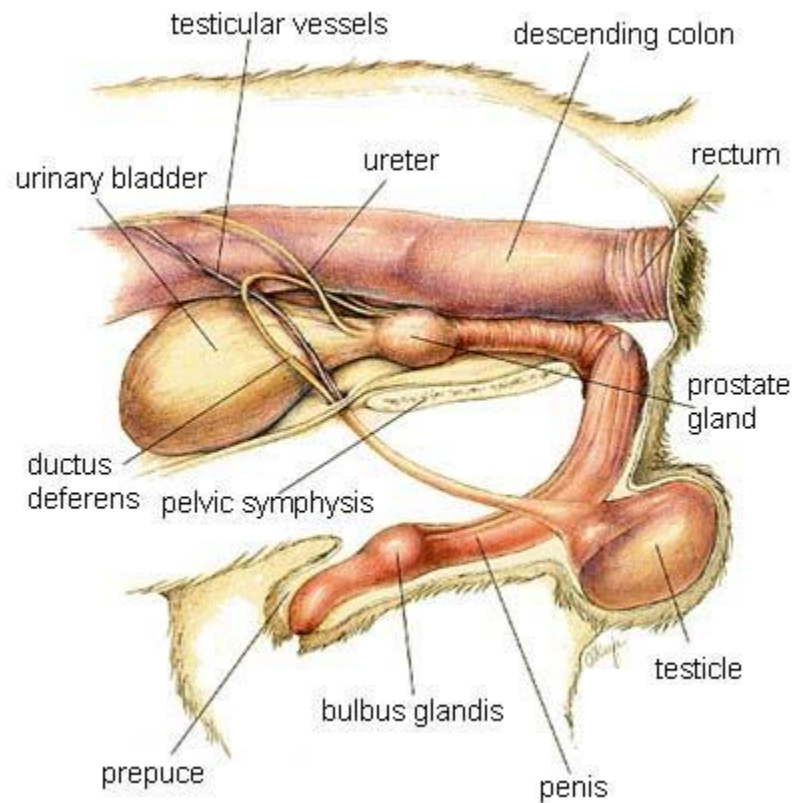




MALE REPRODUCTIVE SYSTEM

By

Dr. Mahmoud Awad

INTRODUCION

❖ **Functions of the male reproductive system**

- Production of sperms.
- Storage and maturation of sperms.
- Secrets a suitable media for nourishment of sperms.
- Production of male sex hormones.
- Transfer of sperms to the female via the copulatory organ.

Male Reproductive System

Primary sex organs

Testis

Secondary sex organs

Epididymis

Vas deferens

Penis

Accessory genital glands

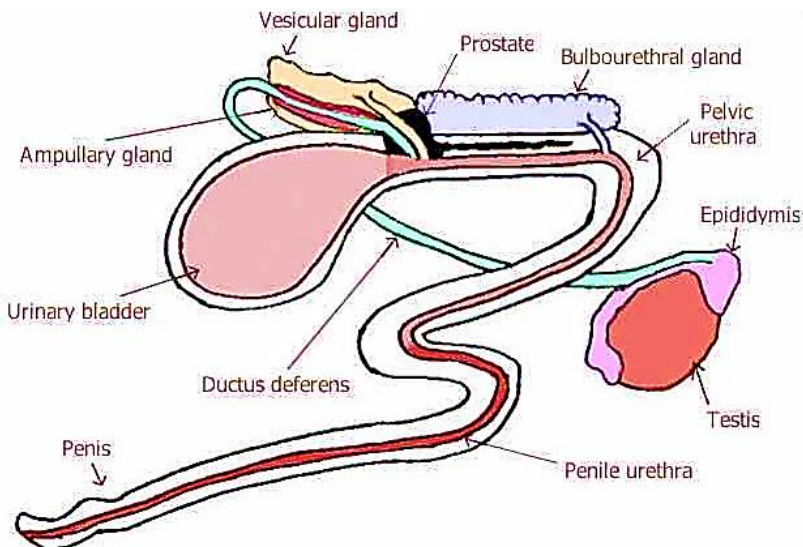
Urethra

Ampulla of ductus deferens

Vesicular gland

Prostate gland

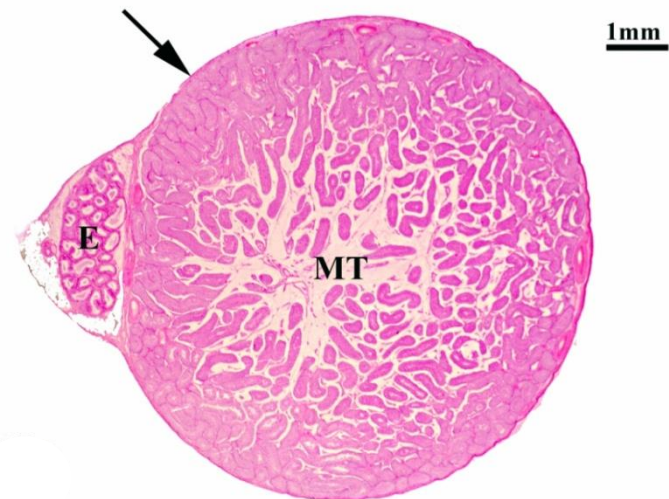
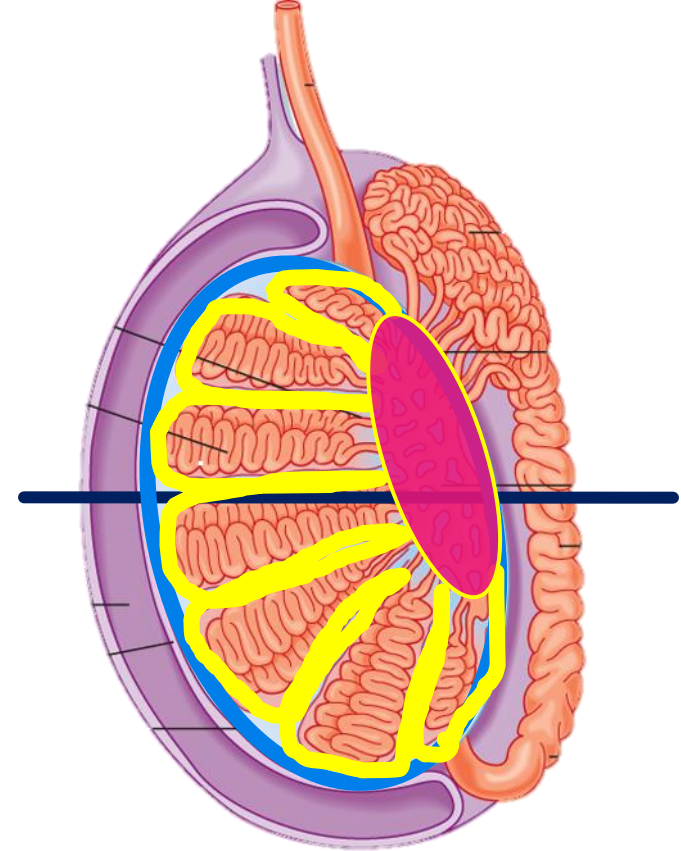
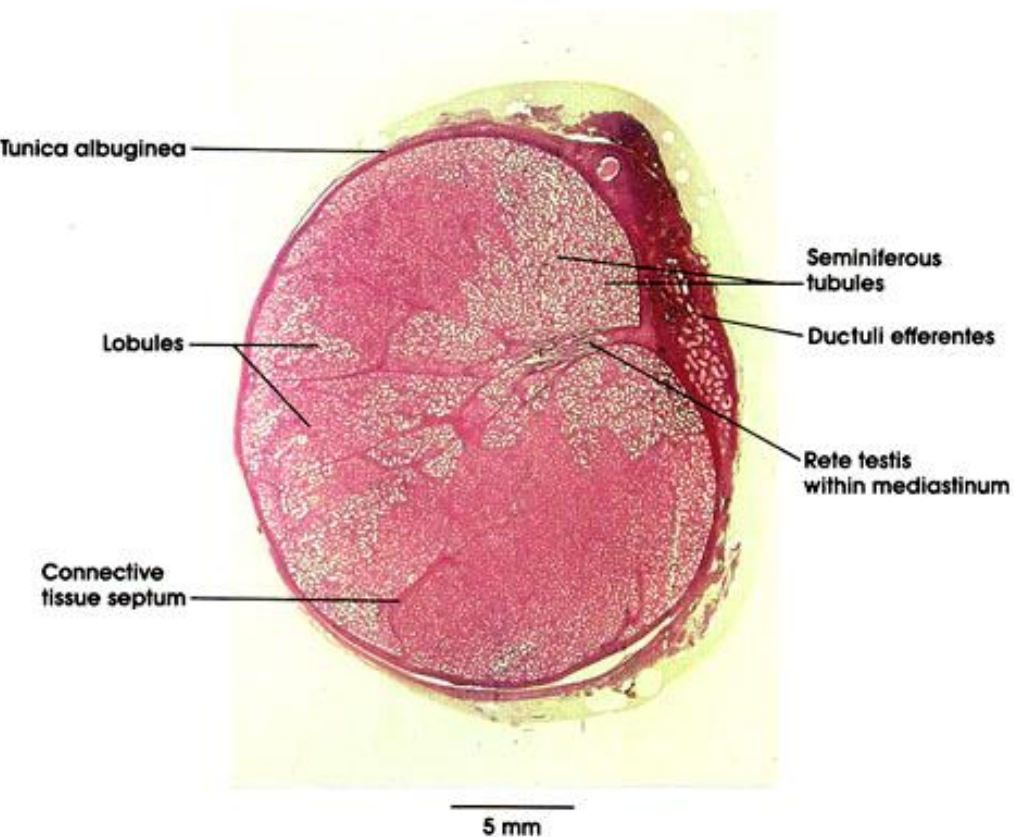
Bulbo-urethral glands



Testes

A. Stroma

- 1 – *Tunica albuginea*
- 2- *Tunica vacuolosa*
- 3- *Septae*
- 4-*Mediastinum testis*



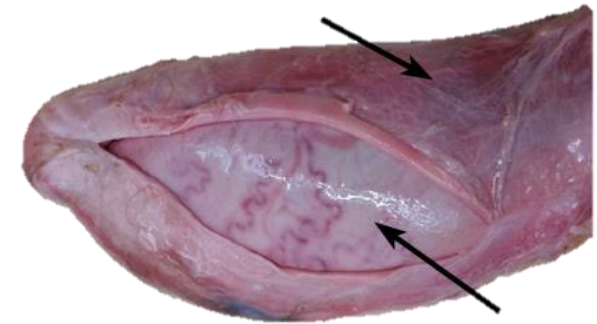
Testes

A. Stroma

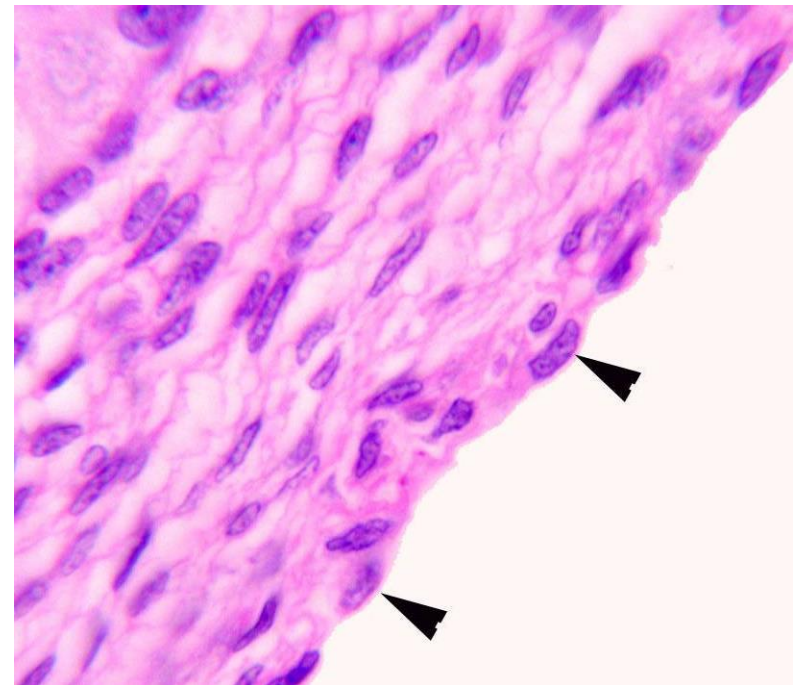
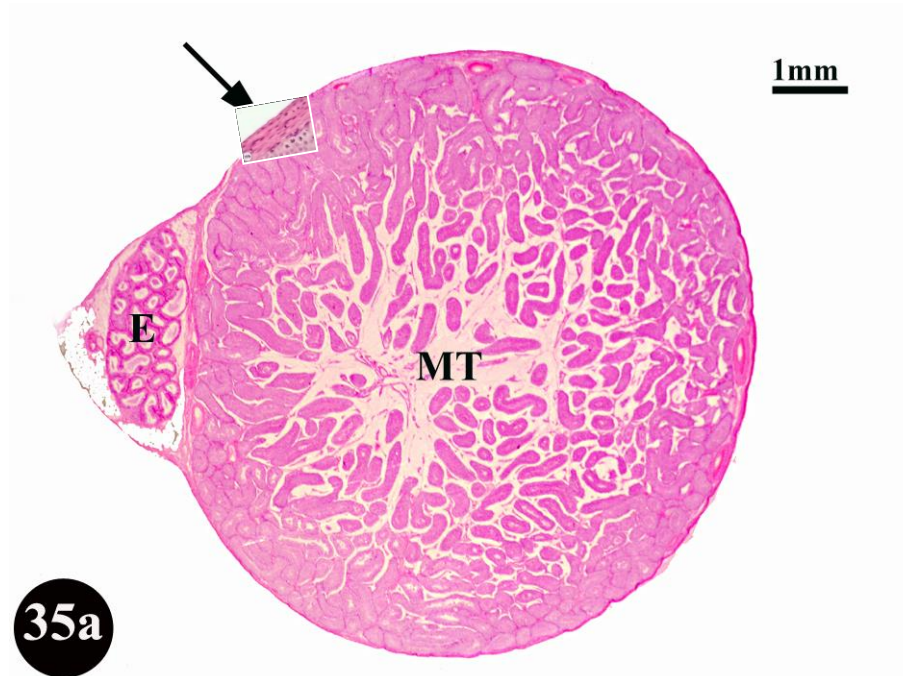
1 – Tunica albuginea

- Dense irregular white fibrous collagenous connective tissue.
- Covered by mesothelium (visceral layer of tunica vaginalis).

