

**The University Of Jordan  
Faculty Of Medicine**



# **Histology of Male reproductive system**

**DR. Ahmed Salman**

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**Assistant professor of Anatomy and Histology  
Jordan university**

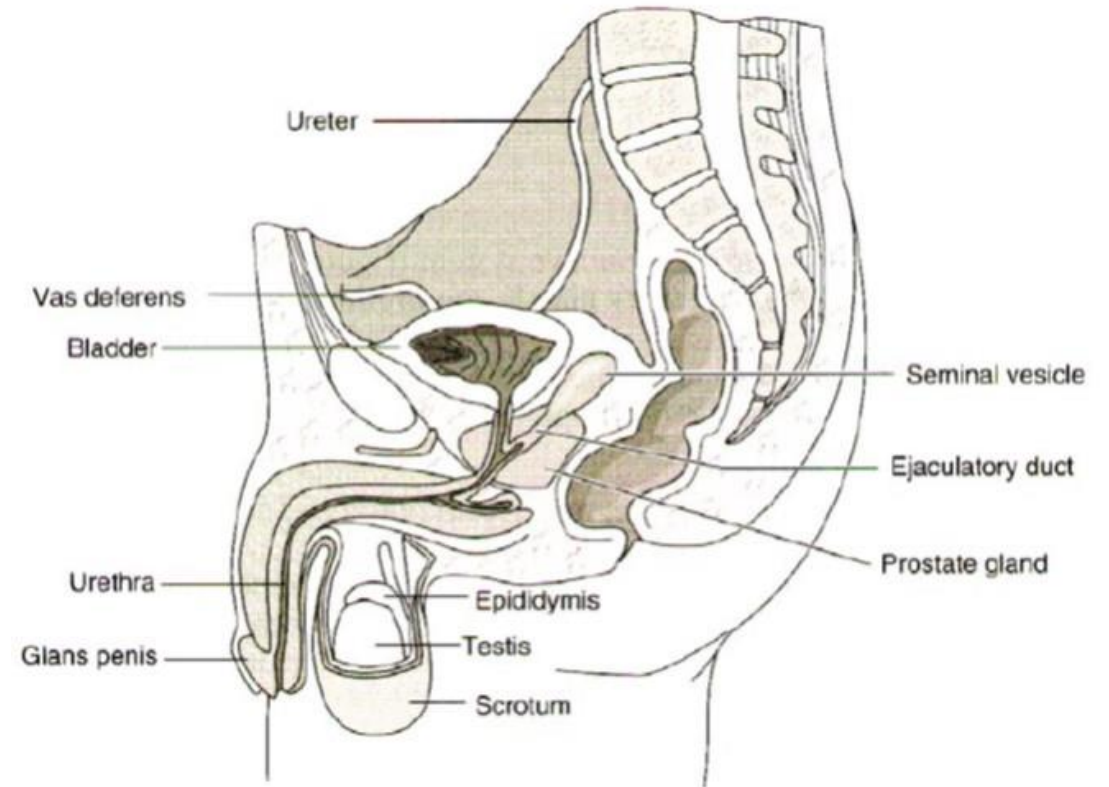
*Edited by: Dana Alnasra♥*

# Objectives

- Identify the components and functions of the male reproductive system.
- Identify the histological structure of testis.
- Describe the histological structure of blood testes barrier
- Describe the histological structure of male genital ducts.
- Identify the histological structure of the accessory male genital glands.

# Components of the male reproductive system

- **Primary sex organ:**
  - Paired testis
- **Secondary sex organs:**
  - **Genital ducts** (Epididymis ,Vas Deference and Ejaculatory duct)
  - **Accessory glands** (the paired seminal vesicles, the single prostate gland and two bulbourethral glands)
  - The penis



# Male reproductive system

## Primary sex organ

Testis

### Function :

1. Produce Spermatozoa
2. Synthesis of male sex hormone

## Accessory Glands

Two Seminal Vesicles  
One Prostate  
Two Bulbourethral

Manufacture and secrete the seminal fluid

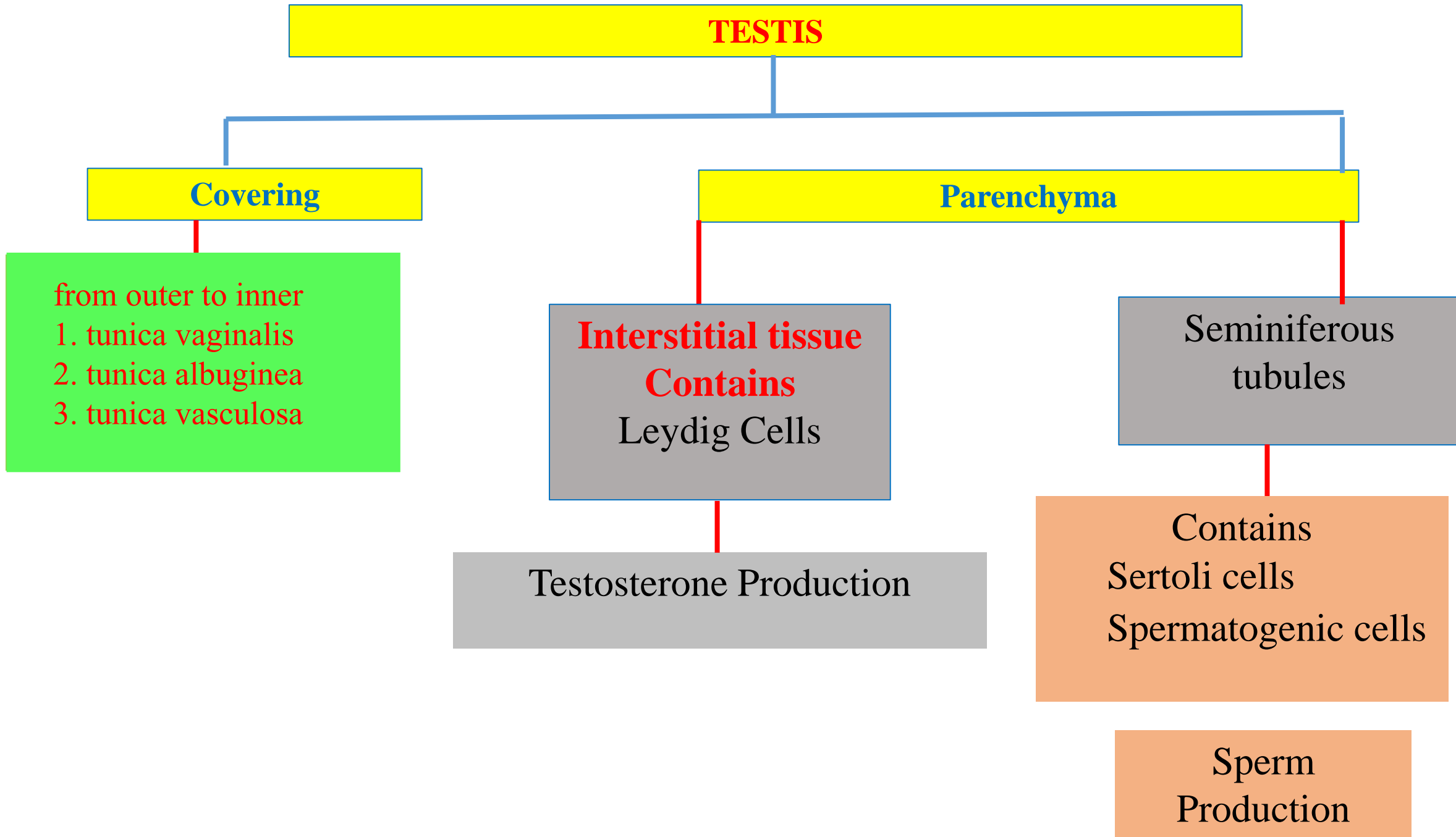
## Accessory Ducts

Epididymis  
Vas Deference  
Ejaculatory duct

Passage of sperm and seminal fluid

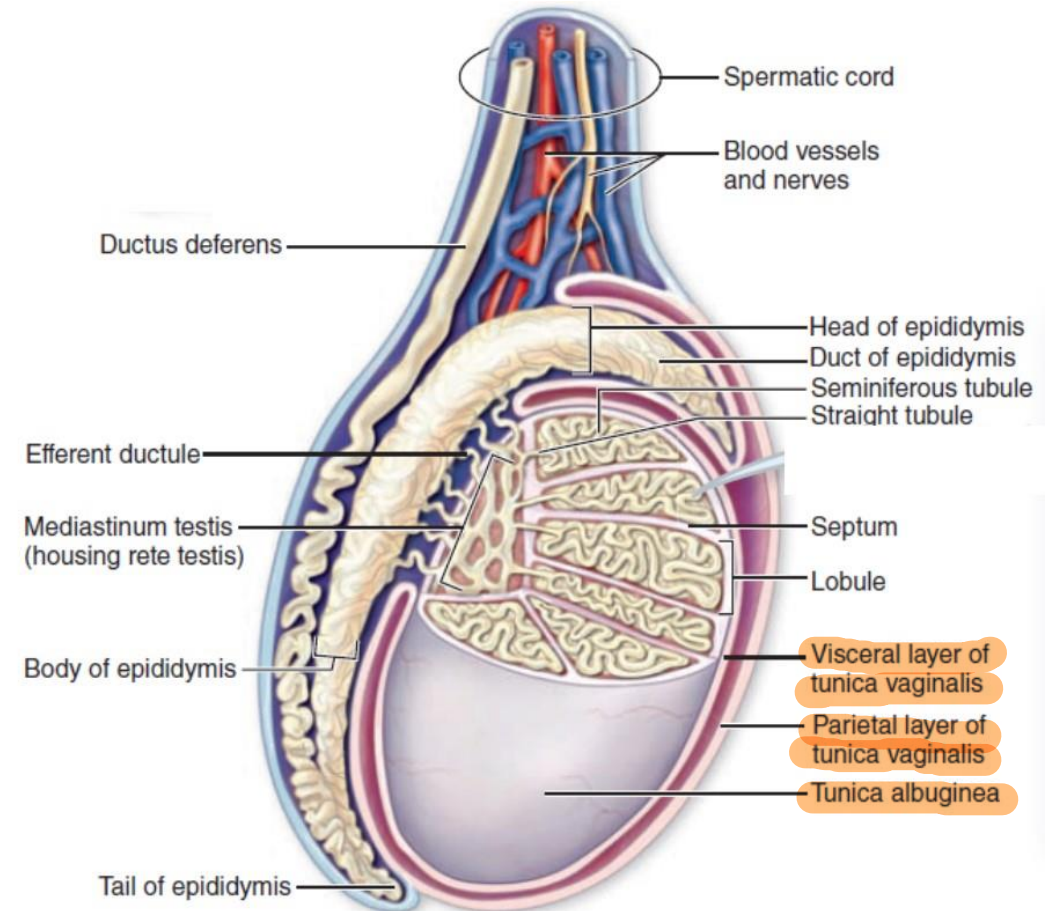
## Copulatory Organ

Penis



# Testis

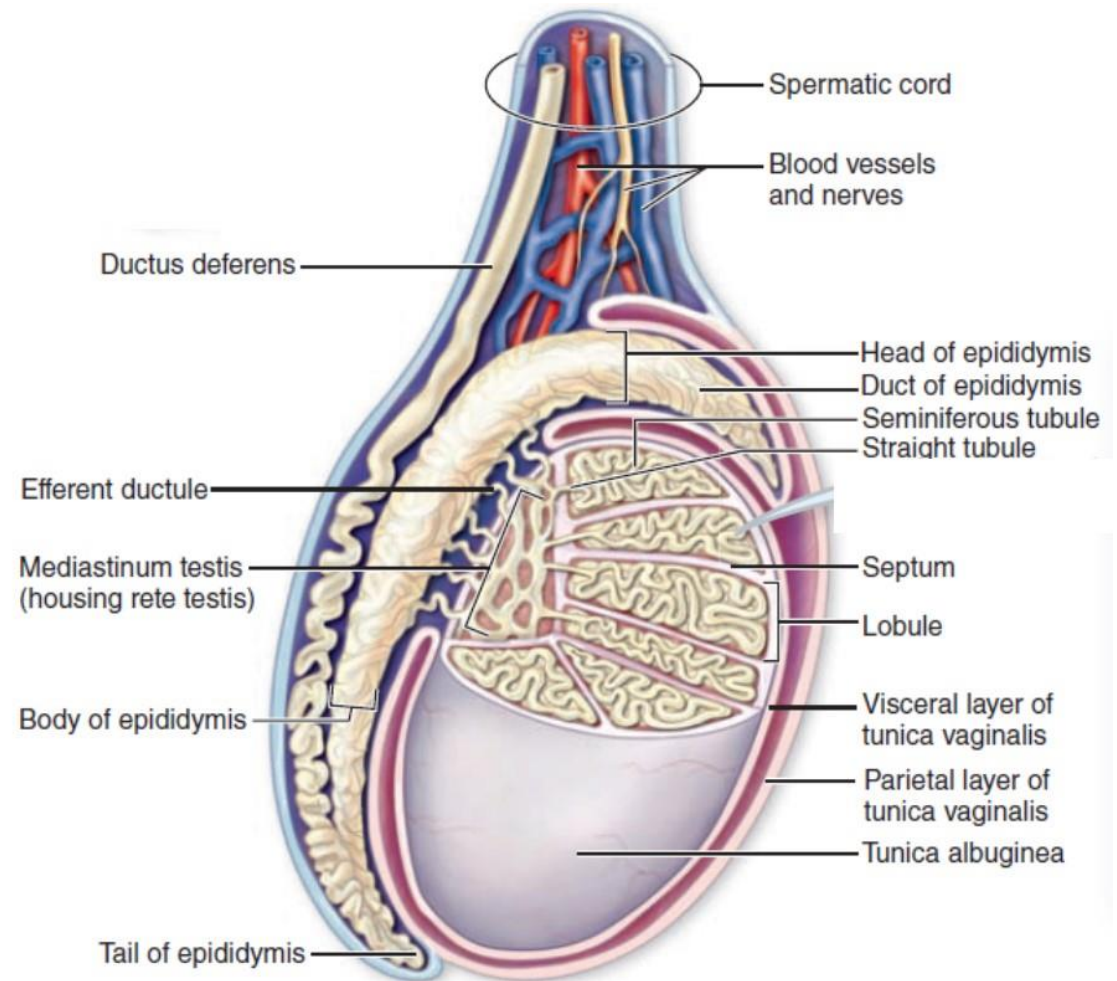
- Located outside the body cavity, in the scrotum
- Ovoid in shape
- Covered by **tunica vaginalis** (**visceral** and **parietal** layers) on its anterolateral surface
- **Functions:**
  - 1-Production of the spermatozoa
  - 2-Production of the male sex hormones (testosterone)



# Testis - Capsule and mediastinum

- Covered by dense irregular collagenous connective tissue capsule (**tunica albuginea**)
- The tunica albuginea thickens along the posterior surface to form the mediastinum testis (*rete testis*)
- **Fibrous septa project** from the mediastinum testis and **form pyramid-shaped lobules**

*remember: seminiferous tubules -> straight tubules -> rete testis -> efferent ductules -> head of epididymis*

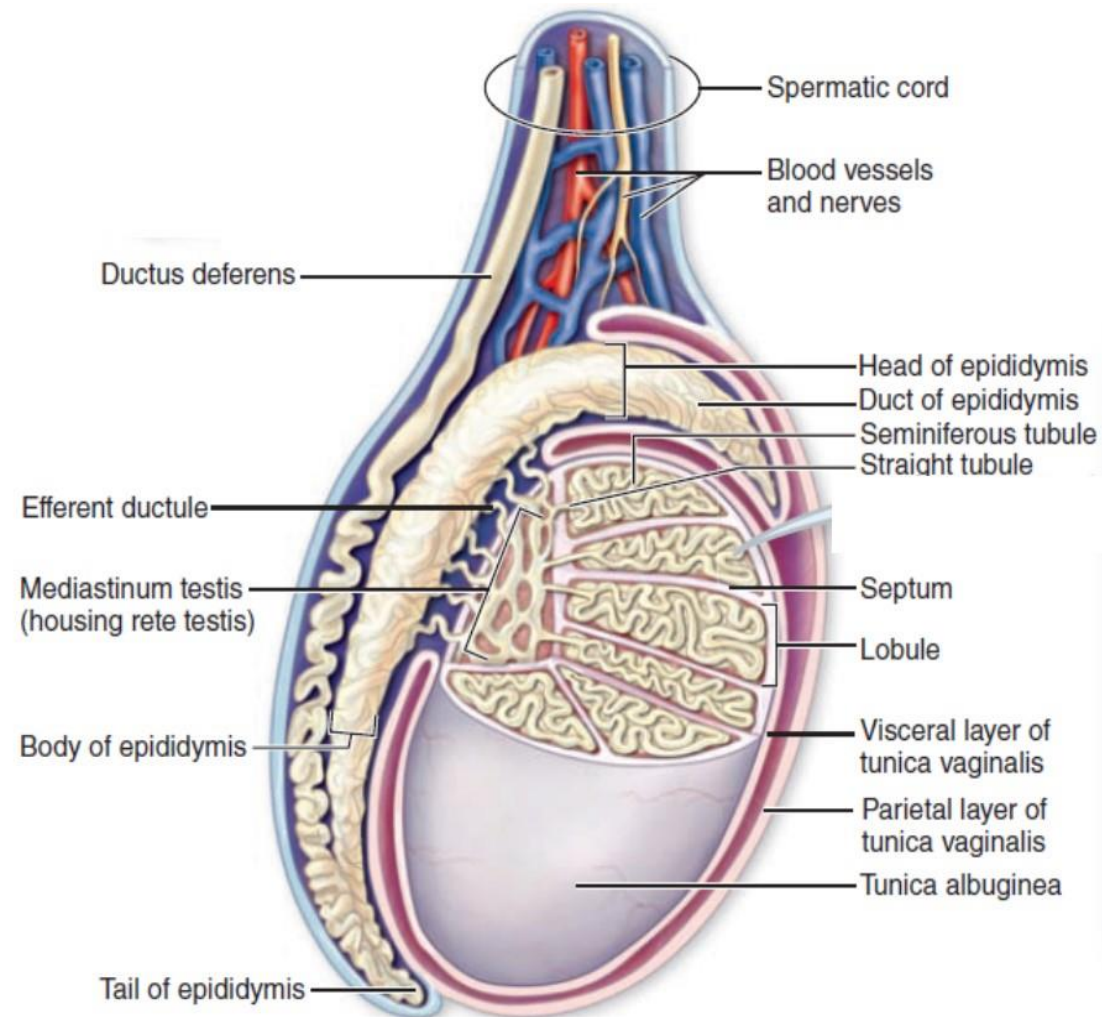


# Testis - Lobules

- Each contains **1-4 seminiferous tubules**
- Each seminiferous tubule forms a lobe that ends in a short straight tubules
- Seminiferous tubules are surrounded by extensive capillary bed

seminiferous tubules are lined by spermatogenic cells (produce sperms), and in between these cells there are Sertoli cells.

Now between the seminiferous tubules themselves there is interstitial tissue, and it contains Leydig cells that produce testosterone.





**Testis H&E**

**epididymis**

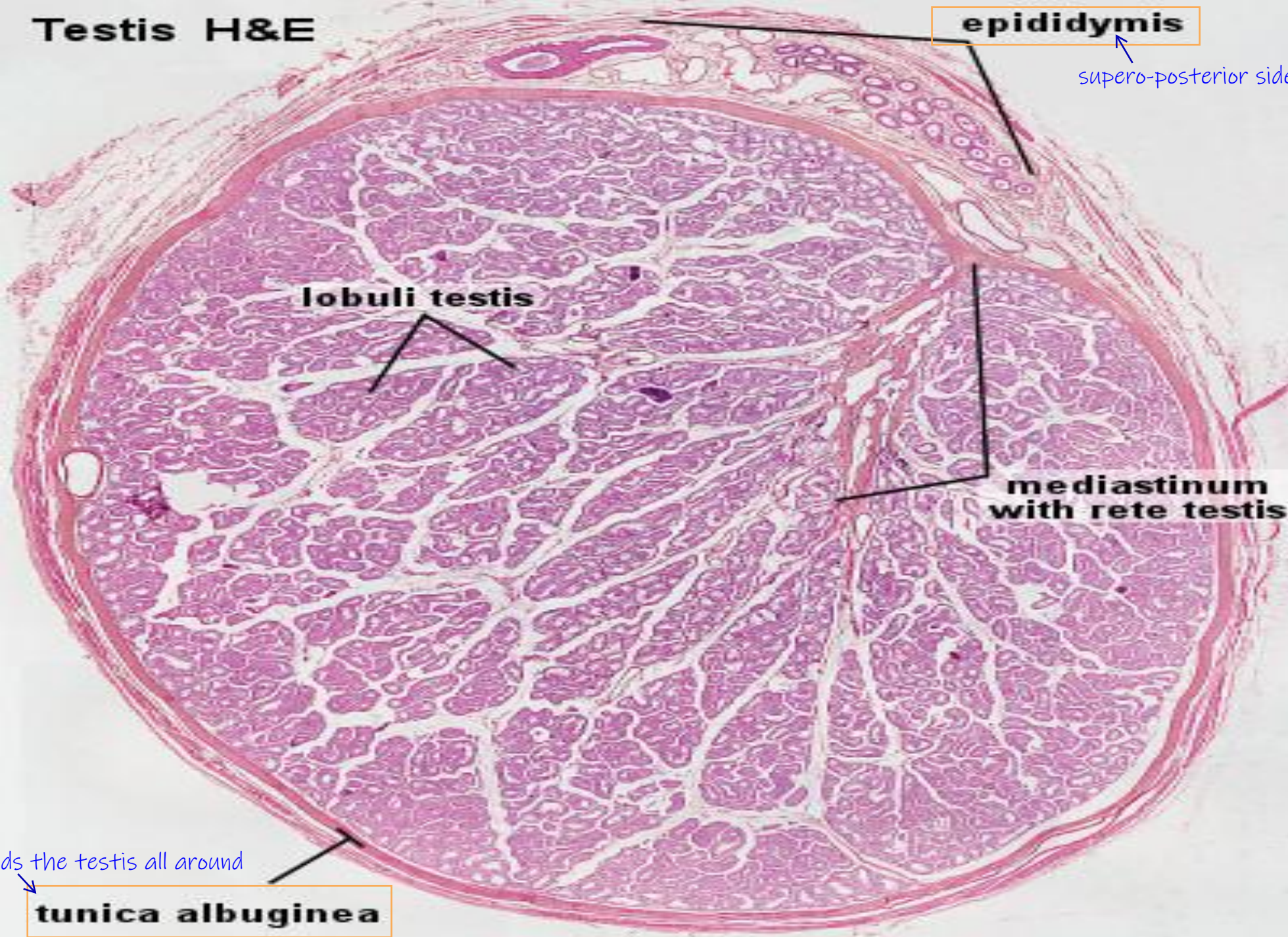
supero-posterior side of the testis

**lobuli testis**

**mediastinum with rete testis**

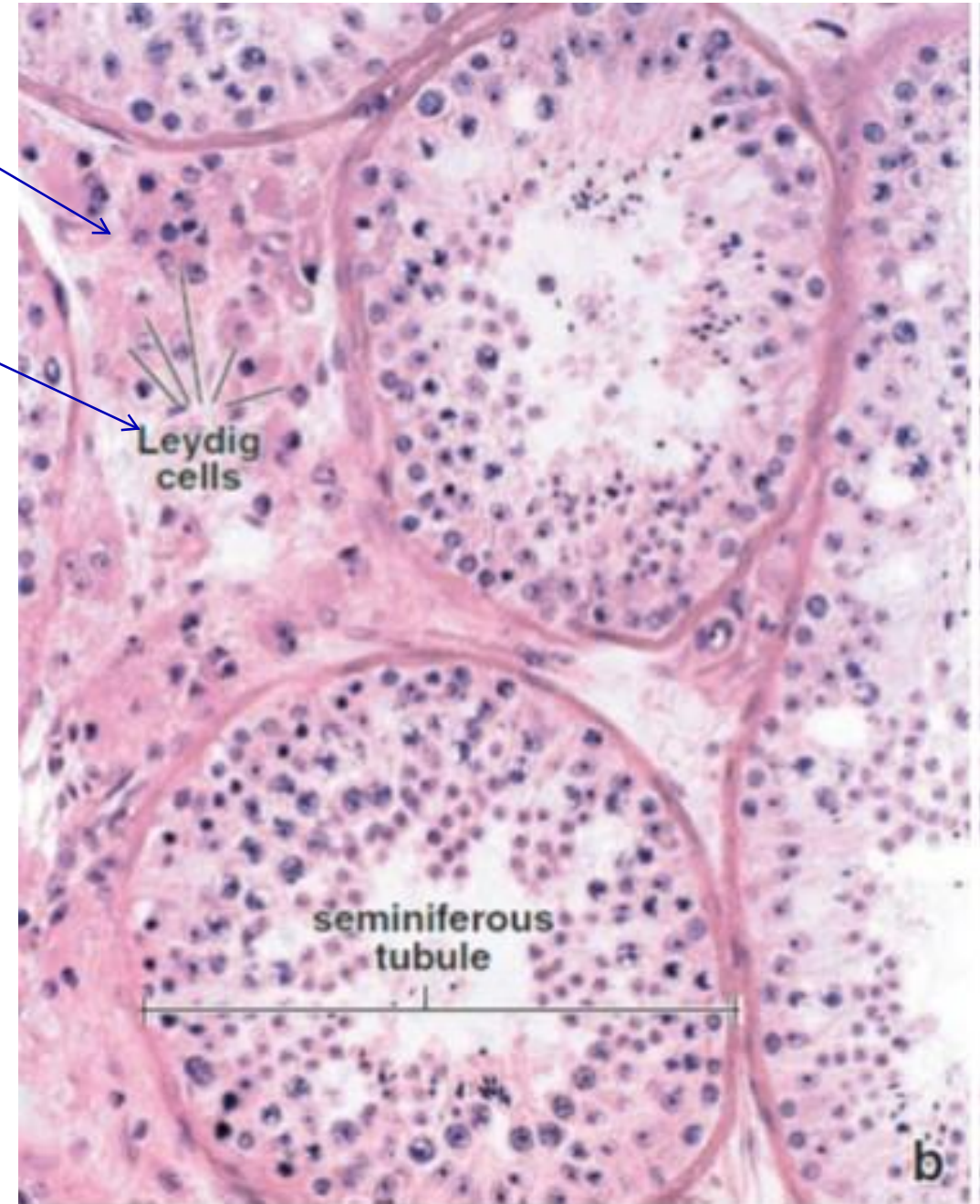
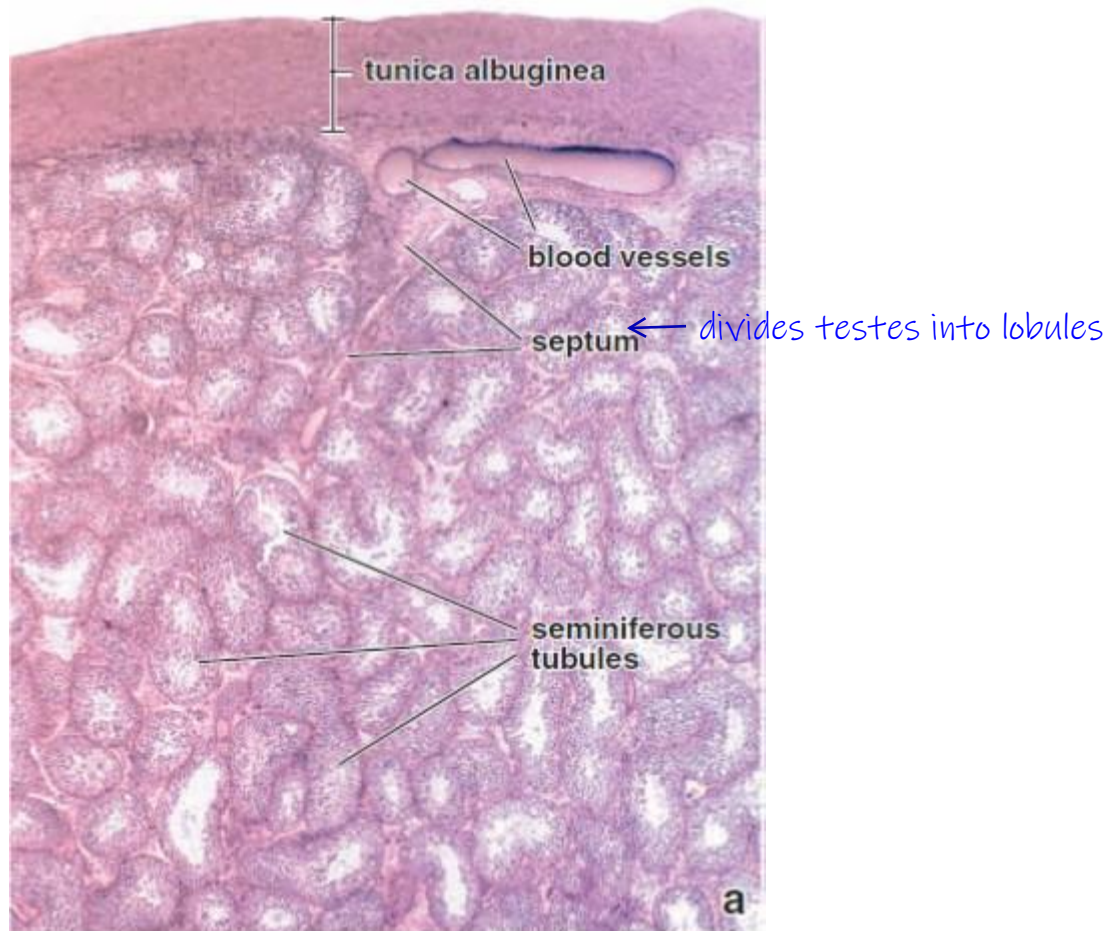
**tunica albuginea**

