

Histology of male reproductive system

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The male genital system

The male genital system is composed of:

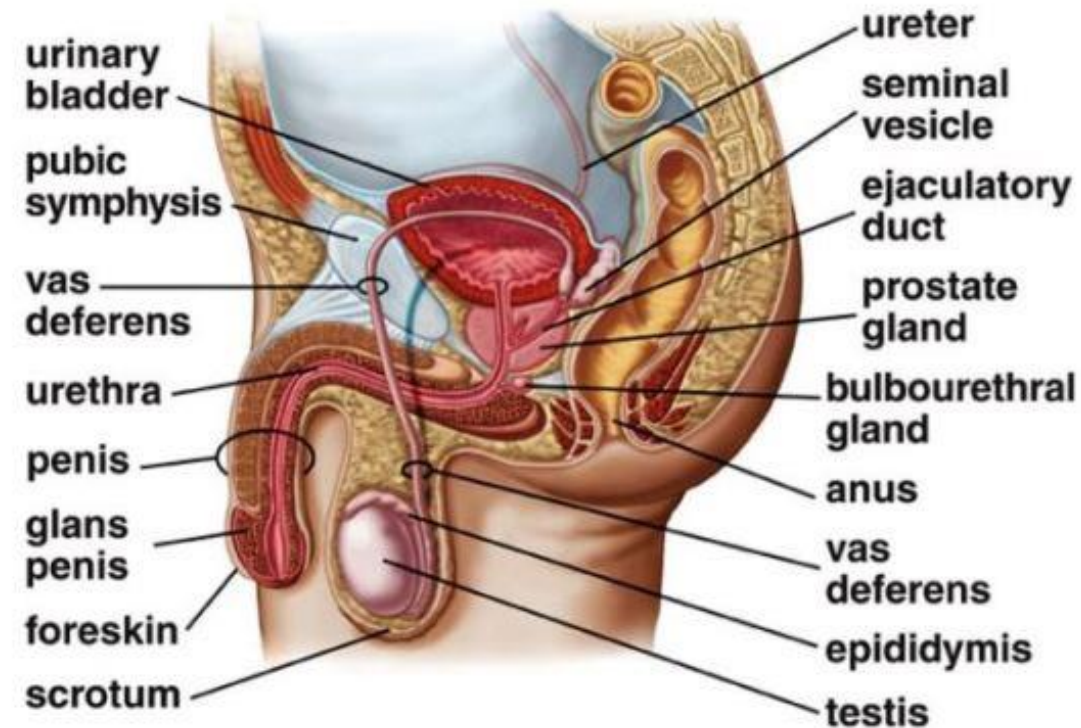
1. **Primary sex organs:** Two testes: mixed, compound tubular glands which have an endocrine function (secretion of testosterone hormone), and an exocrine function (production of the male gametes: spermatozoa).

2. **Secondary sex organs**

a. **System of excretory ducts:** For collection, storage and transport of spermatozoa.

They include:

- Tubuli recti
- Rete testis
- Vasa efferentia.
- Epididymis
- Vas deferens
- Ejaculatory duct
- Male urethra



- b. Accessory glands: To provide the necessary fluid medium (seminal fluid) for nutrition and viability of sperms. They include: two seminal vesicles, one prostate and two Cowper's (bulbo-urethral) glands.
- c. Copulatory organ (Penis): For introduction of the spermatozoa into the female genital system (vagina),

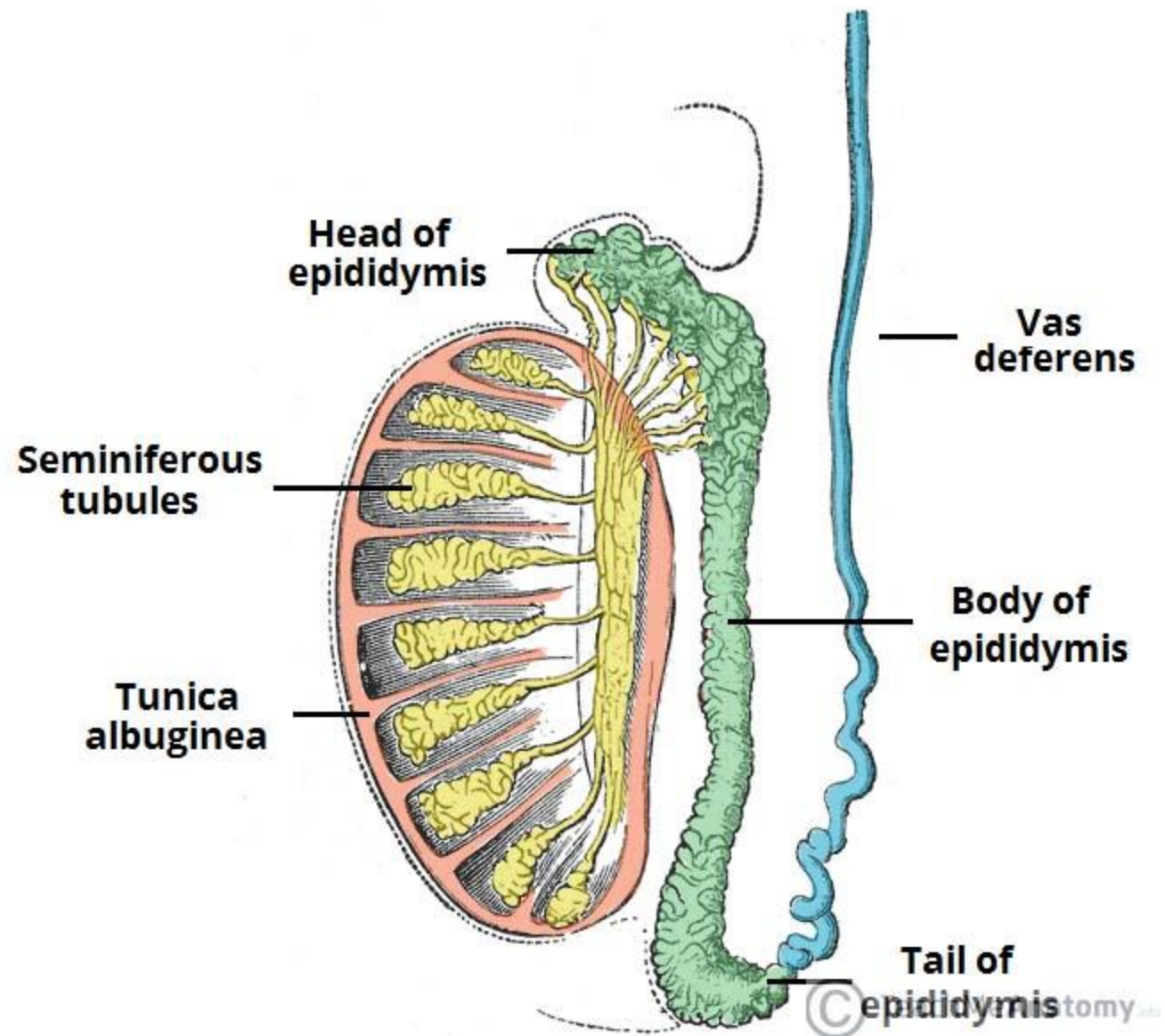
THE TESTIS

It is a paired organ which develops retroperitoneally on the dorsal wall of the abdominal cavity. Then they migrate during the fetal development to be finally suspended outside the body cavity in a pouch of skin called the scrotum.

The Scrotum:

- It is a highly specialized skin pouch, devoid of fat to maintain the testis at a temperature about 2-3°C below body temperature (34-35 °C) which is essential for normal development of sperms (spermatogenesis). It contains numerous eccrine sweat glands. In its deeper layer, smooth muscle fibers are arranged haphazardly forming the dartos muscle. This muscle plays a role in keeping the temperature of the testis low (refer to factors affecting spermatogenesis).

Each testis is formed of stroma and parenchyma:



Stroma of the testis:

Inside the scrotum, the testis is covered by three coats = tunica. From outside inwards they are:

- 1. Tunica vaginalis:** It is a double walled peritoneal pouch brought down by the testis during its descent from the dorsal wall of the abdomen (where it developed) to the scrotum. It is formed of an outer (parietal) layer lining the scrotum, and an inner (visceral) layer covering the tunica albuginea. A potential space is found between the two layers, containing watery fluid which acts as a lubricant, allowing the free movement of the testis within the scrotal sac. Both layers are lined with simple squamous mesothelium.

2. **Tunica albuginea:** (albu = white): It is formed of thick, dense white fibrous CT. which is thickened posteriorly to form the mediastinum testis. From the mediastinum testis, C.T. septa radiate to divide the testis into about 250 pyramidal compartments "testicular lobules". Each lobule contains 1-4 seminiferous tubules which are embedded in loose C.T. rich in blood vessels, lymphatics, nerves and interstitial cells of Leydig.

3. **Tunica vasculosa:** It is a layer of delicate, highly vascular C.T. lining the tunica albuginea and the septa from inside.

Parenchyma of the testis:

It is formed of:

- I. Exocrine part: The seminiferous tubules which produce spermatozoa.
- II. Endocrine part: Interstitial cells of Leydig which produce testosterone.

1. The Seminiferous Tubules

- They are the site of production of spermatozoa.
- Each testis has 250-1000 seminiferous tubules.
- They are highly convoluted with narrow lumen, each is 30-70 cm long and 150- 250 μm in diameter.
- They are lined with a highly specialized stratified epithelium called the spermatogenic epithelium.

The spermatogenic epithelium rests on a clear basement membrane surrounded by a layer of flattened contractile myoid cells. Their contraction helps to propel the non-motile spermatozoa towards the rete testis (spermatozoa only acquire their motility after they have passed the epididymis).

The spermatogenic epithelium consists of two types of cells:

- A. Spermatogenic cells.
- B. Sertoli (supporting) cells.

