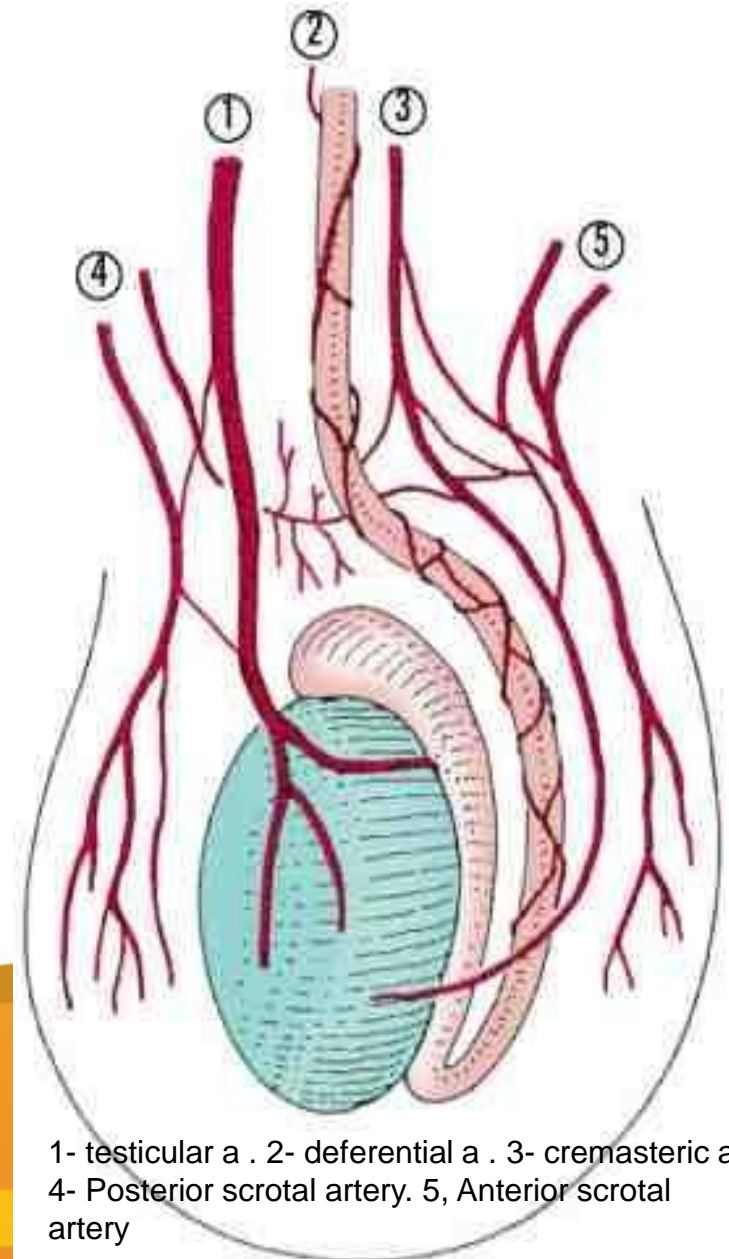
which is a branch from the aorta. reaching the posterior border of testis where it breaks up into branches which enter the mediastinum testis and distributed along the septa and on the deep surface of tunica albugenia.

2- Cremasteric artery :

a branch of inferior epigastric artery supplying coverings of cord anastomosing with testicular artery .

3- Deferential artery

branch of superior vesical artery



1- testicular a . 2- deferential a . 3- cremasteric a
4- Posterior scrotal artery. 5, Anterior scrotal artery

Venous drainage of testis :

- ❑ Venous drainage coming from the testis and epididymis joins to form the pampiniform plexus of veins .
- ❑ The vessels of plexus are very numerous, and ascend along the cord in front of the ductus deferens; below the superficial inguinal ring they unite to form three or four veins, which pass along the inguinal canal, and, entering the abdomen through the abdominal inguinal ring, coalesce to form two veins which drains via the internal spermatic vein into the inferior vena cava on the right side and to the renal vein on the left side.

Innervation of the testis :

The nerves for the testis accompany the internal spermatic artery, and are derived through the aortic and renal plexuses from the T10 segment of the spinal cord . The afferent fibers from the epididymis reach the spinal medulla through the posterior roots of the T11 -12 and L1.

Lymphatics of the testis :

A superficial plexus and a deep plexus of lymph vessels drain the testis and the epididymis upward through the spermatic cord to the lateral and preaortic lymph nodes.

The epididymis

Gross anatomy :

- ❑ The epididymis rests on the superior and posterolateral surfaces of the testis . The efferent ductules arise from the testis join together forming the epididymis which is a single highly convoluted duct about 5-6 meters in length .
- ❑ The epididymis consists of a central portion or **body(corpus)**; an upper enlarged pole, the **head** (caput) (*Globus major*); and a lower pointed pole, the **tail** (Cauda)(*Globus minor*), which is continuous with the ductus deferens,
 - The head** ; contains the efferent ductules arising from the testis and the initial part of the ductus epididymis.
 - The tail** ; contains the terminal segment of the ductus epididymis which connects with the vas deferens.
 - The body** ; runs along the side of the testis and contains most of the length of the ductus epididymis
- ❑ Between the body and the testis is a pouch, sinus of the epididymis (*digital fossa*)..

❑ On the head of the epididymis is a second small appendage (sometimes duplicated); it is named the **appendix of the epididymis** (*pedunculated hydatid*)

❑ **Aberrant Ductule :**

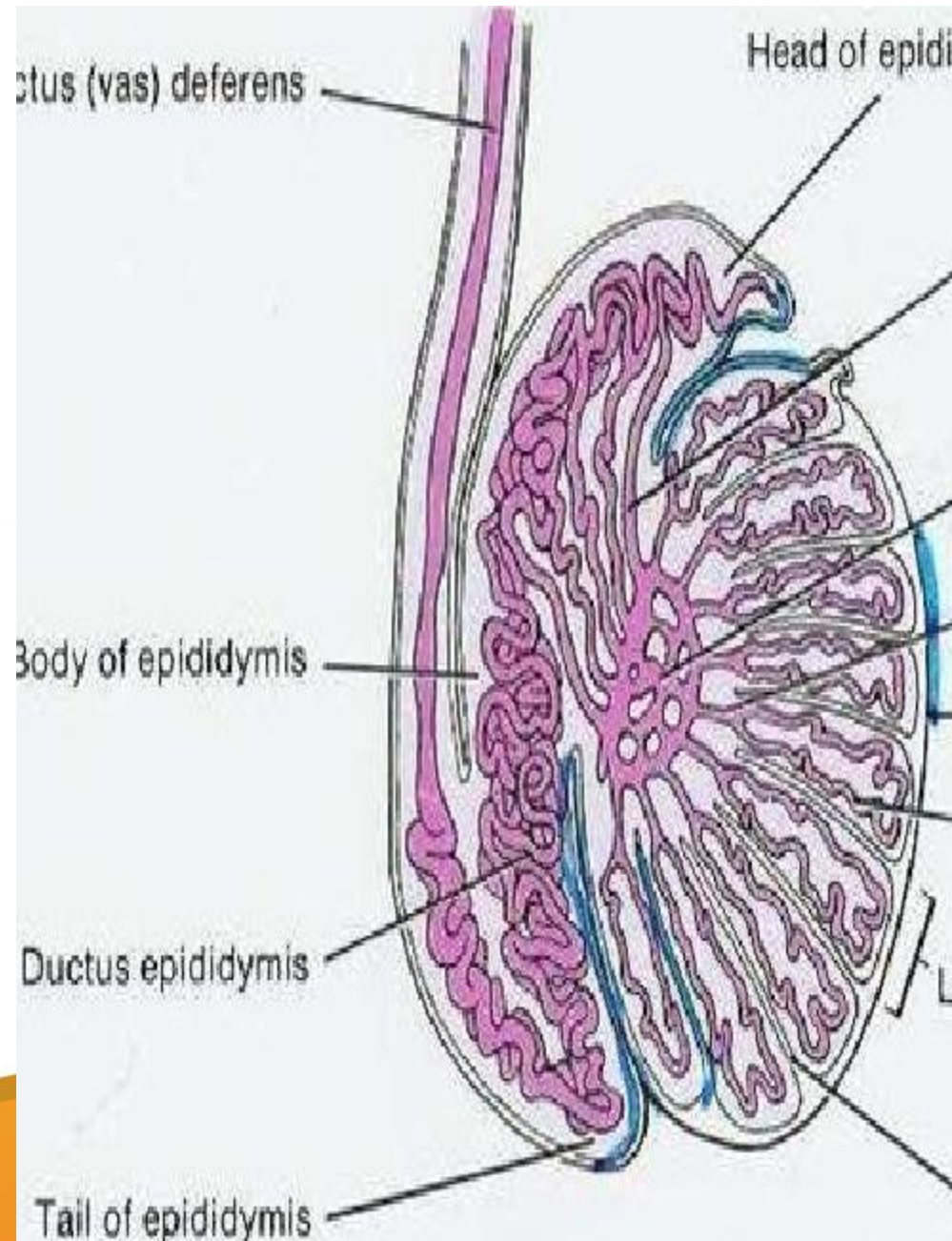
superior aberrant ductule A tube occurs in the head of the epididymis; it is connected with the rete testis

inferior aberrant ductule

A long narrow tube found connected with the lower part of the canal of the epididymis. Its length varies from 3.5 to 35 cm., and it may become dilated toward its margin.

❑ **Paradidymis (organ of Giralvés).**

small collection of convoluted tubules, situated in front of the lower part of the cord above the head of the epididymis. These tubes are lined with columnar ciliated epithelium



Microscopic anatomy:

- **Capsule** :dense regular collagenous connective tissue
- **Stroma** : loose connective tissue
- **Parenchyma (the ductus epididymis)**

composed of epithelial and muscular tissue

□ **The epithelium** of epididymal duct is pseudo stratified columnar epithelium consisting of :

1- Principle cells which are of various heights generally shorter distally rich in rough endoplasmic reticulum ,mitochondria and Golgi complexes with luminal microvilli , sterocilia and cytoplasmic protrusions extending into the lumen responding for secretory function

2- Basal cells are spherical in shape and don't extend to the lumen . their function is unknown but thought to be precursor of principle cells

3- Residual cells are lymphocytes

□ **Thin smooth muscle layer**

surrounds the epithelium. The muscle is mainly circular along most of the ductus epididymis

Stereocilia

The Stereocilia of the epididymis aid in absorption. They are long cytoplasmic projections that have no motility, they are like absorptive microvilli of other epithelia. increasing the surface area of the cell for absorption and secretion.

The Stereocilia in the epididymis are shaped by an internal actin network with no microtubule structure.

Blood epididymal barrier :

The blood epididymal barrier consists of epithelial cell to cell tight junctions preventing the passage of large molecules (toxic metabolites) into the lumen

Blood supply of epididymis:

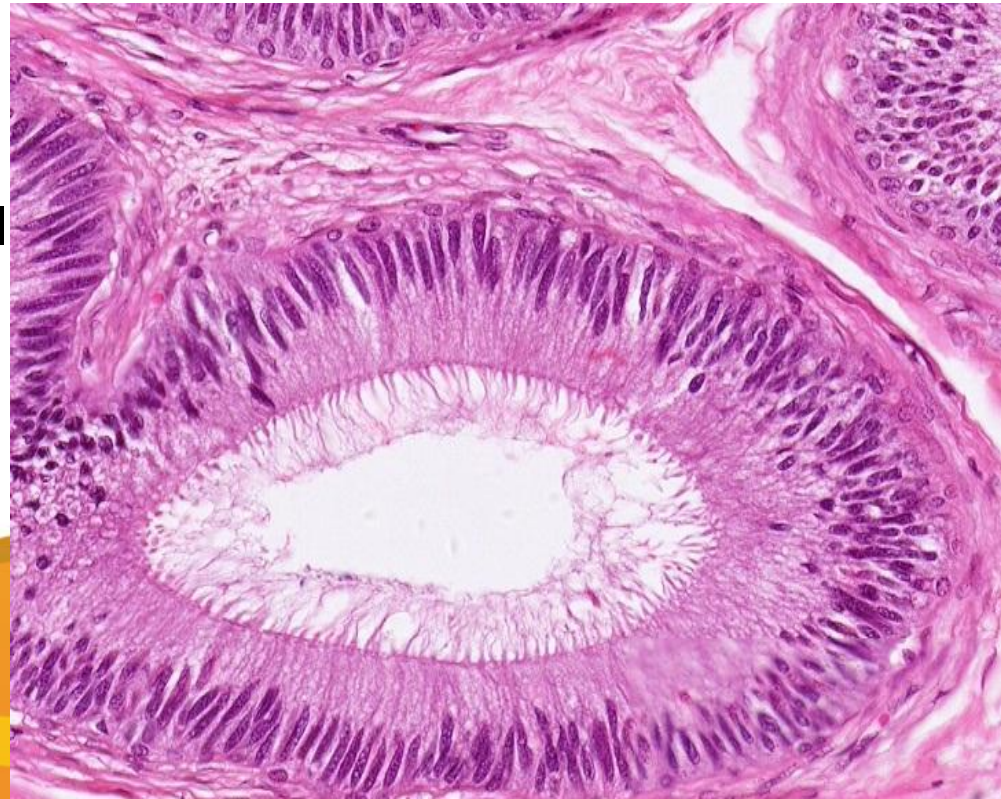
- ❑ Testicular artery (Caput & Corpus),
- ❑ Deferential artery (Cauda); collateral circulation exists from Deferential & Cremasteric arteries .

Venous drainage :

Via the pampiniform plexus of veins

Innervation :

Autonomic nerve supply



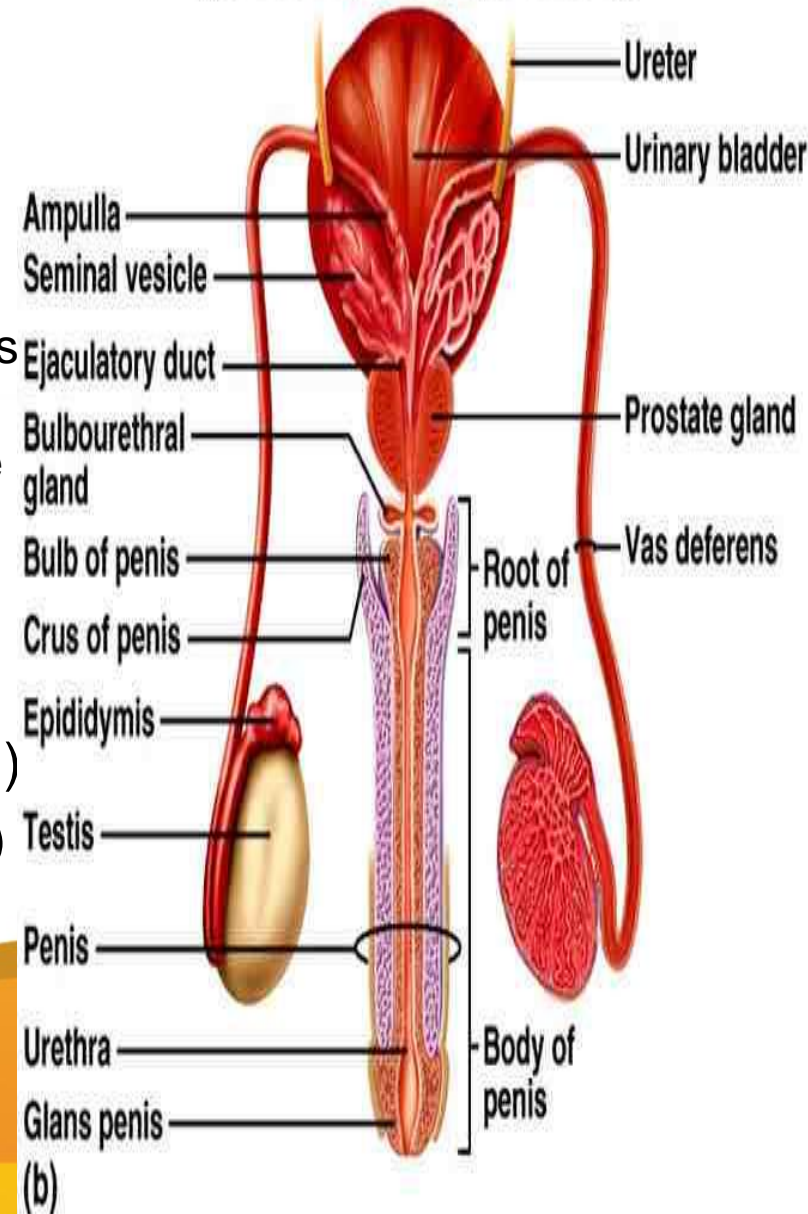
Ductus Deferens

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The ductus deferens, or vas deferens, is a fibromuscular tube that is continuation of the epididymis and is an excretory duct of the testis. Each ductus is 30-45 cm in length and serves to transport sperms from the respective epididymis to the ipsilateral ejaculatory duct. The ductus deferens presents a hard and cord-like sensation to the fingers and is of cylindrical form, its walls are dense and its canal is extremely small.

Anatomically its divided into 5 portions :

- 1- Epididymal portion (within tunica vaginalis)
- 2- Scrotal portion(outside the tunica vaginalis)
and that is the site of vasectomy
- 3- Inguinal portion
- 4- Pelvic portion
- 5- Ampulla

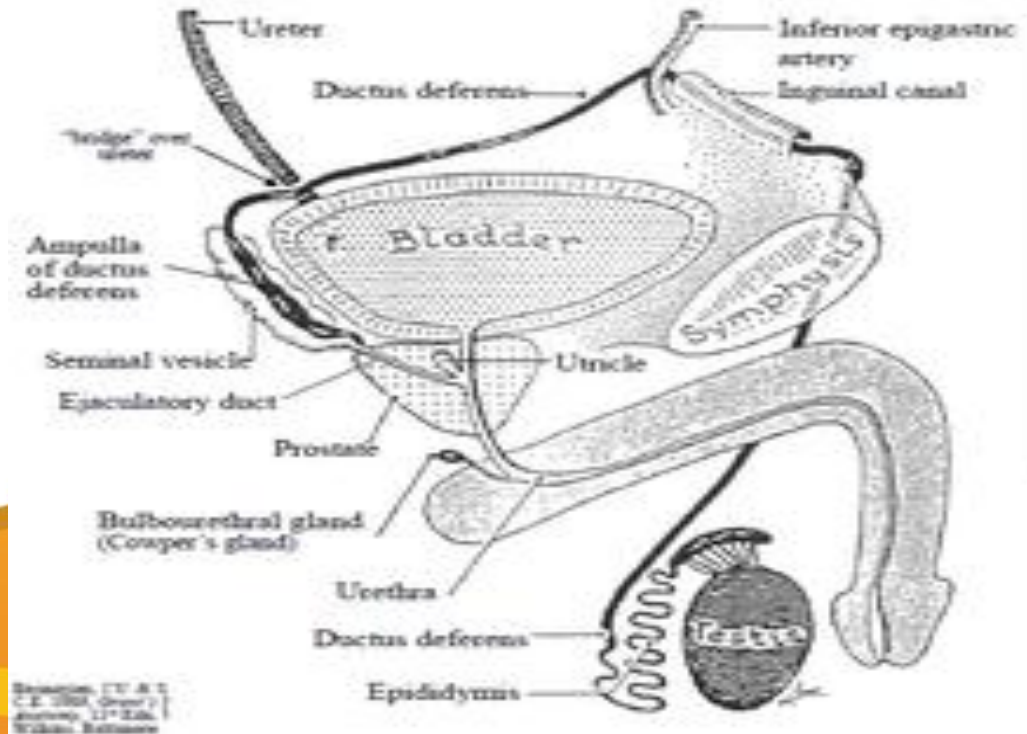
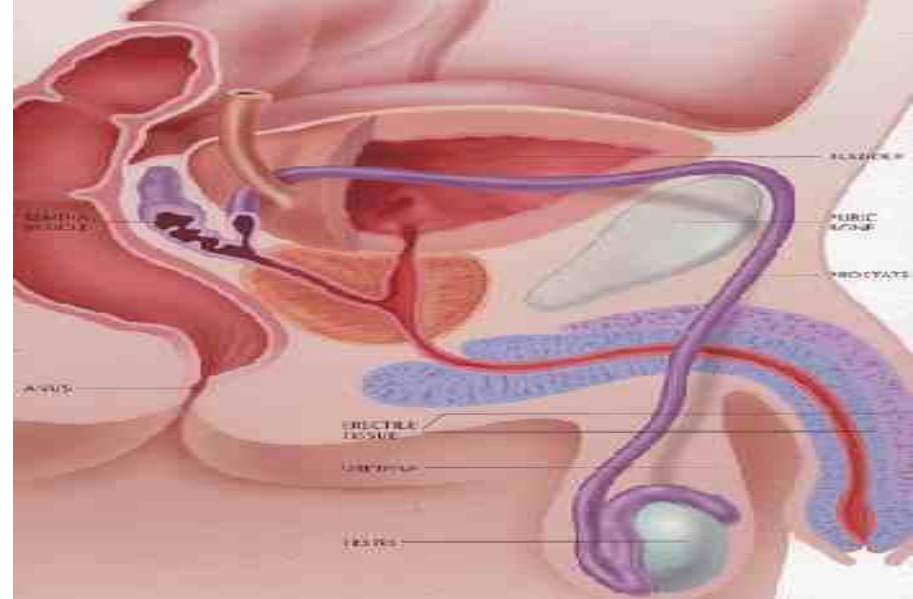


Course of the ductus deferens

Continuing from the tail of epididymis, It ascends along the posterior border of the testis and medial side of the epididymis in the spermatic cord, traverses the inguinal canal to the deep inguinal ring.