surrounds the testis all around



# Testis – Interstitial tissue

- Loose connective tissue between the seminiferous tubules
- Contains the interstitial cells of Leydig



# Testis H&E

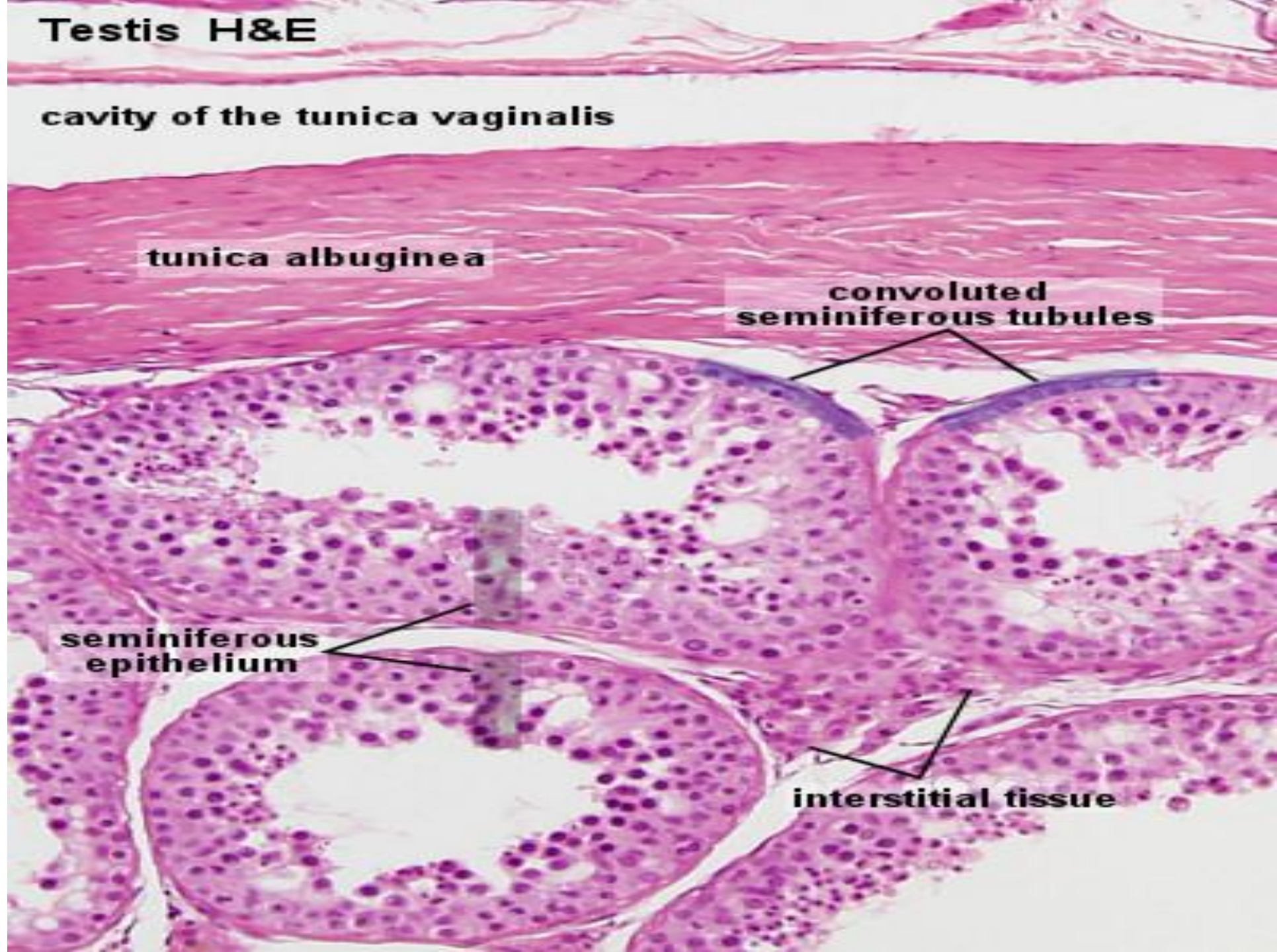
cavity of the tunica vaginalis

tunica albuginea

convoluted  
seminiferous tubules

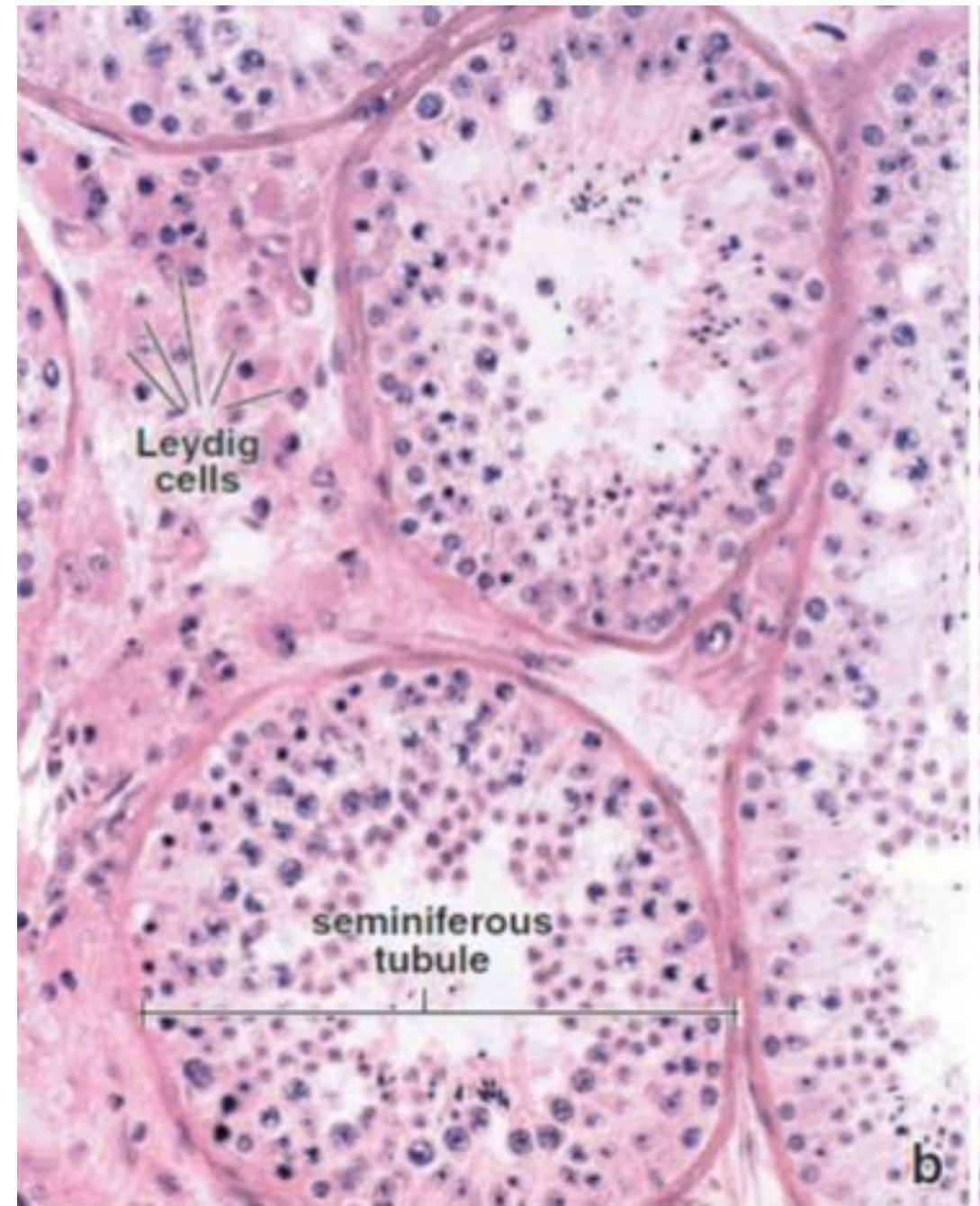
seminiferous  
epithelium

interstitial tissue

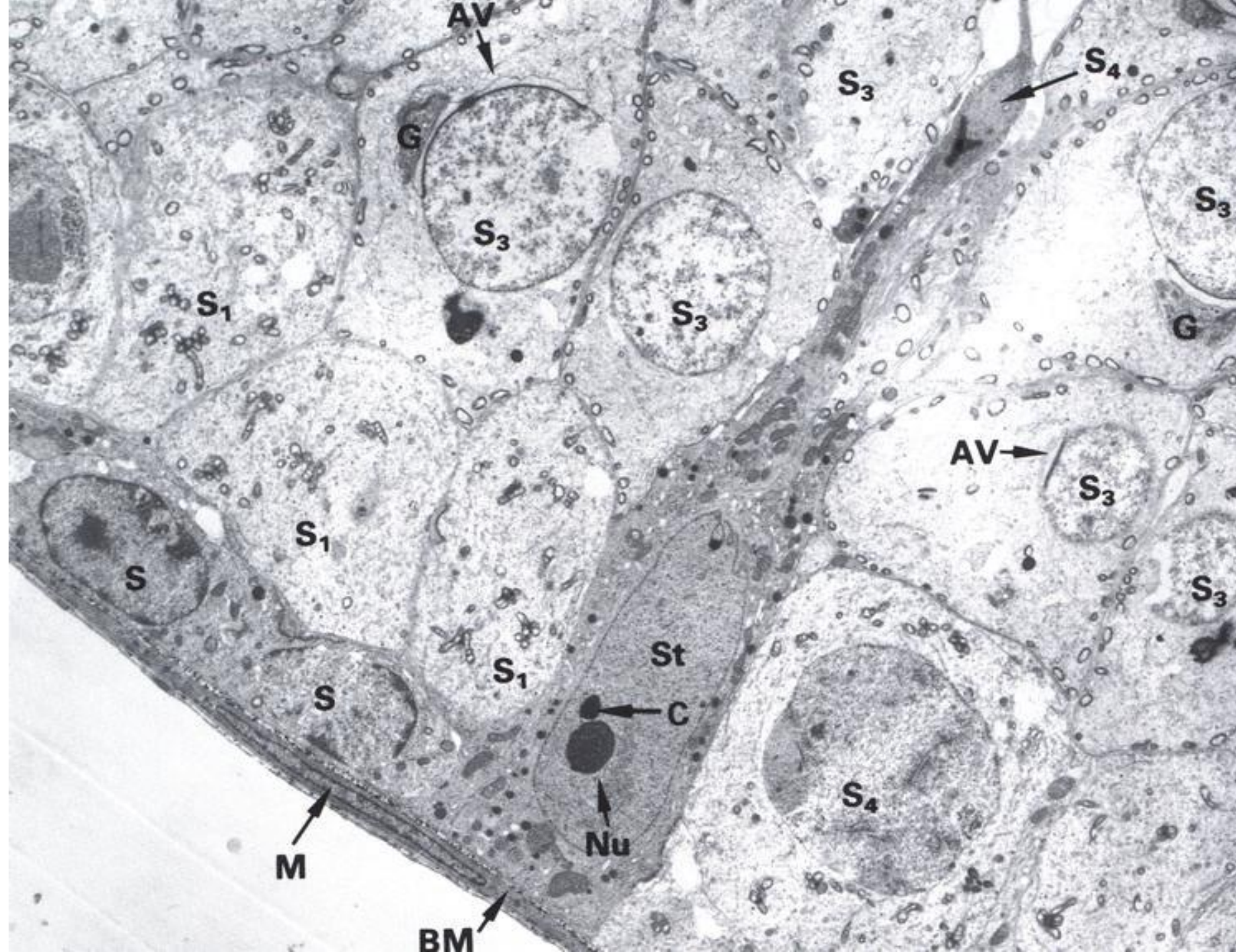


# Seminiferous tubules

- Lined by stratified epithelium known as seminiferous epithelium rests on Basement membrane (Basal Lamina)
- The epithelium is composed of Two populations of cells:
  - **Sertoli cells** (Mesodermal) *between spermatogenic cells*
  - Spermatogenic cells (Endodermal)
  - The connective tissue around tubules contains fibroblast and myoid cells
  - The **Myoid cells** produce **peristalsis** waves to help **movement of spermatozoa and testicular fluid** *(around the basement membrane)*

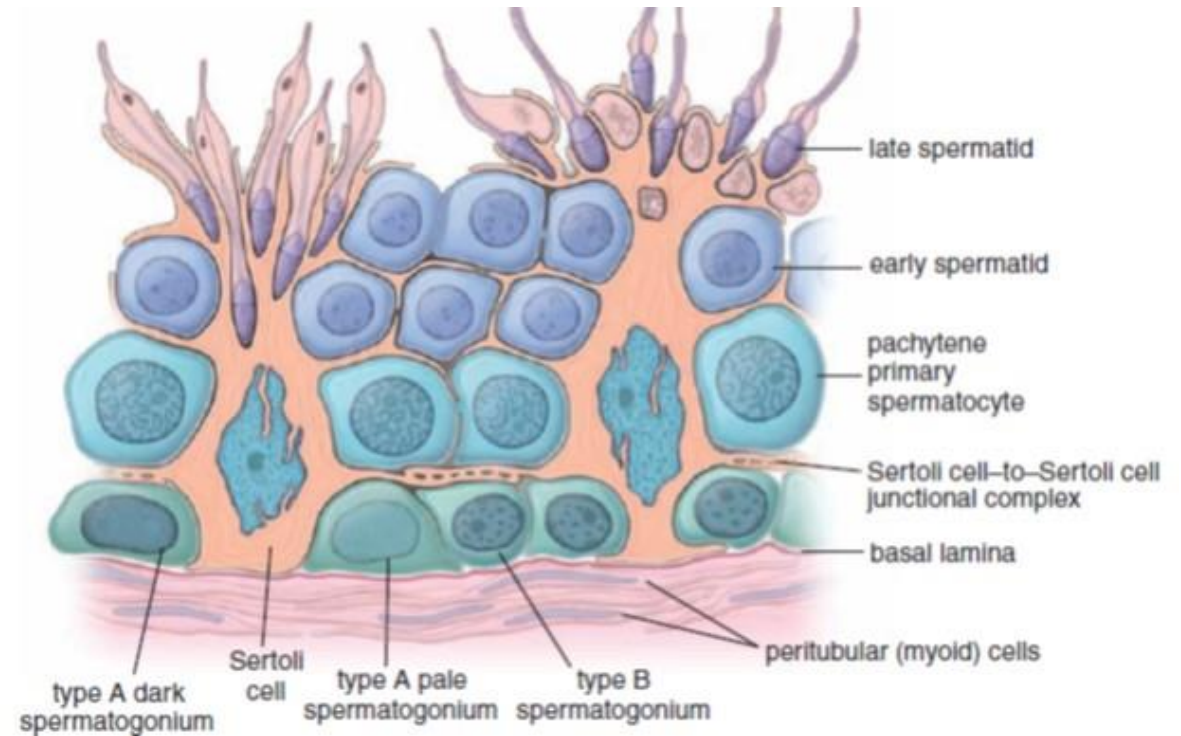


(BM) Baseme membrane  
(M) myoid cells  
(St) Sertoli cells  
(S) Spermatogonia



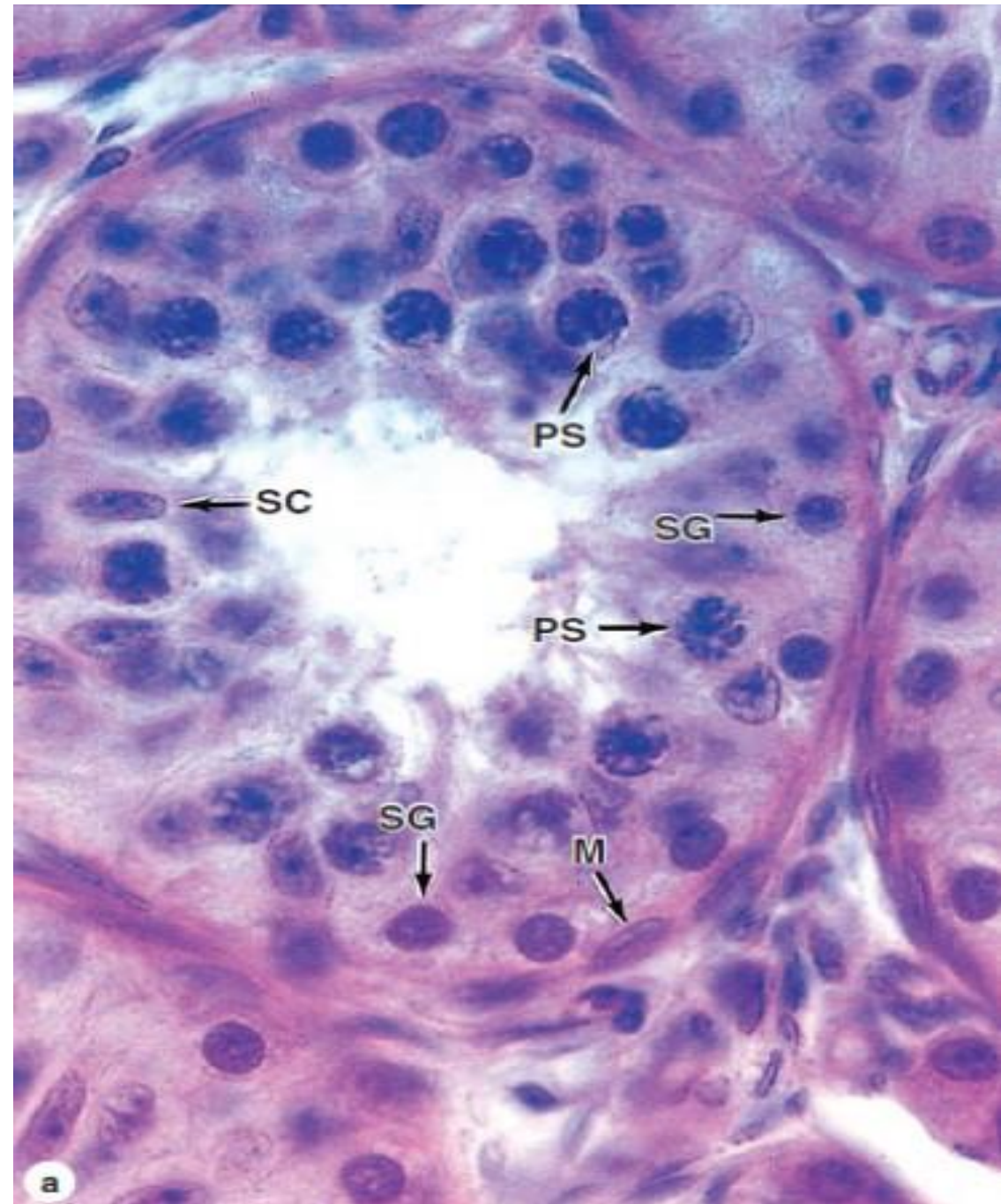
# Spermatogenic cells

- Male germ cells that replicate and migrate from the basal lamina to the lumen
- Endodermal in origin
- Include:
  - Spermatogonia
  - Primary spermatocytes
  - Secondary spermatocytes
  - Spermatids



# Spermatogonia

- Initial germ cells
  - Rest on the basal lamina and closely associated with Sertoli cell surfaces
  - Small rounded cells
  - Have diploid number of chromosomes and DNA
- 
- **(SG)** Spermatogonia
  - **(PS)** primary spermatocytes
  - **(M)** myoid cells
  - **(SC)** Sertoli cells



By repeated mitosis they are differentiated into :

**Type A dark and Pale spermatogonia.** *(just below the basement membrane)*

They have a spherical nuclei

Dark type remain as a reserve and Pale type gives Type B spermatogonia

**Type B spermatogonia**

Larger and lightly stained nuclei

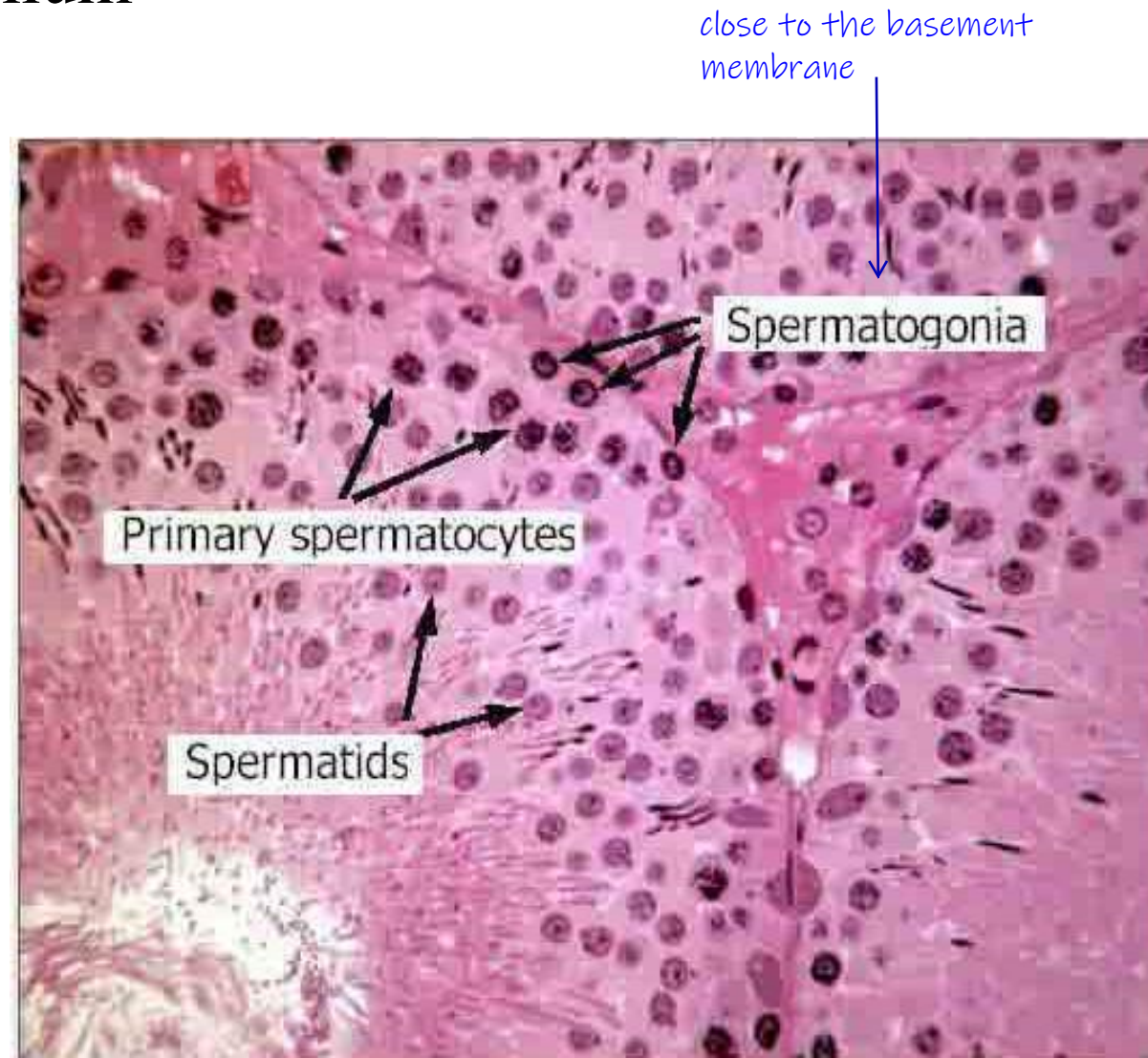
At puberty under effect of **FSH** they undergo mitotic activity and gives

