TESTIS

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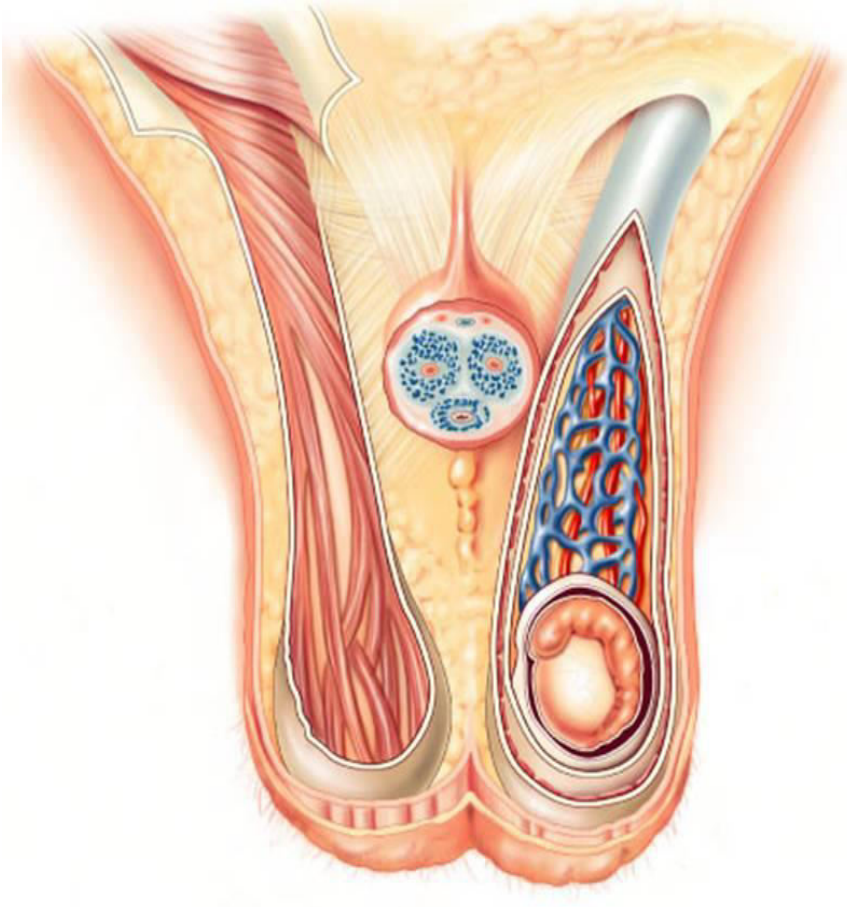
TESTIS

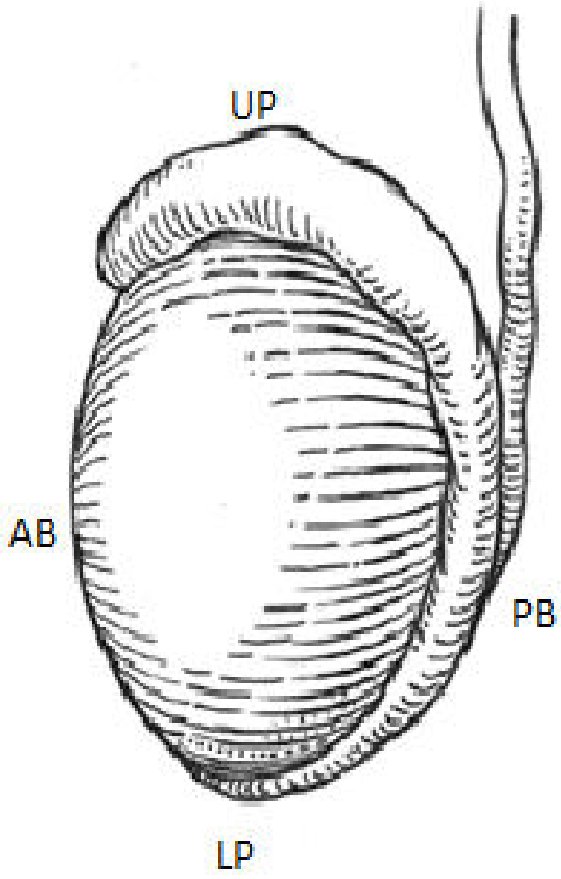
- Male gonad
- The testis are a pair of reproductive glands that produce sperm and hormone testosterone.



- Situated in scrotum
- suspended by spermatic cord
- Left testis is 1 cm lower than right

MEASUREMENTS

- Shape - Elliptical
- Length – 5cms.
- Breadth – 2.5 cms.
- Thickness – 3 cms.
- Weight – 10 –14gms
- But varies with each individual.

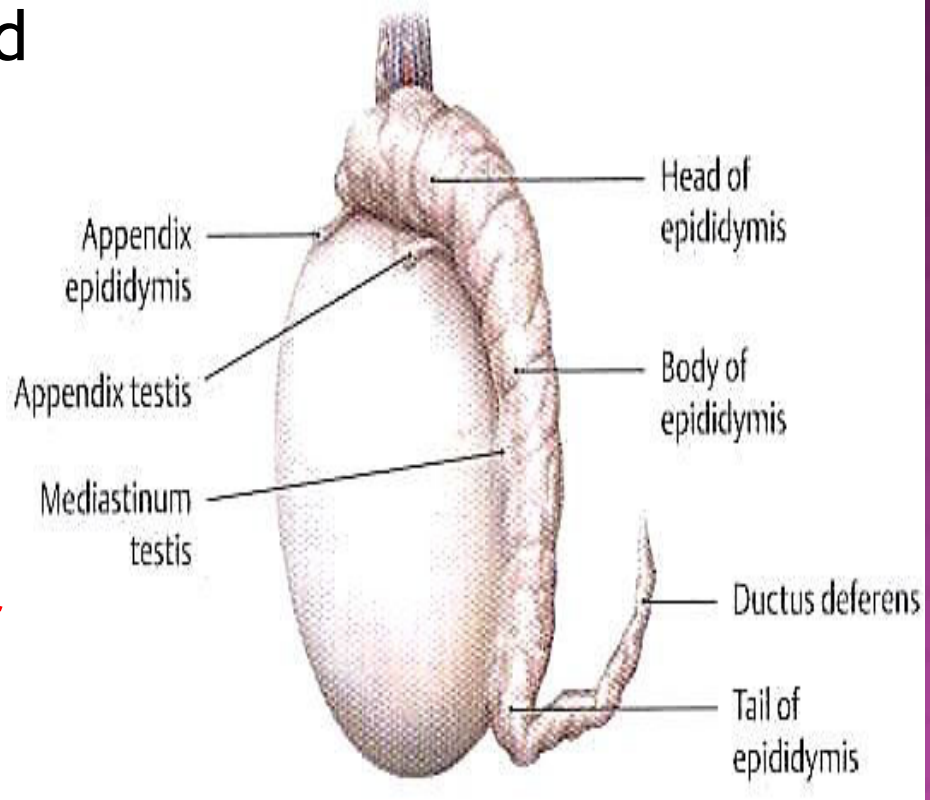


Presenting Parts

- Poles – Upper & lower
- Borders - Anterior & Posterior
- Surfaces - Medial & Lateral

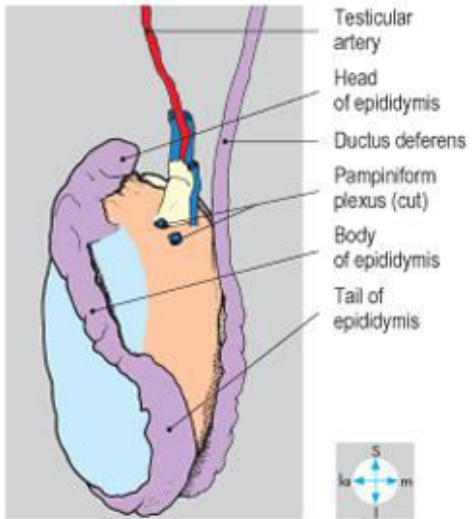
UPPER POLE

- Overlapped by the head of epididymis
- Directed upwards & laterally
- Gives attachment to a sessile fibrofatty structure – Appendix of testis
- Embryological remnant of Cephalic part of Mullerian duct



LOWER POLE

- Directed downwards & medially.
- Gives attachment to the tail of epididymis.
- Epididymis overlaps the upper pole, posterior border & lower pole of the testis.



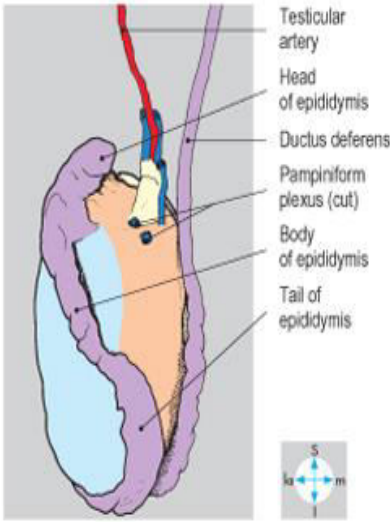
BORDERS

- Anterior: smooth & convex
- Posterior: broad & flat

  post-lateral ; body of epididymis

  post-medial ; vas deferens

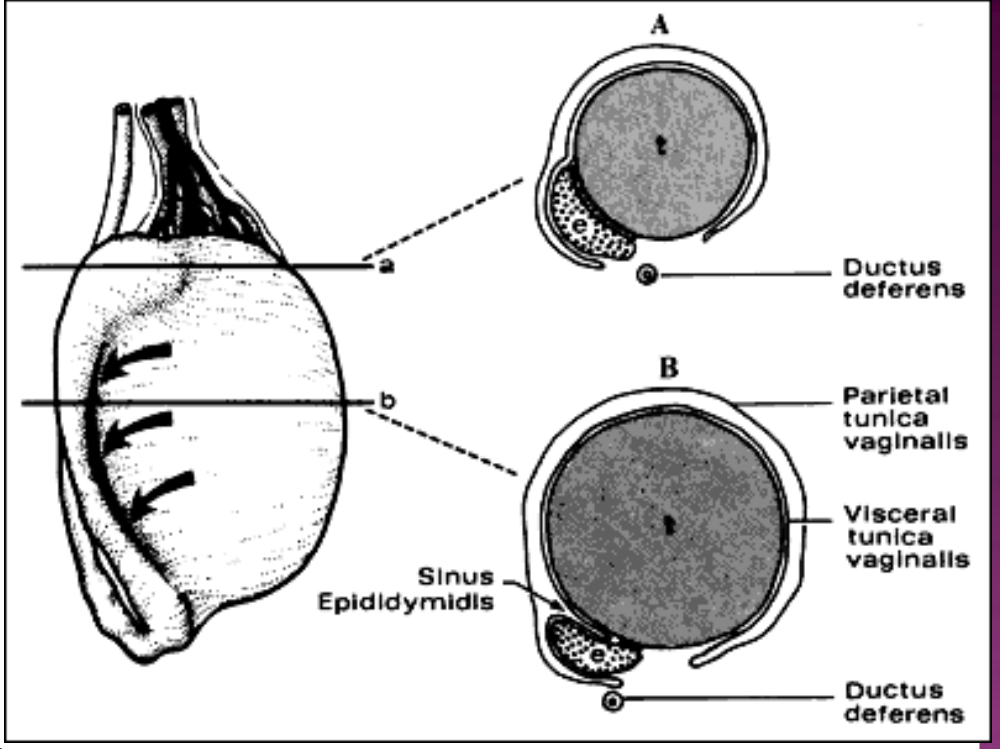
  upperpart ; attachment of spermaticord



SURFACES

- medial :Smooth & convex
- Lateral surface: Overlapped by the epididymis.
- But separated from it by a semilunar recess - Sinus of epididymis.
- Sinus of epididymis:

the side determination of the testis.



COVERINGS OF THE TESTIS

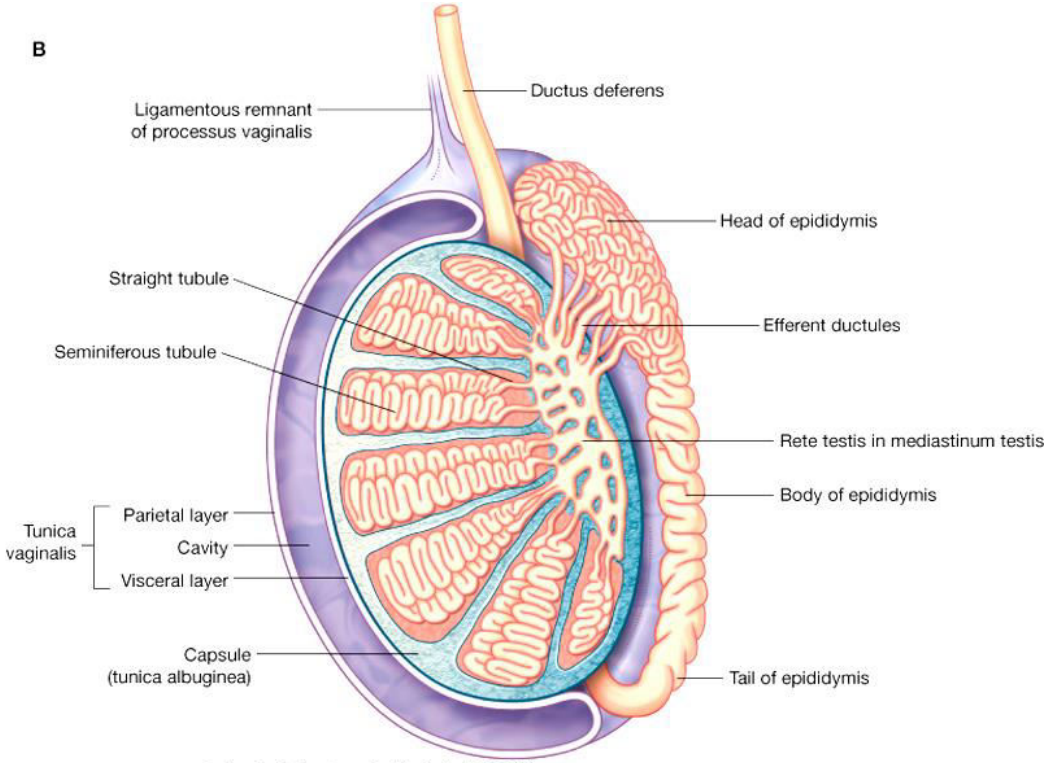
Three intrinsic coverings.

(Outside to inside)

Tunica vaginalis

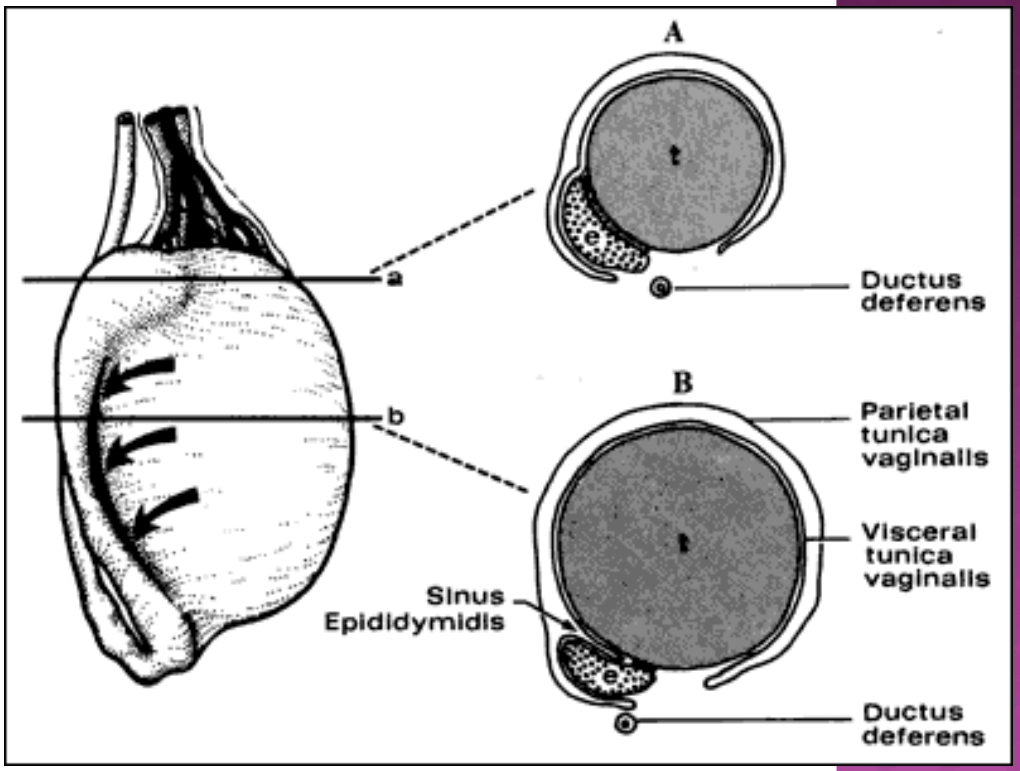
Tunica albuginea

Tunica vasculosa



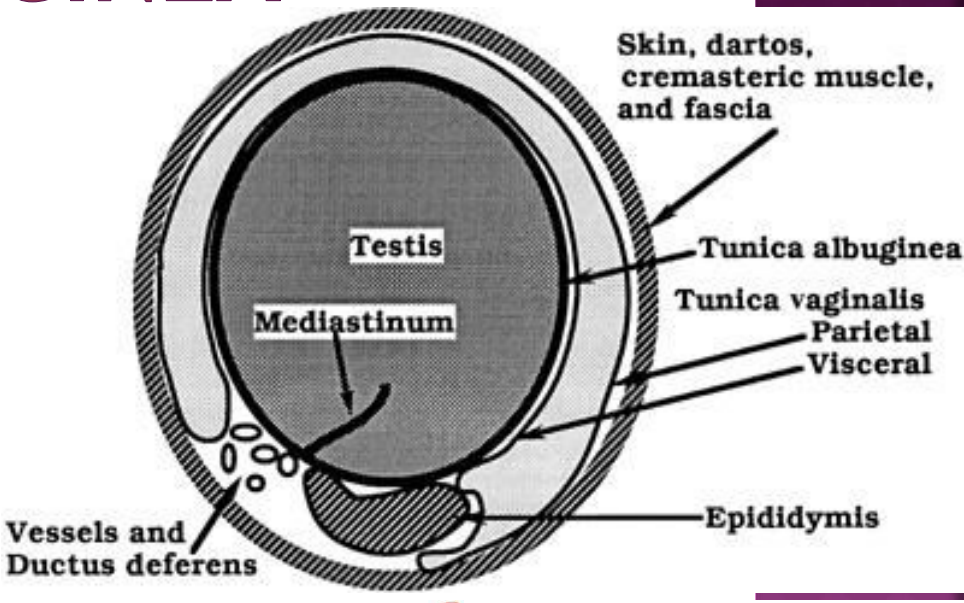
TUNICA VAGINALIS

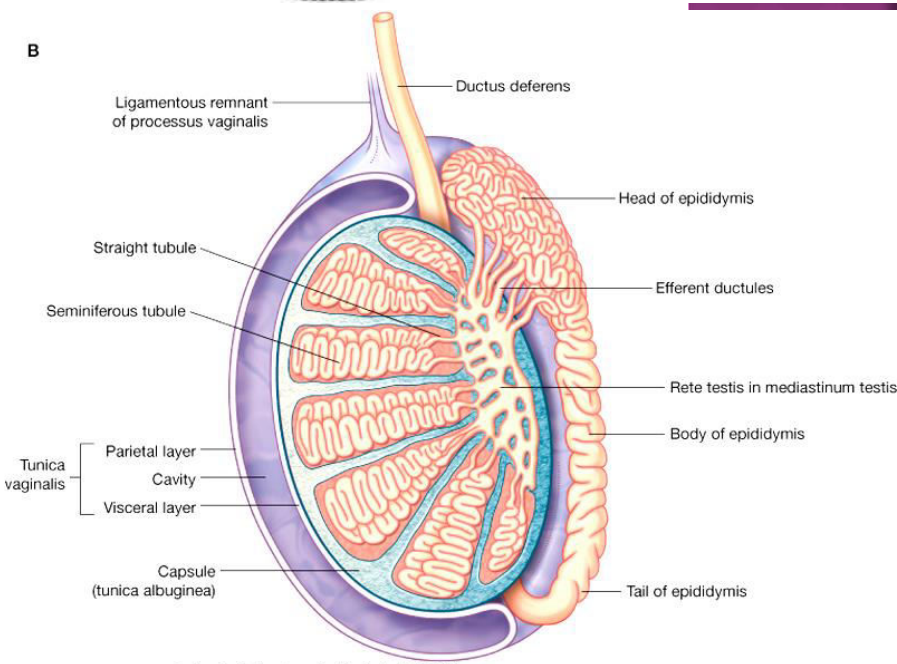
- Double layered peritoneal sac – Processus Vaginalis
- Invaginated by the testes from behind.
- Has visceral layer applied to the testes.
- Parietal layer lining the inside of the scrotum.
- Both the layers are continuous with each other along posterior border.