Here in the deep ring it separates from the other structures of the cord, curves around the inferior epigastric artery entering pelvis between the peritoneal membrane and the lateral pelvic wall.

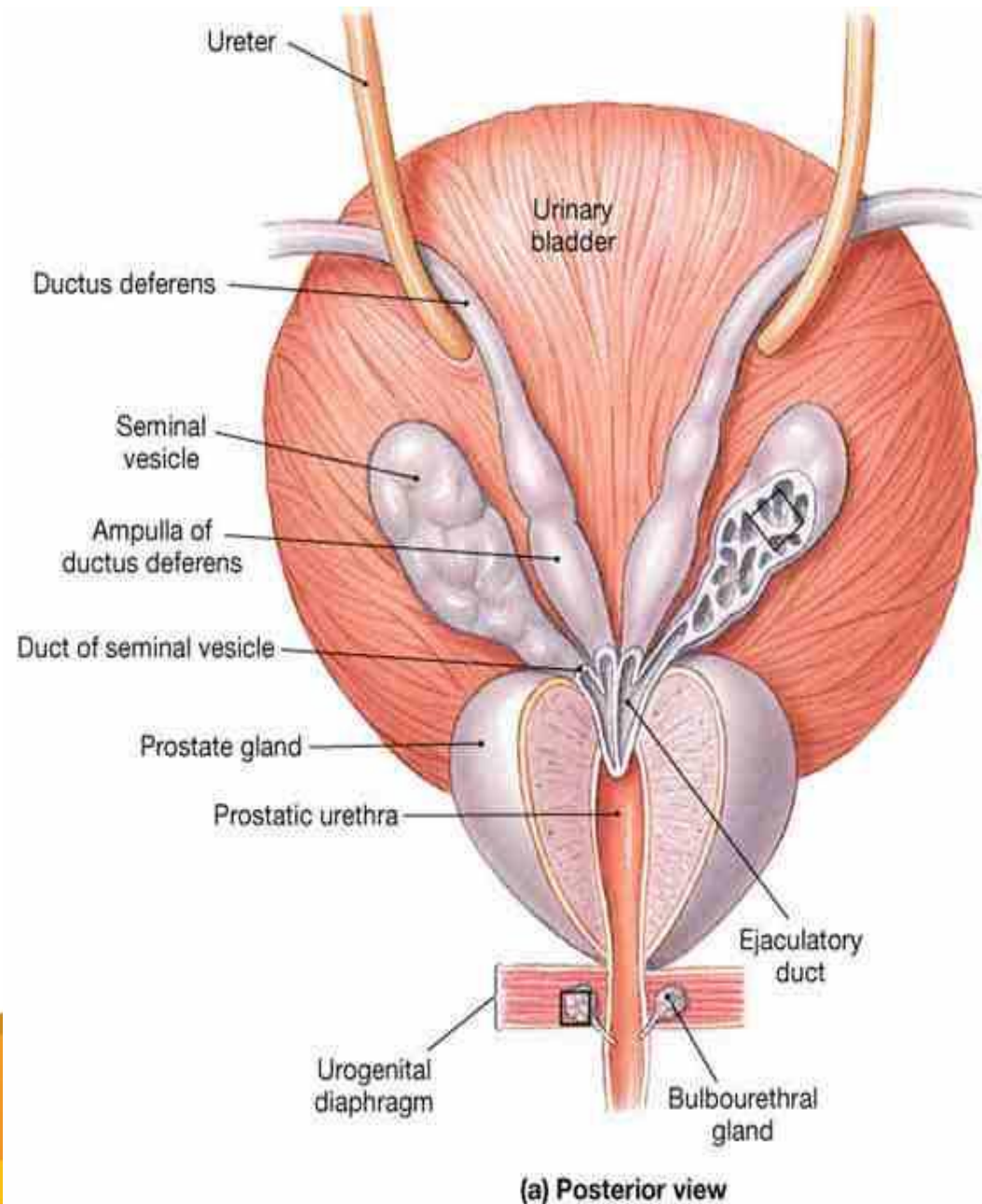
It then crosses in front of the ureter, runs medial between the fundus of the bladder and the upper end of the seminal vesicle.



□ Reaching the medial side of the seminal vesicle, it is directed downward and medially in contact with it gradually approaching the opposite ductus.

□ as it runs medially to seminal vesicle , it enlarges and terminates into a sacculated structure called the ampulla of the ductus.

□The ampulla attenuates at the base of the prostate and merges with the seminal vesicle duct to form the ejaculatory duct.



Microanatomy :

The ductus deferens consists of three coats:

(1) External or areolar coat:

connective tissue.

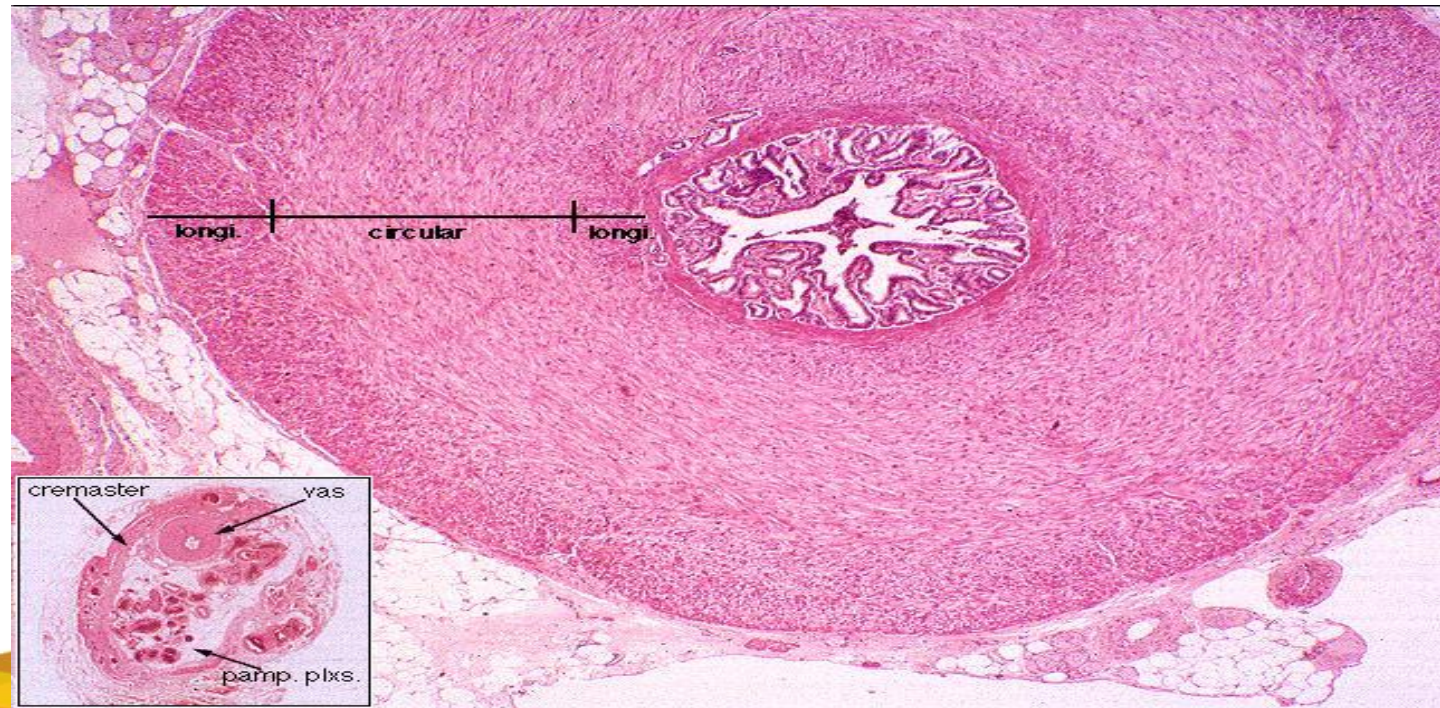
(2) Muscular coat

which in the greater part of the tube consists

Inner longitudinal smooth muscle layer

Middle circular smooth muscle layer (thickest)

Outer longitudinal smooth muscle layer



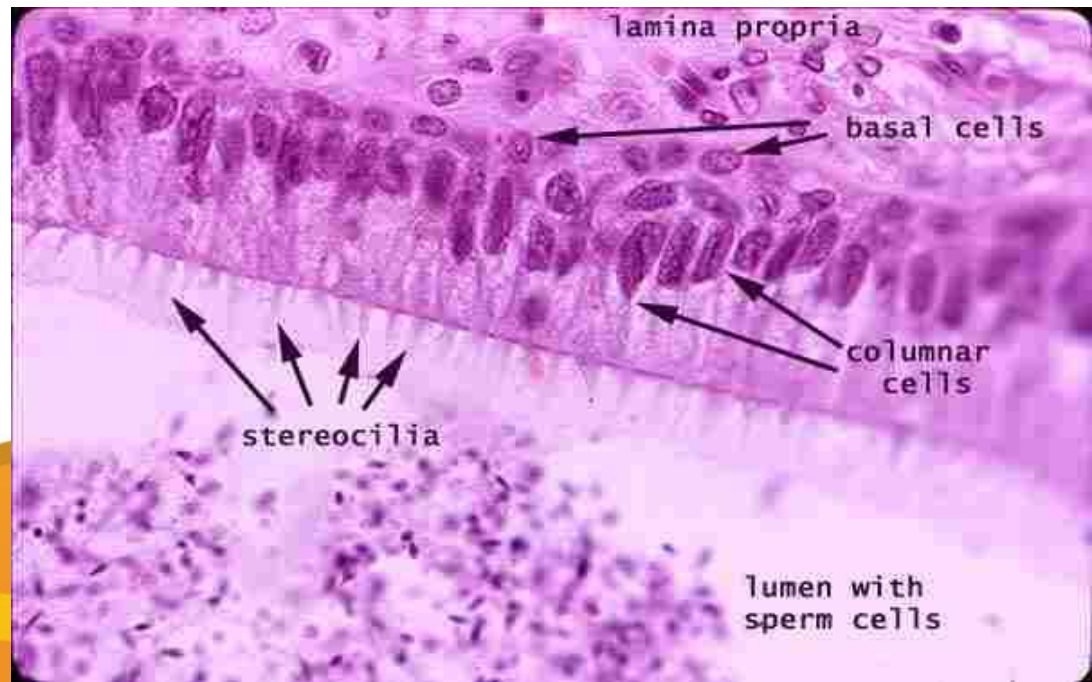
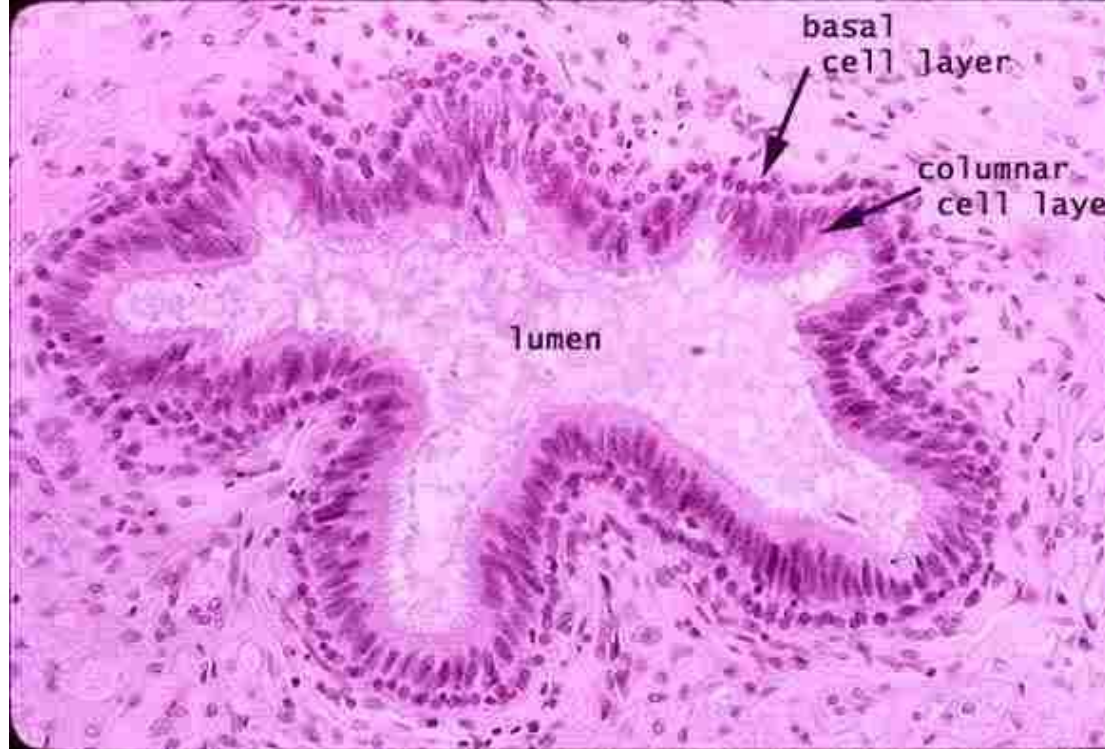
3) Internal or mucous coat

□ which is pale and arranged in longitudinal folds lined by pseudo stratified epithelium.

□ Height of epithelium decreases along the length of ductus

□ Pseudo stratified epithelium is composed of basal cells & 3 types of columnar cells (Principal cells, Pencil cells & Mitochondrian-rich cells)

□ Columnar cells all show Stereocilia & irregular convoluted nuclei



Arterial supply:

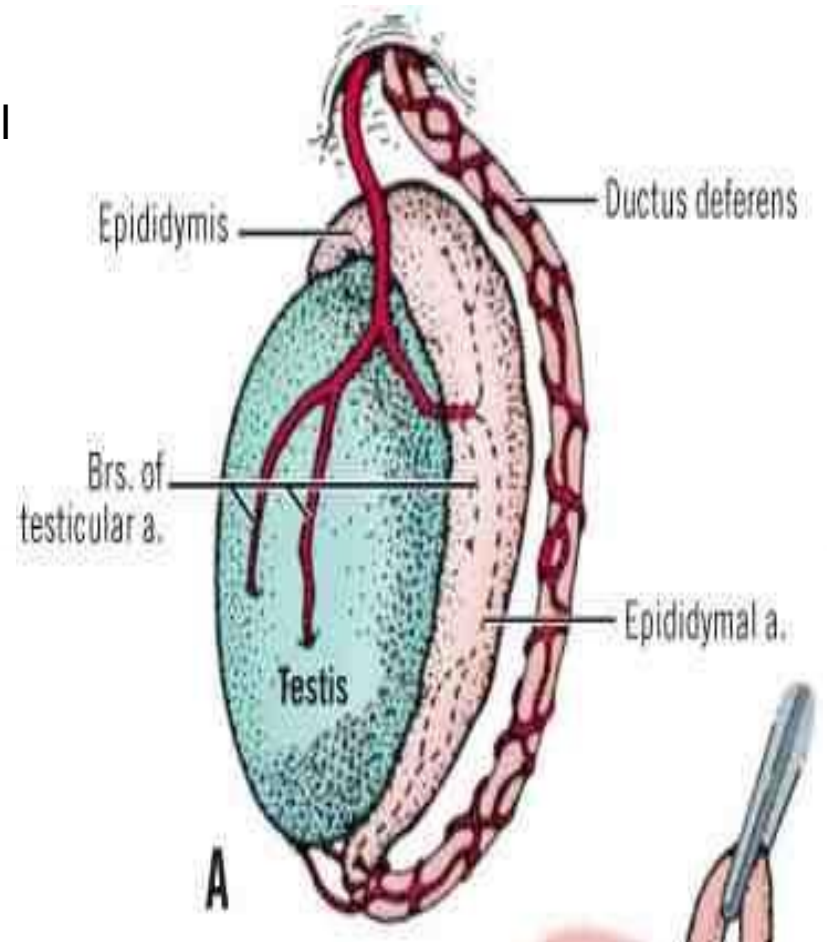
Vas deferens receives blood supply from vasal artery or deferential artery that comes from inferior vesical artery which is a branch of internal iliac artery .

Venous drainage :

Through the pampiniform plexus to internal spermatic vein.

Nervous supply:

Parasympathetic , Sympathetic (derived from Hypogastric nerves , it also receive short adrenergic nerves present in all 3 layers of the muscle layers of vas deferens



Seminal vesicles

Gross anatomy :

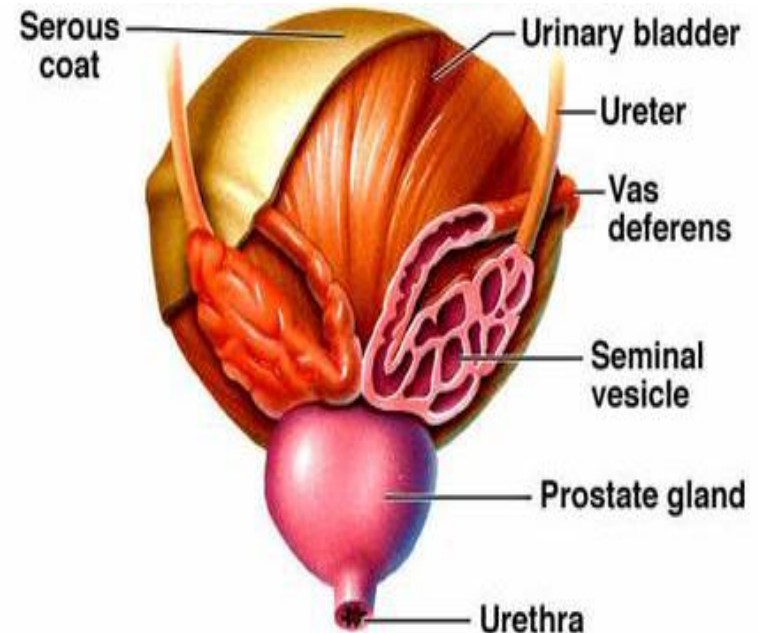
❑ Two lobulated membranous pouches placed between the fundus of the bladder and the rectum. Each sac is pyramidal in form. It is about 7.5 cm long , 2 cm wide

❑ **The anterior surface** is in contact with the fundus of the bladder extending from the termination of the ureter to the base of the prostate.