**Primary spermatocytes**



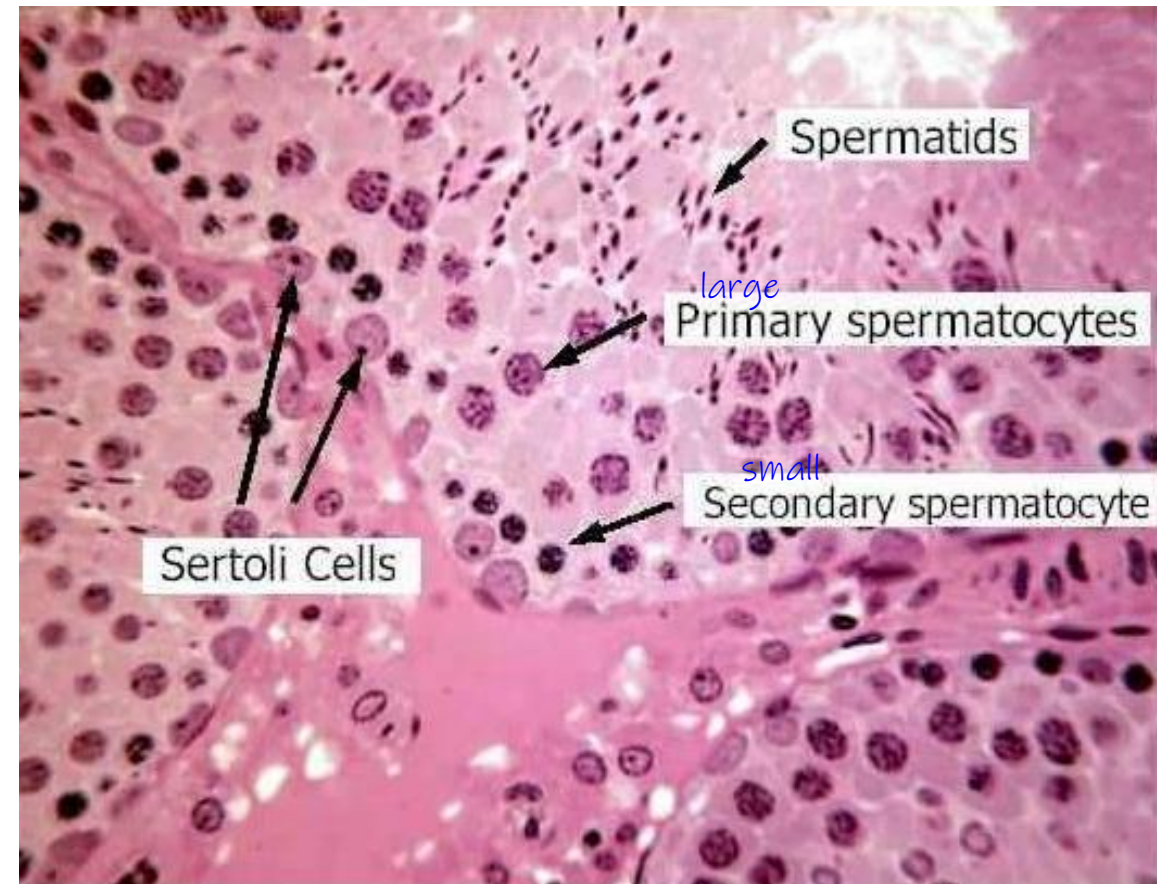
# Primary spermatocytes

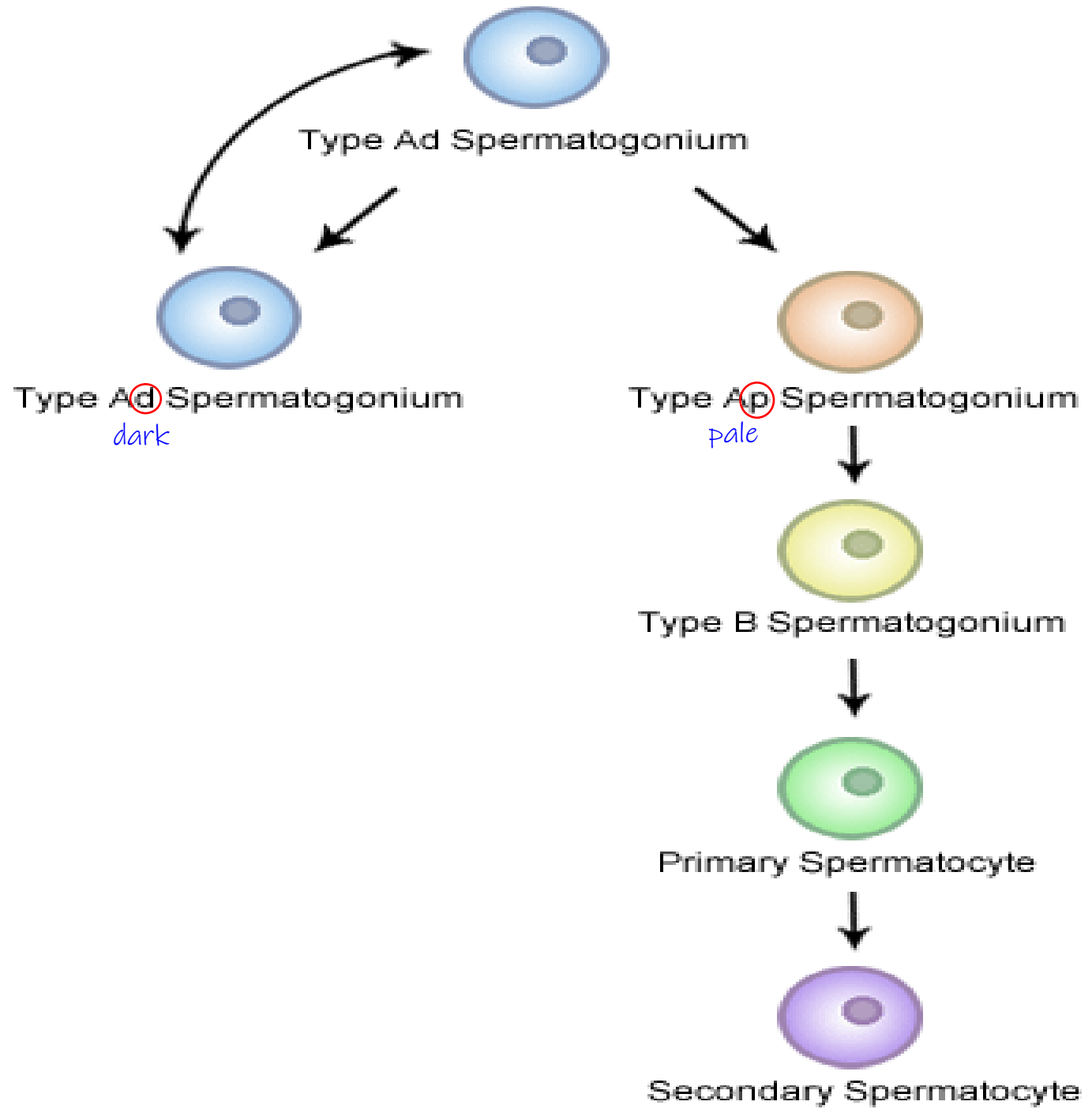
- The largest cells of the seminiferous epithelium
- spherical cells with euchromatic nuclei
- Has 46 chromosomes
- Enter the **first meiotic division to produce secondary spermatocytes**



# Secondary spermatocytes

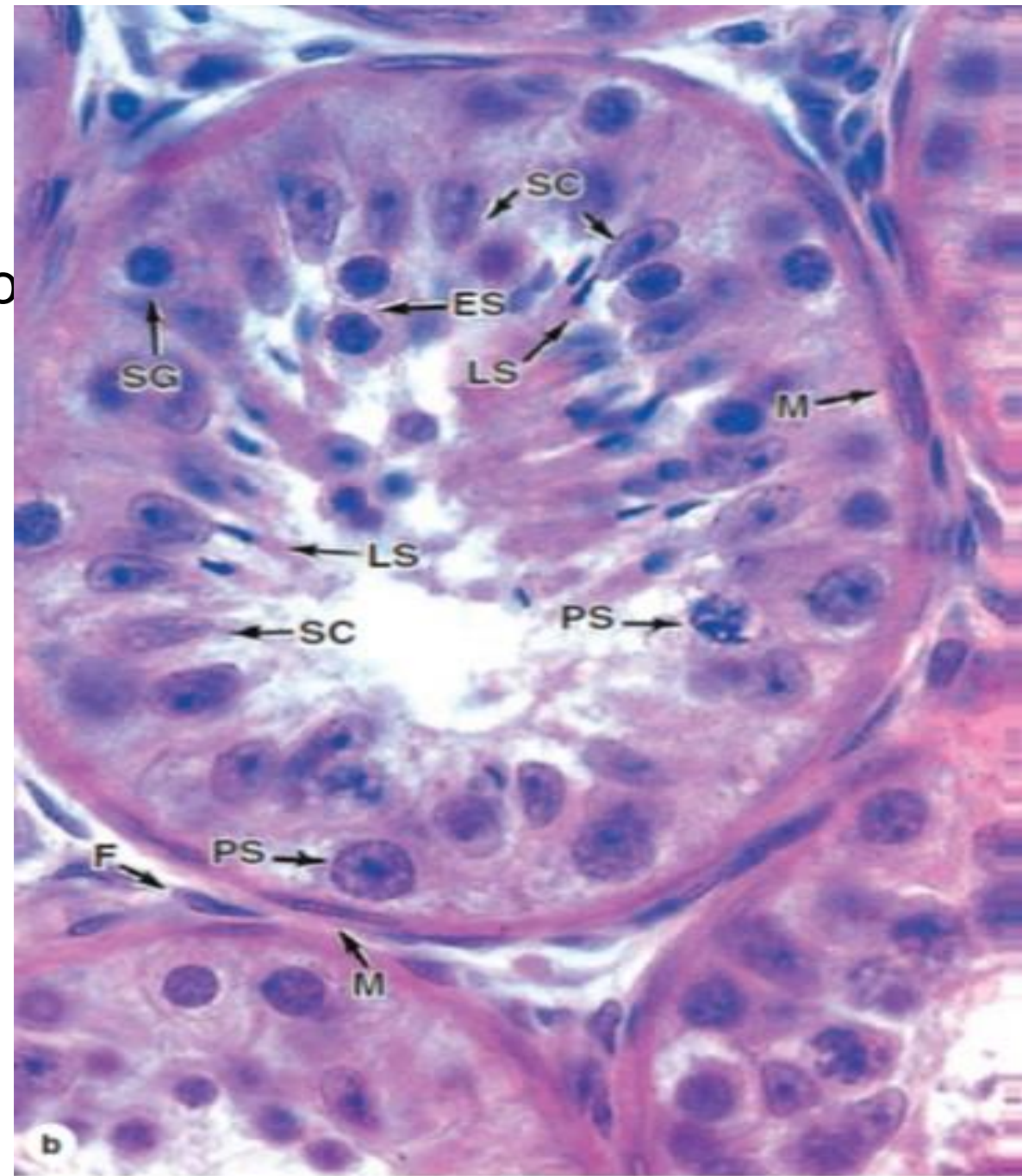
- Derived from the first meiotic division of primary spermatocytes
- Have 23 chromosomes
- Small cells, and because they are very short-lived cells, they are rarely seen in the seminiferous epithelium.
- Immediately enter the second meiotic division, forming two spermatids.





# Spermatids

- Small round cells with small spherical nuclei .
- Result from the second meiotic division of secondary spermatocytes
- Have **23 chromosomes** and
- Undergo a differentiation process that produces mature sperm.
- (**M**) myoid cells
- (**F**) fibroblasts
- (**SC**) Sertoli cells
- (**SG**) Spermatogonia
- (**PS**) primary spermatocytes
- (**ES**) early spermatids
- (**LS**) late spermatids



**Spermatozoa** : head, neck, middle piece, and tail

important slide!

Mature spermatozoa lies free in lumina of seminiferous tubules

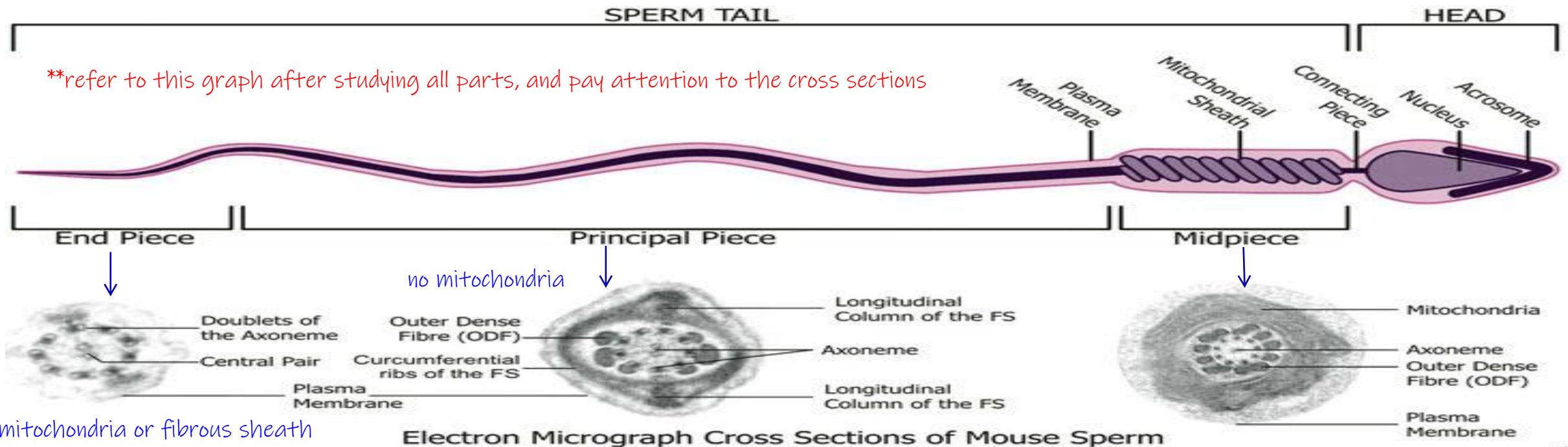
Each consists of

### 1-Head :

It contains condensed **nucleus** Covered with **acrosomal cap** which contains **lysosomes** and plays role for penetration of ovum.

### 2-Neck:

It is a containing the **centrioles** and the **connecting piece**, which for the nine fibrous rings surrounding the axoneme. *see next slide*

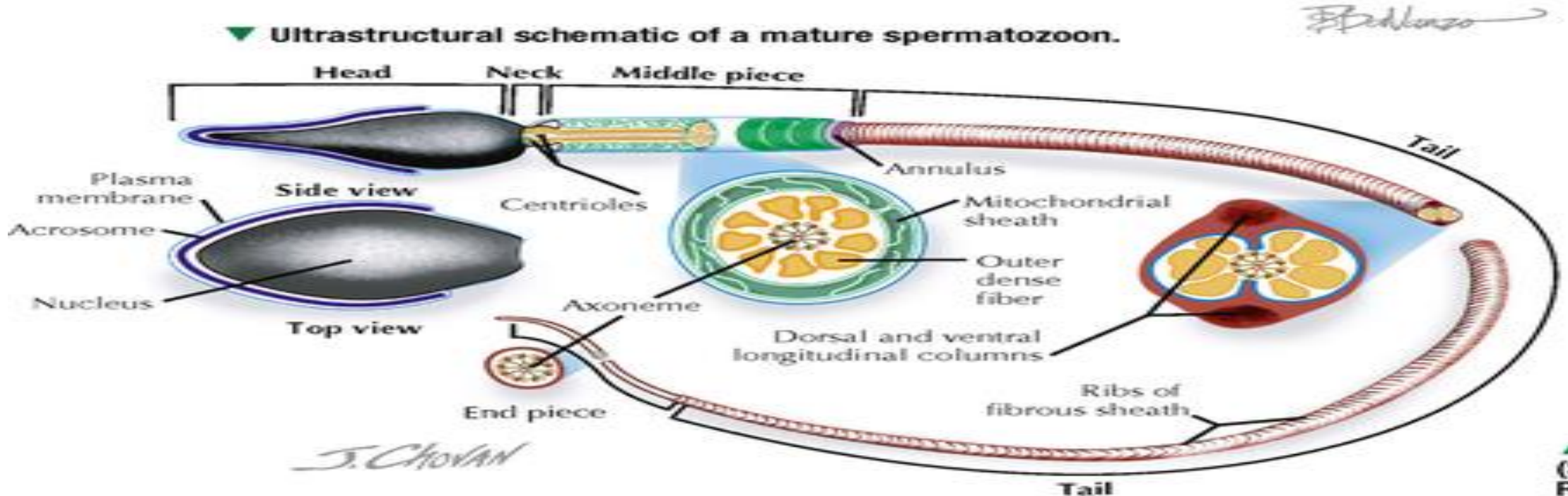


### 3-Middle piece:

important slide!

It consists from outwards inwards:

- ❖ Plasma membrane. *extends all the way down*
- ❖ Elongated mitochondrial sheath. *to provide energy, obviously*
- ❖ Fibrous sheath → *surrounds the axoneme all the way to the end of the principal piece of the tail*
- ❖ **Axoneme** : nine peripheral pairs of fused microtubules around a central pair of individual microtubules (9 + 2) *extends all the way down.*



**Tail:** It consists of:

*important slide!*

**A- Principal piece:** the longest part of the tail consists of:

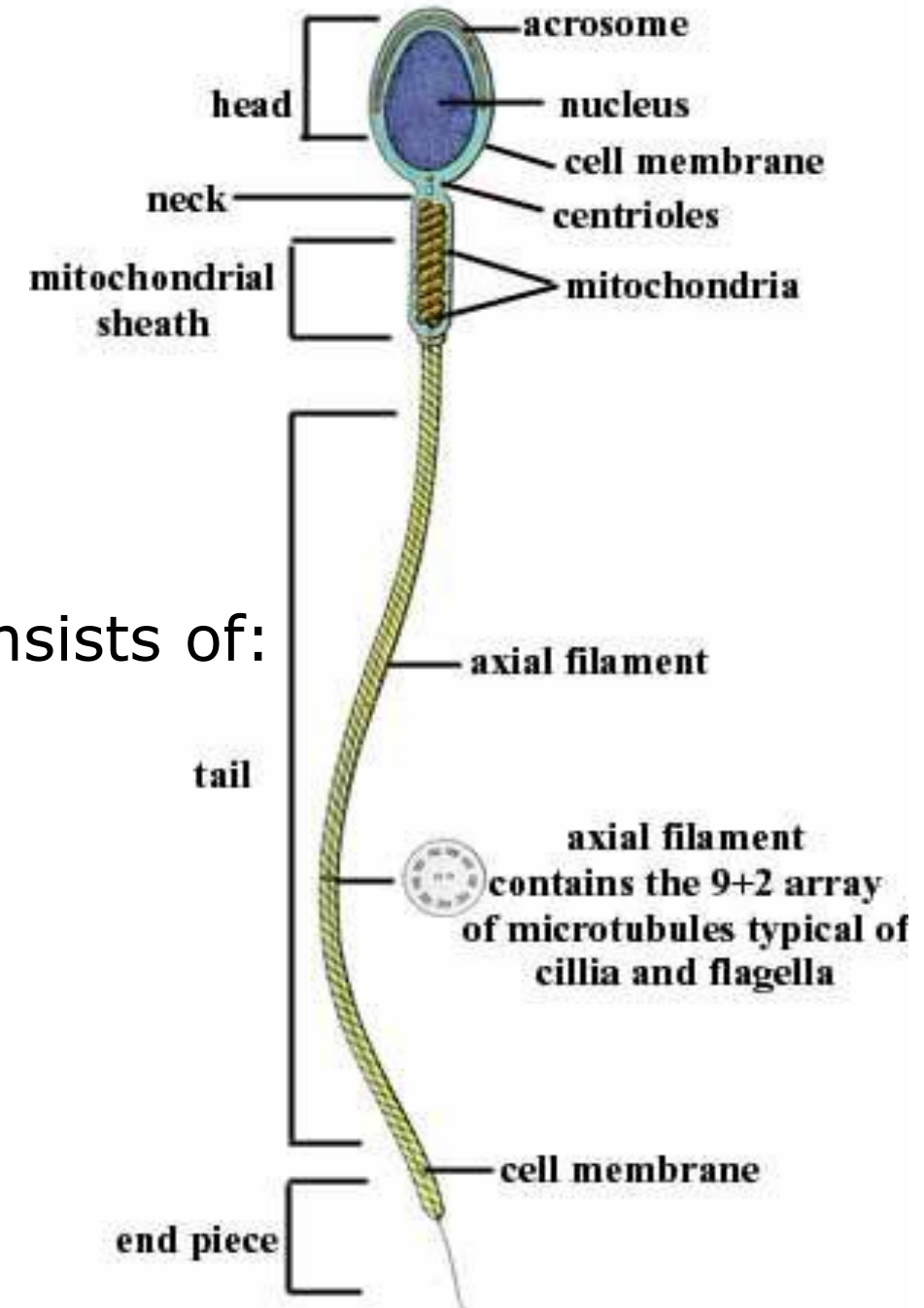
- Plasma membrane.
- Fibrous sheath.
- Axoneme (9 + 2).