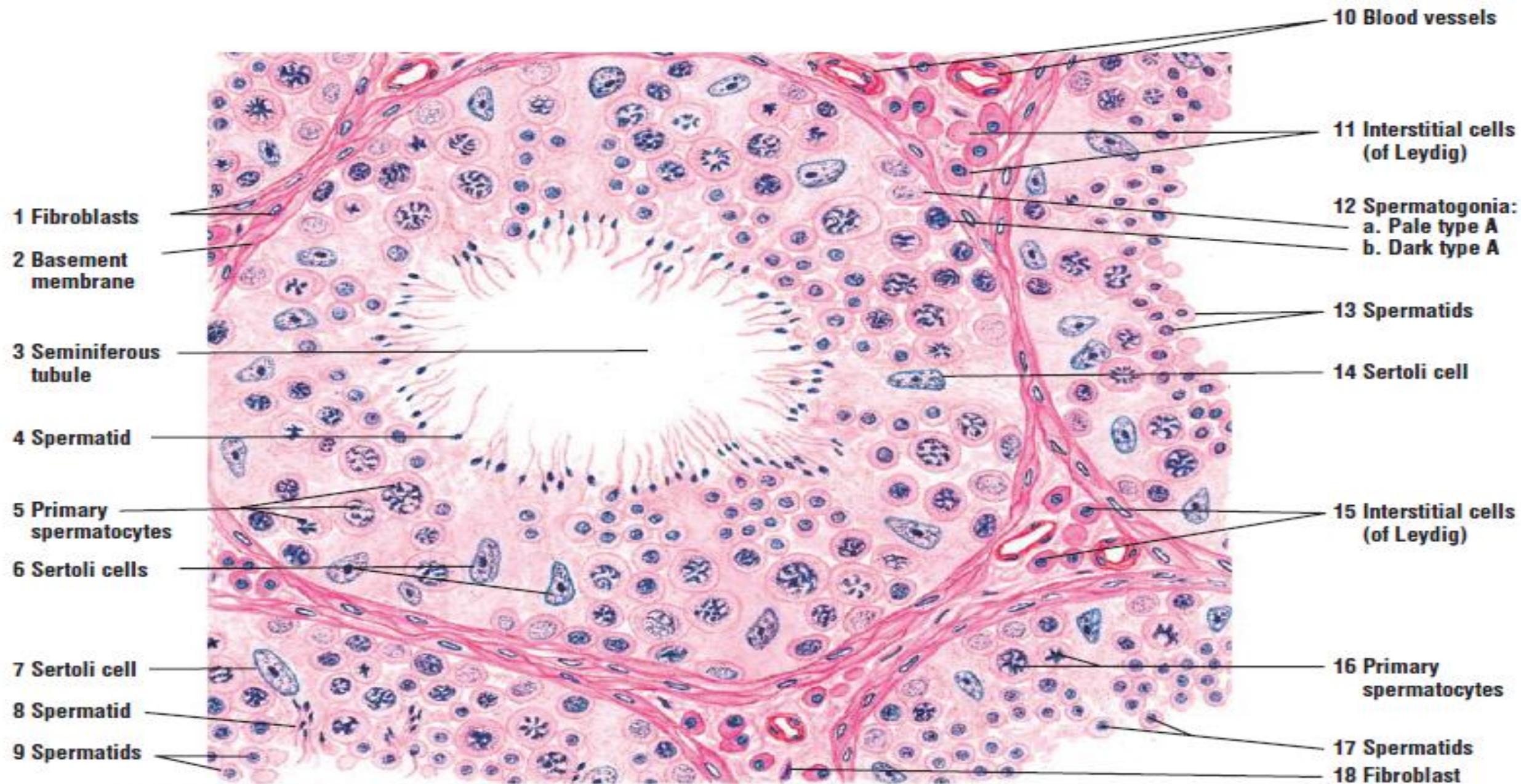


FIGURE 18.3 ■ Primate testis: spermatogenesis in seminiferous tubules (transverse section). Stain: hematoxylin and eosin. Medium magnification.

A. Spermatogenic Cells

They are a series of cells lining the seminiferous tubules extending from the basement membrane to the lumen. They include: spermatogonia, primary spermatocytes, secondary spermatocytes, spermatids and spermatozoa.

1. Spermatogonia: They are the initial male germ cells. They are small in size (12 μm in diameter), rounded with rounded nuclei containing the diploid number of chromosome (44+XY). They are lying, in one or two layers, on the basement membrane in the basal compartment of the seminiferous tubule. There are three types of spermatogonia:

a. Dark type A

They have dark ovoid nuclei.

They are considered as the precursor cells which divide by mitosis to give rise to some additional dark type A and some pale type A spermatogonia.

The additional dark type A remains as reserve cells, while the pale type A are considered as the cycling cells.

b. Pale type A:

They have pale ovoid nuclei. They are the cycling cells which divide by mitosis to give type B spermatogonia.

c. Type B:

Similar to pale Type A but Larger with more spherical pale nuclei. They undergo mitosis, grow in size and differentiate into the primary spermatocytes.

2. Primary Spermatocytes:

They are the largest cells of the spermatogenic series (18 μm).

They have the largest nuclei (with diploid of chromosomes), which appear vesicular with chromosomes at various stages of their coiling processes giving these cells an outstanding appearance in the testicular sections.

They enter the prophase of the first meiotic division. Since this prophase stage takes about 22 days, the majority of the primary spermatocytes seen in sections are in this stage.

By the end of the four stages of the 1st meiotic division, they give rise to the secondary spermatocytes.

3. Secondary Spermatocytes:

Smaller cells with smaller nuclei containing the haploid number of chromosomes (22+X or 22+Y).

They are difficult to observe in testicular sections as they are short-lived cells that remain in the interphase very short time and quickly enter the 24 meiotic division giving rise to spermatids.

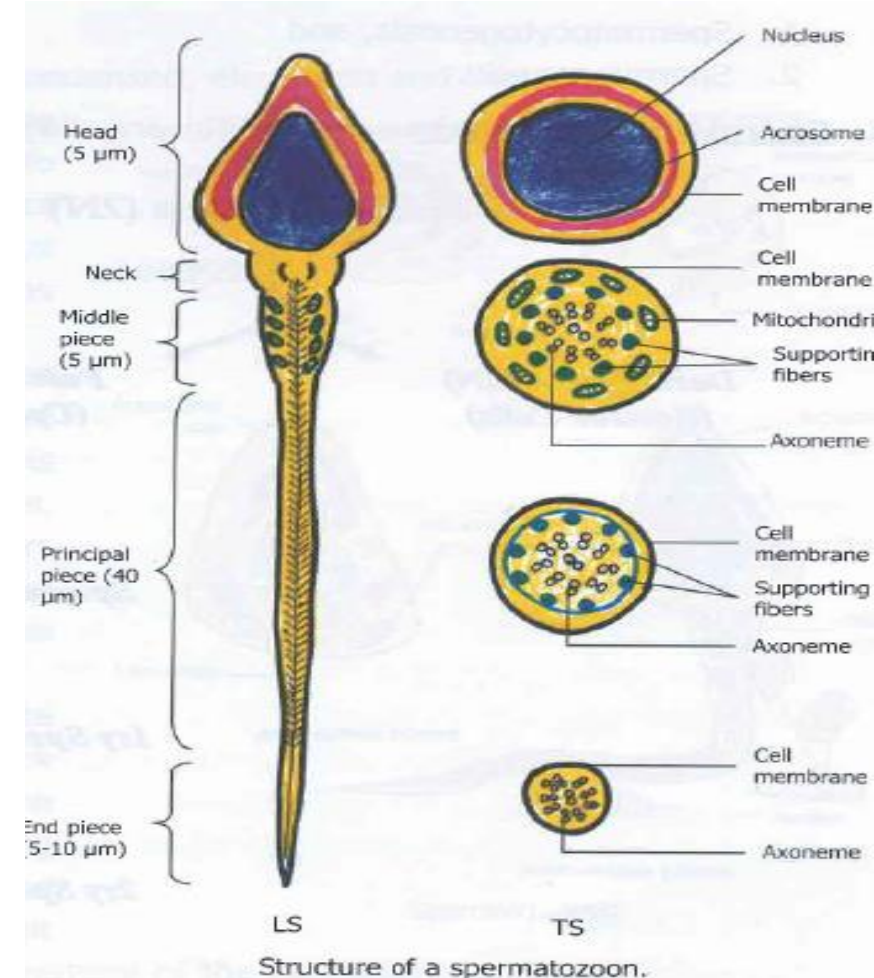
4. Spermatids:

Very small cells (7-8 μm) with central round dark nucleus.

They are located near the lumen of the seminiferous tubules in intimate relation with the Sertoli cells. By their formation, no further cell division occurs. They change into spermatozoa by a process known as spermiogenesis.

5. Spermatozoa:

- About 55-60 μm In length, composed of a head and a tail region. The tail region includes the neck, middle piece, principal piece and the end piece. The whole sperm is covered by a plasma membrane with minimal amount of cytoplasm.
- *The head (5 μm):* Flattened and elongated, Formed mainly of the condensed nucleus. The anterior 2/3 of the head is covered by the acrosome which contains the hydrolytic enzymes which facilitate penetration oocyte.



- *The neck*: Very short segment that connects the head to the middle piece and contains the centrioles.
- *The middle piece (5 μm)*: Formed of the flagellar axoneme (a specialized cilium with nine outer doublet microtubules and a central tubular pair), which is responsible for spermatozoal mobility. The axoneme is surrounded by supporting fibers followed by an outer zone of tightly packed mitochondria = Mitochondrial Sheath.
- *The principal piece (40 μm)*: Formed of the flagellar axoneme surrounded by the supporting fibers.
- *The end piece (5-10 μm)*: Formed of the axoneme only.