parietal tunica vaginalis



visceral tunica vaginalis



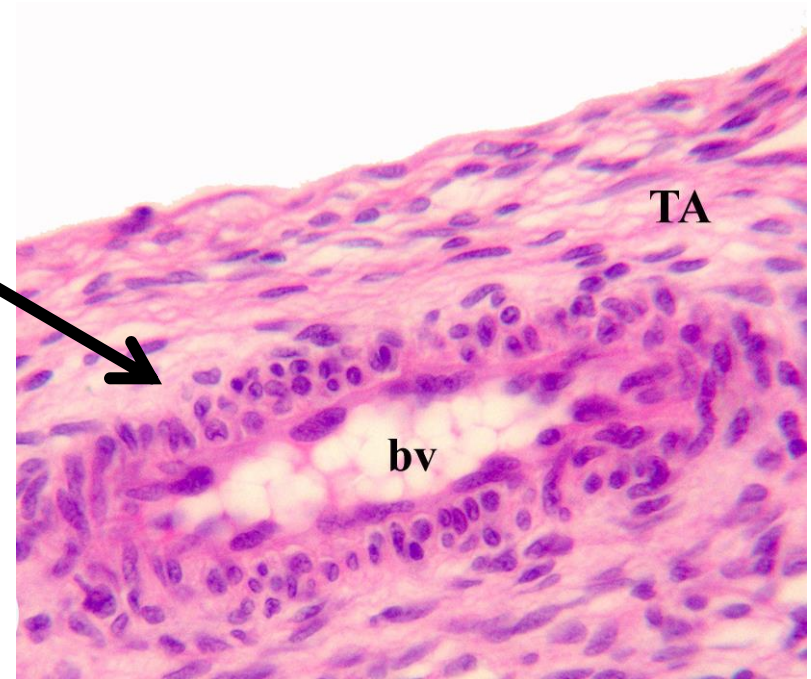
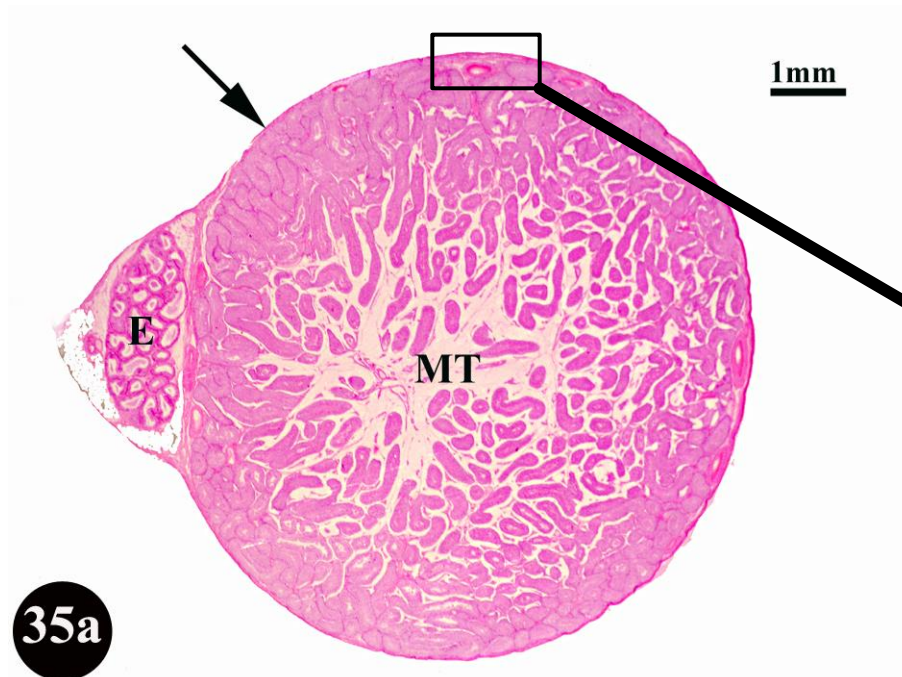
Testes

A. Stroma

1 – Tunica albuginea

2- Tunica vacuolosa

- Highly vascular loose CT underneath tunica albuginea.
- Located deeper; boar and stallion, and superficially; dog and ram.



Testes

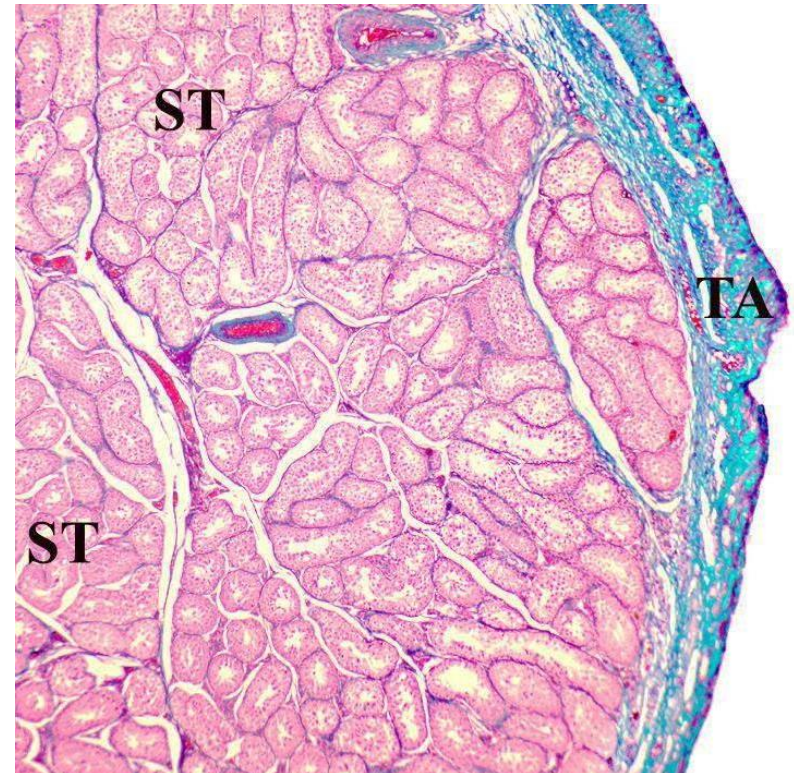
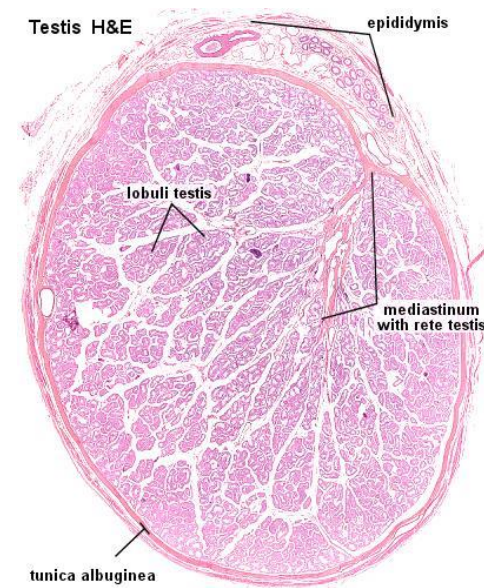
A. Stroma

1 – Tunica albuginea

2- Tunica vacuolosa

3- Septae (septula testis)

- Fibrous c.t. partitions project from the capsule toward the mediastinum testis .
- Septae divide the testis into numerous incomplete compartments; testicular lobules (**lobuli testis**).



Testes

A. Stroma

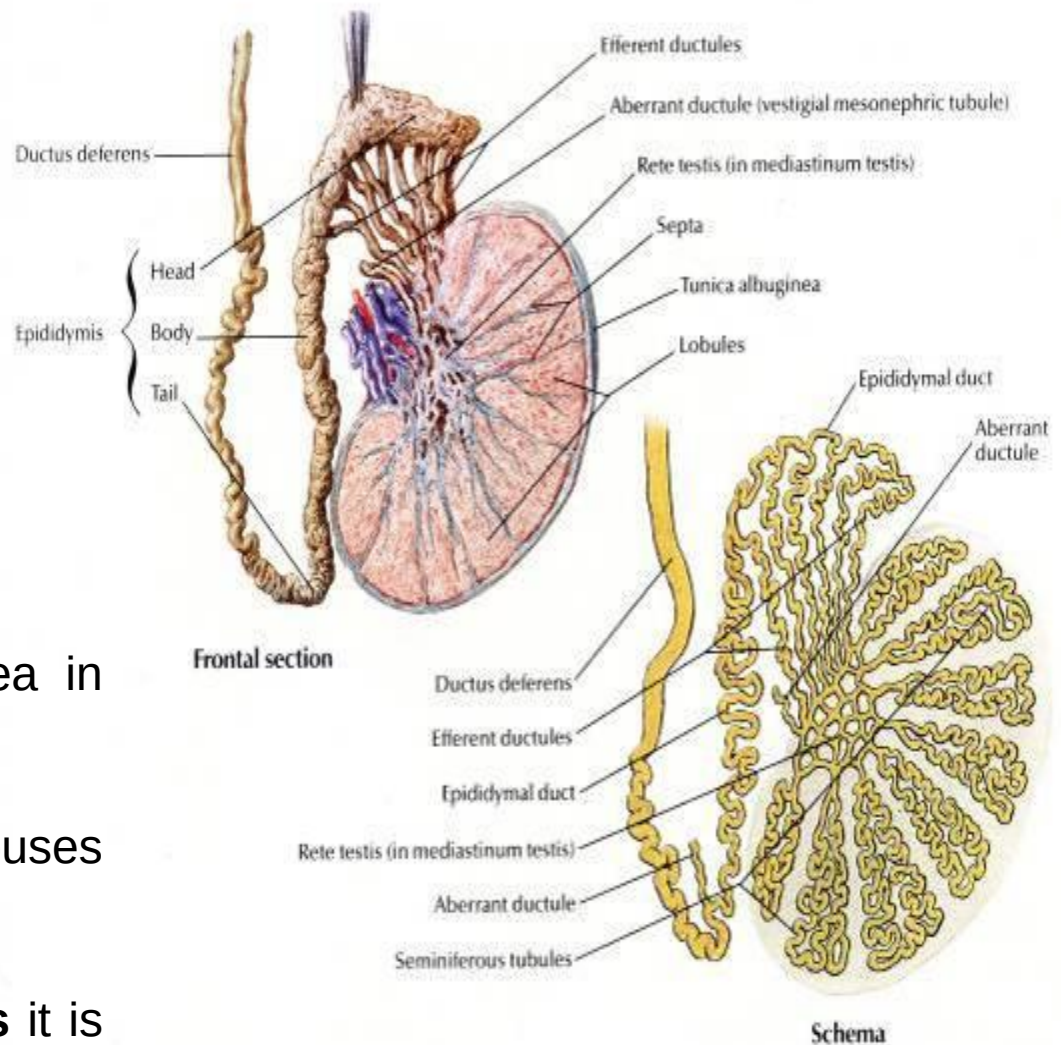
1 – Tunica albuginea

2- Tunica vaculosa

3- Septae (septula testis)

4- Mediastinum testis

- Thickening of the tunica albuginea in the posterior region of the testis.
- It is composed of loose c.t. that houses the rete testis.
- In **stallion**, **tom** and many **rodents** it is located in a posterior position.
- In **dog**, **boar** and **ruminants**, it is centrally located in the testis.



Testes

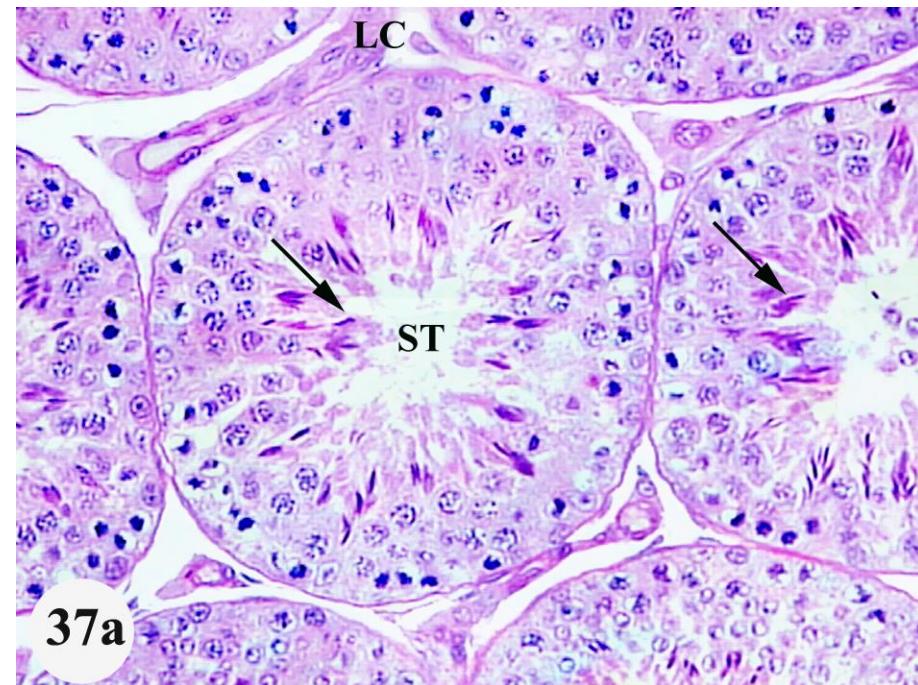
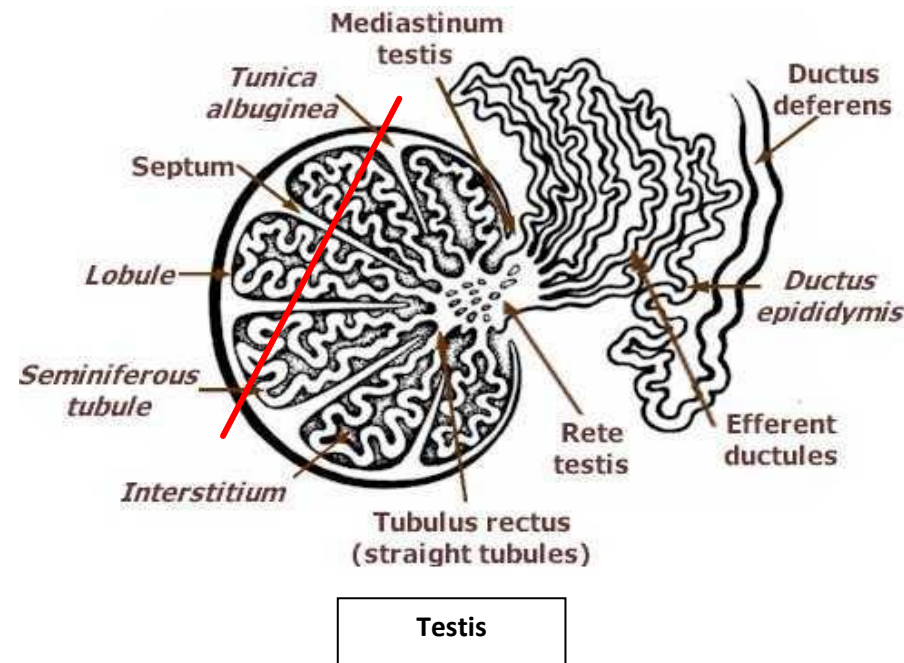
B. Parenchyma

1- Seminiferous tubules (S.T):

- Each testicular lobule is occupied by 1-4 U-shaped seminiferous tubules.
- Can be divided into:
 - Convoluted S.T.
(**Tubuli seminiferi contorti**).
 - Straight S.T.
(**Tubuli seminiferi recti**).

2- Interstitial tissue

- CT between the tubules.
- Contains Leydig cells.