❑ **The posterior surface** rests upon the rectum, from which it is separated by the rectovesical fascia.

❑ **The upper poles** of the two vesicles diverge from each other and are in relation with the ductus deferens and the terminations of the ureters.

❑ **The lower poles** are pointed and converge toward the base of the prostate, where each joins with the corresponding ductus deferens to form the ejaculatory duct.



Microanatomy :

Each vesicle is highly irregular, giving a honeycomb appearance .

Each seminal vesicle have **mucosa** consisting of a lining of columnar cells and a lamina propria , a **thick muscular** wall and **outer coat** .

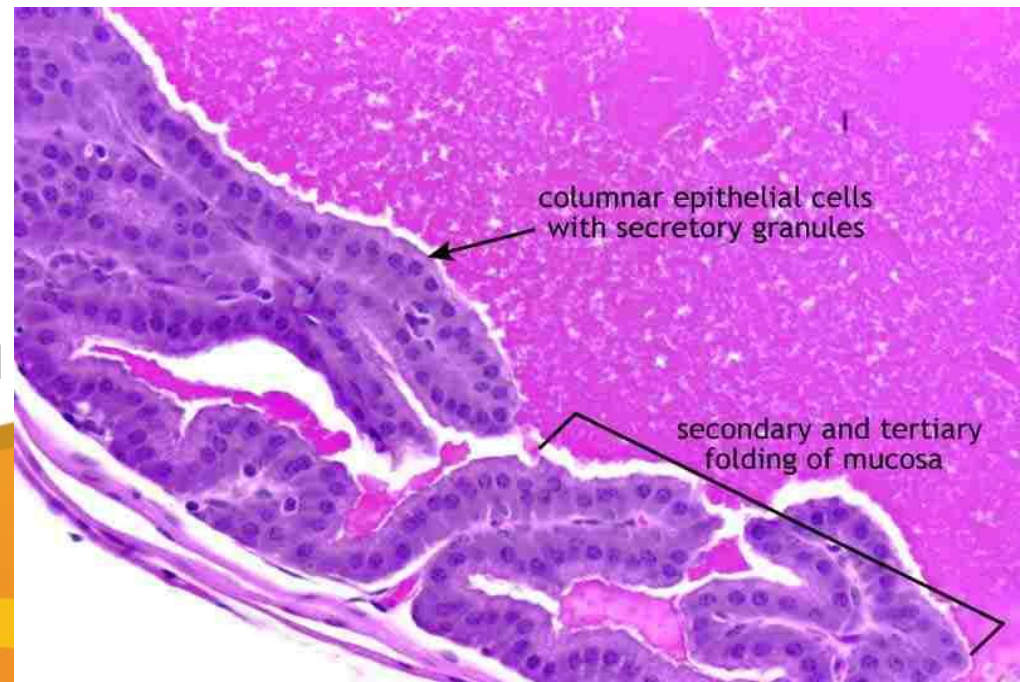
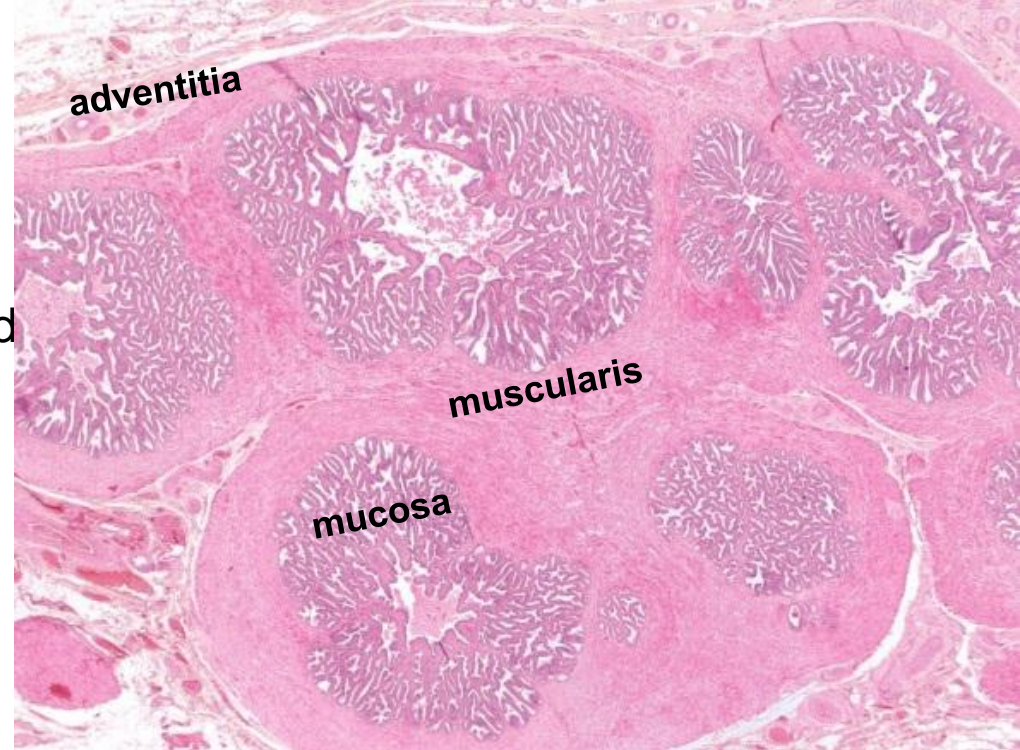
Mucosa (highly folded)

The epithelium is pseudo stratified cuboidal or low columnar in character. most cells contain large acidophilic apical secretory granules.

The lamina propria is highly cellular loose connective tissue, rich in elastic fibers . It also contains underlying small blood vessels and lymphatics.,

An outer muscular layer consisting of an inner circular and outer longitudinal layer of smooth muscle.

Adventitia loose to moderately dense FECT , rich in elastic fibers



Arterial supply :

The arteries supplying the seminal vesicles are derived from the **middle and inferior vesical and middle rectal arteries** .

Venous drainage:

The veins accompany the arteries and drain into **internal iliac veins**.

Lymphatics

also accompany the course of arteries and drain into **internal iliac LNs**

Nerve supply.

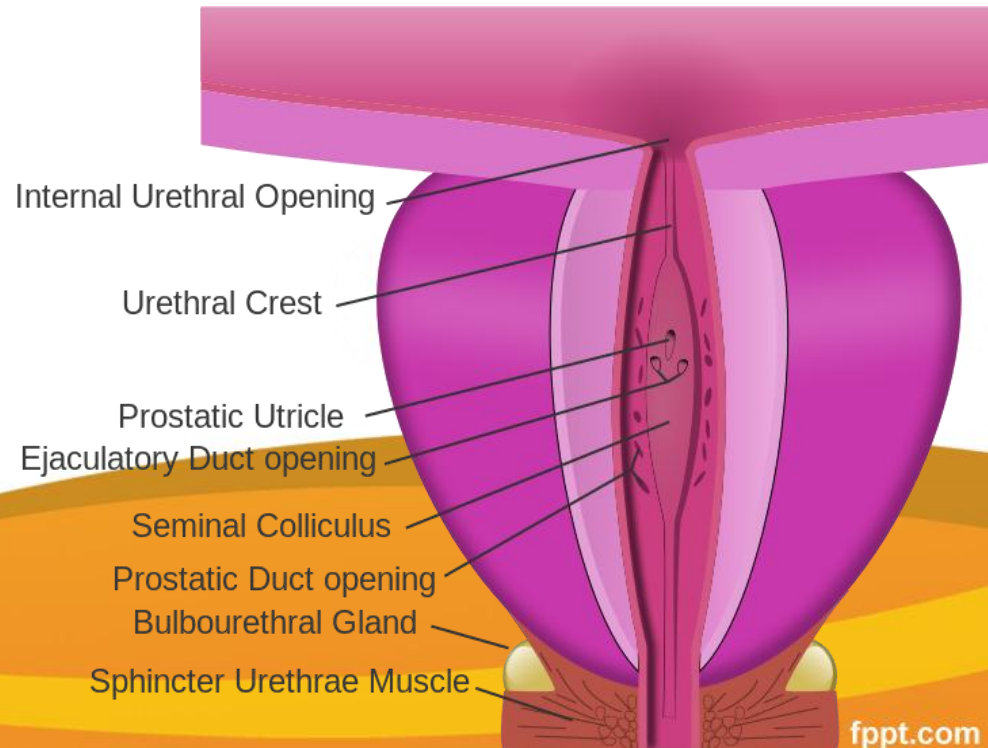
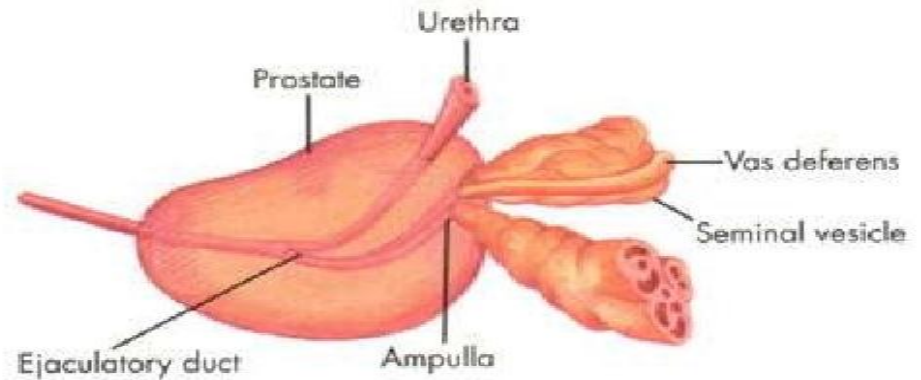
Sympathetic controls rapid contraction during ejaculation derived from superior lumbar & hypogastric n.

parasympathetic derived from pelvic splanchnic n, inferior hypogastric (pelvic) plexus

Ejaculatory ducts

Gross anatomy

- They are two in number, one on either side of the middle line.
- Each is formed by the union of the duct from the seminal vesicles with the ductus deferens, Each is about 2 cm long.
- They begin at the base of the prostate and run forward and downward between its middle and lateral lobes and along the sides of the prostatic utricle, to end by separate slit-like orifices close to or just within the margins of the utricle.



Microanatomy :

The lining epithelium is irregular shape to complex mucosal folds,
The ejaculatory ducts are lined by a mixture of simple columnar and pseudo stratified columnar epithelium

There is strong cell polymorphism in cell height, nuclear shape and amount of secretory organelles.

Blood Supply

deferential artery (inferior vesicle artery)

Venous drainage

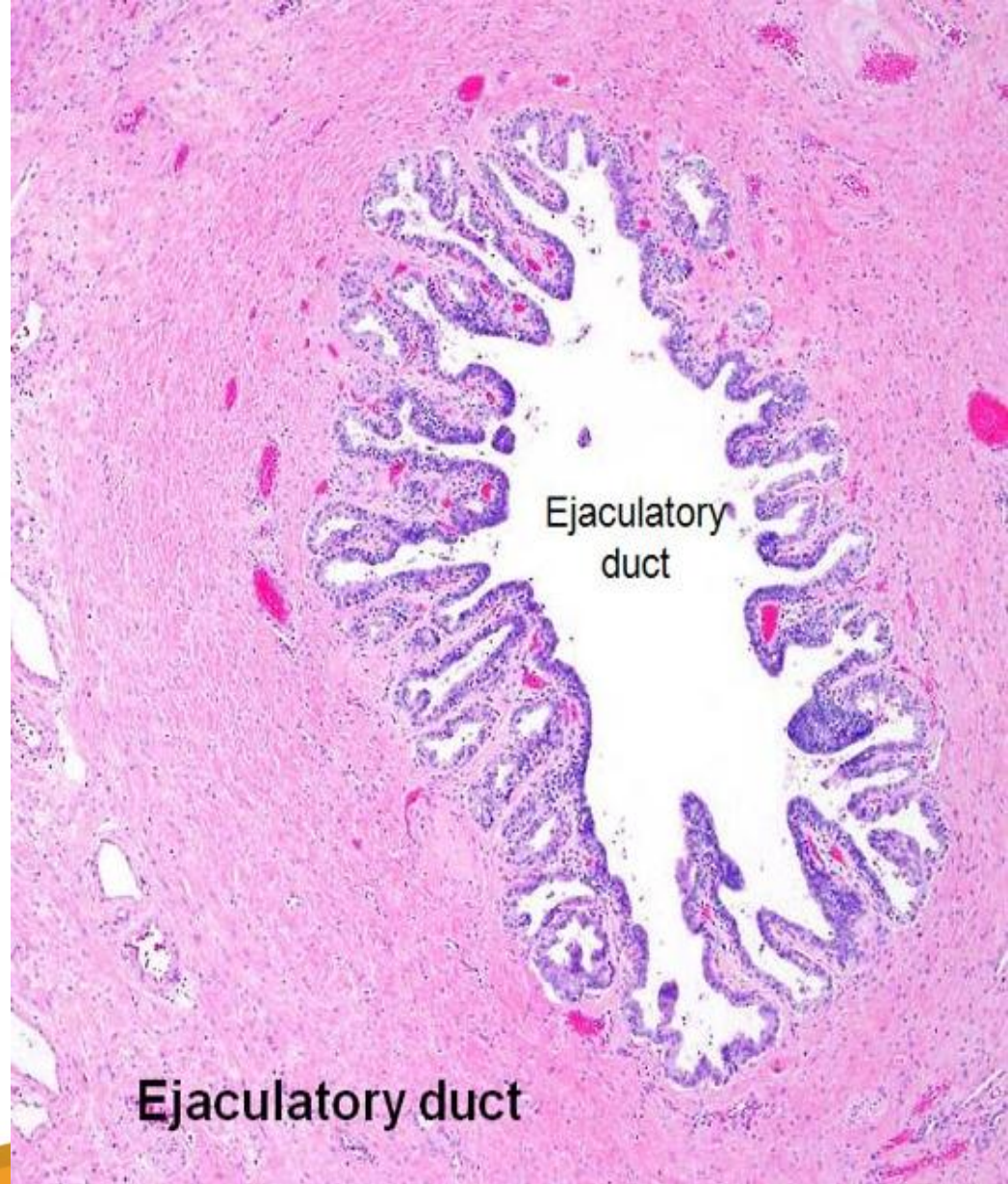
prostatic and vesical venous plexus

Lymph drainage:

external iliac LNs

Nerve supply:

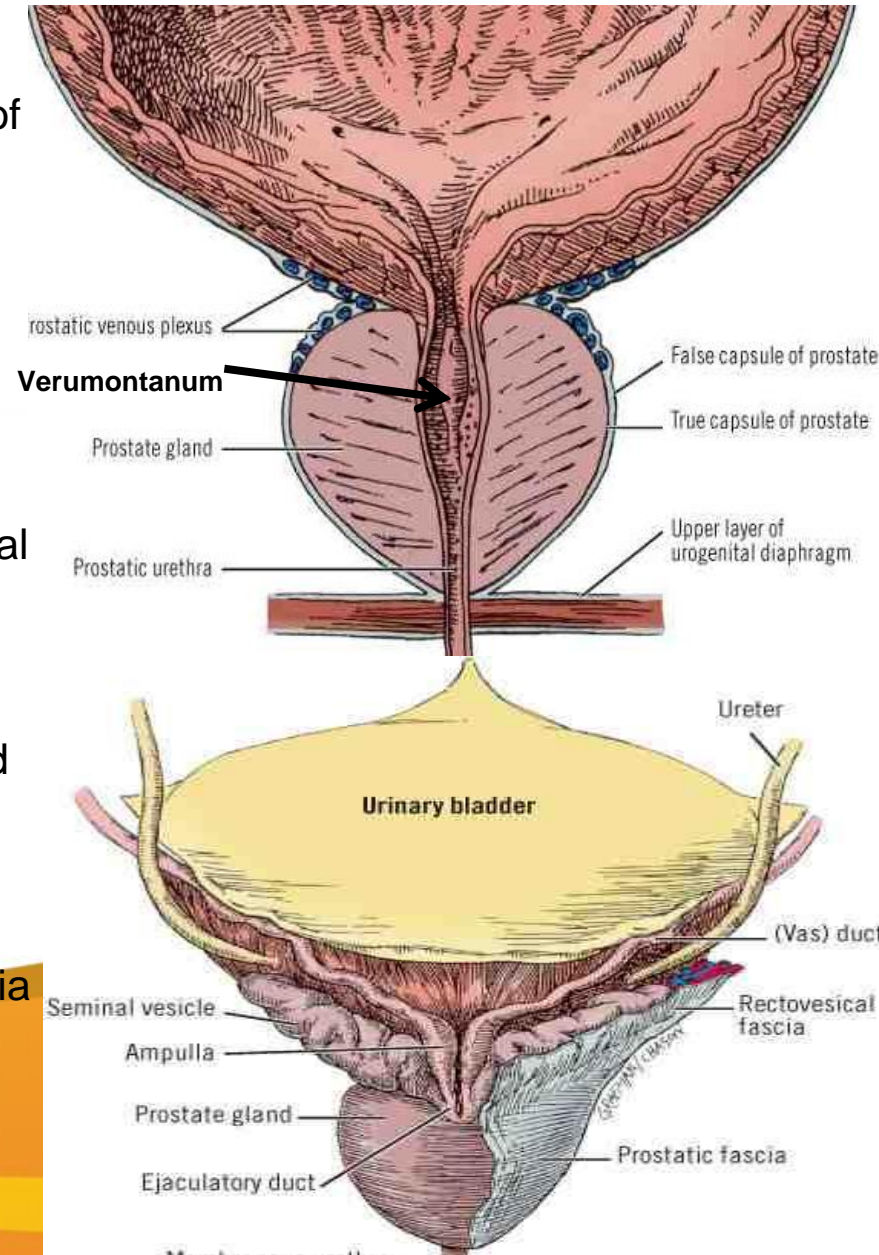
inferior hypogastric plexus



Prostate gland

Gross anatomy :

- ❑ The prostate is a pelvic organ encircling the neck of the bladder shaped like an inverted cone .It is a fibro muscular and glandular organ that surrounds the prostatic urethra.
- ❑ It is about 3cm long and weighs about 20 g , lies between the neck of the bladder above and the urogenital diaphragm below .
- ❑ The Denonvilliers' fascia, a thin, filmy layer of connective tissue, separates the prostate and seminal vesicles from the rectum posteriorly.
- ❑ The prostate is surrounded by a fibrous capsule ,outside the capsule is a dense fibrous sheath includes the prostate venous plexus , lymphatics and nerves .
- ❑ **Base of the prostate** superiorly lies against the bladder neck.
- ❑ **Apex** inferiorly in contact with the superficial fascia of the urogenital diaphragm .
- ❑ **Verumontanum** is a longitudinal ridge in the apex of the prostate in which the ejaculatory ducts open.



According to McNeal's model of the prostate is divided into 4 different anatomic zones :

1- Peripheral zone :

The area forming the postero inferior aspects of the gland and represents 70 % of prostatic volume it's the zone where majority of prostate cancers occur.