TUNICA ALBUGINEA

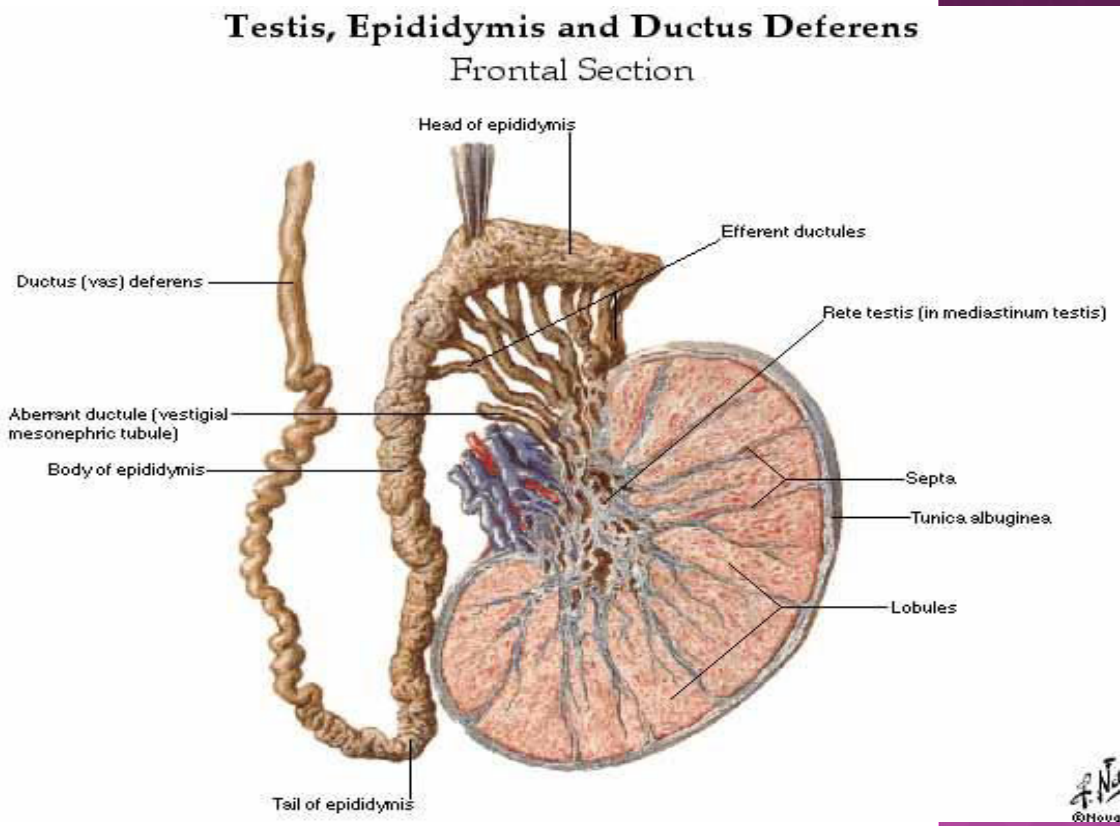
- Thick fibrous membrane
- Completely invests the testes
- Thickened along the posterior border of the testes
- Sends in a incomplete vertical fibrous septum posteriorly – Mediastinum testes.
- From this numerous fibrous septae extend & divide the testes into 200 – 300 lobules.



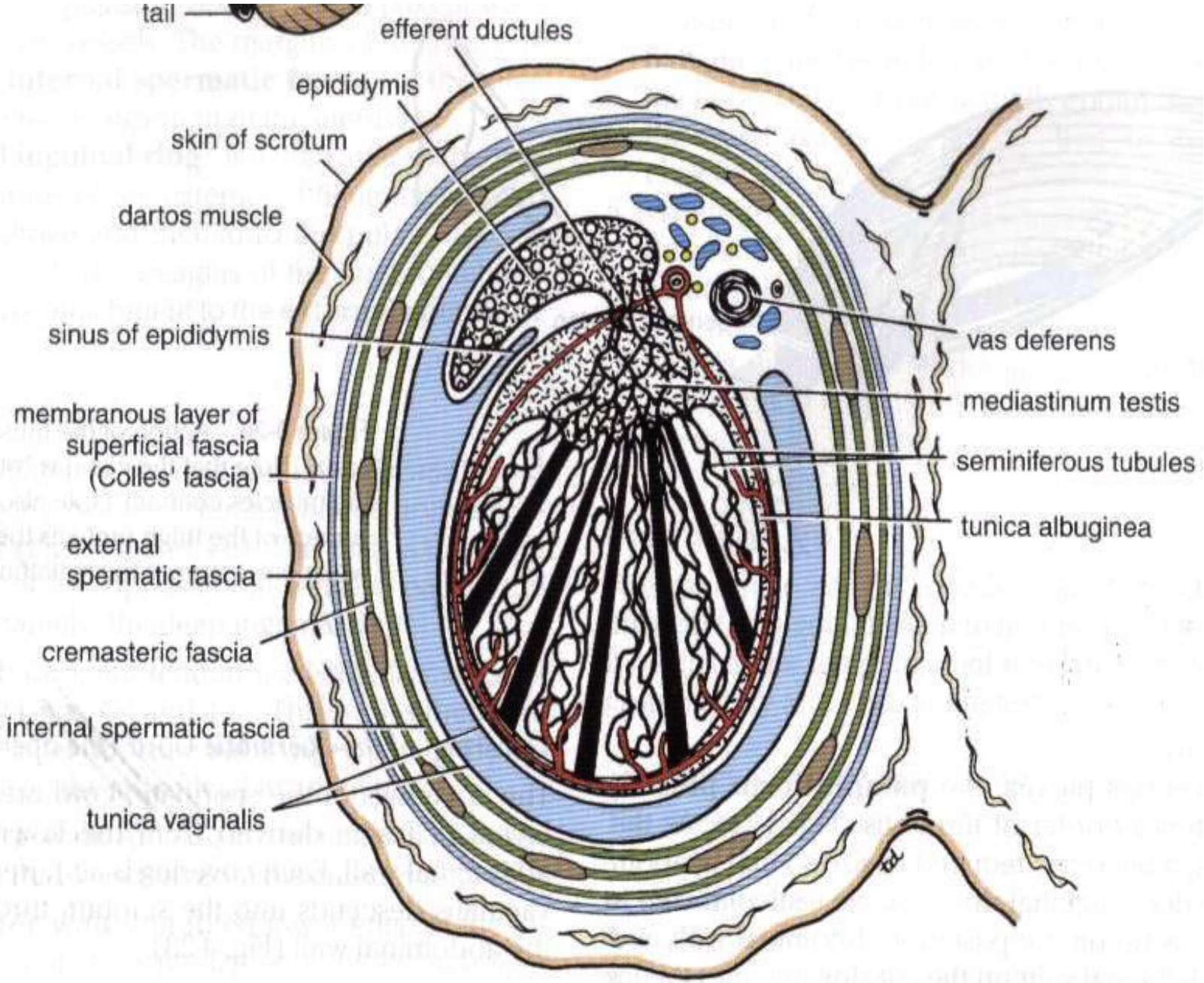


TUNICA VASCULOSA

- Inner most covering
- Vascular membrane
- Lines the individual lobules

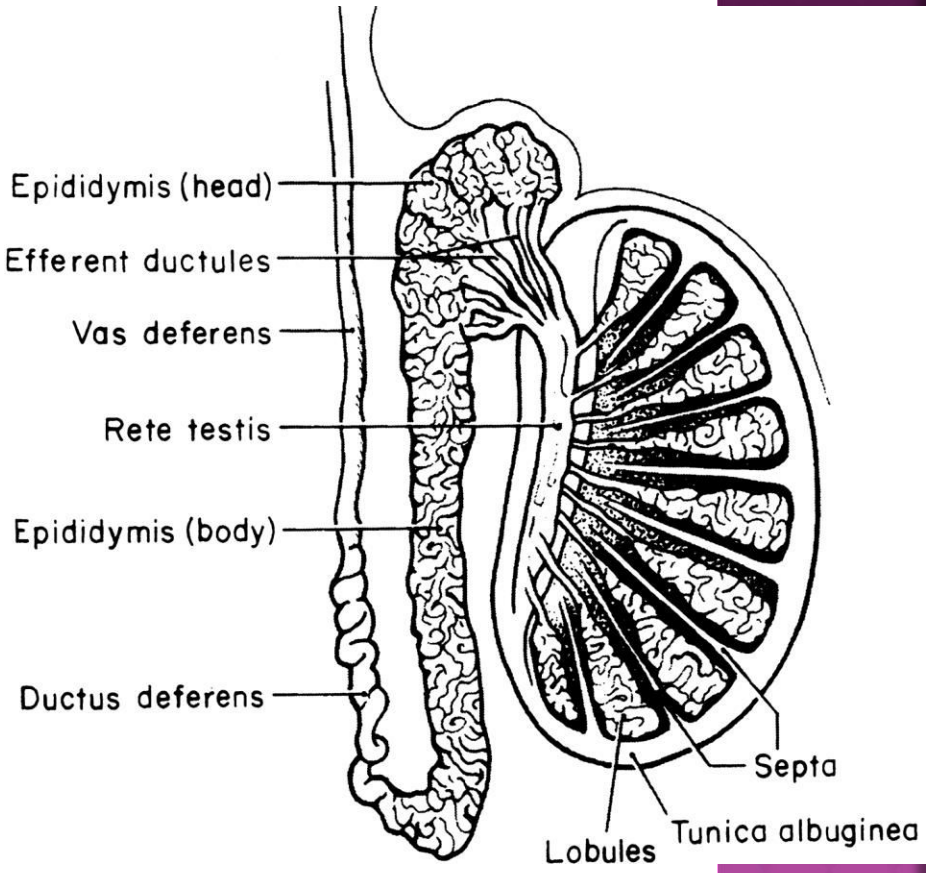


LAYERS OF TESTIS

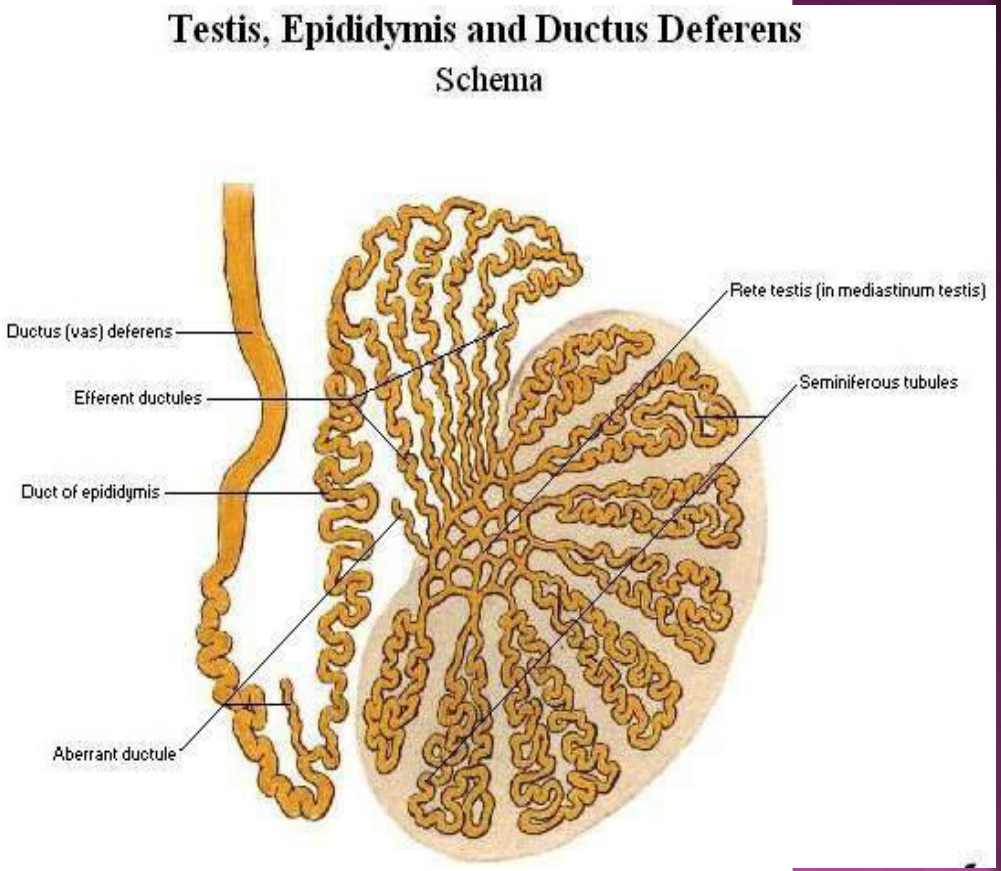


STRUCTURE OF THE TESTES

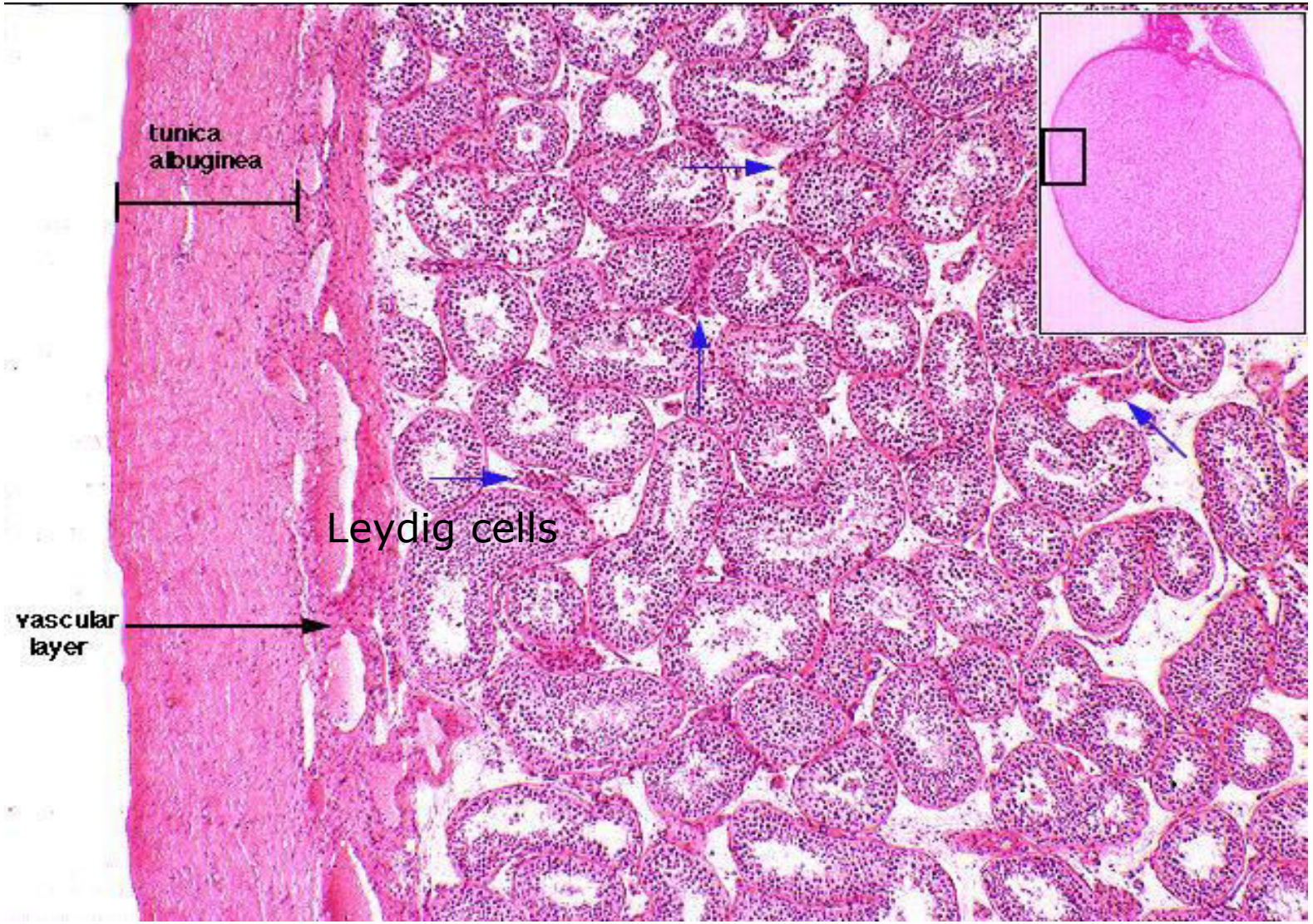
- There are 200 – 300 lobules
- Lobules - triangular in shape
- Apex – towards mediastinum
- Contains 3 – 4 highly coiled seminiferous tubules
- 400 – 600 tubules in each testes
- It has Spermatozoa in various stages of development & sertoli cells.
- In between the seminiferous tubules lie the Leydig cells are present



