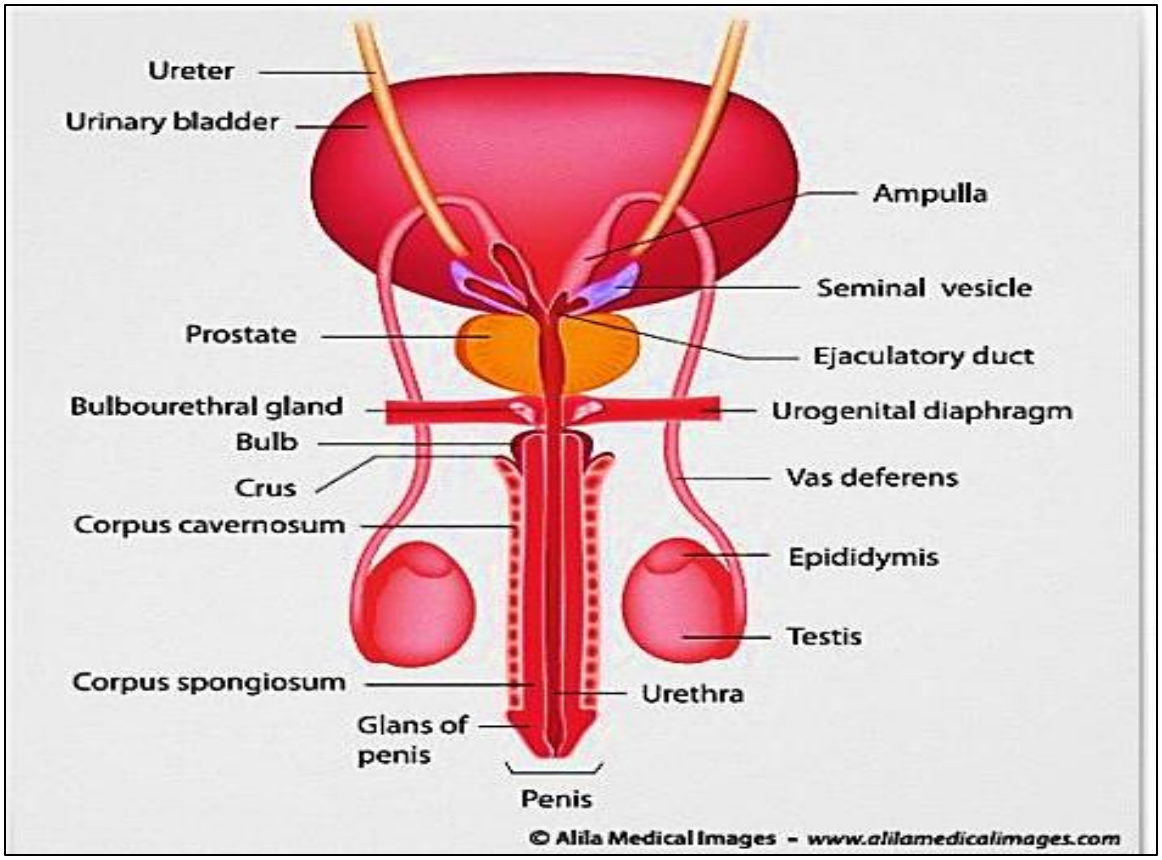
Male Genital System

Professor Dr. Hala El-Mazar

Medical students / 3rd Year



Male genital system is formed of:

- **2 testes:**

  Main glands; *formation of **spermatozoa** + synthesis & release of **testosterone***

- **Genital ducts:**

  Collection, storage & transport of Spermatozoa

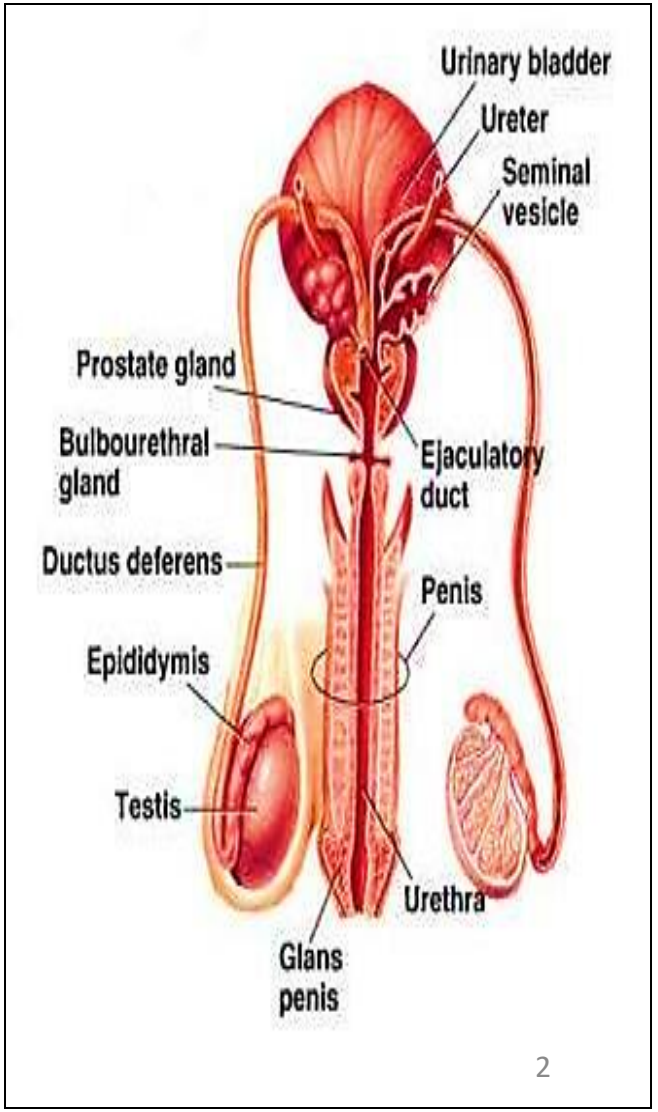
- **Accessory glands:**

  - Two seminal vesicles
  - One prostate gland
  - Two bulbourethral (Cowper's) glands

  Formation of semen fluid

- **Penis:**

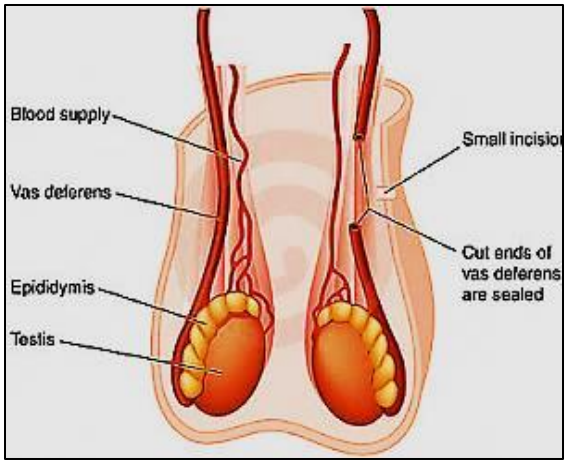
delivery of the spermatozoa



The Scrotum

- Highly specialized skin pouch devoid of fat

- Maintain the testes at 2-3 C below body temperature (34-35C) which is essential for spermatogenesis (normal development of sperms)

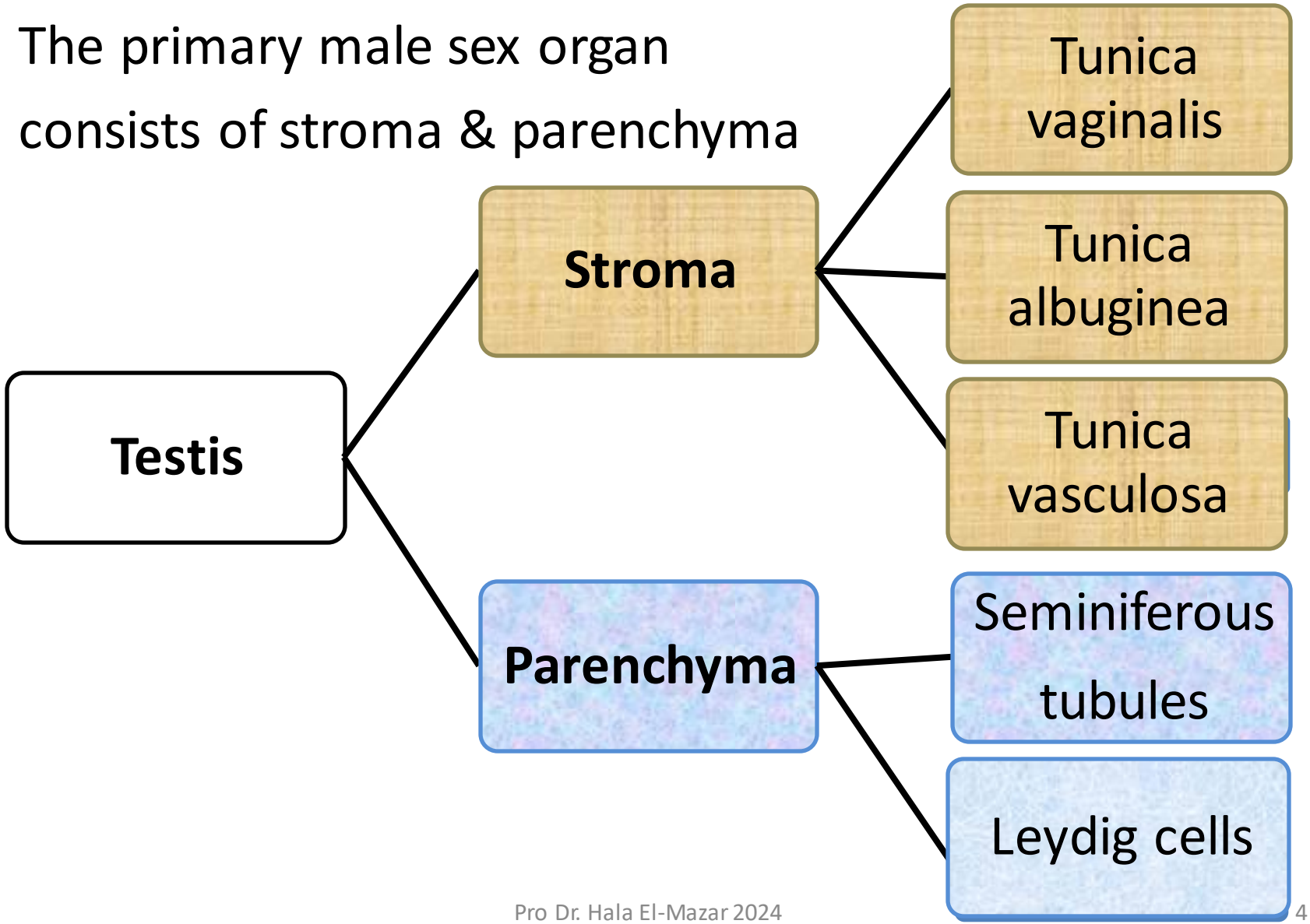


- It contains numerous sweat glands

- Its wall has random arranged smooth ms. fibers called dartos muscle . Plays a role in keeping the temperature of testis low

The testis

- The primary male sex organ
- consists of stroma & parenchyma

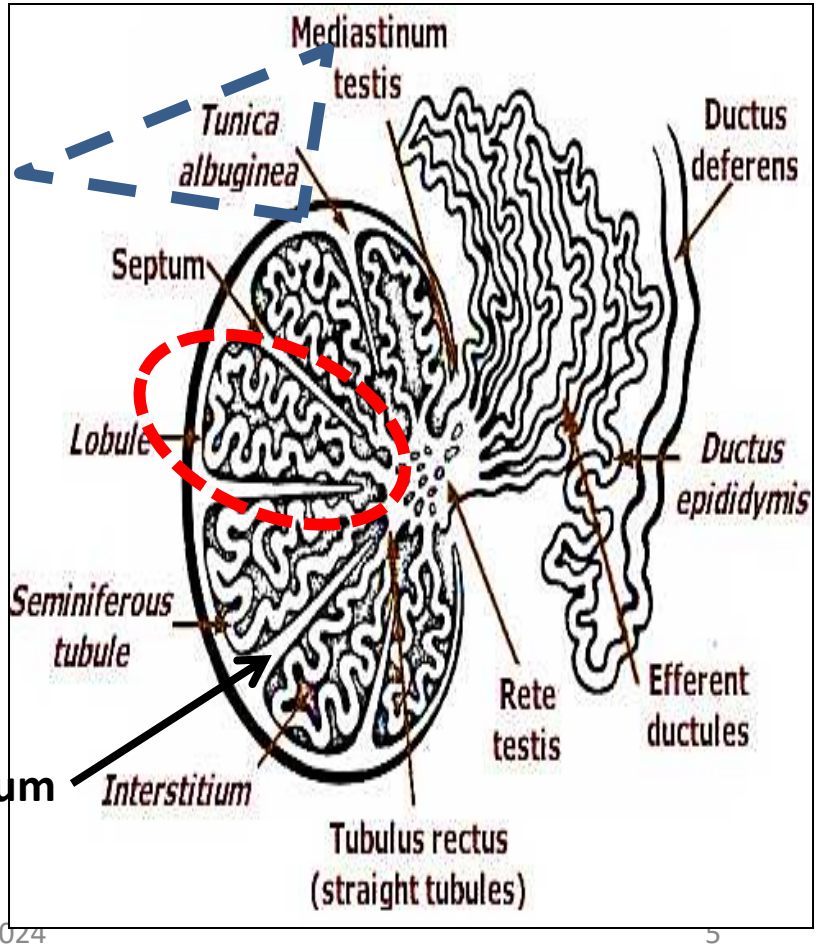


Tunica albuginea:

- Collagenous C.T. capsule surrounds each testis , from which septa arise and divides the testis into testicular **lobules** (about **250** testicular lobules)

- Each lobule contains:
  - Seminiferous tubules (1-4)
  - interstitial cells of Leydig