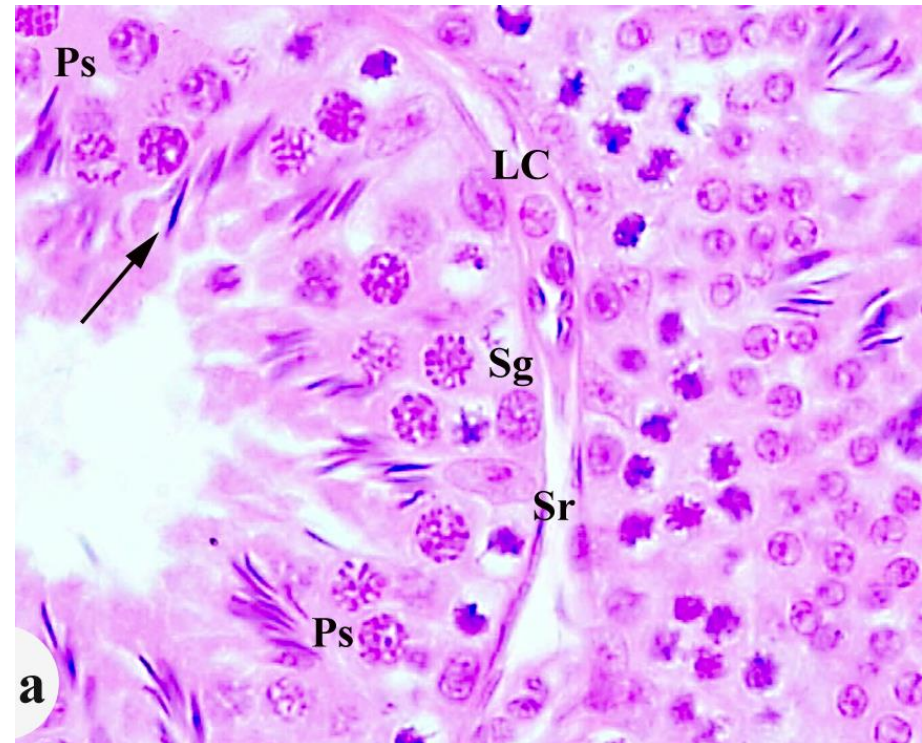
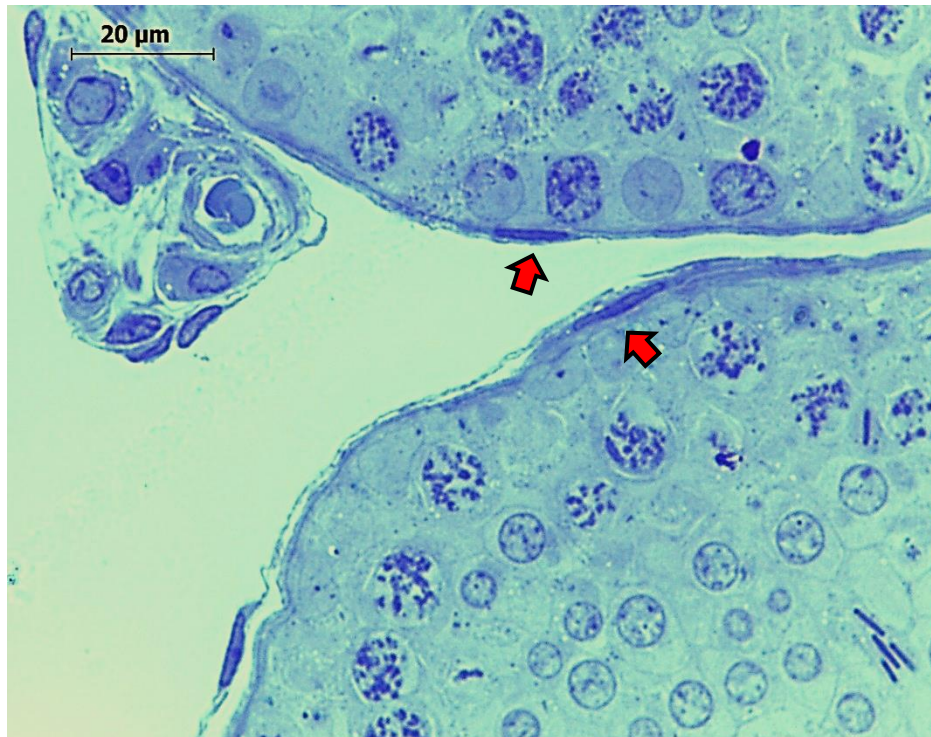
Testes

B. Parenchyma

1- Seminiferous tubules (S.T.):

- Each S.T. surrounded by fibrous c.t. layer with characteristic of smooth muscle fiber (myoid cells).

- Each S.T. lined by stratified epithelium, which consists of two different basic cell types:
 1. Sertoli cells (Sustentacular cell).
 2. Spermatogenic cells of the seminal lineage.



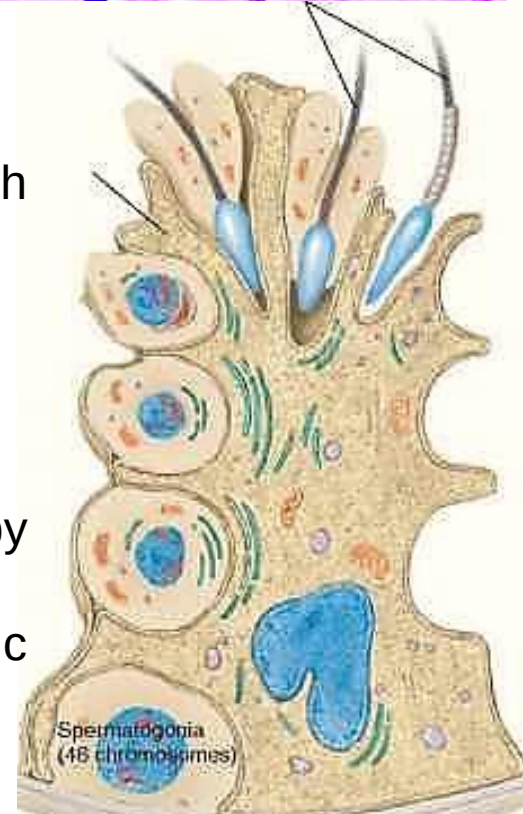
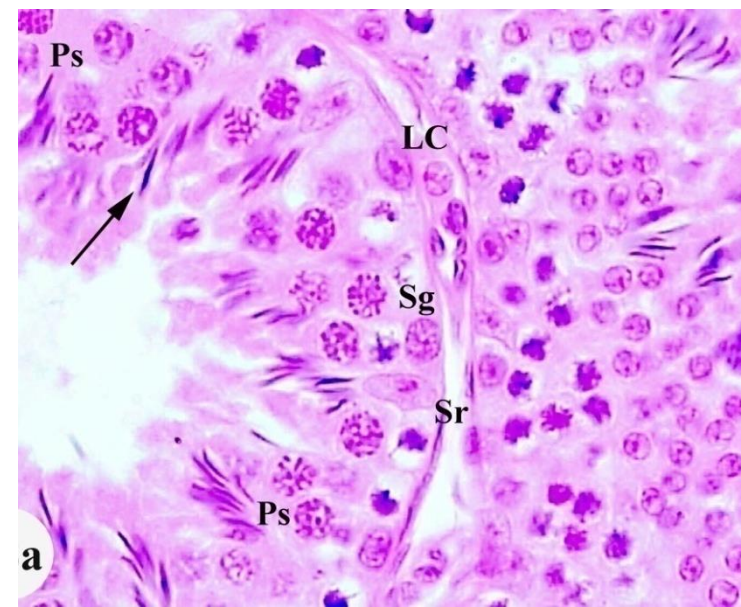
Testes

1- Seminiferous tubules (S.T):

a. Sertoli cells

✓ With L.M.

- Large elongated pyramidal-shaped cells.
- Rest on a basement membrane.
- The apical plasma membranes have irregular “pockets” which house developing sperms.
- Nucleus is large basal oval vesicular with distinct nucleolus.
- Lateral surfaces are irregular and connected to each other by cell junction forming rooms for the developing spermatogenic cells.



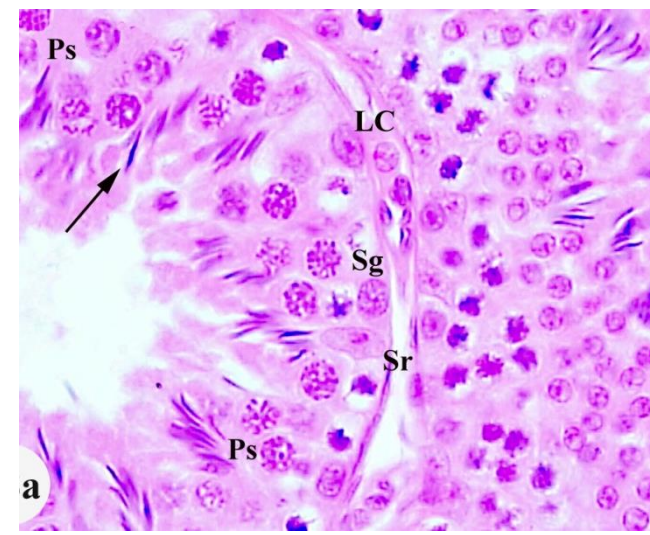
Testes

1- Seminiferous tubules (S.T):

a. Sertoli cells

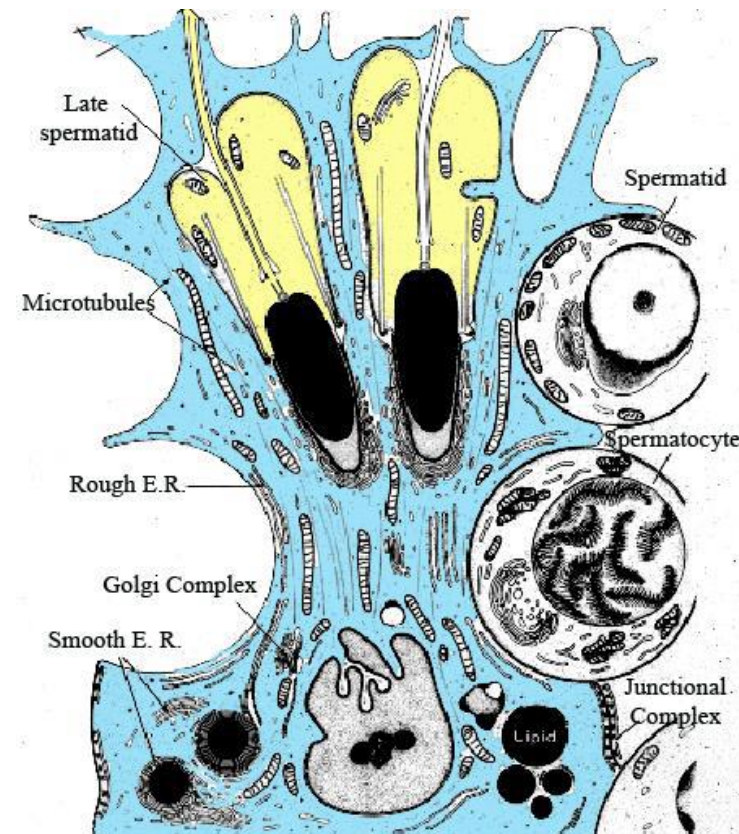
✓ With E.M.

- Abundant SER, lipid granules, mitochondria and lysosomes and adjacent cells sealed by occluding junctions.



❖ Functions of Sertoli cells

1. Nurse cells; provide mechanical and nutritive support for the spermatogenic cells.
2. Secrete inhibin and activin - which provide positive and negative feedback on FSH secretion from the pituitary.
3. Formation of testis-blood barrier.
4. Phagocytosis of spermatid excess fragments.



Testes

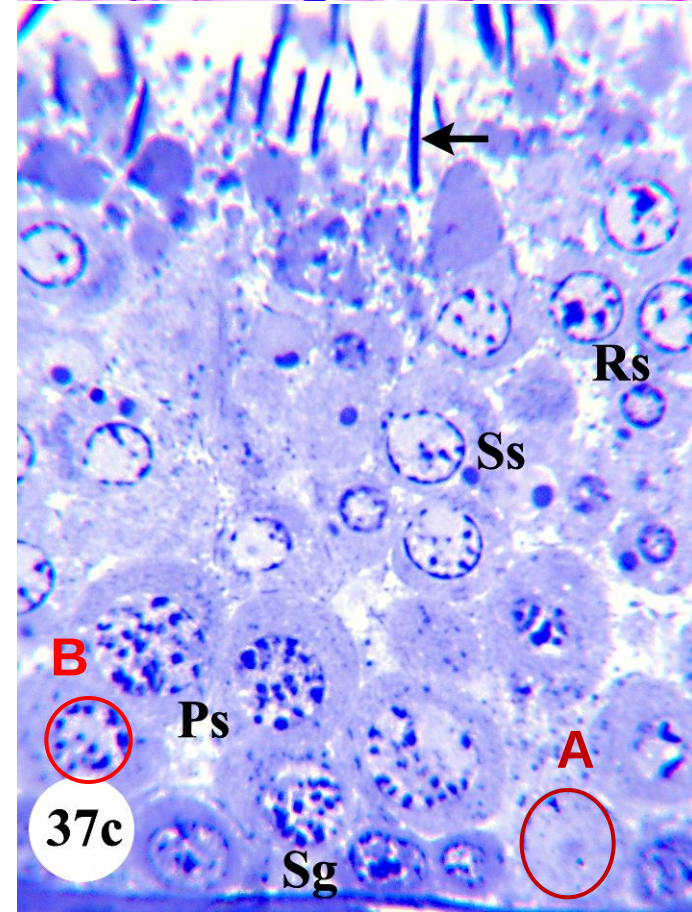
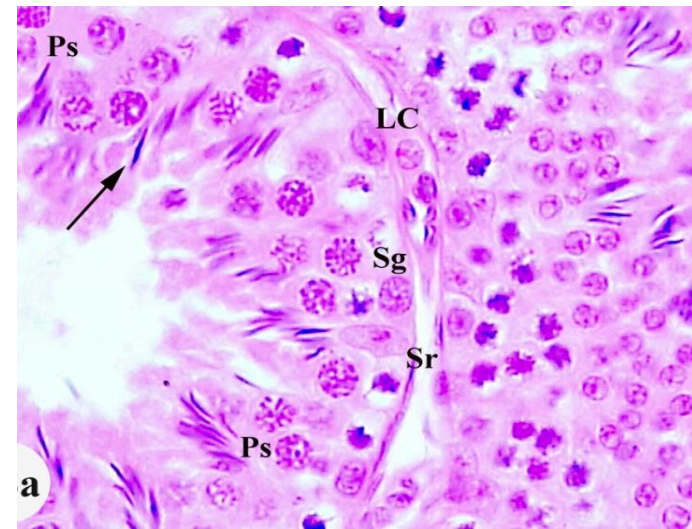
1- Seminiferous tubules (S.T):

b. Spermatogenic cells

- 3-7 layer representing different stages of sperm development.

1. *Spermatogonia*

- ✓ Rounded cells with rounded centrally located vesicular nucleus.
- ✓ Close to the basement membrane of the tubules.
- ✓ 2 types; spermatogonia type A and type B.
 - ***Type A spermatogonia***
By mitosis divide into 50% spermatogonia type A and 50% type B.
 - ***Type B spermatogonia***
By mitosis into primary spermatocytes.



Testes

1- Seminiferous tubules (S.T):

b. Spermatogenic cells

2. Primary spermatocytes

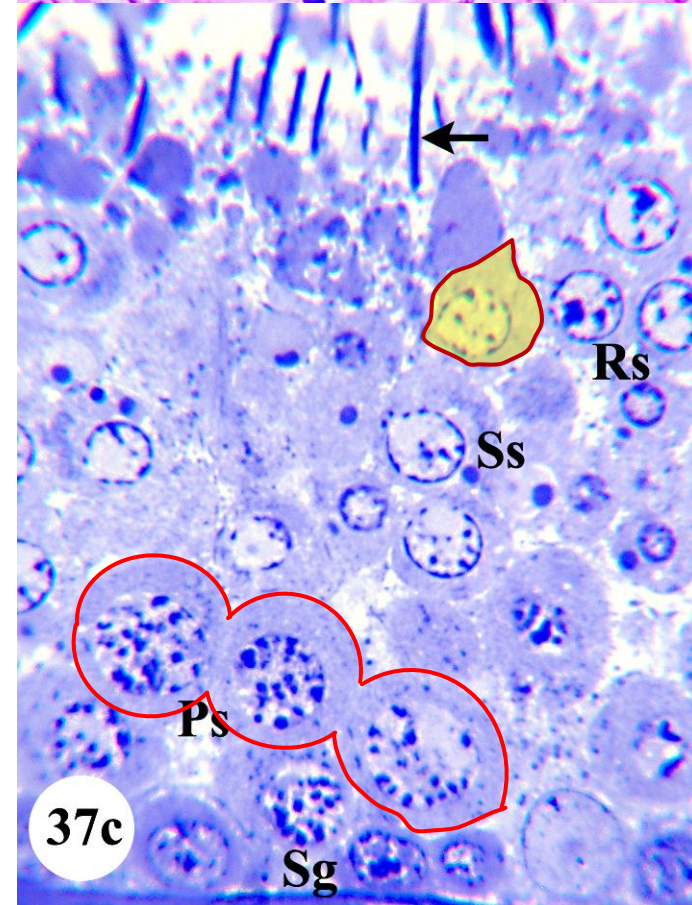
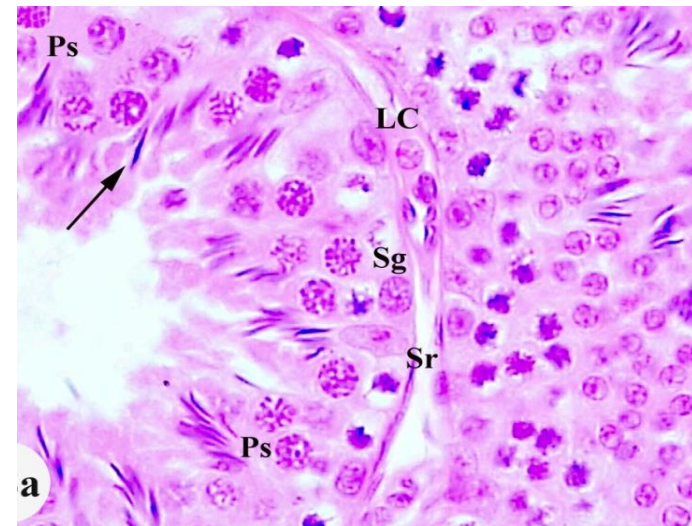
- Largest cells.
- Rounded with large rounded central nucleus.
- Divide by meiosis giving secondary spermatocytes.