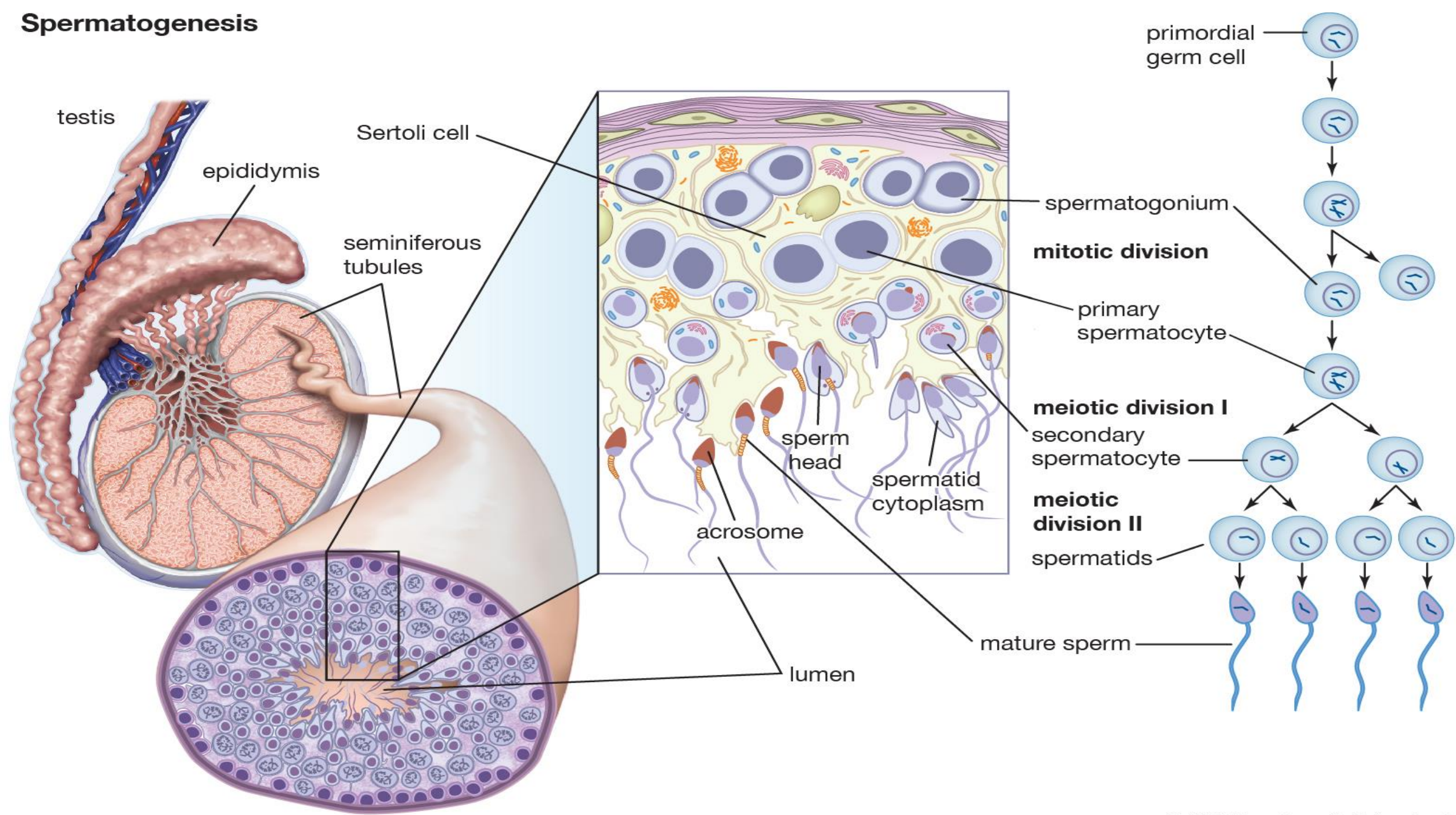
Spermatogenesis:

It is the process of formation of the spermatozoa from the spermatogonia, it begins at puberty under the control of FSH of the pituitary gland. It lasts about 64-70 days and includes two stages

1. Spermatocytogenesis, and
2. Spermiogenesis.

1. Spermatocytogenesis: see the following diagram

Spermatogenesis



2. Spermiogenesis: It is the final stage in the production of the spermatozoa. In this stage no cell division occurs, and spermatids are transformed into spermatozoa by metamorphosis. It includes three phases:

a. Golgi Phase:

Hydrolytic enzymes are formed in rER then modified and packaged in Golgi apparatus to be released as small membrane bound proacrosomal granules.

These granules then fuse together to form a single acrosomal granule located within a membrane-bound acrosomal vesicle at one pole of the spermatid.

At the same time, the two centrioles migrate to the opposite poles of the spermatid.

b. Acrosomal phase:

The nucleus becomes condensed, elongated and flattened.

The acrosomal granule and vesicle spread to cover the anterior half of the condensed nucleus and become known as the acrosomal cap.

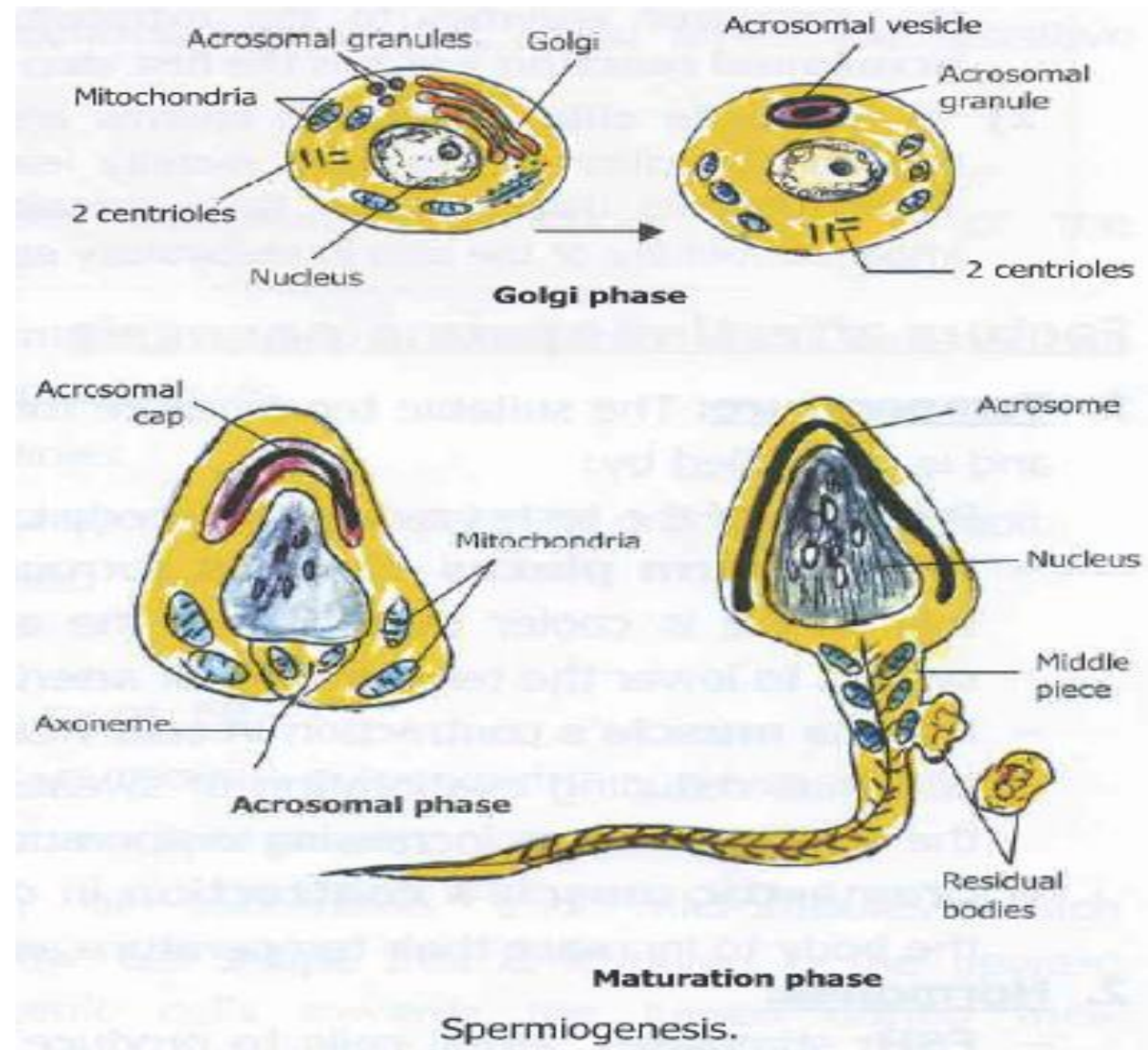
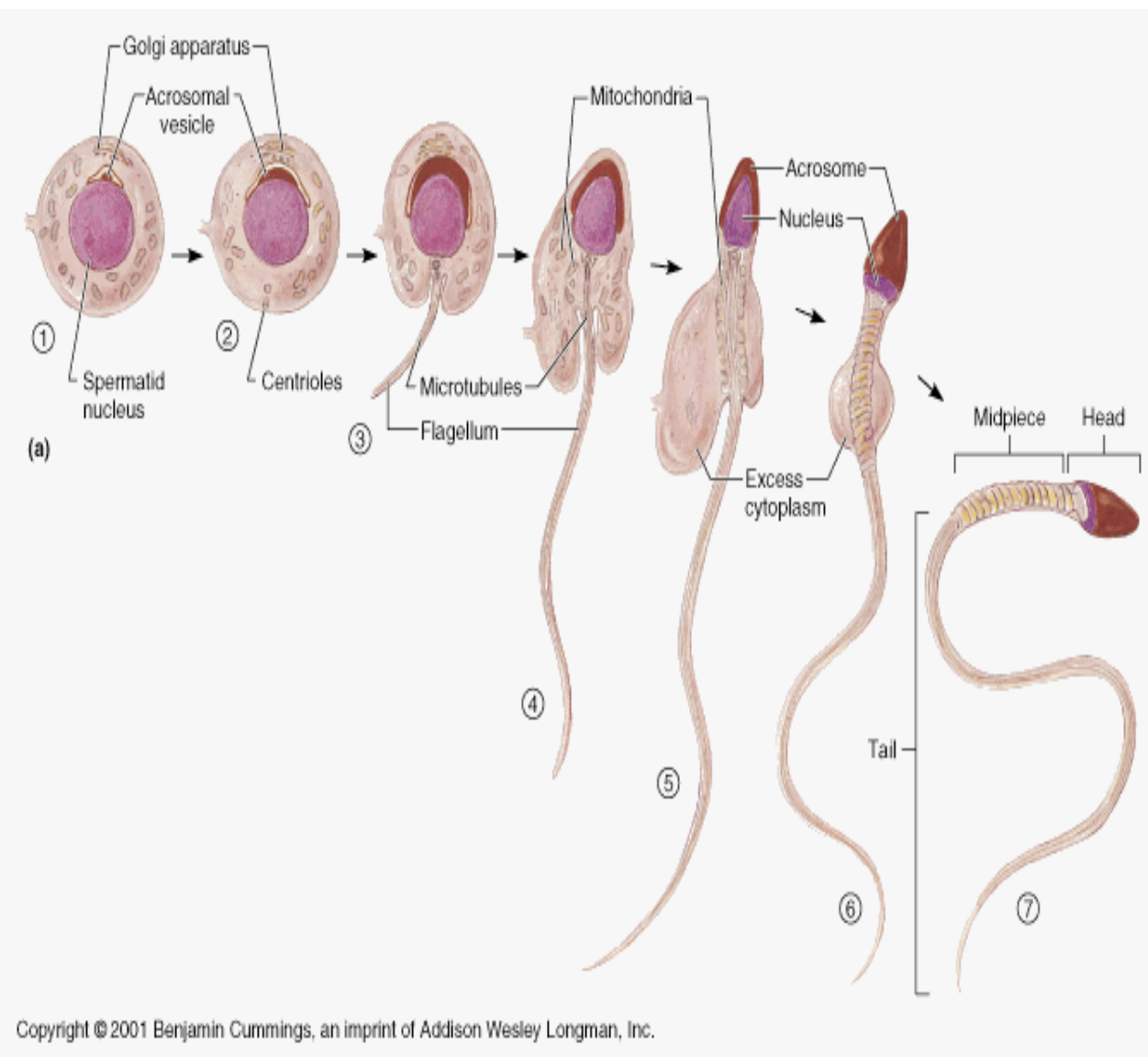
One of the two centriole forms the flagellar axoneme. As this axoneme elongates, supporting fibers become arranged longitudinally around the axoneme.