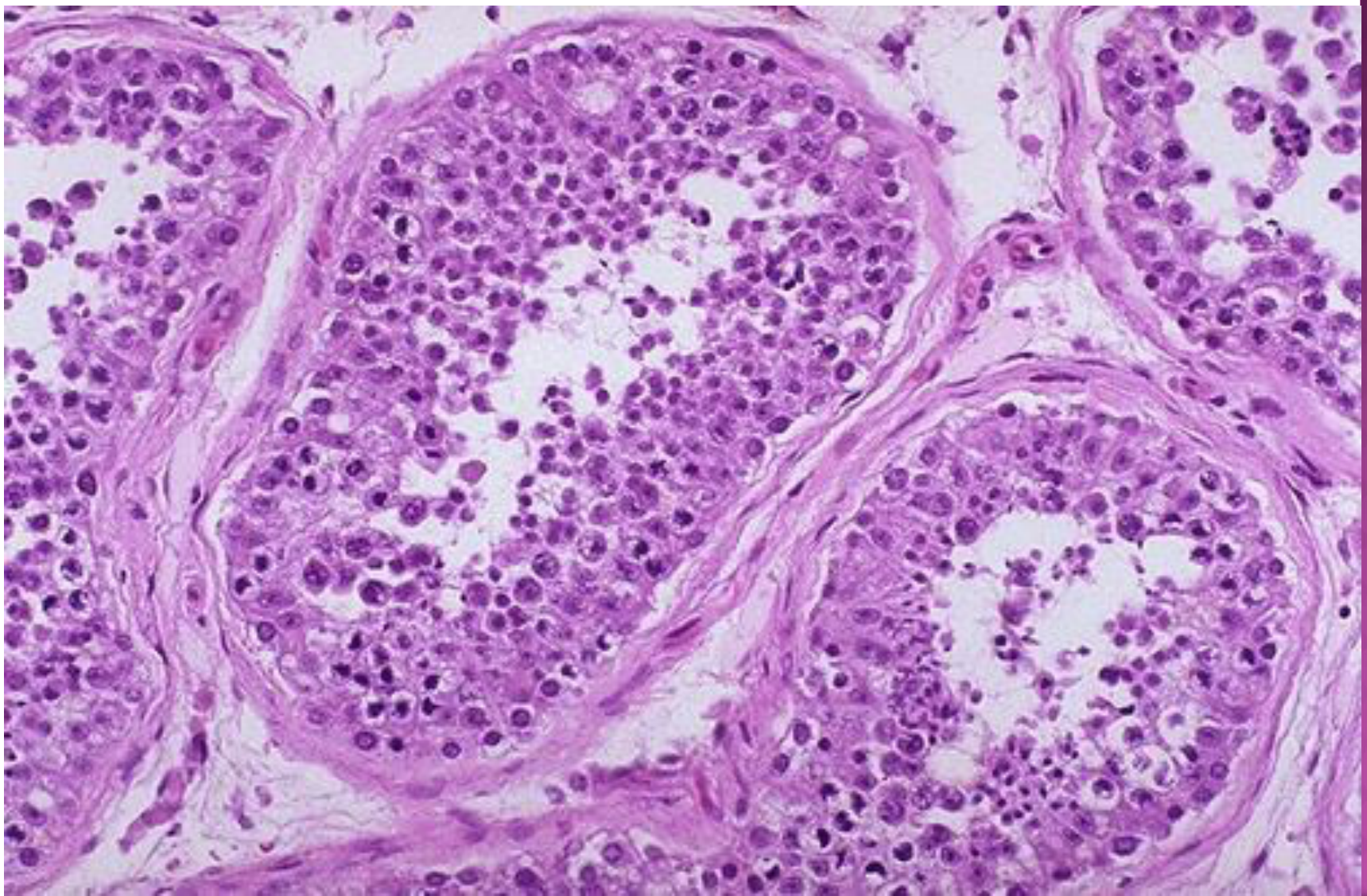
- The seminiferous tubules become uncoiled towards the mediastinum of the testes
- Join to form 15 to 30 straight tubules
- They join & form a network of tubules known as the Rete testis
- 12 to 20 efferent ductules arise from the rete testis.
- The efferent ductules unite to form a single duct – canal of epididymis.
- This becomes highly coiled & form the head & body of epididymis.



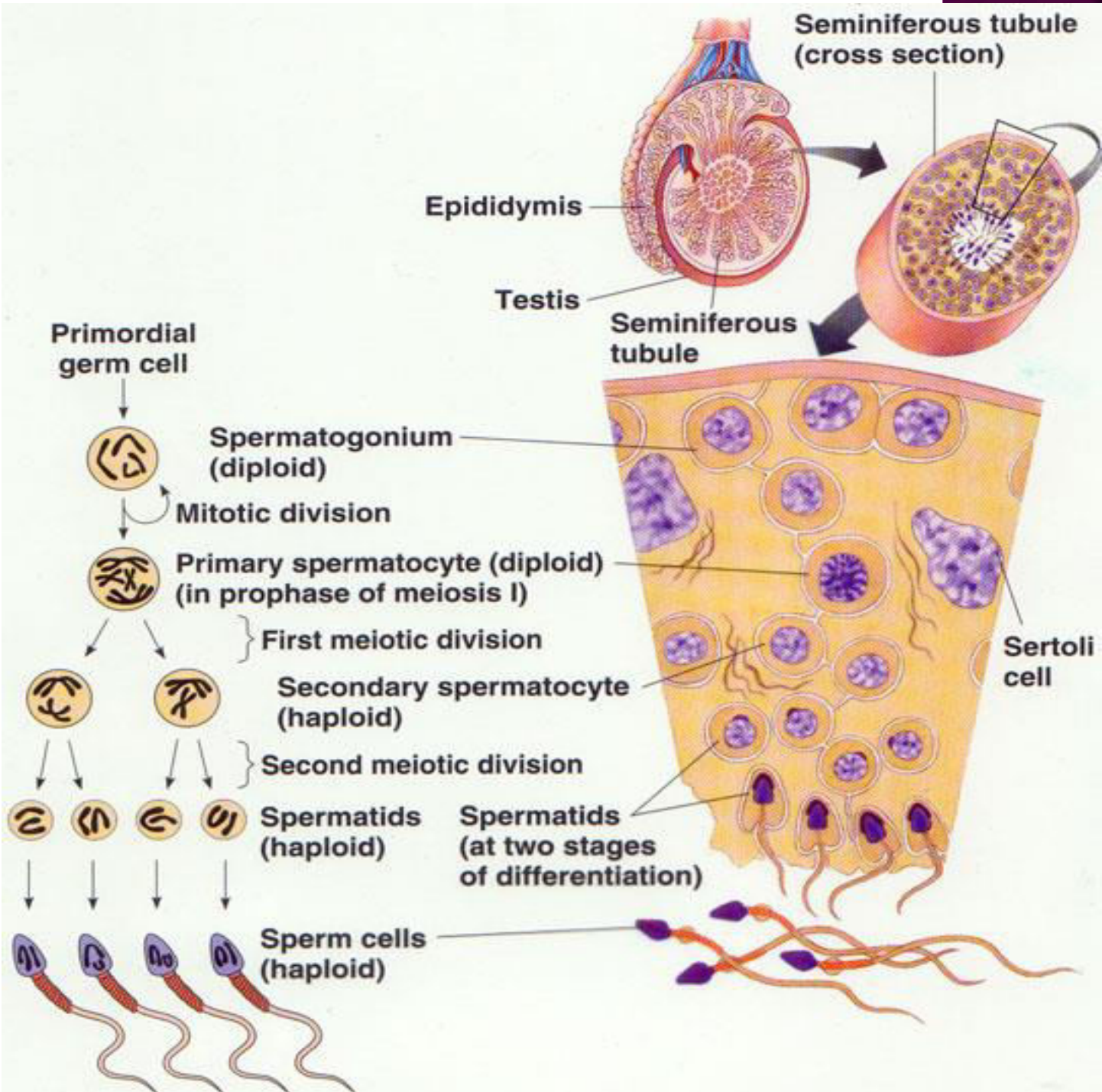
MICROSCOPIC STRUCTURE OF TESTIS

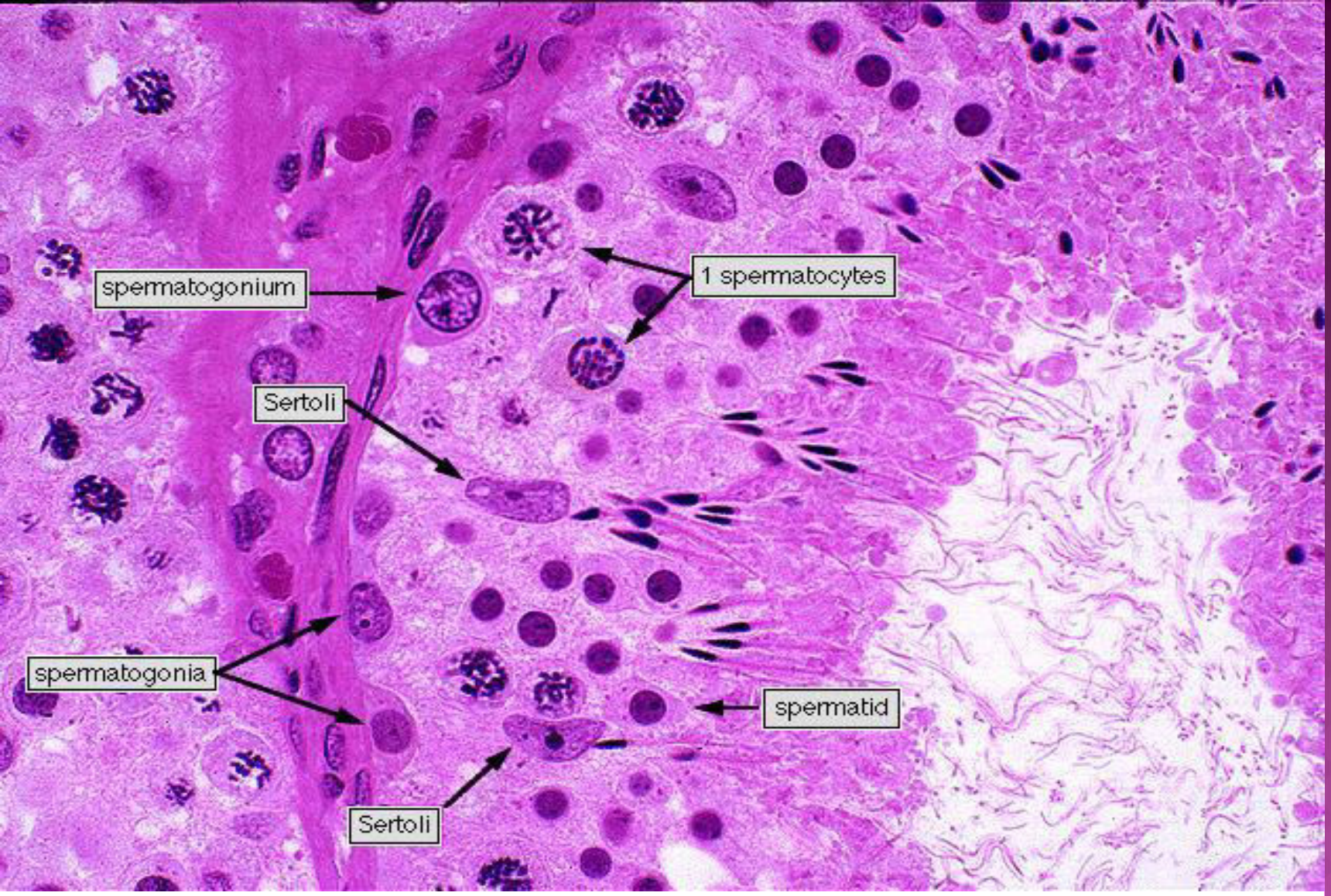


HIGH POWERVIEW: SEMNIFEROUS TUBULE



SEMNIFEROUS TUBULE





Semniferous tubule

SERTOLI CELL

- Elongated polyhydral cells
- Extend from basement membrane to lumen of semniferous tubule
- Do not divide during reproductive life
- Functions:
- support
- nutrition
- phagocytosis
- production of inhibin,Antigen binding protein
- anti mullarian harmone in foetus
- forms blood testis barrier

Sertoli cells/Sustentacular cells/Nurse cells/Mother cells/Tree cells/Stringy cells

- Sertoli cells are called so because of their eponym **Enrico Sertoli**, an Italian physiologist who discovered them while studying medicine in the University of Pavia, Italy.
- He published a description of this cell in 1865. In the 1865 publication, his first description used the terms **"tree-like cell"** or **"stringy cell"** and most importantly he referred to these **"mother cells."** It was other scientists who used Enrico's family name, Sertoli, to label these cell in publications, starting in 1888.

Sertoli Cells or Sustentacular Cells

- These **are tall columnar cells** that
- **Extend from the basal lamina to the lumen of the seminiferous tubule,**
- **Interposed between the developing spermatogenic cells.**

Sustentacular Cells or Sertoli Cells

- Each Sertoli cell is 70-90 um long and nearly 3o um wide.
- Due to their loose association with spermatogenic cells, the lateral margins of Sertoli cells are irregular and can not easily be distinguished under L/M.

Sustentacular cells

- Each sustentacular cell has a large **pale-** staining (euchromatic) nucleus which is located in the basal portion of the cell.
- **The nucleus exibits two distinctive features:**
- 1) the nuclear envelope shows **many infoldings**, and,
- 2) **the nucleolus is very prominent (Dark nucleolus)**.

Luminal surface of a Sertoli cell

shows many **grooves** in which **heads of the maturating spermatozoa are embeded**.

Sustentacular or Sertoli cells

Under L/M,

The cytoplasm of a Sertoli cell is seen to contain:

1. Lipid droplets,
2. Glycogen granules and
3. Crystalloid.

Sertoli Cells

E/M shows that these cells contain:

1. **A well-developed Golgi apparatus,**
2. **An abundant smooth endoplasmic reticulum,**
3. **Some rough endoplasmic reticulum,**
4. **Numerous mitochondria and**
5. **Many lysosomes.**

Functions of Sertoli cells

- A **Sertoli cell** is a 'nurse' cell or 'mother' cell of the testes.
- It is activated by follicle-stimulating hormone and has FSH-receptor on its membranes.

Functions of Sertoli Cells

1.Support, protection and nutritional regulation of developing spermatozoa.

Adjacent Sertoli cells are bound together by **occluding junctions** just above the level of spermatogonia, which lie in a basal compartment that has free access to material carried in blood.

Functions of Sertoli cells cont...

- The spermatocytocytes cross these junctions and come to lie in an adluminal compartment.
- This compartment is protected from blood-borne materials by a blood-testis barrier formed by occluding junctions between Sertoli cells.

Functions of Sertoli Cells cont..

- The spermatocytes, spermatids and developing spermatozoa are isolated from the blood circulation and depend on Sertoli cells to mediate the exchange of nutrients and metabolites.
- The blood-testis barrier protects the cells in the adluminal compartment from blood-born harmful substances and from autoimmune reaction against sperm-specific proteins.

Functions of Sertoli Cells cont...

2. Secretions: Sustentacular cells of Sertoli secrete a fluid into the lumen of the seminiferou tubules which flows in the direction of genital ducts and is used for sperm transport.

- Sertoli cells secrete the following substances:
- anti-Müllerian hormone (AMH) - secreted during the early stages of fetal life.
- inhibin and activins - secreted after puberty, and work together to regulate FSH secretion
- androgen binding protein (also called testosterone binding globulin) - increases testosterone concentration in the seminiferous tubules to stimulate spermatogenesis

- estradiol - aromatase from Sertoli cells convert testosterone to 17 beta estradiol to direct spermatogenesis
- glial cell line-derived neurotrophic factor (GDNF) - has been demonstrated to function in promoting undifferentiating spermatogonia, which ensures stem cell self-renewal during the perinatal period.
- the Ets related molecule (ERM transcription factor) - needed for maintenance of the spermatogonial stem cell in the adult testis.
- transferrin - a blood plasma protein for iron ion delivery.

Functions of Sertoli Cells cont....

3. Phagocytosis:

During sperminogenisis excess spermatid cytoplasm is shed as residual bodies which are phagocytized and broken down by Sertoli cells.

Functions of Sertoli Cells cont...

During the maturation phase of spermiogenesis, the Sertoli cells consume the unneeded portions of the spermatozoa.

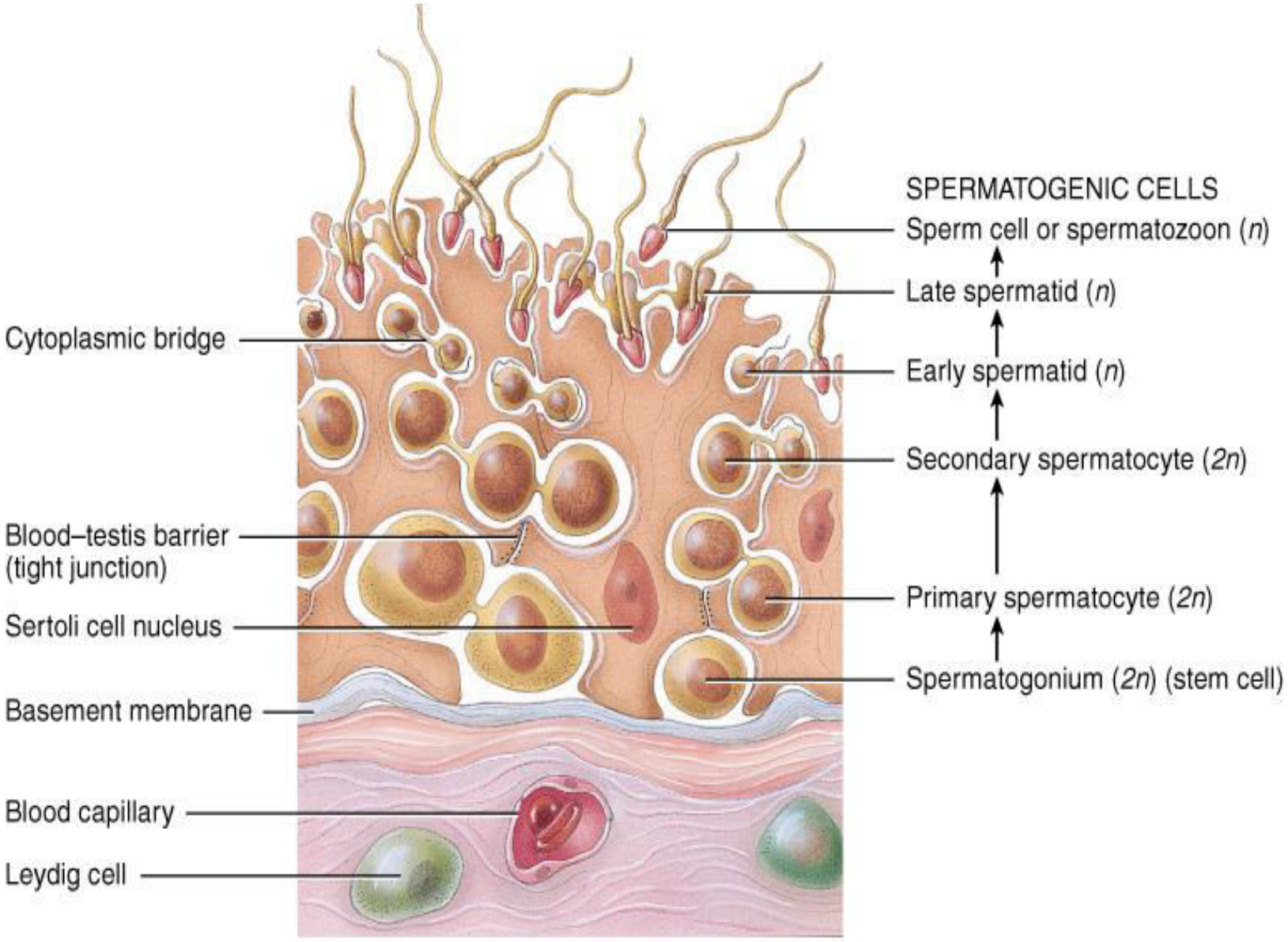
BLOOD TESTIS BARRIER

- Lateral surfaces of sertoli cells bound together by tight junctions at the level of spermatogonia, form blood testis barrier
- Divide into 1)basal

  2)ad-luminal compartments

In male ,mature spermatozoa appear from puberty acts as secluded antigens because circulating plasma proteins not exposed to new sperm proteins due to BTB

DISRUPTION of barrier would produce antispermic antibody-supression of spermtogenesis



(b) Transverse section of a portion of a seminiferous tubule

HISTOLOGY OF THE TESTIS

- Leydig cell:polyhydral cells
- Rich in vitC,lipid droplets, cholesterol,rinkes crystals
- Foetus:Placental gonado trophic harmone
- Puberty: I.C.S.H
- Functions: secretes testosterone
- descent of testis
- Growth of secondary sexual characters

Interstitial Cells of Leydig

- **Leydig cells**, also known as **interstitial cells of Leydig**, are found adjacent to the seminiferous tubules in the testicle. They produce testosterone in the presence of luteinizing hormone (LH).
- Leydig cells are named after the German anatomist Franz Leydig, who discovered them in 1850

Structure

- Leydig cells are polyhedral in shape, display a large prominent nucleus, an eosinophilic cytoplasm and numerous lipid-filled vesicles.