2- Central zone :

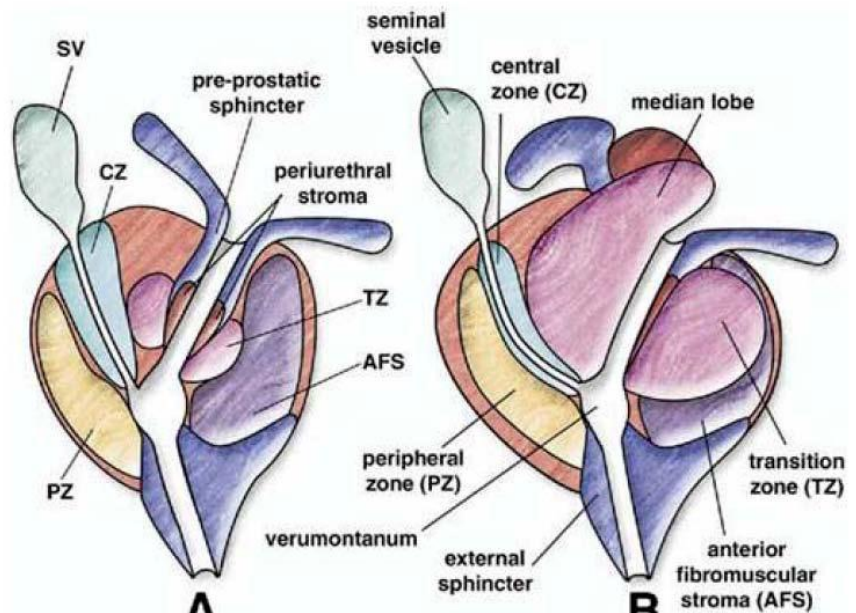
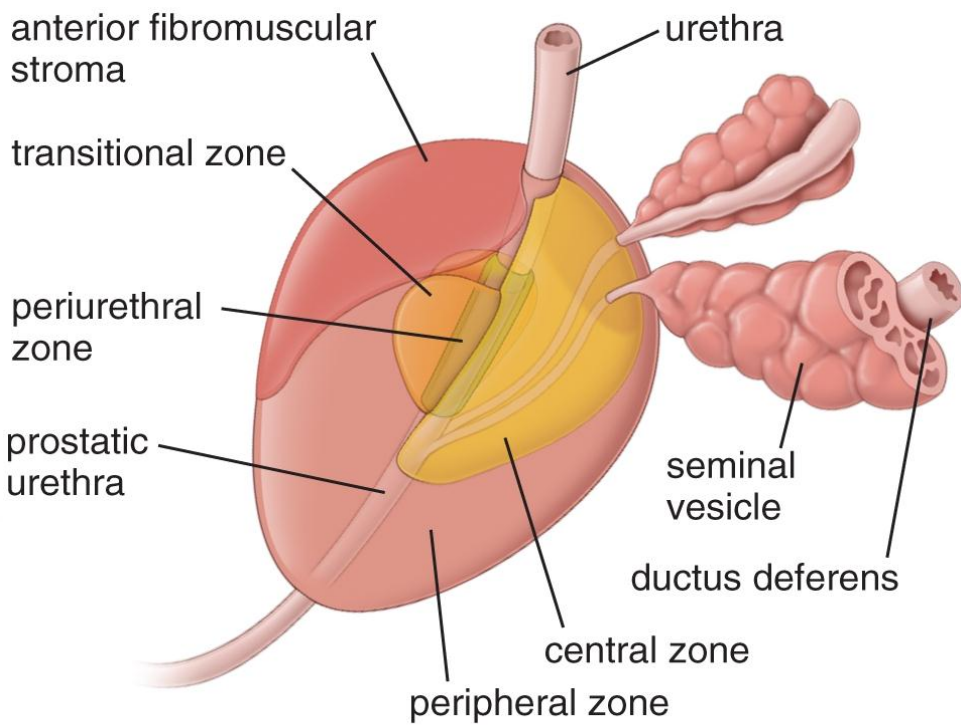
Represents 25% of prostatic volume and contains the ejaculatory ducts .it's the zone which usually gives rise to inflammatory process (prostatitis)

3- Transitional zone :

Represents only 5% of total prostate volume. it's the zone where BPH occur and consists of two lateral lobes together with periurethral glands . 25% of prostate adenocarcinomas occur in this zone

4- Anterior zone

Fibro muscular with no glandular structures.



Microscopic anatomy of the prostate :

The prostate is a collection of 30 – 50 tubulo-alveolar glands that surrounds the proximal urethra. Histologically , the prostate is formed of : glandular organization and prostatic stroma and capsule.

➤Glandular organization

The organ contains 3 separate groups of compound tubulo-alveolar glands arranged concentrically around the urethra :

Mucosal (inner periurethral glands)

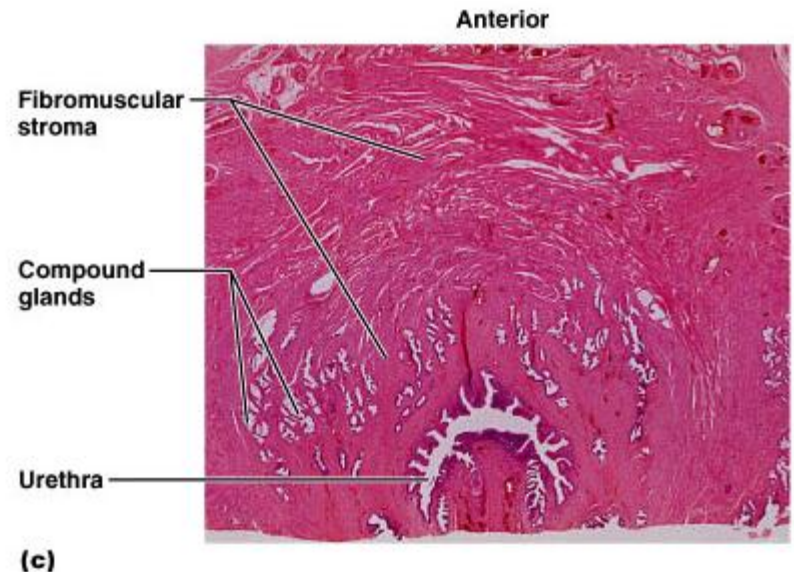
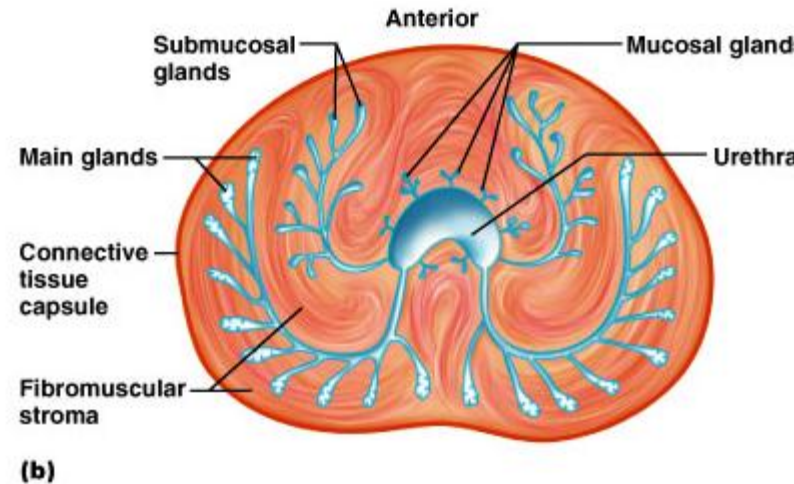
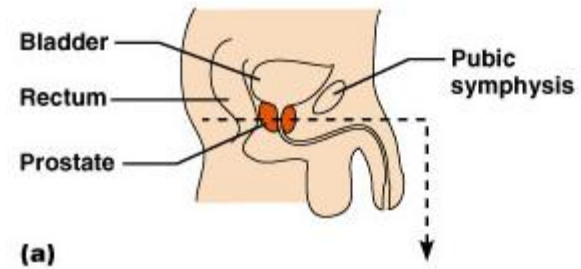
These open directly into the urethra over its entire surface ,this layer is the smallest of the three.

Sub mucosal (outer periurethral glands)

Glands from this layer which is larger than the mucosal glandular layer drain through short ducts into the urethra sinuses

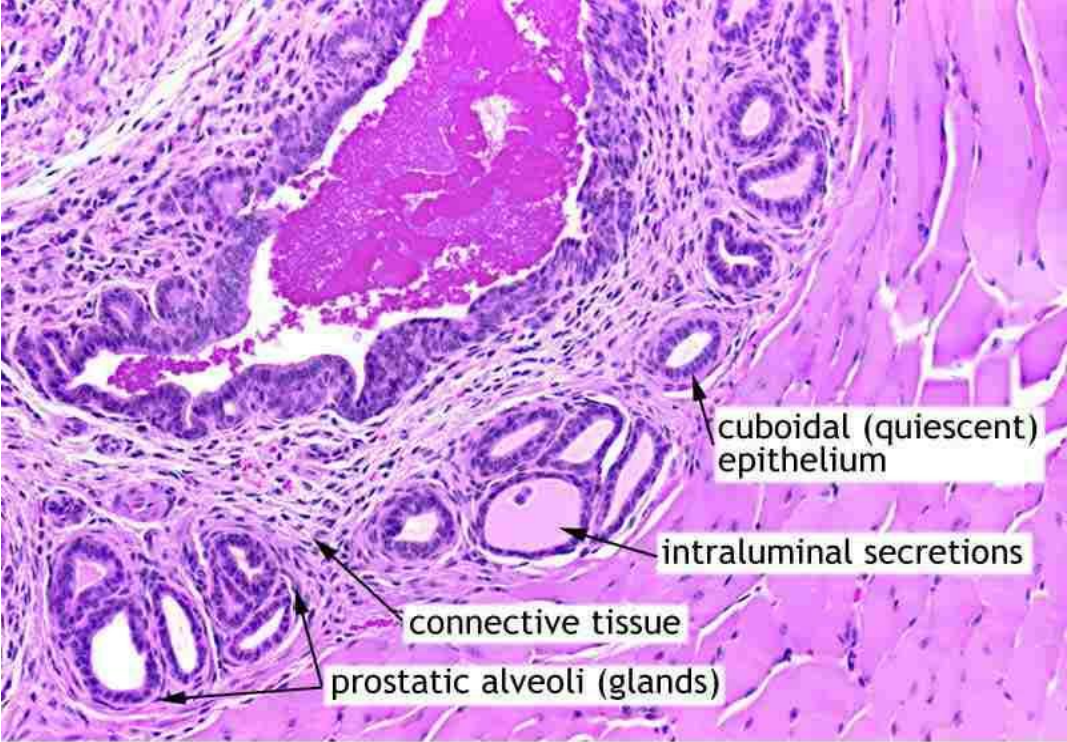
Main prostate gland

This layer constitutes the bulk of the organ drain into the urethra via long ducts.



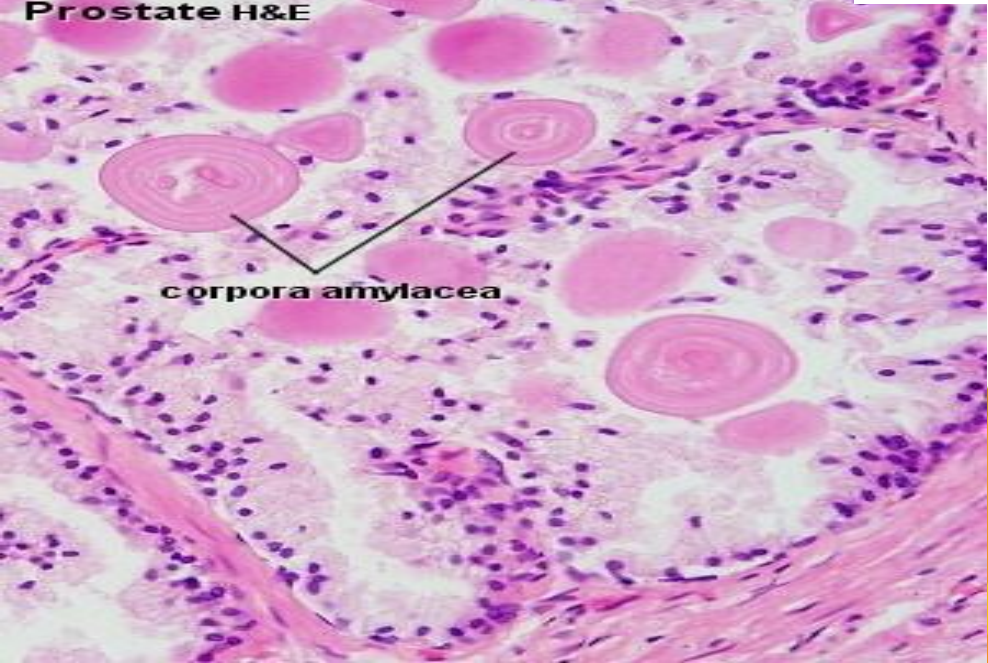
Lining epithelium of the gland :

An inner layer of tall columnar cells and an outer layer of cuboidal cells with basally located round nuclei and moderately acidophilic apical cytoplasm containing numerous secretory granules. The lumen may contain ovoid or spherical or esinophilic lamellated bodies called **corpora amylicea** or prostate concretions that Contains desquamated cells and condensed secretory material

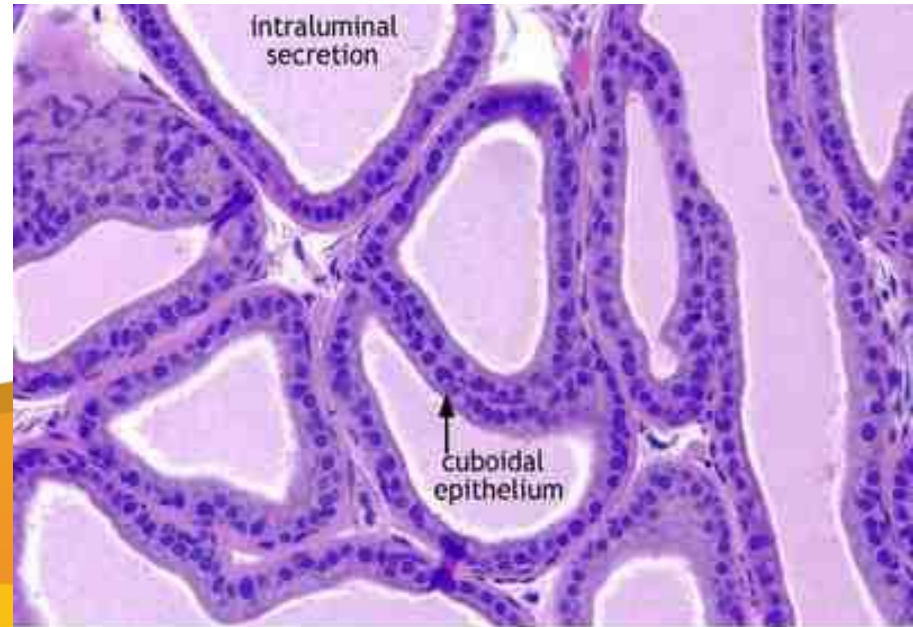


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Prostate H&E



corpora amylicea



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➤ Prostatic Stroma

loose to moderately dense fibro elastic connective tissue containing abundant smooth muscle and highly vascular

➤ Capsule

Moderately dense to dense fibroelastic connective tissue containing smooth muscle, extends into the gland to form septa

According to McNeal :

Peripheral zone:

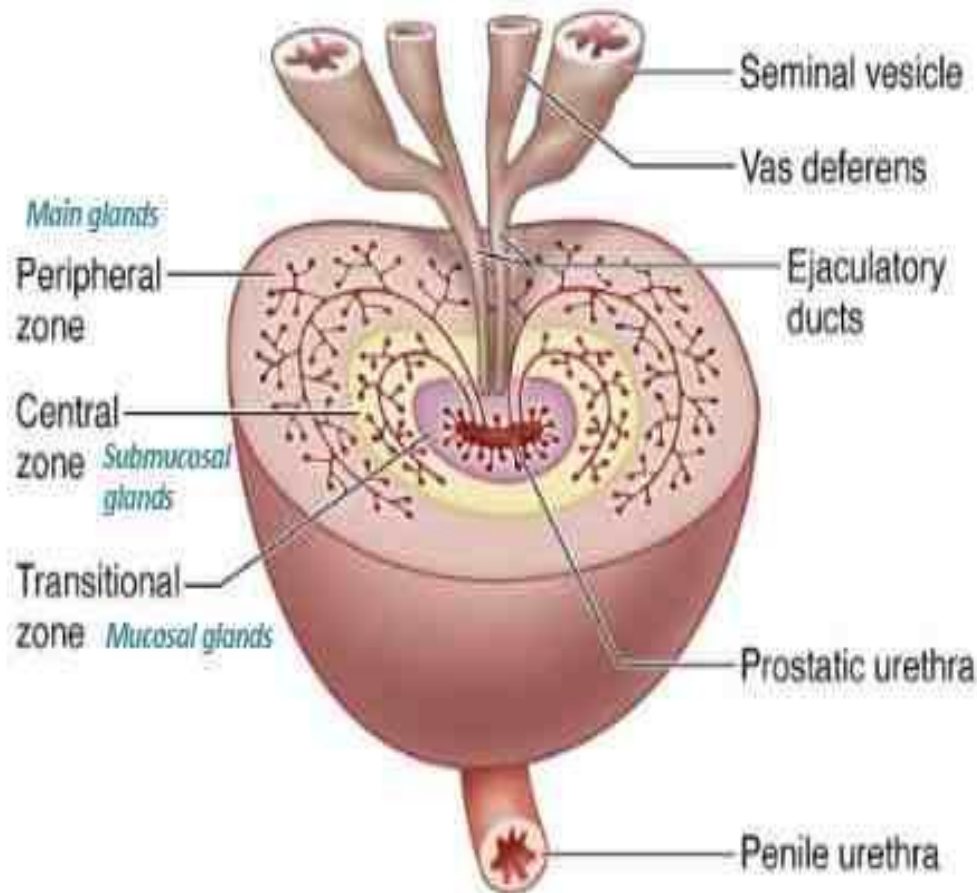
Acini are Small , round and smooth walled and their ducts drain distal to the Verumontanum into the urethra .

Central zone :

Acini are large and irregular with significant intraluminal folds and ridges surrounded also by muscular tissue closely follow the shape of the acini

Transitional zone:

Similar to peripheral zone with more compact stroma .



Arterial supply :

Prostatic artery : branch of inferior vesical artery divided into urethral branch and capsular branch and apical branch

Small branches from middle rectal and internal pudendal arteries

Venous drainage :

Into the **Santorini Plexus** eventually into the internal iliac vein .

Lymphatic drainage :

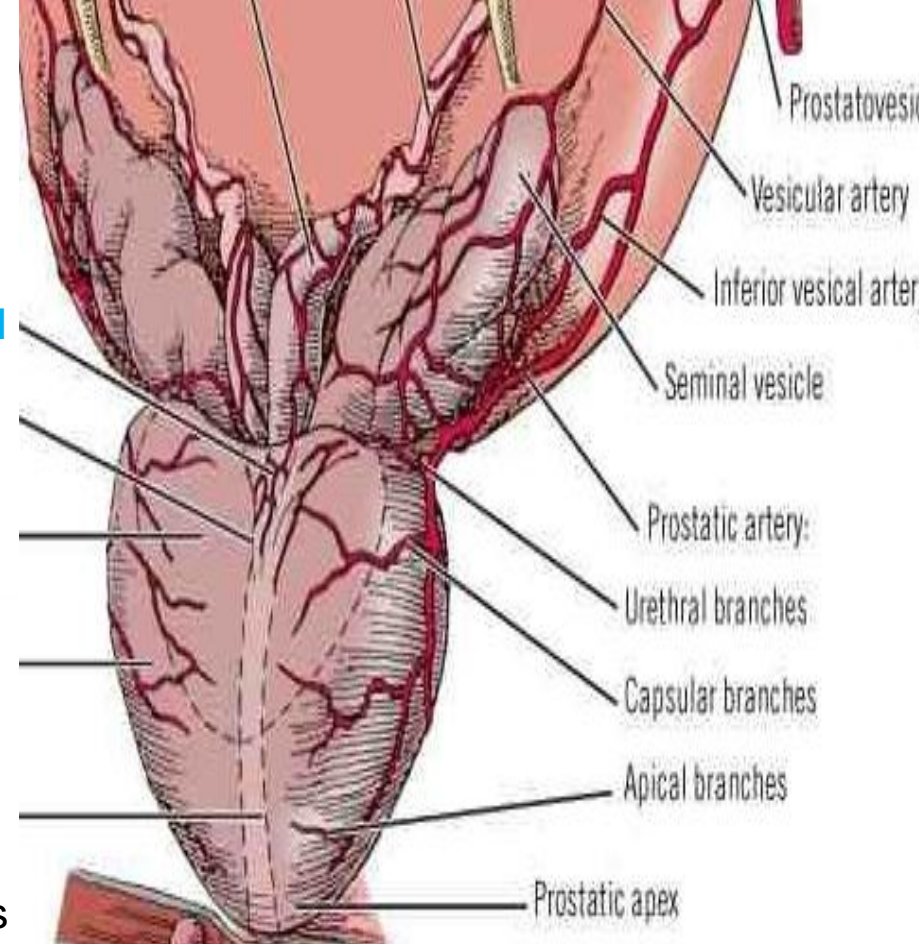
Drain into the obturator lymph nodes to the hypogastric chain .