Both are embedded in loose CT rich in BV, lymphatics, nerves,



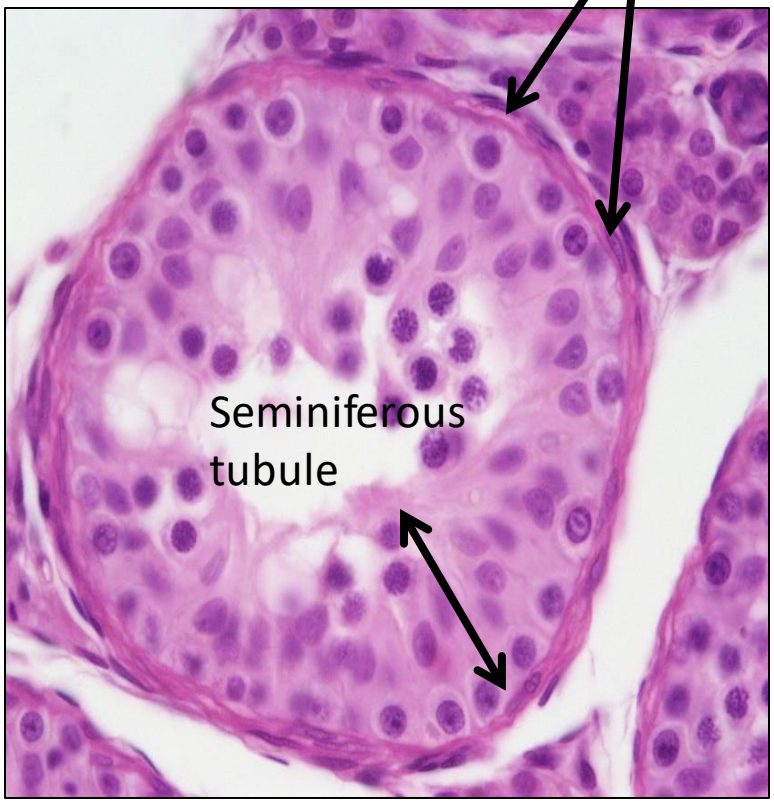
Parenchyma

A. Seminiferous tubules (exocrine part) → spermatozoa

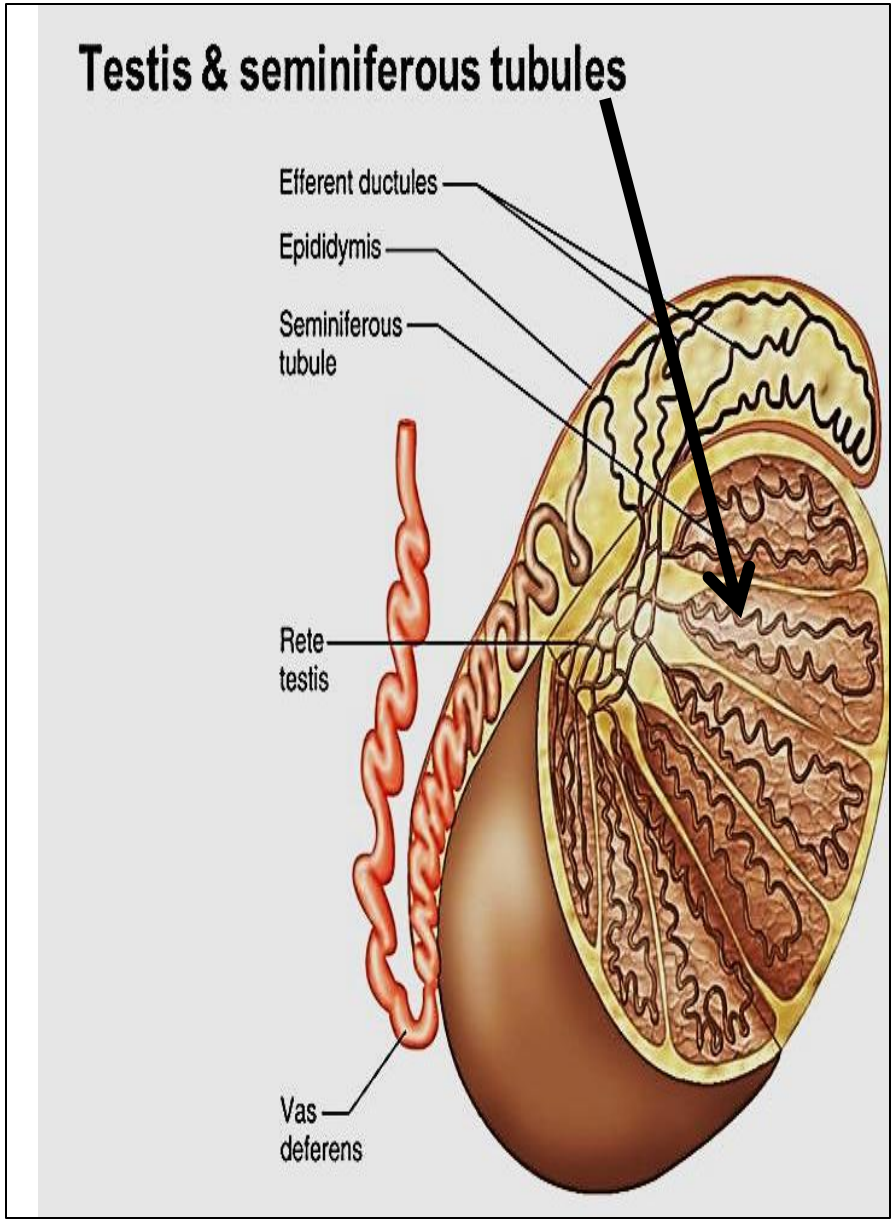
B. Interstitial cells of Leydig (endocrine part) → testosterone

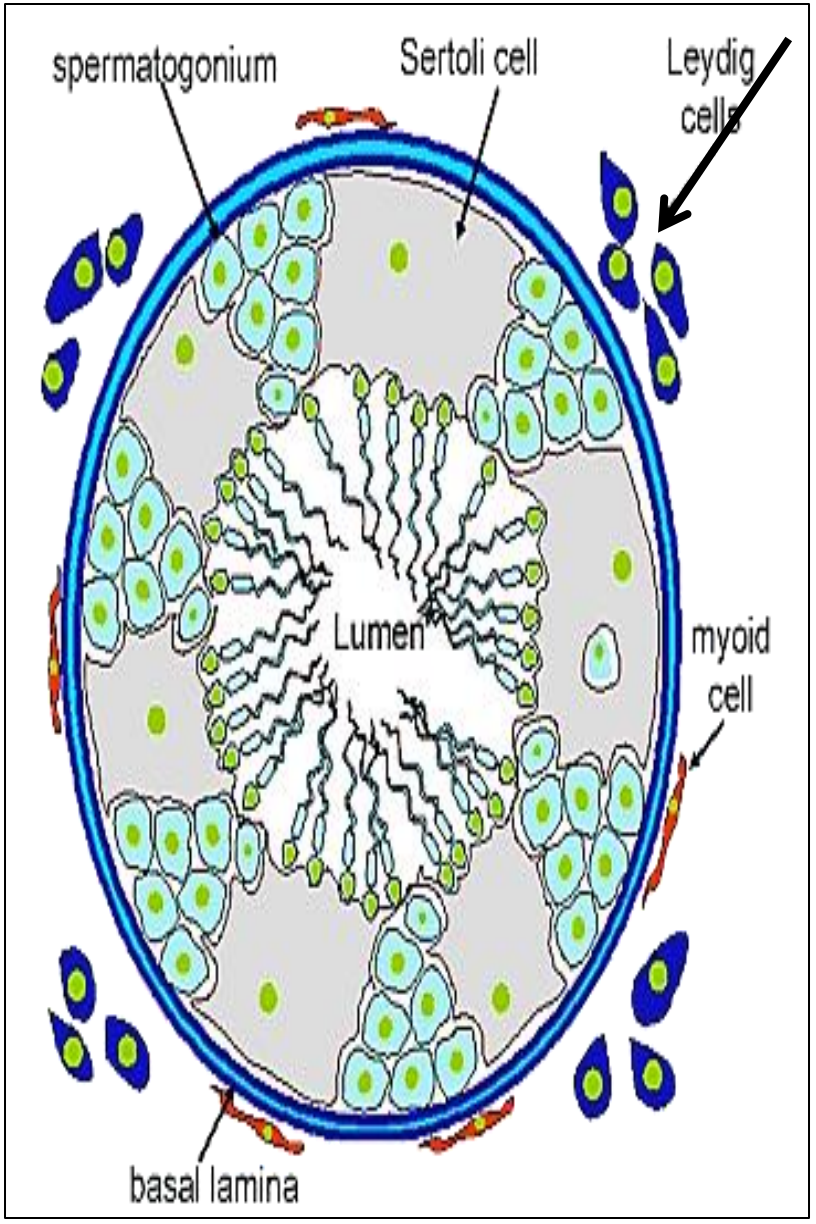
Seminiferous tubules

- Site of production of spermatozoa
- Each testis has 250- 1000 ST
- Under control of **FSH**
- Highly convoluted e narrow lumen



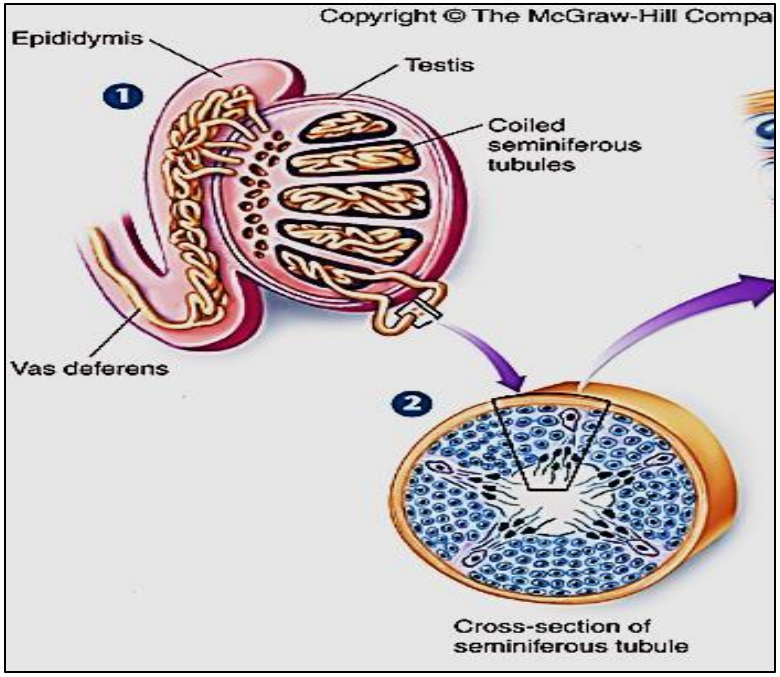
- **lined e stratified epithelium called spermatogenic epith.**
- The epith. rests on a clear basement membrane which surrounded with a layer of contractile myoid cells

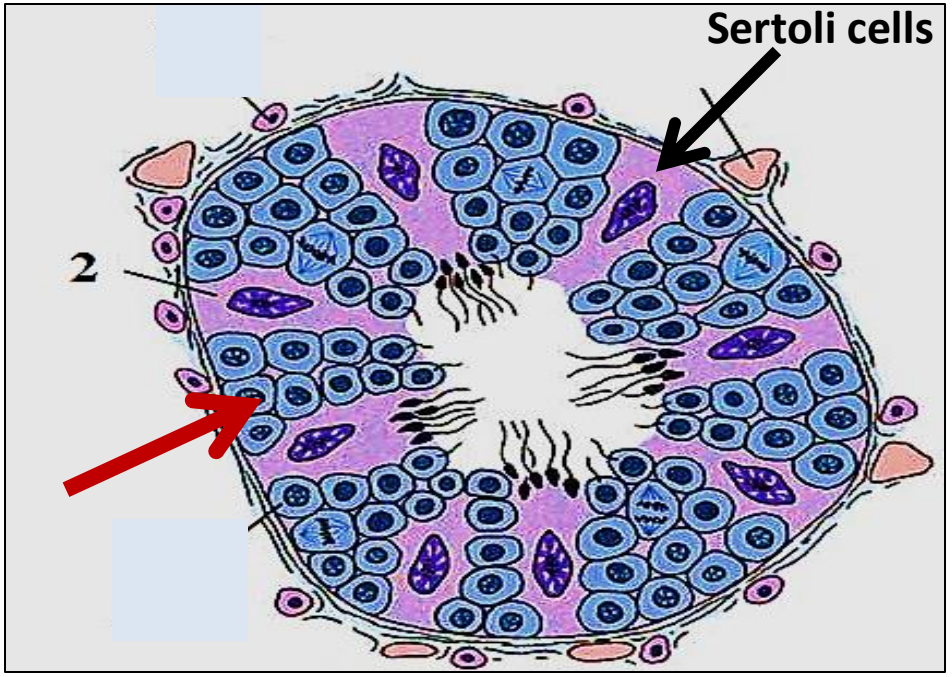

Testis & seminiferous tubules
Efferent ductules
Epididymis
Seminiferous tubule
Rete testis
Vas deferens


spermatogonium
Sertoli cell
Leydig cells
Lumen
myoid cell
basal lamina

Spermatogenic epithelium

- The spermatogenic epithelium consists of 2 types of cells:
  - Spermatogenic cells
  - Sertoli cells
- The spermatogenic cells are arranged in 4- 8 layers





spermatogenesis

At puberty, spermatogonia → spermatozoa

Divided into 3 phases:

1- Spermatocytogenesis: spermatogonia divide repeatedly by mitosis→ 1ry spermatocyte

2- Meiosis: the 1ry spermatocyte → reduction division → spermatids

3- Spermiogenesis: spermatids undergo morphological changes→ spermatozoa

spermatocytogenesis

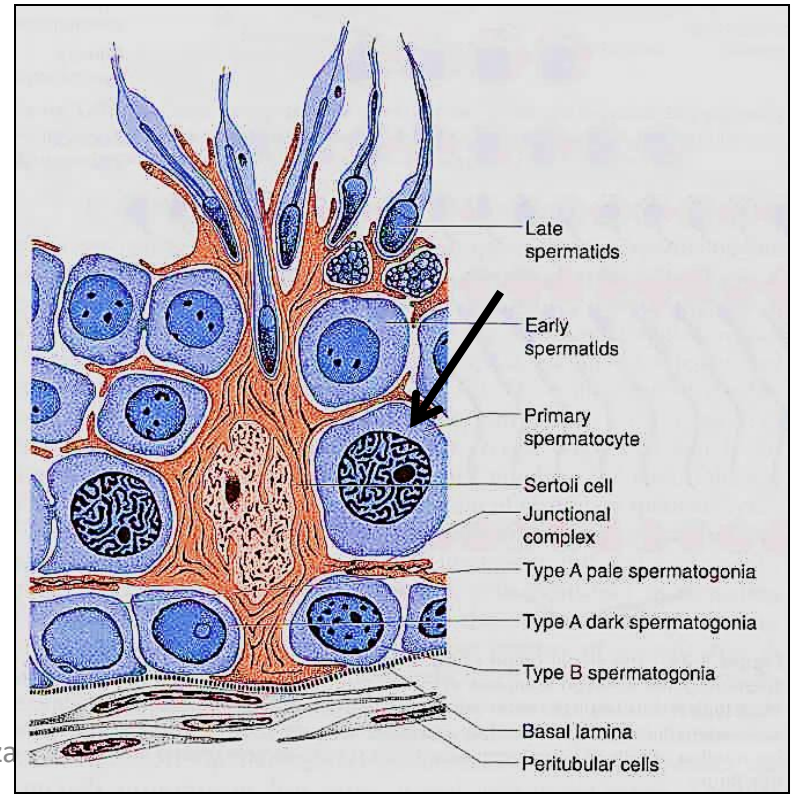
Spermatogonia → mitosis → 2 cells

1- spermatogonia *type A* → remain as stem cells for further spermatogenesis

2- spermatogonia *type B* → →change to → 1ry spermatocyte

Primary spermatocytes

- largest cells of the Spermatogeic epithelium
- Contains 46 chromosomes (diploid # = 4cDNA)
- enter 1st meiotic division to give rise to 2ry spermatocytes

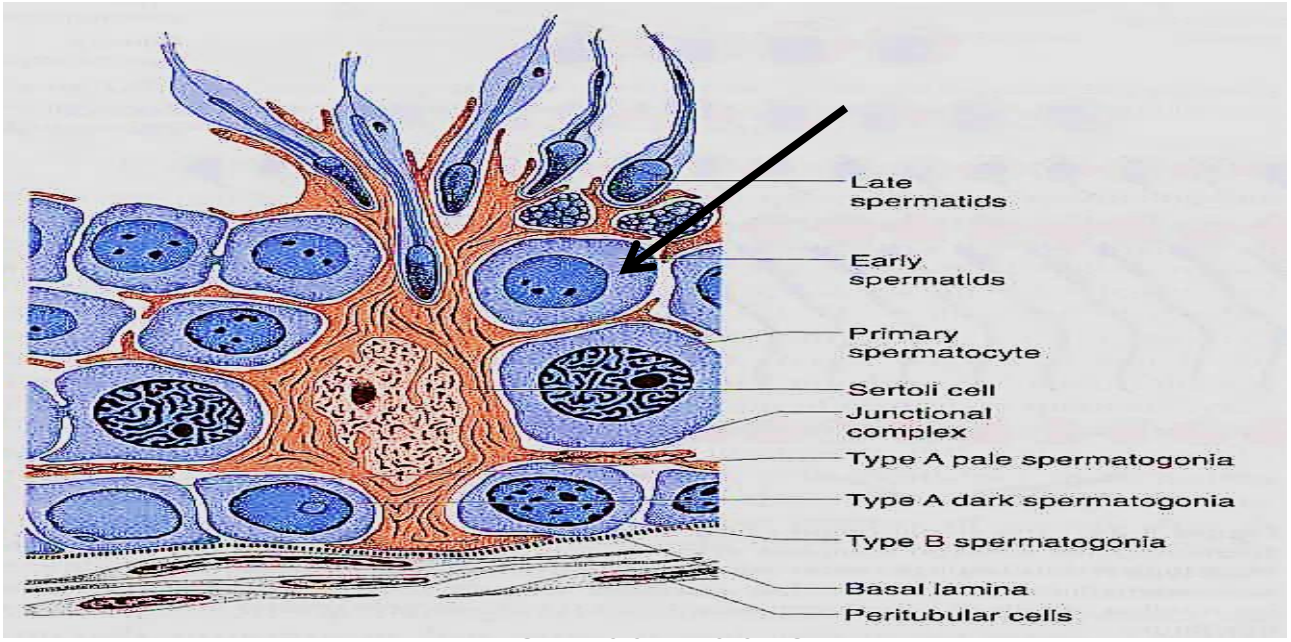


meiosis

2ry spermatocytes:

- 2ry spermatocyte (haploid = 2cDNA)

- Short lived cells, quickly enter 2nd meiotic division→ **spermatids** 1cDNA (23 ch.)