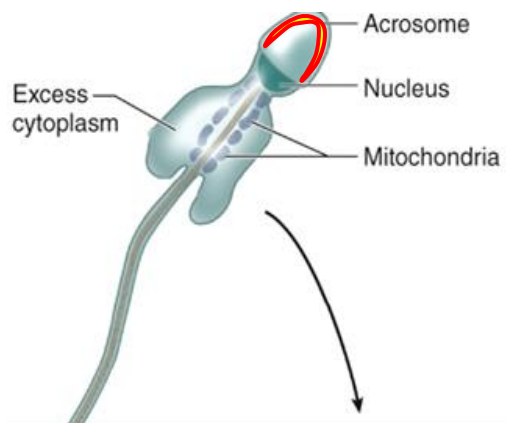
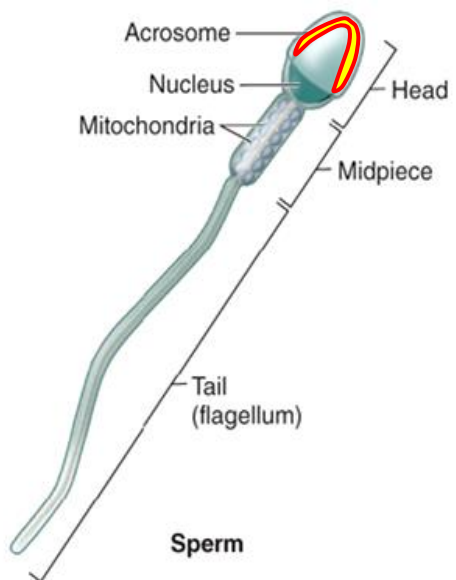
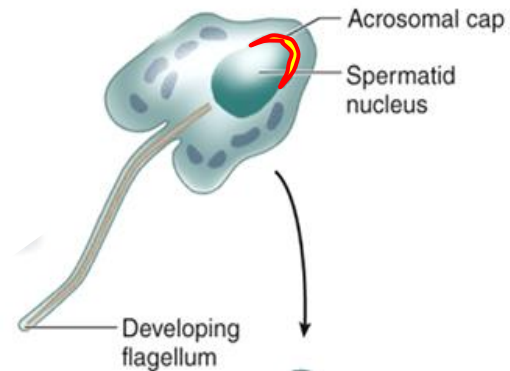
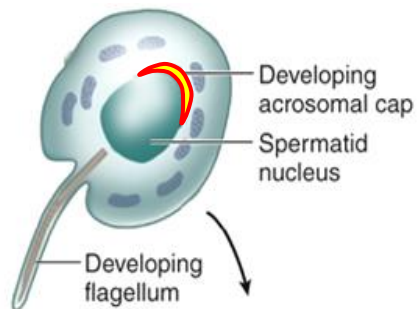
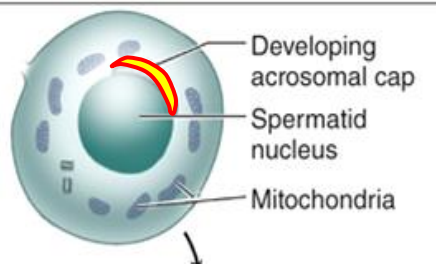
3. Secondary spermatocytes

- Rounded cells with central rounded nucleus.
- Smaller than primary spermatocytes.
- Contain haploid number of chromosomes.
- Rapidly dividing cells into spermatids (not usually seen).

4. Spermatids

- Located close to the seminiferous tubule lumen.
- Small rounded cells with central rounded nucleus.
- Metamorphosed (without division) into sperms.







Testes

1- Seminiferous tubules (S.T):

b. Spermatogenic cells

5. Sperm cells (spermatozoa)

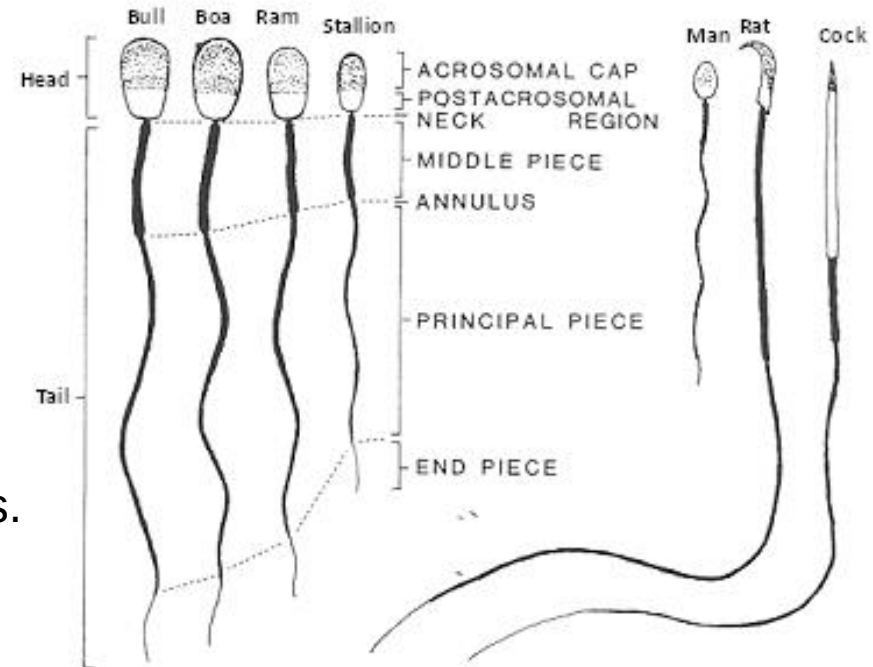
➤ With LM

- Elongated structure formed of
 1. Head (containing the nucleus)
 2. Tail (extension from it).

➤ With EM

1- Head

- Shapes are different according to species.
- Nucleus (half number of chromosomes).
- Acrosomal cap covers anterior portion of the nucleus; it contain hydrolytic enzymes to penetrate the ovum.



Testes

1- Seminiferous tubules (S.T):

b. Spermatogenic cells

5. Sperm cells (spermatozoa)

- With EM

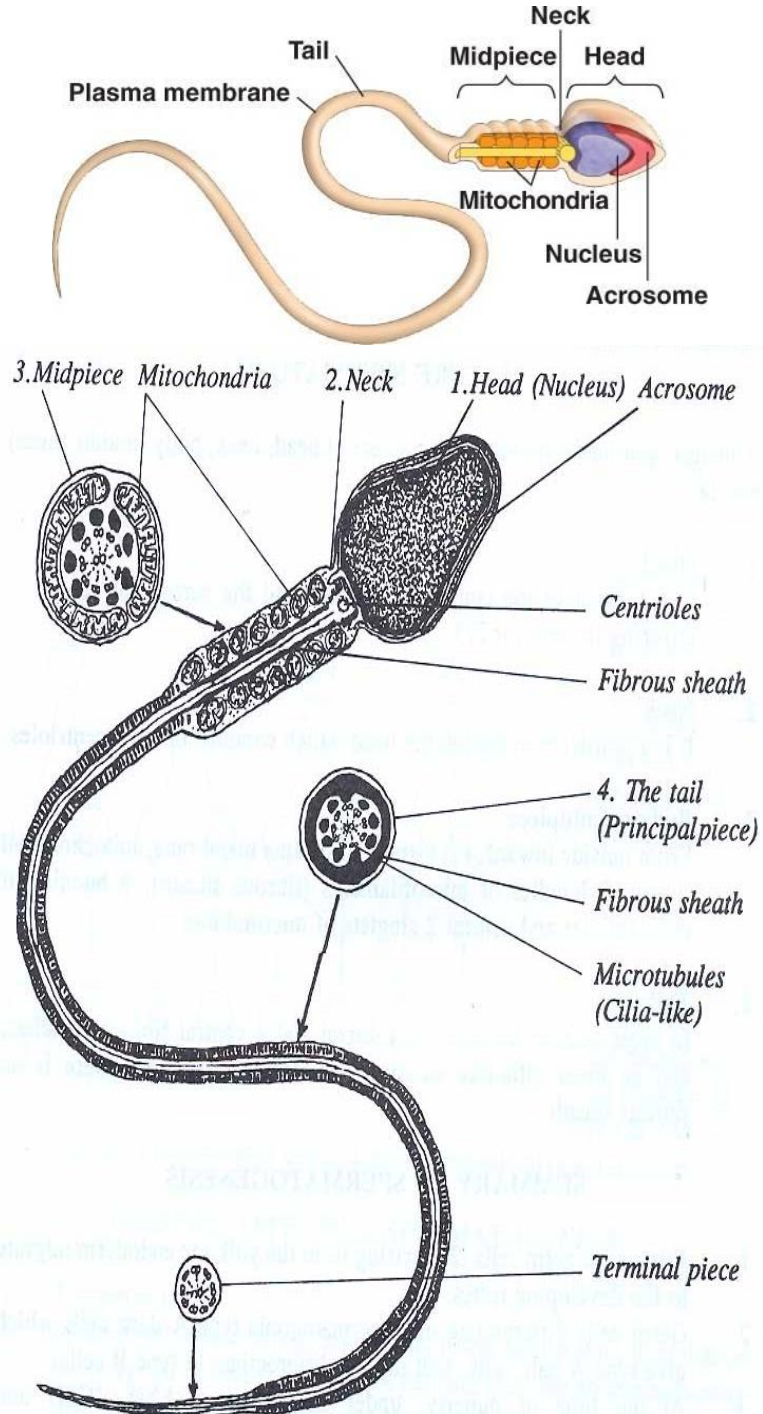
2- Tail

a. Neck

b. Middle piece

c. Principle piece

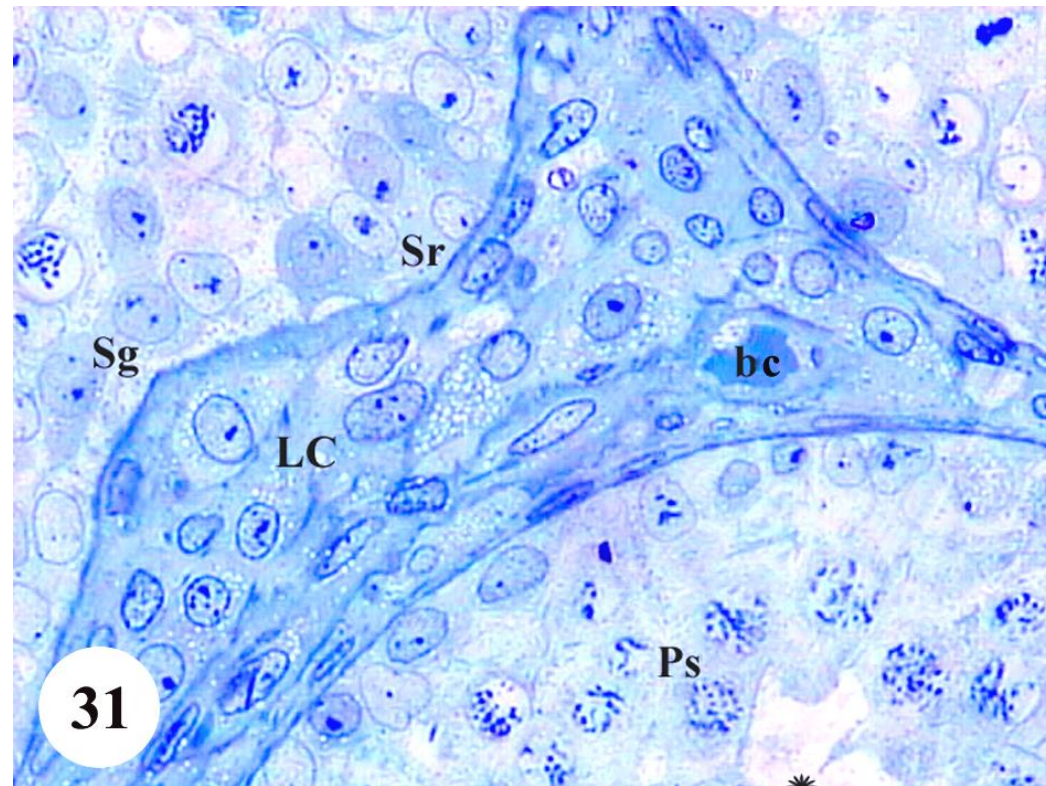
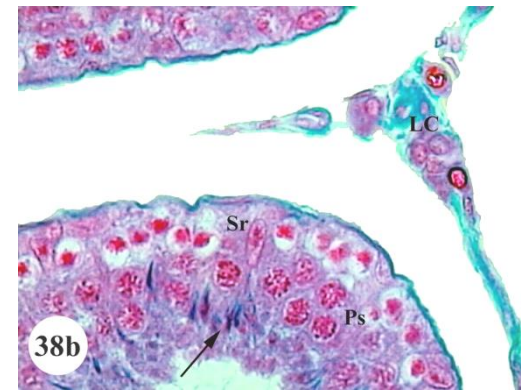
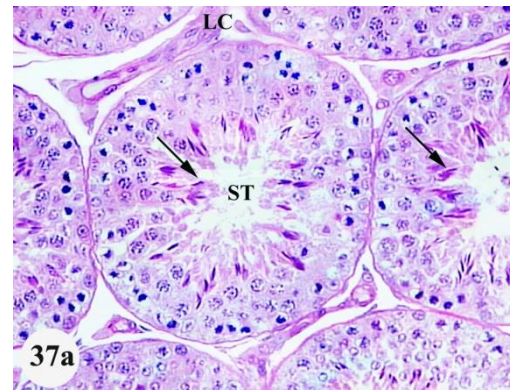
d. End piece

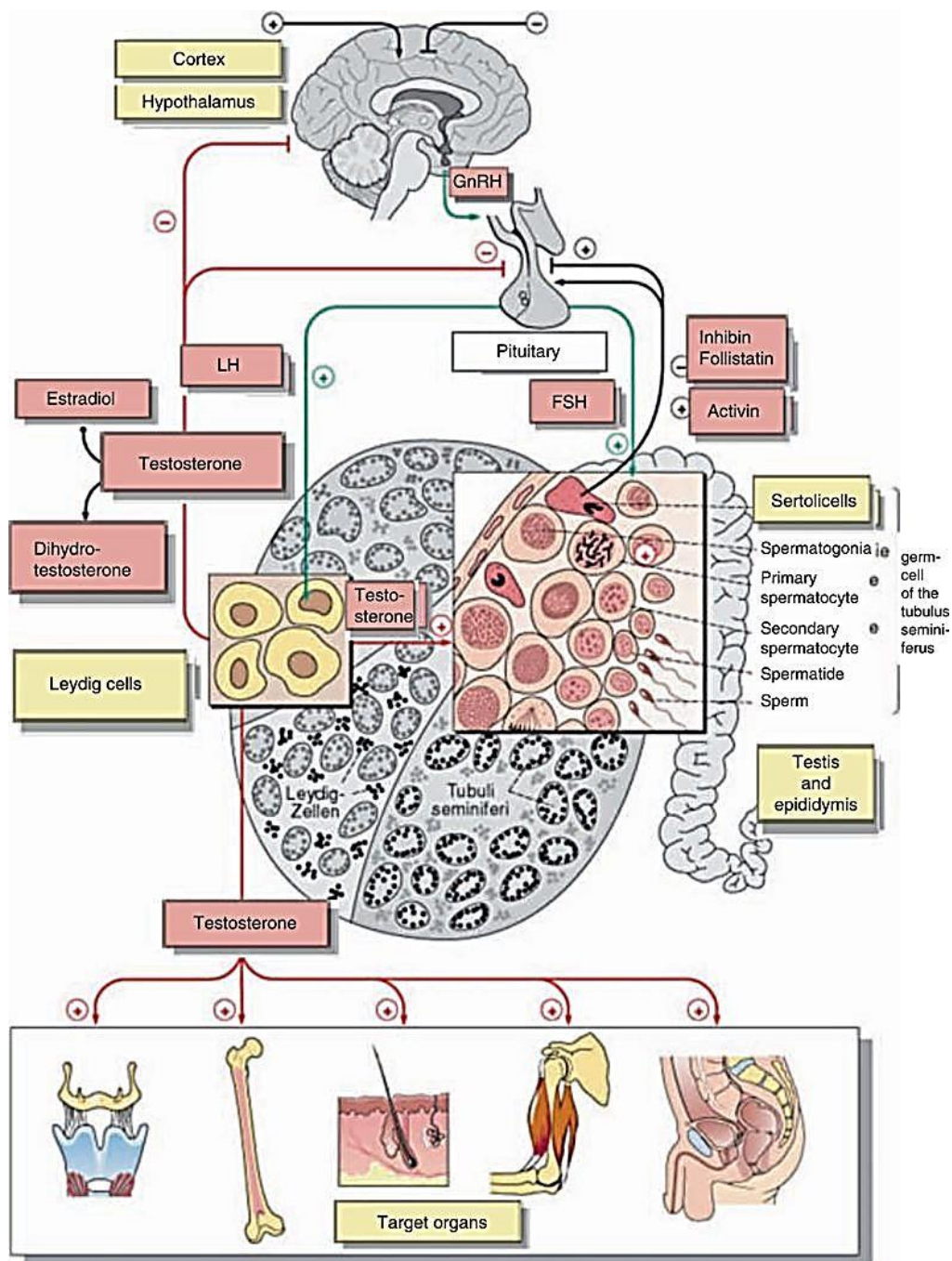


Testes

2- Interstitial tissue

- CT between the tubules.
- Contains Leydig cells which secrete male sex hormone; *testosterone*.
- With LM
 - Leydig cells are clusters of polyhedral cells with vacuolated cytoplasm (lipids) separated by blood vessels.
- with EM
 - Has well developed smooth endoplasmic reticulum and abundant mitochondrial and many lipid droplets.