Mitochondria aggregate below the neck surrounding the supporting fibers forming the middle piece segment. This segment is the region where movement of the flagellum is generated.

c. Maturation phase:

In this phase, the acrosomal cap spreads to cover the anterior $\frac{2}{3}$ of the nucleus and is now called the acrosome. The acrosome contains hydrolytic enzymes (hyaluronidase, acid phosphatase and trypsin-like protease known as acrosin). Thus the acrosome serves as a specialized type of lysosome that releases its enzymes when the spermatozoa contact oocytes. These enzymes dissociate the cells of corona radiata and digest the zona pellucida surrounding the oocyte, thus facilitating penetration of the spermatozoon during fertilization.

Pinching off of the excess cytoplasm particularly from the neck and middle piece regions forming residual bodies. These residual bodies are phagocytosed by Sertoli cells. The newly formed spermatozoa are then disconnected from the apices of Sertoli cells and lie free in the lumen of the seminiferous tubules (a process called spermiation), marking the end of spermiogenesis.



Factors affecting spermatogenesis:

1. **Temperature:** The suitable temperature for spermatogenesis is about 34°C-35°C and is controlled by:

- ❑ Presence of the testes outside the body cavity in the scrotum.
- ❑ Pampiniform plexus of veins surrounding the testicular artery. Blood in this plexus is cooler than that in the artery thus forming a heat-exchange system to lower the temperature of arterial blood reaching the testis.
- ❑ Dartos muscle's contraction in cold weather causing wrinkling of scrotal skin and thus reducing evaporation of sweat. In hot weather it relaxes to stretch the scrotal skin thus increasing evaporation of sweat.
- ❑ Cremastic muscle's contraction in cold weather pulls the testes towards the body to increase their temperature and vice-versa in hot weather.

2. Hormones:

- ✓ FSH: stimulates Sertoli cells to produce androgen binding protein (ABP) which accumulates testosterone inside the seminiferous tubules.
- ✓ Testosterone: stimulates the meiotic division of spermatogenic cells.
- ✓ LH: stimulates Leydig cells to secrete testosterone.
- ✓ Inhibin: depresses FSH secretion from the anterior pituitary gland, thus suppressing spermatogenesis.

3. Vitamins: Vitamins A & E are necessary for proper spermatogenesis.

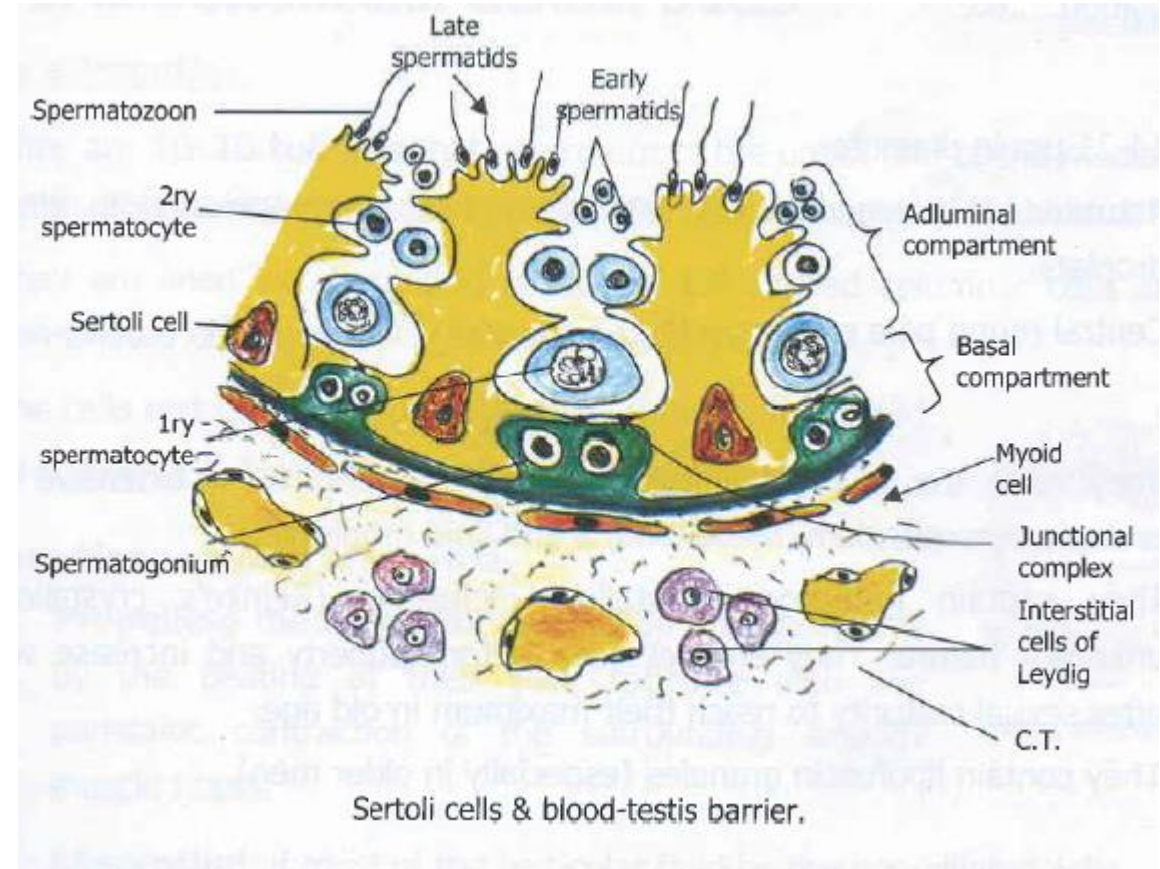
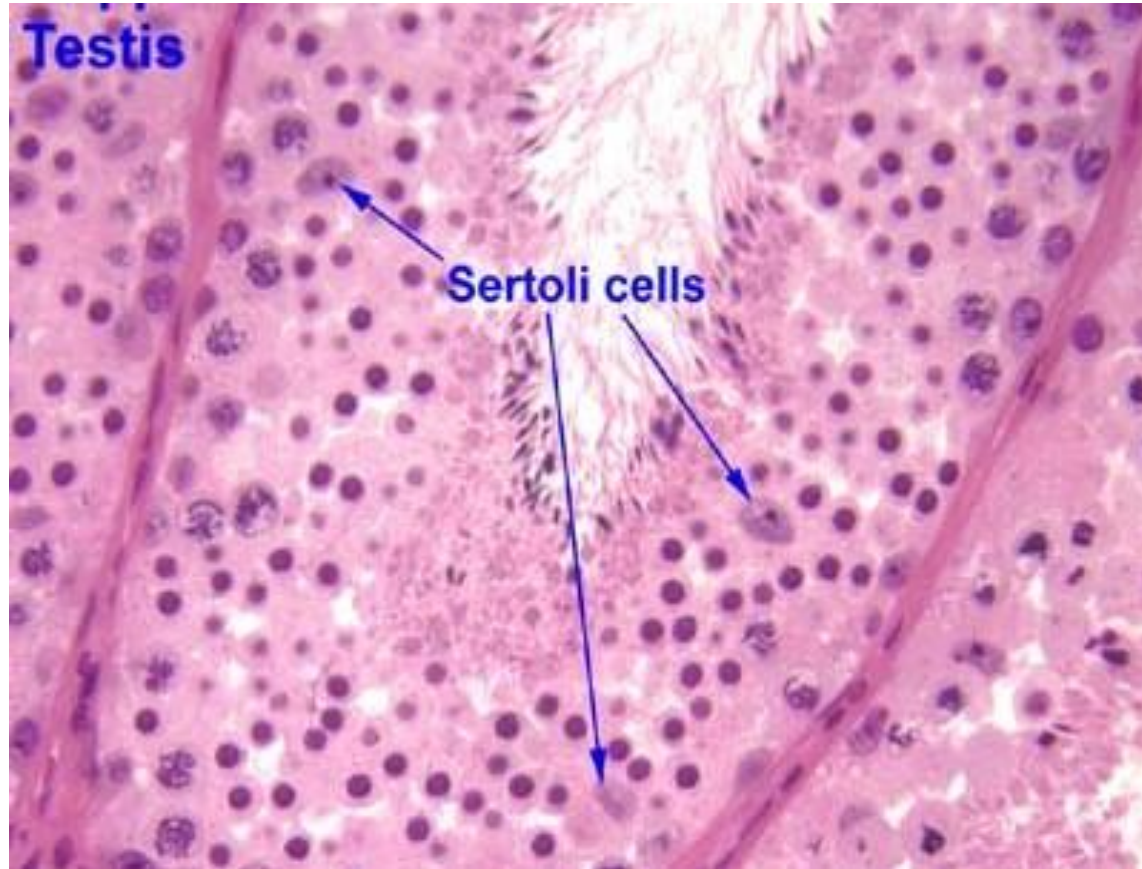
4. Other factors: Toxemia, alcoholism, X-ray irradiation some drugs & malnutrition could suppress spermatogenesis.