Nerve supply:

The prostate receives dual autonomic innervations

Sympathetic(noradrenergic) from the hypogastric plexus (L1_2) control the prostatic musculature and close the bladder neck during ejaculation of seminal fluid into the urethra .

Parasympathetic(cholinergic) from the pelvic nerve (S2_ S4) innervate the smooth muscle of the capsule and space around blood vessels responsible for the secretory function of epithelial part.



Bulbourethral “COWPER” glands & urethral “LITTRE” glands

Gross anatomy

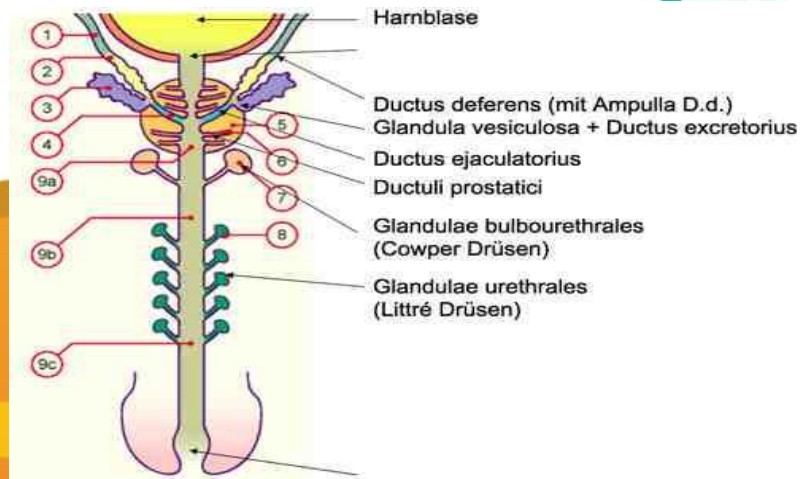
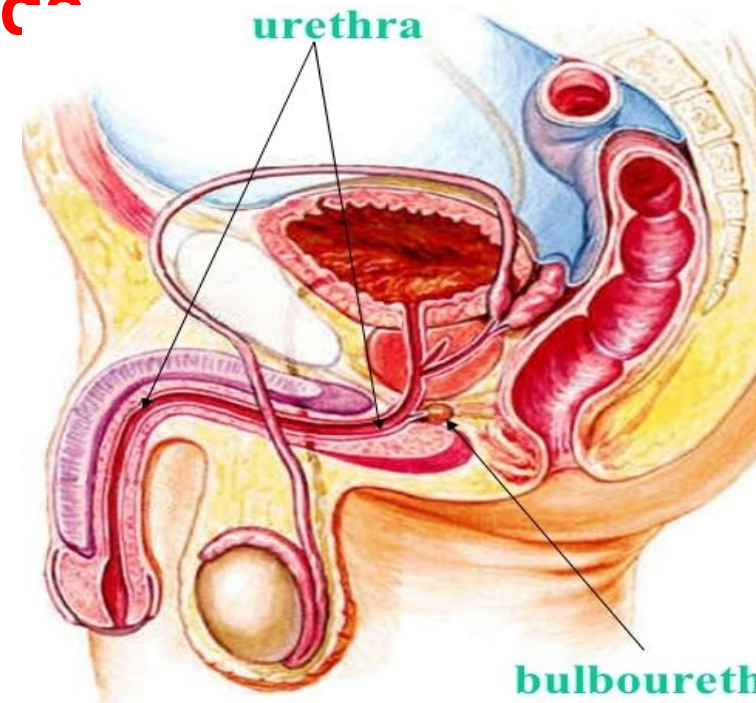
Bulbourethral glands

- ❑ Two small, rounded, lobulated bodies placed behind the membranous urethra
- ❑ The excretory duct of each gland nearly 2.5 cm long, passes obliquely forward beneath the mucous membrane and opens by a minute orifice on the floor of the cavernous portion of the urethra.

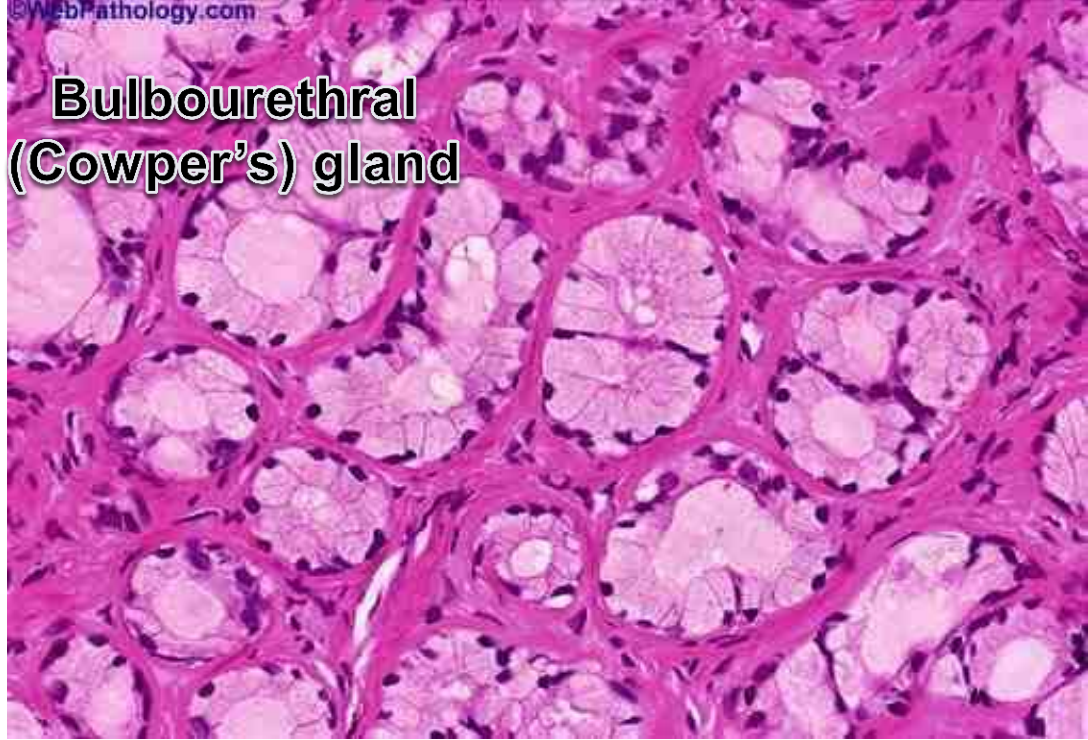
Littre glands

- ❑ They are glands that branch off the wall of the urethra located along the whole length of the urethra but are most numerous along the section of the urethra that passes through the penis .

They both secrete clear fluid that comes out during sexual excitement forming the prosemen



Bulbourethral (Cowper's) gland



Microanatomy

COWPER glands

Each gland is made up of several lobules held together by a fibrous investment. Each lobule consists of a number of acini opening into one duct which joins with the ducts of other lobules outside the gland to form a single excretory duct.

a. Parenchyma tissue

(1) Compound tubulo-alveolar glandular units lined by cuboidal to low columnar mucous epithelium .

(2) Collecting ducts - simple columnar epithelium

(3) Excretory ducts - pseudo stratified columnar epithelium which may become stratified columnar in the main duct connecting each gland to the urethra .

b. Stroma and "capsule"

are loose to moderately dense connective containing elastic fibers, smooth muscle, and skeletal muscle .

LITTRE glands

They are tubuloacinar mucinous glands (some with ducts, some just acini)

Arterial supply of bulbourethral gland :

From bulbourethral artery a branch of common penile artery .

Innervation

Pelvic nerve (parasympathetic) S1-4 , Hypogastric nerve (sympathetic) T12 , L1-2

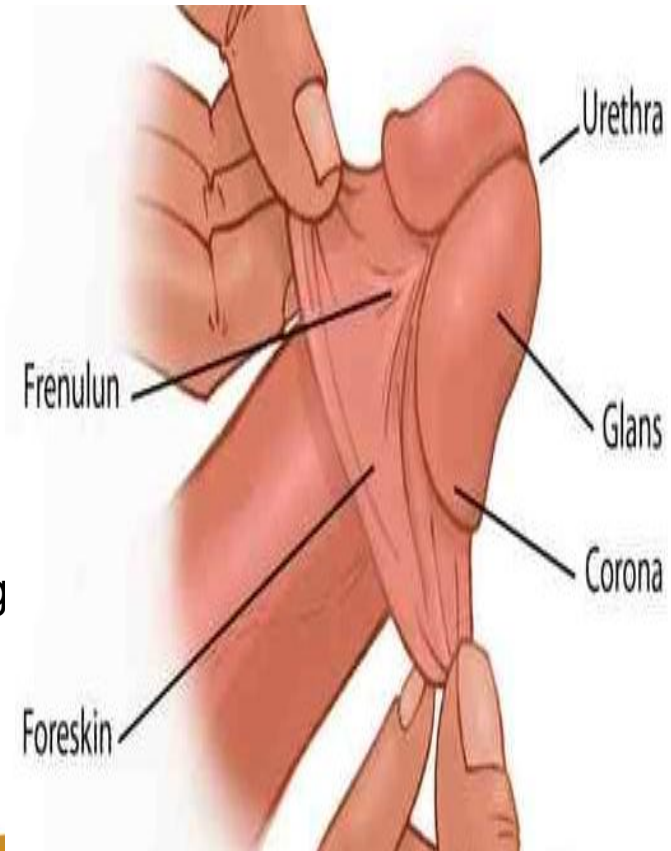
The Penis

The **penis** is an external male sexual organ. It is a passage both for urine and for the ejaculation of semen

Gross anatomy :

Skin of the penis :

- ✓ It is thin loosely attached to the underlying fascia ,
- ✓ The loose attachment helps the free movement of skin over the penile shaft that is of great significance in the penile erection and flaccidity with changes in its size .
- ✓ It is marked by a median **raphé**, continuous with the raphé of the scrotum.
- ✓ At the distal of the shaft , the skin folds on itself forming the **prepuce** then continues as thin adherent layer that covers the glans .
- ✓ A small secondary fold of skin that is just proximal to the urethral meatus called the **frenulum** which is a fibrous band of tissue attaching foreskin to ventral glans
- ✓ The circumference of the base of the glans penis (**corona**) that forms a rounded projecting border behind which is the neck of the penis



Superficial Fascia (colle's fascia)

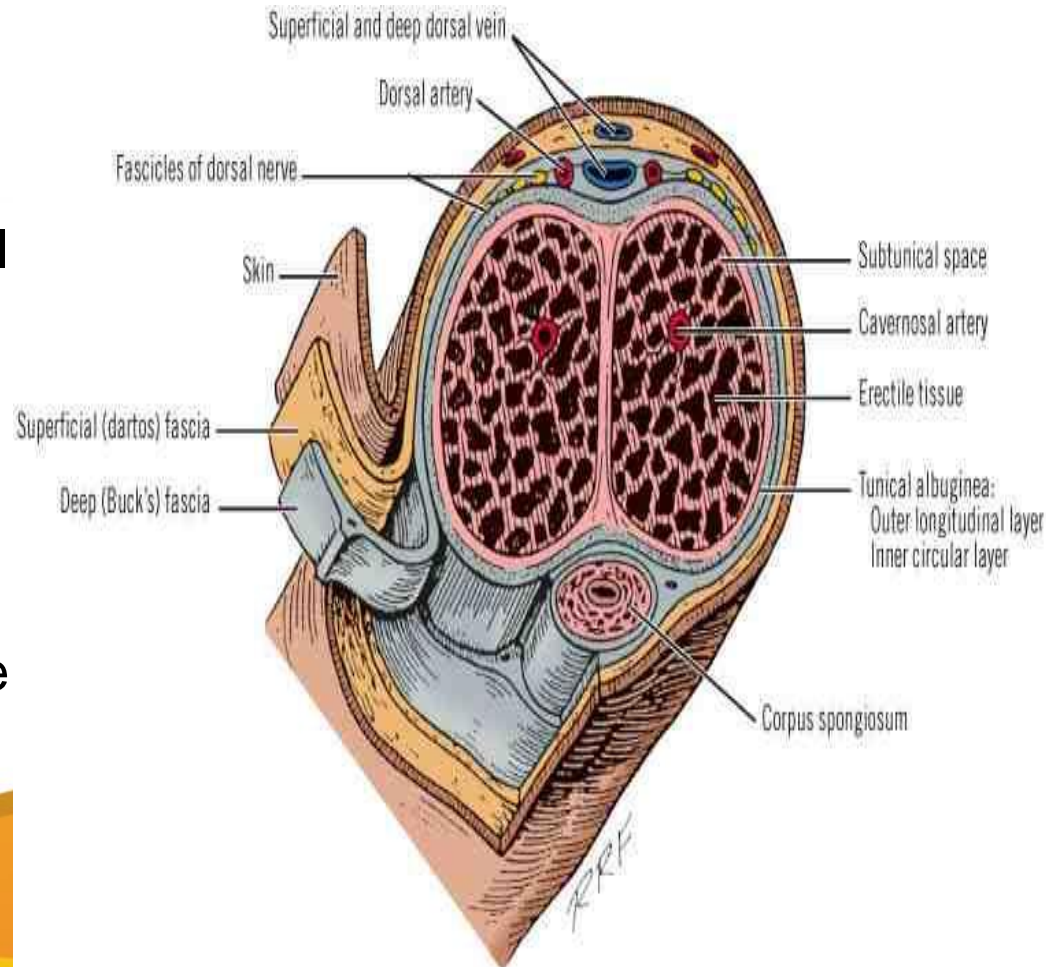
❑ It is a thin layer that extends to be continuous with the fascia of the scrotum and its also loosely attached to the underlying buck's fascia.

Deep Fascia (buck's fascia):

❑ It is a strong layer that extends from the base of the glans penis till the attachment of the penile root with the pubic bone.

❑ It is firmly attached to the underlying tunica albugenia of the penile corpora.

❑ It is firmly encloses the penis like a capsule from behind the glans till the membranous urethra

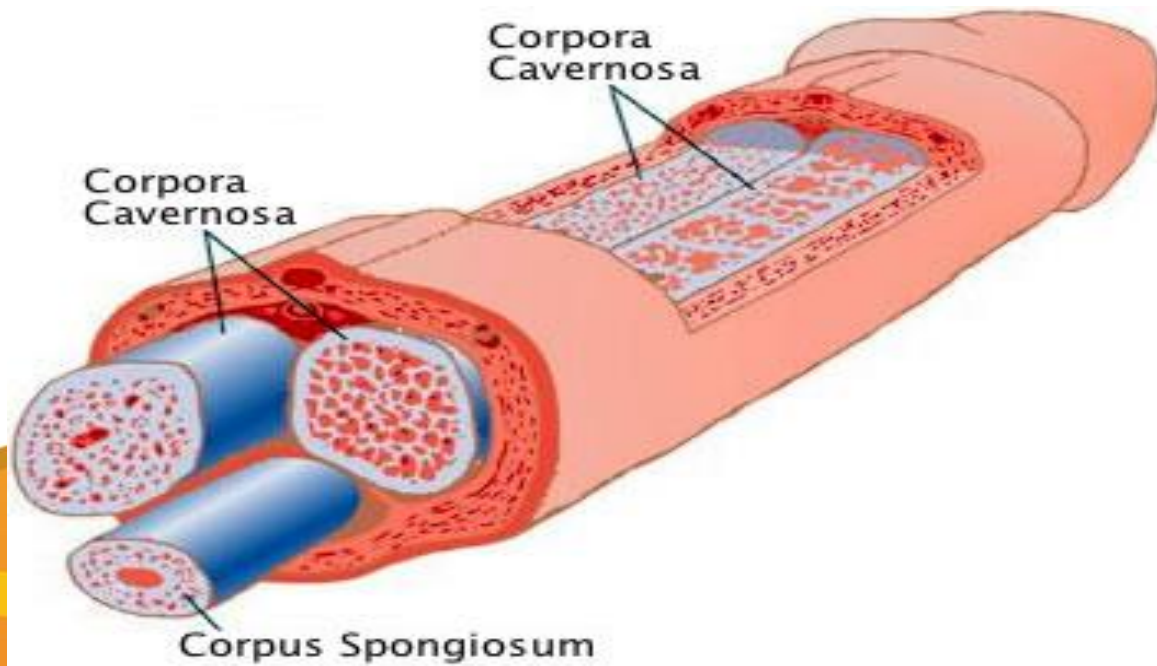


Compartments of the penis:

The penis consists of fixed **root** consisting of two crura and a bulb , and a **body** that hangs free consisting of two corpora cavernosa and corpus spongiosum .