**B- End piece:** the shortest part of the tail consists of:

- Plasma membrane.
- Axoneme (9 + 2)

*there's no fibrous sheath here, so in a cross section we would only find the axoneme surrounded by plasma membrane*

*\*\*now go back and study the cross sections↑*



# Sertoli cells

- Mesodermal in origin
- Resistant to heat, x-irradiation, infection and malnutrition
- The **most numerous** cells in the epithelium **before puberty** and **reduced** (make up to **10 %** of the cell population) **after puberty** because of the increase in germ cells
- Have plasma membrane **receptors for** follicular stimulating hormone **(FSH)** *(to promote secretion of the androgen-binding protein ABP)*



## Sertoli cells

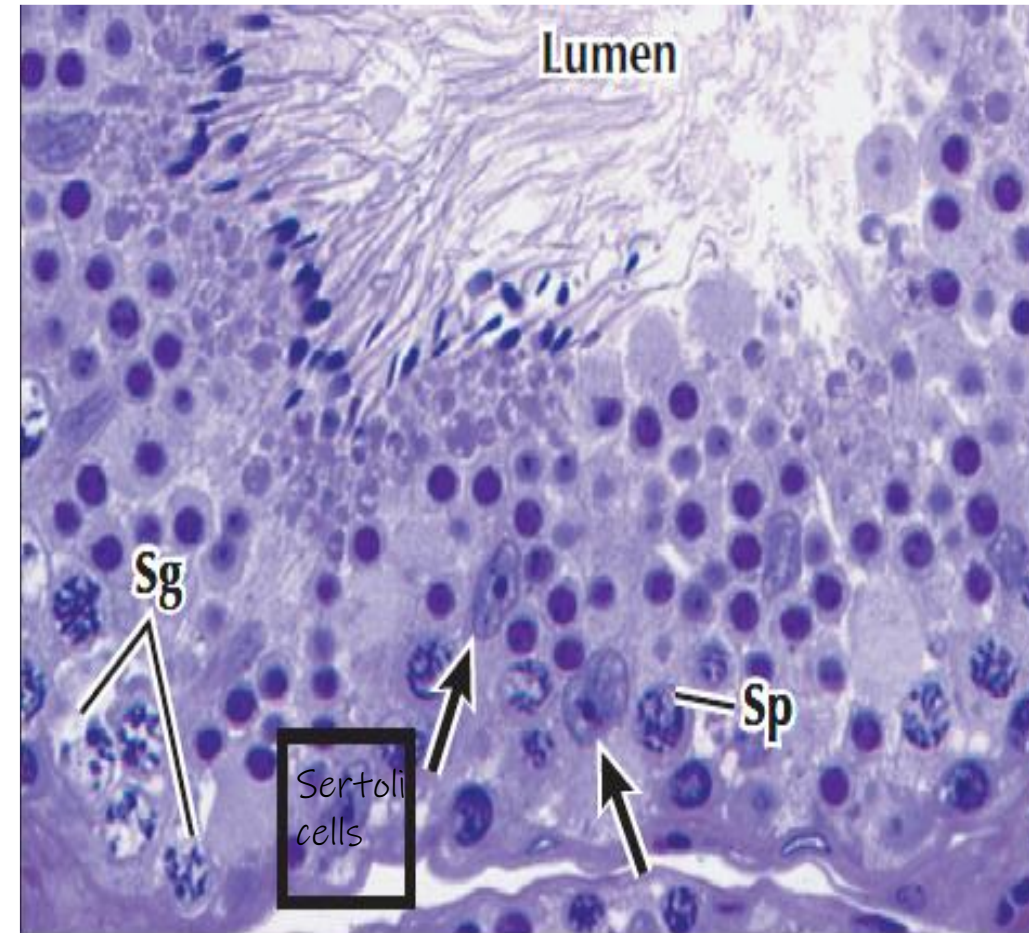
### LM:

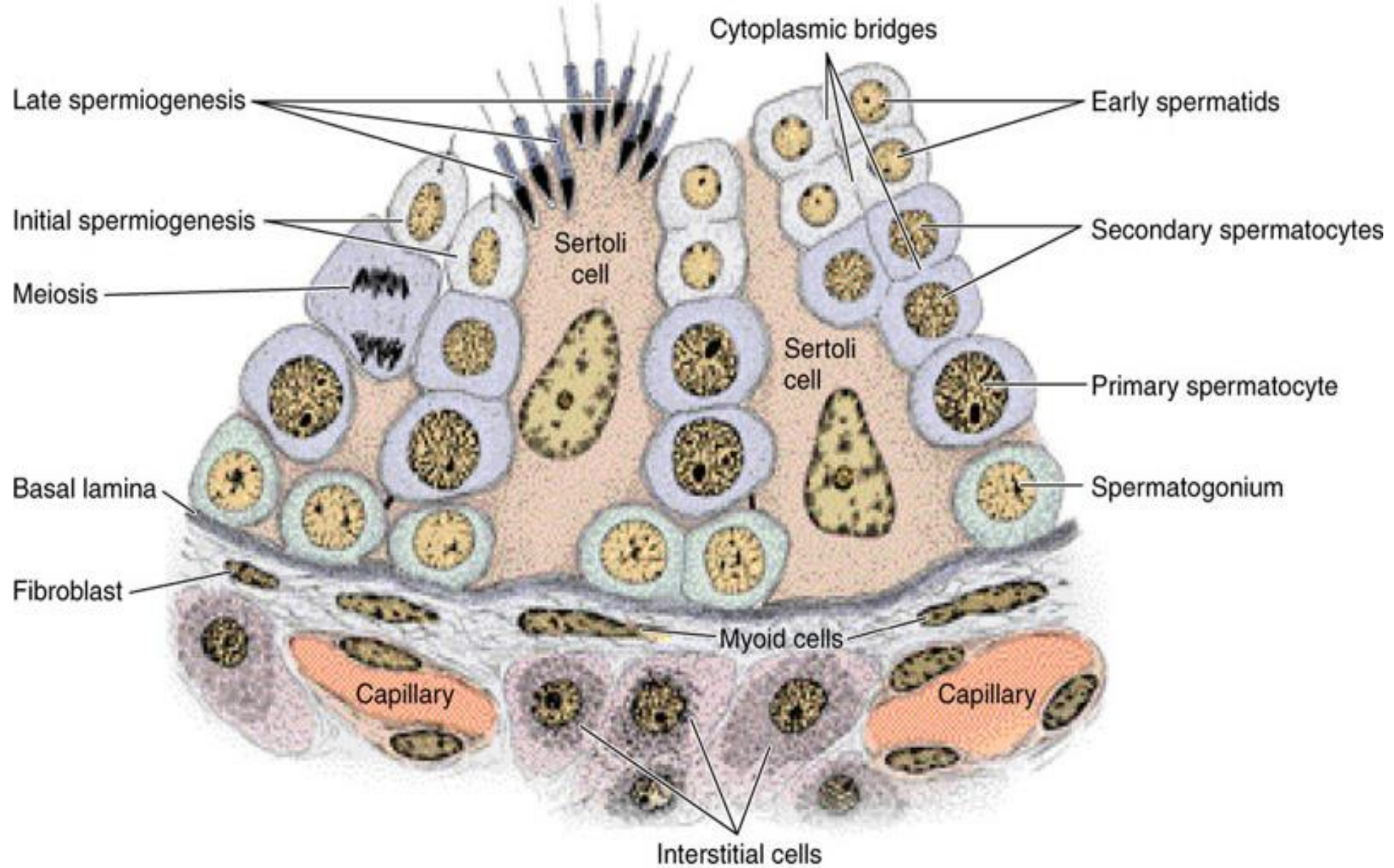
Tall columnar epithelial cells

Extend through the full thickness of the epithelium

Indistinguishable borders due to complex basal, lateral and apical cell margins as it surrounds the adjacent germ cells

Each has euchromatic nucleus usually ovoid with a prominent nucleolus



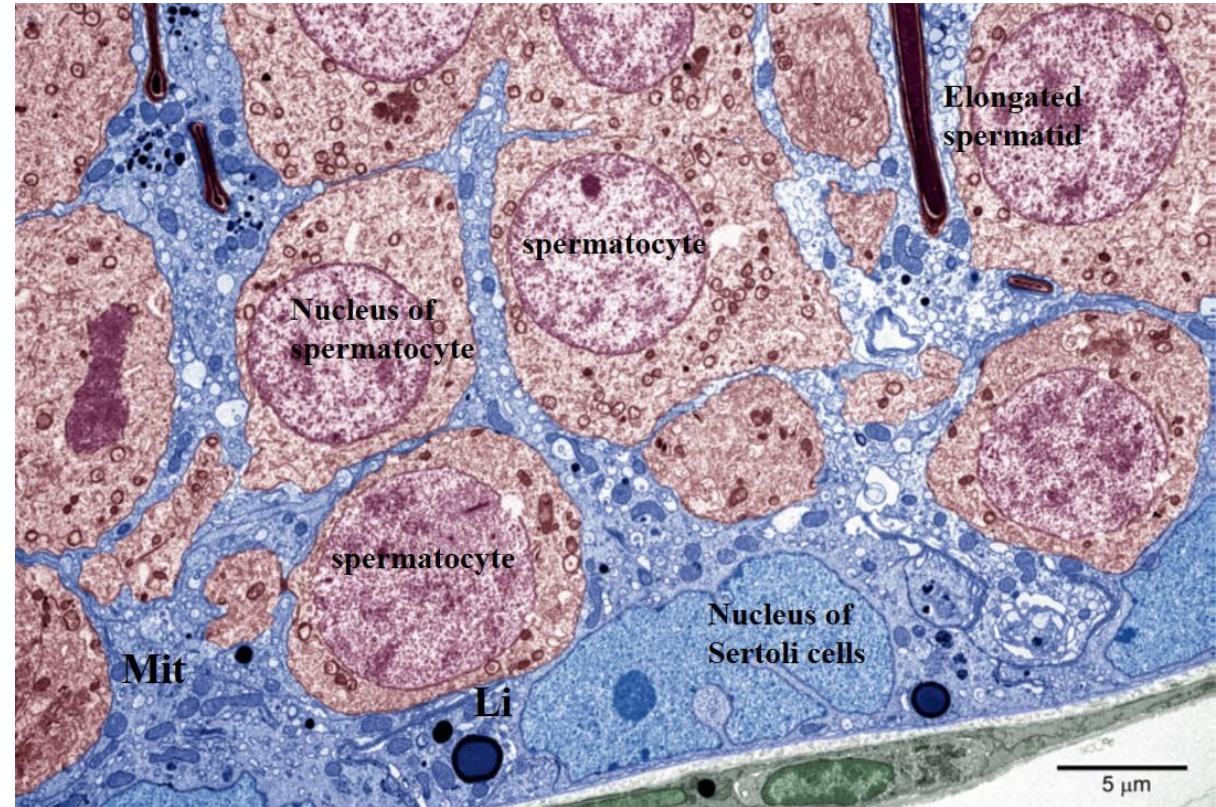


**Part of a seminiferous tubule with its surrounding tissues. The seminiferous epithelium is formed by 2 cell populations: the cells of the spermatogenic lineage and the supporting or Sertoli cells**

# Sertoli cells

## EM:

- Have complex apical and lateral processes that surround adjacent germ cells.
- Have an extensive SER and a well-developed RER, Lysosomes
- Abundant cytoskeleton (microfilaments and microtubules)
- Euchromatic nucleus, basally located and has with a large, centrally positioned nucleolus.



- Sertoli cells are bound to each other and to the germ cells by several types of cell-cell junctions

- **Sertoli-basal lamina junctions:**

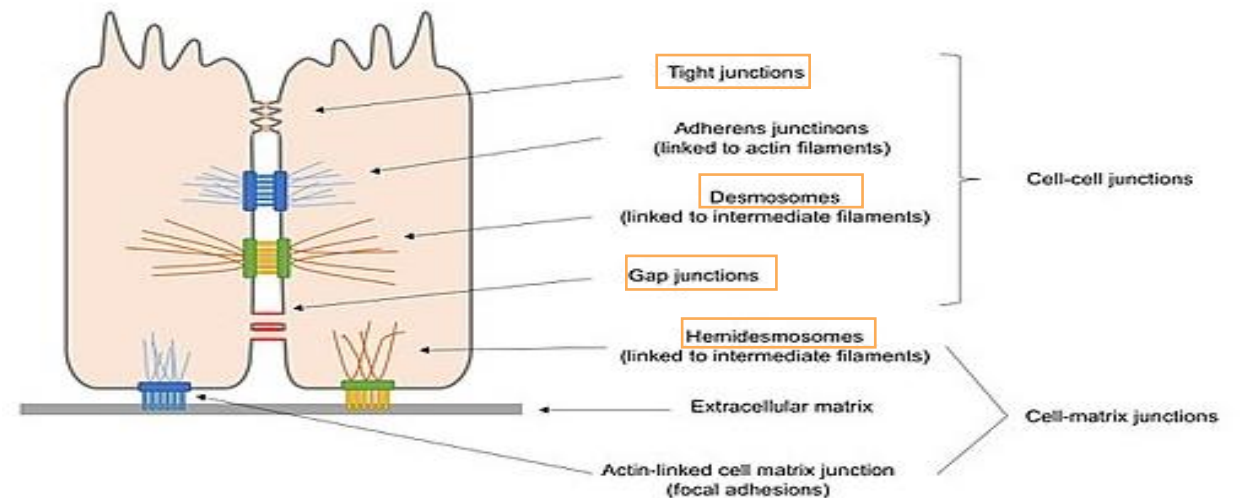
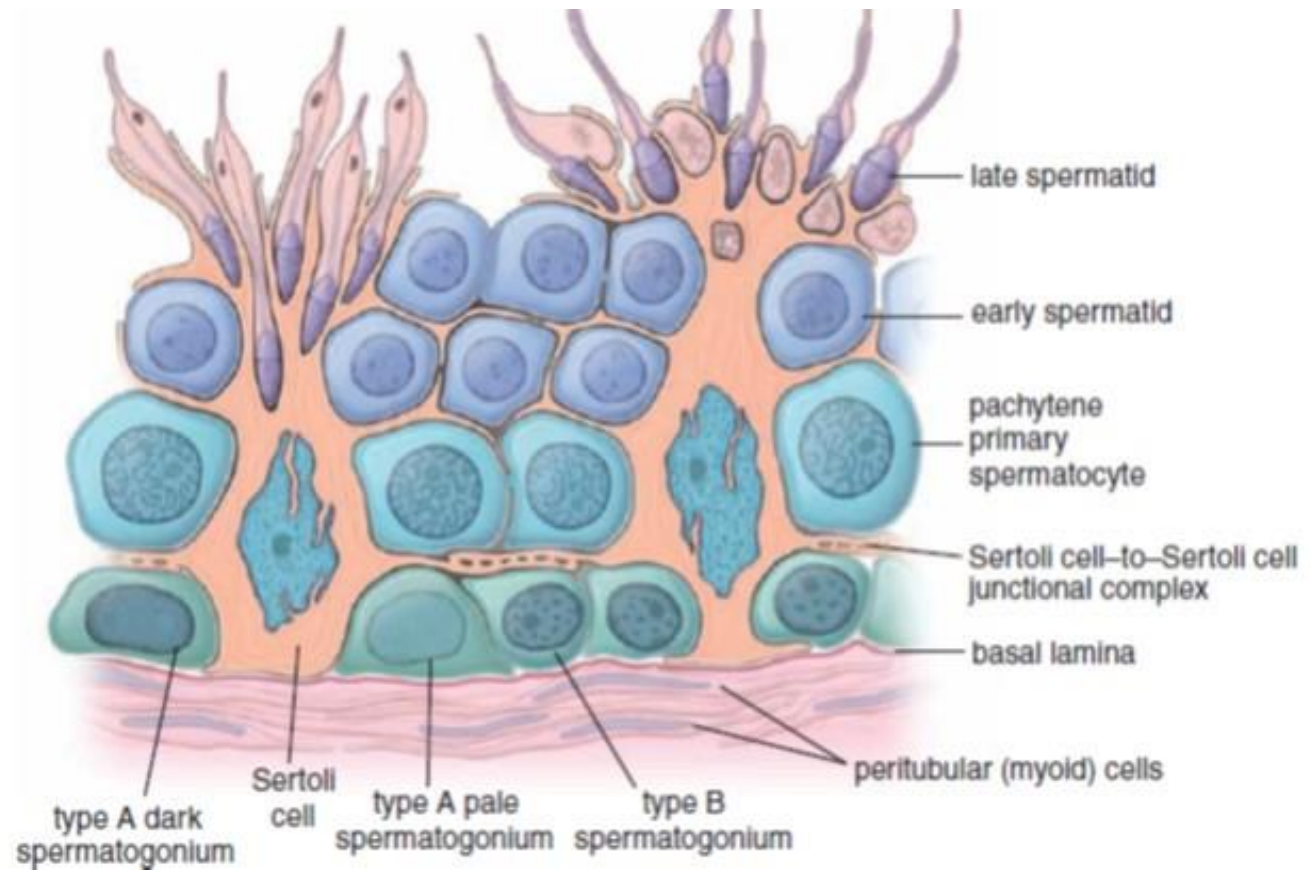
- Hemidesmosomes

- **Sertoli-germ cell junctions:**

- Desmosome

- **Sertoli-Sertoli junctions:**

- Gap junctions
- Tight junctions



# Functions of Sertoli cells

## 1. Supporting cells.

Sertoli cells surround and physically support the developing germ cells.

## 2. Phagocytic cells.

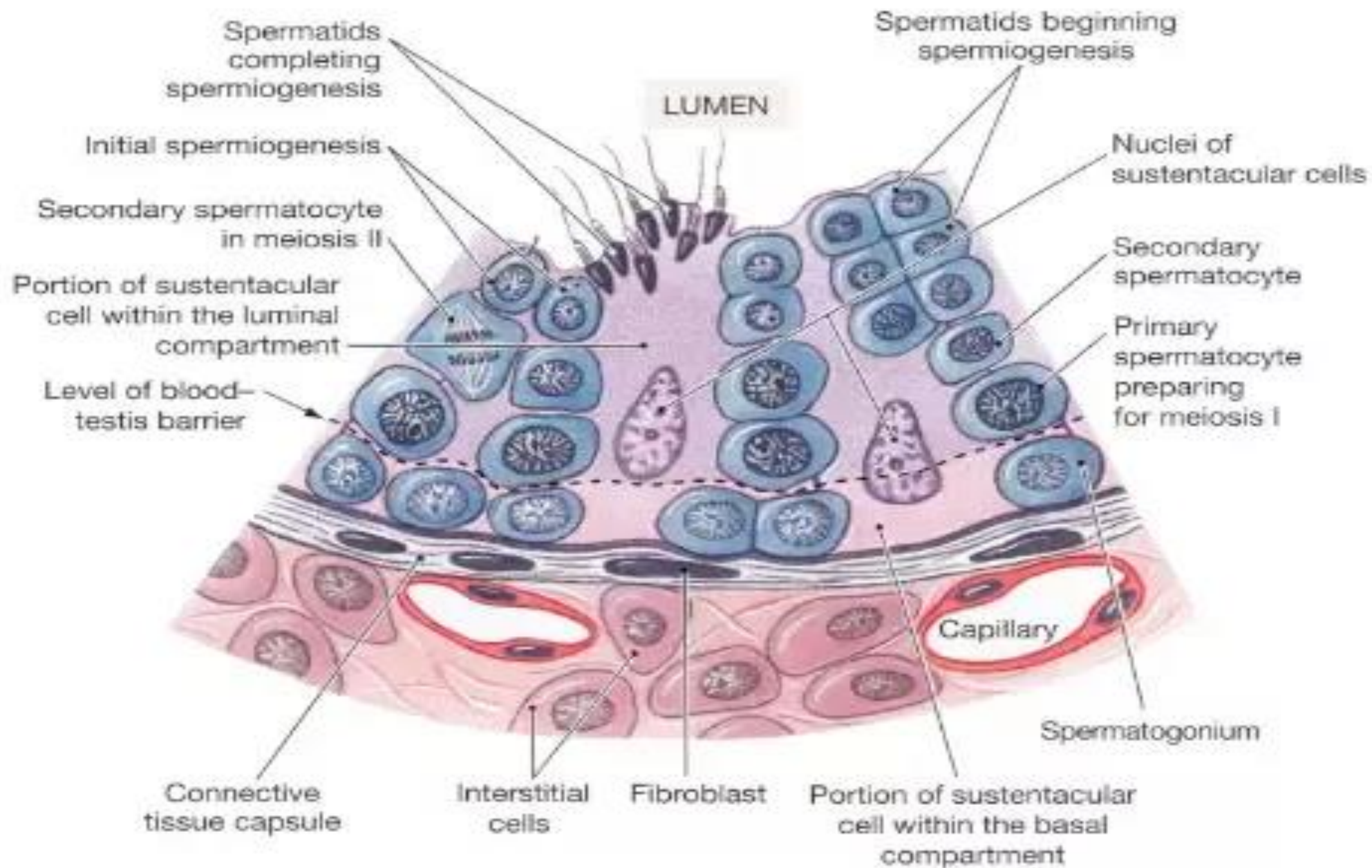
- Sertoli cells phagocytize and digest the residual bodies released in the last stage of spermiogenesis,.

## 3. Secretory cells.

- The testicular fluid carry non motile sperm to epididymis
- Androgen-binding protein (ANP) which concentrates testosterone to a level required for spermiogenesis, is promoted by follicle-stimulating hormone (FSH)
- Inhibin which inhibits the secretion of **FSH** (recently, inhibin injections are used as male contraceptive as it inhibits spermatogenesis ). *these ducts develop the female genital system, so we need to inhibit this development by this hormone ↘*
- Anti-mullerian hormone that causes regression of the embryonic müllerian ducts

4. **Nutrition** They supply the spermatogenic cells with nutrition taken from near by capillaries, as the spermatogenic cells are isolated from blood supply by the testis barrier.

## 5. Formation of blood-testis barrier



## The blood-testis barrier:

remember when we said that Sertoli cells are connected to each other by tight junctions?  
well now these tight junctions form this barrier and divide the seminiferous tubule into basal part and adluminal part

### General Features:

It is the barrier that controls the passage of tissue fluids, from outside to the inside of the seminiferous tubule.

It is formed by the tight junctions between the basal parts of the Sertoli cells, thus subdividing the lumen of the seminiferous tubule into a basal and an adluminal compartment. Each compartment has a separate distinct population of spermatogenic cells.

**The basal compartment** : extends from the basal lamina of germinal epithelium to the tight junction (containing spermatogonia).

**The adluminal compartment** : extends between the tight junctions and the lumen of the tubule. It contains primary, secondary spermatocytes and spermatids.

## Functions of the blood-testis barrier

*important!*

1- It allows the passage of useful materials needed for spermatogenesis as hormones (Testosterone) , vitamins, electrolytes,...

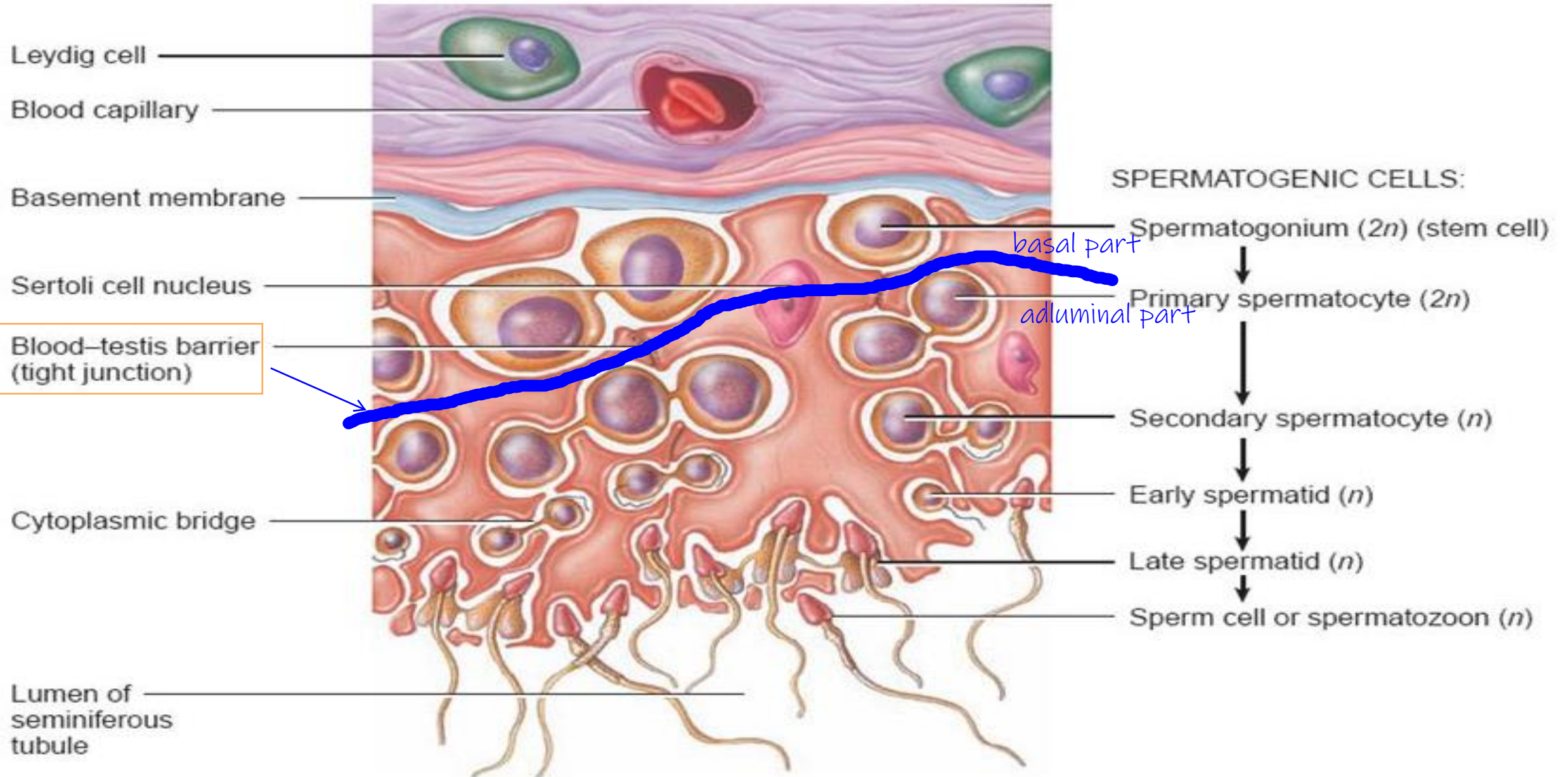
2-It prevents the entrance of damaging substances as antigens, antibodies and toxins.

3-It prevents the passage of sperms from the seminiferous tubule to the blood stream and the formation of antibodies against them (autoimmune disease).

Because spermatogenesis begins after puberty, the newly differentiating germ cells, would be considered "foreign cells" by the immune system.