B. Sertoli Cells

- They are the second type of cells lining the seminiferous tubules.
- They are not affected by the injurious agents that could affect the sensitive spermatogenic cells.

LM:

- Tall elongated pyramidal cells, occupying the whole thickness of the seminiferous tubules.
- Their bases adhere to the basement membrane, while their apical ends extend into the lumen of the seminiferous tubules.
- They have ill-defined cell boundaries.
- They have large, oval or triangular, vesicular nuclei with prominent nucleoli.
- Their cytoplasm is pale acidophilic.



EM:

- Abundant smooth ER and some rough ER.
- Well developed Golgi apparatus, numerous mitochondria and lysosomes.
- Clusters of free ribosomes and many lipid droplets.
- Well developed cytoskeleton of microfibrils and microtubules which participates in the change of the cell shape that is involved in the upward movement of the spermatogenic cells towards the lumen during their development.
- Irregular ill-defined cell boundaries due to many ramifying cytoplasmic extensions forming deep invaginations (pockets) in their lateral borders where developing spermatogenic cells lie. Each Sertoli cell supports 30-50 spermatogenic cells at various stages of development.
- At the basal part of the lateral borders of Sertoli cells, the ramifying cytoplasmic extensions make contact with those from the neighboring Sertoli cells by occluding Junctions. Such tight junctions divide the seminiferous tubule into a basal (outer) compartment and an adluminal (inner) compartment.

Functions of Sertoli Cells:

1. Supportive and nutritive function: The spermatogenic cells are supported by the pockets in the lateral wall of Sertoli cells. Also, Sertoli cells regulate the passage of the nutrients to the developing spermatogenic cells and transport the waste materials resulting from spermatogenesis to the blood and lymph vessels surrounding the seminiferous tubules.

2. Phagocytic function: They phagocytose:

- Residual cytoplasm (residual bodies) shed during spermiogenesis to be digested by their lysosomal enzymes.
- Degenerating spermatogenic cells that fail to complete spermatogenesis.

3. Secretory function: This function varies with sexual maturity:

- In male embryo: at about 5th or 9th week of fetal development, Sertoli cells secrete antimüllerian hormone that suppresses further development of the müllerian duct system---->establishing maleness of the developing embryo.

In pre-pubertal testis: they may secrete a substance which prevents meiotic division of the spermatogenic cells.

In post-pubertal testis: they secrete:

a. Testicular fluid

- Rich in fructose.
- Flows in the direction of the genital ducts for transport of immotile spermatozoa.

b. Androgen-binding protein (ABP) under the control of FSH from the anterior pituitary gland. This ABP combines with testosterone to transport and concentrate it inside the seminiferous tubule, as testosterone is necessary for spermatogenesis.

c. Inhibin hormone which inhibits the synthesis and release of FSH in the anterior pituitary gland, thus playing an important feedback role in controlling the rate of spermatogenesis

4. Blood-Testis Barrier function:

Definition: It is the barrier that separates the tissue fluid outside the seminiferous tubule from the spermatogenic cells inside the seminiferous tubule.

How It is formed: By the tight occluding junctions between the ramifying cytoplasmic extensions at the basal part of the lateral borders of the Sertoli cells, dividing the interior of the tubule into a basal and adluminal compartments:

Spermatogonia lie in the basal compartment that is situated below the barrier so tissue fluid can directly reach them through easy penetration of the basement membrane.

Primary & secondary spermatocytes, spermatids and spermatozoa lie in the adluminal compartment above the barrier, thus tissue fluid cannot reach them in except after being controlled by the blood-testis barrier.

The newly formed primary spermatocytes disrupt the cell adhesion of the barrier to reach the adluminal compartment and new junctions are established without compromising the barrier.

Importance of the blood-testis barrier:

a. Selection: of the proper nutrients, fluids and hormones needed for spermatogenic differentiation.

b. Isolation, and protection of the sensitive developing spermatogenic cells from any damaging substance that might be present in the blood stream e.g. antigens, drugs and toxic materials.

c. Creation of a special environment: rich in Na^+ , K^+ , ABP and testosterone in the adluminal compartment which is essential for proper spermatogenesis.

d. Prevention of autoimmune reaction since spermatozoa are formed only after sexual maturity at puberty, the body's immune system could consider these cells as foreign antigens and produce autoantibodies against the spermatozoa (antisperm Ig). These antibodies could destroy the spermatozoa. Thus, the blood-testis barrier prevents the passage of these antibodies into the seminiferous tubule.

II. The Interstitial Tissue

They are the spaces enclosed between the seminiferous tubules. They are filled with:

- ✓ *Loose C.T. with many fibroblasts, undifferentiated mesenchymal cells (UMCs), mast cells and macrophages.*
- ✓ *Nerves.*
- ✓ *Lymphatic vessels.*
- ✓ *Fenestrated capillaries.*
- ✓ *Clusters of interstitial cells of Leydig.*

Interstitial Cells of Leydig:

- *They are considered a diffuse type of endocrine cells.*

- *They are present in close relation to the fenestrated capillaries in the interstitial tissue.*
- *They secrete the male hormone testosterone, under the control of LH from the anterior pituitary gland. Testosterone is responsible for appearance of the male secondary sex characters and is essential for spermatogenesis.*

On the contrary of the spermatogenic cells, Leydig cells are resistant to injurious factors as high temperature (not affected in cases of undescended testes), x-ray irradiation.....etc.

LM:

14-21 um in diameter.

Rounded or polygonal cells with acidophilic cytoplasm rich in small lipid droplets.

Central round pale nucleus with 1-2 nucleoli.

EM:

- ✓ *They have the characteristics of steroid-secreting cells: extensive smooth endoplasmic reticulum, mitochondria and lipid droplets.*
- ✓ *They contain numerous crystalloid inclusions (Reinke's crystalloids) of unknown nature. They are not seen before puberty and increase with age after sexual maturity to reach their maximum in old age.*
- ✓ *They contain lipofuscin granules (especially in older men).*

MALE GENITAL DUCTS

A. Intratesticular ducts

- 1. Tubuli recti (straight tubules)*
- 2. Rete testis*

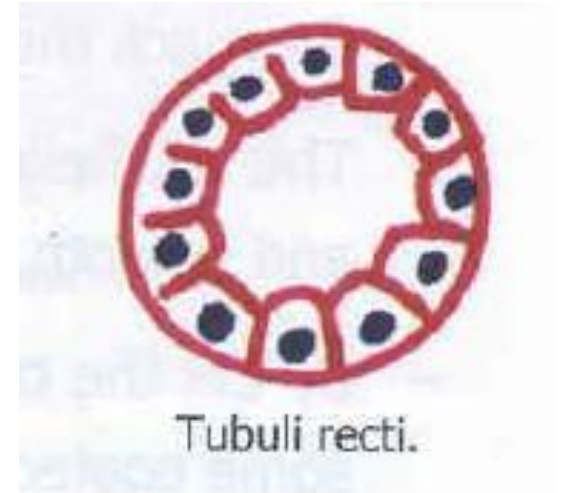
B. Extratesticular Ducts

- 1. Vasa efferentia*
- 2. Epididymis*
- 3. Vas deferens*
- 4. Ejaculatory duct*
- 5. Male urethra*

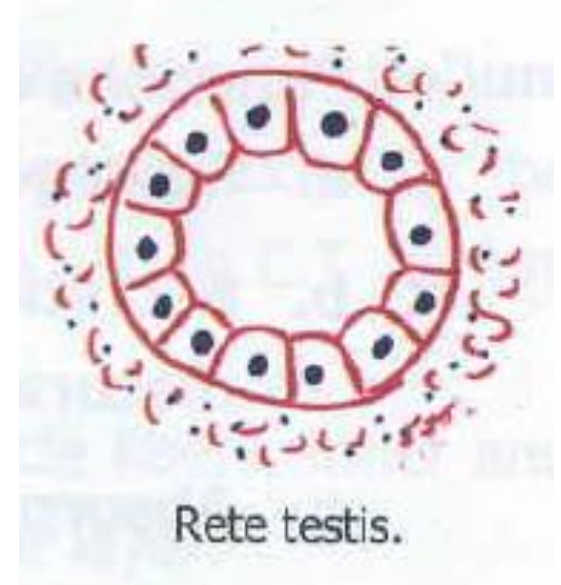
N.B.: The first part of the vasa efferentia is intratesticular while its main part is extratesticular.

A. Intratesticular Genital Ducts

1. Tubuli recti: They are the straight ends of the seminiferous tubules which gradually lose their spermatogenic cells to be lined only by Sertoli cells then become abruptly lined by cuboidal cells.



2. Rete testis: They are a highly anastomosing network of tubules present inside the mediastinum testis. They are lined by cuboidal cells and surrounded by a layer of C.T.



B. Extratesticular Genital Ducts

1. Vasa efferentia:

They are 10-20 tubules that emerge from the upper end of the mediastinum testis, penetrating the tunica albuginea to enter the head of the epididymis.

They are lined by alternating groups of tall ciliated columnar cells and low non-ciliated columnar cells (festooned epithelium).

The cells rest on a clear basement membrane surrounded by a layer of C.T, with some smooth muscle fibers.



Functions of vasa efferentia:

- a. Propelling the spermatozoa towards the epididymis by the beating of their cilia, together with the peristaltic contraction of the surrounding smooth muscle fibers.*
- b. Absorption of most of the testicular fluid by the non-ciliated cells.*

2. The Epididymis:

It is a single tubule, 400-500 um in diameter and 4-6 meters in length when uncoiled. However, being highly convoluted, it forms a compact organ 7.5 cm long.