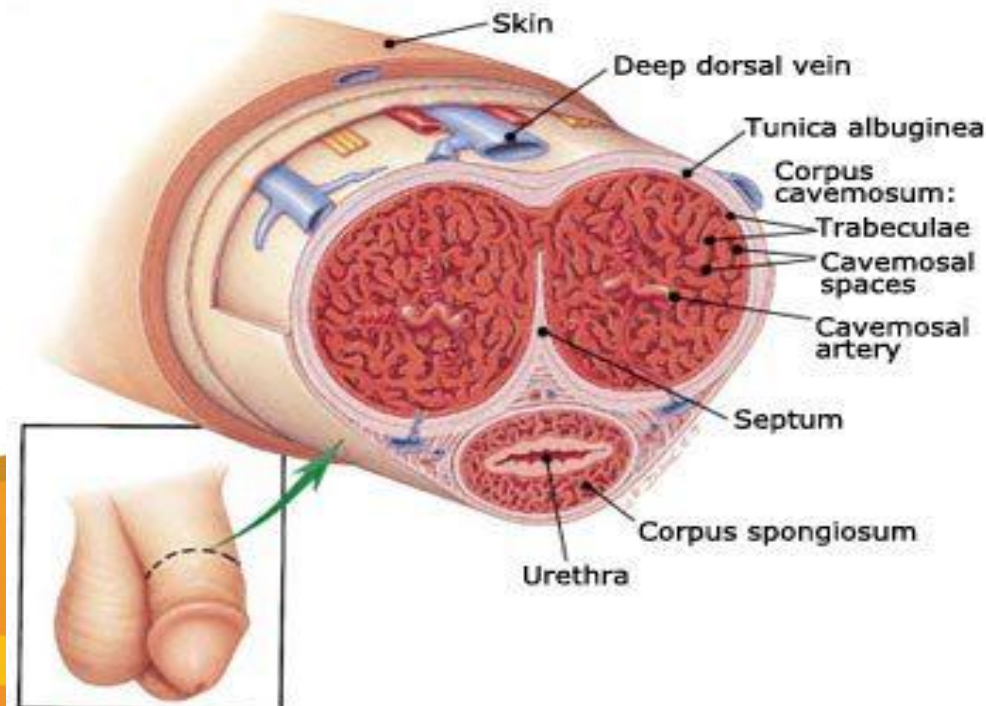
The body of the penis

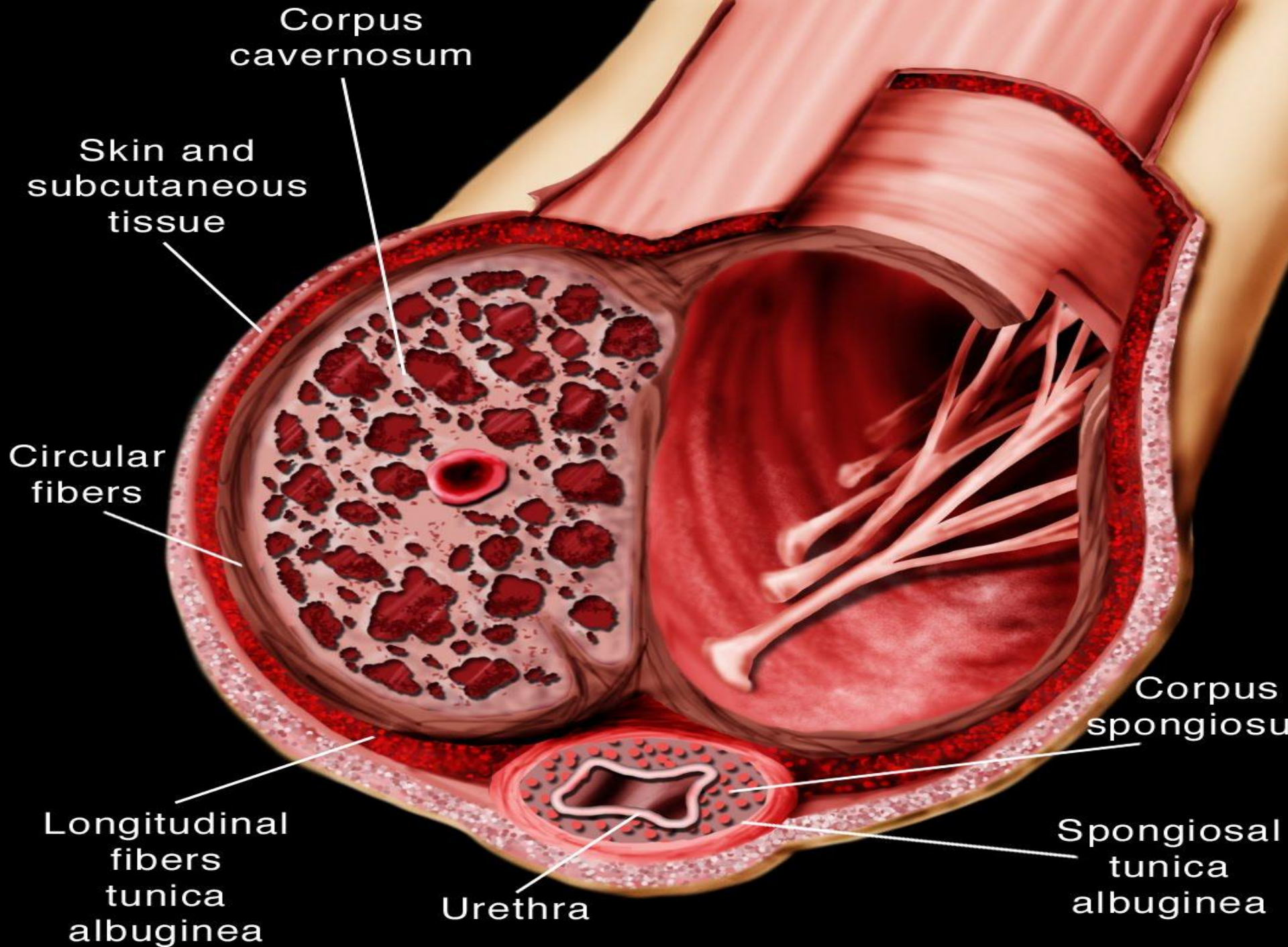
- ❑ Consists of 3 corporal bodies , two corpora cavernosa dorsally and one corpus spongiosum ventrally which contains the urethra and expands distally to form the glans penis.
- ❑ These corpora cavernosa are intimately bound to one another within the body.
- ❑ The body is ensheathed by fascia, which is continuous with the dartos tunic of the scrotum and the fascia of Colle's.
- ❑ The corpora cavernosa are separated on the anterior or dorsal surface by shallow groove, and on the posterior or urethral aspect by a deeper and wider groove in which lies the corpus spongiosum



The Corpora Cavernosa

- ❑ Form the greater part of the substance of the penis. They are unique vascular bed of sinuses(trabeculae).
- ❑ For their anterior three-fourths they lie in intimate apposition with one another but behind , they diverge in the form of two tapering processes (crura).
- ❑ The corpora cavernosa are surrounded by a strong fibrous envelope (**tunica albuginea**) consisting of *superficial longitudinal* fibers form a single tube which encloses both corpora and *deep circular fibers* form the septum of the penis by their junction in the median plane.
- ❑ The septum is incomplete especially near the terminal part where its interrupted by number of slit like perforations (**septum pectiniforme**)





Corpus cavernosum

Skin and subcutaneous tissue

Circular fibers

Longitudinal fibers tunica albuginea

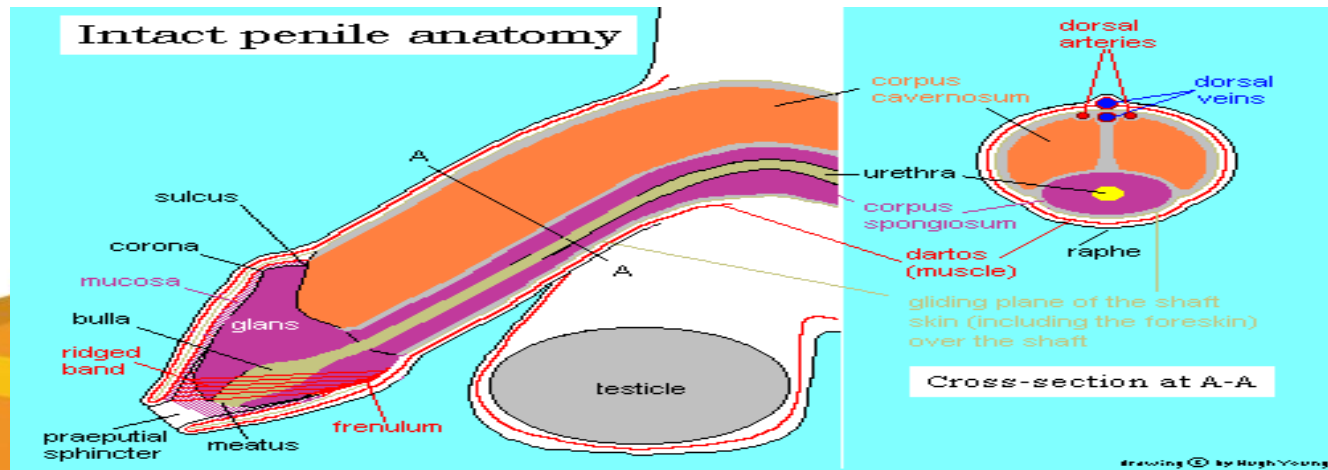
Urethra

Corpus spongiosum

Spongiosal tunica albuginea

corpus spongiosum

- ❑ Behind, it is expanded to form the urethral bulb, and lies in apposition with the inferior fascia of the urogenital diaphragm, from which it receives a fibrous investment.
- ❑ The urethra enters the bulb nearer to the superior than to the inferior surface. On the latter there is a median sulcus (groove), from which a thin fibrous septum projects into the substance of the bulb and divides it imperfectly into two lateral lobes or hemispheres.
- ❑ The portion of the corpus spongiosum in front of the bulb lies in a groove on the under surface of the conjoined corpora cavernosa penis. It is cylindrical in form and tapers slightly from behind forward.
- ❑ Its anterior end is expanded in the form of an obtuse cone, flattened from above downward. This expansion, termed the **glans penis**, is moulded on the rounded ends of the corpora cavernosa penis, extending farther on their upper than on their lower surfaces.
- ❑ At the summit of the glans is the slit-like vertical external urethral orifice, also known as the meatus.



The root of the penis

➤ The root of the penis is consisting of two diverging crura, one on either side and median urethral bulb.

➤ Lies in the perineum between the inferior fascia of the urogenital diaphragm and the fascia of Colle's. In addition to being attached to the fascia and the pubic rami, it is bound to the front of the symphysis pubis by the fundiform and suspensory ligaments.

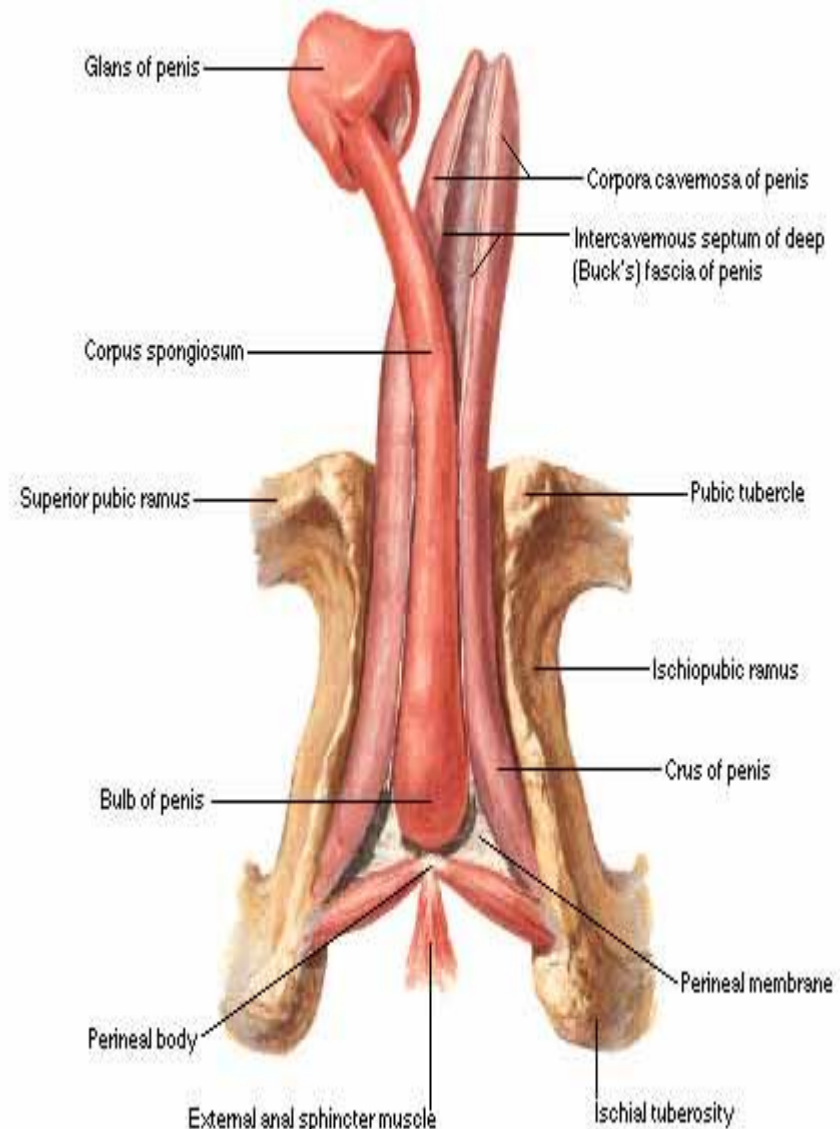
Such anatomy prevents the erect penis from sinking into the perineum when faced with an axially-oriented vaginal compressive load during intercourse.

The two crura :

❑ They are the proximal extension of the two corpora cavernosa which are attached to the ipsilateral ischiopubic ramus and covered by ischiocavernosus muscle.

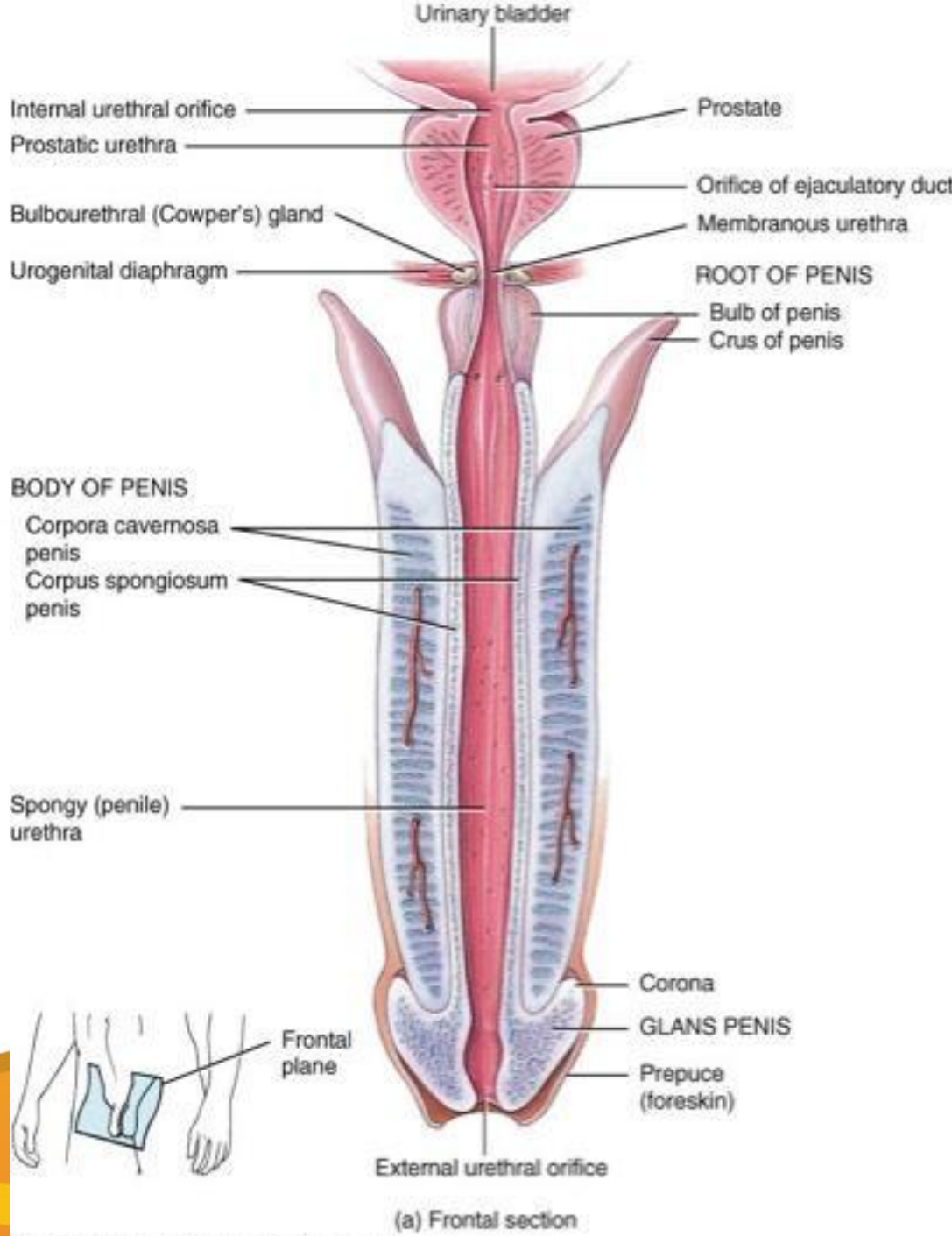
❑ Traced from behind forward, each crus begins by a blunt-pointed process in front of the ischial tuberosity.

Penis [Continued]



The bulb :

- ❑ The proximal extension of the corpus spongiosum .It lies between the 2 crura.
- ❑ The bulb is situated in the midline and is attached to the undersurface of the urogenital diaphragm. It is traversed dorsally by the urethra
- ❑ It is covered on its outer surface by the bulbospongiosus muscle.



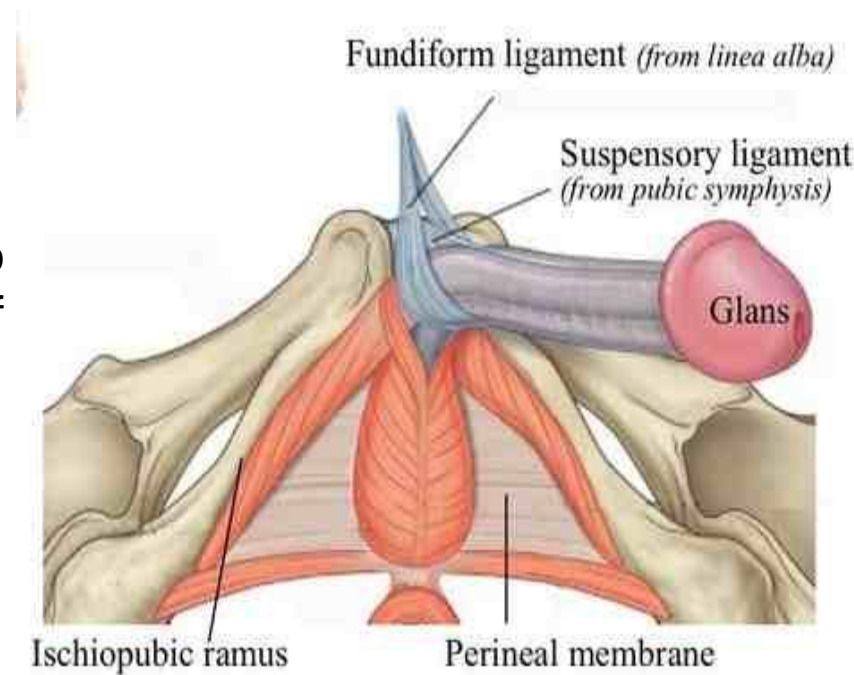
Ligaments of the penis:

The fundiform ligament :

❑ Arise from the fascia of the anterior abdominal wall then it passes superficially to be inserted into the superficial fascia of the penis on either side of the penis then fuse again inferiorly as apart of scrotal septum .

The suspensory ligament :

❑ Arise from the pubic symphysis then passes deeply to be inserted into the deep fascia of the penis



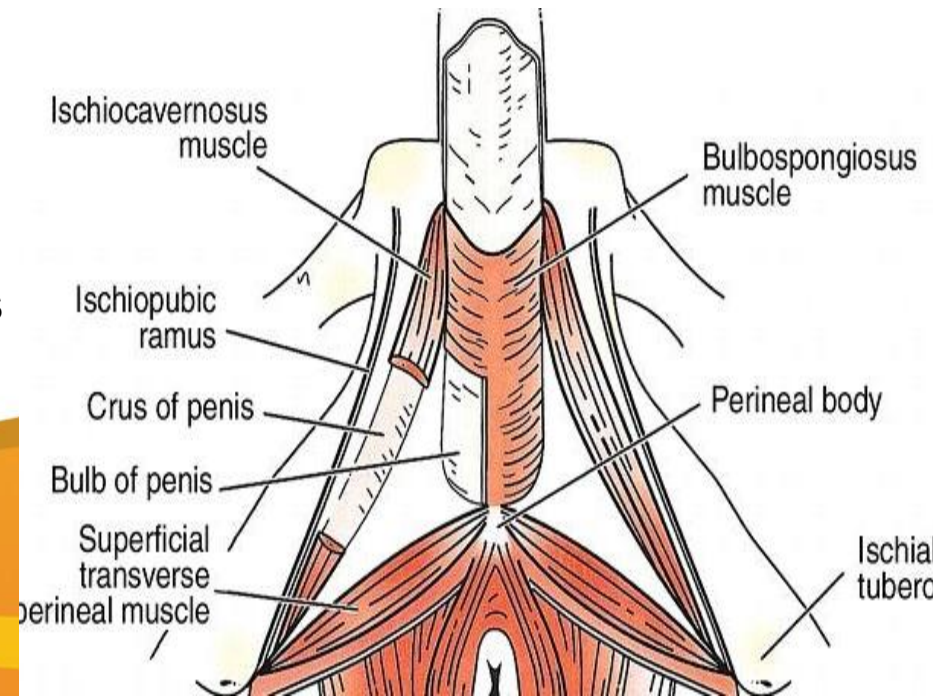
Muscles of the penis :

The ischiocavernosus muscles :

Covering the crura and attached to the ischial tuberosity on each side and inserted in buck's fascia in the midline .