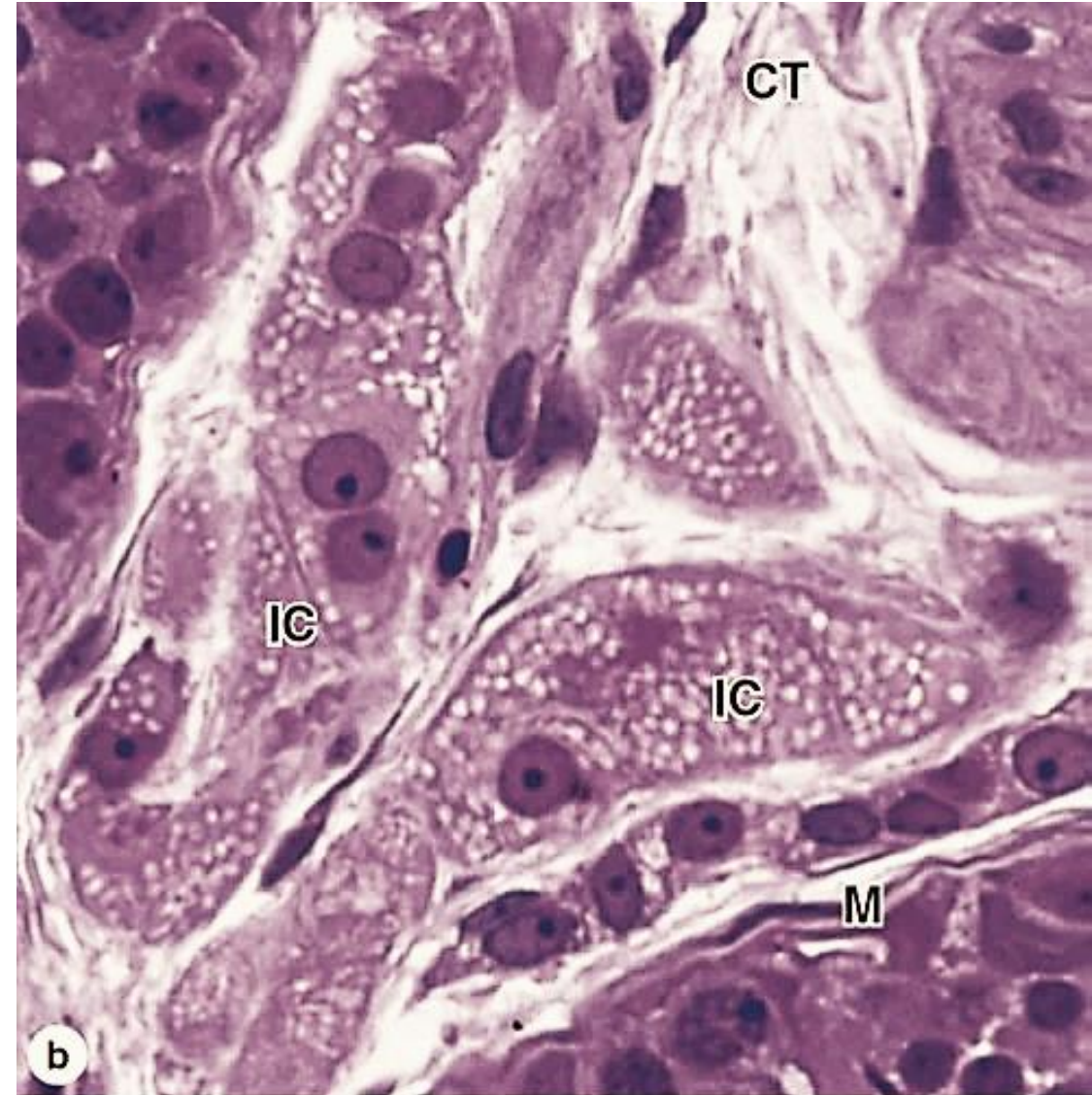


# Blood-testis Barrier



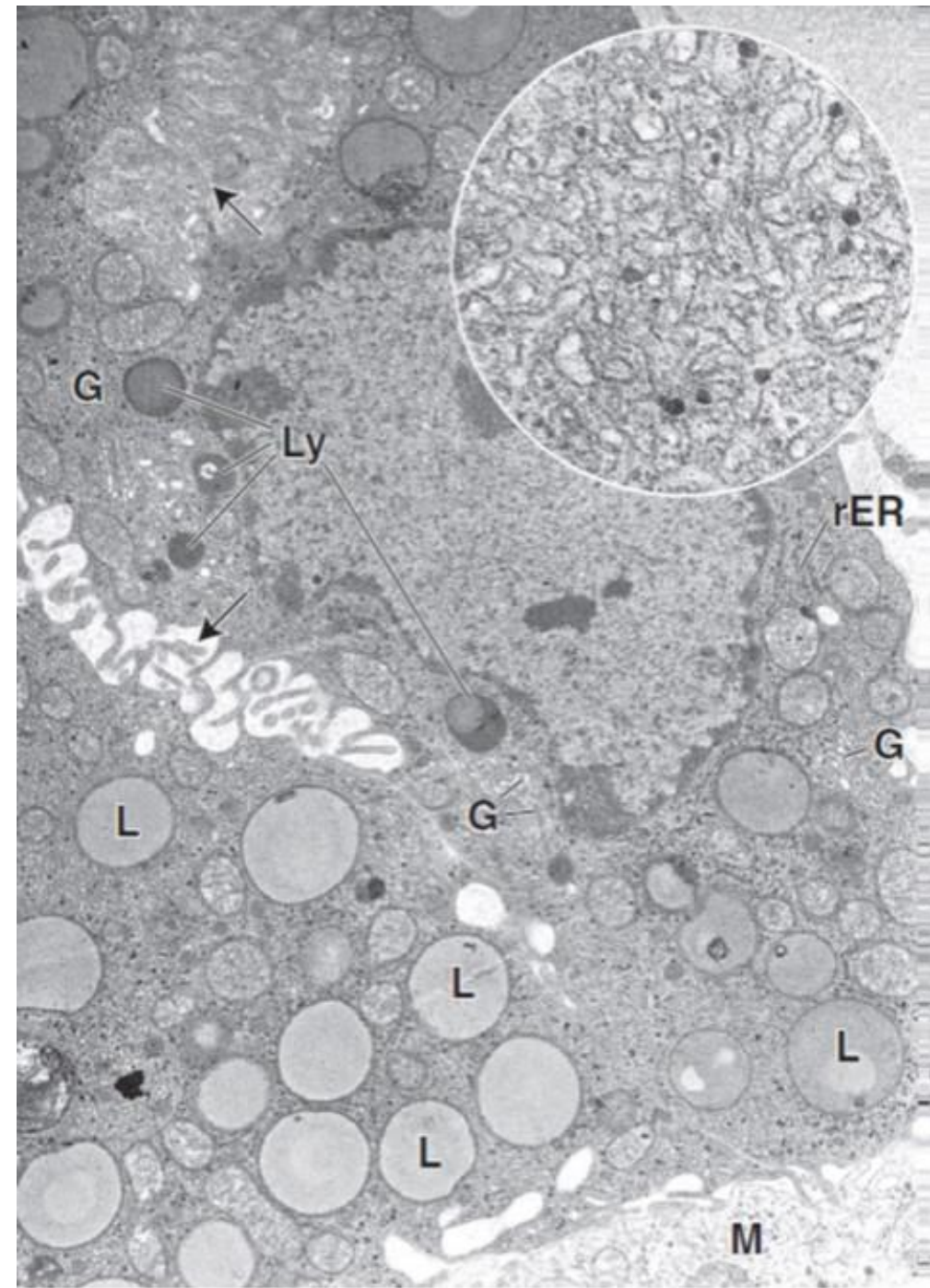
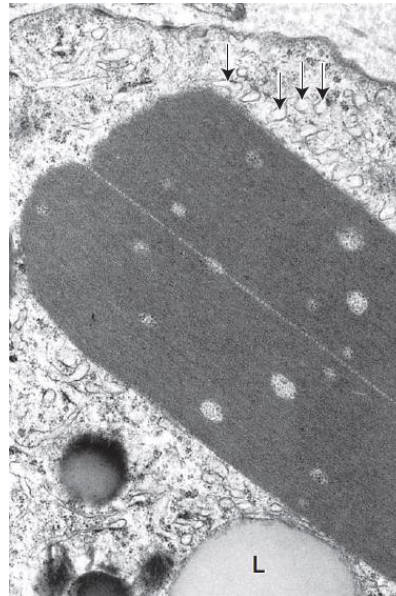
# Interstitial cells of Leydig

- ✓ They found in groups between seminiferous tubules in the interstitial connective tissue.
- ✓ Constitute 3% of cells in the interstitium after puberty
- ✓ Tend to decrease with age
- ✓ Mesodermal in origin
- ✓ Large rounded or polygonal cells with central nucleus and acidophilic cytoplasm
- ✓ Rich in small lipid droplets and lipochrome pigment



- **E.M.**
- It has **abundant SER** ,well developed Golgi apparatus , mitochondria.
- **Function :**

**Secrete testosterone** under the effect of **L.H** of pituitary gland



**Testis H&E**

**Leydig cells**

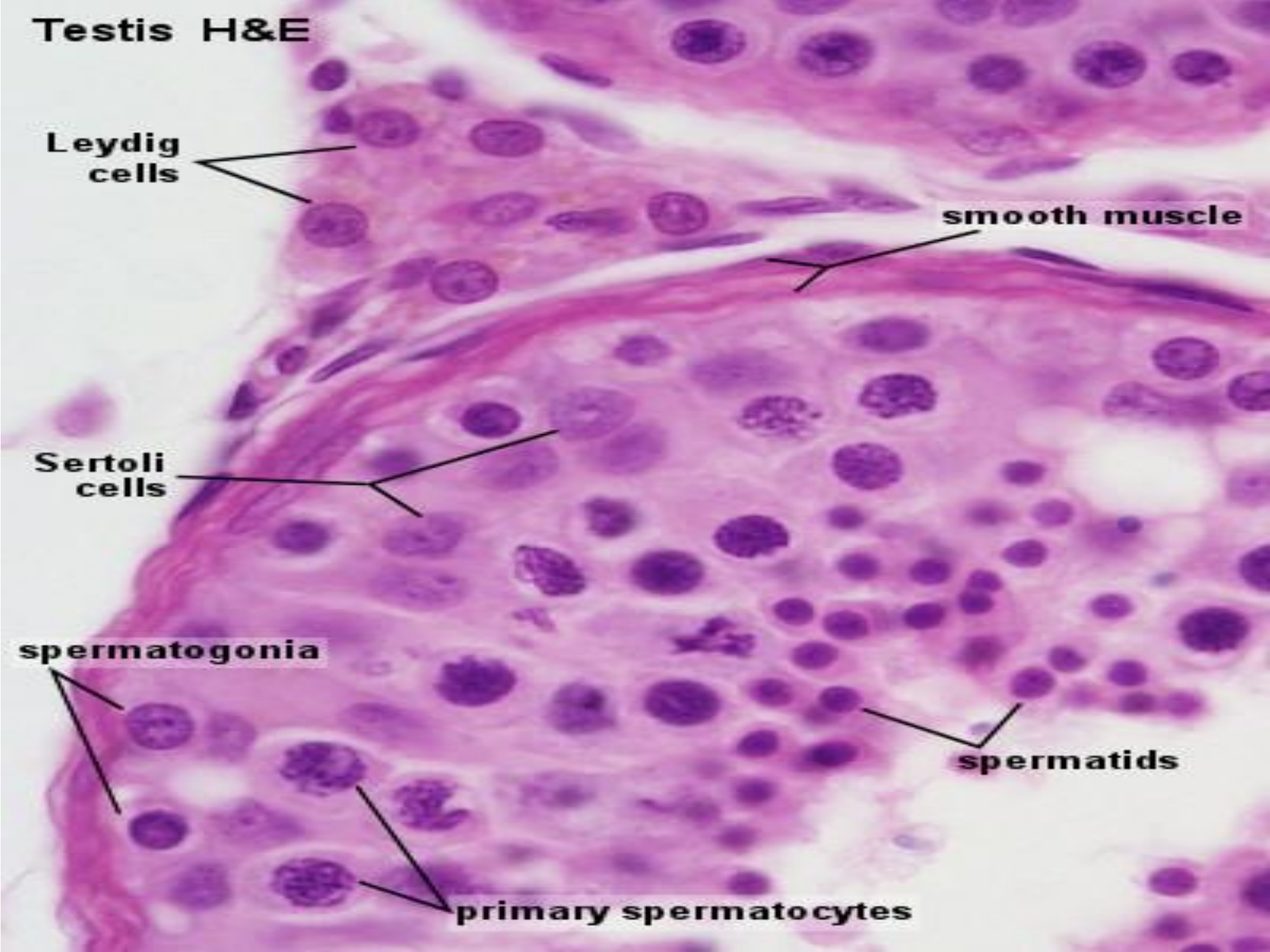
**smooth muscle**

**Sertoli cells**

**spermatogonia**

**spermatids**

**primary spermatocytes**



## Testosterone secretion

Testosterone secretion by interstitial cells is triggered by the pituitary gonadotropin, **luteinizing hormone (LH) at puberty** when the hypothalamus begins producing gonadotropin-releasing hormone.

*GRH from the hypothalamus stimulates the release of LH from pituitary*

**In embryonic phase** placenta secretes gonadotropin which stimulates interstitial cells to synthesize the testosterone needed for development of the ducts and glands of the male reproductive system

The embryonic interstitial cells are very active during the third and fourth months of pregnancy then regress and become inactive cells until puberty

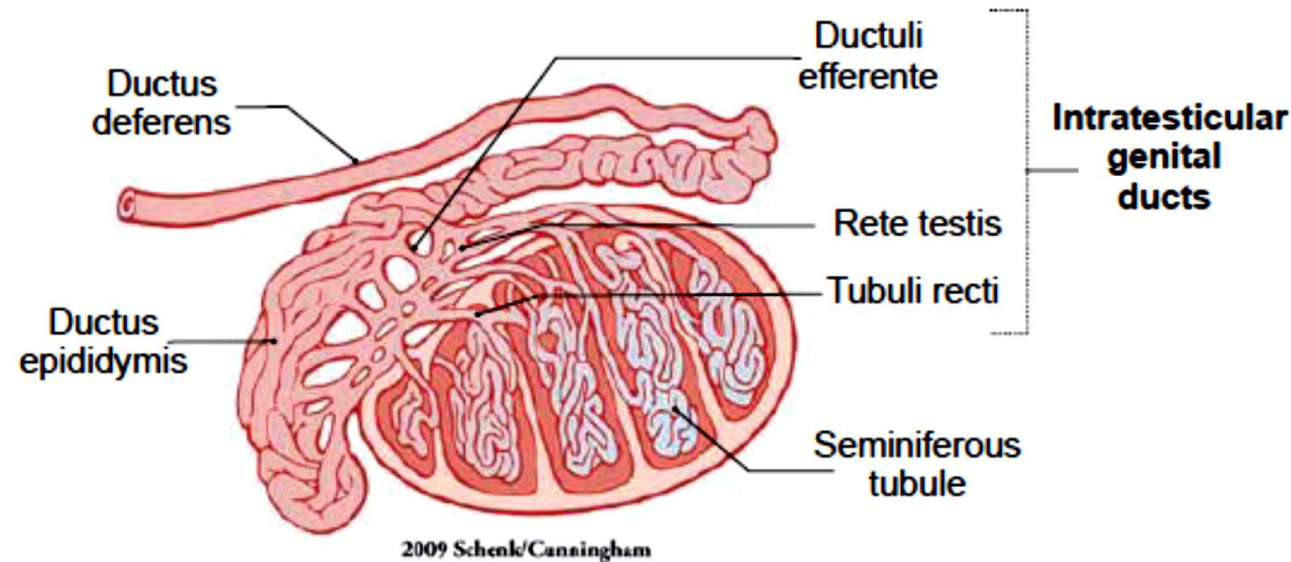
# Genital ducts

## Intratesticular ducts:

- Straight tubules (tubuli recti).
- Rete testis.
- Efferent ductules (ductuli efferenti).

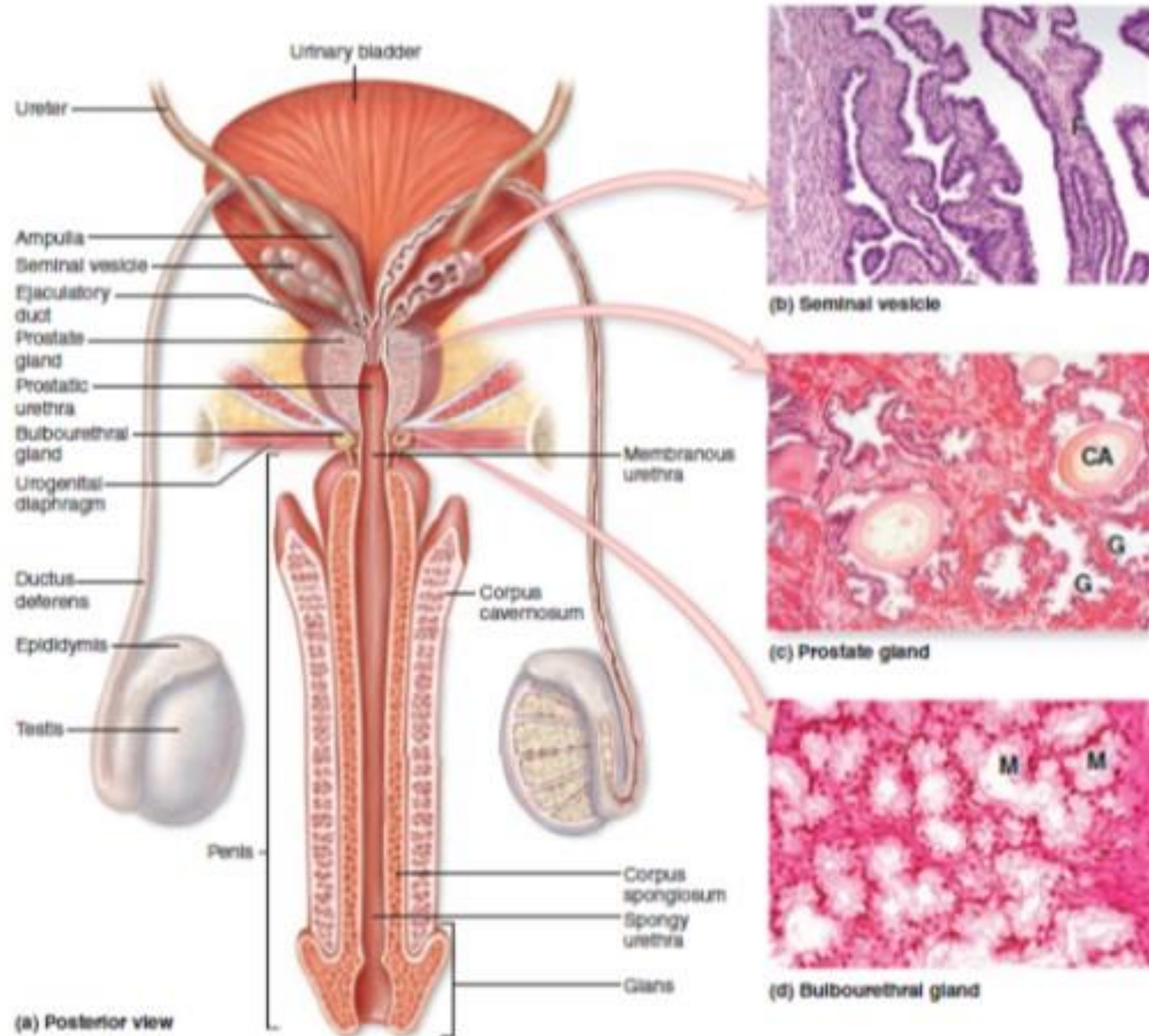
## Excretory genital ducts:

- The epididymis.
- The ductus (or vas) deferens.
- The urethra.



# Accessory glands

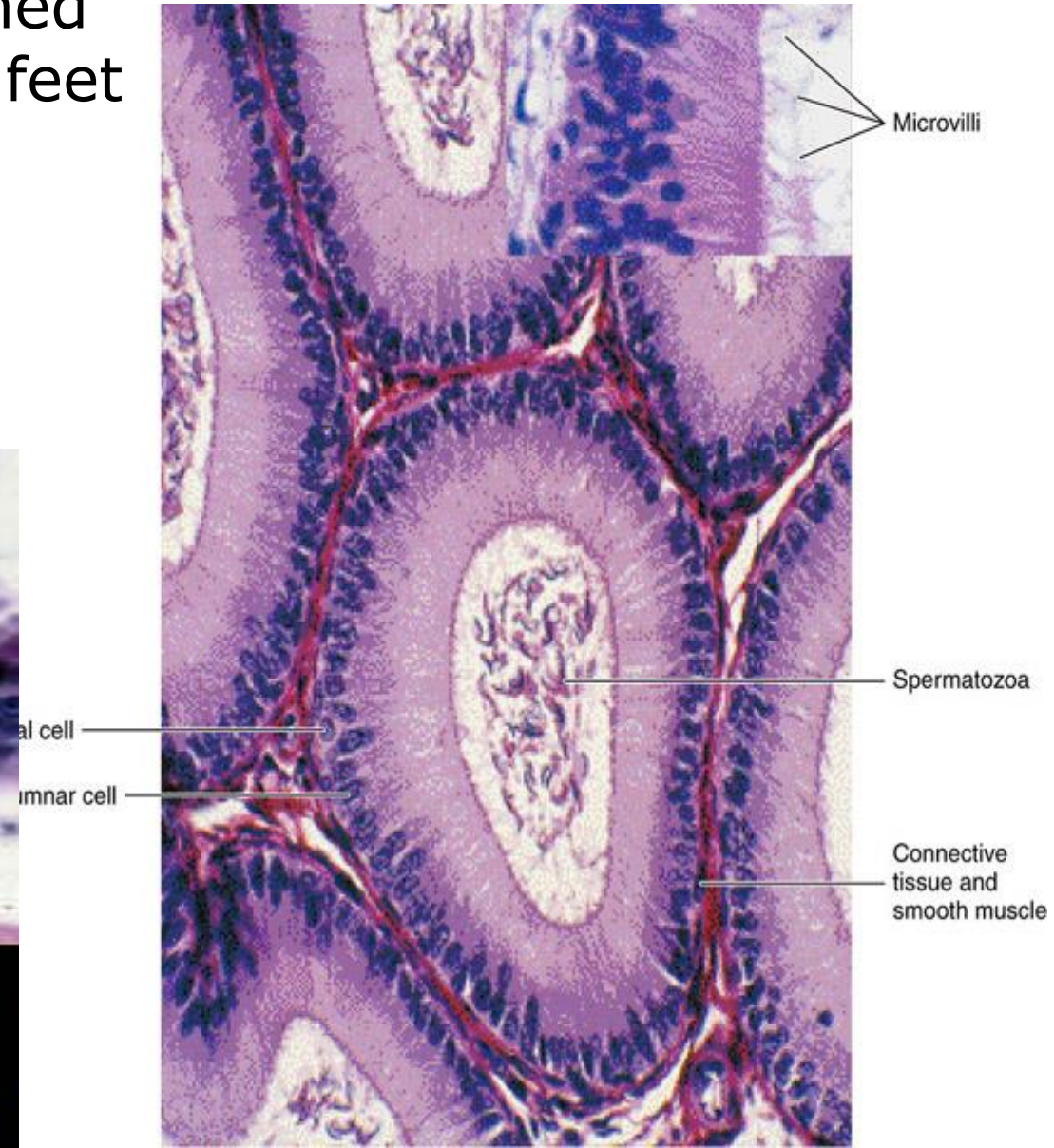
- Paired seminal vesicles
- Single prostate gland
- Two bulbourethral glands



# THE EPIDIDYMISS

*has a head, body, and a tail*

- The body & the tail of epididymis are formed of a single narrow duct which is about 20 feet (6 meters) & is **highly coiled** to form the gland.





**Mucosa** : This duct is lined by **pseudostratified columnar epithelium** composed of rounded basal cells & columnar cells.

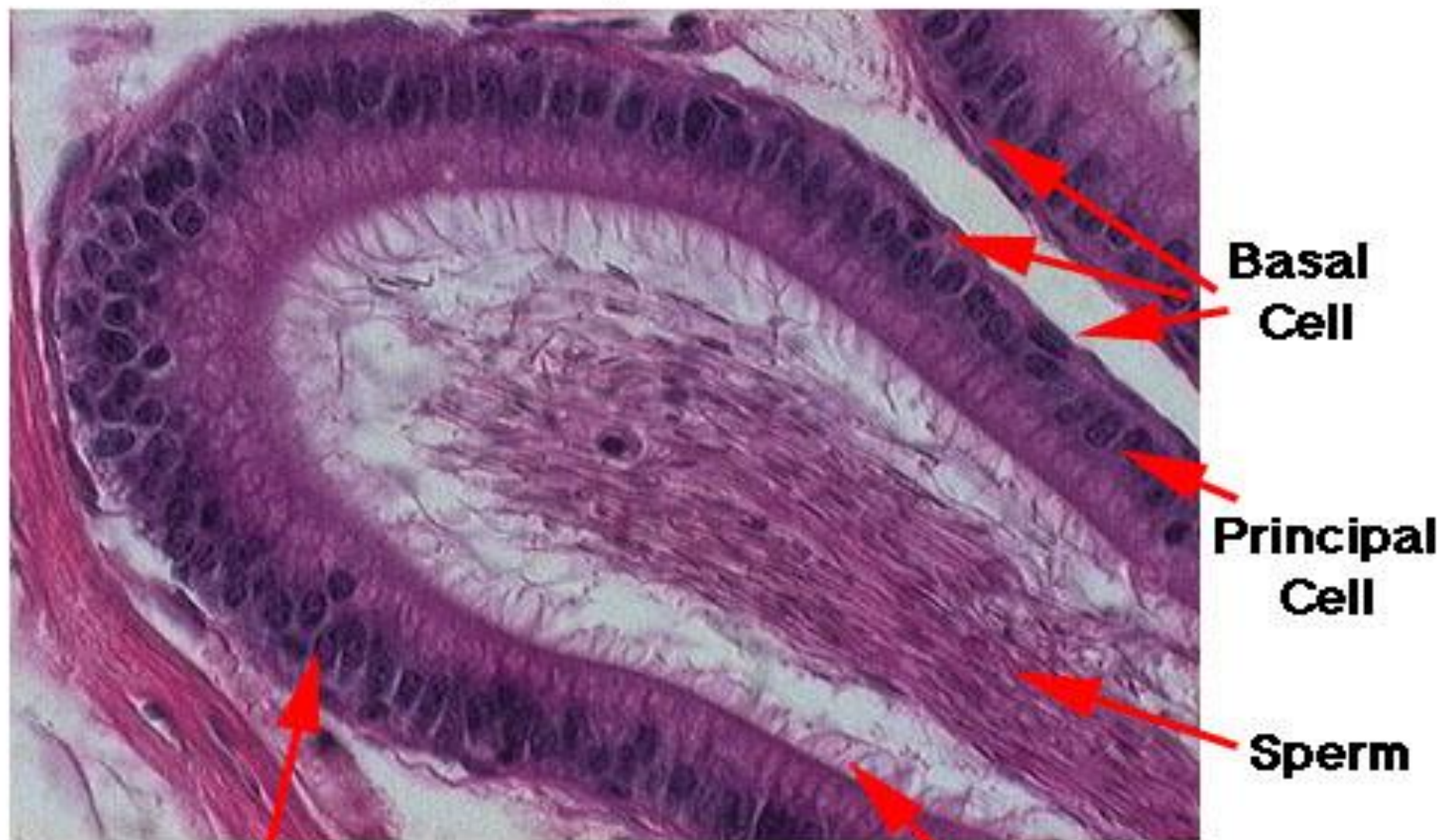
- The cells have long branched **microvilli called "stereocilia"** *to aid in the slow movement of the sperms*
- Musculosa** : A **circular smooth muscle layer** *there's only one muscle layer here, because we don't want excessive peristaltic movements.*
- Adventitia** : A connective tissue layer

*why do we need the sperms do move slowly? to make sure they're mature enough before leaving the epididymis*

**•Function :**

- It is site for storage and maturation of the sperms.
- Reabsorption of testicular fluid
- Phagocytosis and digestion of degenerative spermatozoa