Structure cont..

Leydig cell has a single eccentrically located ovoid nucleus. The nucleus contains one to three prominent nucleoli and large amounts of dark-staining peripheral heterochromatin.

Structure cont...

- The **acidophilic** cytoplasm usually contains numerous membrane-bound **lipid droplets** and large amounts of smooth endoplasmic reticulum (**SER**).

Structure cont.

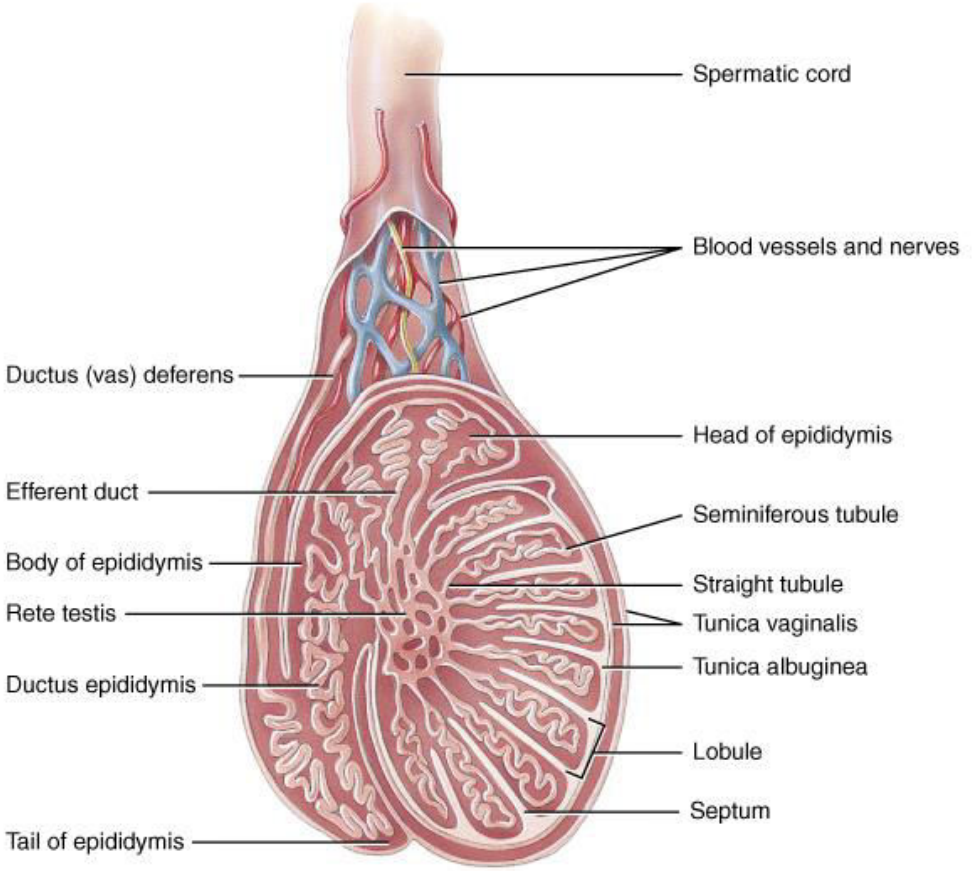
- Besides the obvious abundance of SER with scattered patches of rough endoplasmic reticulum, several mitochondria are also prominent within the cytoplasm.

Structure cont....

- Frequently, lipofuscin pigment and rod-shaped crystal-like structures 3 to 20 micrometres in diameter (**Reinke's crystals**) are found. These inclusions have no known function.

PATHWAY OF SPERM IN MALE GENITAL TRACT

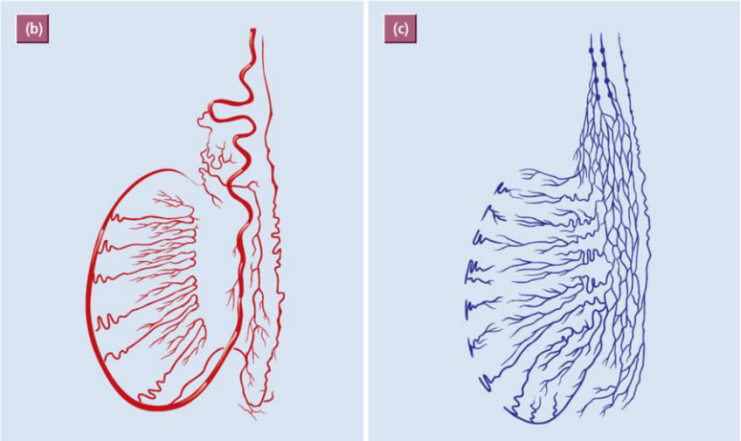
1. Seminiferous tubule
2. Straight tubule
3. Rete testis
4. Efferent duct
5. Ductus Epididymis
6. Ductus deferens
7. Ejaculatory duct
8. Prostatic urethra



(a) Sagittal section of a testis showing seminiferous tubules

ARTERIAL SUPPLY

1. Testicular artery
2. Artery to vasdeference
3. Cremasteric artery

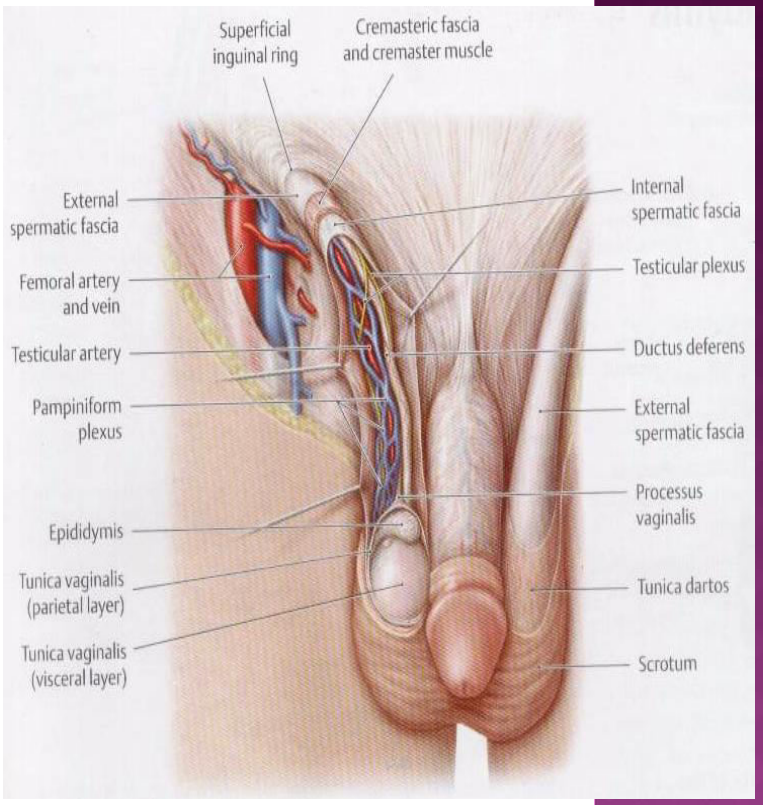


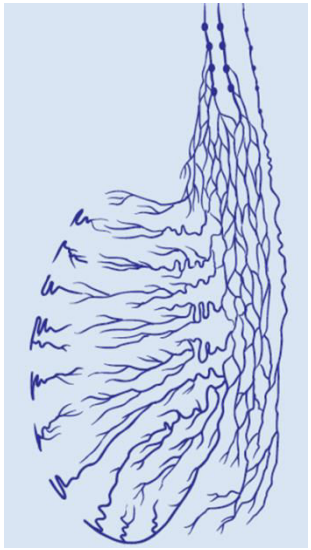
VENOUS DRAINAGE

- 15 – 20 veins emerge from the posterior border & unite to form – PAMPINIFORM PLEXUS OF VEINS.

These gradually reduce in number & becomes

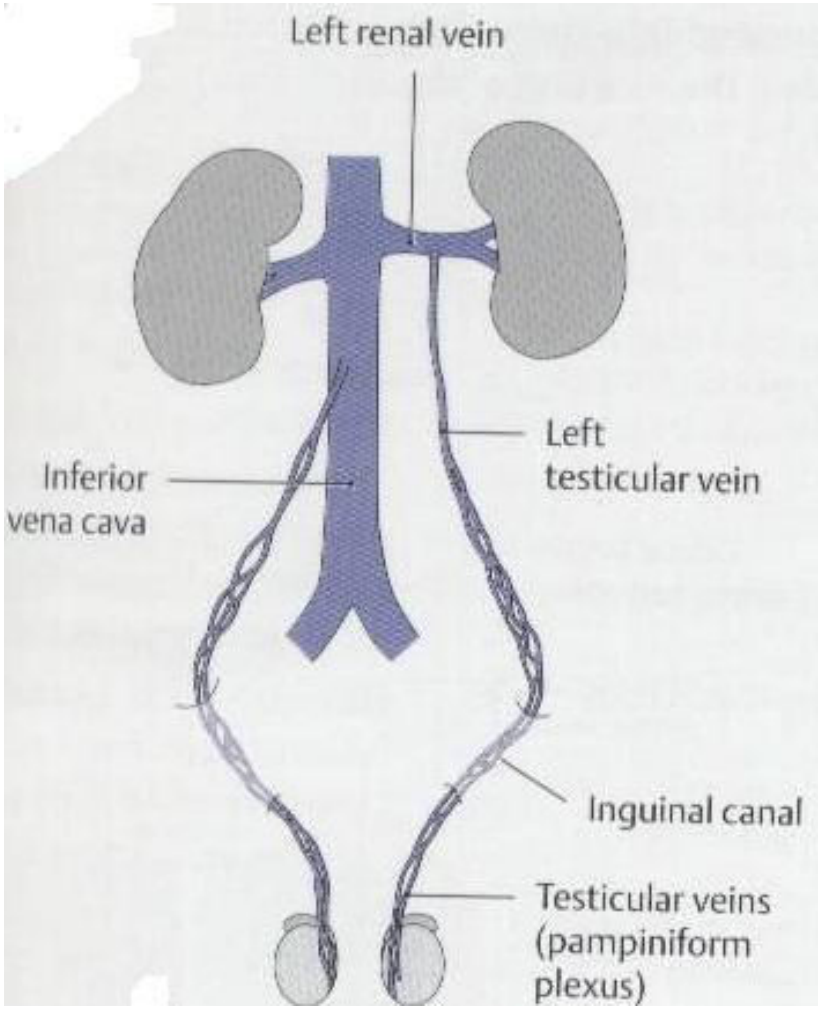
- 4 at superficial inguinal ring
- 2 at deep inguinal ring
- 1 at posterior abdominal wall.





Drains into:

- Rt side: Inferior venacava.
- Lt side: Left renal vein.



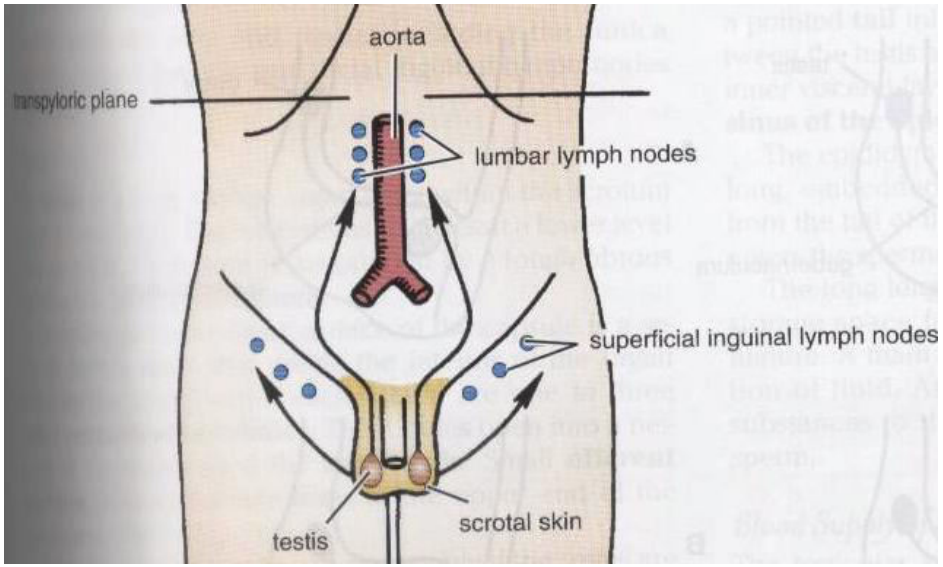
Nerve supply

Sympathetic:

- Pre Ganglionic fibres – T_{10} & T_{11}.
- Post ganglionic fibres: Renal & Aortic plexuses.
- Nerves are both sensory & vasomotor.
- Pain is referred to umbilicus.

Lymphatic drainage

Preaortic & Para aortic lymph nodes



GENITAL SYSTEM

- Gonads (primitive sex glands)
- Genital ducts
- External genitalia

İndifferent stage

SEX DETERMINATION

- Chromosomal and genetic sex is established at fertilization
- Before 7th week gonads of 2 sexes are identical (indifferent gonads)
- The type of gonads that develop is determined by the sex chromosome complex of the embryo (XX or XY)
- Key to sexual dimorphism is Y chromosome which

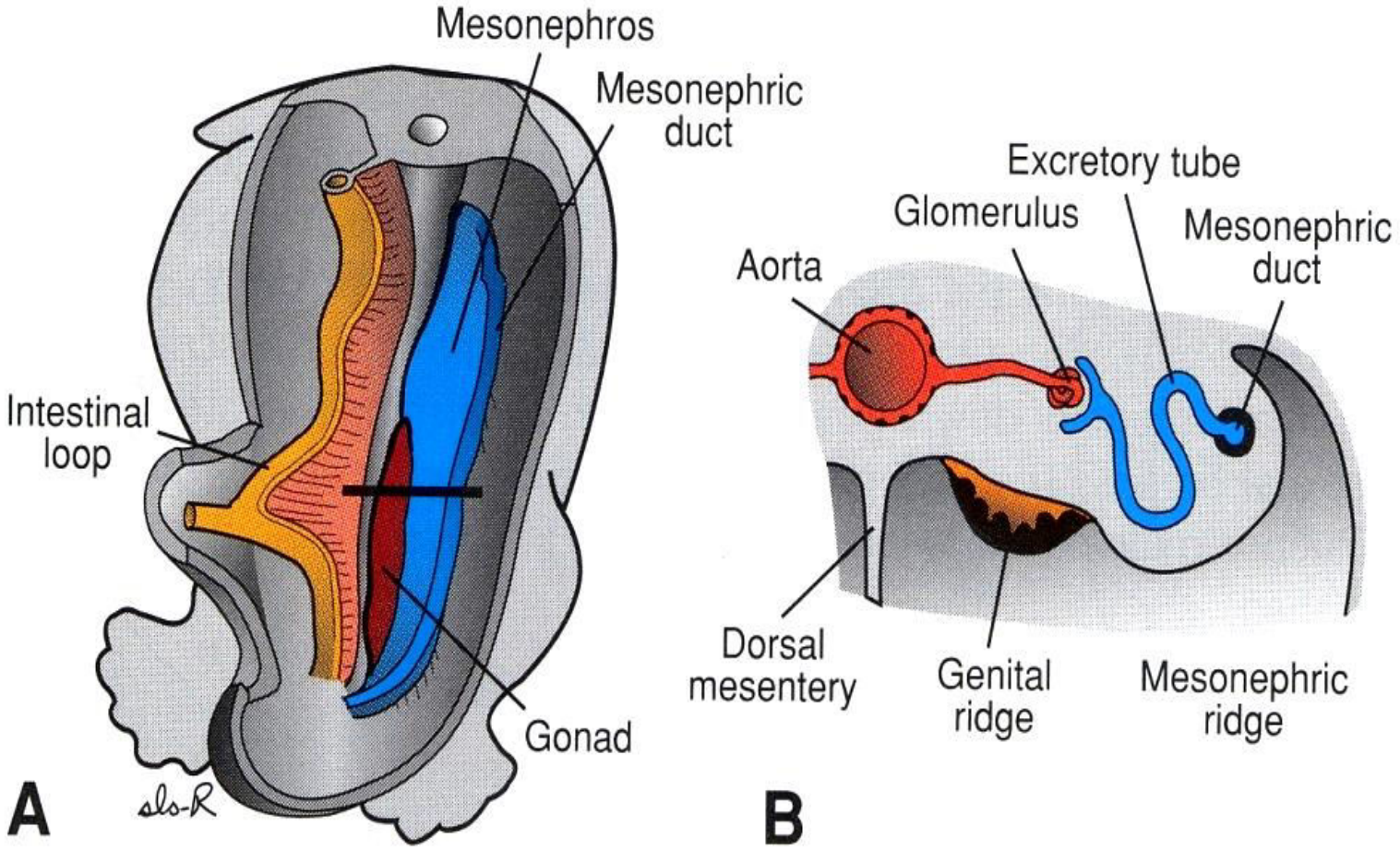
  contain SRY GENE on its short arm(yp11)