The bulbocavernosus muscles :

Attached to the perineal body posteriorly and attached to each other on the midline around the penile crura



Microanatomy of the penis :

Each corpus is composed of three elements :

1- Tunica albuginea :

❑ Dense white fibrous coat contains some elastic fibers and may be divided into an outer layer of longitudinally directed fibers and an inner layer of circular fibers.

❑ Inner layer bundles support and contain the cavernous tissue and are oriented circularly. Radiating from this layer are intracavernous pillars acting as struts, which augment the septum and provide essential support to the erectile tissue.

❑ Outer layer bundles are oriented longitudinally. These fibers extend from the glans penis to the proximal crura, where they insert into the inferior pubic ramus. There are no outer layer fibers between the 5 and 7 o'clock positions

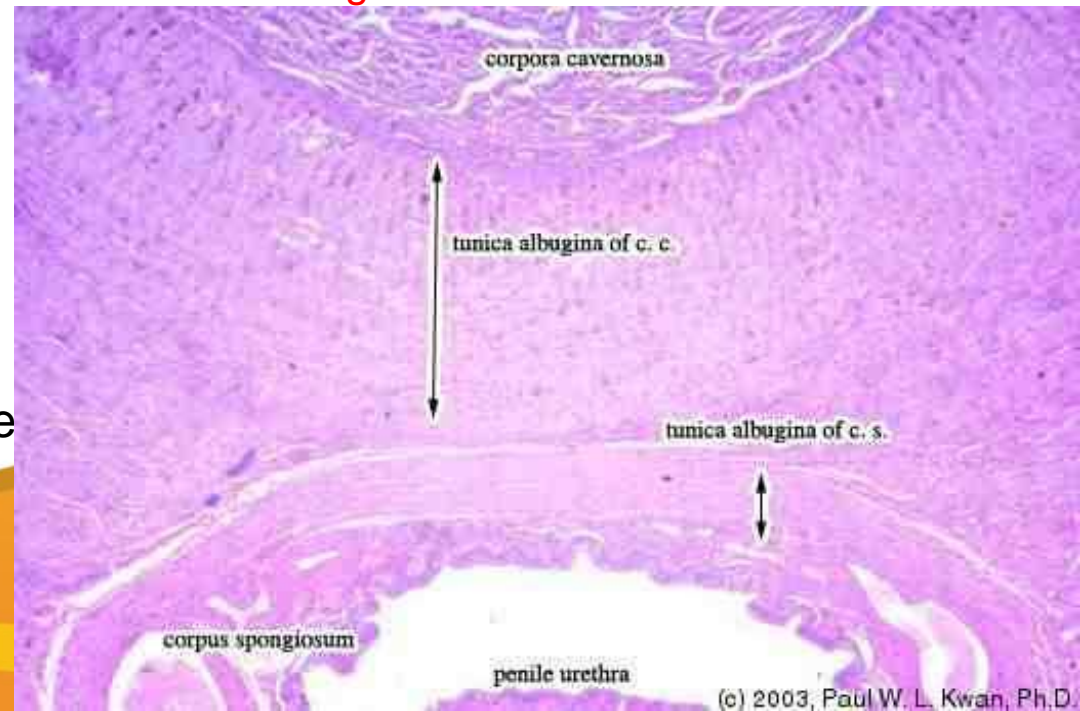


- ❑ These elastic fibers normally form an irregularly interlacing network on which collagen fibers rest
- ❑ Collagen fibers composed of fibrillar collagen (mainly type I and also type III) in organized arrays interlaced with elastin fibers .
- ❑ While collagen has a great tensile strength than steel, in contrast elastin can be stretched to 150% of its length , it's the elastin content that allows the compliance of tunica albugenia and helps to determine stretched penile length .

Disorganization of the circular or longitudinal layers of tunica as well as disruption of elastin or decrease in elastin content can cause penile deformities during erection as well as erectile dysfunction .

2- Areolar layer of smith

Thin layer of areolar connective tissue just under the tunica albugenia separating it from the cavernous tissue

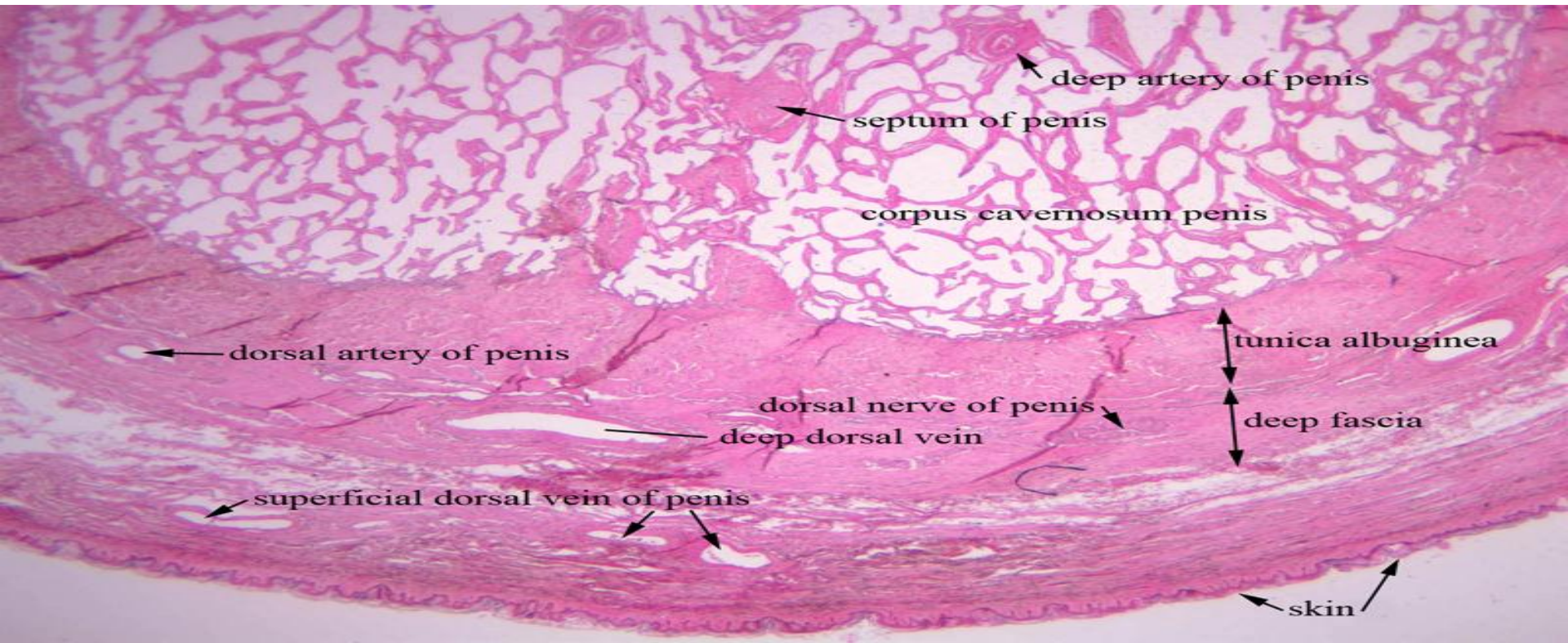


3- Cavernous tissue

□ Numerous fibrous strands called trabecular corporum cavernosorum proceed from the deep surface of the tunica albuginea and stretching across the interior of the corpus cavernosum forming a fine sponge-like framework whose interspaces communicate freely with one another and are filled with blood.

□ These blood-containing spaces widely communicative and larger in the center of the corpora, having a Swiss-cheese appearance ,

This fact enables the blood within the penis to transfer easily from the top to the bottom of the corpora. This also enable the penis to have a common intracavernosal pressure and a common penile rigidity

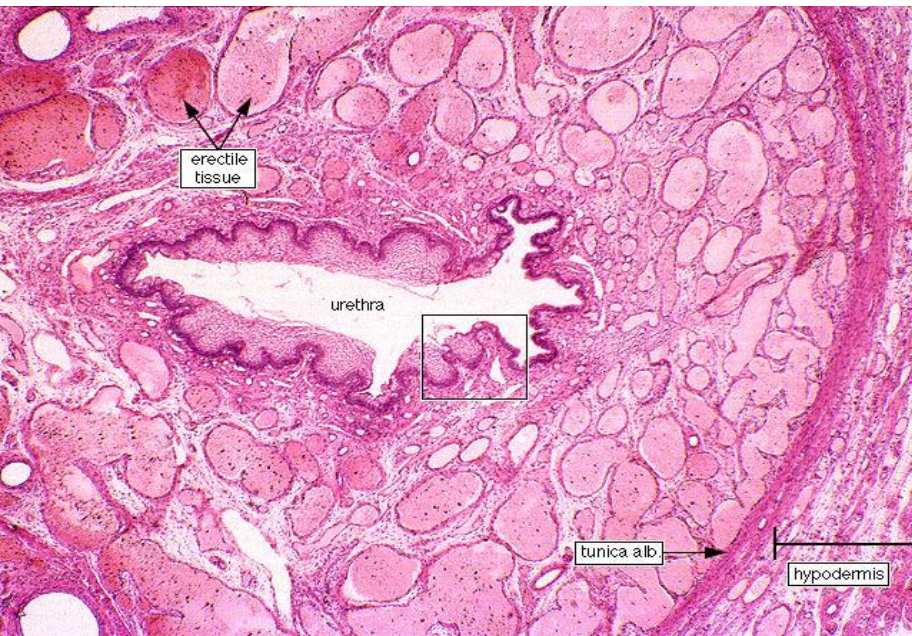


❑ The sinusoids are smaller in the periphery and have a grape-like appearance. Peripheral sinusoids have a greater individual surface area than central sinusoids. These characteristics aid in the passive process of corporal veno-occlusion by sub-tunical venule compression against the tunica albugenia

❑ All lacunar spaces are lined with endothelial cells, thought previously to have only a slippery surface preventing blood clotting. Recent research has revealed that endothelial cells have secretory function and synthesize factors involved in the regulation of corporal smooth muscle tone.

❑ The structure of the corpus spongiosum resembles that of the corpora cavernosa but the fibrous coat is much thinner and more elastic, and trabeculae are finer .

❑ The glans penis is composed of cavernous tissue which communicates by a rich venous plexus situated on the ventral aspect of the urethra, with the corpus spongiosum . No strongly marked tunica albugenia is present



Arterial supply of the penis :

The arterial blood supply of the penis is primarily via

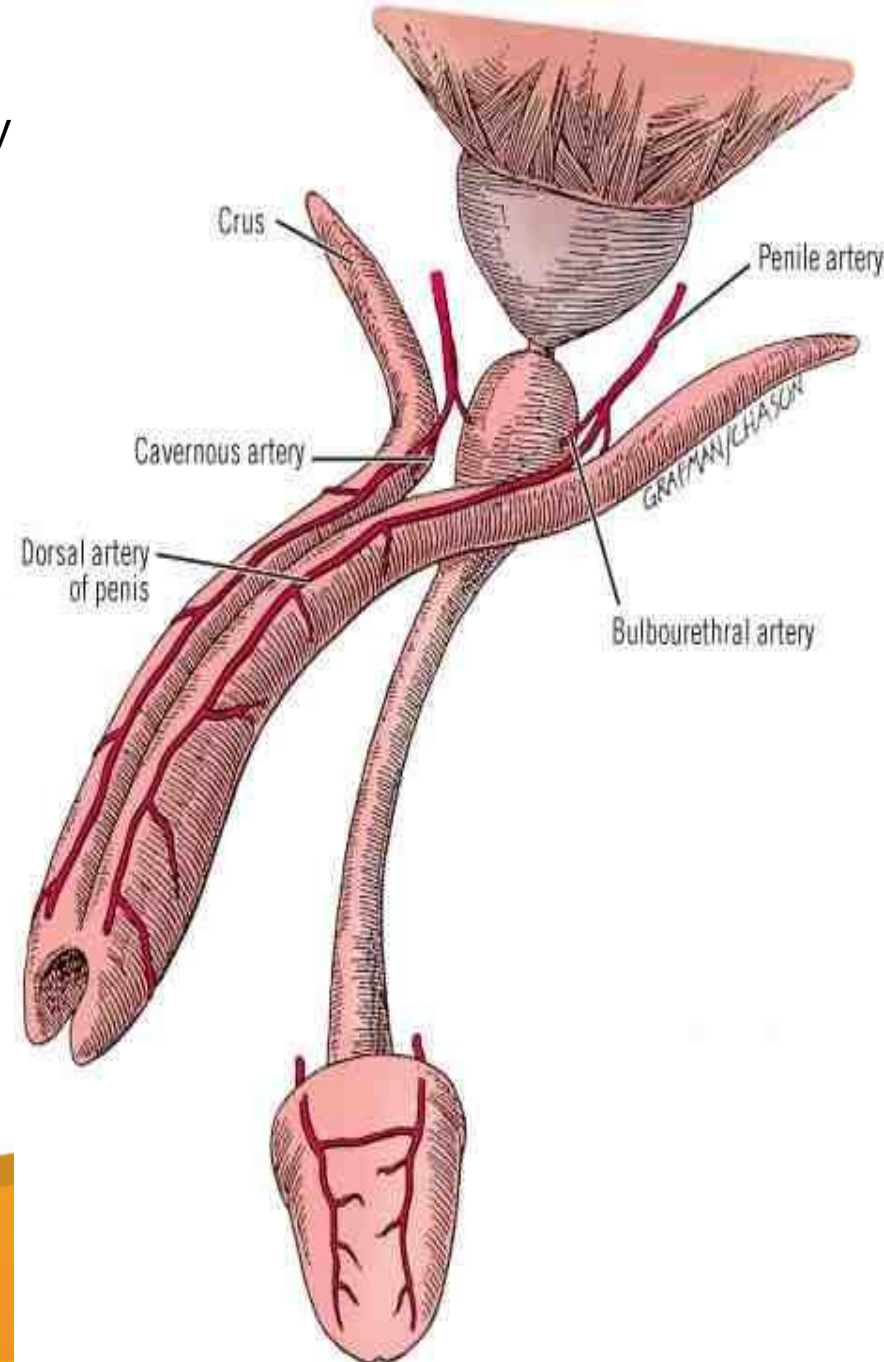
the hypogastric artery which gives rise to **internal pudendal artery** which proceed becoming

the common penile artery

The internal pudendal artery splits into :

1- The **bulbourethral artery** :

Supplies the urethra and the glans , the bulbar artery is short artery provides blood to the proximal urethra and Cowper's gland the rest of the urethra is supplied by the urethral artery as does the corpus spongiosum .

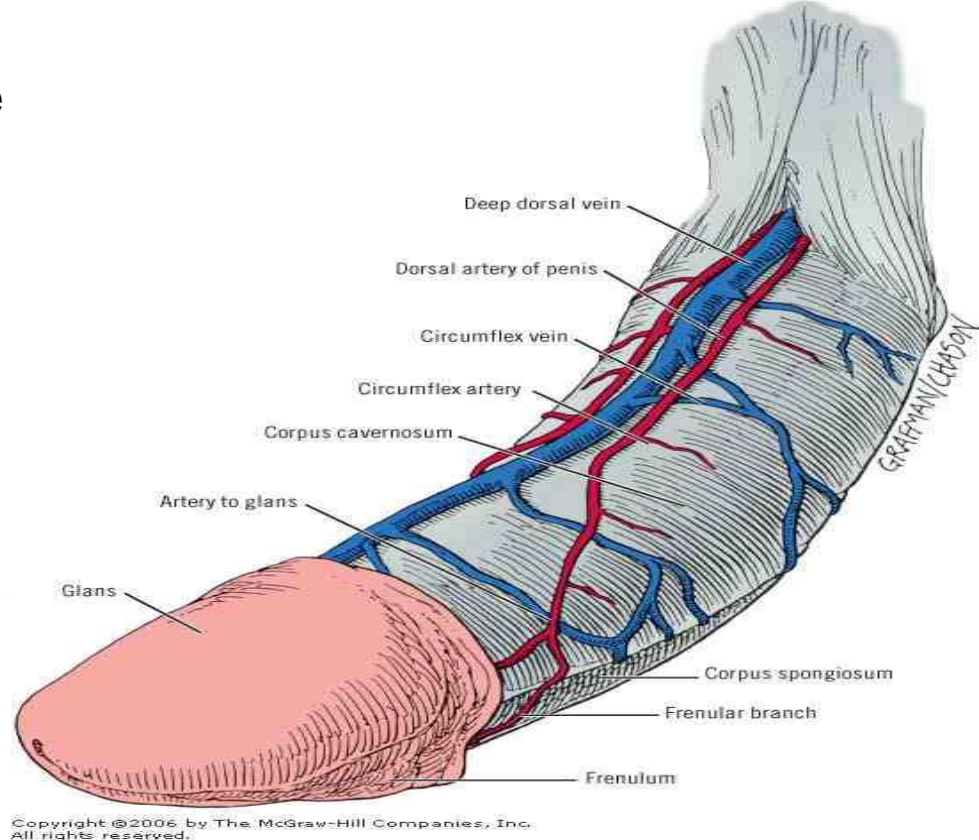


2- The cavernosal arteries

Enter the corpora cavernosa at point where the two crura converge, as the cavernosal arteries proceed proximally, they lie in the middle of corporal bodies giving rise to the helicine arterioles which feed the individual trabeculae.

3- The paired dorsal penile arteries

Proceed down the penis along with the dorsal nerves and supply superficial structures of the penis as well as supplying the corpora cavernosa via the circumflex arteries



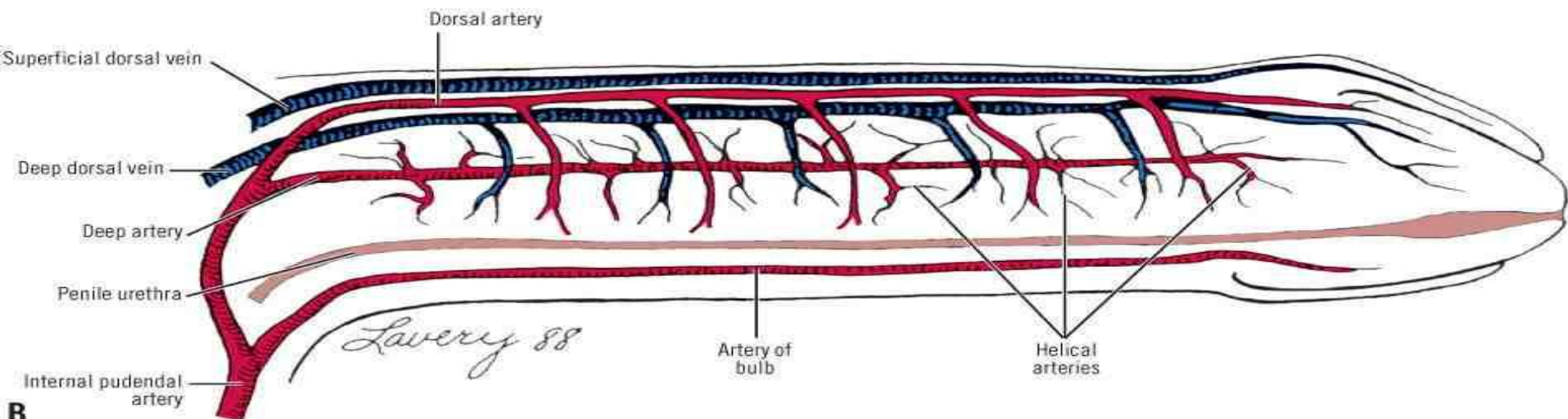
❑ The dorsal penile arteries can supply the cavernous tissue with multiple branches along the shaft of the penis as normal variant ..