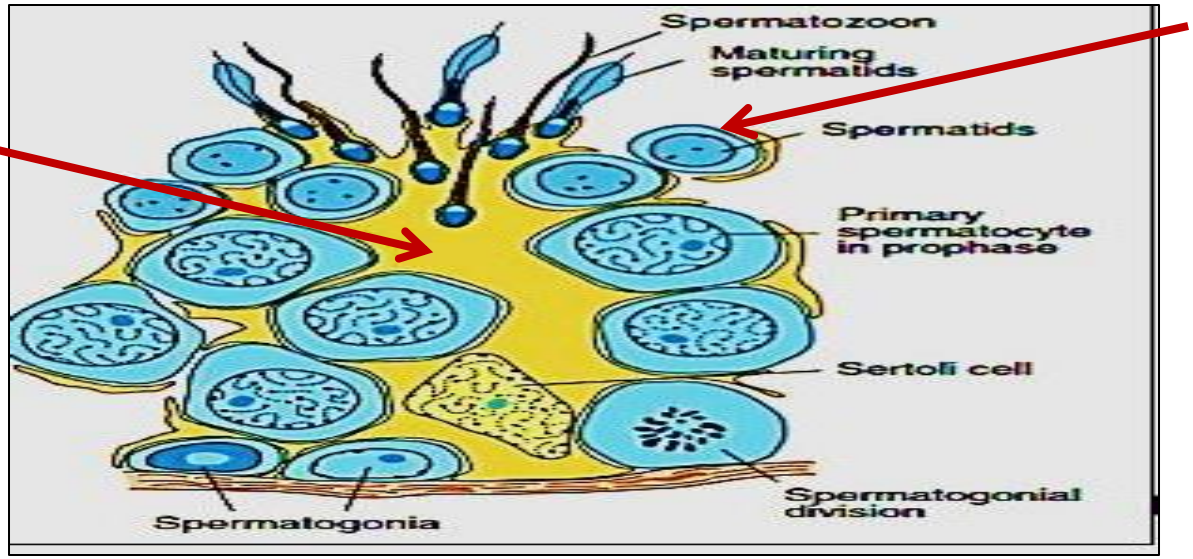


Spermiogenesis

Is **Metamorphosis** process → **transformation** of **spermatids → spermatozoa (sperms)**

Spermatids:

- Very small cells e central rounded dark nucleus
- Located near lumen of ST in intimate relation e Sertoli cells
- by their formation no further cell division occurs

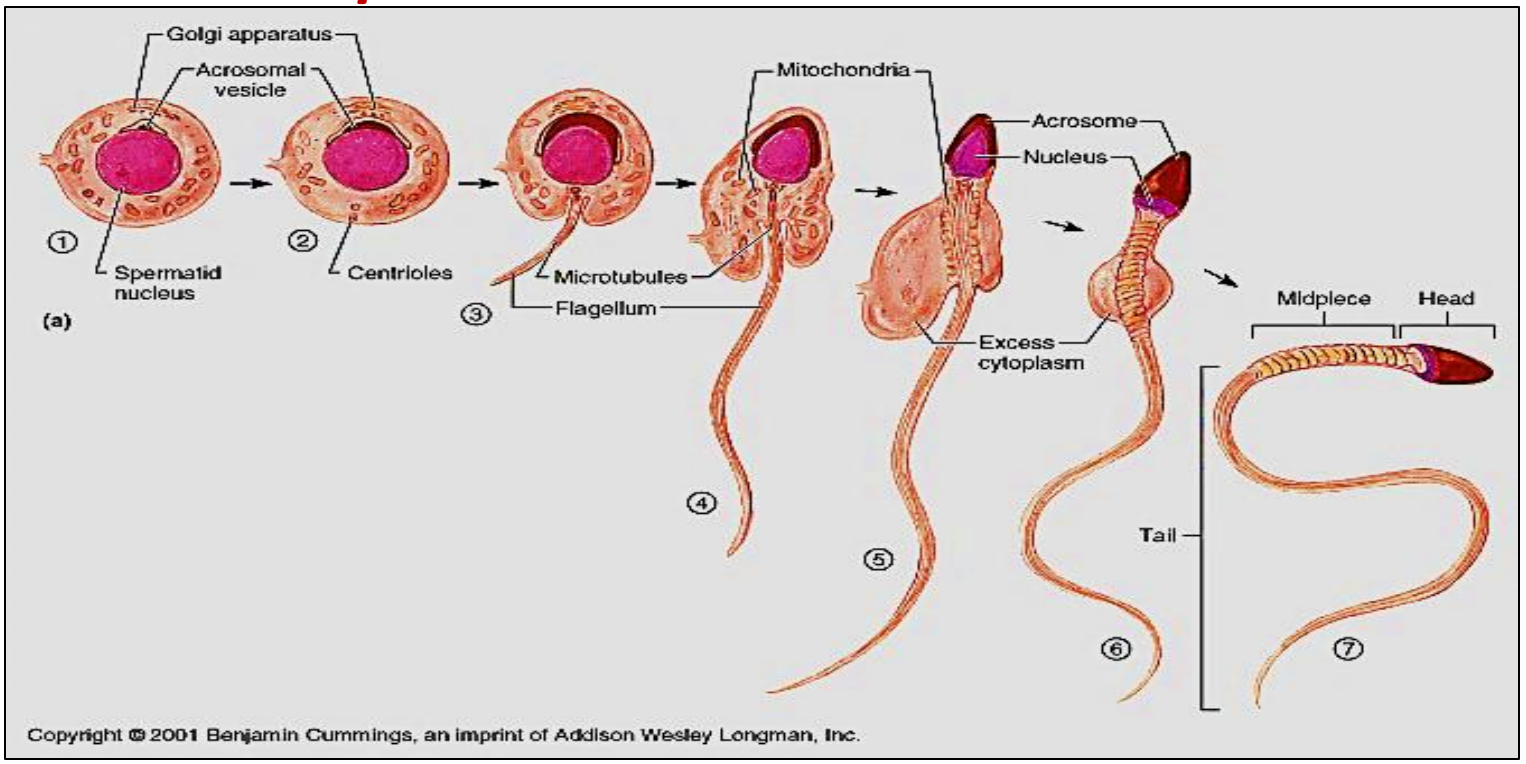


Spermiogenesis includes 3 stages:

1) *Golgi phase*

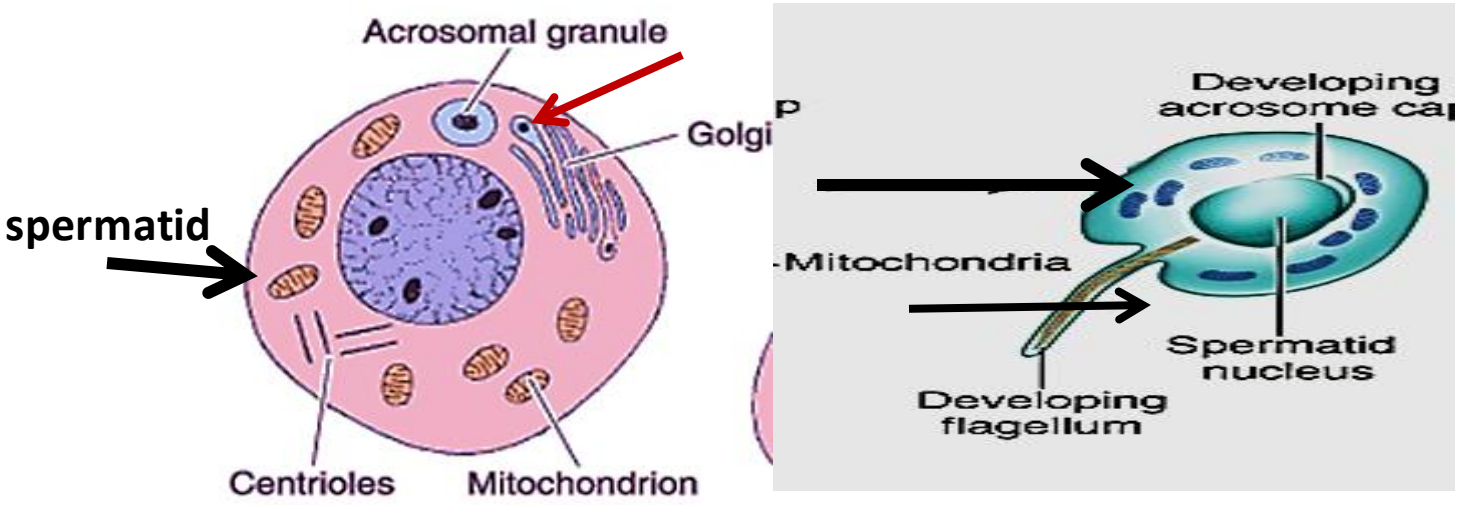
2) *Acrosomal phase*

3) *Maturation phase*



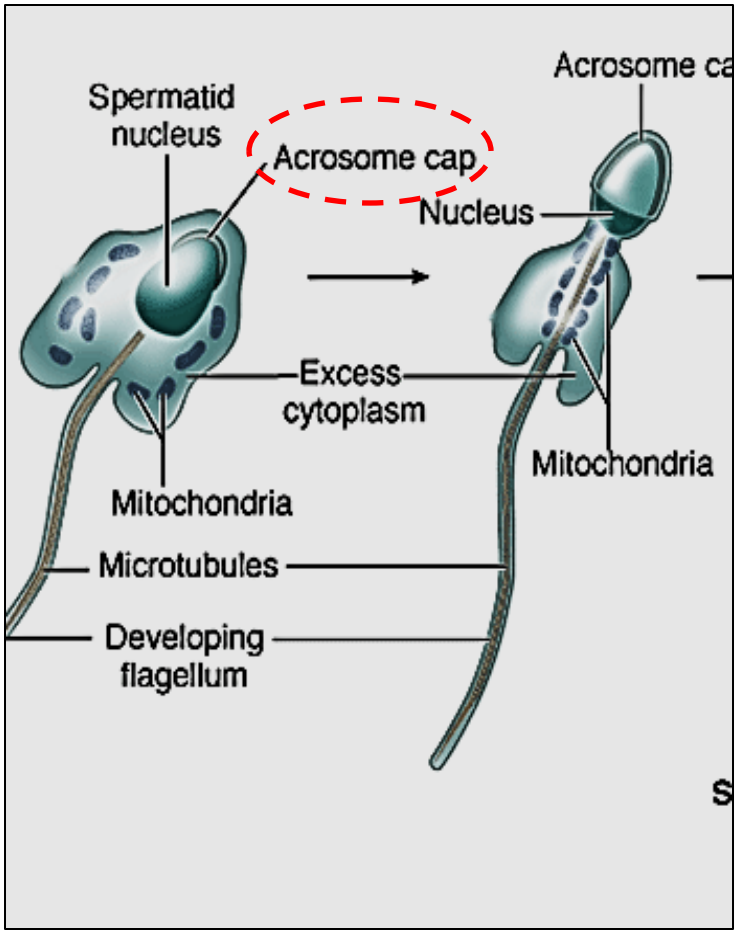
Golgi phase

- rER form hydrolytic enzymes → packaged in Golgi apparatus to be released as small **pro-acrosomal granules**
- The granules fuse together →**single acrosomal vesicle**→ at one pole of the nucleus
- At the same time 2 centrioles migrate to the opposite pole to form the developing flagellum



Acrosomal phase:

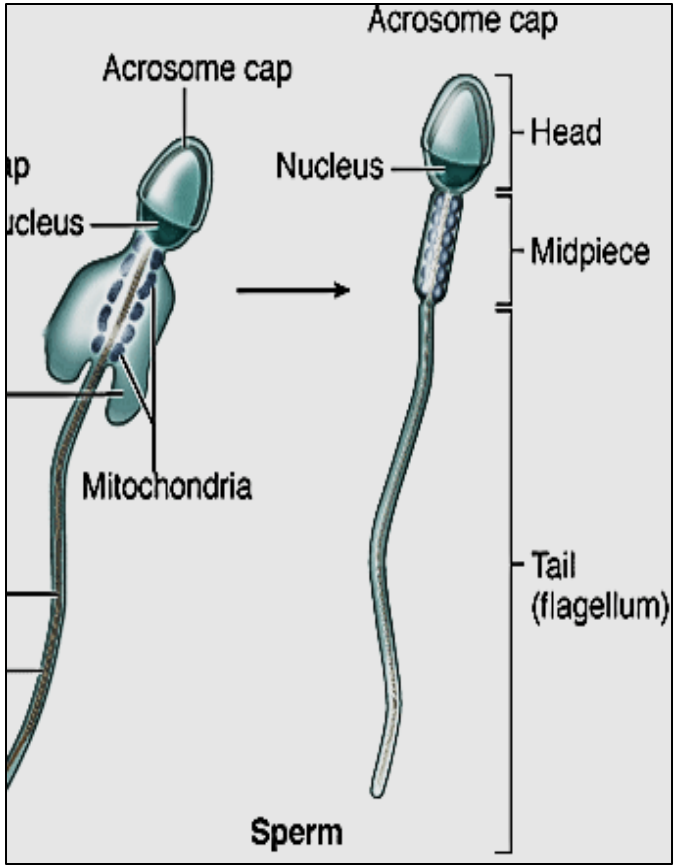
- The nucleus become elongated & condensed
- The acrosomal vesicle spread & cover the ant ½ of nucleus → **acrosomal cap**
- One of the centrioles → grows to form **flagellum**
- Mitochondria collect below the neck around the flagellum → form **middle piece**