DUCT SYSTEM

Intra-testicular duct system

1

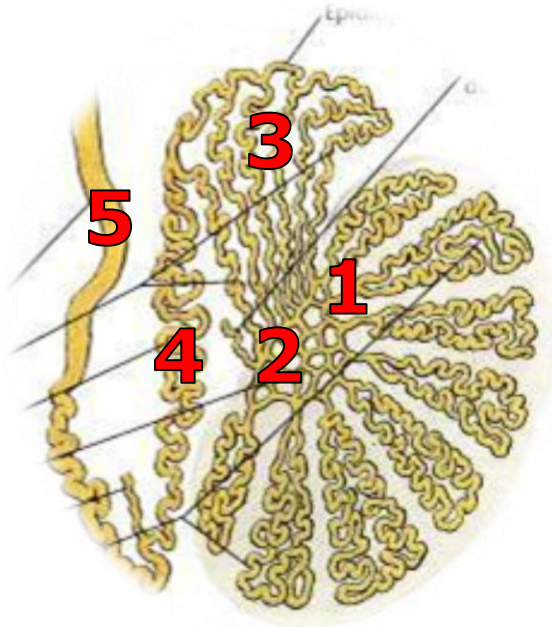
Tubuli recti

2

Rete Testis

3

Ductuli efferentes



Extra-testicular duct system

4

Epididymis

5

Ductus deferens

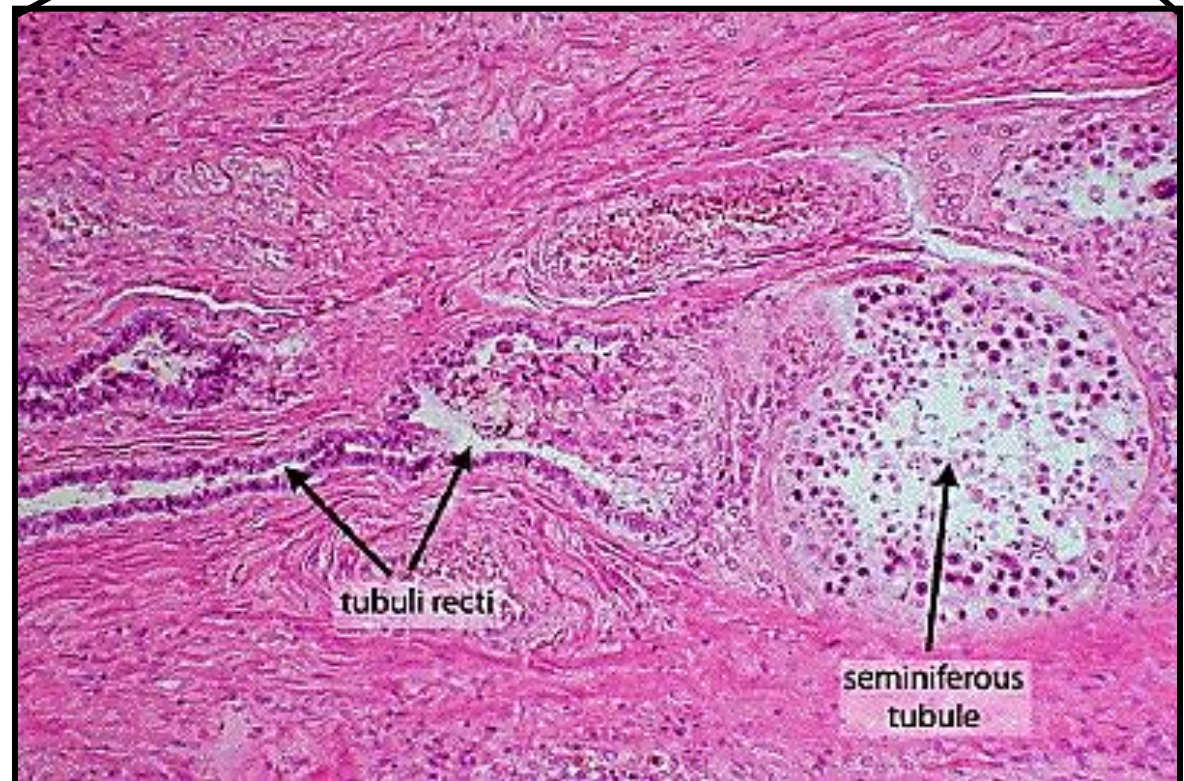
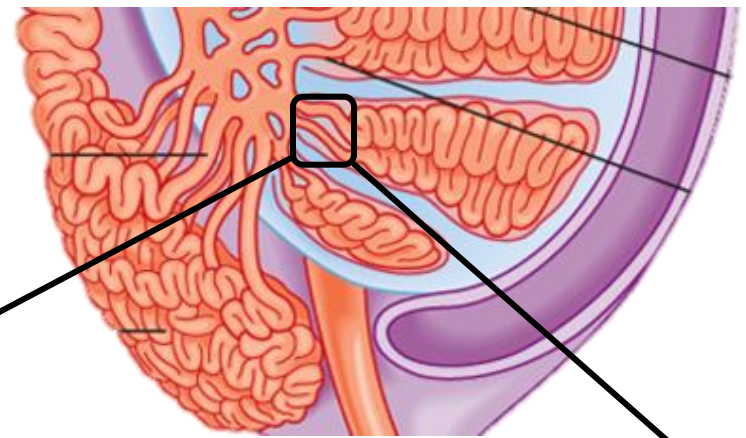
DUCT SYSTEM

A. Intra-testicular duct system

1- Tubuli recti.

They are lined with:

- 1- High columnar ciliated cells.
- 2- Low columnar cells.
- 3- Basal cells .

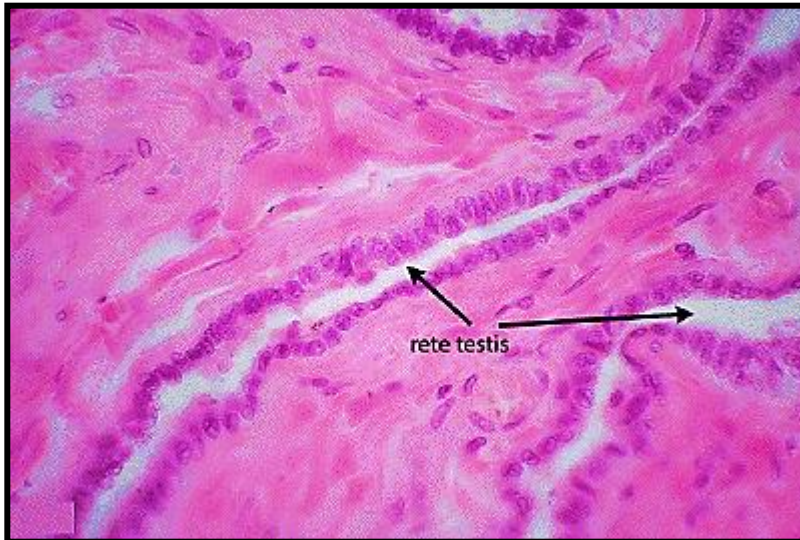
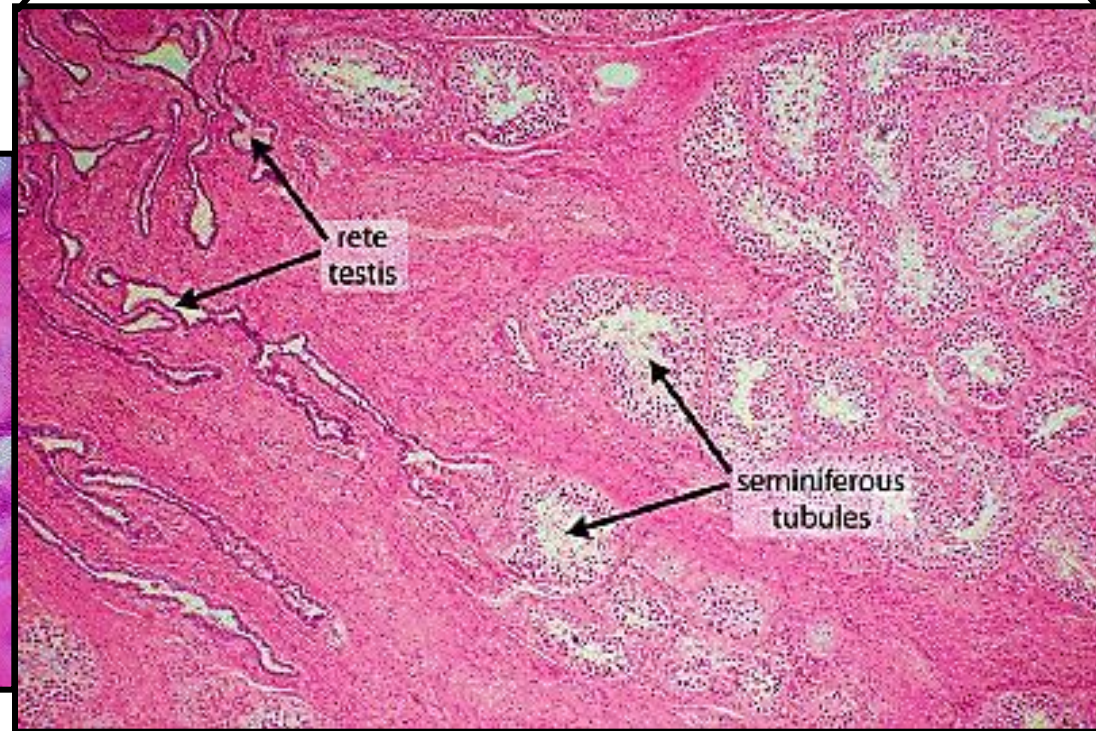
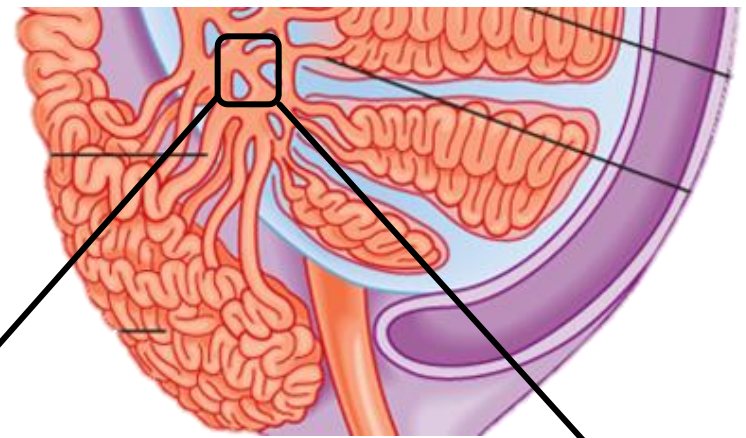


DUCT SYSTEM

A. Intra-testicular duct system

2- Rete Testis

- Network of tubules.
- They occupy most of the space within the mediastinum testis.
- lined with a simple cuboidal epithelium.

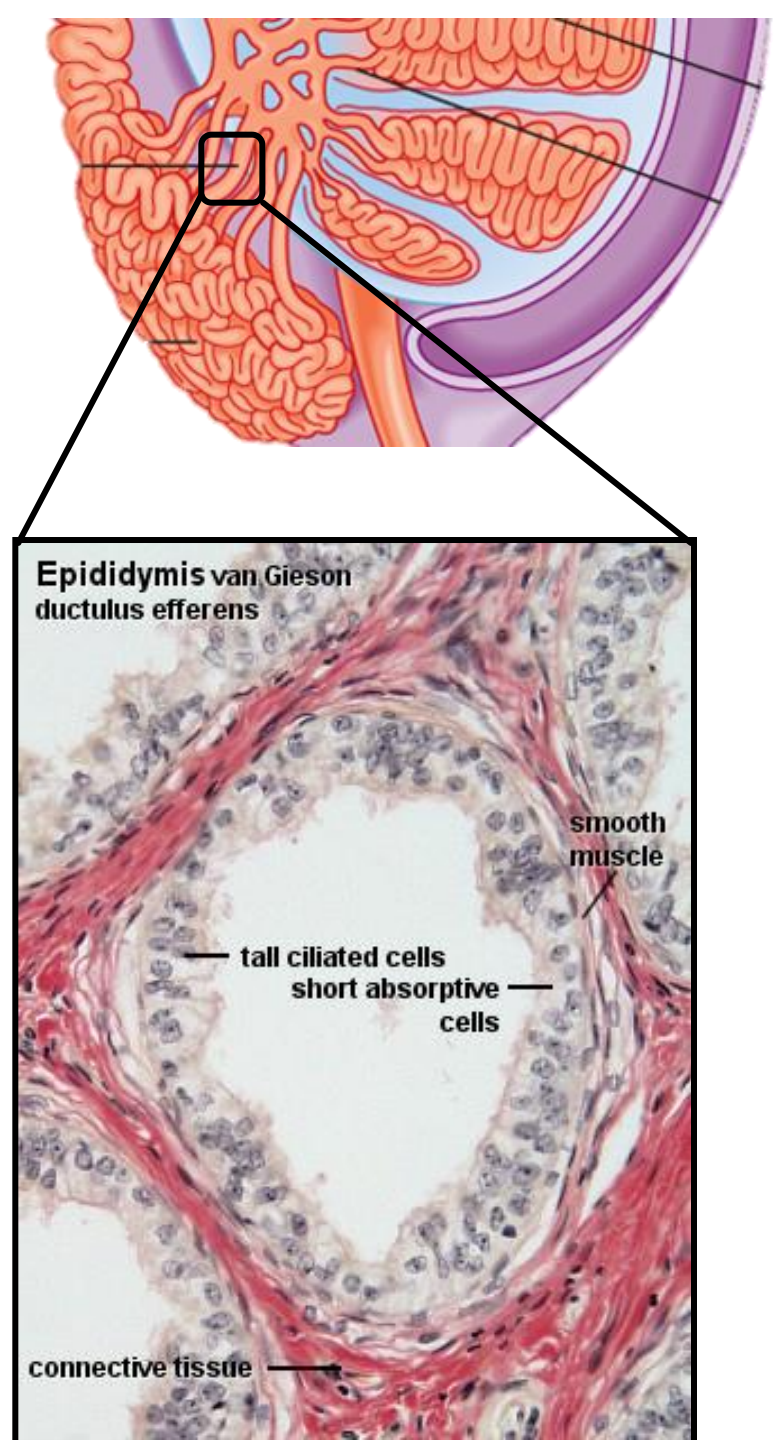


DUCT SYSTEM

A. Intra-testicular duct system

3- Ductuli efferentes

- Convolutured tubules.
- Are lined with pseudostratified columnar :
 - Ciliated** (involved in moving sperms forward) .
 - Not ciliated** (involved with fluid absorption).
- Surrounded with a thin layer of smooth muscle.