❑ Up to 10 circumflex branches are given off and pass over the lateral surface of the corpora, these contribute to the blood supply of corpus spongiosum, the urethra and the terminal branches providing the blood supply responsible for the distension of glans during erection.

❑ **The arterial blood supply of the skin of the penis is very good. It originates from the external pudendal artery (from the common femoral artery) which gives origin to a dorsolateral and a ventrolateral branch**

INTRACORPORAL CIRCULATION

- ❑ Arterial blood is conveyed to the erectile tissues in the deep arterial system by means of dorsal, cavernous and bulbo-urethral arteries to helicine arteries open directly into the sinusoids
- ❑ The emissary veins at the periphery collect the blood from the sinusoids through the subalbugineal venous plexuses and empty it into the circumflex veins which drain into the deep dorsal vein.
- ❑ The venous tributaries between the sinusoids and the subalbugineal venous plexus are compressed by the dilating sinusoids and the stretched tunica albuginea.
- ❑ The direction of blood flow could be summarized as follows: cavernous artery -> helicine arteries -> sinusoids -> post-cavernous venules -> subalbugineal venous plexuses -> emissary vein.



Venous drainage of the penis :

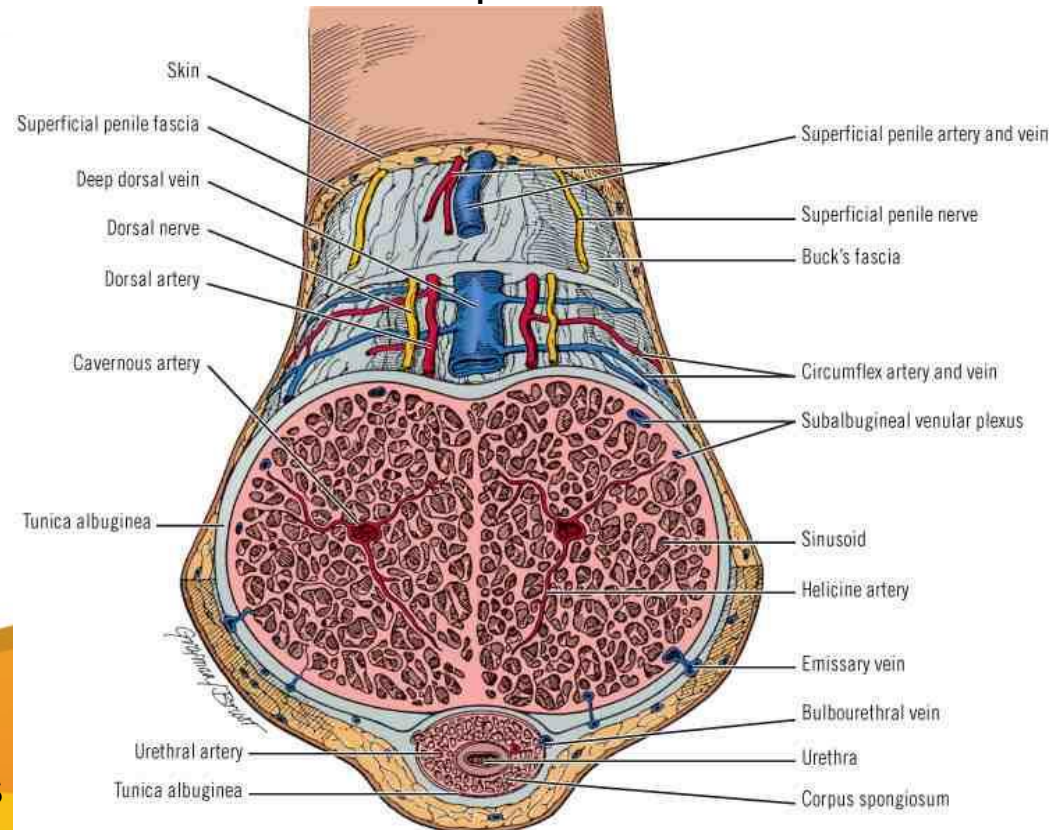
The venous drainage of the penis occurs through 3 systems : superficial , intermediate and deep .

1- The superficial venous system:

- ❑ Lies above the buck's fascia and primarily drains the penile skin .
- ❑ It can also have anastmotic connections to the deep dorsal vein .
- ❑ The superficial system drains into the femoral vein via the saphenous and external pudendal veins .

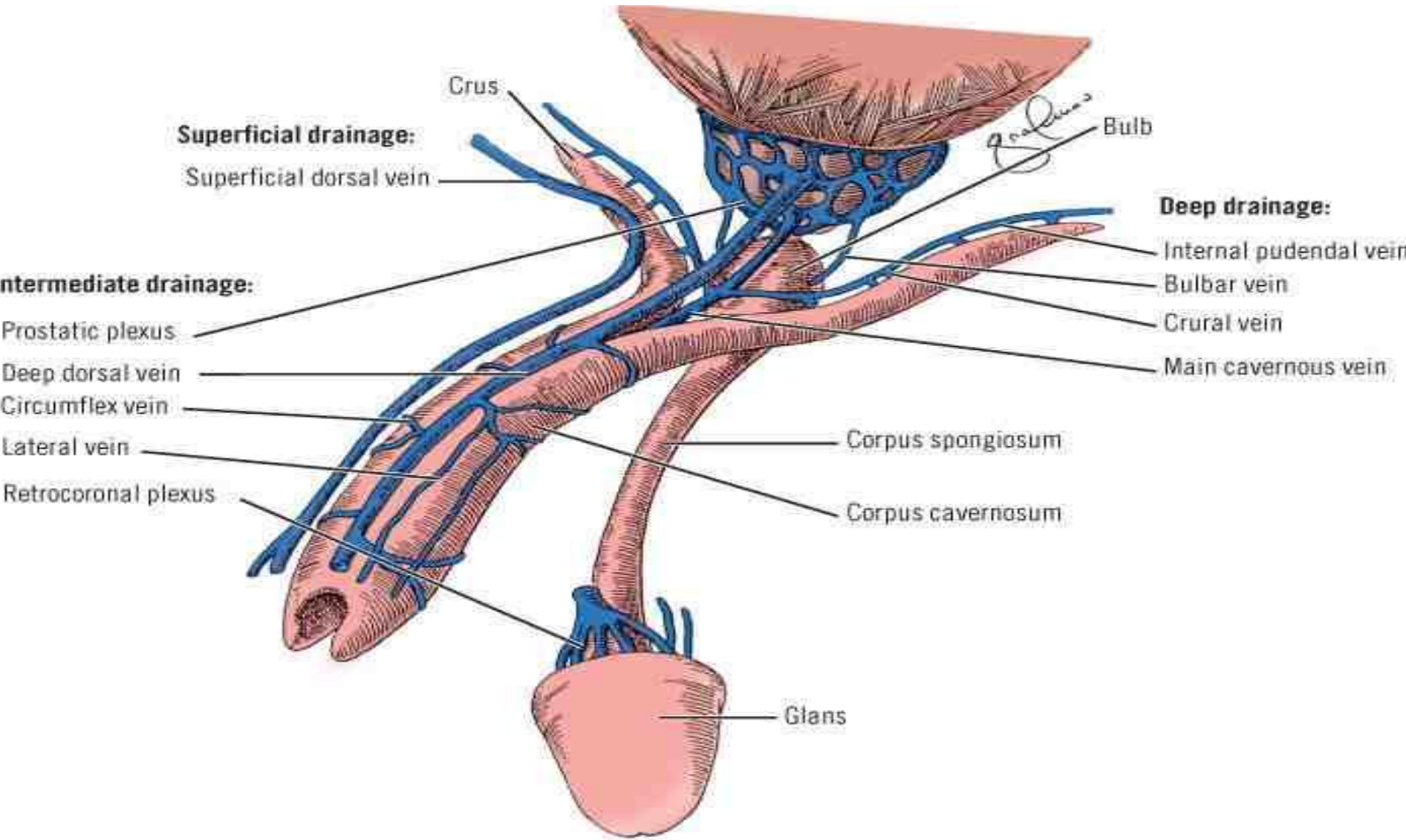
2- The intermediate venous system:

- ❑ Lies beneath the buck's fascia and consists of deep dorsal and circumflex.
- ❑ This system drains blood from the glans penis , corpus spongiosum and distal two thirds of corpora cavernosa .
- ❑ The retro coronal plexus made up of veins from the glans penis drain into the deep dorsal vein which run in the groove between the corpora , this blood drain into periprostatic plexus into the internal pudendal vein .



3- The deep venous system :

Include the crural and cavernosal veins which empty into the internal iliac veins via internal pudendal veins



Nerve supply of the penis:

Innervations of the penis can be divided into autonomic (sympathetic and parasympathetic) and somatic (sensory and motor)

The 3 sets of peripheral nerves involved in erectile function are the Thoracolumbar sympathetic , sacral parasympathetic and sacral somatic .

1- Thoracolumbar sympathetic pathway :

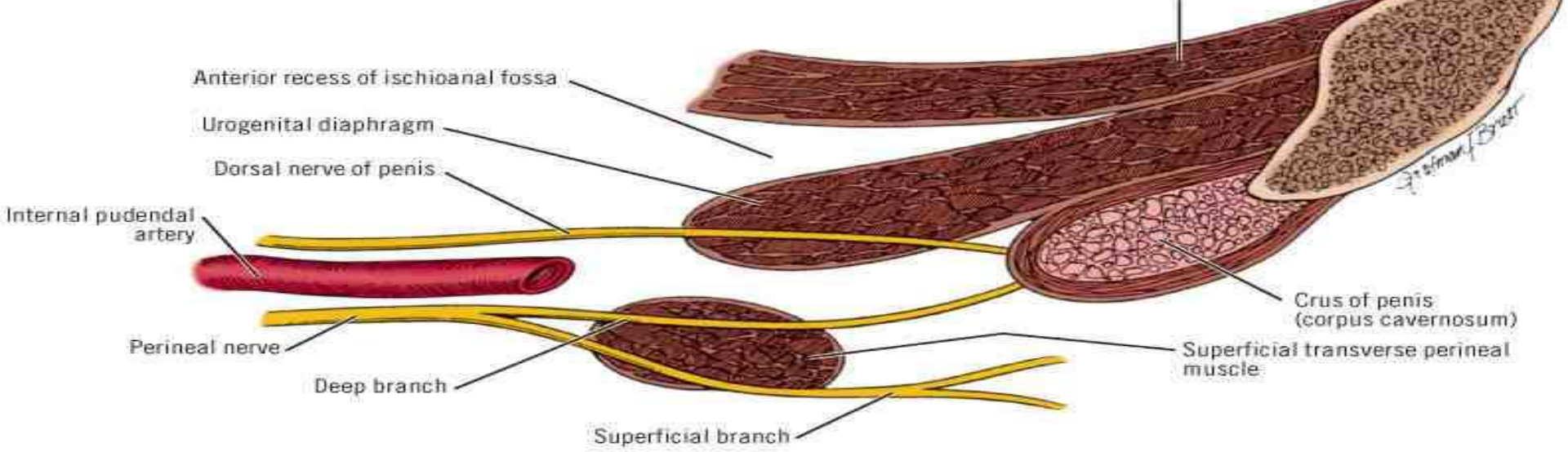
- ❑ Arising from T11 to L2 segments of the cord and passes to the sympathetic chain ganglia from which the fibers travel in the hypogastric nerves to the pelvic plexus.
- ❑ Sympathetic preganglionic fibers descend in the sympathetic chain to the sacral ganglia from which postganglionic fibers pass in sacral nerves and at that point they join the pudendal nerves .

2- Sacral parasympathetic pathway :

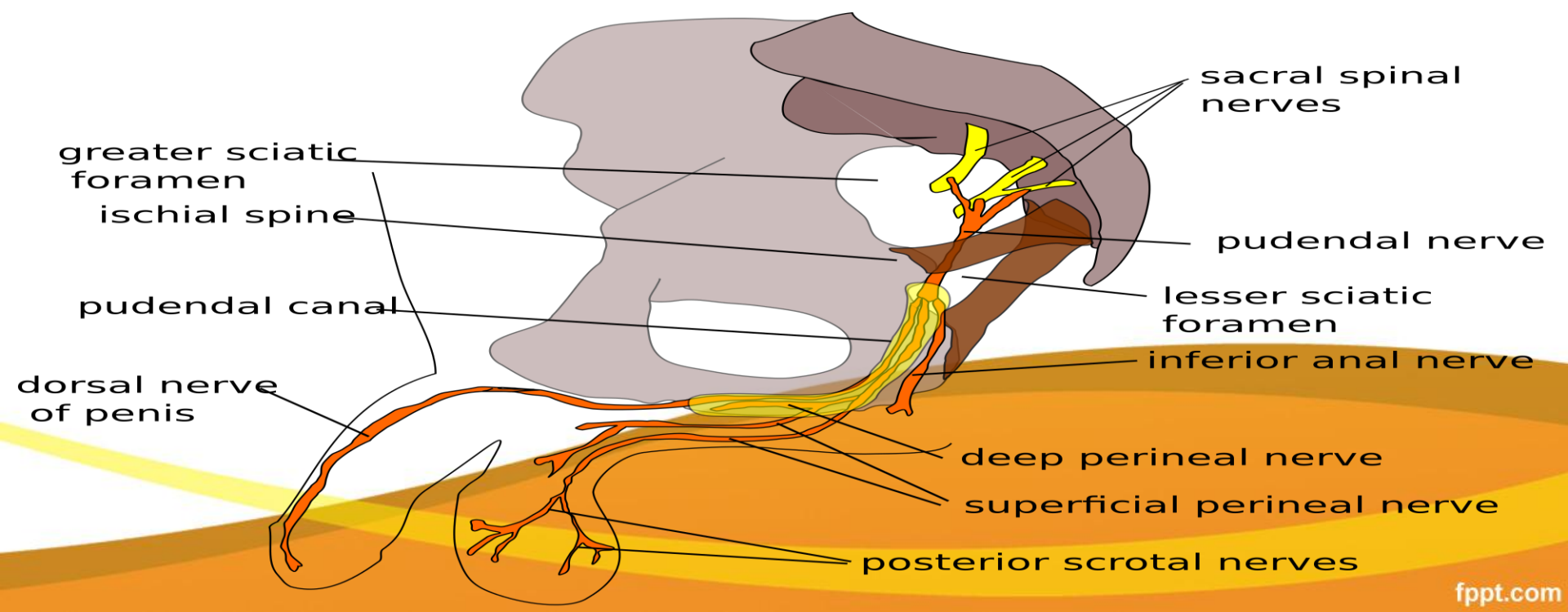
Preganglionic axons arise in the S2 to the S4 segments and pass in the pelvic nerves to the pelvic plexus .Ganglion cells in the pelvic plexus send axons to the cavernous nerves which passes in close proximity to the prostate.

3- Somatic pathway :

Through the pudendal nerve which arise from S2 to S4 segments , branches of the pudendal nerve innervate the external sphincter and the bulbocavernosus and the ischiocavernosus muscles as well as providing sensory fibers to the dorsal nerve of penis .



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Pudendal nerve stimulation :

- ❑ During coitus stimulation of pudendal nerve results in contraction of bulbocavernosus muscle and ischiocavernosus muscle leading to increased intracorporal pressure above the systolic pressure causing stoppage of blood flow in internal pudendal artery leading to rigid erection, this is maintained only for minutes due to muscle fatigue acting as a protective mechanism to prevent ischemia and tissue damage.
- ❑ Contraction of the ischiocavernosus muscles produce a rigid erection phase through compression of engorged corpora cavernosa . Rhythmic contractions of the bulbocavernosus muscle propels semen down the urethral lumen resulting in ejaculation.

Lymphatic drainage of the penis :

- ❑ Lymphatic drainage of the penis is to superficial and deep inguinal lymph nodes of the femoral triangle which in turn drain into the external and common iliac lymph nodes.
- ❑ Lymphatic drainage of the posterior urethra is to the internal iliac lymph nodes.
- ❑ Drainage from the anterior urethra is also to the inguinal lymph nodes .

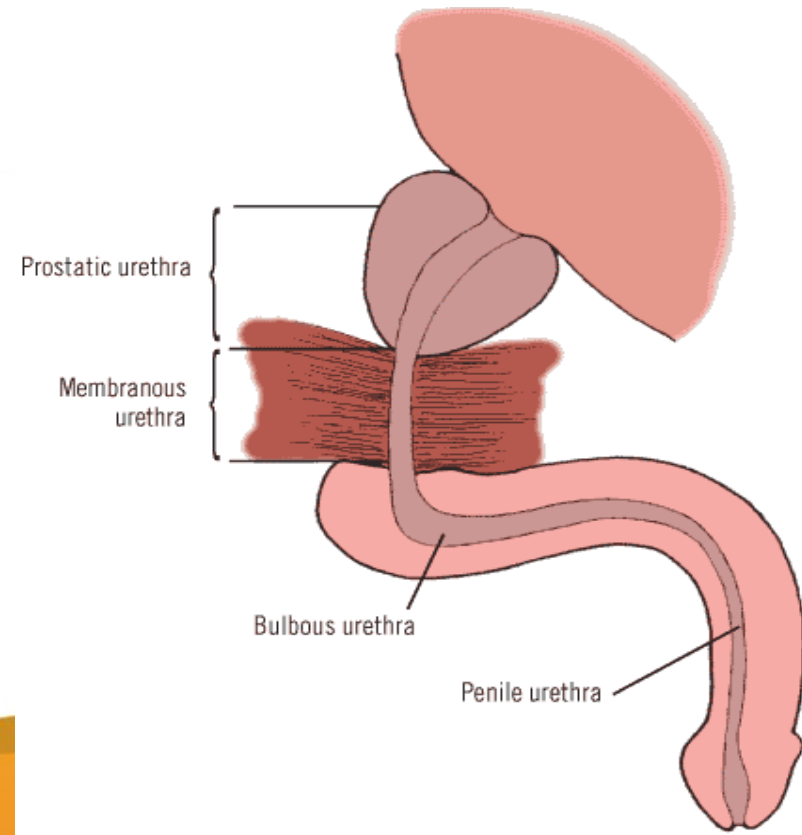
Male urethra

The male urethra extends from the internal urethral orifice in the neck of urinary bladder to the external urethral orifice at the glans penis.

Its length varies from 17.5 to 20 cm and it is divided into three portions, the prostatic, membranous, and cavernous or penile part.

The prostatic portion

- ❑ The widest and most dilatable part of the canal, is about 3 cm long. It runs almost vertically through the prostate from its base to its apex lying nearer its anterior than its posterior surface, it joins the membranous portion
- ❑ Upon the posterior wall or floor is a narrow longitudinal ridge, the **urethral crest** formed by an elevation of the mucous membrane , It is from 15 to 17 mm. in length, and contains muscular and erectile tissue. , When distended, it may serve to prevent the passage of the semen backward into the bladder



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The prostatic urethra is lined by transitional epithelium

The membranous portion

- ❑ The shortest, least dilatable and, with the exception of the external orifice, the narrowest part of the canal.
- ❑ It extends downward and forward between the apex of the prostate and the bulb of the urethra perforating the urogenital diaphragm below and behind the pubic symphysis.

Its lined by pseudo stratified columnar epithelium

The penile portion

- ❑ The longest part of the urethra, and is contained in the corpus spongiosum It is about 15 cm long.
- ❑ It extends from the termination of the membranous portion to the external urethral orifice.
- ❑ The part of urethra lies within the glans penis dilated to form the **fossa navicularis (fossa terminalis)**
- ❑ The Cowper's gland open in penile urethra below urogenital diaphragm .

Penile urethra is lined by stratified columnar and simple columnar epithelium while fossa navicularis lined by stratified squamous epithelium

Thanks