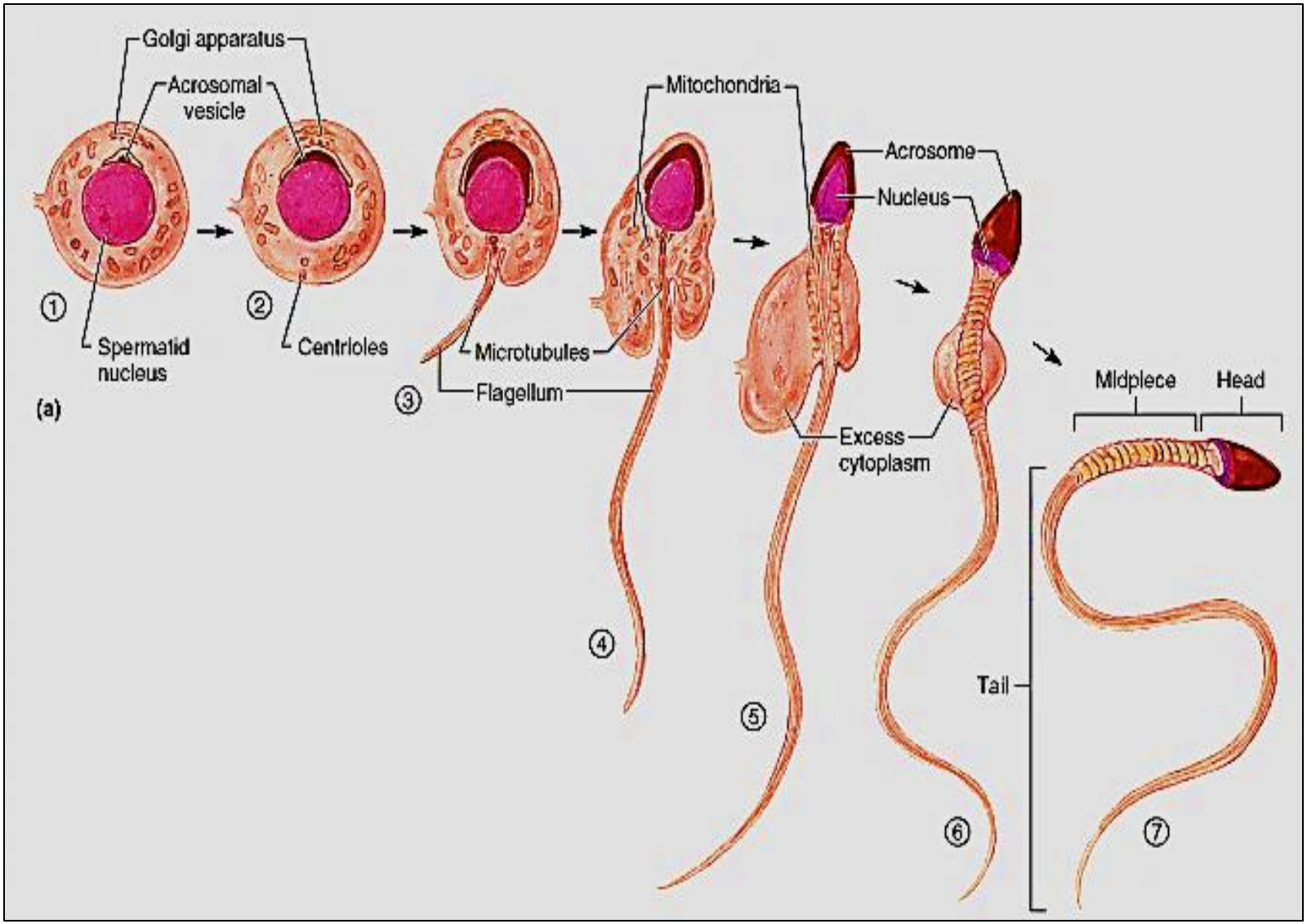
Maturation phase:

- The acrosome cap covers the ant. 2/3 of the nucleus & called **acrosome** and contains **hydrolytic enzymes**

- Excess cytoplasm is shed off→ **residual bodies**



- The newly formed spermatozoa are released tail 1st into the lumen of ST
- Spermatozoa remain immotile until they leave the epididymis
- Capacitation occur in female reproductive tract


Golgi apparatus
Acrosomal vesicle
Mitochondria
Acrosome
Nucleus
Midpiece
Head
Spermatid nucleus
Centrioles
Microtubules
Flagellum
Excess cytoplasm
Tail
(a)
①
②
③
④
⑤
⑥
⑦

Spermatozoa (sperm)

head , Middle piece & tail

The head:

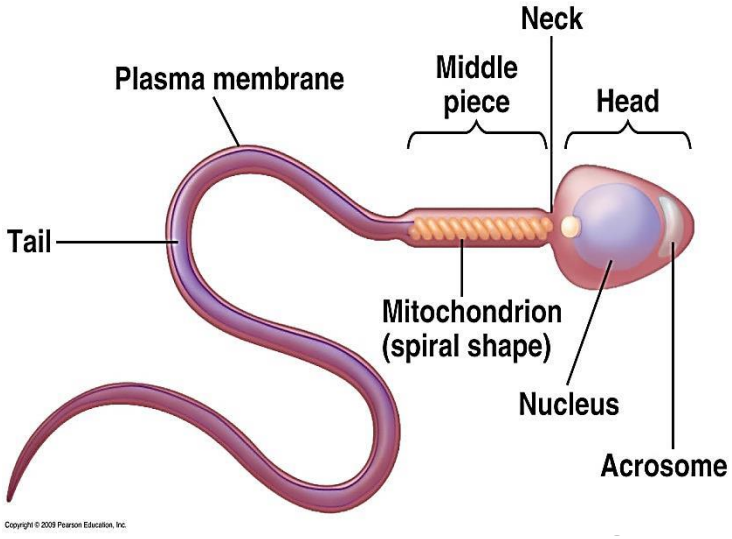
- Flat & elongated formed mainly of the nucleus +acrosome (contains hydrolytic enzymes → facilitate penetration of oocyte)

Middle piece:

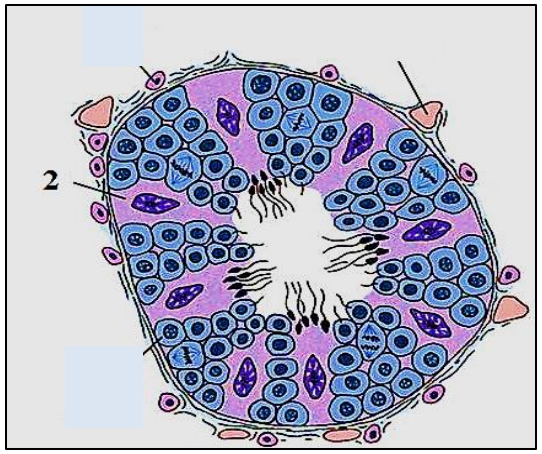
- Formed of flagellum + mitochondrial sheath
- Is responsible for sperm motility

The tail:

Formed of flagellum +supporting fibers

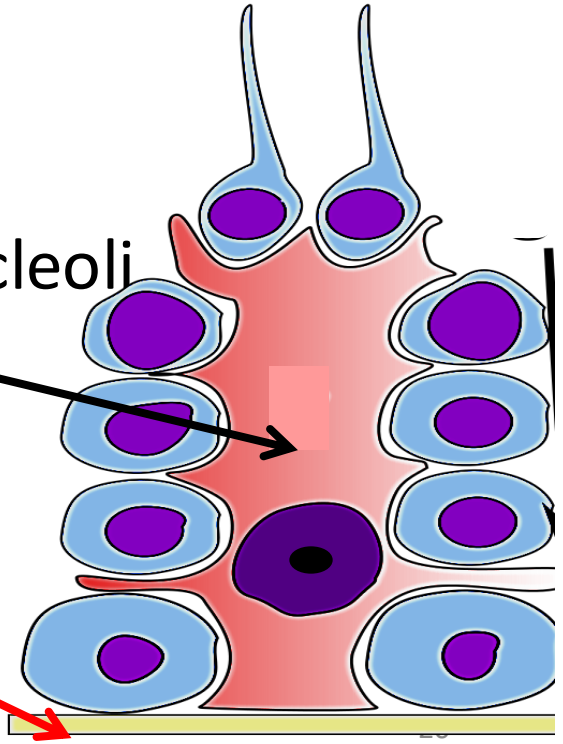


Sertoli cells

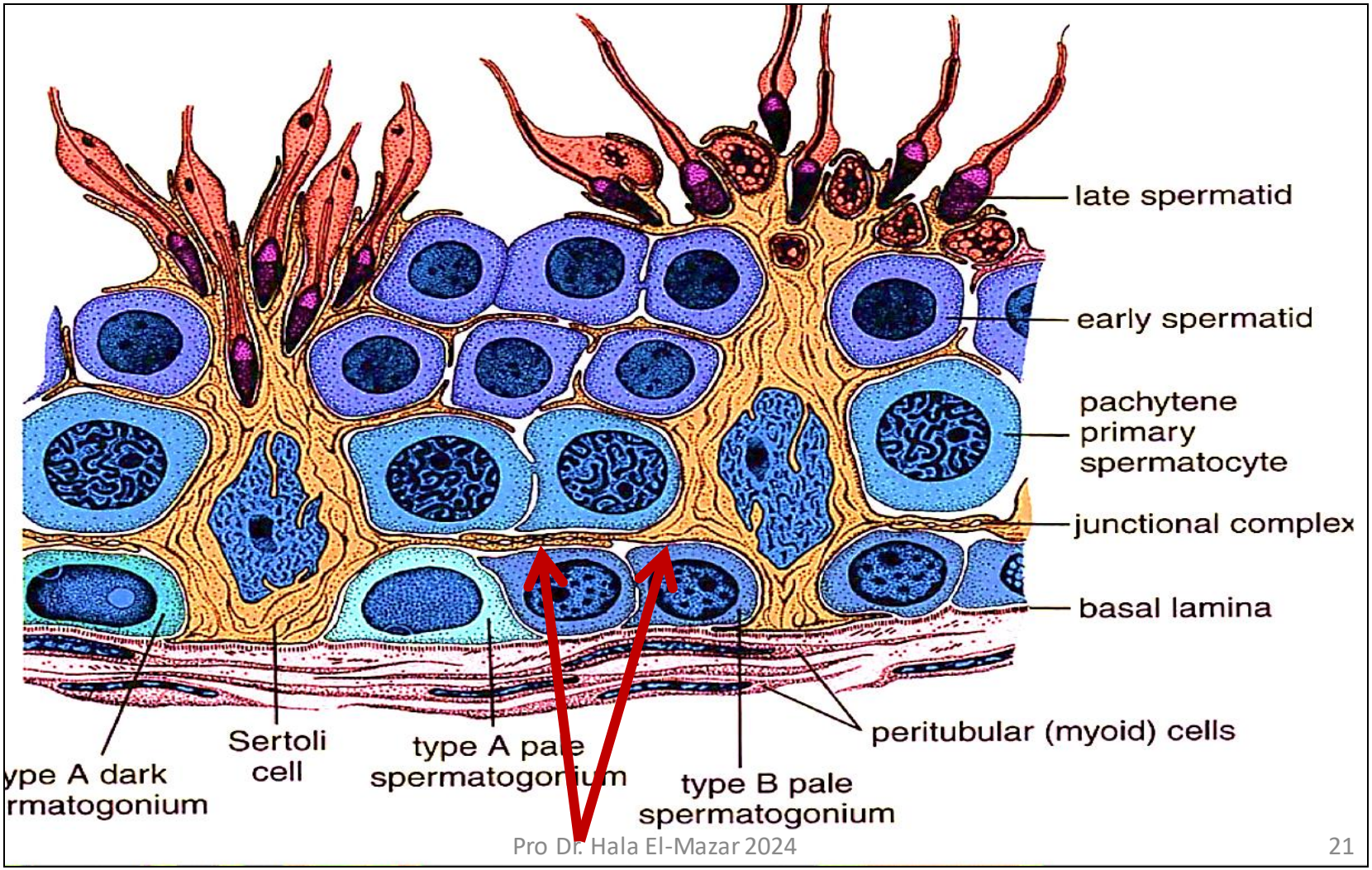


L/M:

- Tall pyramidal cells extend between the spermatogenic epith
- Their bases adhere to basement membrane
- Their apices extend into lumen of ST
- Have elongated nucleus + prominent nucleoli
- Have **ill defined** cell borders
- Cytoplasm pale acidophilic

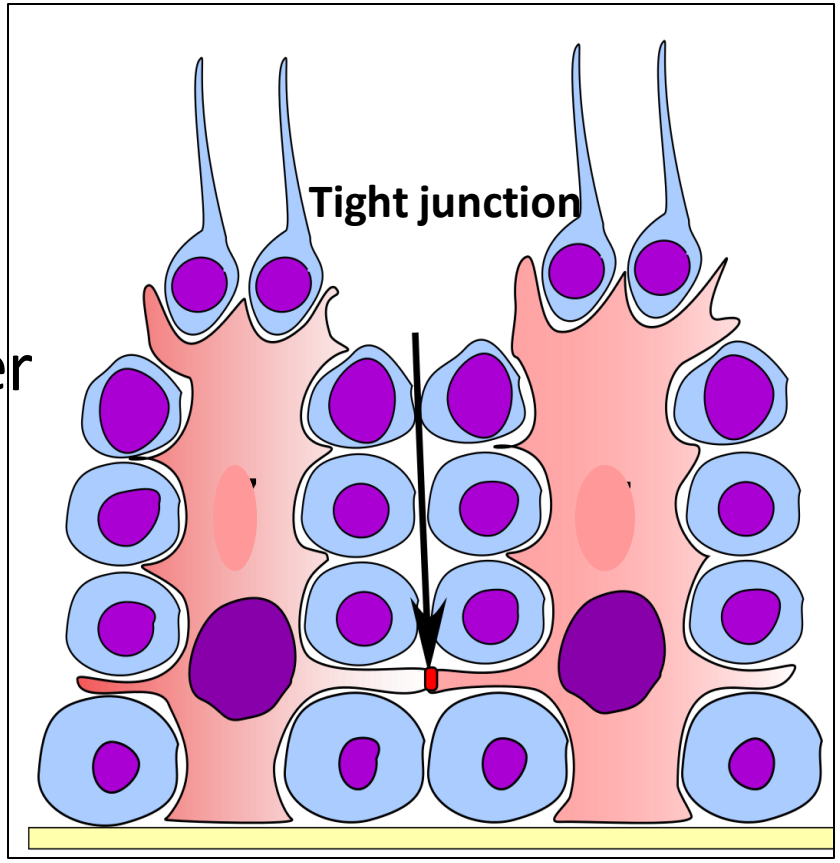


- cytoplasmic extensions from the basal part of Sertoli cells are bound together by tight junctions → form blood- testis barrier



Function of Sertoli cells:

- Support , nourish, protect the developing spermatozoa
- Phagocytic function
- Formation of blood- testis barrier
- Secretion of fluid which is used for sperm transport



- Secretion of **androgen-binding protein**:
  (ABP combines e testosterone & concentrate it inside ST,
  (testosterone is necessary for spermatogenesis)

- Secrete **Inhibin** hormone: inhibit FSH→ feedback control **the rate** of spermatogenesis

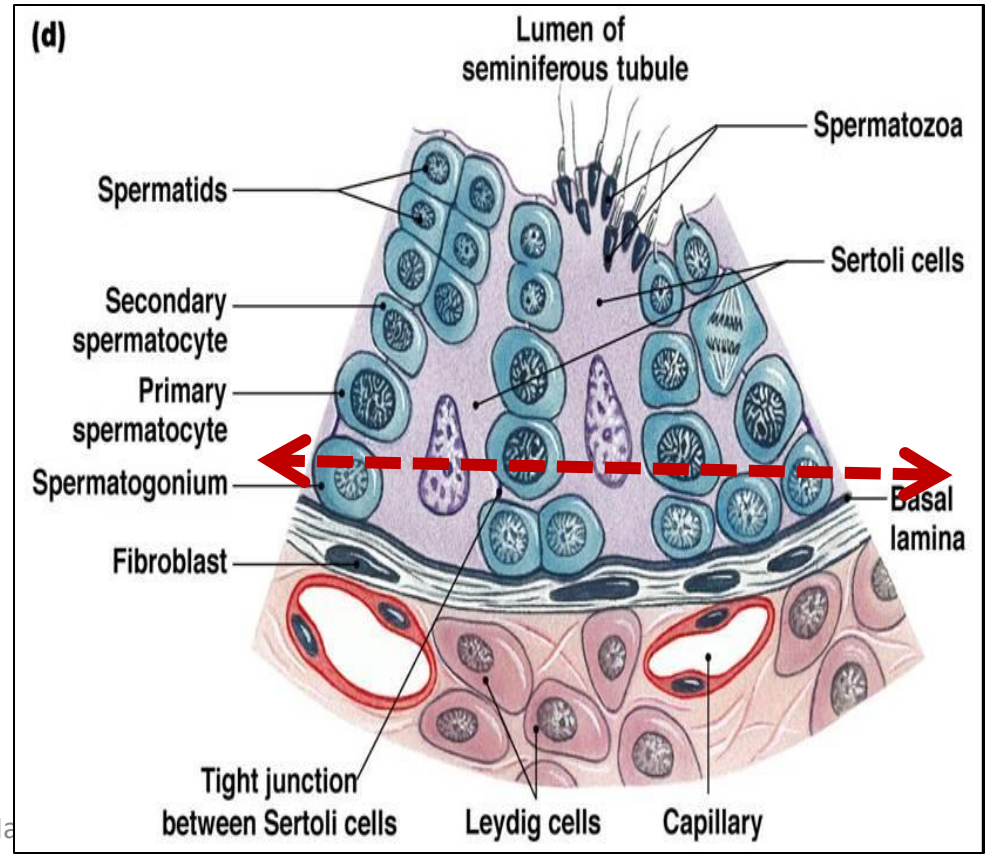
- **FSH act on Sertoli cells to secrete ABP**
- **LH stimulates interstitial cells of Leydig to produce testosterone**