# Epididymis



**Basal  
Cell**

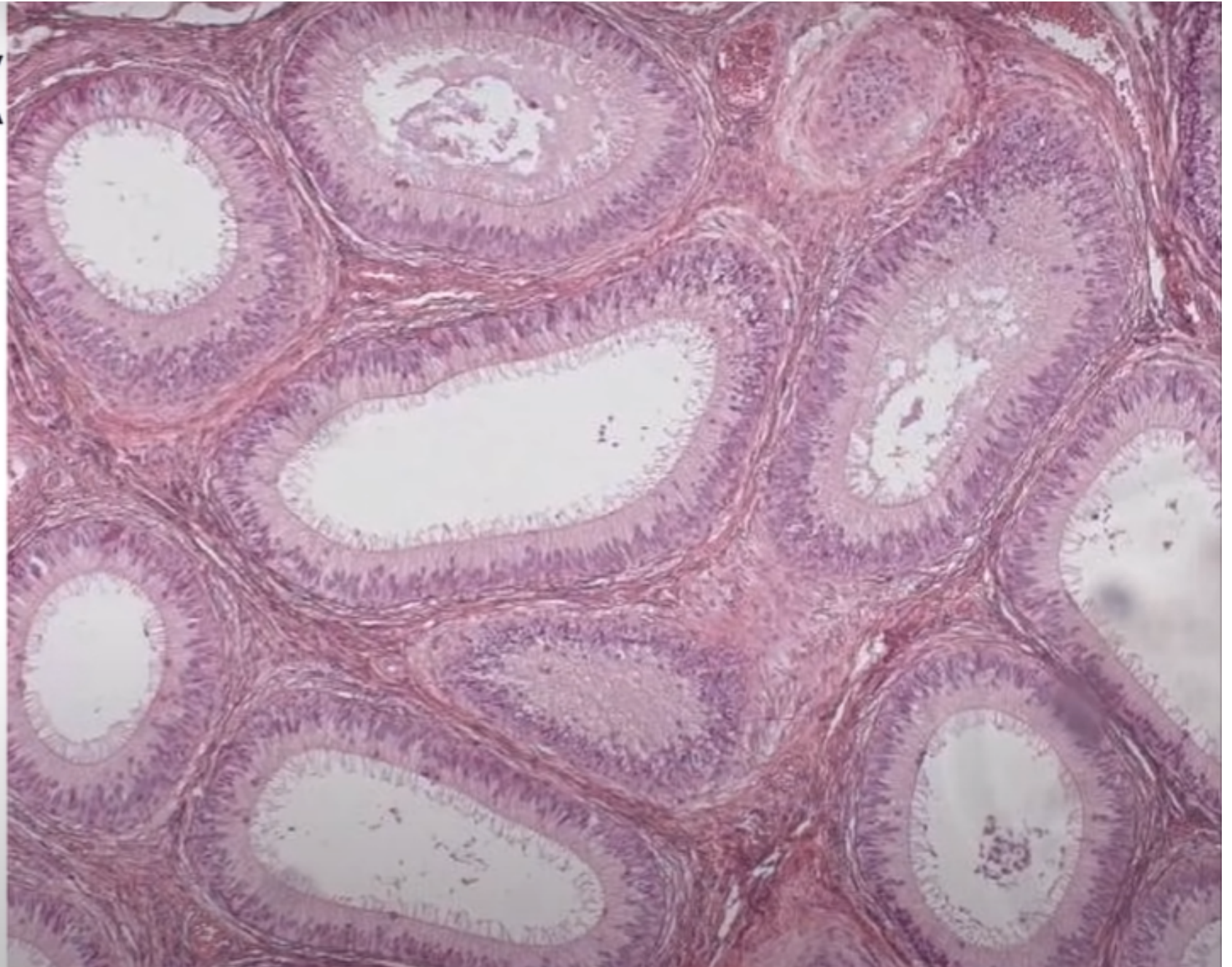
**Principal  
Cell**

**Sperm**

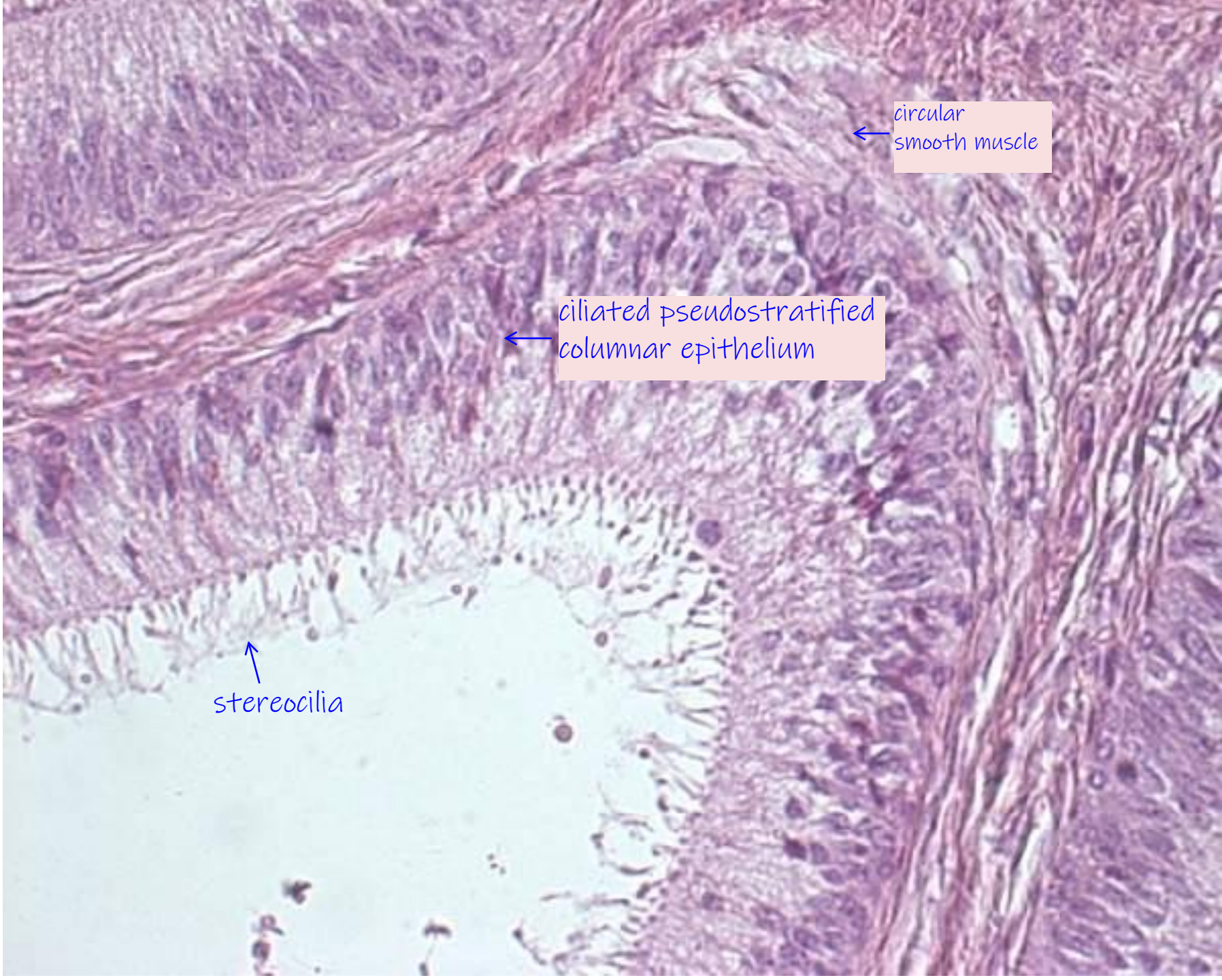
**Pseudostratified Columnar  
Epithelium**

**Stereocilia  
(microvilli)**

Epididymis HE (



# Epididymis HE (



circular smooth muscle

ciliated pseudostratified columnar epithelium

stereocilia

# Vas Deferens

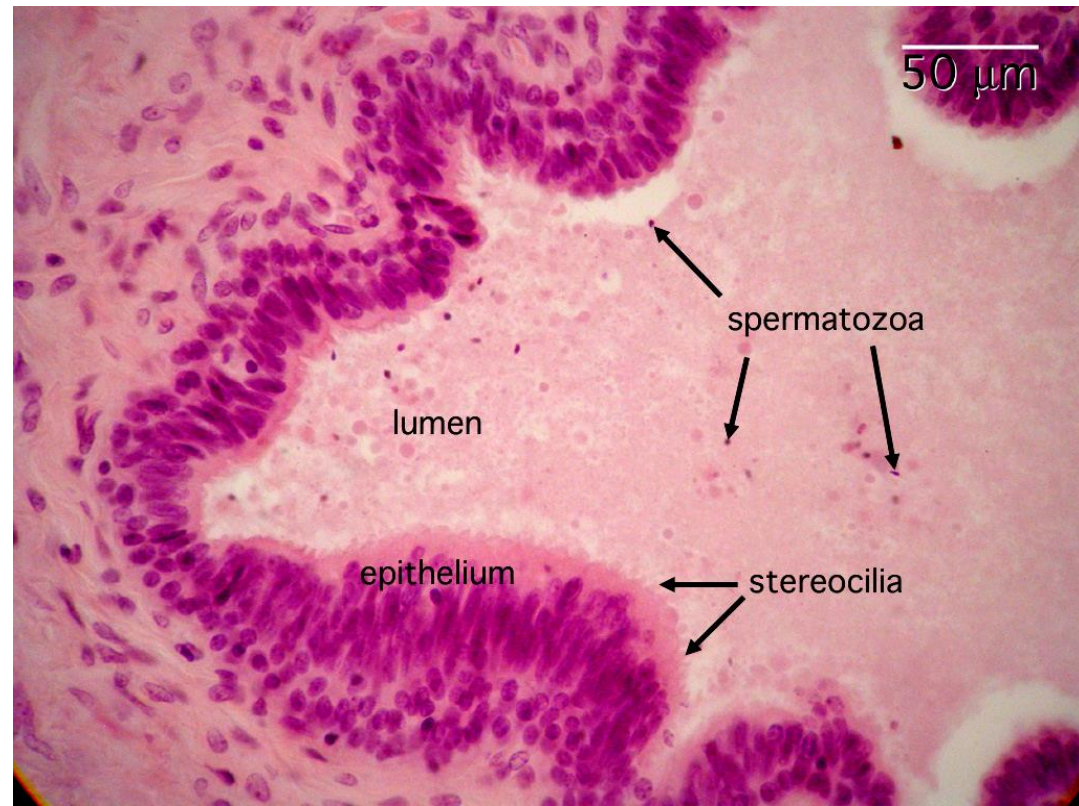
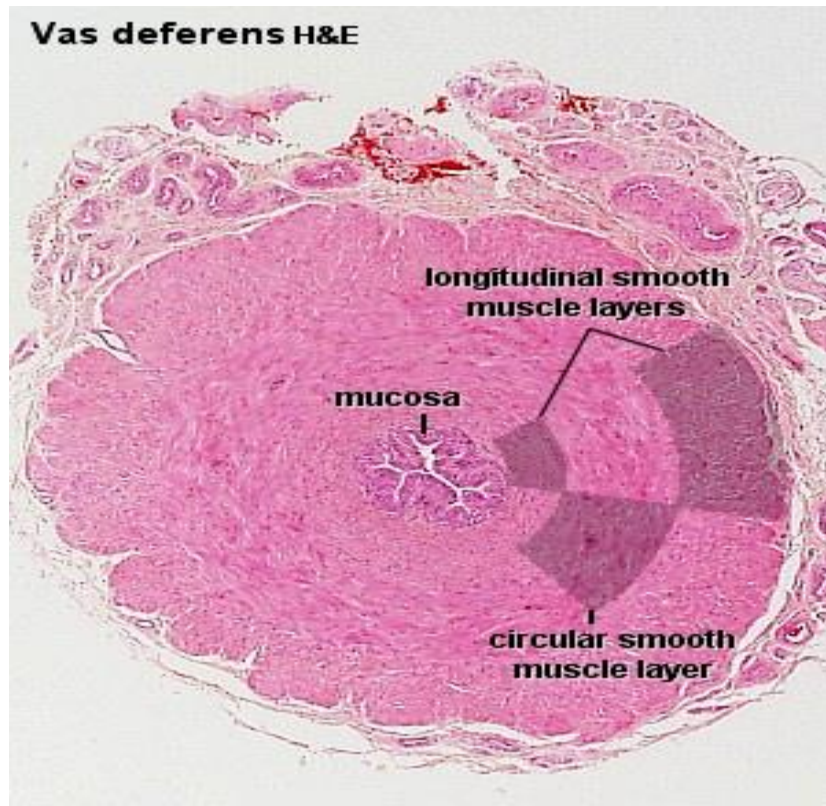
**Mucosa** is irregular. It is lined by a **pseudostratified columnar epithelium** cells with **stereocilia**.  
The lamina propria is unusually rich in elastic fibres.

*but less than in the epididymis*

**Musculosa** <sup>← needed for ejaculation</sup> is **well developed** (up to 1.5 mm thick) and consists of a **thick circular layer** of smooth muscle between **thinner inner** and **outer longitudinal layers**.

It is innervated with sympathetic innervation

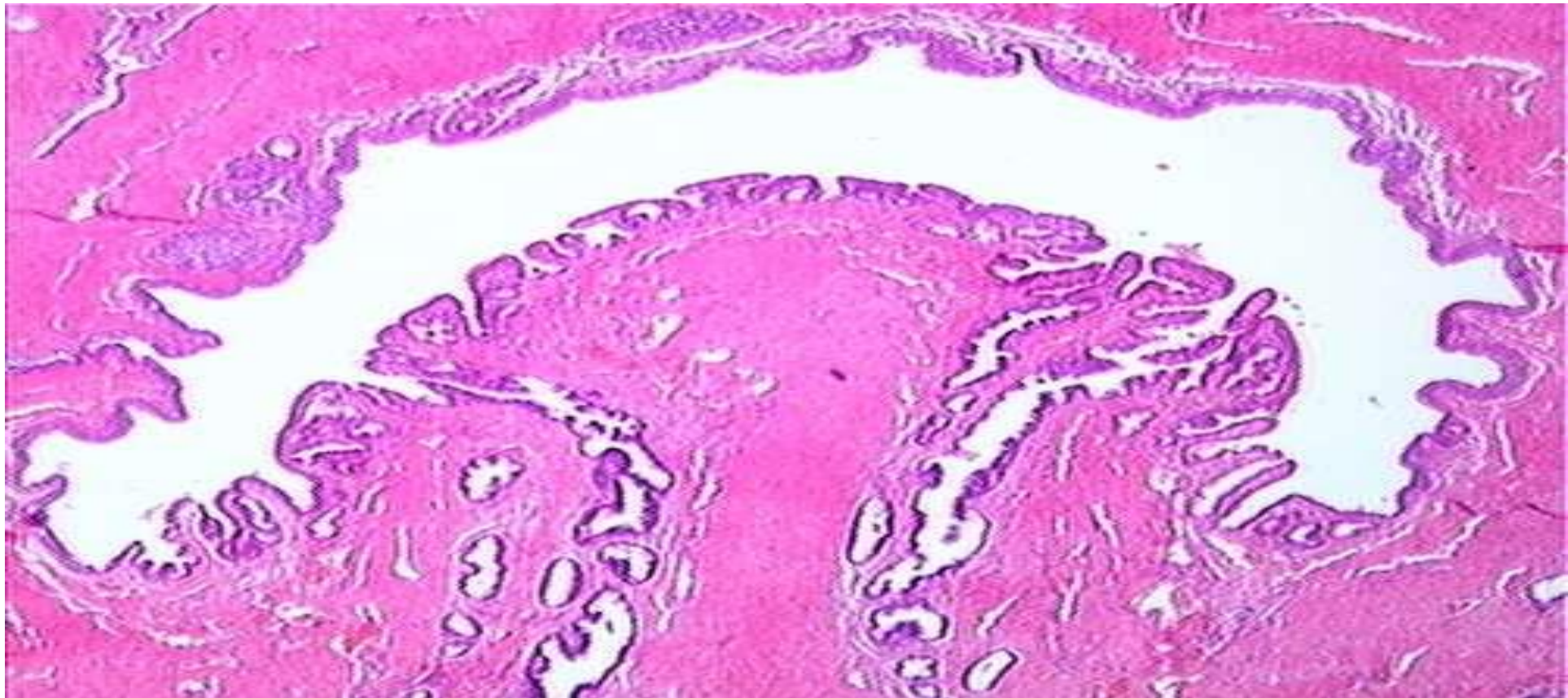
**Adventitia** : A connective tissue layer



# The ejaculatory ducts

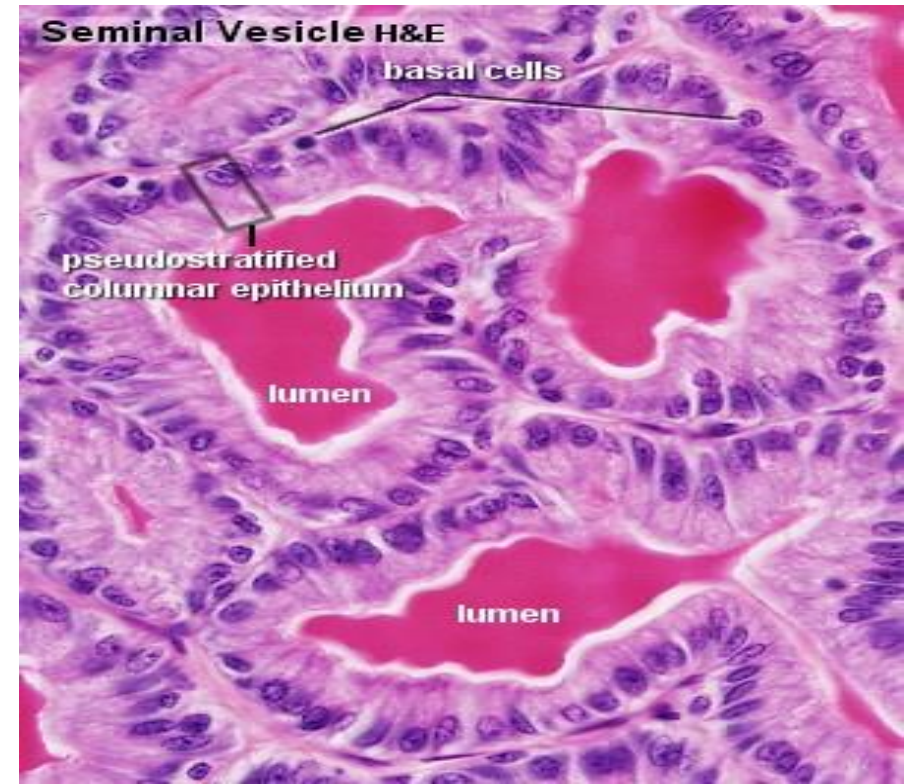
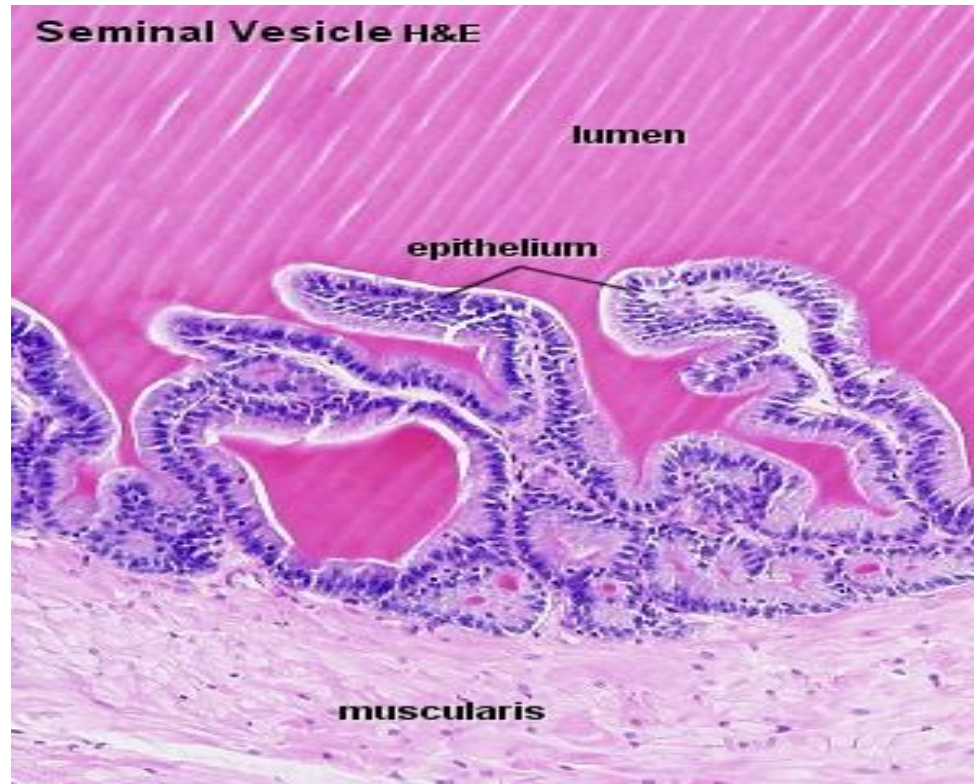
It is formed by the union of the ampulla of the vas deferens with the seminal vesicle & opens in the prostatic urethra through the prostate gland

Histology: simple or pseudostratified columnar epithelium (secretory in function), no muscular coats

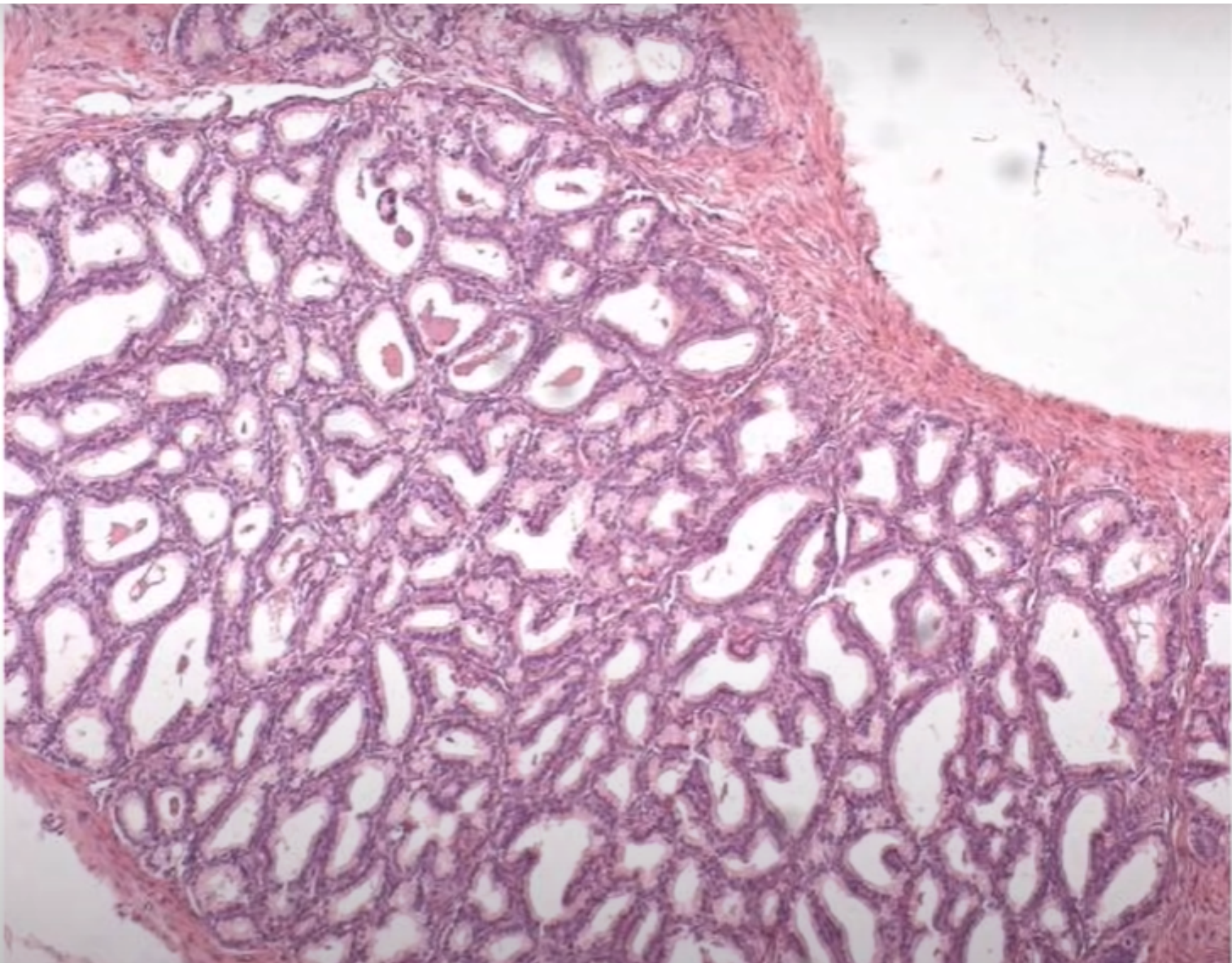


## The Seminal Vesicle

- Each seminal vesicle consists of one coiling tube (about 15cm long).
- **Mucosa** shows thin, branched, anastomosing folds. The **epithelium is variable** appearing **columnar** or **pseudostratified columnar** secretory epithelium .
- **Muscularis** consists of **inner circular** and **outer longitudinal** layers of smooth muscle.
- **Adventitia** : A thin fibroelastic connective tissue layer
- **Functions** The **secretion of the seminal vesicles is thick, yellowish, alkaline fluid rich in protein, fructose and vitamin C**, these are of importance for nutrition and production of energy for sperms.