It is divided into a head, body and tail. The vasa efferentia ductules enter from the head, while the tail gives rise to the vas deferens

- It is lined by pseudostratified columnar ciliated epithelium. However, these cilia are non-motile (stereocilia). They are actually extremely long microvilli as they lack the internal arrangement of microtubules in the cilia.

The epithelium is resting on a clear basement membrane surrounded by C.T. and smooth muscle fibers.

By EM the cells are rich in lysosomes, rough ER, prominent Golgi complex and some coated vesicles.

Functions of epididymis:

- a. Storage of the formed spermatozoa.*
- b. Secretion of some glycoproteins which are believed to play a role in maturation of spermatozoa.*
- c. Absorption of the remaining testicular fluid.*
- d. Phagocytosis and digestion of residual bodies and degenerated spermatozoa.*
- e. Propelling spermatozoa to the vas deferens by the peristaltic contraction of the surrounding smooth muscle fibers.*

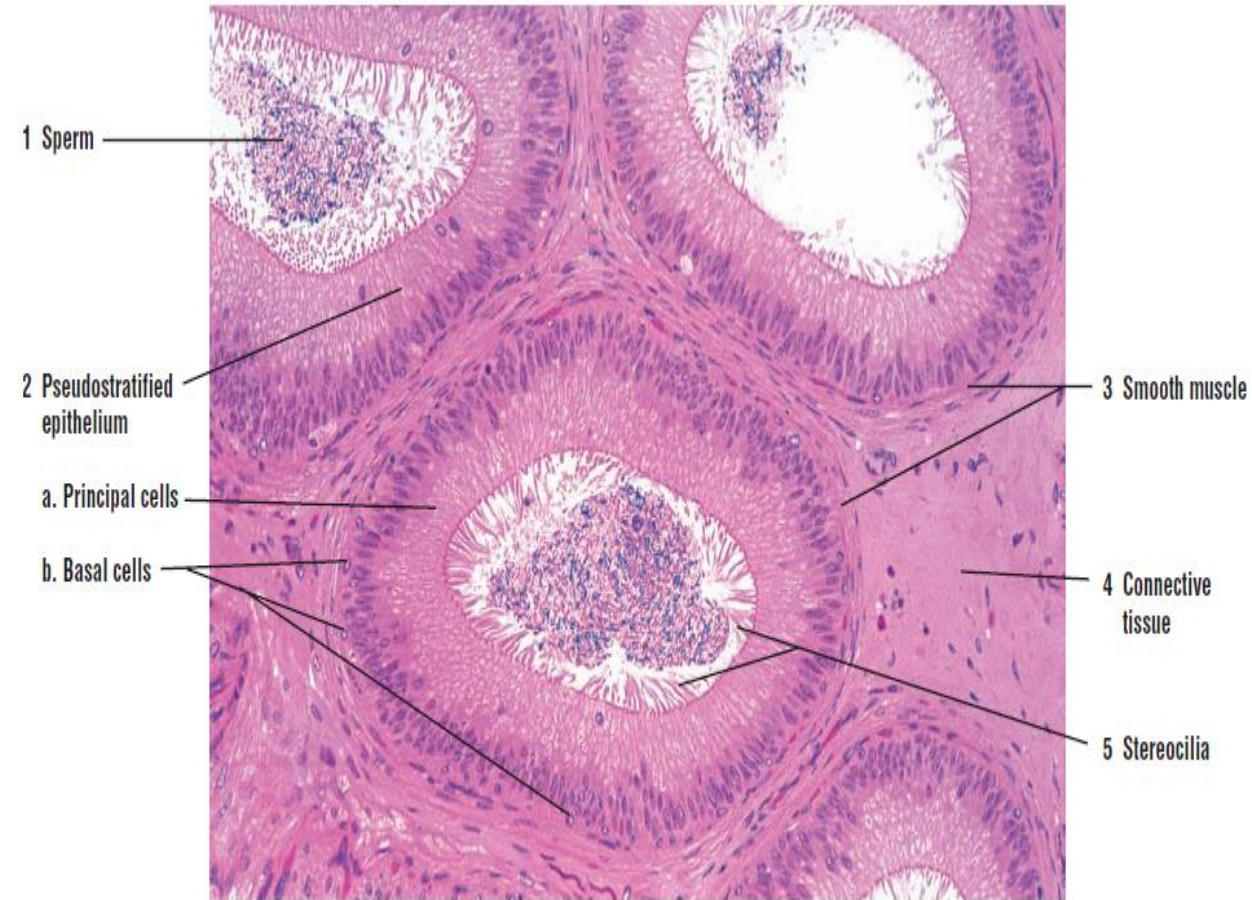


FIGURE 18.7 ■ Tubules of the ductus epididymis (transverse section). Stain: hematoxylin and eosin (plastic section). ×50.

Note : *Spermatozoa on leaving the seminiferous tubules are still immature, immotile, and unable to penetrate oocytes. The achievement of the spermatozoa full maturity, motility and the power of fertilization is a process known as capacitation. For the spermatozoa to be capacitated, they have to pass through a series of biochemical changes. This capacitation starts in the epididymis to reach its peak in the fallopian tube, near the oocyte in the female genital tract.*

3. vas deferens:

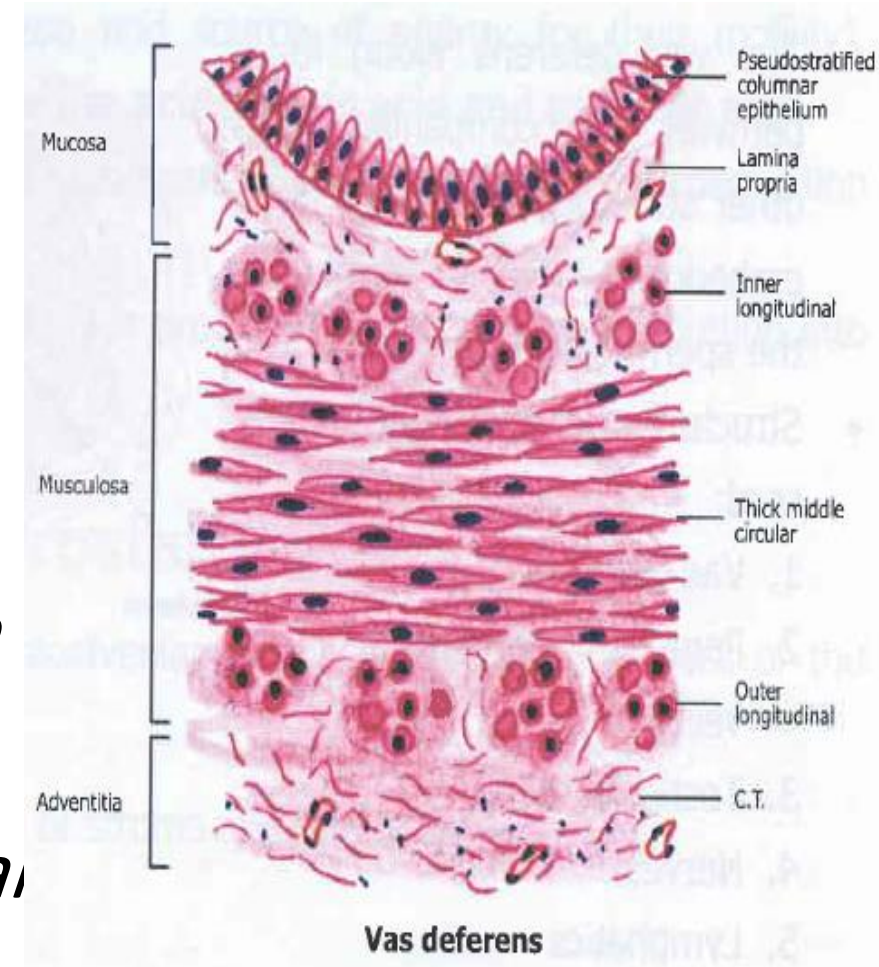
It is a single muscular tube, about 45 cm long and 3 mm in diameter.

It starts at the tail of the epididymis and continues upward to pass through the inguinal canal.

Near its distal end (close to the base of the urinary bladder) it becomes dilated to form the ampulla of the vas.

The ampulla is joined by the duct of the seminal vesicle to form the ejaculatory duct

The vas deferens is formed of three layers:



a. Mucosa: lined by pseudostratified columnar ciliated epithelium (stereocilia). The cilia disappear gradually along its length such that the upper half of the vas is devoid of cilia. The epithelium lies on C.T. corium rich in elastic fibers.

b. Musculosa: formed of three layers of smooth muscle fibers, inner and outer longitudinal layers and a very thick middle circular layer.

c. Adventitia: loose C.T. rich in elastic fibers,

Function of the vas deferens: Propelling of the spermatozoa forward to the ejaculatory duct and urethra during ejaculation. This is done by the strong peristaltic contraction of its abundant thick musculosa.