DUCT SYSTEM

A. Extra-testicular duct system

1- Ductus epididymis

- Highly coiled and tortuous long single duct.
- It is divided into 3 segments; **head**, **body** and **tail**.

i. Mucosa

a. Lamina epithelialis

Pseudostratified columnar epithelium with **stereocilia**.

b. Lamina propria

CT is underneath the epithelium.

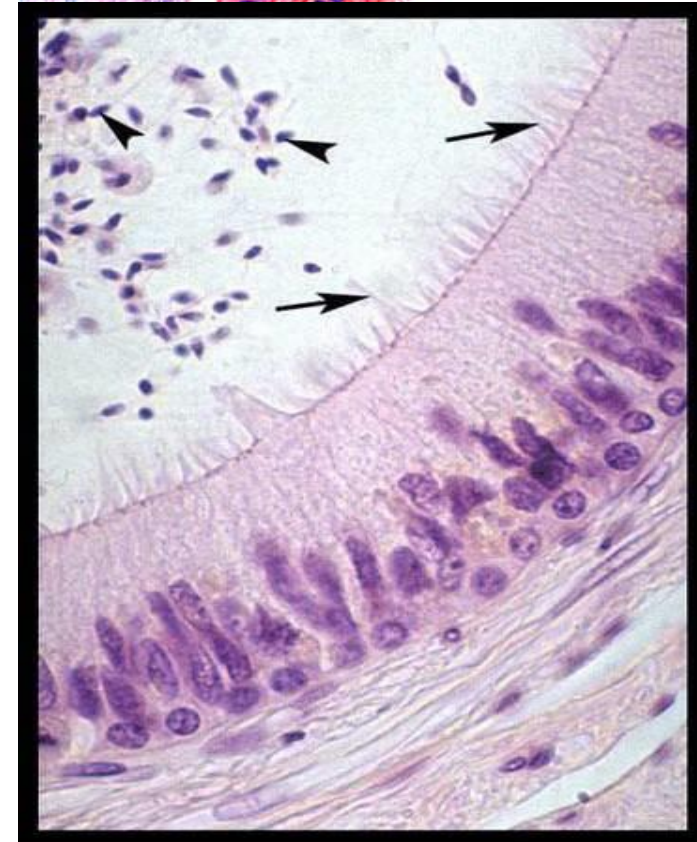
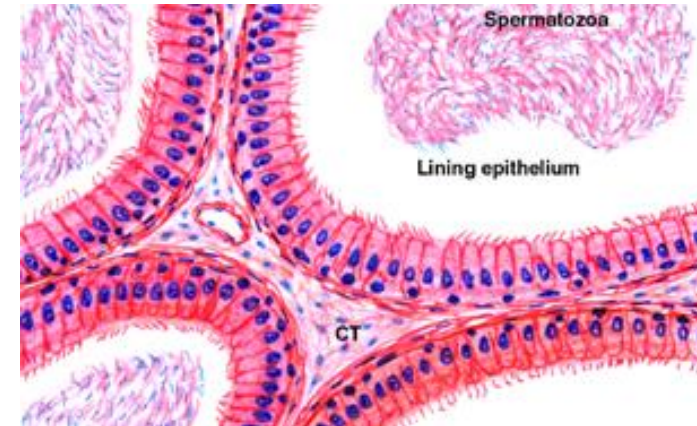
ii. Muscular layer

- Smooth muscle arranged:

Head	Circumferentially
Body	Inner circular and outer longitudinal
Tail	Circular, oblique and longitudinal

❖ Function

Sperm maturation occurs in epididymis.



DUCT SYSTEM

A. Extra-testicular duct system

2. Ductus deferens

i. Mucosa (folded)

a. Lamina epithelialis

Pseudostratified columnar epithelium with long *stereocilia*.

b. Lamina propria-submucosa

Connective tissue.

ii. Muscularis

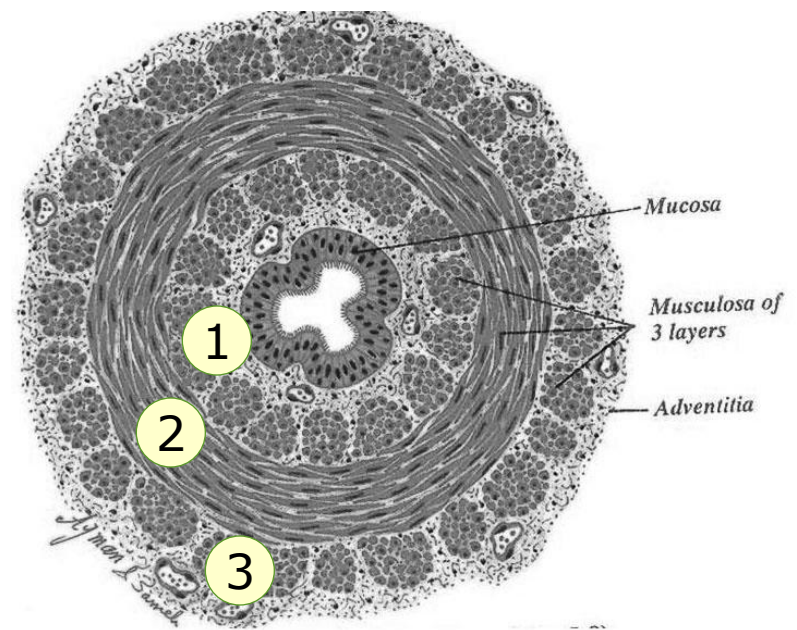
- Very thick smooth muscles arranged into;
 - 1) Inner longitudinal.
 - 2) Middle circular.
 - 3) Outer longitudinal.

iii. Adventitia

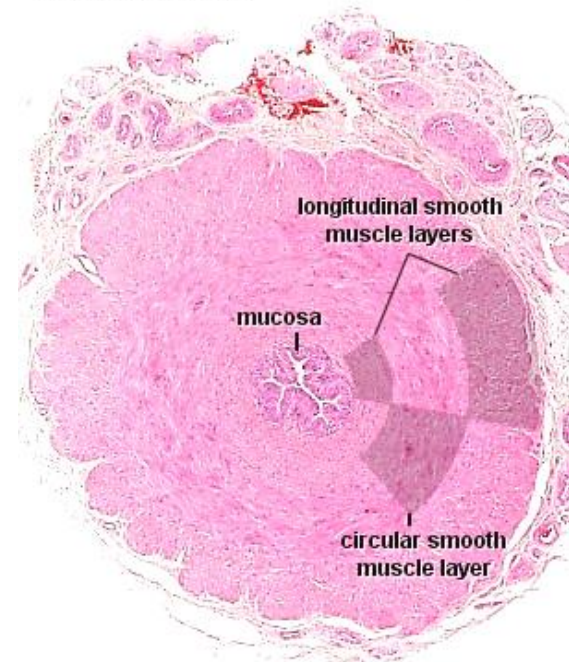
- Connective tissue.

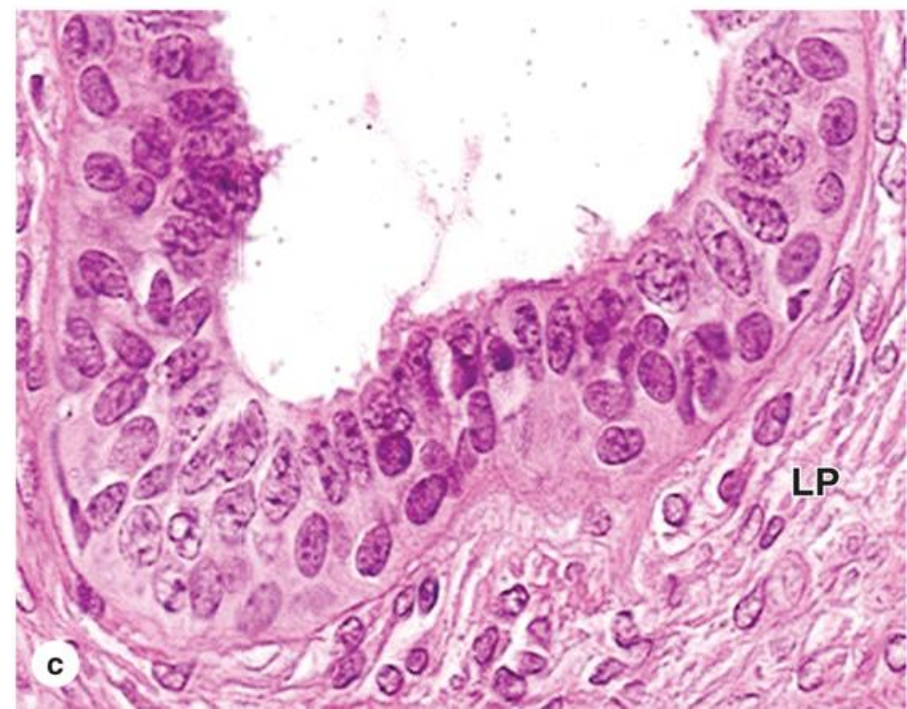
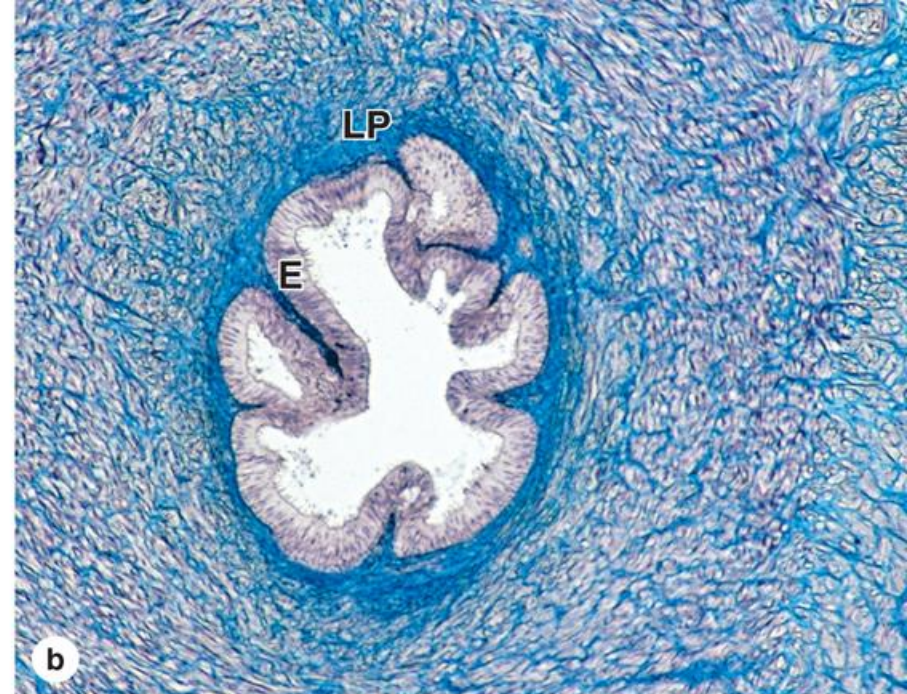
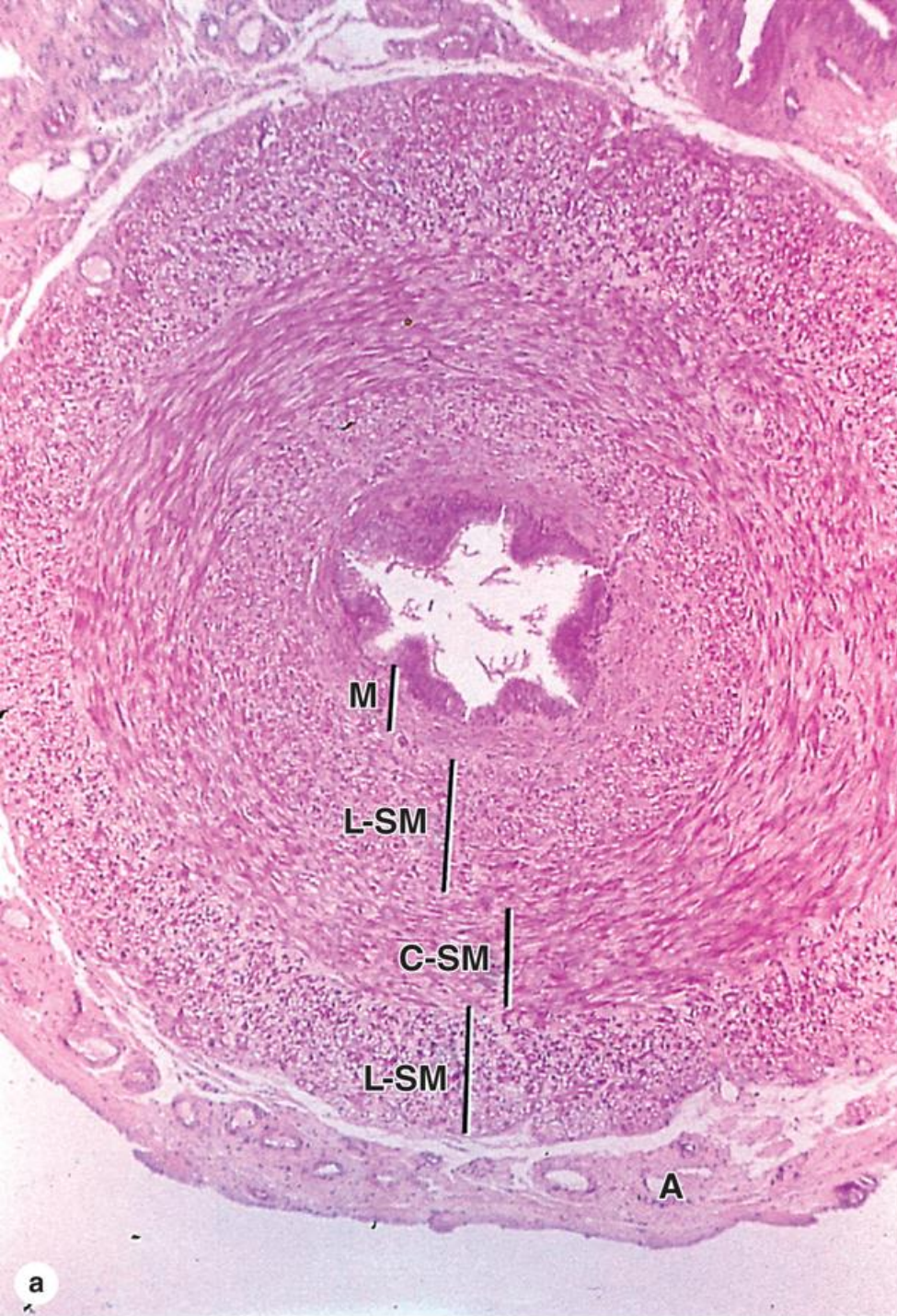
❖ Function

Strong contractions of the muscular layers expel the sperms in ejaculation.