  (SRY-sex determining region on Y gene)

  Protein product of SRY gene is
  testis determining factor(TDF)

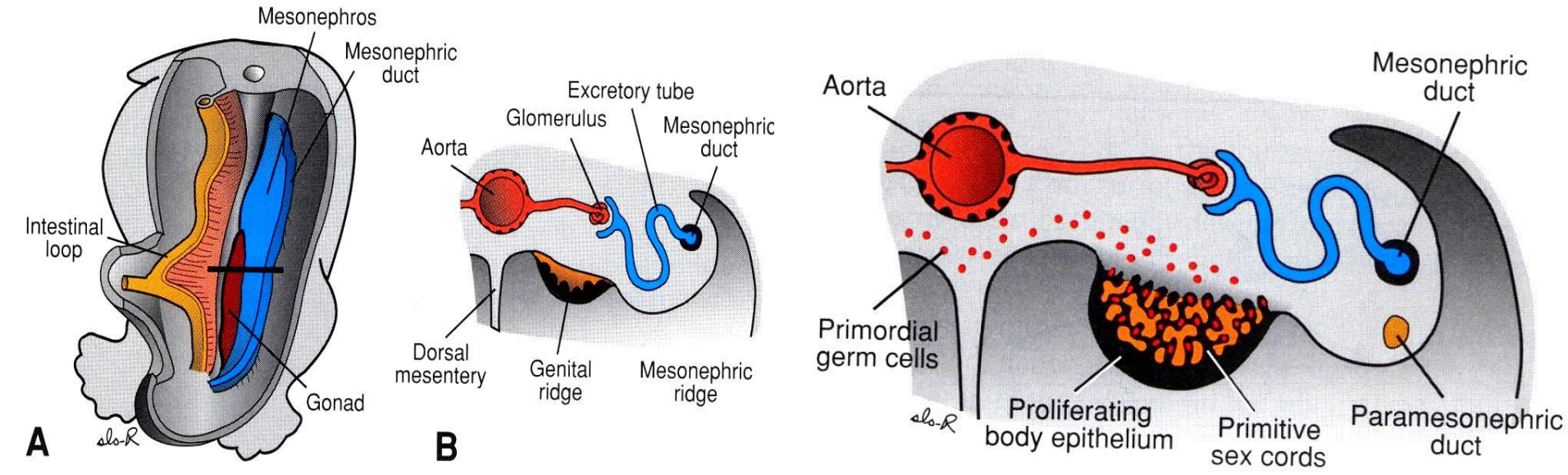
DEVELOPMENT OF GONADS (TESTES AND OVARIES)

- Gonadal ridge
- The primordial germ cells



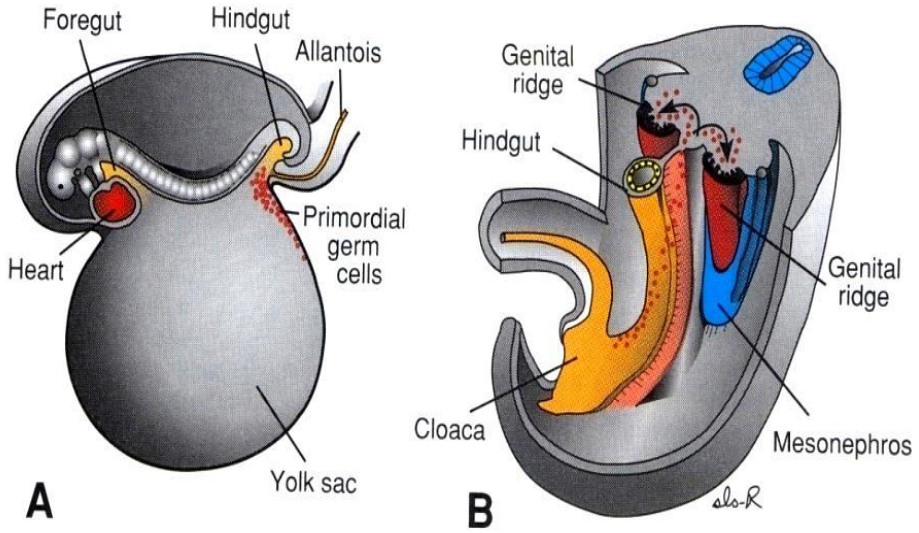
INDIFFERENT GONADS

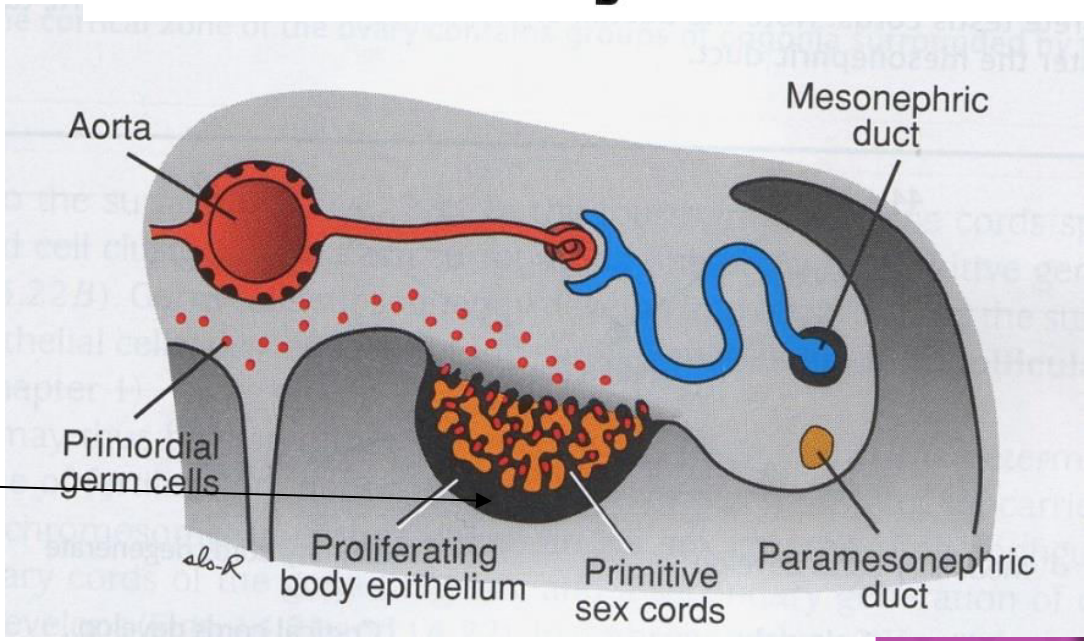
- During the 5th week a thickened area from intermediate mesoderm develops on the medial side of the mesonephros: a pair of gonadal(genital) ridges
- Finger-like epithelial cords (gonadal cords) grow into the underlying mesenchyme
- The indifferent gonad now consists of an external cortex and an internal medulla.
- If the embryo is XX: cortex will differentiate into an ovary, medulla regress
- If the embryo is XY medulla differentiates into a testis, cortex regress except for vestigial remnants



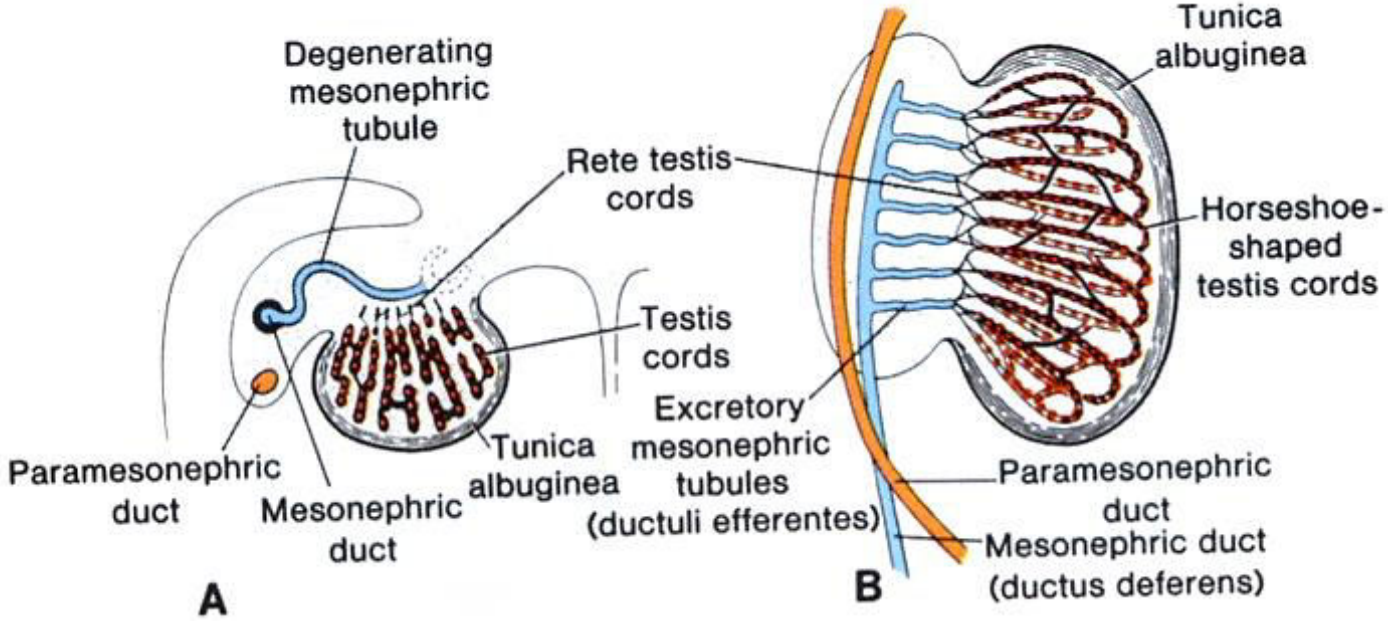
PRIMORDIAL GERM CELLS

- Origin: epiblast
- at 3rd week reside among the endodermal cells of the yolk sac near the origin of the allantois
- During folding of the embryo dorsal part of the yolksac is incorporated into embryo
- Thus the primordial germ cells migrate along the dorsal mesentery of the hindgut to the genital ridges at 4th wk
- During 6th week primordial germ cells enter the underlying mesenchyme and are incorporated in the gonadal cords.





DEVELOPMENT OF TESTES



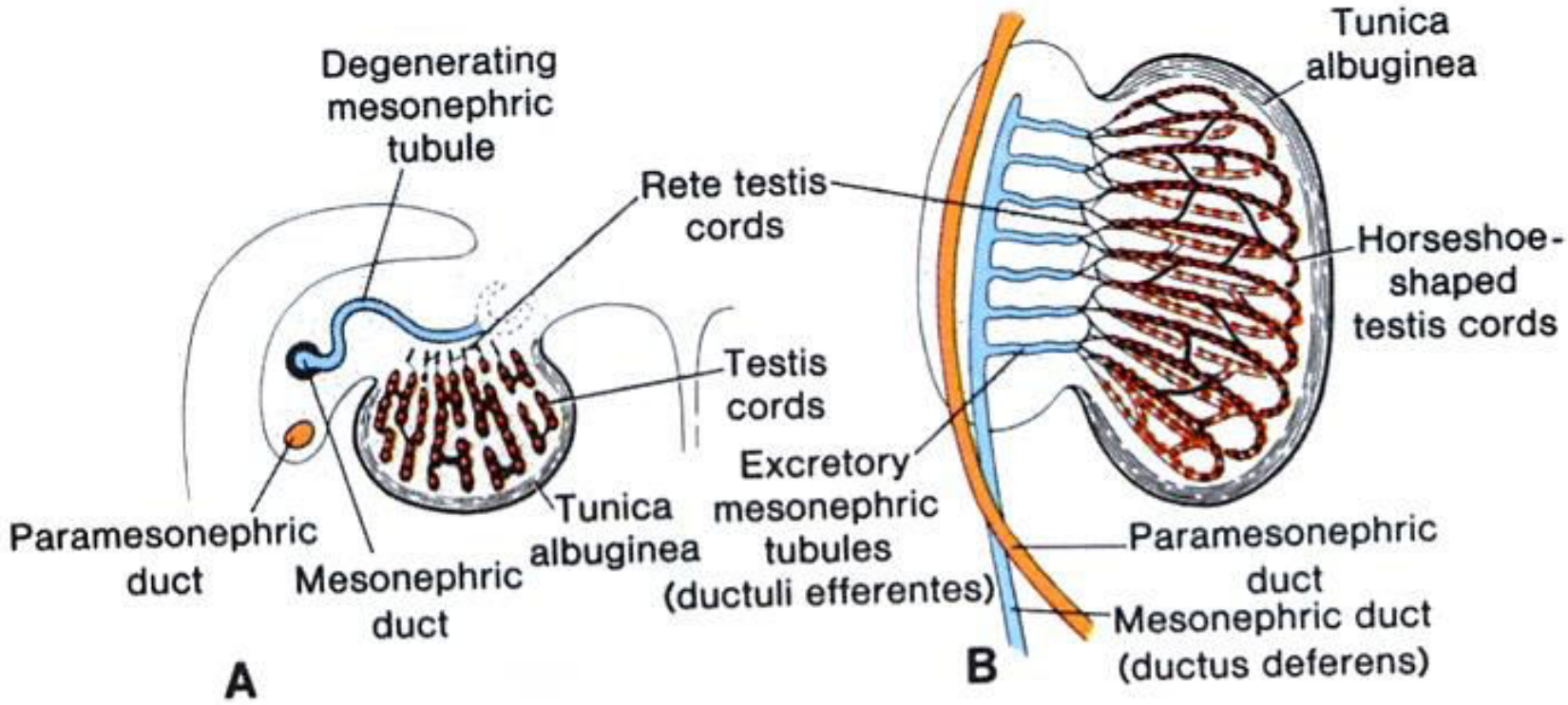
- TDF induces the gonadal cords (seminiferous cords) to condense and extend into the medulla of the indifferent gonad; where they branch and anastamose to form the rete testis.
- A dense layer of fibrous Connective tissue (tunica albuginea) separates the testis cords from the surface epithelium
- In the 4th month testis cords become horseshoe shaped; their extremities are continous with those of the rete testis
- Testis cords are now composed of primitive germ cells and sustentacular cells of Sertoli derived from the surface epithelium of the gland

DEVELOPMENT OF TESTES

- Interstitial cells of Leydig derived from the original mesenchyme of the gonadal ridge begin development shortly after onset of differention of these cords
- Leydig cells lie between the testis cords and begin testosterone production by 8th week of gestation
- Thus the testis is able to influence sexual differentiation of the genital ducts and external genitalia.

DEVELOPMENT OF TESTES

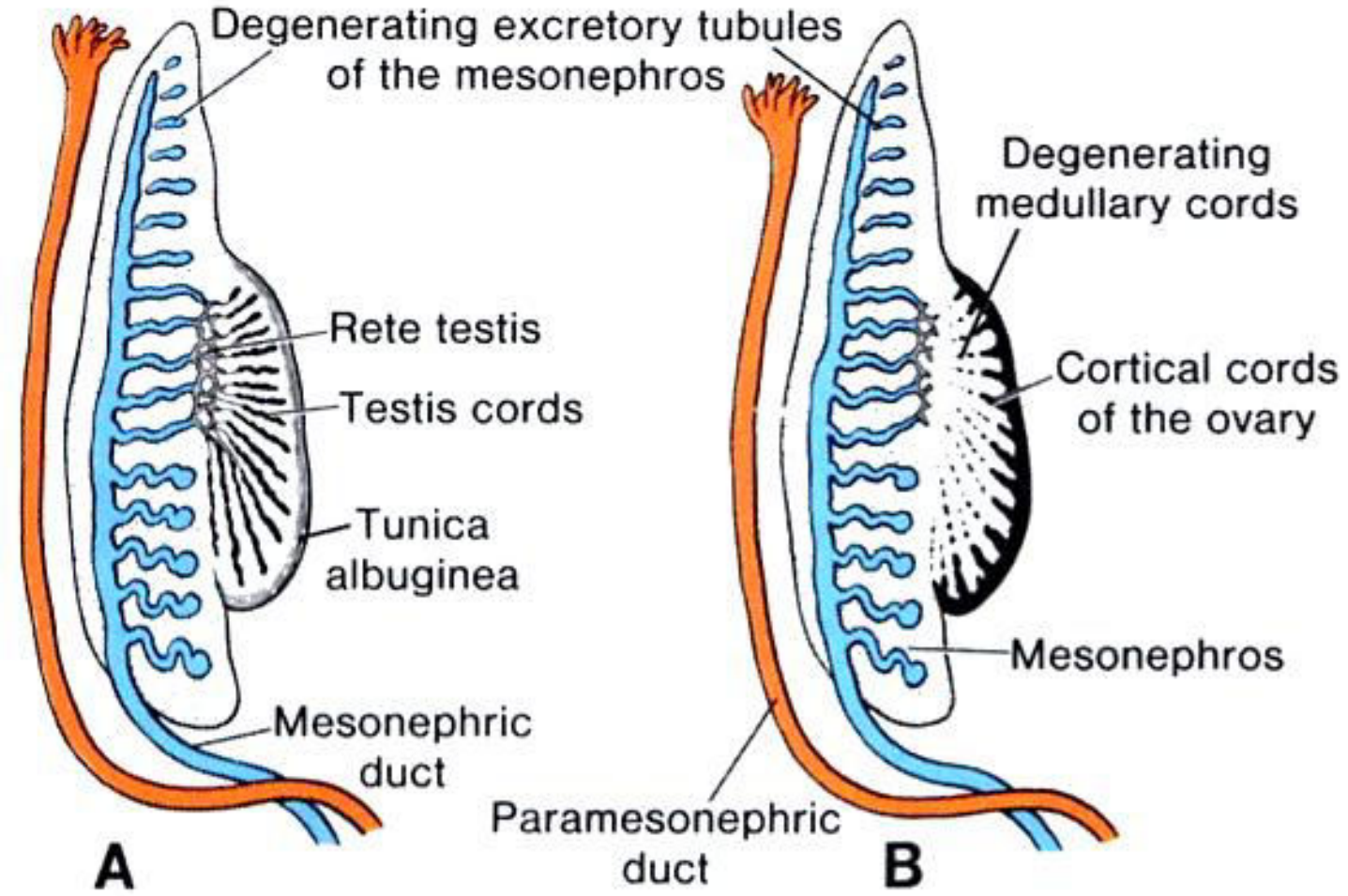
- Testis cords remain solid untill puberty; when they are canalyzed forming seminiferous tubules
- Thus they join rete testis tubules, which in turn enter the ductuli efferentes which are the remaining parts of the excretory tubules of the mesonephric system
- They link the rete testis and the mesonephric or wolffian duct which becomes ductus defferens