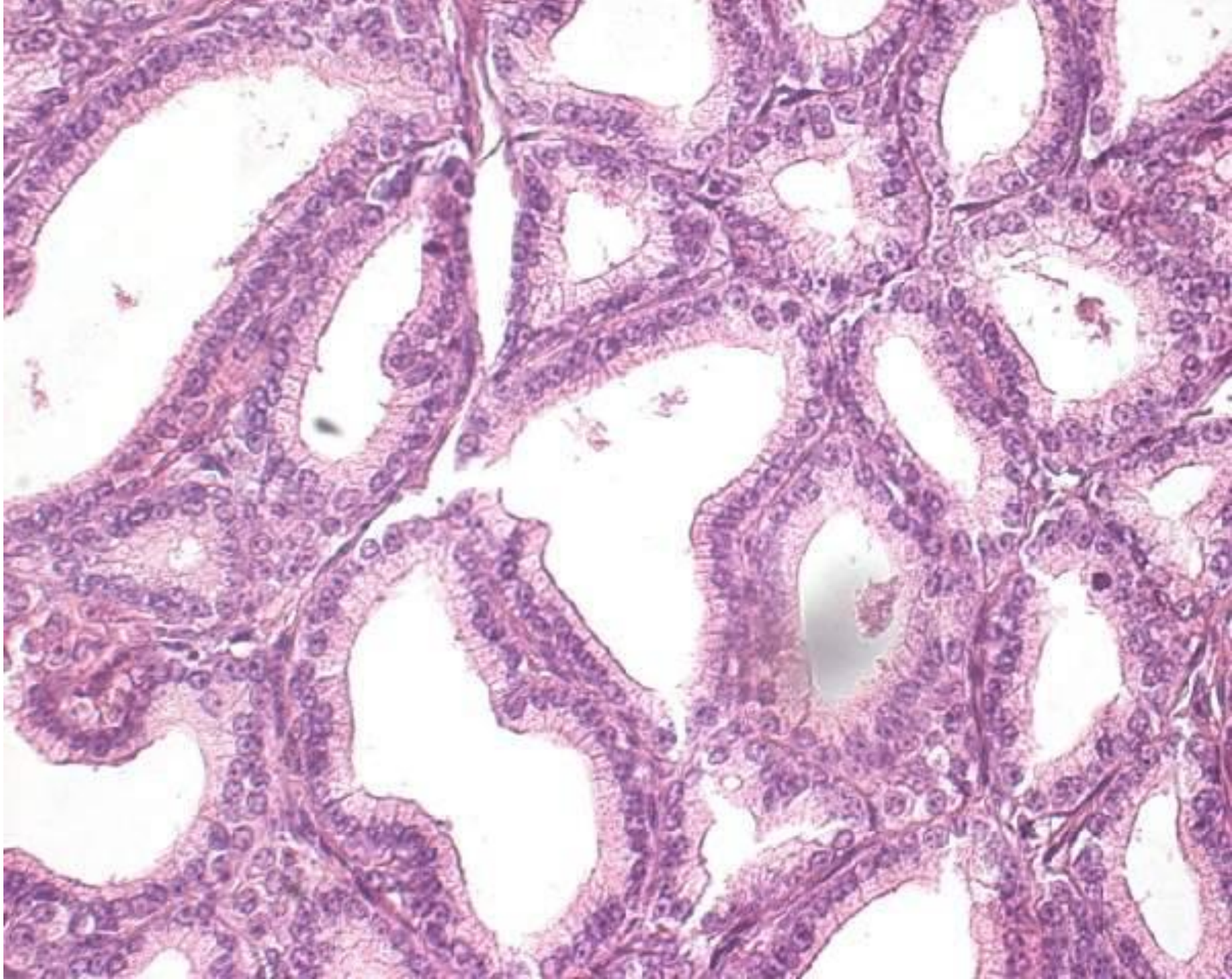
Semi





# Semi

epithelium is  
either simple  
columnar or  
pseudostratified  
columnar but  
there are no cilia



# The Prostate

It is formed of 30-50 compound tubulo-alveolar glands surrounding prostatic urethra, from which numerous ducts drain independently into the prostatic urethra.

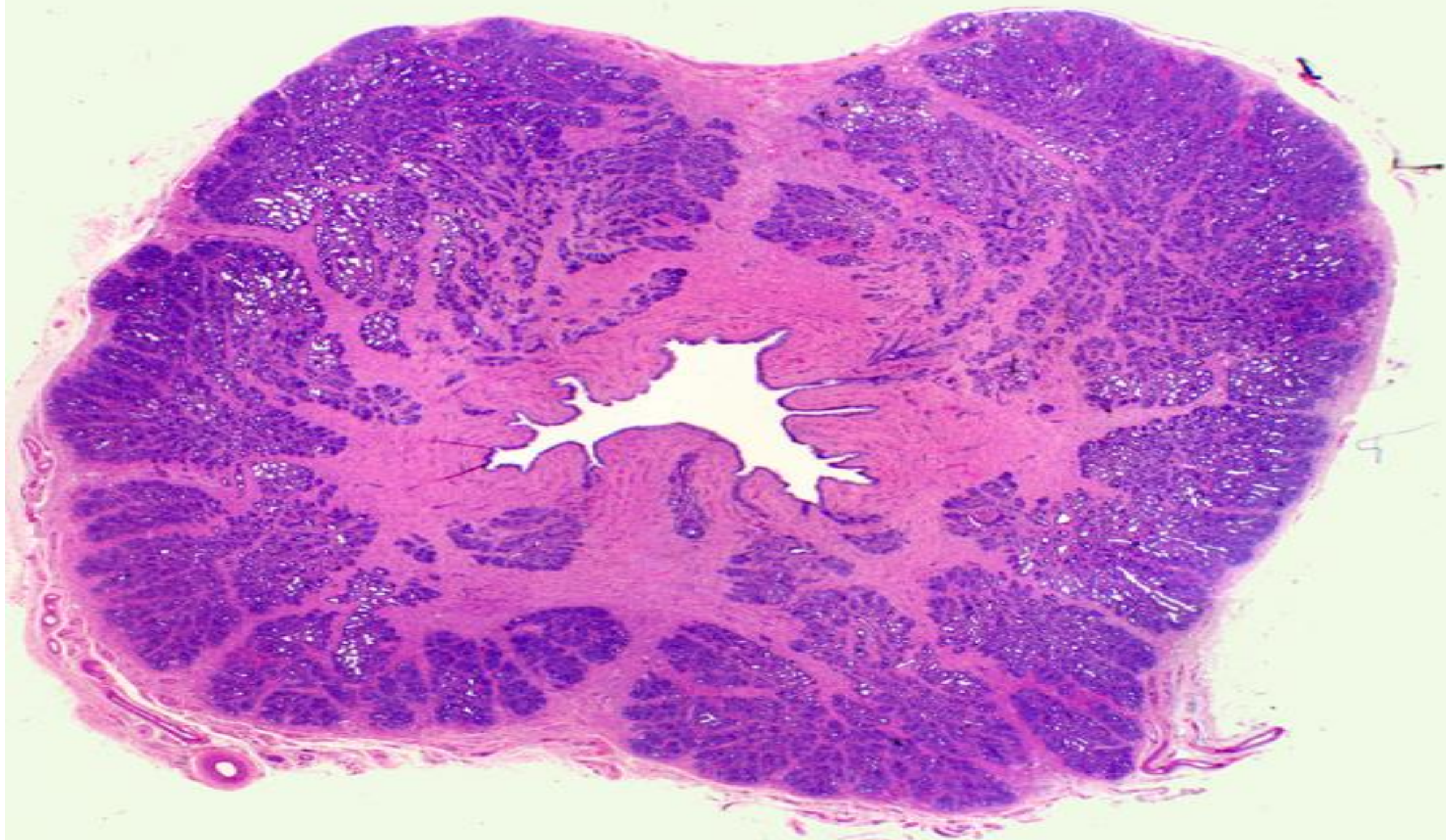
The gland is made of stroma and parenchyma.

## 1- Stroma:

*the capsule sends trabeculae that divide the gland into lobules*

It is made of **capsule and trabeculae** formed of fibromuscular C.T. rich in smooth muscle collagenous and elastic fibers

**2-Parenchyma:** It is made of **30-50 glands** arranged concentrically around the prostatic urethra. The acini are arranged in 3 levels:

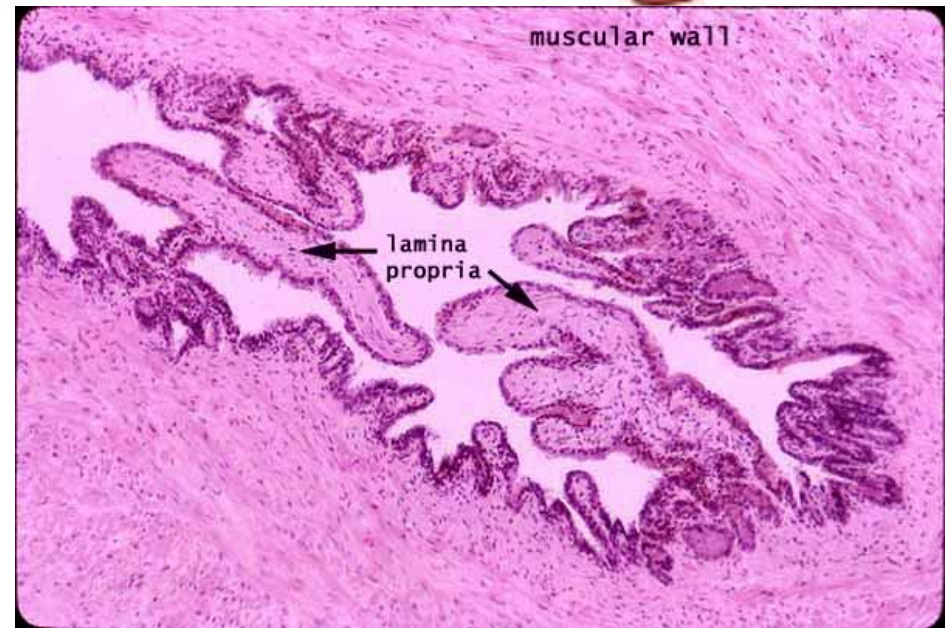
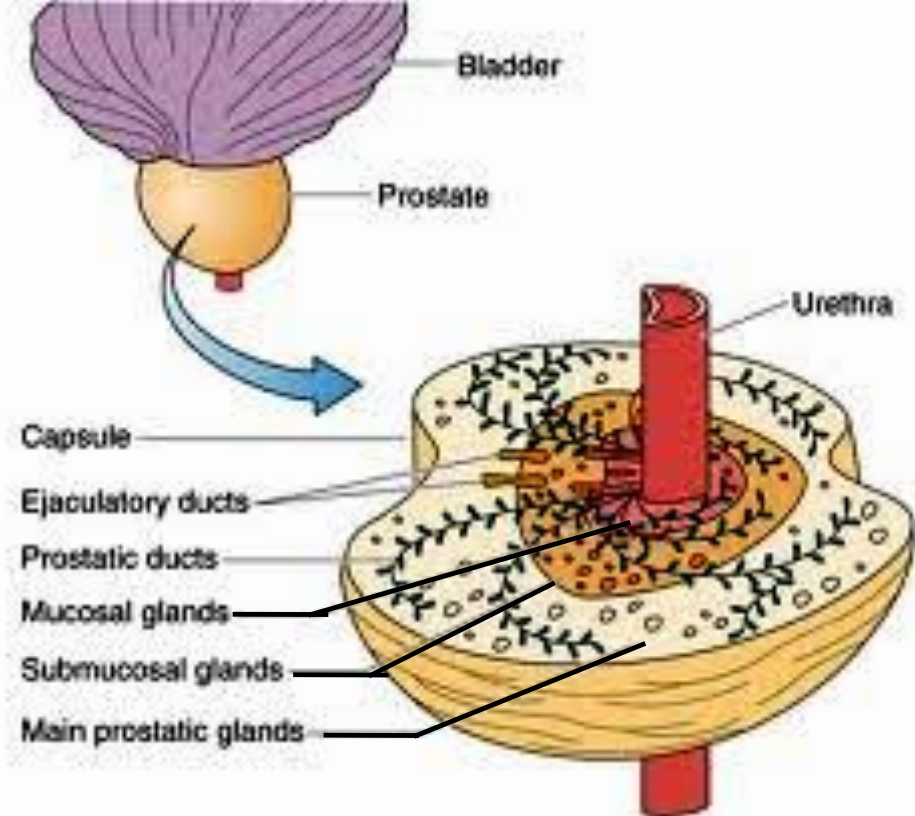


3 types of glands in prostate:

**(1) Periurethral glands** (mucosal)  
– smallest, around urethra

**(2) Submucosal glands**  
surround the periurethral tissue

**(3) Main Prostatic Glands**  
(external, proper)–outer largest  
portion of gland; provide most  
prostatic secretions



## Structure :

The **glandular epithelium** differs greatly within the gland may be simple or pseudostratified columnar or low cuboidal or squamous

The **acini and ducts** are lined with simple columnar epithelium

The secretory cells are slightly acidophilic and secretory granules may be visible in the cytoplasm.

## Functions

It secretes a thin milky alkaline secretion, which gives the characteristic smell. The secretion is rich in acid phosphatase

## Clinical notes on the prostate:

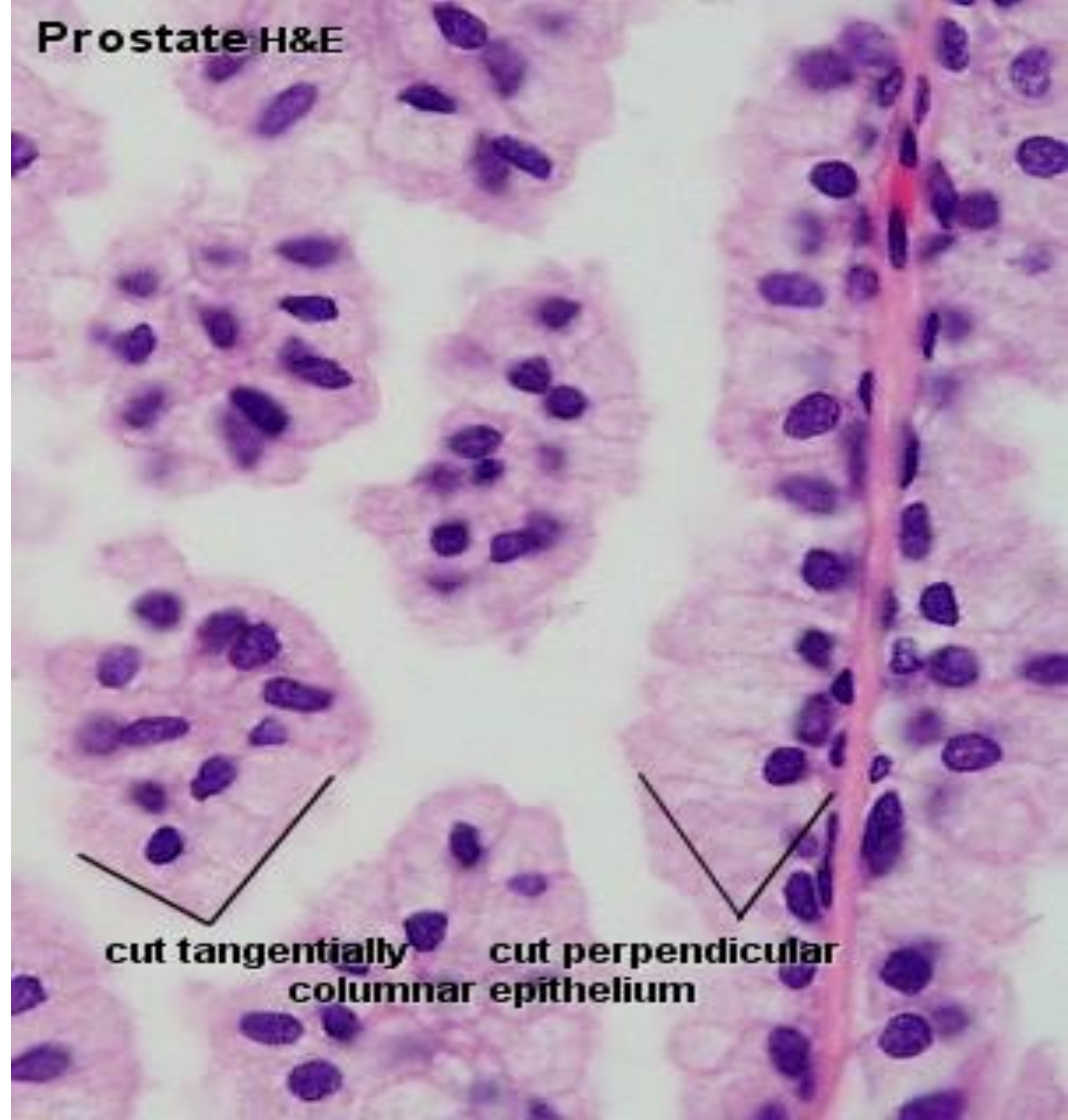
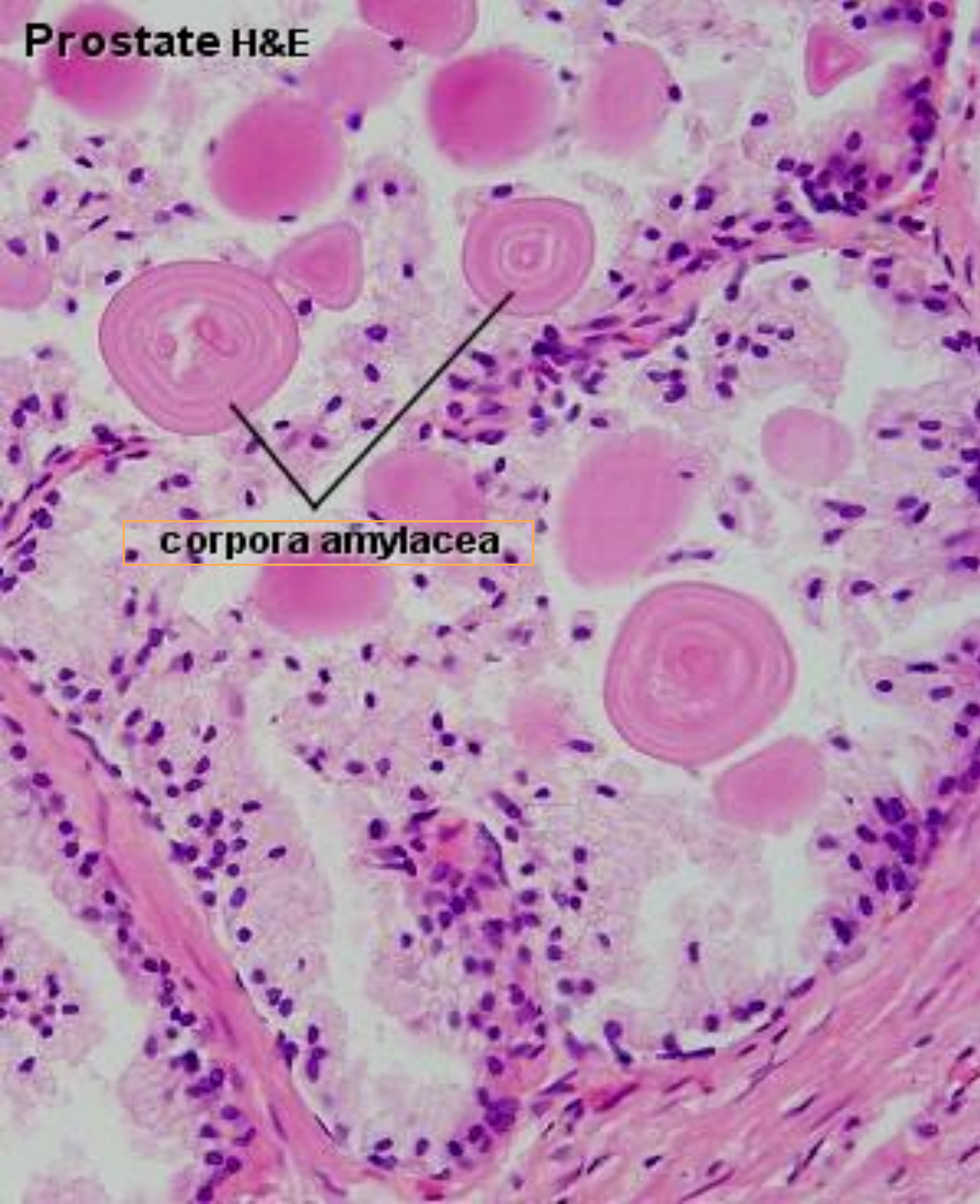
The **mucosal and submucosal glands** enlarge after the age of 40 causing pressure on the urethra and difficulty in micturition, condition known as **senile prostate**.

**Carcinoma of the prostate** affects the outer glands.

It is diagnosed by presence of high levels of acid phosphatase in plasma

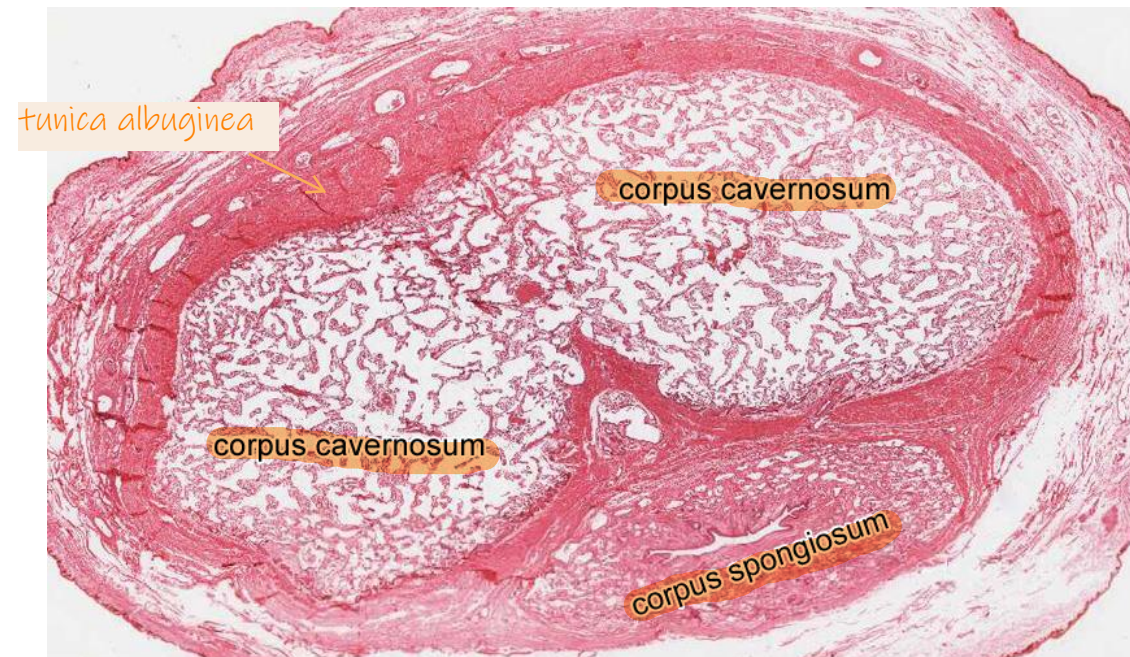
Prostatic concretions (**corpora amylacea**) are thought to result from condensation of secretory material in acini.

They increase with advance of age and may become calcified.



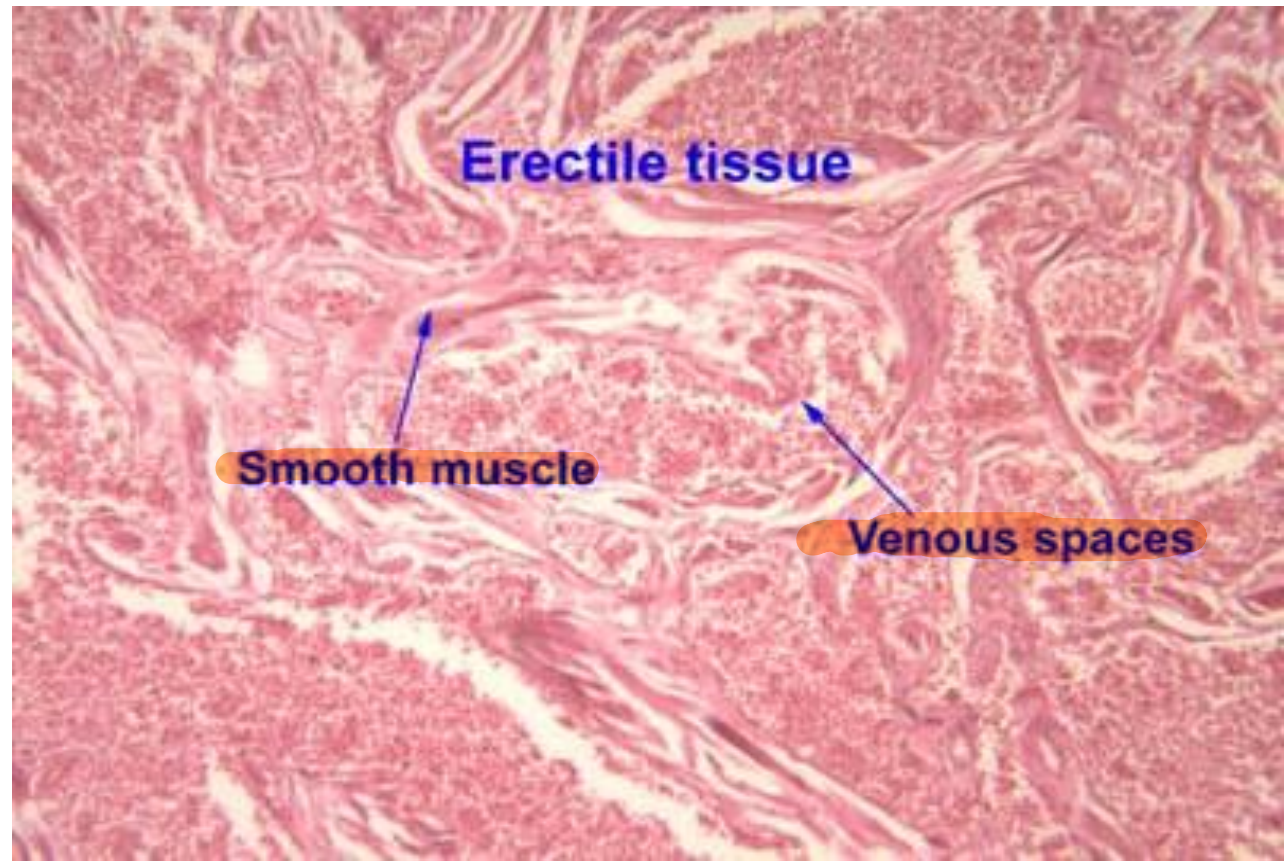
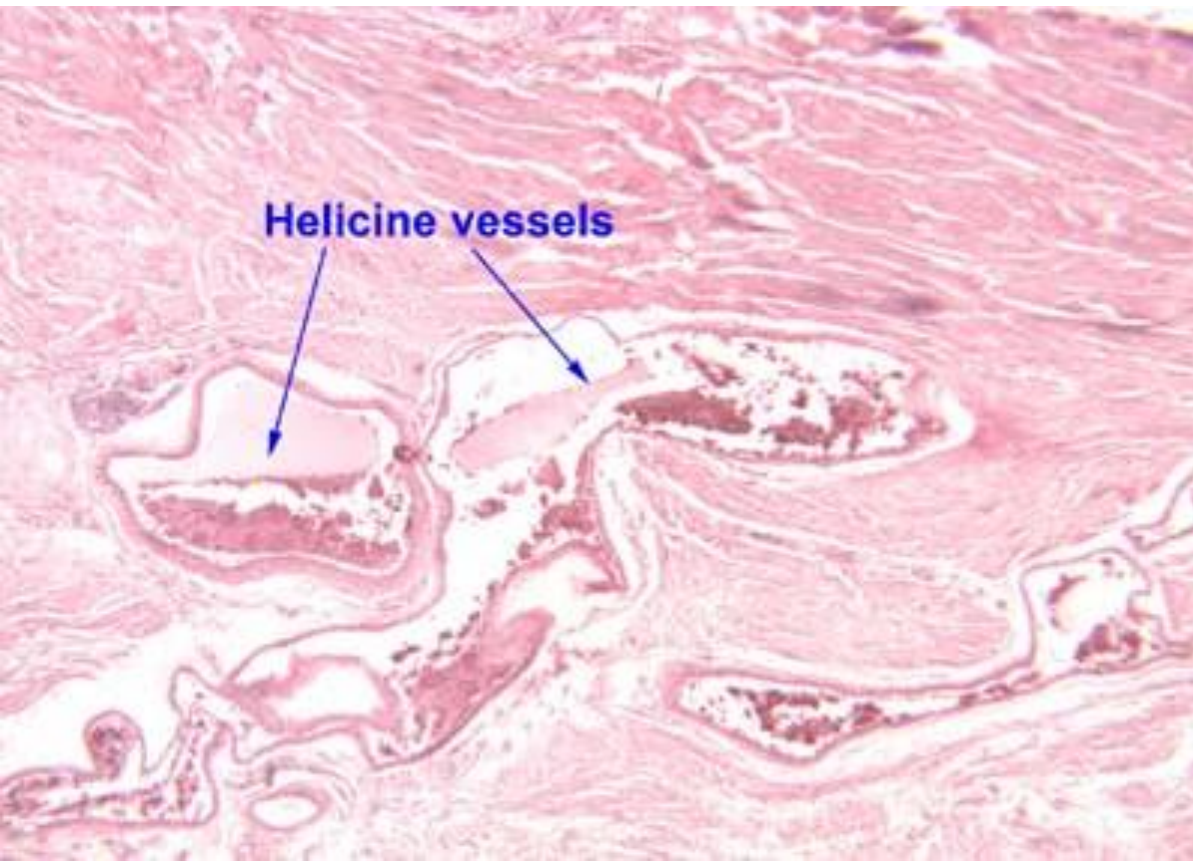
# The penis

- Composed of 3 cylindrical masses of erectile tissue:
  - **2 dorsal corpora cavernosa**
  - **Ventral corpus spongiosum** surrounds the urethra and expands at its end forming the glans penis
- Dense fibroelastic layer, tunica albuginea, binds the three masses together as well as forming a capsule around each one
- Covered by thin skin
- The tunica albuginea of Corpora spongiosum is thinner and more elastic  
*because the urethra passes through it*



# The penis – erectile tissue

- It supplied by **helicine arteries** *coiled vessels*  
*these spaces are needed to hold the huge amount of blood during erection*
- Contains **numerous endothelially lined cavernous blood spaces** separated from one another by trabeculae of connective tissue and **smooth muscle**.