Vas deferens H&E





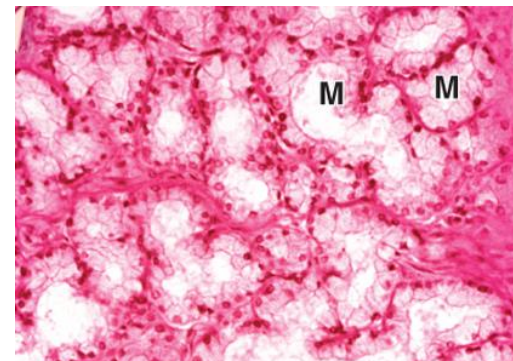
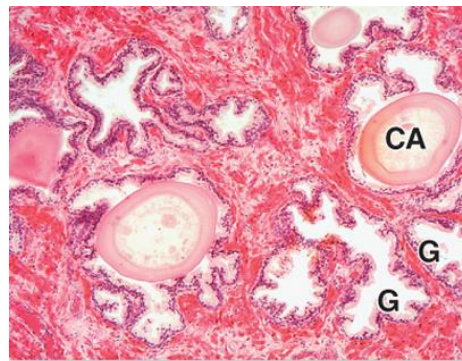
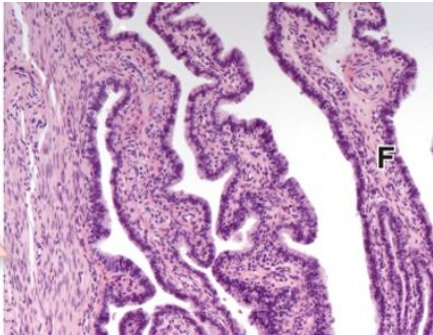
ACCESSORY GENITAL GLANDS

*Seminal vesicles
or vesicular
glands*

*Ampulla ductus
deferens*

Prostate

Bulbourethral glands



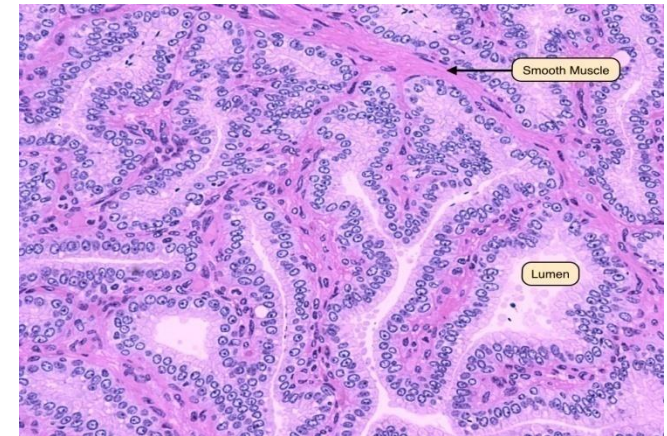
ACCESSORY GENITAL GLANDS

1- Seminal vesicles or vesicular glands

- Compound tubuloalveolar glands.
- Secretory end-pieces are lined with **simple columnar epithelium**.
- Ducts are lined with **stratified columnar epithelium**.
- Absent in **camel**, **dog** and **cat**.

❖ Function:

- They secrete seminal fluid, which serves as a vehicle for the transport of spermatozoa and is important for its nourishment (fructose rich fluid).



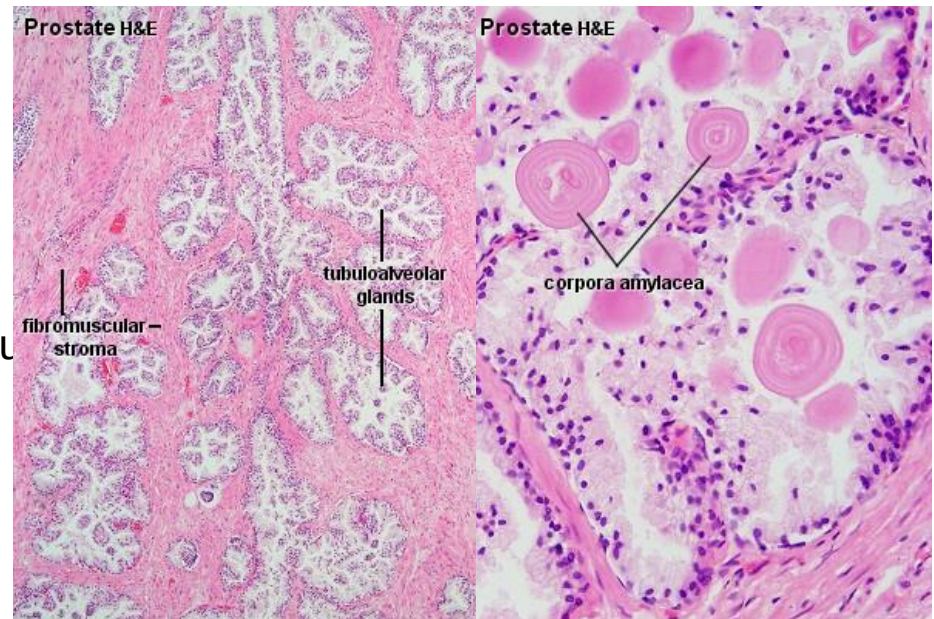
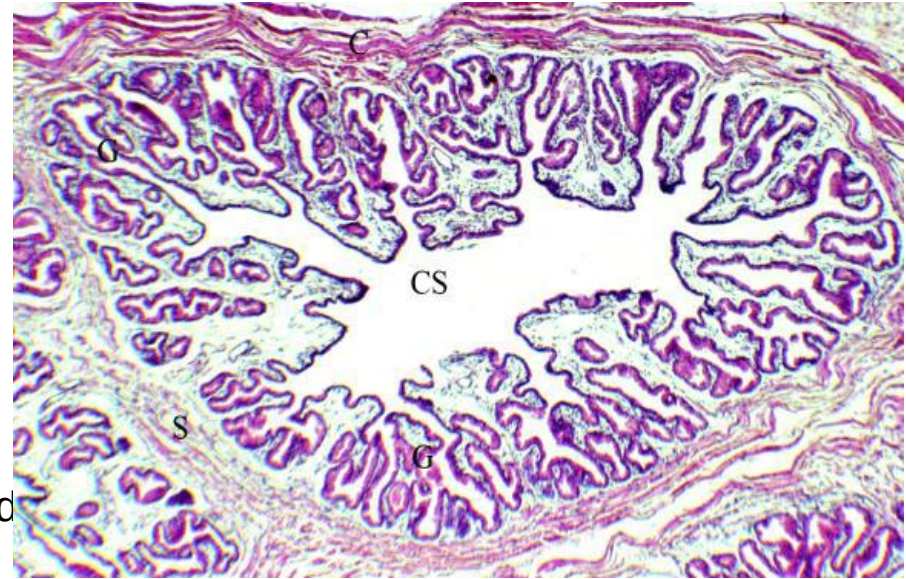
Seminal Vesicle H&E



ACCESSORY GENITAL GLANDS

2- Prostate

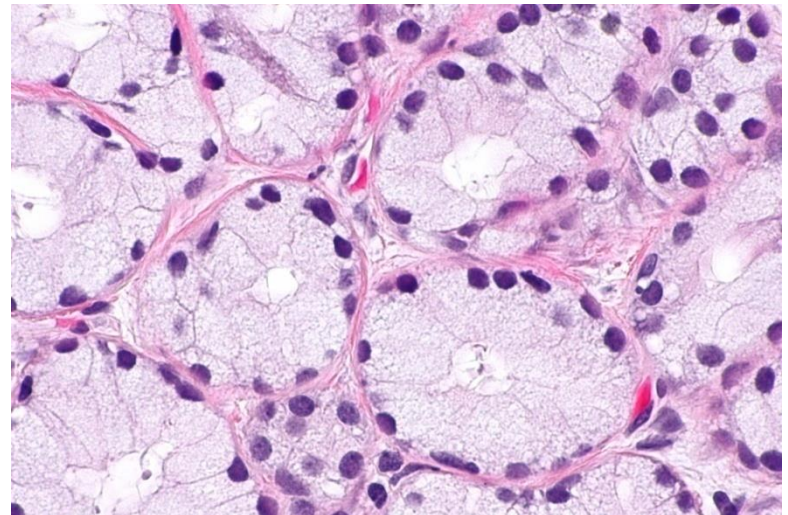
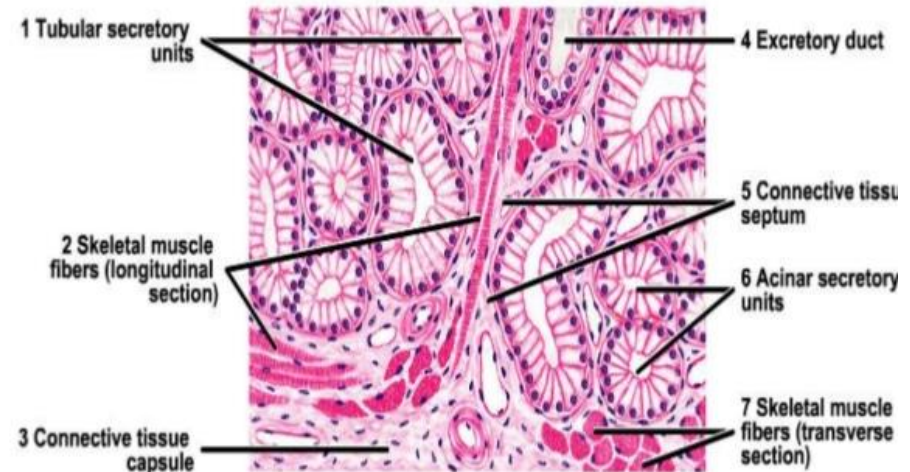
- Largest of the accessory genital glands.
- Absent in **sheep** and **goats**.
- It is composed of tubulo-alveolar glands with excretory ducts opening into the urethra.
- The glands are embedded in a fibromuscular stroma and enclosed in a fibroelastic capsule.
- The secretory end-pieces of this gland are lined with **simple columnar epithelium**.
- Corpora amylacea (prostatic concretions) are laminated bodies in the acini and may be calcified.
- **Function:**
- Clean and lubricate genital tract and urethra just before ejaculation.
- Prostatic fluid helps to neutralize acid vaginal secretions.



ACCESSORY GENITAL GLANDS

3- Bulbourethral glands

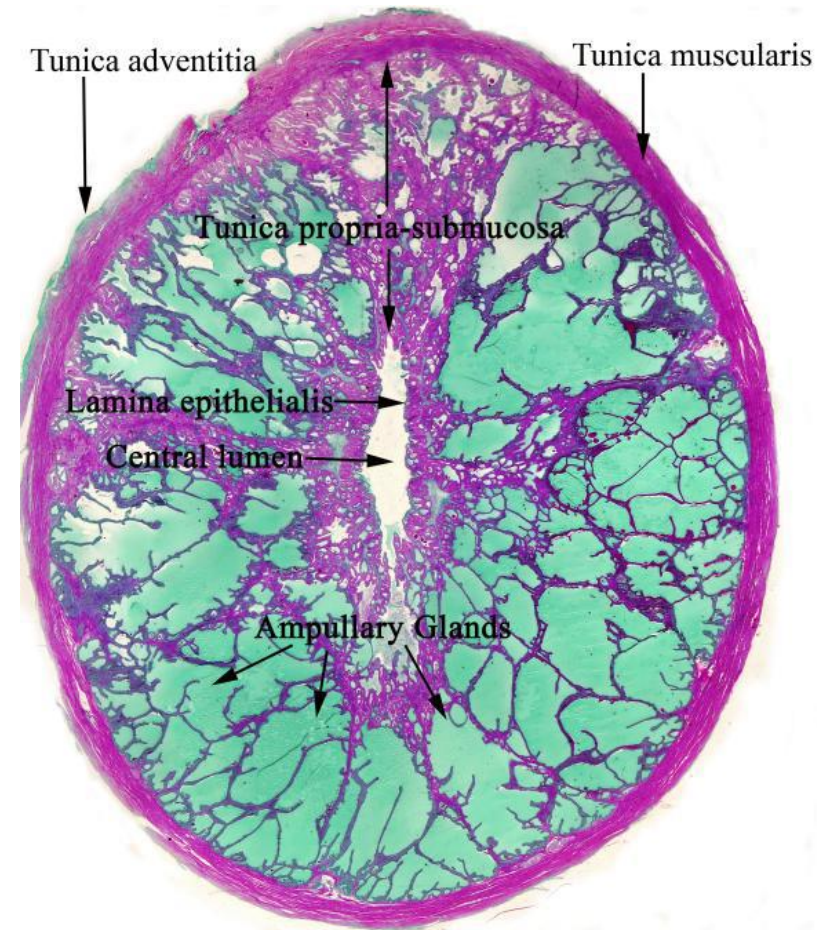
- Paired, compound, tubuloalveolar glands open by ducts into the penile urethra.
- Lined with **simple columnar epithelium**.
- Covered with capsule of dense CT contains some smooth muscle.
- All domestic species have these glands except the **dog**.
- **Function:**
- Secrete mucous fluid, which serves to clear the urethra from urine and to lubricate it and the vagina.



ACCESSORY GENITAL GLANDS

4. Ampulla ductus deferens

- An enlargement of the ductus deferens in its terminal portion.
- Branched tubular gland lined by **simple columnar epithelium**.
- Absent or poorly developed in **boars**.
- The function of its white serous secretion is not known.



Comparative of accessory sex gland

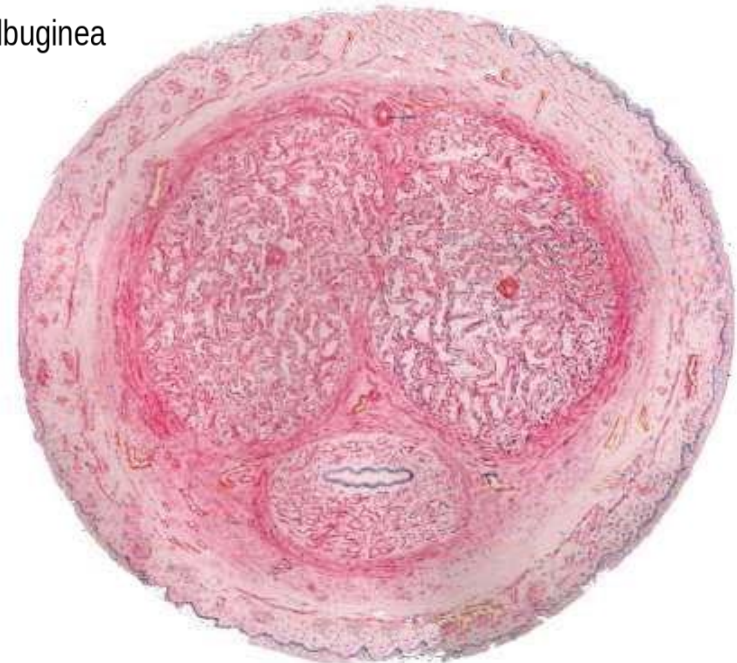
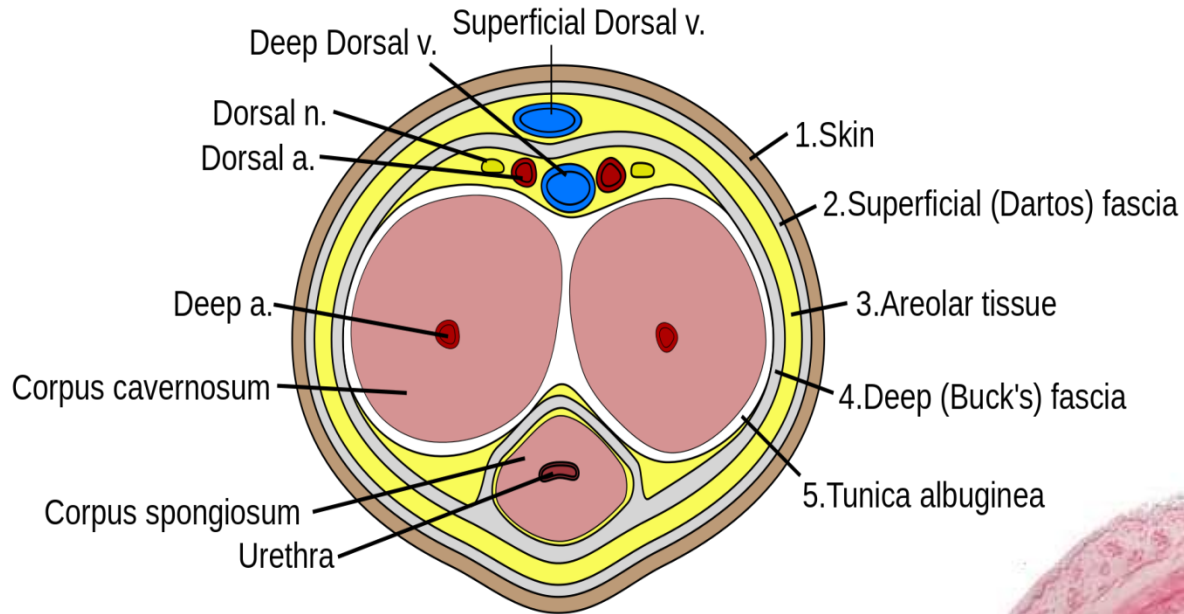
Animals	Seminal vesicle	Ext. prostate	Int. prostate	Bulbourethral	Ampulla
Horse	+	+	-	+	+
Ox	+	+	+	+	+
Sheep&goat	+	-	+	+	+
Camel	-	+	+	+	+
Dog	-	+	-	-	+
Cat	-	+	+	+	+
Pig	+	+	+	+	-