DEVELOPMENT OF GENITAL DUCTS: INDIFFERENT STAGE

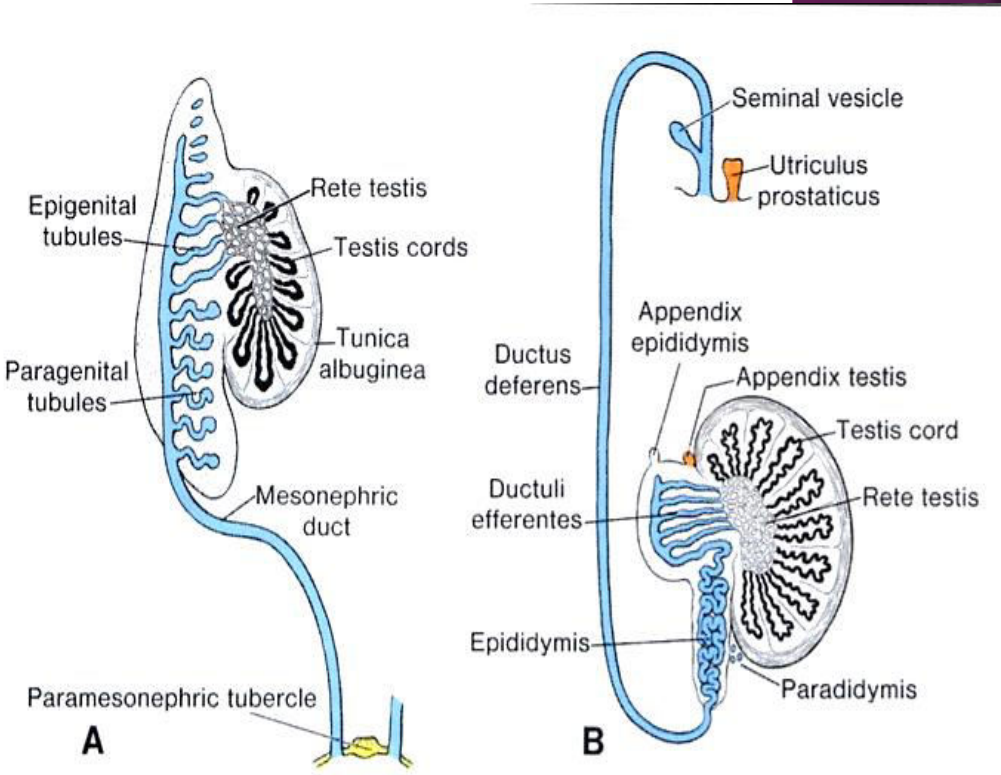
- At the begining both male and female embryos have 2 pairs of genital ducts:
  - Mesonephric (wolffian) ducts
  - Paramesonephric (mullerian) ducts arising as a longitudinal invagination of the epithelium on the ant-lateral surface of the urogenital ridge
- Two paramesonephric ducts are separated by a septum but later fuse to form the uterine canal
- The caudal tip of the combined ducts projects into the posterior wall of the urogenital sinus causing a swelling (paramesonephric/müllerian tubercle)
- The mesonephric ducts open into the urogenital sinus on either side of the müllerian tubercle

GENITAL DUCTS IN MALE &FEMALE



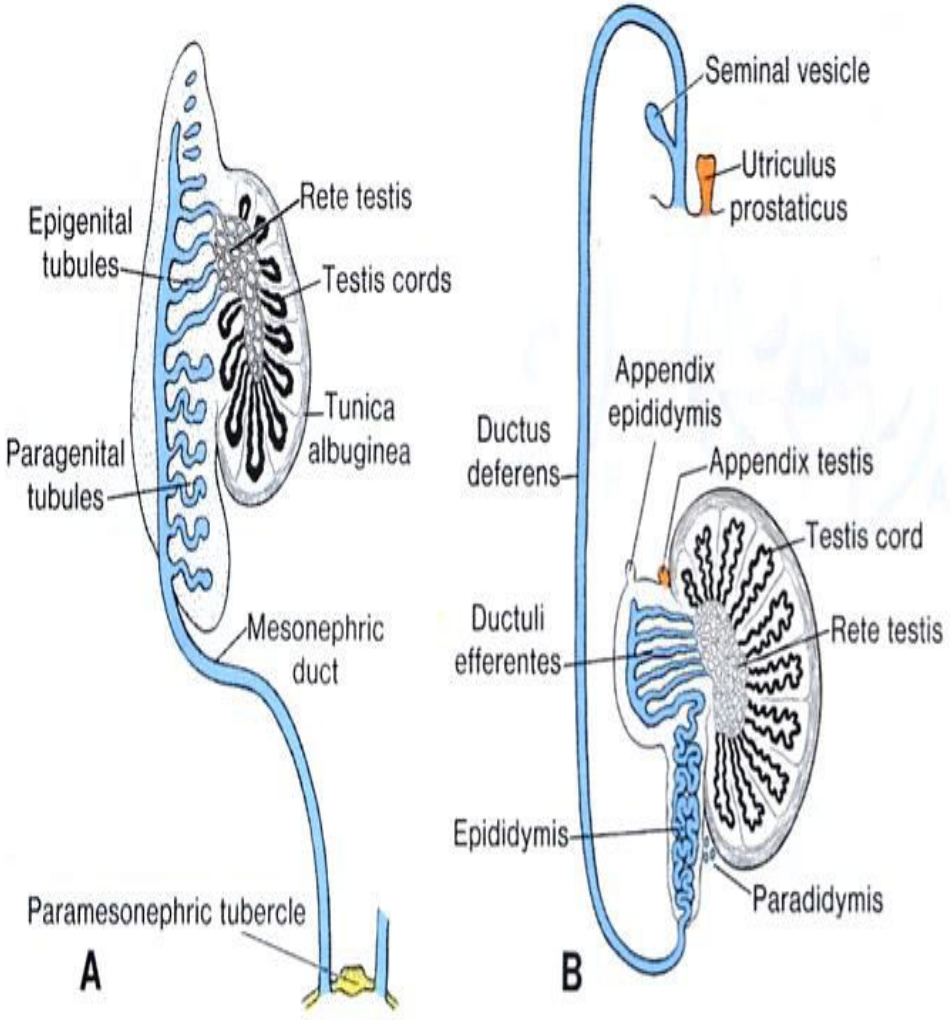
GENITAL DUCT DEVELOPMENT IN MALE

- Mesonephros regress; a few excretory tubules (epigenital tubules) establish contact with cords of the rete testis and finally form efferent ductules of the testis.
- Excretory tubules along the caudal pole of the testis (paragenital tubules) do not join the cords of the rete testis; their vestiges are named paradidymis.



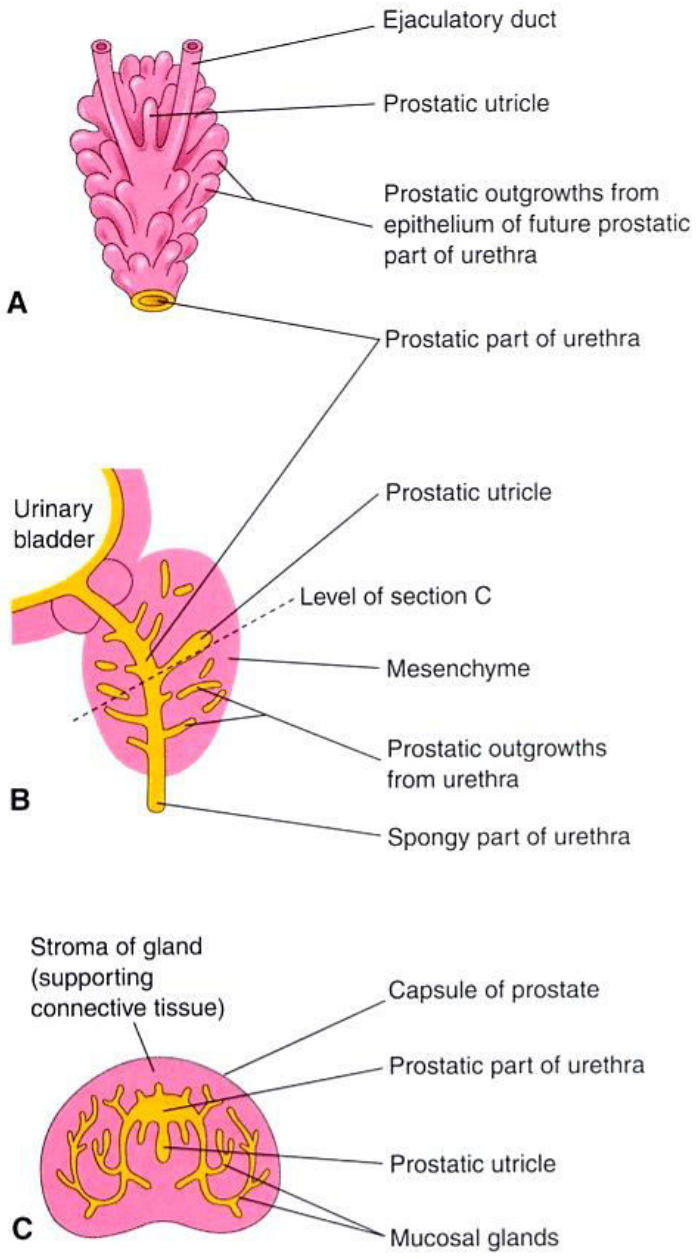
GENITAL DUCT DEVELOPMENT IN MALE

- Mesonephric ducts persist and form the main genital ducts except for the most cranial portion (appendix epididymis)
- Mesonephric duct elongate, become highly convoluted forming the **ductus epididymis** immediately below the entrance of the efferent ductules
- Mesonephric ducts obtain a thick muscular coat and form **ductus deferens** (from the tail of the epididymis to the outbudding of the seminal vesicle)
-
- The region of the ducts beyond the seminal vesicles is the **ejaculatory duct.**
- The paramesonephric ducts degenerate except for a small portion at their cranial ends (appendix testis)



DEVELOPMENT OF MALE GENITAL GLANDS

- A lateral outgrowth from th caudal end of each mesonephric duct gives rise to seminal vesicle/gland
- Multiple endodermal outgrowths arising from the prostatic part of urethra grow into the surrounding mesenchyme and differentiate into prostate glandular epithelium; mesenchyme differntiate into prostatic stroma
- Bulbo urethral glands develop from paired outhgrowths from the spongy part of urethra

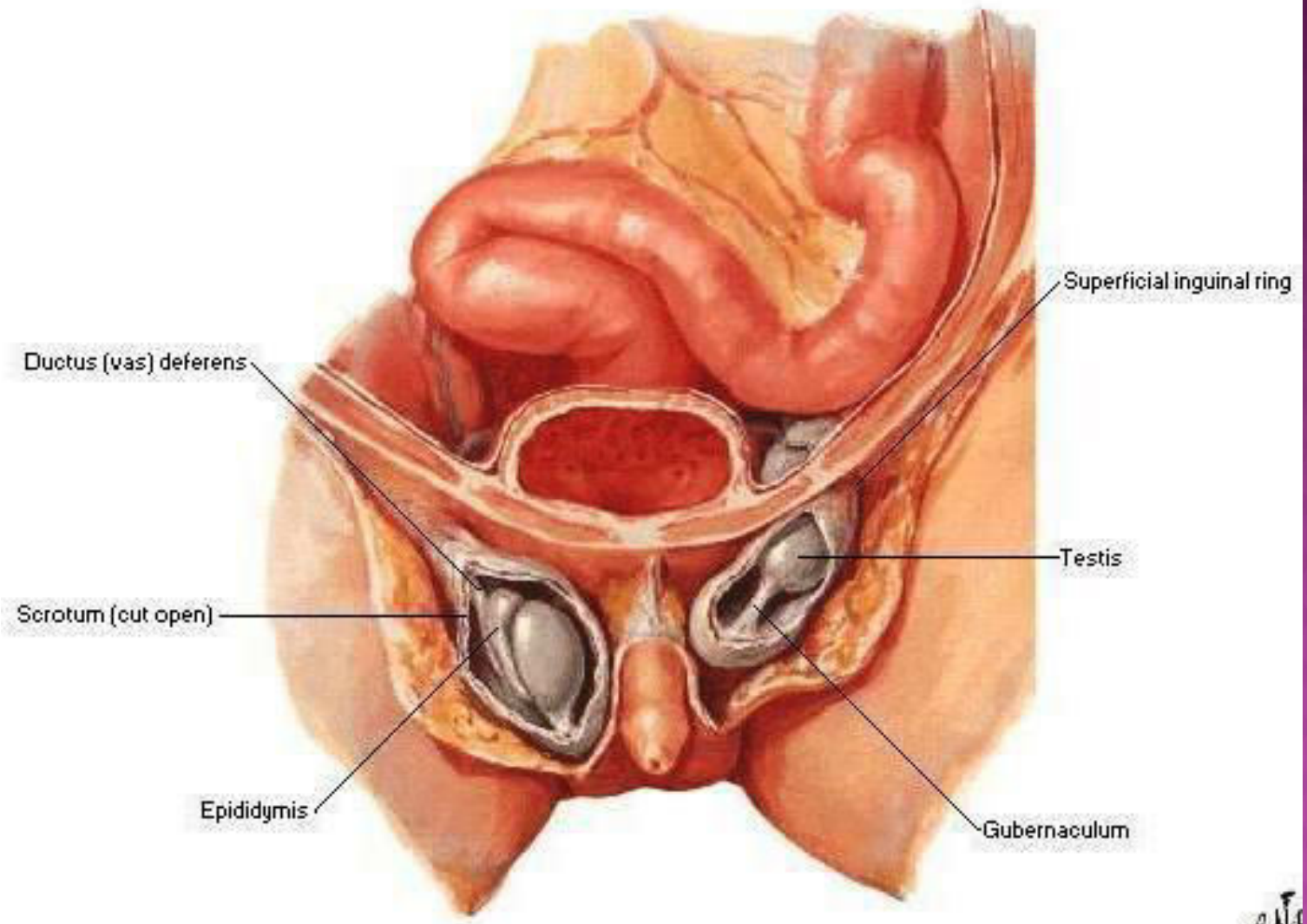


DESCENT OF TESTES

- Testes develops in the posterior abdominalwall
- At T_{10} – T_{11} vertebral level behind peritoneum.
- The descent of testes begins around 2nd month of intra uterine life.
- 3rd month – Iliac fossa.
- 4 – 6th month – Deep Inguinal ring.
- 7th to 8th month – Inguinal canal
- 9th month or slightly after birth – Scrotum.

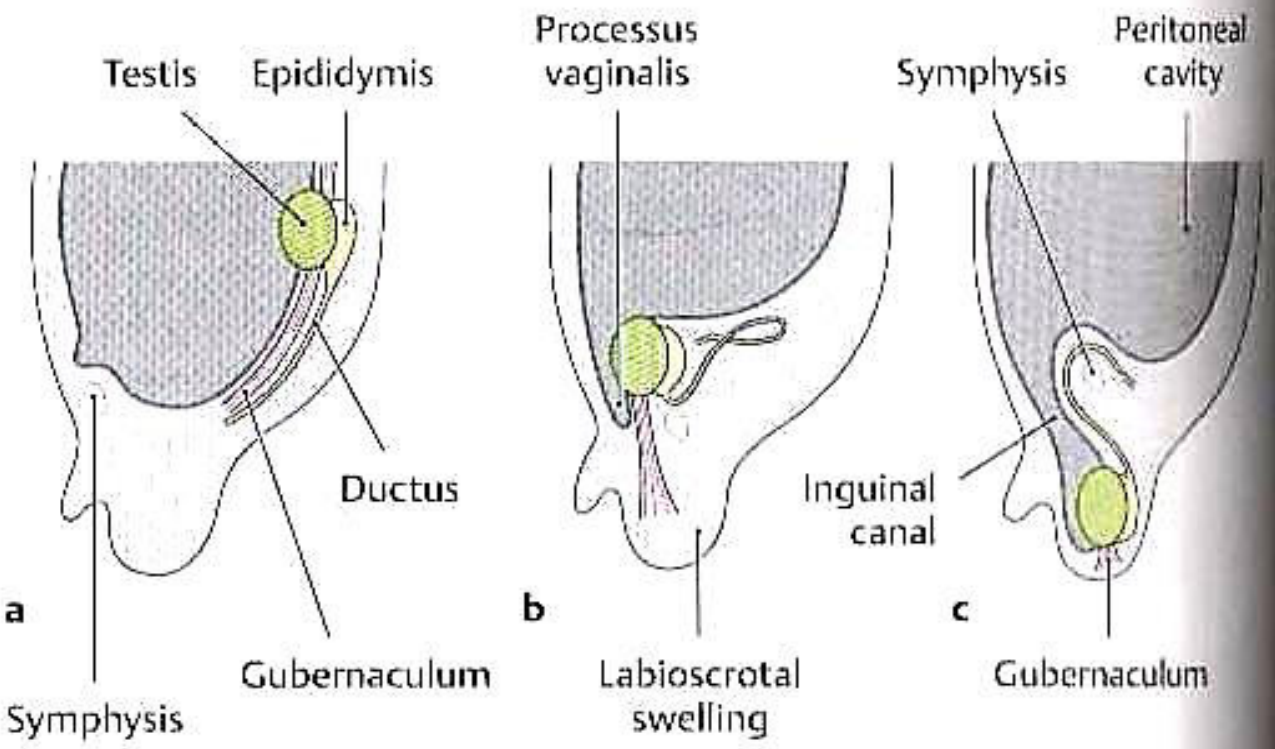
Descent of Testis

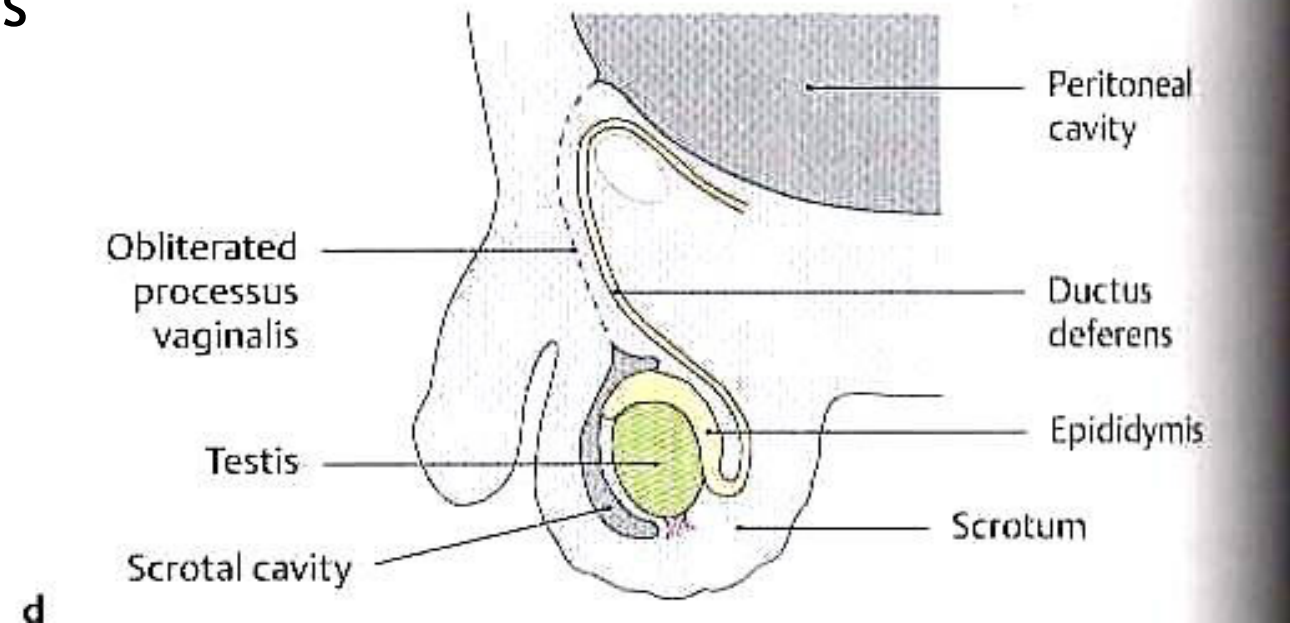
8 Lunar Months



26 cm crown rump

- Desent of testis:
- As the testes descends it carries along with it a double layered peritoneal sac – Processus vaginalis.
- Later on the distal portion of processus vaginalis alone persists as TUNICA VAGINALIS.
- Proximal portion obliterates.