Blood – testis barrier

- Is formed by the tight junction between **Sertoli cells**

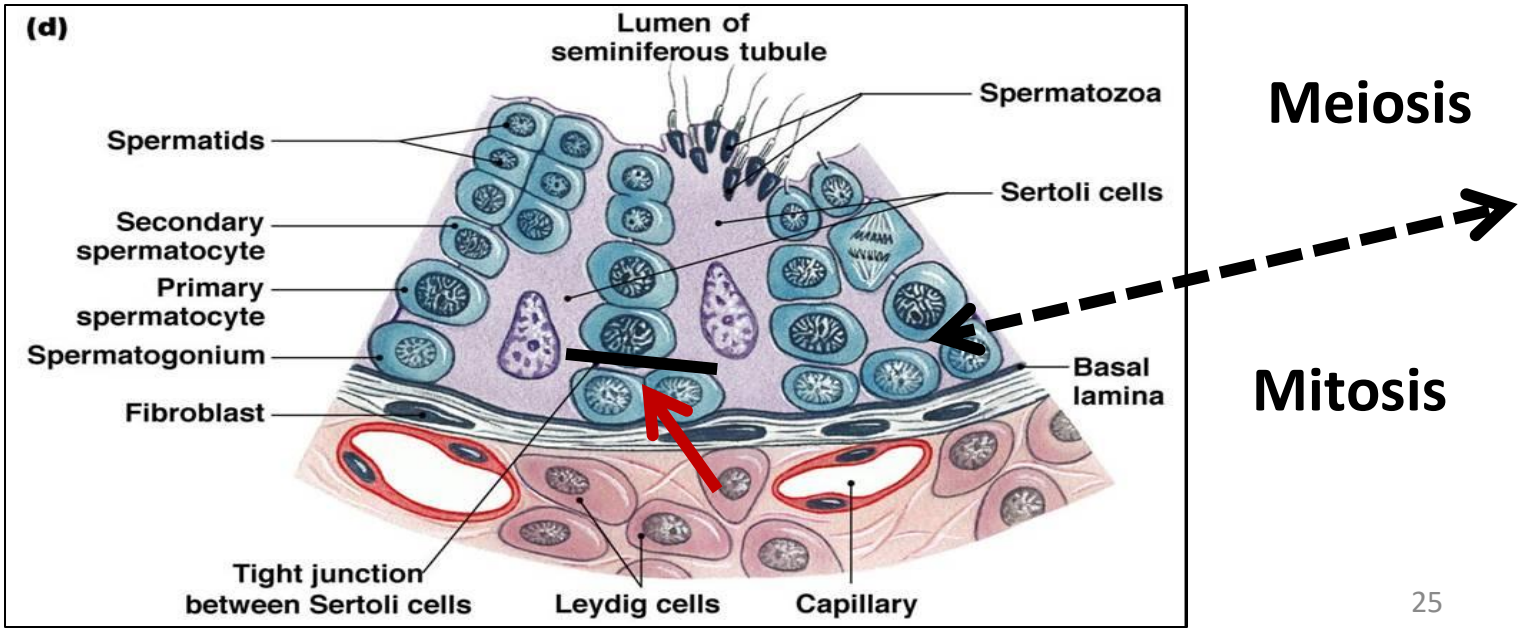
- It divides the ST into **basal** & **adluminal** parts.

Since the sperms are formed only after puberty, they are recognized as foreign cells to the immune system→ barrier prevent autoimmune reaction



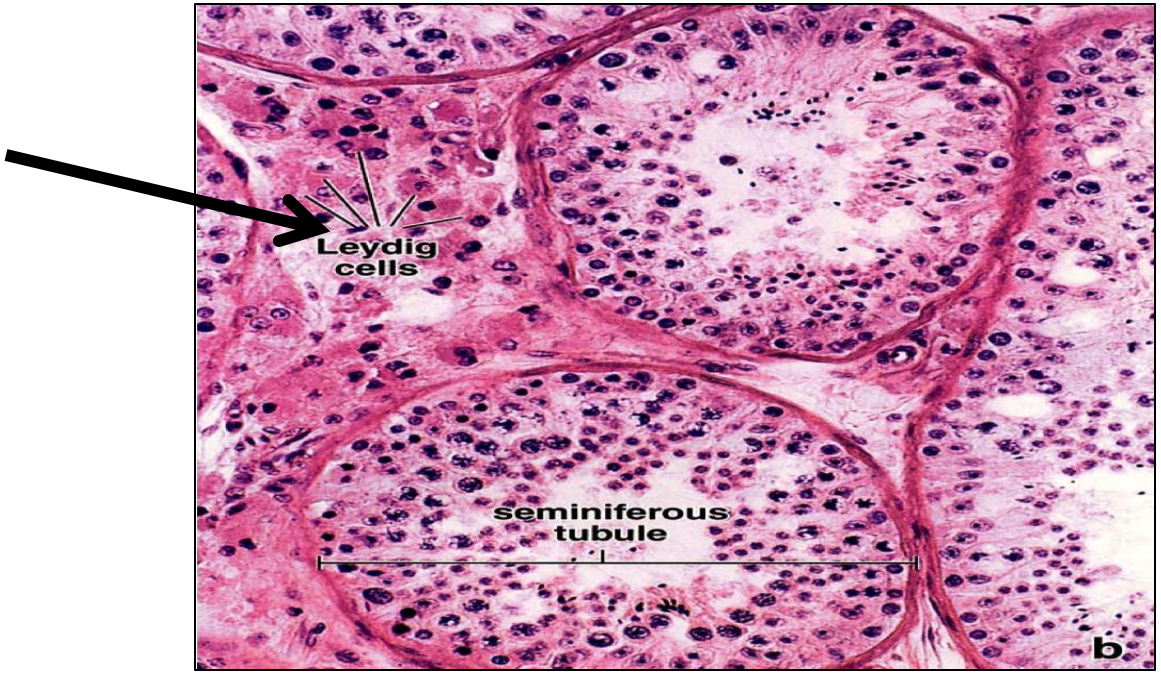
- in the basal part (below the barrier) lie the Spermatogonia →so tissue fluid can directly reach them through penetration of basement membrane

- in the adluminal part (above the barrier) lie 1ry & 2ry spermatocytes, spermatids & spermatozoa → the passage of tissue fluid is controlled by BT barrier



Interstitial cells of leydig

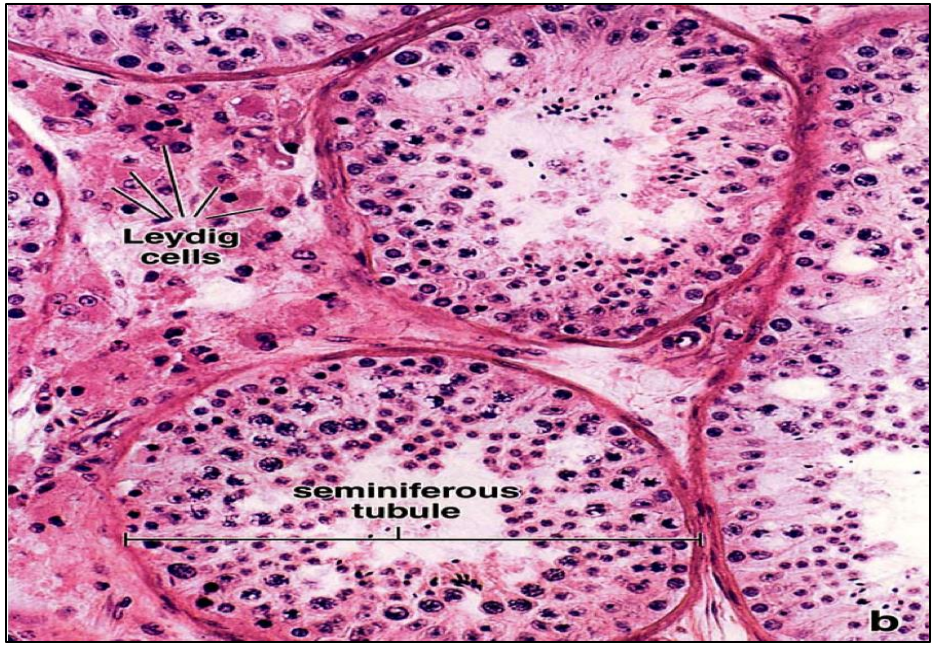
- Cluster of cells present in the spaces between seminiferous tubules
- The endocrine part of the testis
- Surrounded with fenestrated capillaries
- Secret the male hormone **testosterone** under control of LH



Interstitial cells of leydig

L/M:

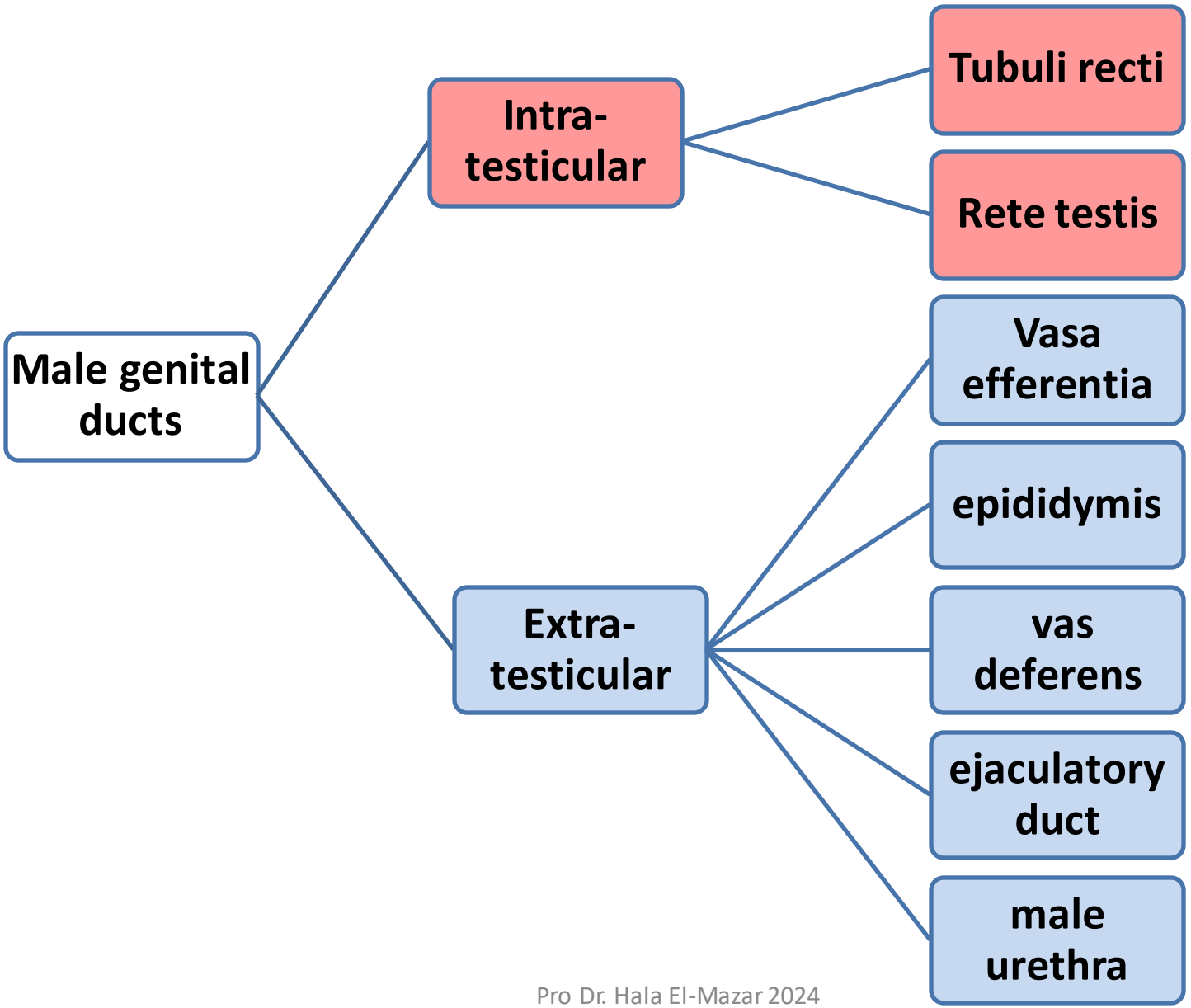
- Rounded cells e acidophilic cytoplasm rich in lipid droplets
- Central round nuclei



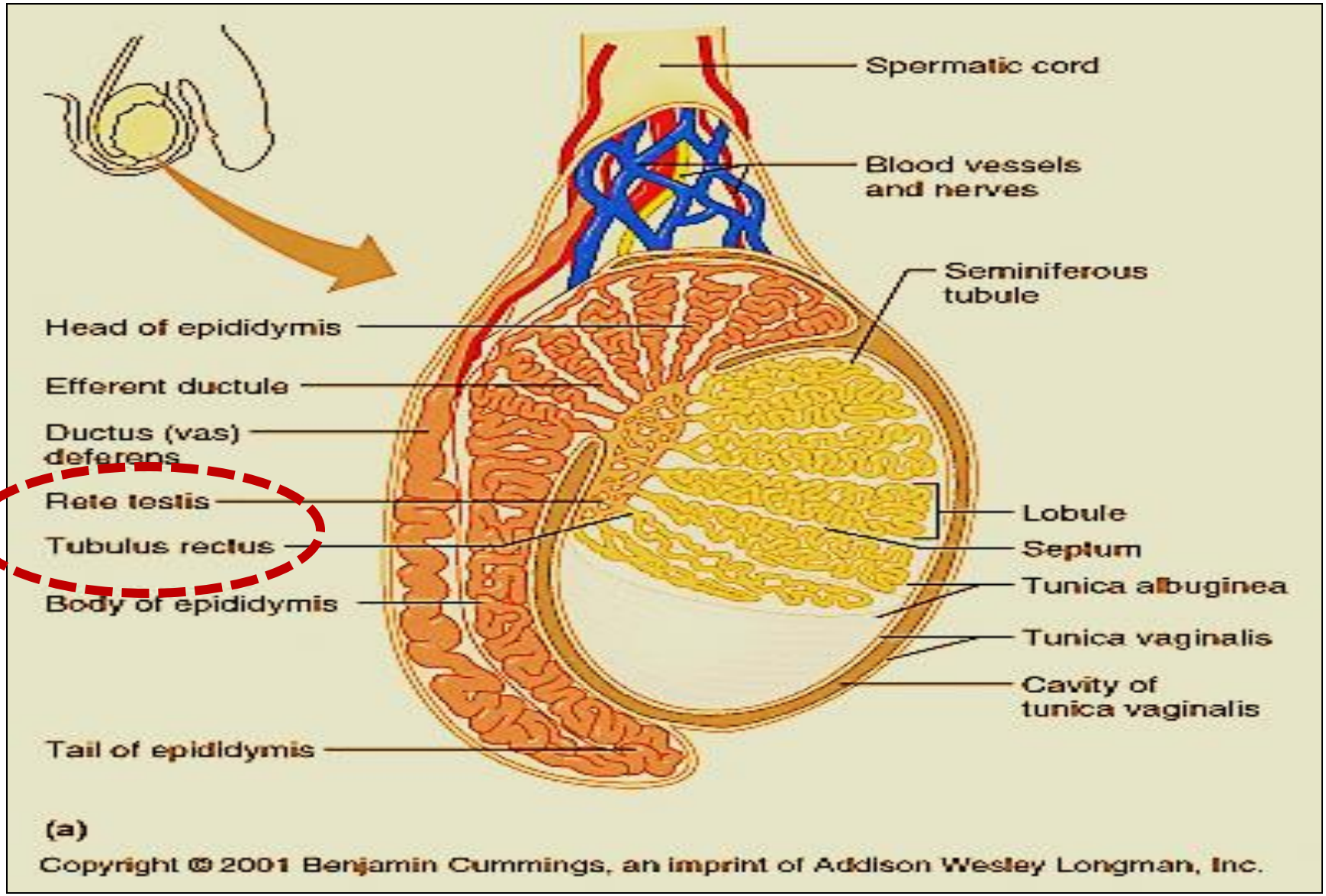
E/M:

- Have the characteristics of **steroid secreting cells**
- ↑sER, mitochondria, lipid droplets

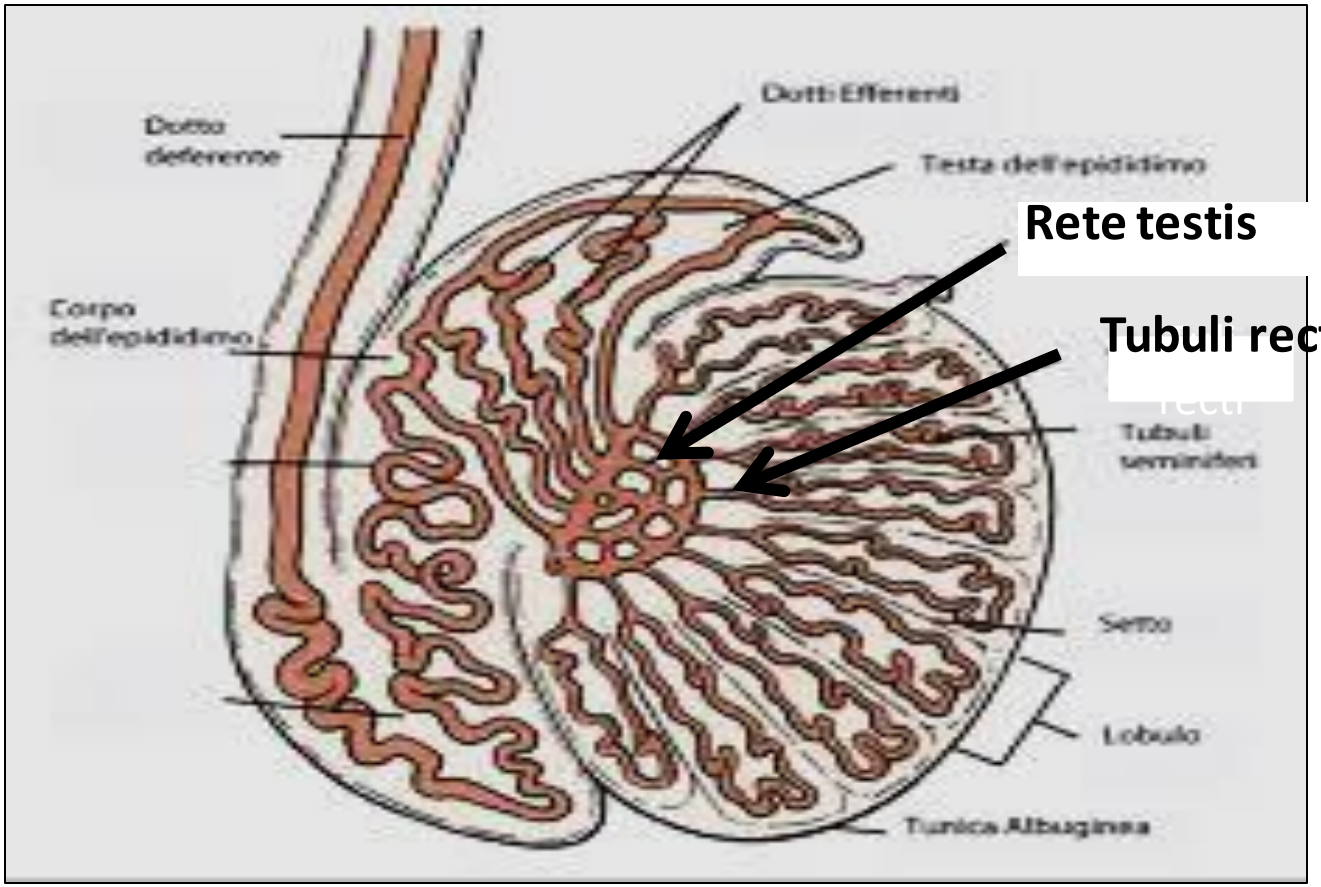
Male genital ducts



Male genital ducts

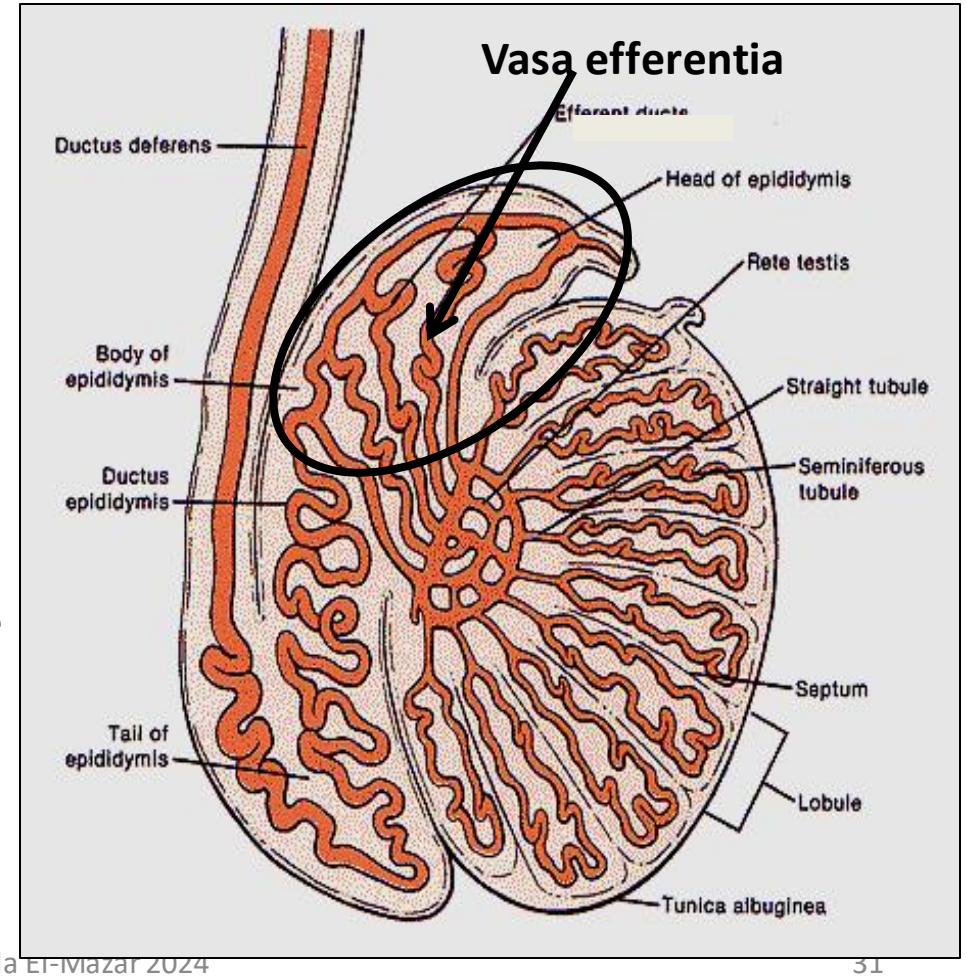


- **Tubuli recti**: straight ends of the seminiferous tubules, lined e Sertoli cells only
- **Rete testis**: anastomosing network of tubules lined e **cuboidal cells**

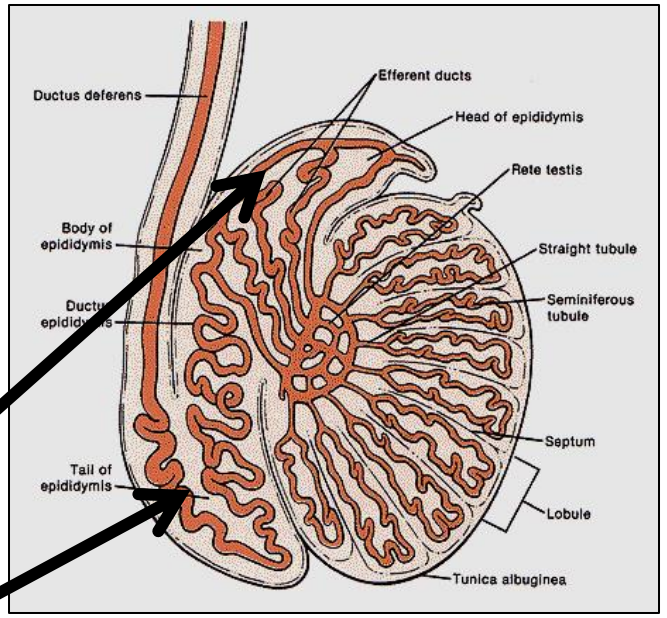


vasa efferentia (ductus efferentia)

- **10-20** tubules , Lined e **simple cuboidal partially ciliated**
- Fuse with head of epididymis (ductus epididymis)
- Move spermatozoa toward epididymis by the peristaltic contraction of smooth ms in their wall
- Absorption of most of the testicular fluid by the non- ciliated cells



Epididymis



- **Single** Coiled tubule (4-6 meter)
- Divides into **head, body & tail**
- **Head** connects e the **Vasa efferentia**

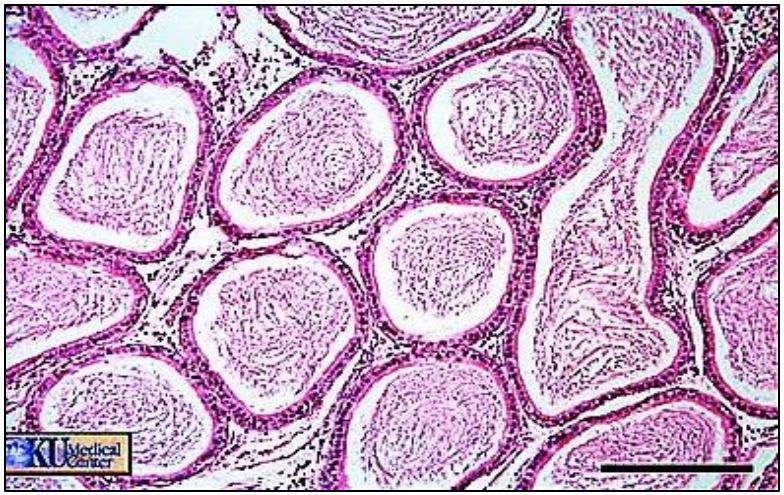
while **tail** connect e the **vas deferens**

Lined e **Principle cells**: **pseudo-stratified columnar with stereocilia**)→ Help in removal of 90% of testicular fluid

- Smooth muscles of its wall help to move sperms by peristaltic contractions
- Produces glycerol-phosphorylcholine → XX capacitation

Function of epididymis:

- Storage: of spermatozoa, gain motility

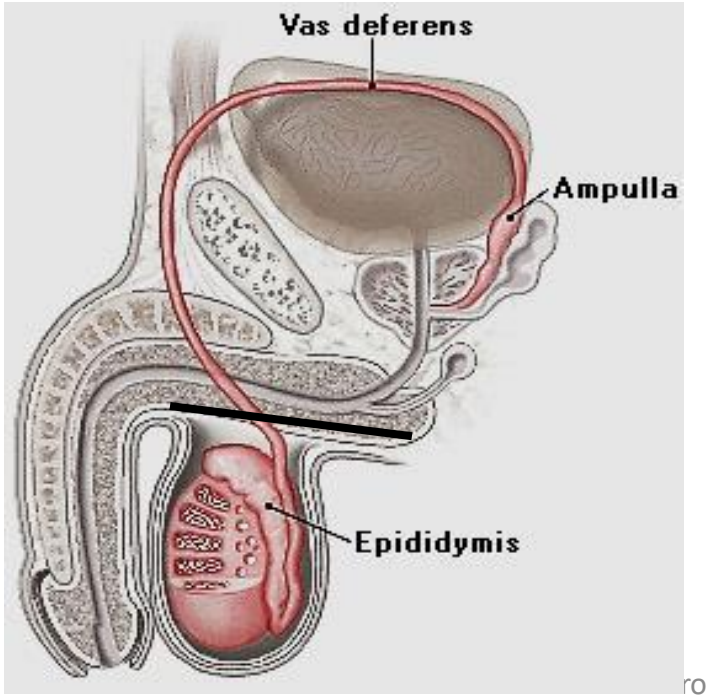


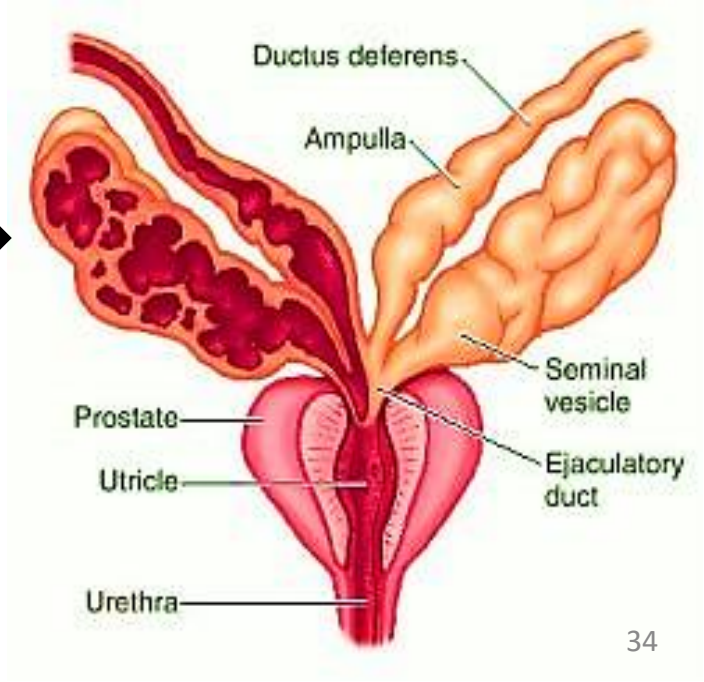
- Secretion: of glycoprotein
  play a role in control
  Capacitation of Spermatozoa
- Absorption: of remaining testicular fluid
- Phagocytosis; residual bodies & degenerated spermatozoa
- Propelling : of spermatozoa to vas deferens by peristaltic contraction of smooth ms in its wall