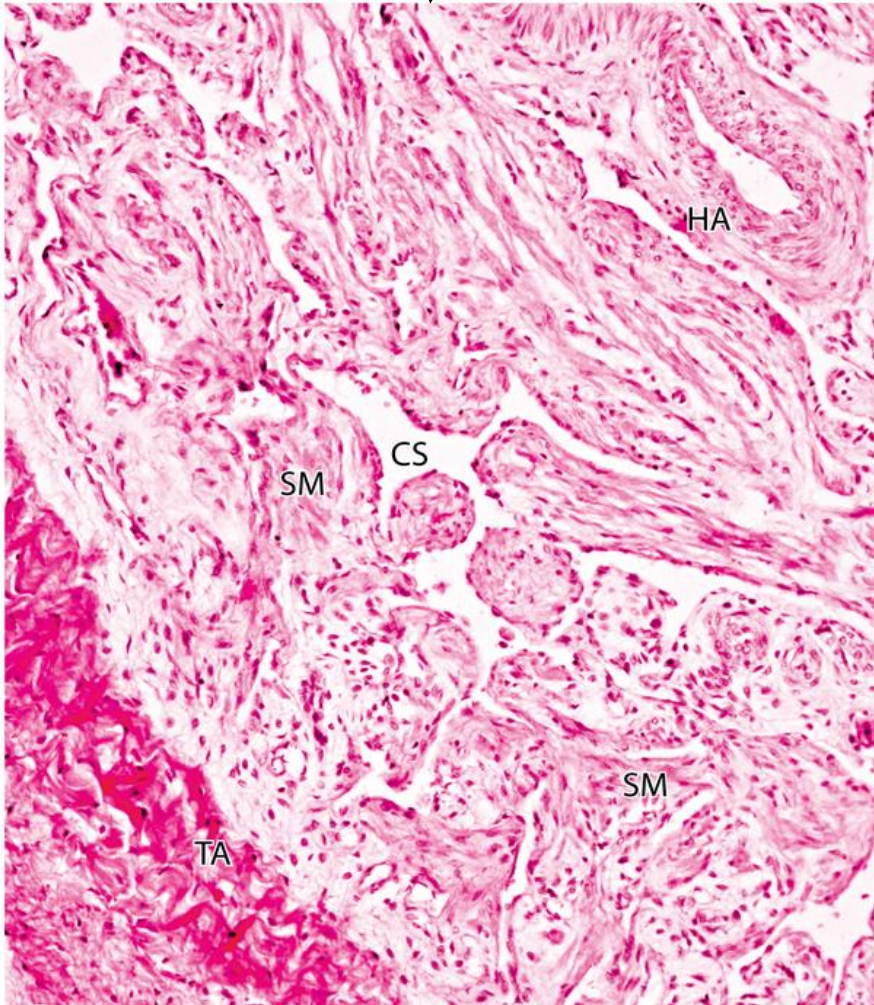
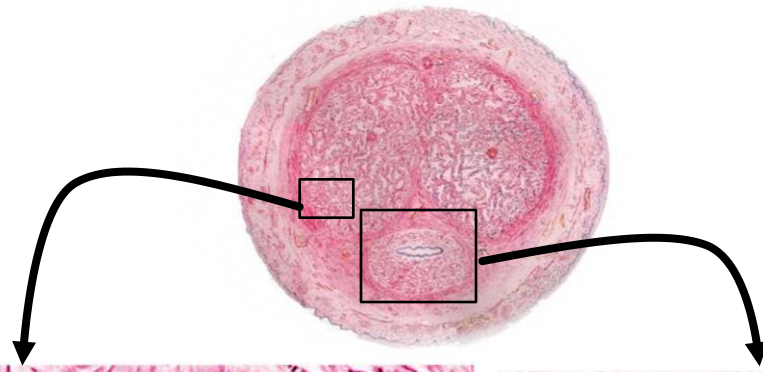
PENIS; THE ORGAN COPULATOR

- 3 parts; root, body and glans penis.
- **Basic architecture**
 1. Outside **skin**.
 2. **Tunica albuginea**; dense CT dividing the penis into spaces.
 3. The penile tissue formed of cylinders of erectile tissues and the penile urethra.
 4. The single **corpus spongiosum** encloses the urethra and enlarges terminally into the glans penis.
 5. **Corpora cavernosa** are paired, parallel and dorsal cylinders of erectile tissues extending only as far as the glans.

PENIS; THE ORGAN COPULATOR

- 3 parts; root, body and glans penis.

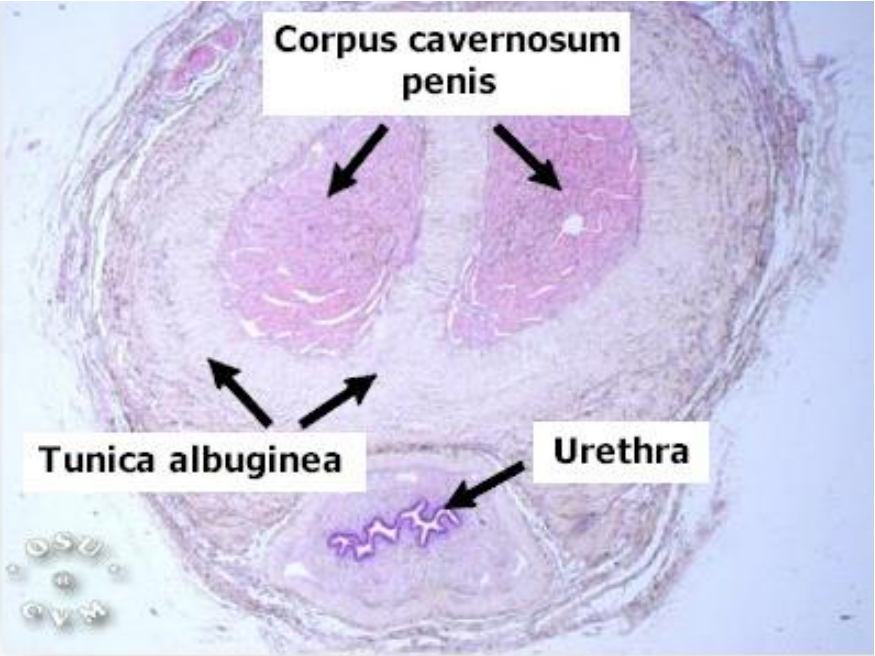




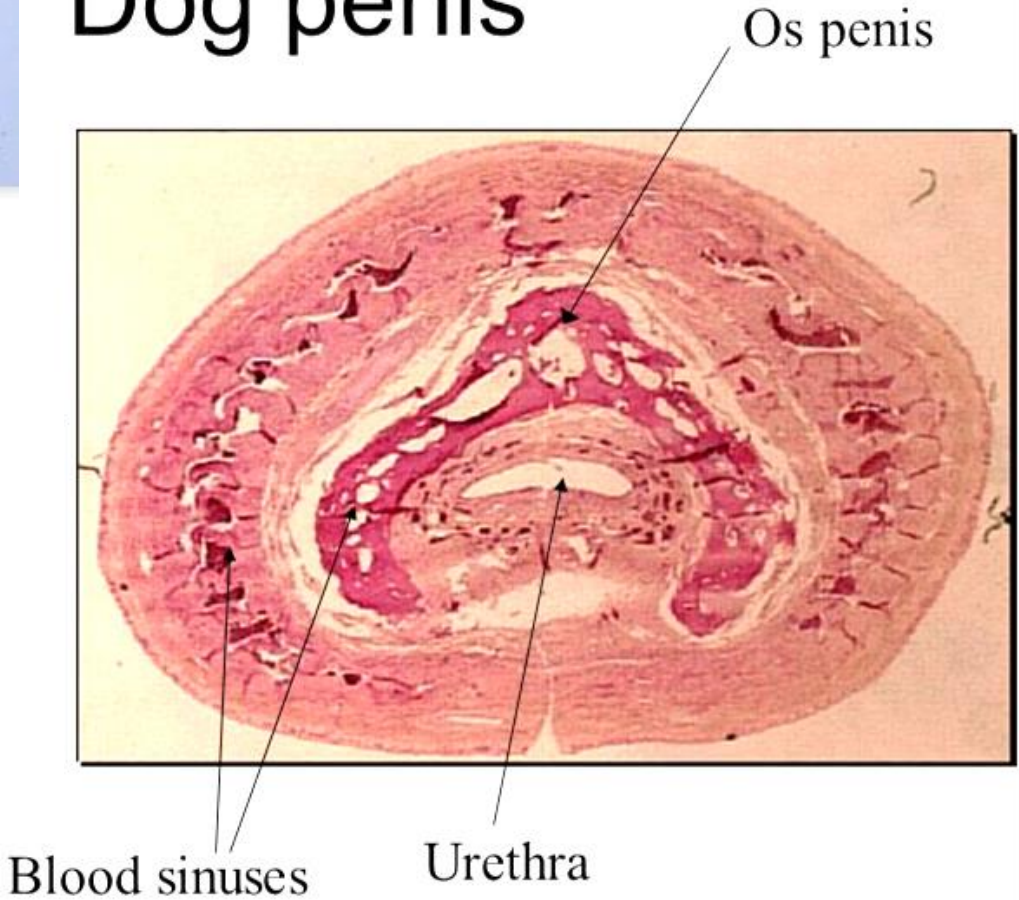
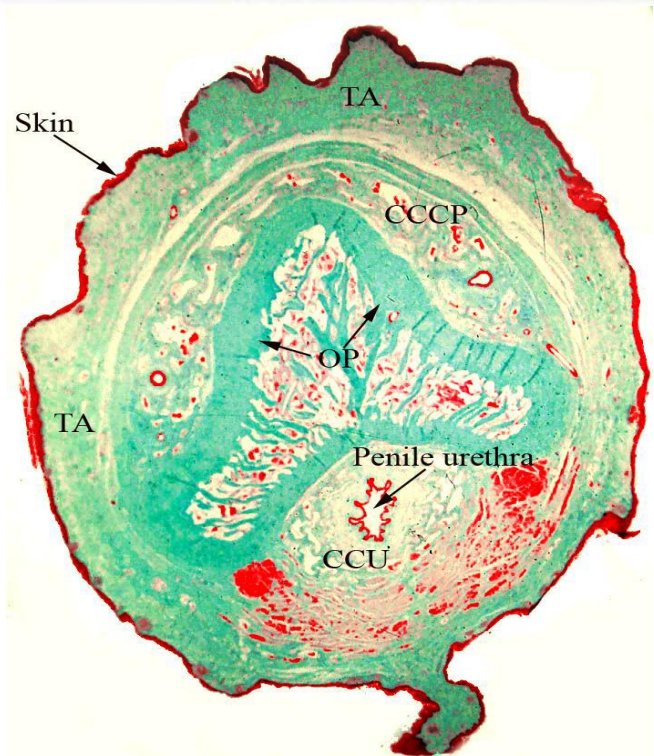
PENIS; THE ORGAN COPULATOR

❖ Types of Penis

Type	Species	features
Vascular-Type Penis	stallions and men	Mostly erectile tissue. Little connective tissue
Fibrous-Type Penis	ruminants and boars	Mostly connective tissue, little or no smooth erectile tissue
Intermediate-Type Penis	carnivores	More CT and erectile tissue as compared to a vascular-type penis



Dog penis



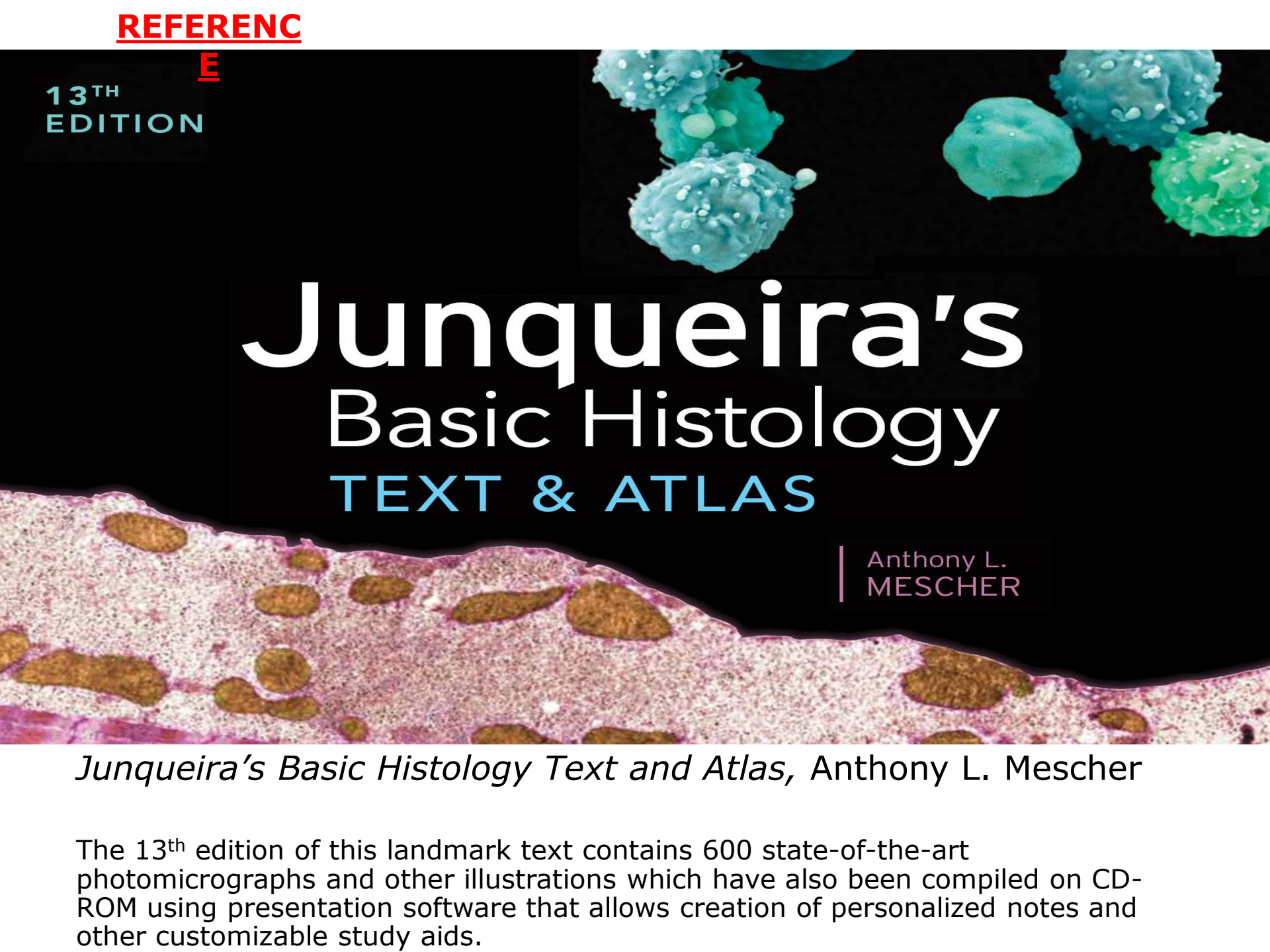
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QUESTION