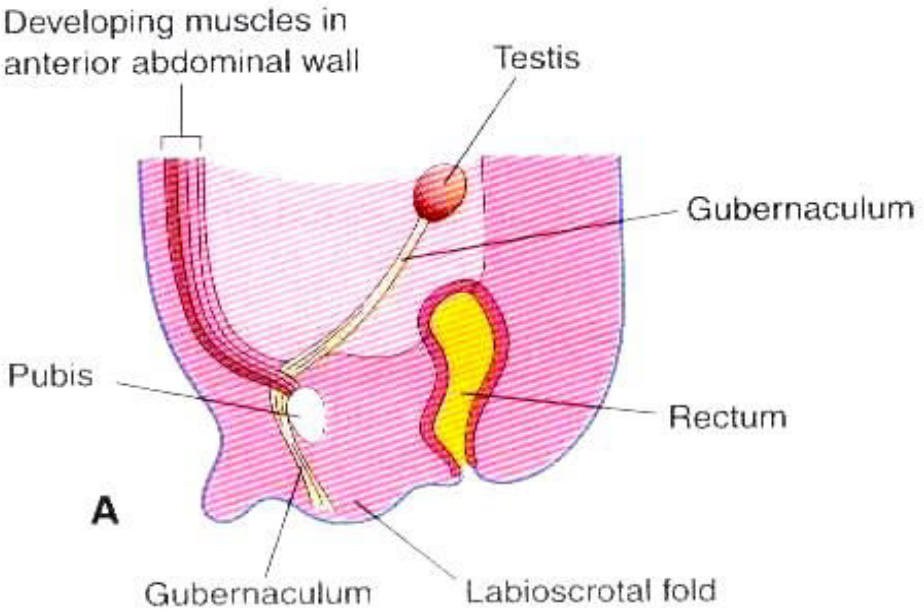
FACTORS HELPING IN THE DESCENT OF TESTES

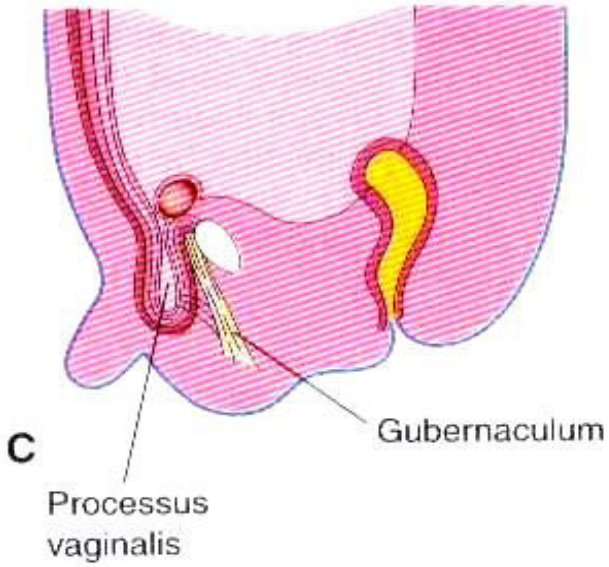
1. Male Sex Hormones produced by Testis and Maternal Gonadotrophins.
2. Calcitonin gene related peptide (CGRP) a neurotransmitter secreted by the Genitifemoral Nerve.
3. Differential growth of abdominal wall.
4. Increase intra abdominal pressure & temperature.
5. Contraction of a fibro muscular band stretching between lower pole ofthe testes to the base of scrotum – GUBERNACULUM TESTIS.
6. Contraction of the arched fibres of internal oblique abdominus muscle.
7. Uncurving of fetal curves.

GUBERNACULUM TESTIS

- Fibro muscular band attached to the lower pole of the testes.

- From caudal end of testis an inguinal fold of peritoneum extends to genital swelling
- Mesenchymal cells with in the inguinal fold are organised to form a fibro muscularband,gubernaculum
- Gubernacular mesenchyme forms
- coverings of testis,spermatic cord&cremaster muscle





GUBERNACULUM TESTIS

1)Proximally;

lower pole of testis

- Peritoneum of saccus vaginalis
- Mesonephricduct

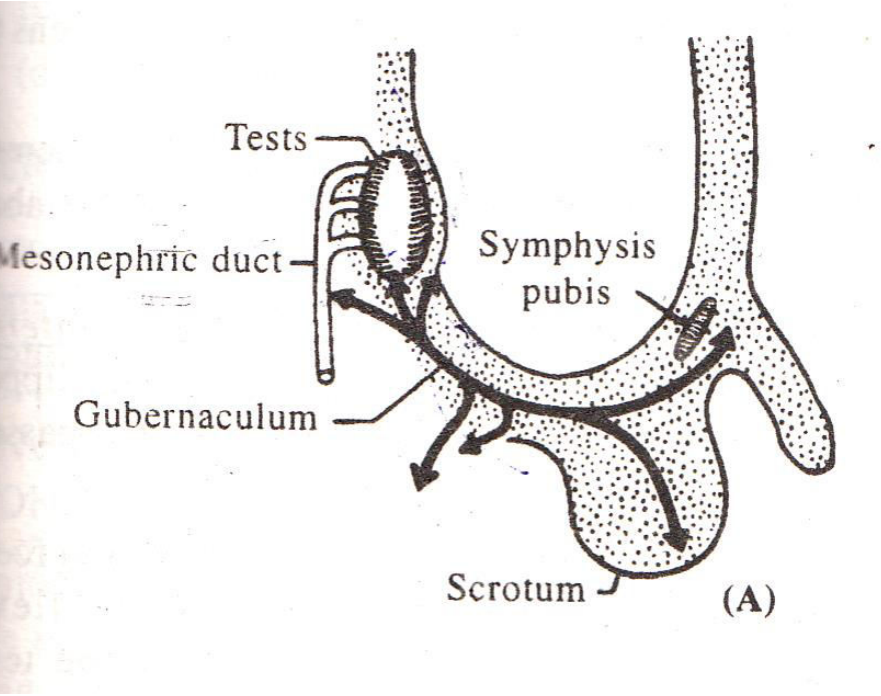
2)Distally: it splits into 4 – 5 fibrous threads

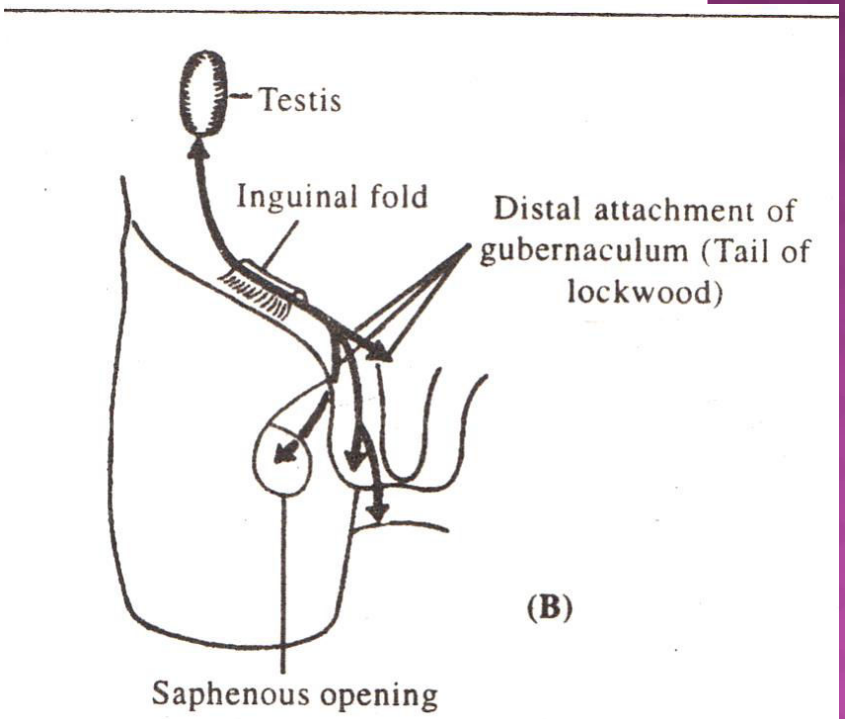
- Tail of Lockwood.

- Each of which is attached to the

1. Bottom of scrotum.
2. Perineum.
3. Symphysis pubis at the root of the penis.
4. Saphenous opening
5. Anterior superior iliac spine.

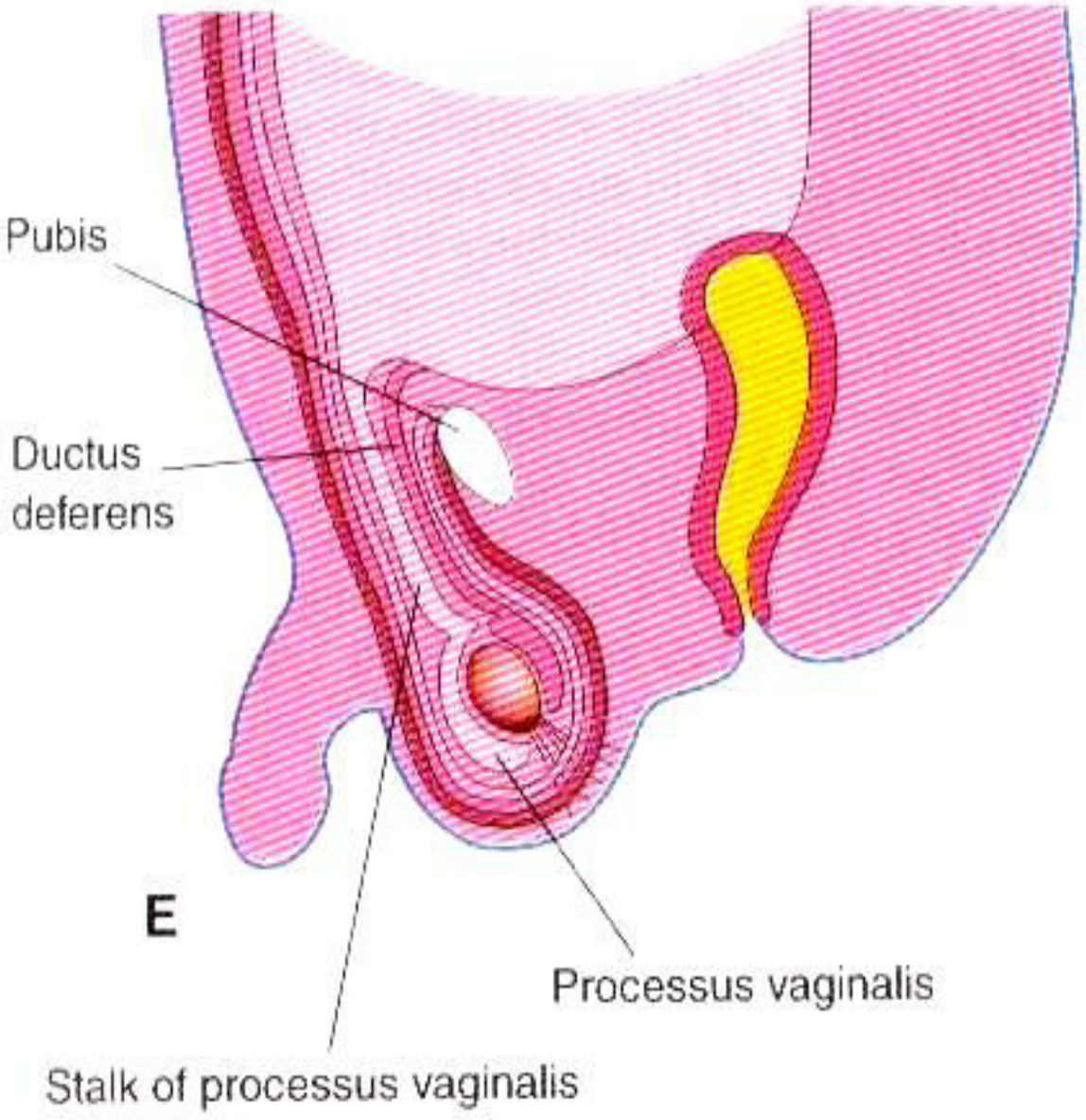
GUBARNACULUM TESTIS





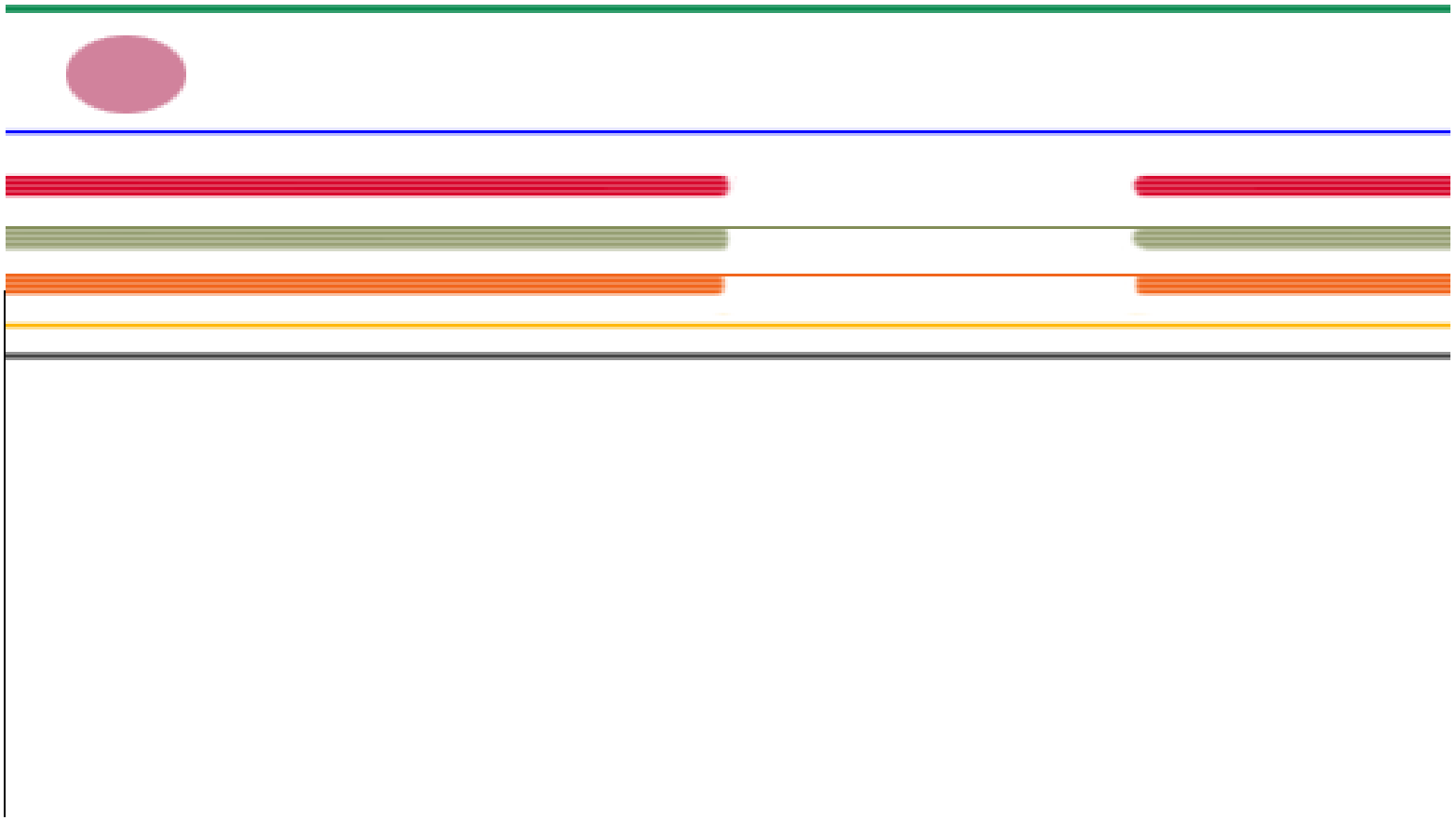
GUBERNACULUM TESTIS

1. All the tails disappears except the one to the scrotum .
- This only guides the descending testes to the scrotum.



EMBRYOLOGICAL REMNANTS IN RELATION TO TESTIS AND EPIDIDYMIS

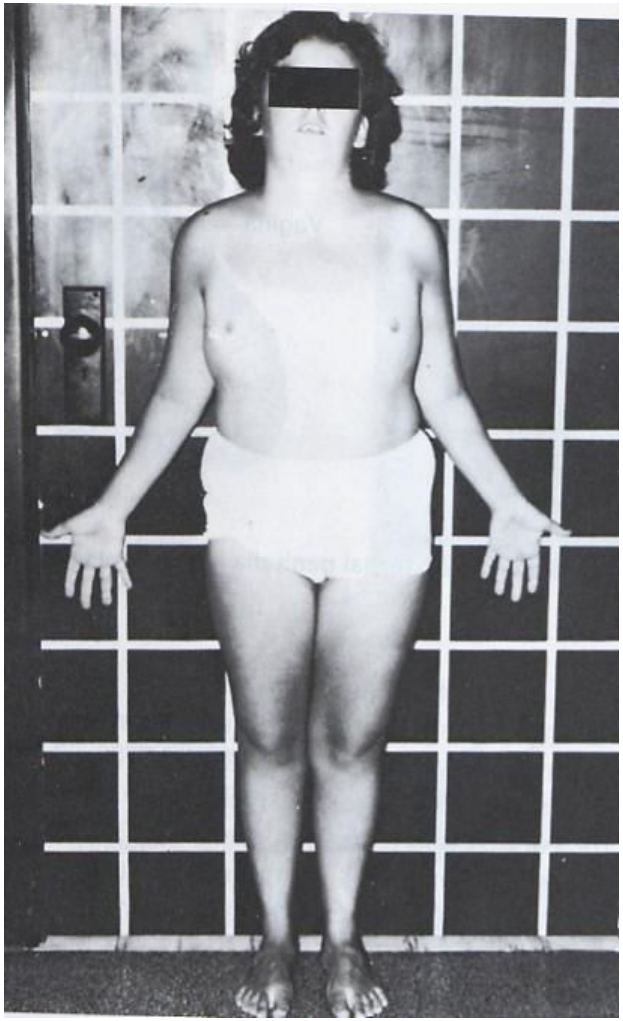
- APPENDIX OF TESTIS
- APPENDIX OF EPIDIDYMIS
- PARADIDYMIS (ORGAN OF GIRALDES)
- SUPERIOR ABERRANT DUCTULES
- INFERIOR ABERRANT DUCTULES