4. Ejaculatory duct:

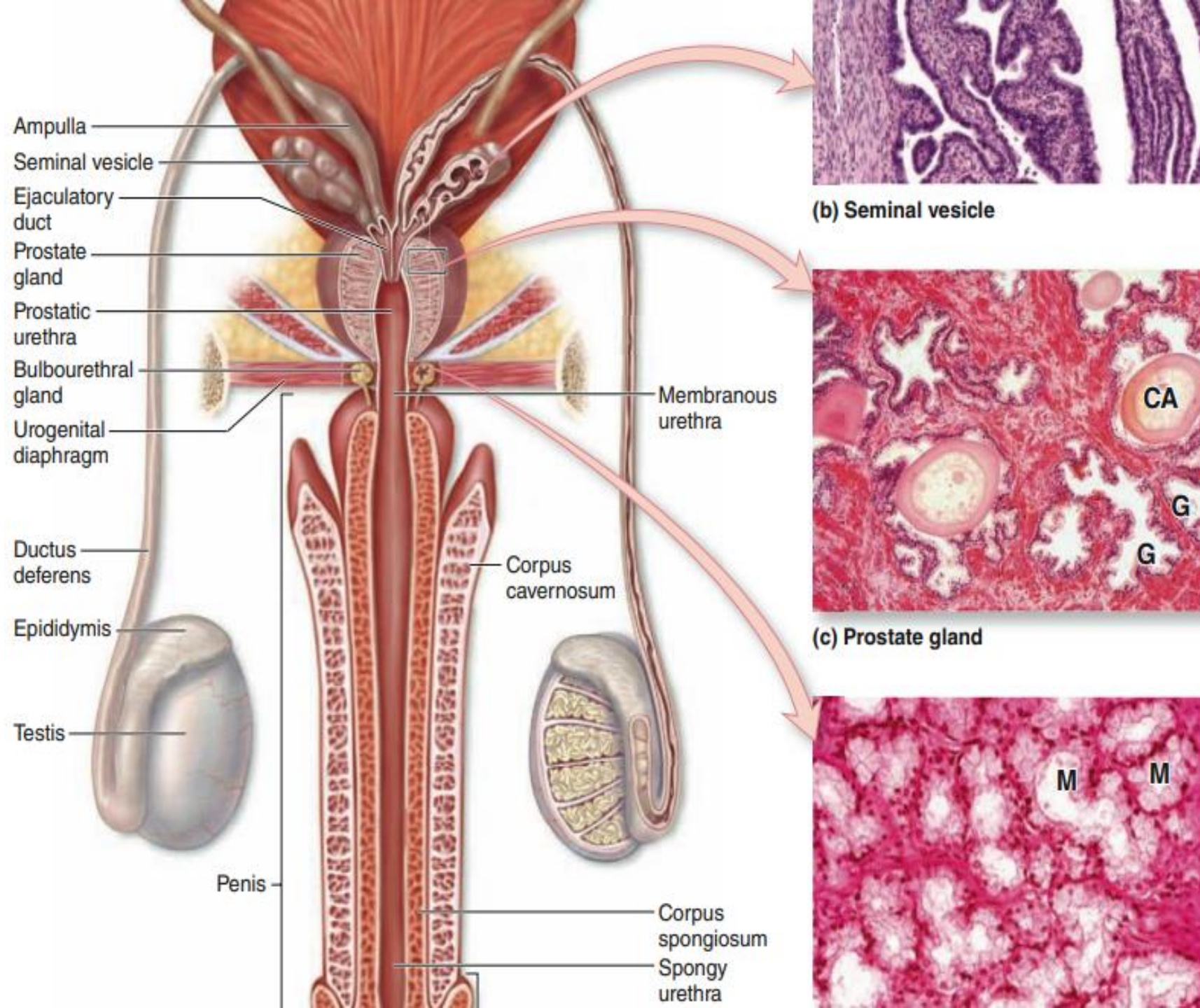
It is about one cm long.

It is formed by union of the ampulla of the vas deferens with the duct of the seminal vesicle.

It pierces the prostate at the base of the urinary bladder to open in the prostatic urethra.

It is lined by pseudostratified columnar non-ciliated epithelium with no muscles in its wall.

5. Male Urethra: refer to the urinary System.



Spermatic Cord:

The vas deferens along its pathway is accompanied by other structures. They are all embedded in C.T. forming the spermatic cord.

- *Structures in the spermatic cord:*

1. *Vas deferens*

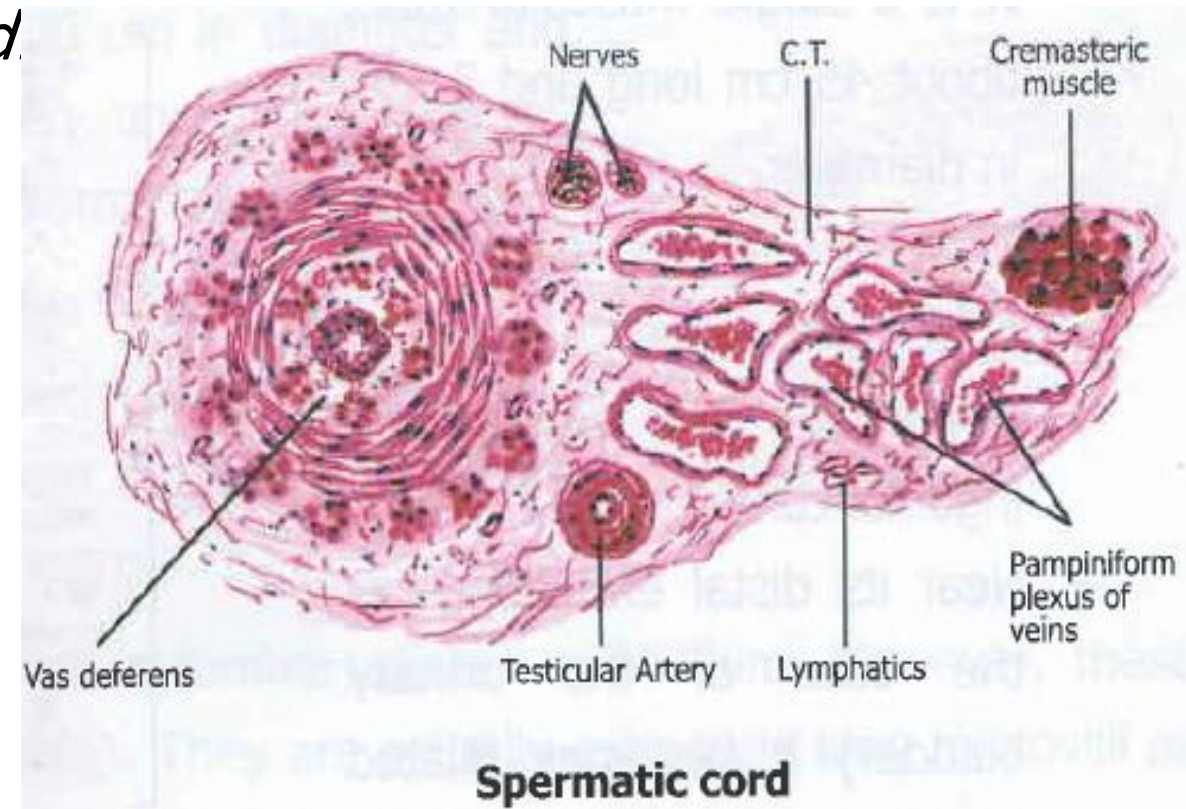
2. *Pampiniform plexus of veins*

3. *Testicular artery*

4. *Nerves*

5. *Lymphatics*

6. *Cremasteric muscle: Longitudinal fibers of striated involuntary muscle which plays an important role in maintaining the suitable temperature of the testes (refer to factors affecting testicular temperature),*



MALE ACCESSORY GENITAL GLANDS

Seminal Vesicles

- *They are two highly tortuous tubes. Each is 15 cm long, but is coiled on itself to form a body about 5-6 cm long.*
- *Histologically, it is formed of three layers:*

a. Mucosa:

Highly folded to provide a wide surface area for secretion.

It is lined by pseudostratified columnar non ciliated epithelium.

By EM the cells have the characteristics of protein secreting cells (abundant rER, Golgi complex and large secretory granules).

The height of these cells and their degree of activity are dependent on testosterone level.

The epithelium is lying on a lamina propria rich in elastic fibers.

b. Musculosa: formed of inner circular and outer longitudinal smooth muscle fibers.

c. Adventitia: formed of



Functions of seminal vesicles:

They give about 70-80% of the seminal fluid.

Their secretion is viscid & yellowish (due to lipochrome pigment).

Their secretion is rich in spermatozoa-activating substances such as fructose (main nutrient for spermatozoa and source of energy for their motility), prostaglandins, proteins, amino acids, citric acid and ascorbic acid.

Their secretion is also rich in fibrinogen which is responsible for coagulation of the semen after ejaculation,

Contraction of their smooth muscles propels their accumulated secretion into the ejaculatory duct.

Prostate

It is an exocrine compound tubuloalveolar gland, surrounding the neck of the urinary bladder.

Histological structure: It is formed of stroma and parenchyma.

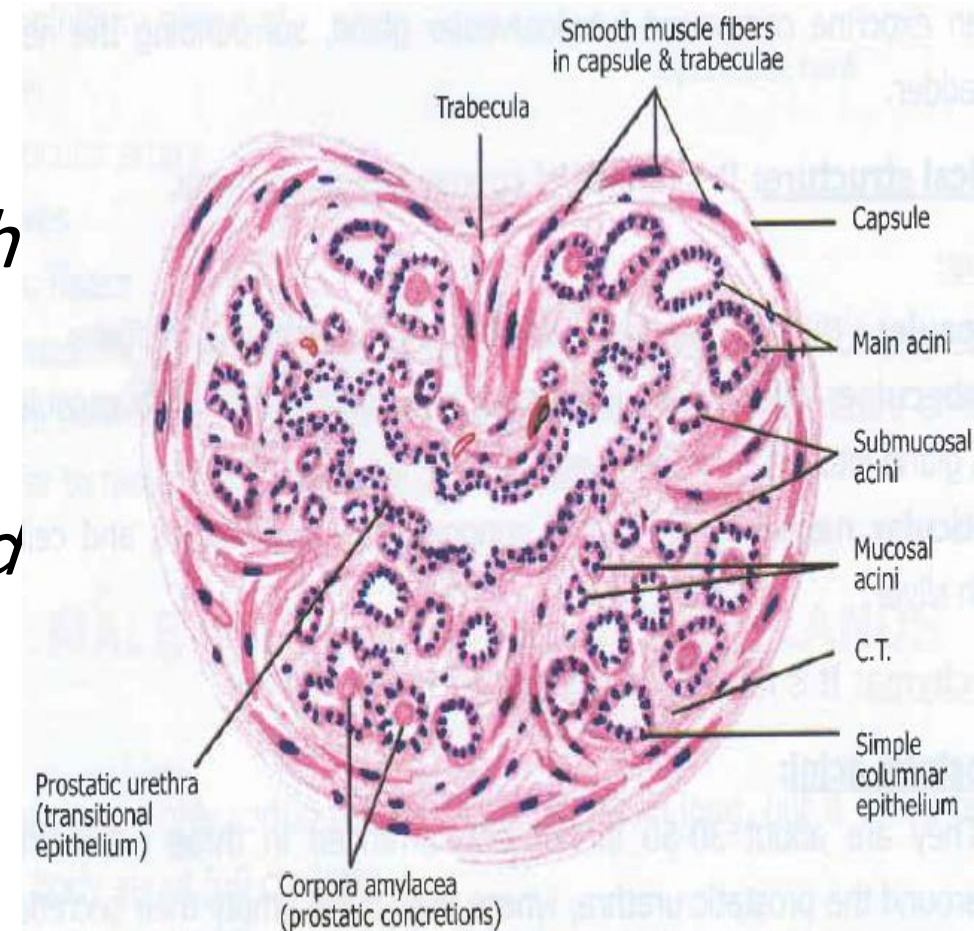
A. Stroma:

1. Capsule: a thick fibromuscular capsule with smooth muscle fibers.

2. Trabeculae: thick fibromuscular septa extending from the capsule dividing the gland into lobes and lobules,

3. Reticular network: formed of supporting reticular fibers and cells stained with silver

B. Parenchyma: It is formed of acini and ducts



Prostate

1. Prostatic acini:

They are about 30-50 in number, arranged in three concentric groups around the prostatic urethra, where their ducts empty their secretions:

a. Mucosal group (central zone): small acini embedded directly around the urethra. They open in the urethra directly or by short ducts around the entire surface of the urethra.

b. Submucosal group (Transition zone): medium-sized acini that open through short ducts into the postero-lateral aspect of the urethra.

c. Main group (peripheral zone): large-sized acini which open into the posterior aspect of the urethra via long ducts. They constitute 70% of the gland.

LM of prostatic acinus:

Prostatic acinus has a highly folded simple columnar or pseudostratified columnar epithelium which is surrounded by an unclear basement membrane and a lamina propria of C.T.

Corpora amylacea (prostatic concretion) are small spherical bodies of glycoproteins (often calcified) frequently observed in the lumen of the prostatic acini. Their number increases with age. Their significance is not yet understood.

The prostatic epithelium depends on adequate testosterone level to maintain its structural and functional integrity. Inadequacy of this hormone manifests by the change of the acinar epithelium to simple cuboidal with reduced secretory activity. This change is seen in old age.

EM of Prostatic acinar cells Reveals the picture of protein-synthesizing cells (prominent Golgi complex, ER, and secretory granules),

2.Prostatic ducts: *they are lined by simple cuboidal or columnar cells.*

Function of the prostate:

Its secretion is thin and milky. It gives the semen its characteristic odour.

Its secretion is rich in acid phosphatase, amylase and fibrinolysin.

Fibrinolysin is responsible for the liquefaction of the coagulated semen after its deposition in the female vagina to allow the free movement of the sperms towards the uterus.

The Bulbo-Urethral (Cowper's) Glands

- They are two small compound tubuloalveolar glands present on the undersurface of the membranous urethra where their ducts open.*
- Each is 3-5 mm in diameter. Their acini are lined by mucus-secreting simple cuboidal or simple columnar epithelium.*
- Skeletal and smooth muscle fibers are present in the C.T. septa dividing the glands into lobes.*
- They secrete clear mucoïd fluid containing abundant sugars. This fluid precedes the thicker seminal fluid along the penile urethra during ejaculation and it has a lubricating function*

THE PENIS

It is the copulatory organ.

- It is composed of three cylindrical masses of erectile tissue, two are dorsally located (corpora cavernosa) and a smaller one that is ventrally located (corpus spongiosum) and through which the penile urethra runs. Small mucus-secreting glands (glands of Littre) are found throughout the length of the penile urethra.*

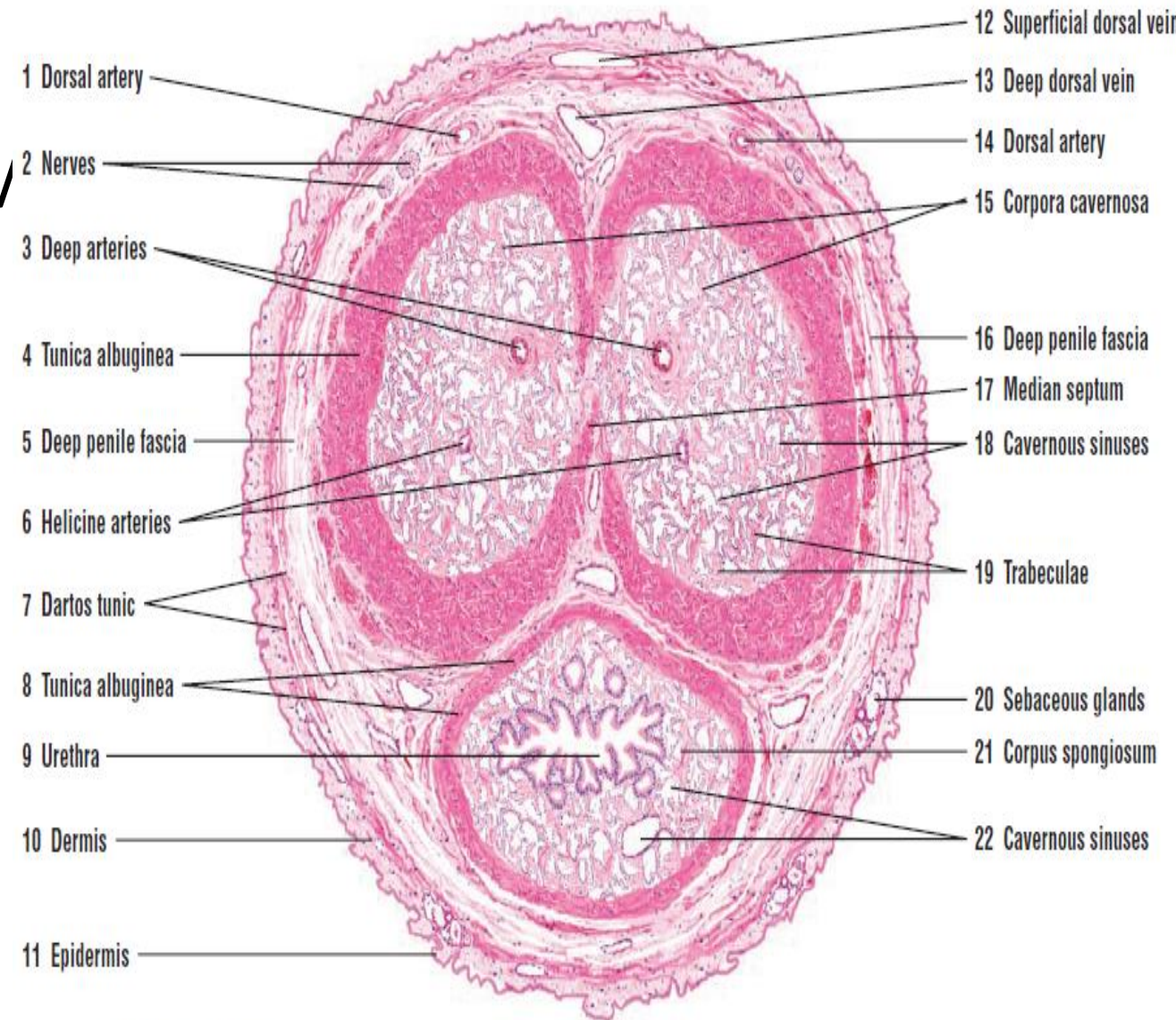


FIGURE 18.15 ■ Human penis (transverse section). Stain: hematoxylin and eosin. Low magnification.

penile urethra.

At its end, the corpus spongiosum expands forming the glans penis.

The penis is surrounded by skin which has hair only at the root of the penis and is devoid of subcutaneous fat to allow free movement of the skin during intercourse. Under the skin, fascia penis is present which is rich in elastic fibers.

- The corpora cavernosa are covered by a thick layer of dense C.T. (Tunica albuginea), while the corpus spongiosum is covered by a thin tunica albuginea.*

Erectile Tissues:

They are interconnecting vascular spaces lined with endothelial cells. They are separated by trabeculae of smooth muscle, collagen and elastic fibers. Corpus spongiosum is surrounded by more elastic fibers than the corpora cavernosa.

In flaccid penis, these vascular spaces are empty, while in erected penis they are filled with blood.

Blood supply of the penis:

Arterial supply of the penis is provided by dorsal and deep arteries.

From the deep arteries two types of branches arise: nutritive branches to supply oxygen and nutrition and helicine branches which empty directly into the cavernous spaces.

Helicine arteries are spiral in flaccid penis and straight in erected penis.

- Arterio-venous shunts connecting the helicine arteries with the deep veins are present.

These shunts are the normal route of the helicine arterial blood flow in the flaccid penis.

Mechanism of erection:

Penile erection involves filling of cavernous spaces with blood controlled by parasympathetic nervous stimulation which causes:

1. Closure of the A-V shunts thus diverting the blood from the helicine arteries to the cavernous spaces instead of passing to the deep veins.

2. Causing relaxation of the smooth muscle fibers:

a) In the walls of deep, dorsal & helicine arteries leading to their dilatation and increasing blood flow to the penis,

b) In the trabeculae between the cavernous spaces, thus helping in the distension of these spaces,

3. The filled cavernous spaces compress the veins and venules against dense tunica albuginea blocking outflow of blood, thus blood is trapped in cavernous spaces producing rigidity and erection of the penis.

Ejaculation & resuming the flaccid state:

Ejaculation is the forceful expulsion of the semen from the male genital ducts and is controlled by sympathetic nervous stimulation. Sympathetic stimulation at beginning of ejaculation causes:

1) Opening of the A-V shunts, so blood passes from the helicine arteries

2) Return of the intrinsic tone of the smooth muscle fibers causing:

a) Constriction of deep, dorsal & helicine arteries leading to decreasing blood flow to the penis

b) Preventing the distension of the cavernous spaces

3) The empty cavernous spaces lower their pressure on veins and venules, allowing them to open and draining most of the blood from the erectile tissue and the penis returns to its flaccid state.