Vas deferens

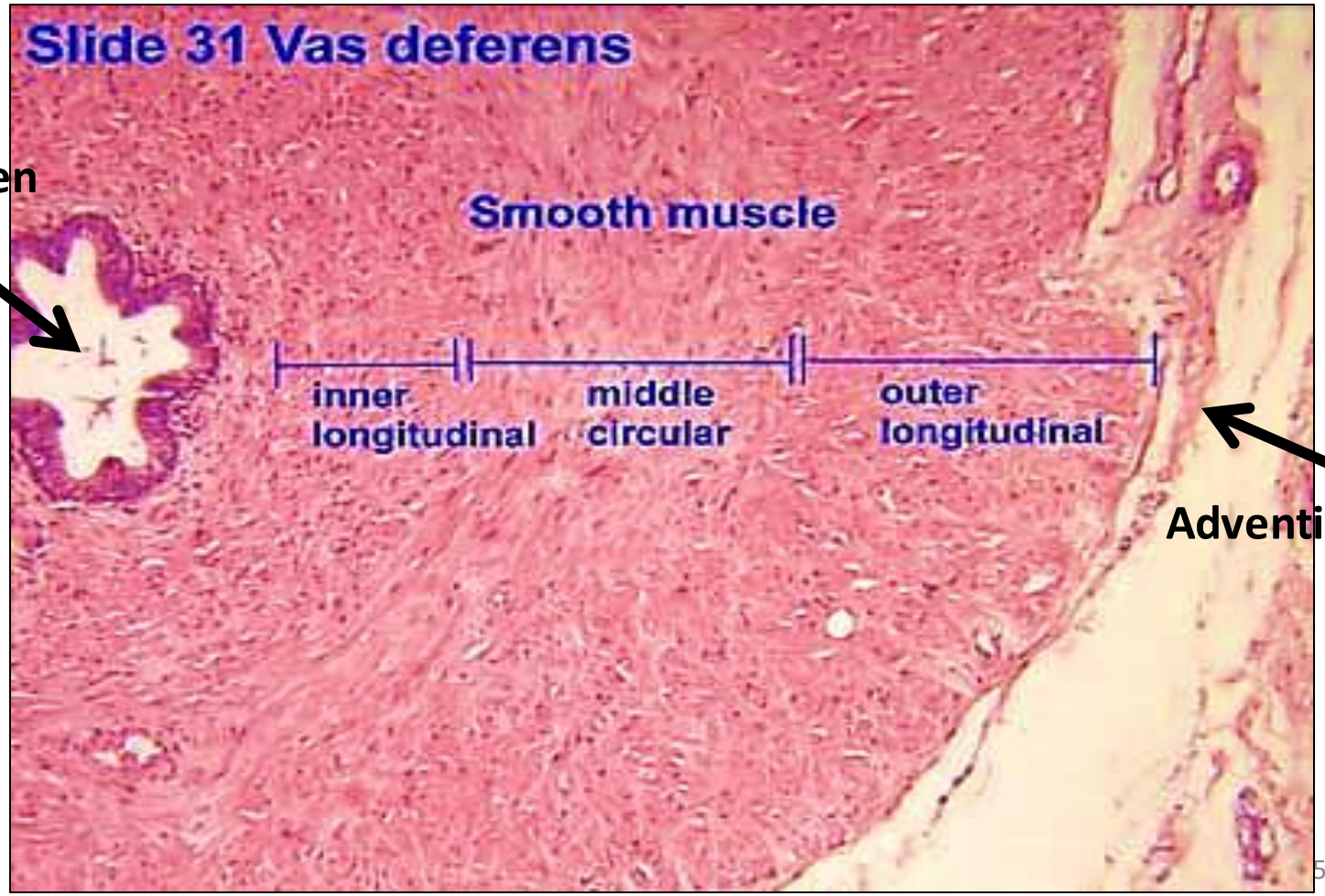
- Single muscular tube. Starts at tail of epididymis & ends by a dilated part called ampulla of vas

- The ampulla is joined by duct of seminal vesicle gland to form ejaculatory duct → prostatic urethra



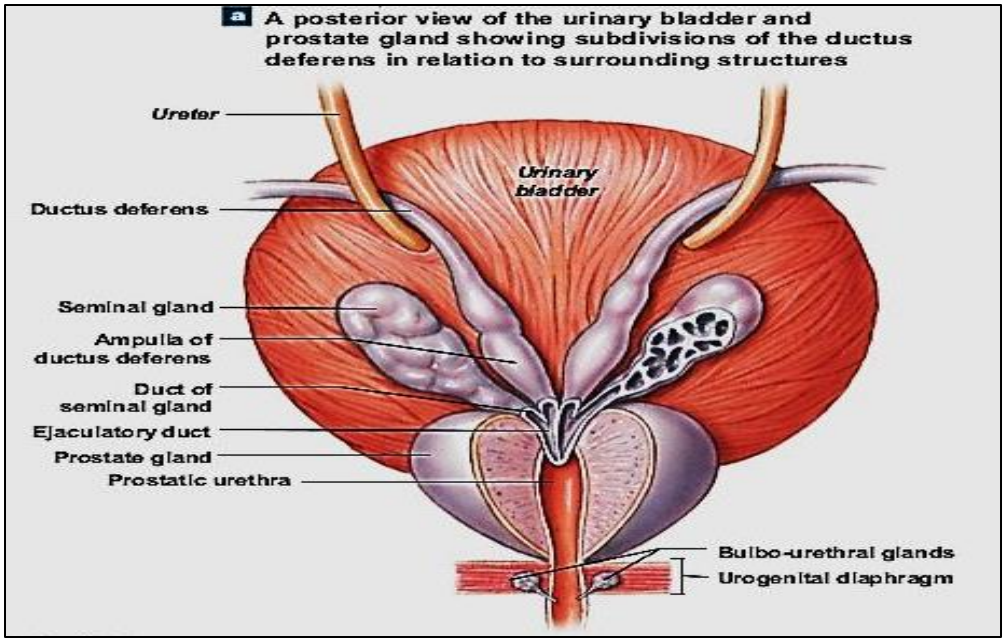


- Narrow lumen & thick layer of smooth ms
- Its mucosa covered e pseudostratified columnar e stereocilia



The ejaculatory duct

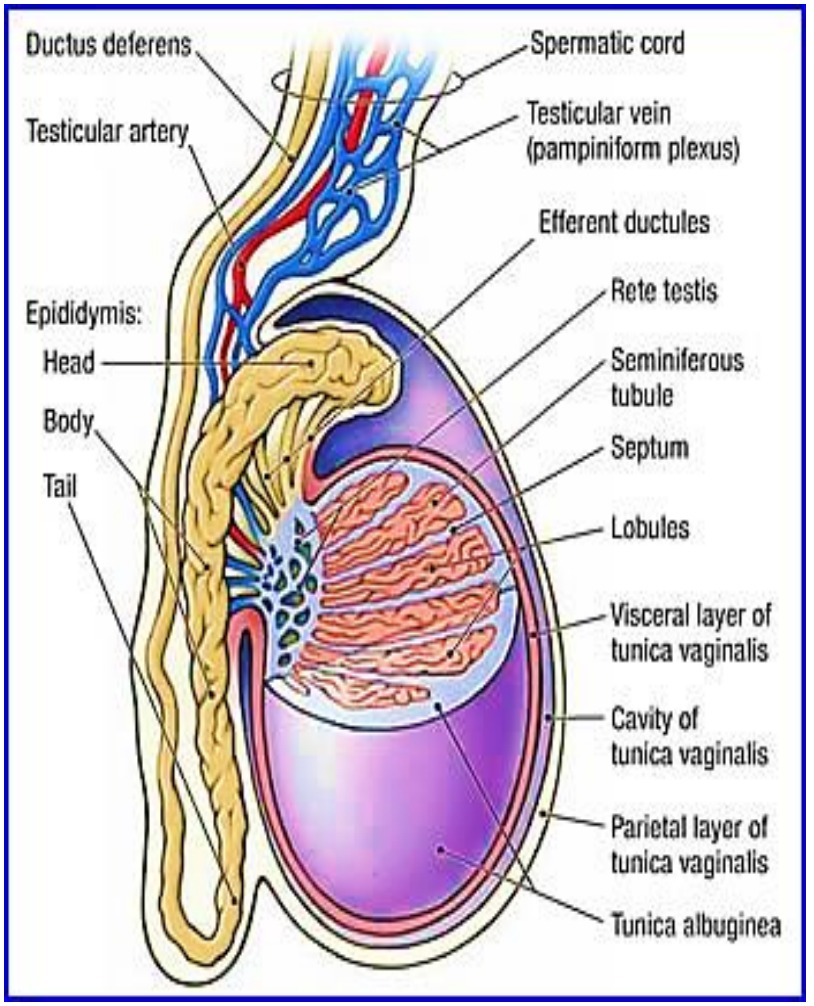
- Short duct = 1 cm
- Formed by union of ampulla of vas deferens & duct of seminal vesicle gland
- It pierce the prostate at the base of urinary bladder to open into the prostatic urethra
- **Lined e pseudo-stratified columnar epith.**



Spermatic cord

Is composed of:

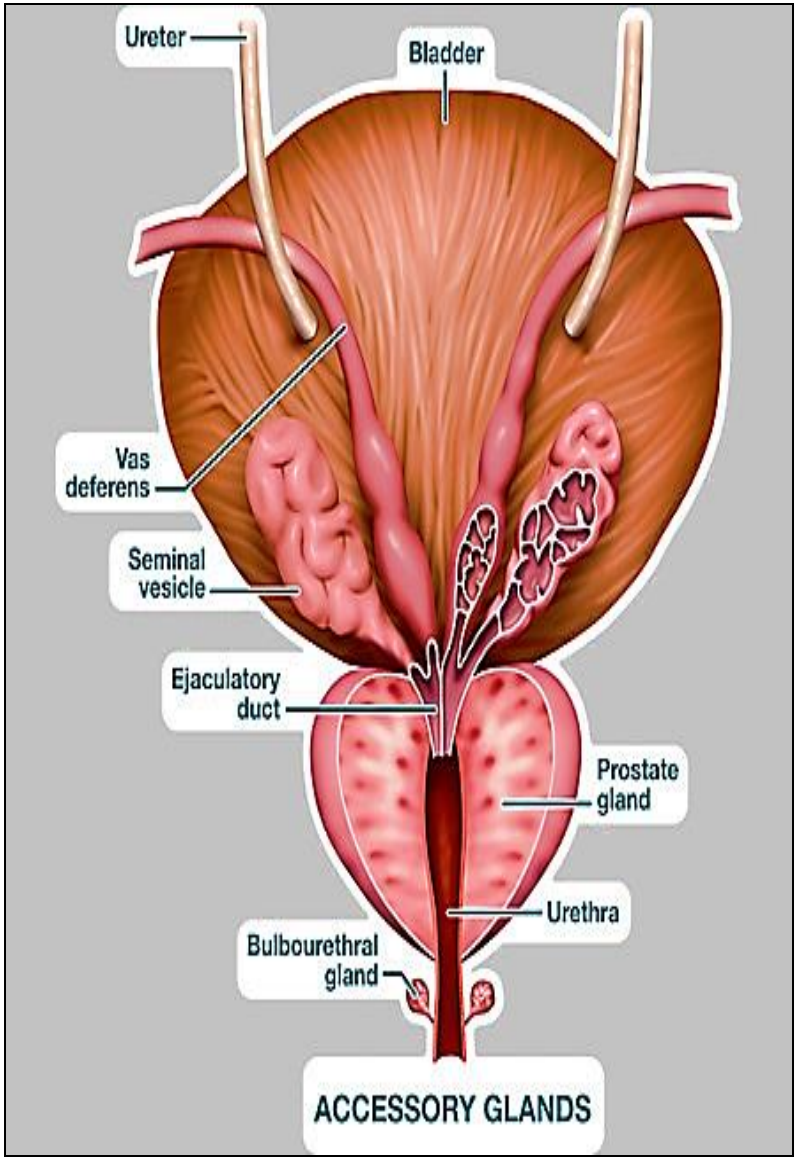
1. Vas deferens
2. Pampiniform plexus of veins
3. Testicular artery
4. Nerves
5. Lymphatic
6. Cremastric muscle: LT fibers of striated involuntary ms.



Accessory glands

1. **Seminal vesicles**
2. **Prostate**
3. **bulbo-urethral (cowper's)**

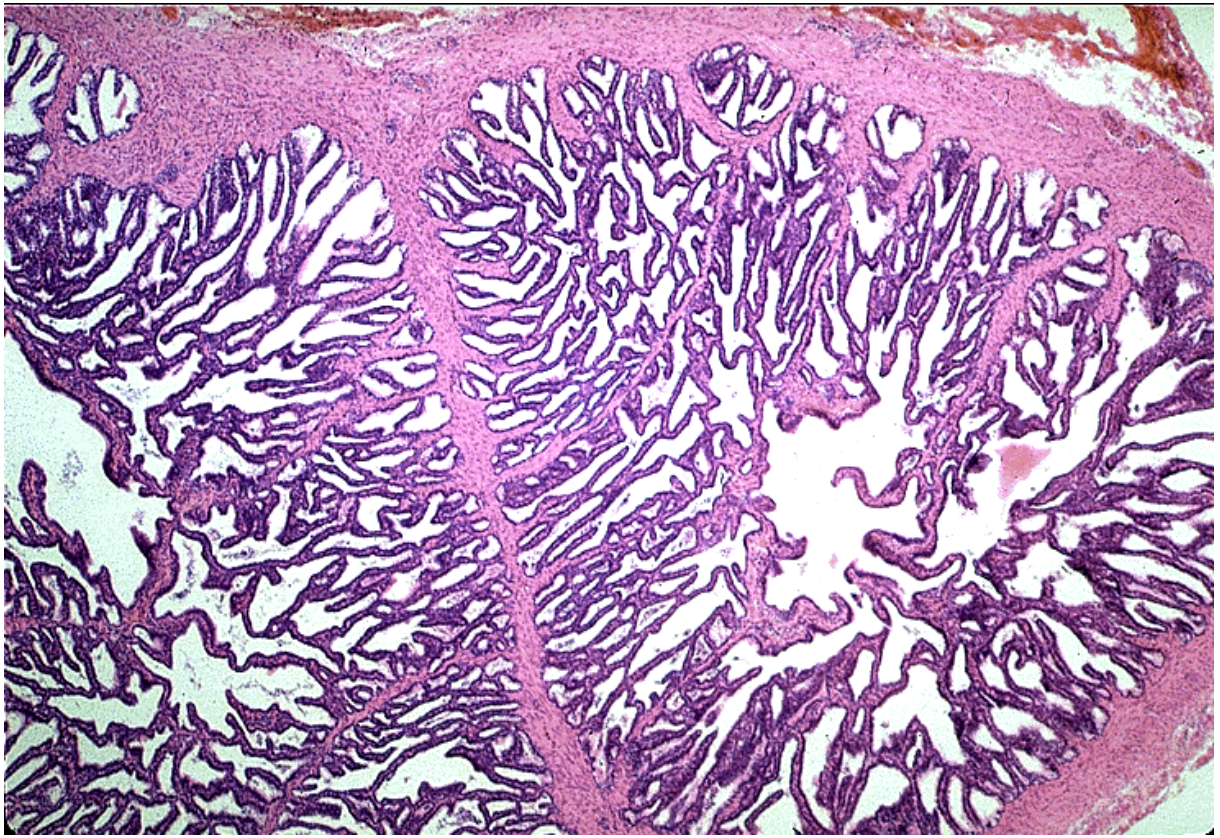
(All regulated by testosterone)



1- Seminal vesicles

Mucosa:

- Extensively folded → ↑ surface area for secretion
- Lined e **pseudostratified columnar epithelium** with height that varies e testosterone levels



Function:

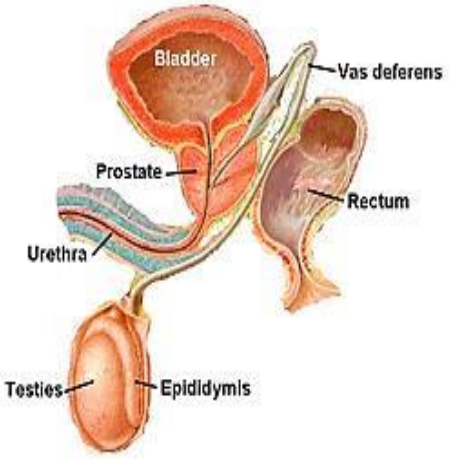
form 70%of the seminal Fluid

(alkaline,

yellow & viscid,

rich in fructose)

2- Prostate



Exocrine gland surround the neck of bladder

Parenchyma: 30 -50 branched tubular glands (acini – ducts) that open into prostatic urethra

Porstate has 3 zones:

1- Transitional: 5%

Benign prostatic hyperplasia

2- Middle zone (central) : 25%

3- Peripheral zone (main): 70%

Site of prostatic cancer

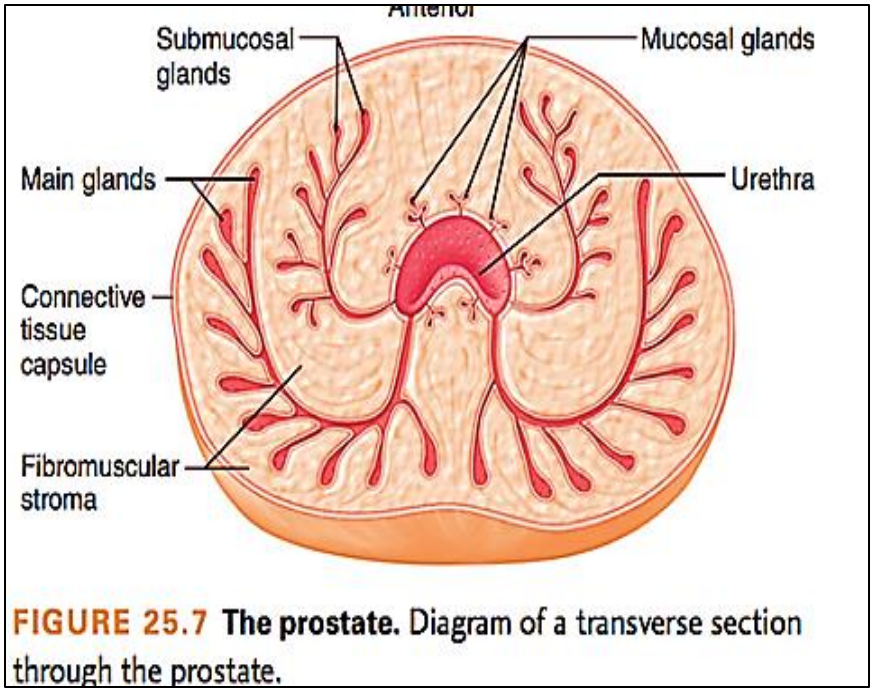


FIGURE 25.7 **The prostate.** Diagram of a transverse section through the prostate.

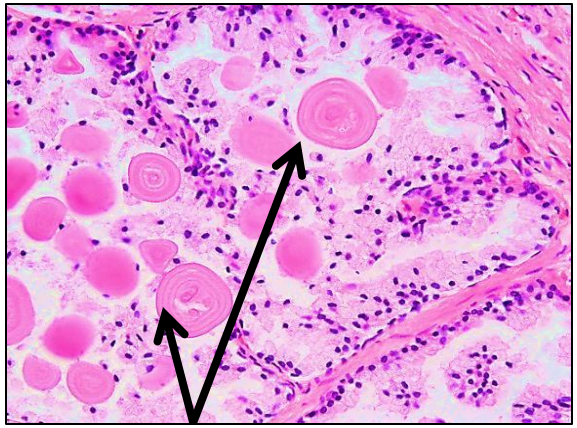
L/m of prostatic acinus:

- Highly folded pseudo-stratified columnar epithelium

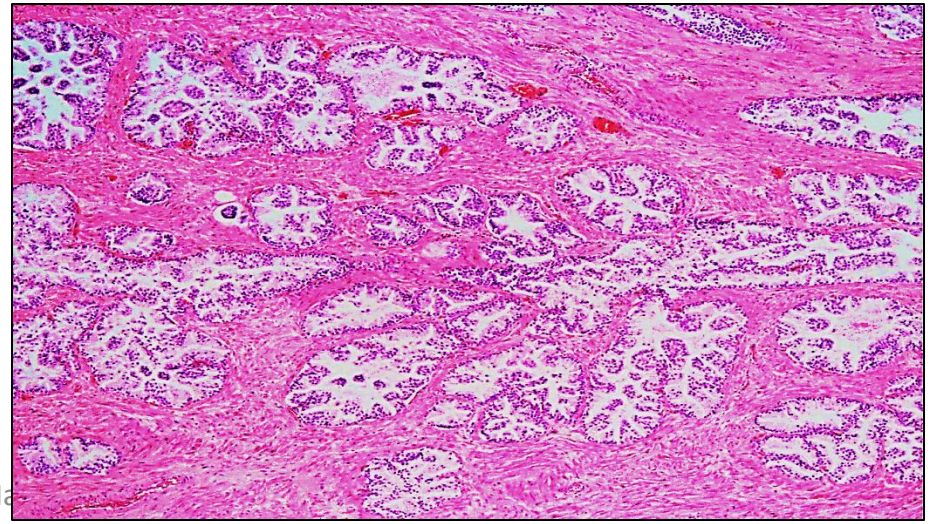
produce prostatic fluid (thin & milky. gives semen its odor, ++ fibrinolysin → liquefy the coagulated semen after deposited in female genital tract)

- Corpora amylacea (prostatic concretions):

rounded calcified glycoproteins found in lumen of prostatic acini. (its # ↑ with age)



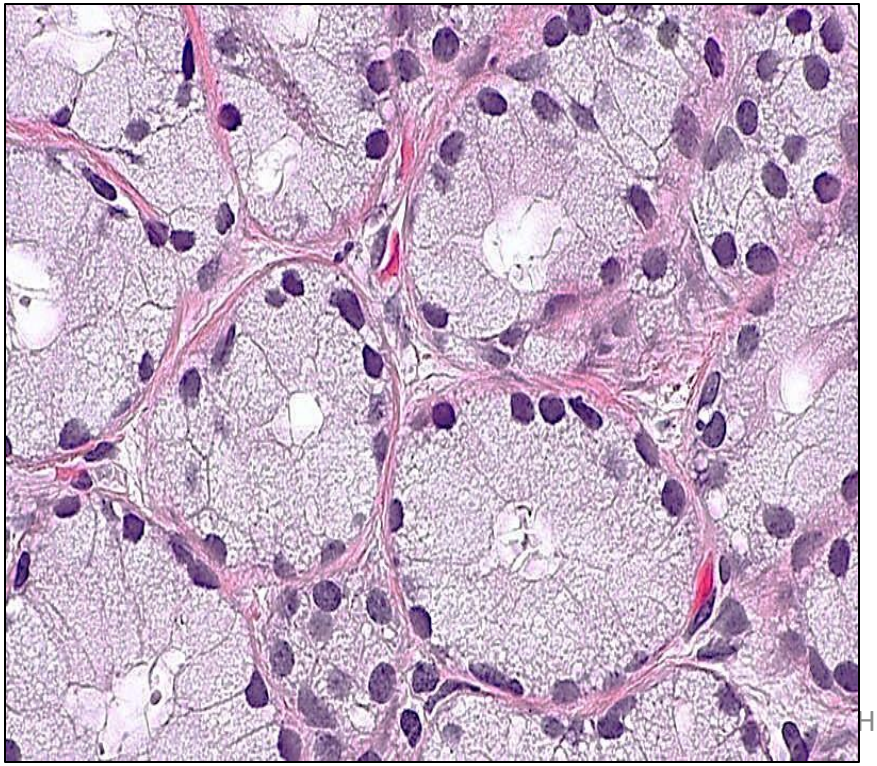
Corpora amylacea

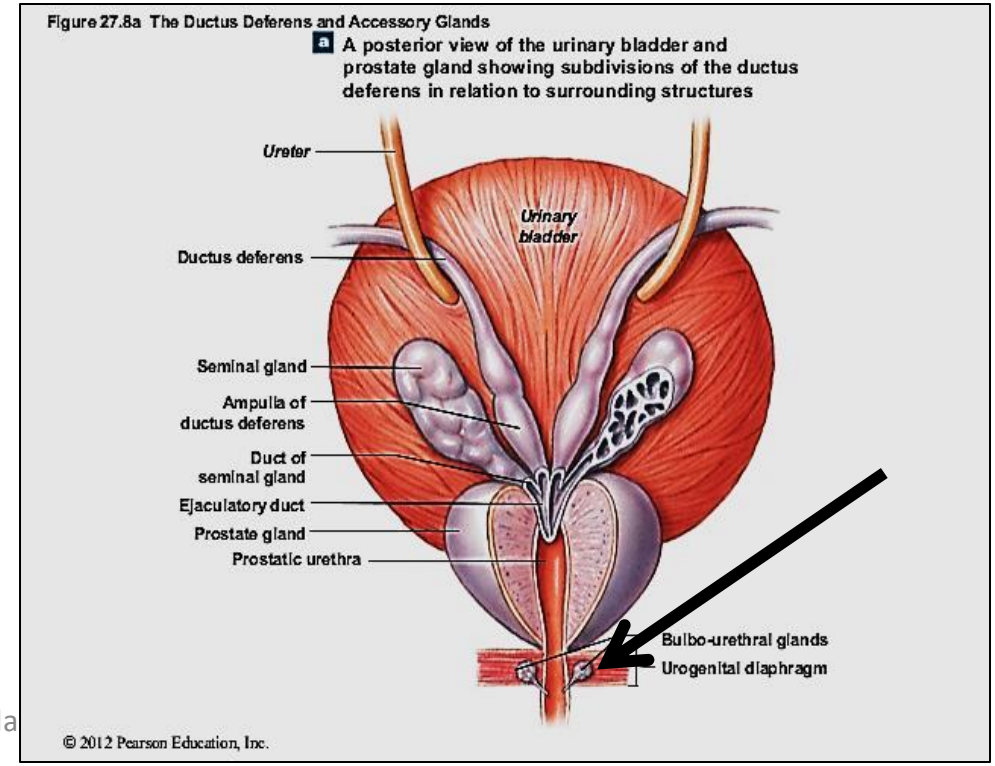


3- Bulbo- uretheral (cowper's) glands:

- 2 glands. Open in proximal penile urethra

- Their acini lined with **simple cuboidal epithelium, mucus secreting** → mucus act as lubricant



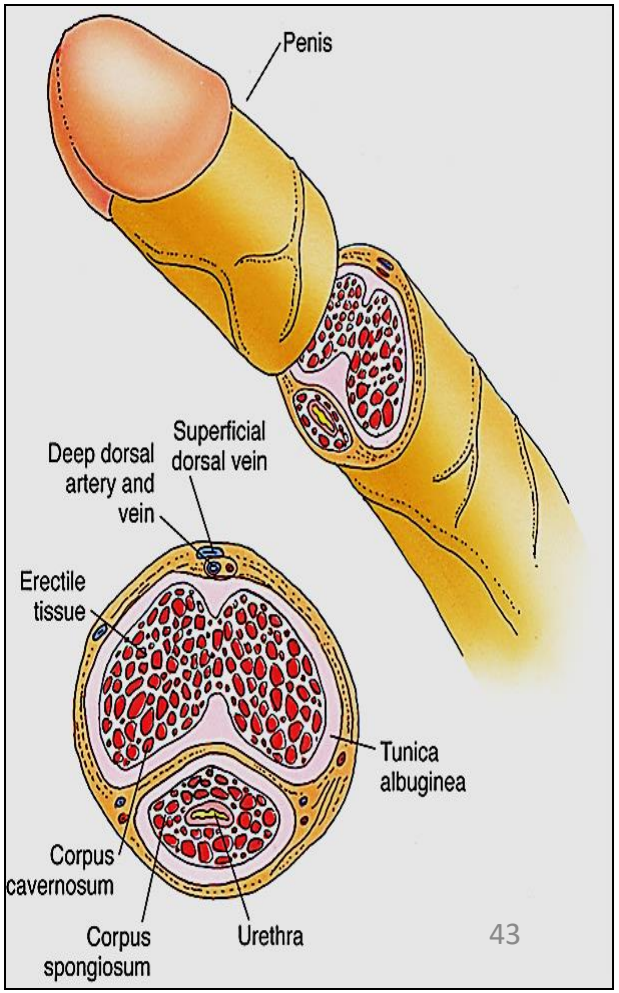


The penis

- the body composed of 3 masses of erectile tissue

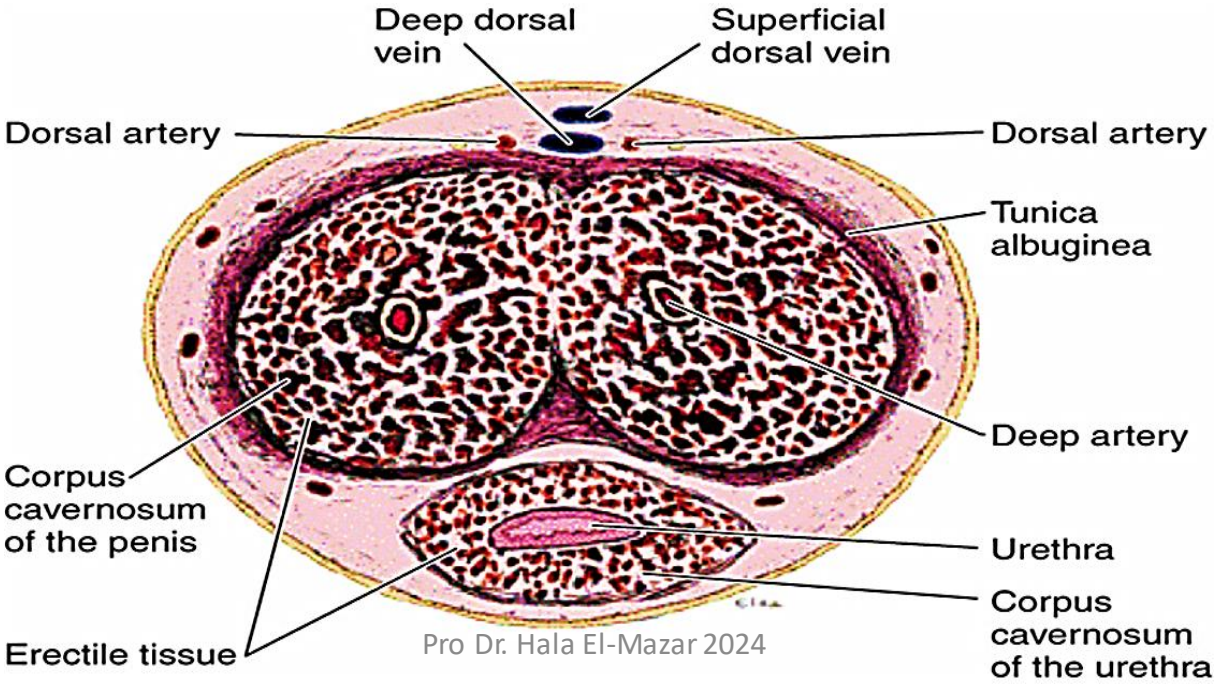
- 2 corpora cavernosa (dorsally) & single corpus spongiosum (ventrally) through which runs the penile Urethra

- At the end of the penis the Corpus spongiosum expands forming glans peins



- *Corpora cavernosa* surrounded by thick tunica albuginea (dense CT)
- *Corpus spongiosum* surrounded by a thin one

- **Erectile tissue:**
  - Vascular spaces that become engorged with blood



Thank you