ABNORMAL SEX CHROMOSOME COMPLEXES

- XXX, XXY
- Number of X chromosome appears to be unimportant in sex determination
- If a normal Y chromosome is present the embryo develops as a male. If Y chromosome or its testis determining region is absent female development occurs

TURNER SYNDROME (45X)



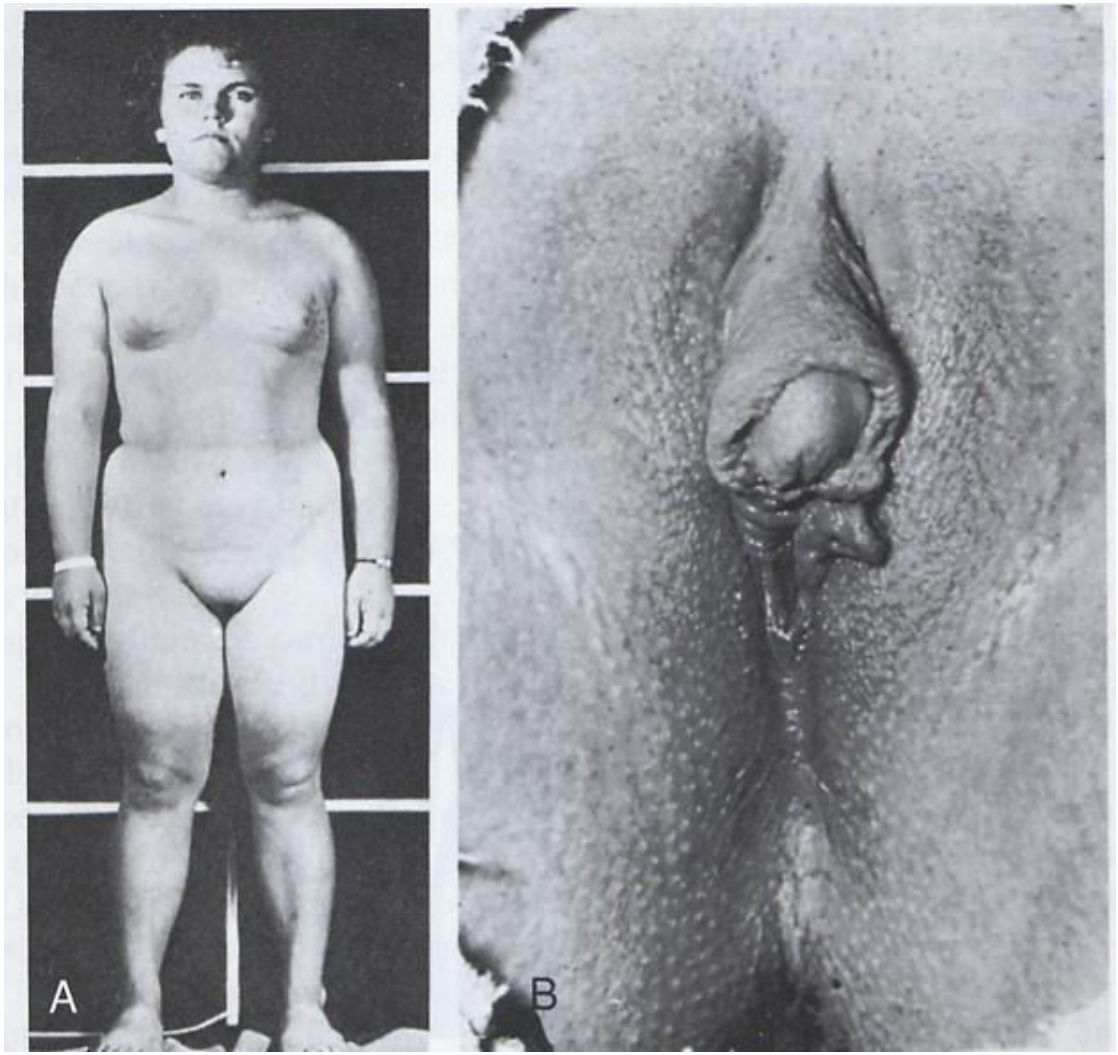
CONGENITAL MALFORMATIONS : DETERMINATION OF FETAL SEX

- True hermaphroditism: having ovarian and testicular tissue either in the same or opposite gonads (70 % are 46 XX, 20 % 46 XX/46 XY mosaicism, 10 % 46XY)

- Female pseudohermaphroditism: 46 XX, having ovaries,
- resulting from the exposure from excessive androgens of female fetus. Virilization of ext genitalia occurs.
- Common cause is congenital adrenal hyperplasia, rare cause may be maternal masculinizing tumor.

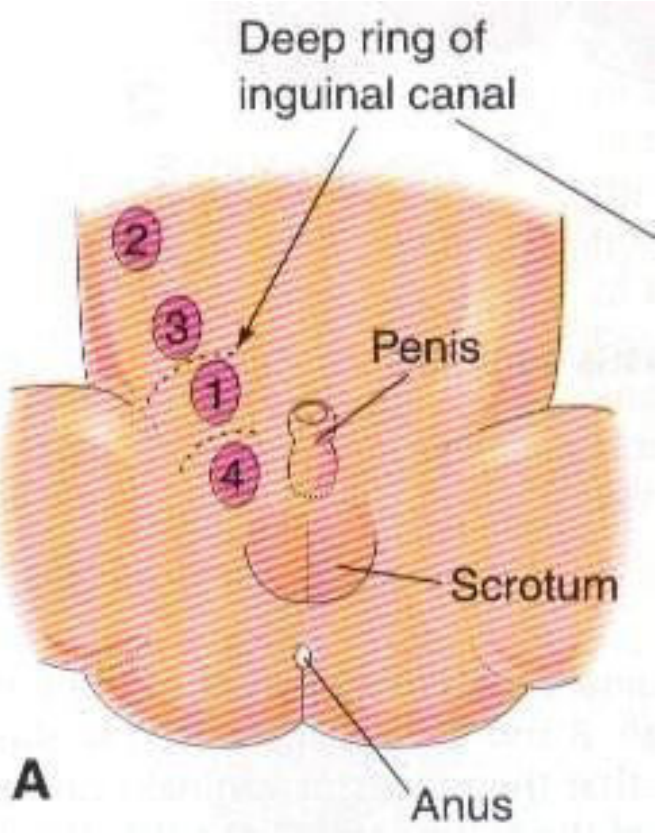
- Male pseudohermaphroditism: 46XY having testis, with no sex chromatin.
- Int and ext genitalia are varible caused by inadequate production of testosterone and MIF by testes.

FEMALE PSEUDOHERMAPHRODITISM (CAUSED BY CONGENITAL ADRENAL HYPERPLASIA)



ABNORMALITIES OF DESCENT

- Anorchism – Absence of both the testes in scrotum.
- Monorchism – Absence of one testis in the scrotum.
- Undescended testis :in this condition the testis during its descent although travelling in normal path may fail to reach the base of the scrotum

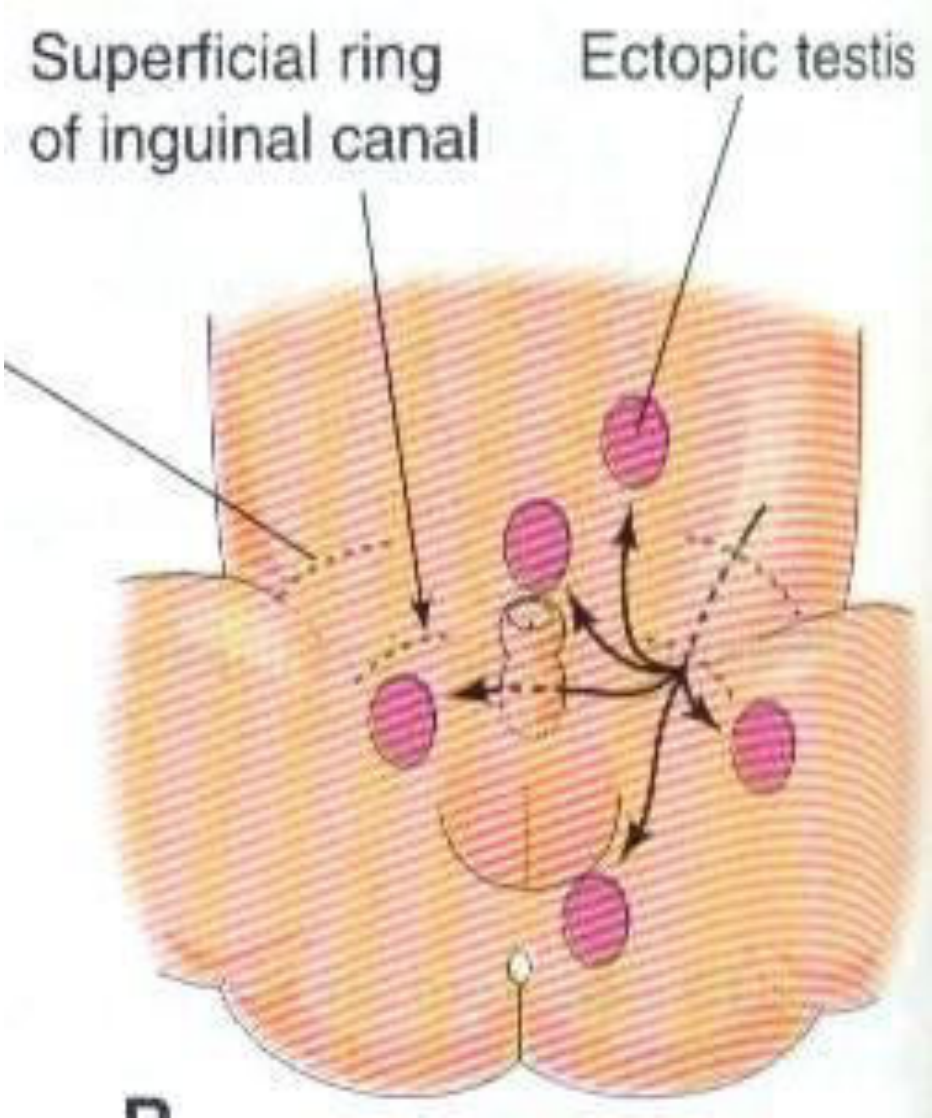


UNDESCENDED TESTIS

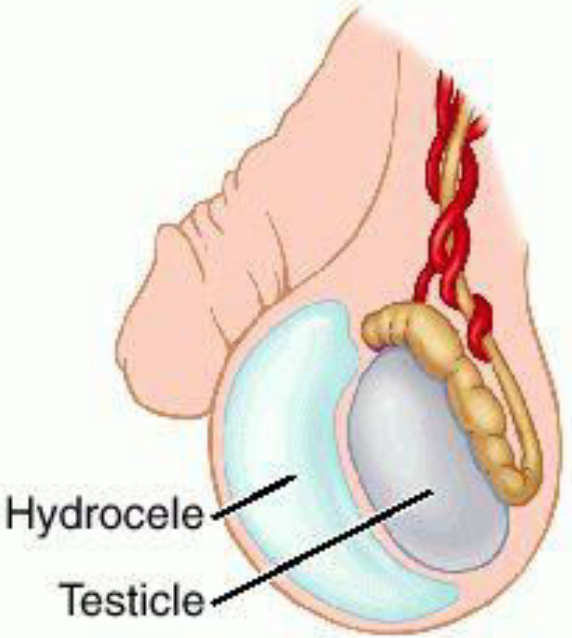
- Thus, it may be found at the following FIVE SITES:
- 1. Within the abdomen
- 2. At the deep inguinal ring
- 3. Within the inguinal canal
- 4. At the superficial inguinal ring
- 5. High up in the scrotum

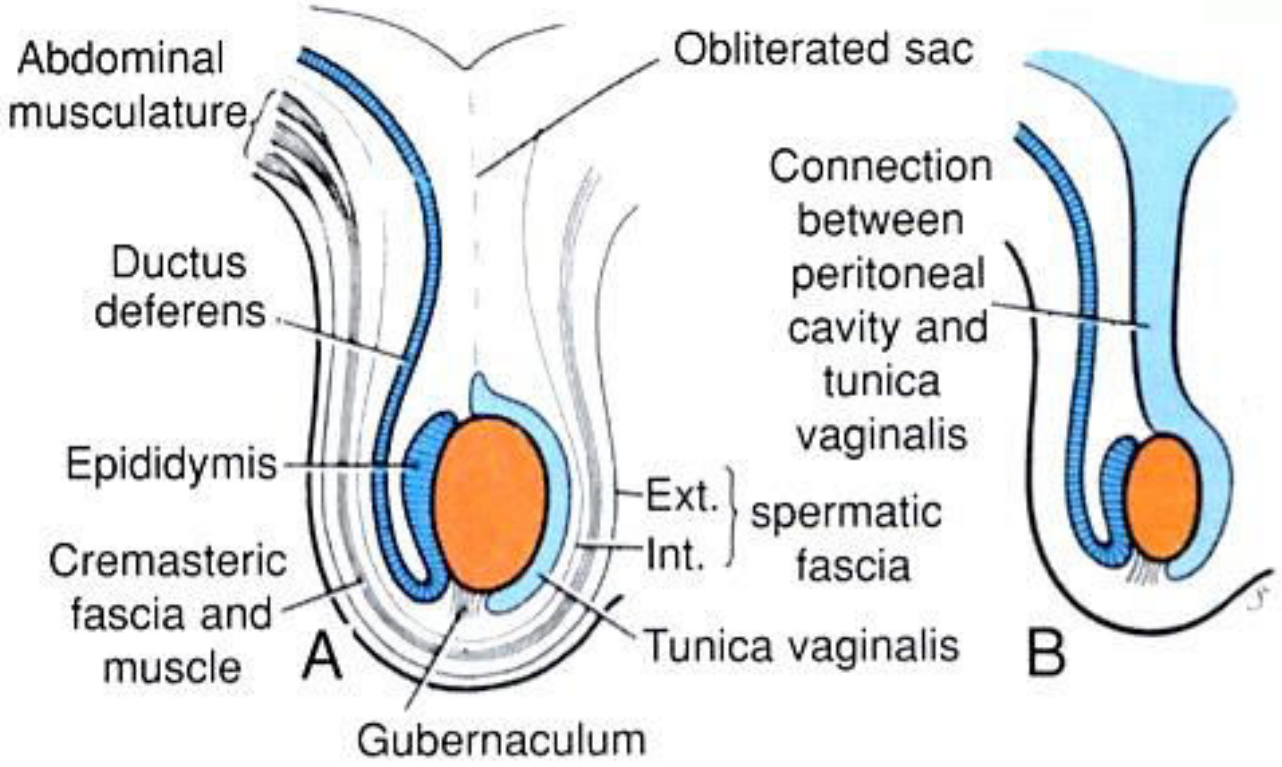
ECTOPIC TESTES

- Testes travels down along an abnormal path, and therefore fails to reach scrotum
- FOUR SITES
- Superficial fascia of lower part of anterior abdominal wall
- In front of pubis
- In the perineum
- In the thigh
- Usually due to persistence of tail of Lockwood.
- Processus vaginalis reaches an abnormal site and testis follows it



CONGENITAL INGUINAL HERNIA & HYDROCELE





ANOMALIES OF DESCENT

- **COMPLETELY PATENT PROCESSUS VAGINALIS:**
- It is the frequent cause of congenital hernia
- **ENCYSTED HYDROCELE OF SPERMATIC CORD:**
- When the processus is closed at the deep ring and above the testis but remains patent in the middle, the spermatic cord presents an encysted hydrocoele
- **INVERSION OF TESTIS:**
- Sometimes the processus vaginalis extends behind the testis and makes the posterior border of testis free.

VARICOCOELE

It ia a clinical condition in which veins of the PAMPNIFORM PLEXUS become dilated, tortuous and elongated

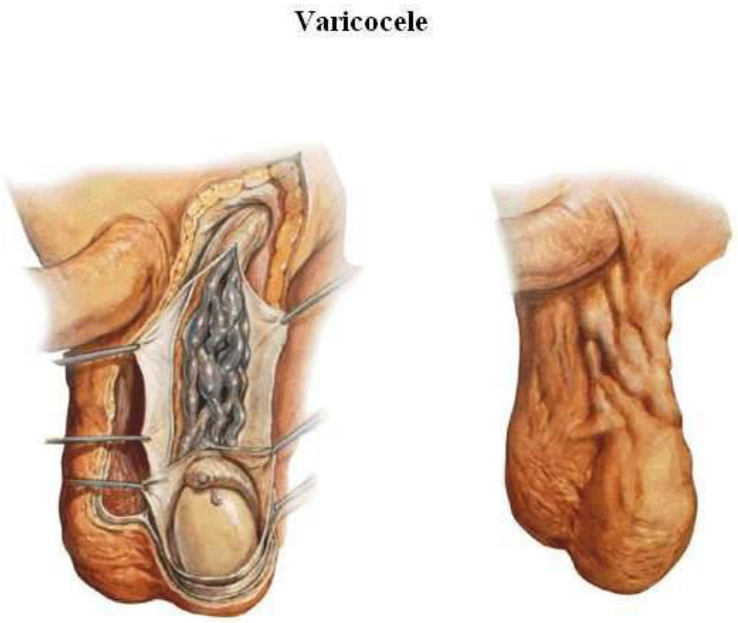
It commonly affects adolescents and young adults .

It mostly occurs on the left side due to the following reasons

a) Left testicular vein drains at a right angle into the left renal vein, hence venous pressure is high in left renal vein

b) compression of left testicular vein by loaded constipated sigmoid colon

c) Blockage of entry of the left testicular vein in left renal vein may some times occur by growth in the malignant tumour of the left kidney



VARICOCOELE

- It is must for clinicians to investigate left kidney in rapidly developing left sided varicocoele
- The pampniform venography is advised in cases of recurrent varicocoeles
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THANQ