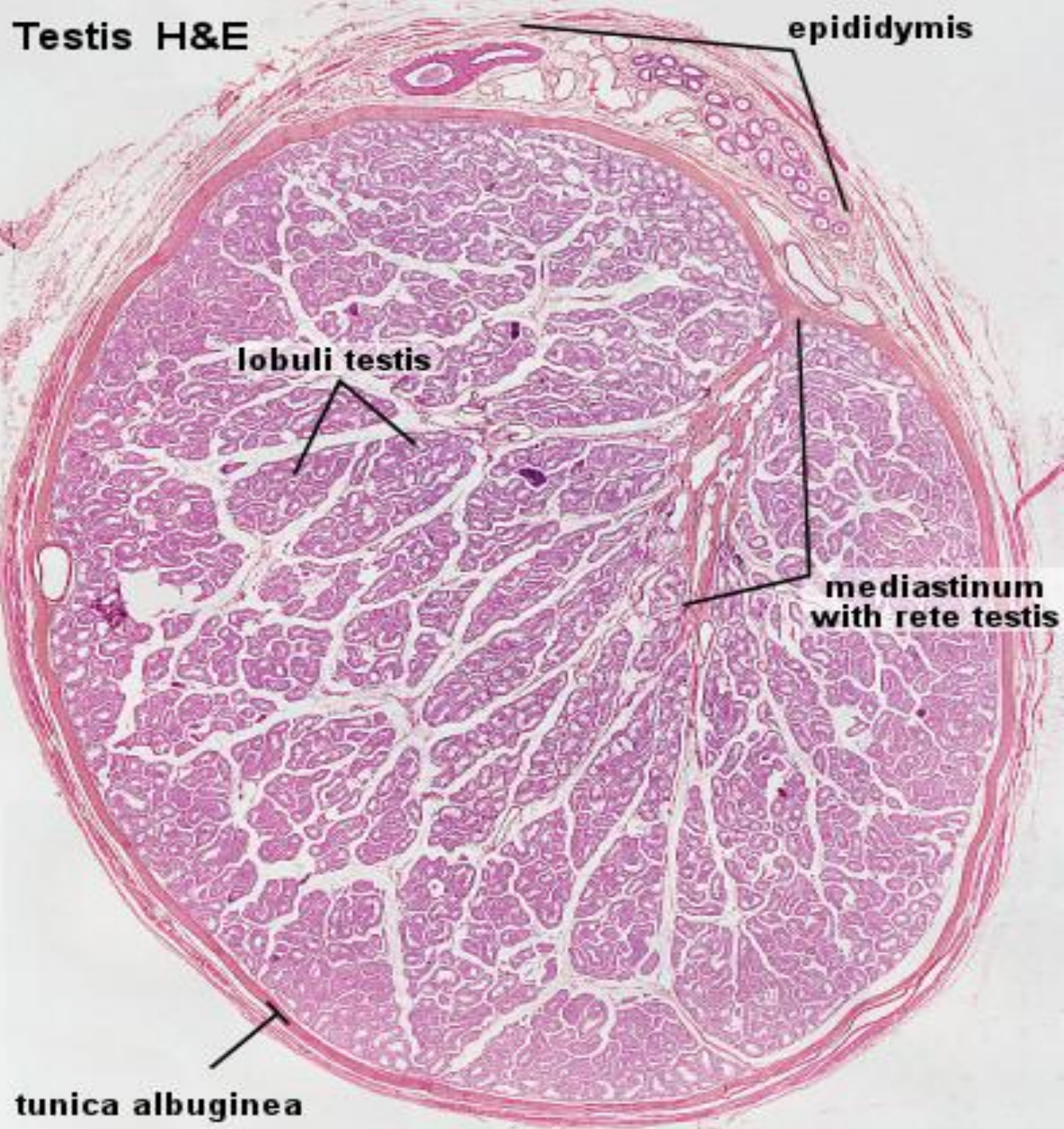
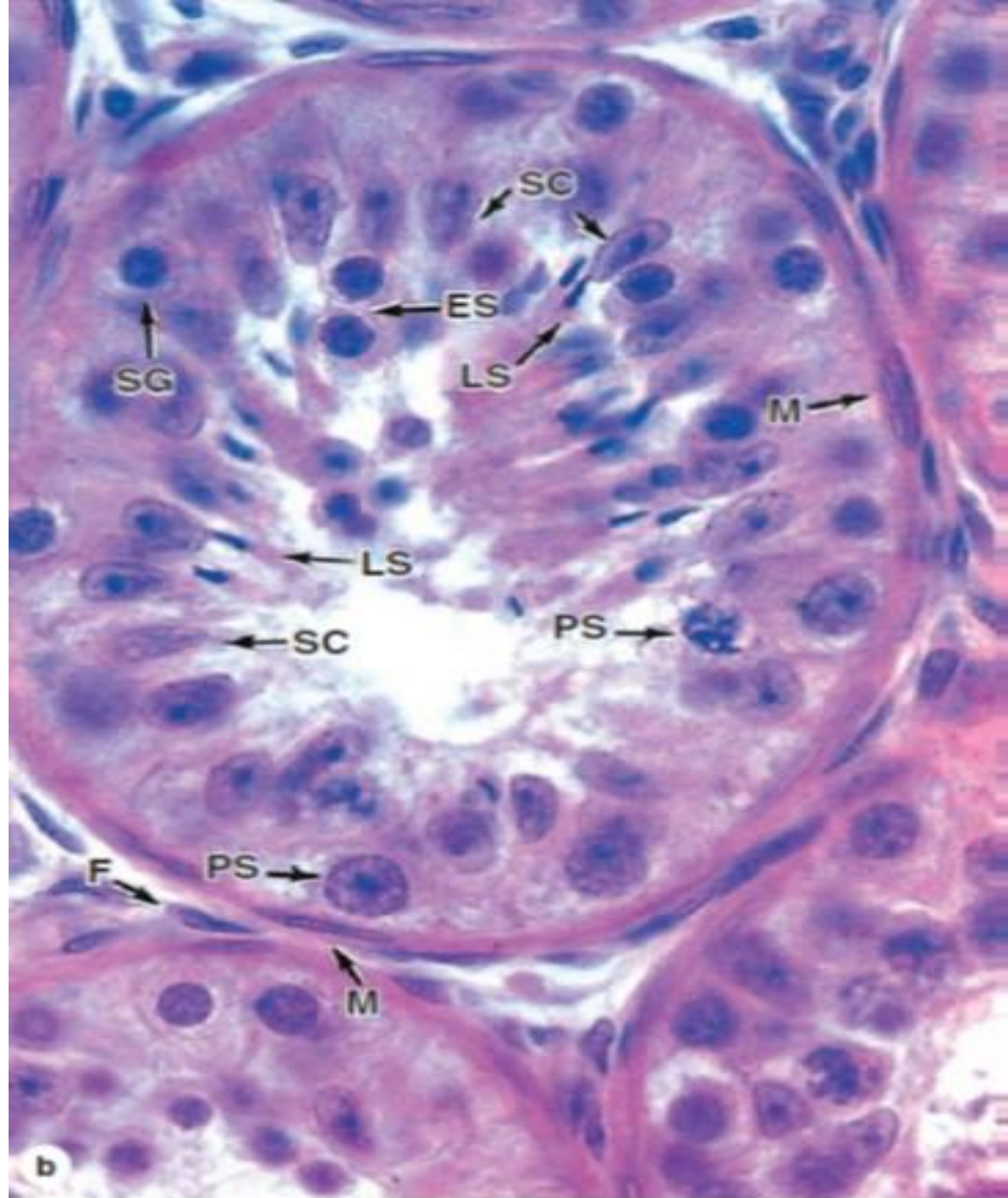


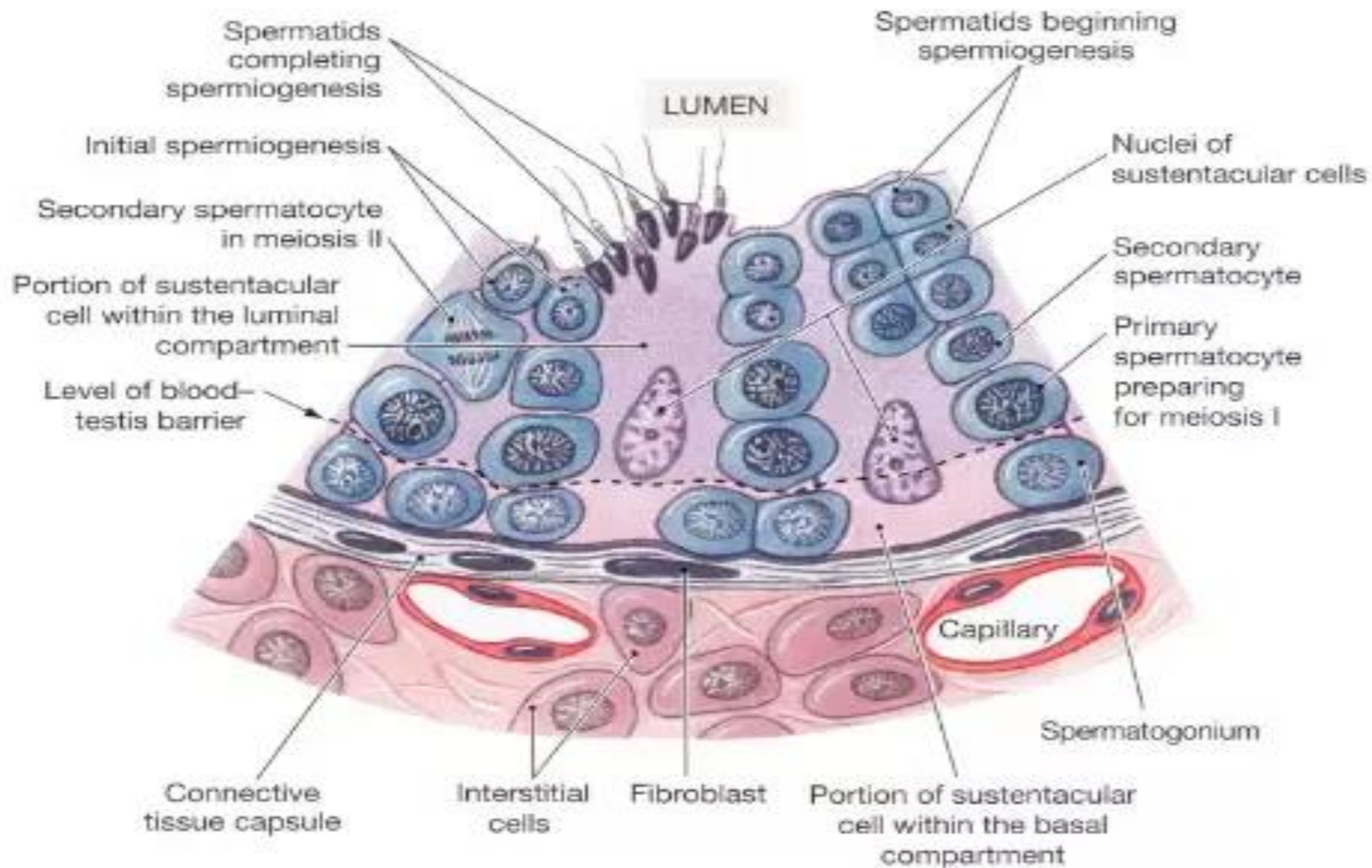


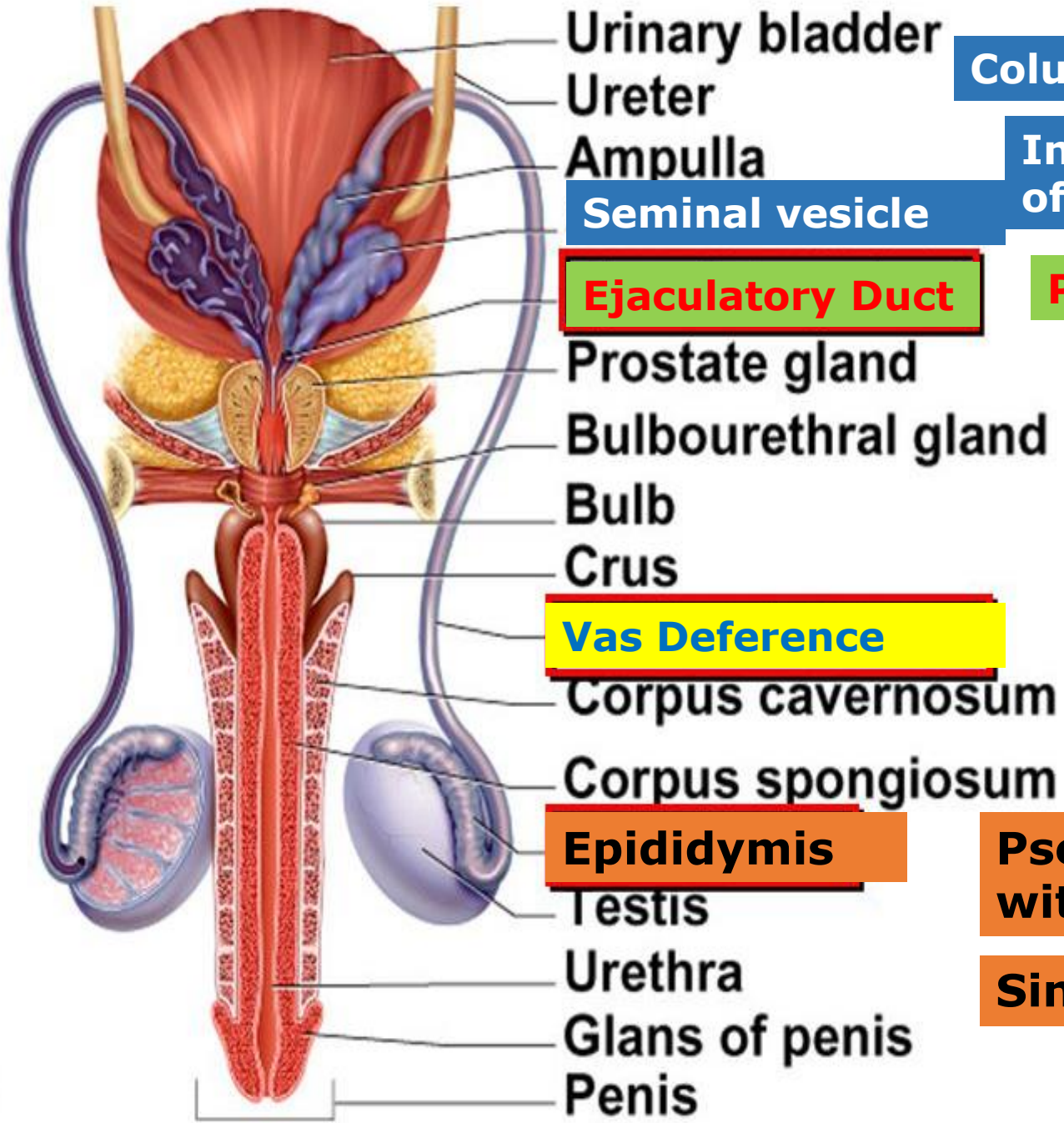


# SUMMARY

*there's nothing new here but you can refer to the  
video starting at 51:08*







Columnar or pseudostratified columnar epithelium

Inner circular and outer longitudinal layers of smooth muscle

Pseudostratified columnar epithelium

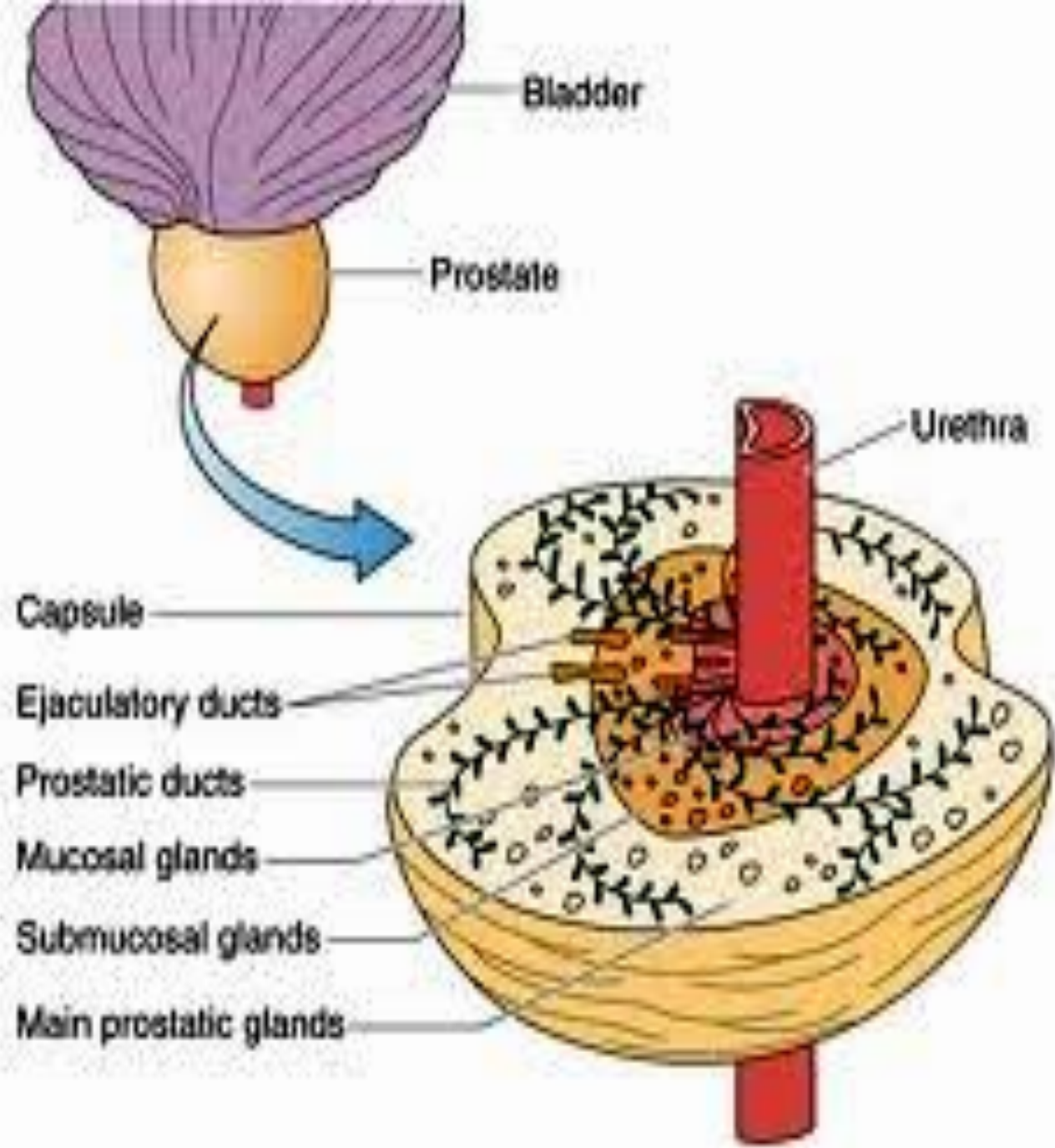
NO muscular coats

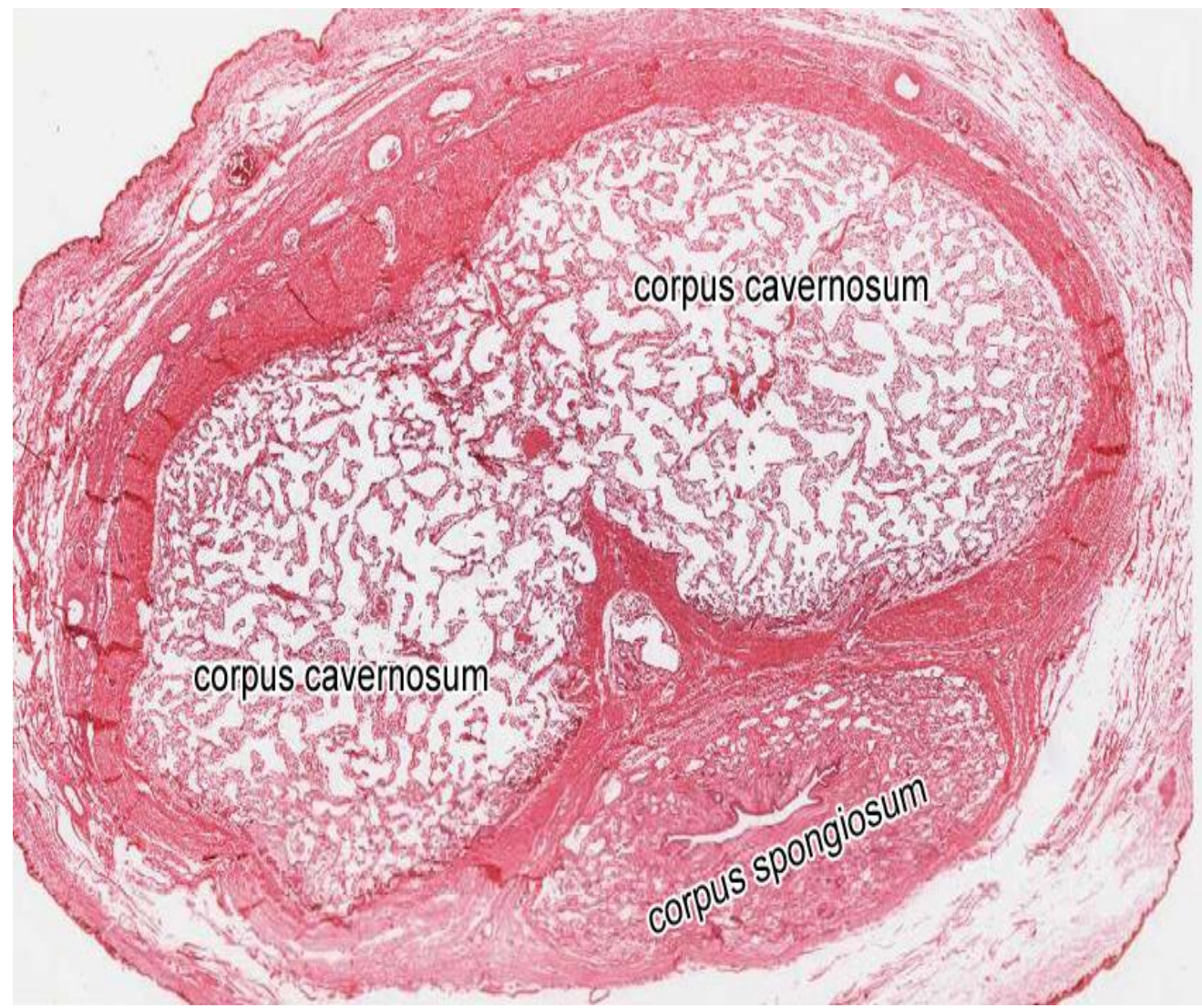
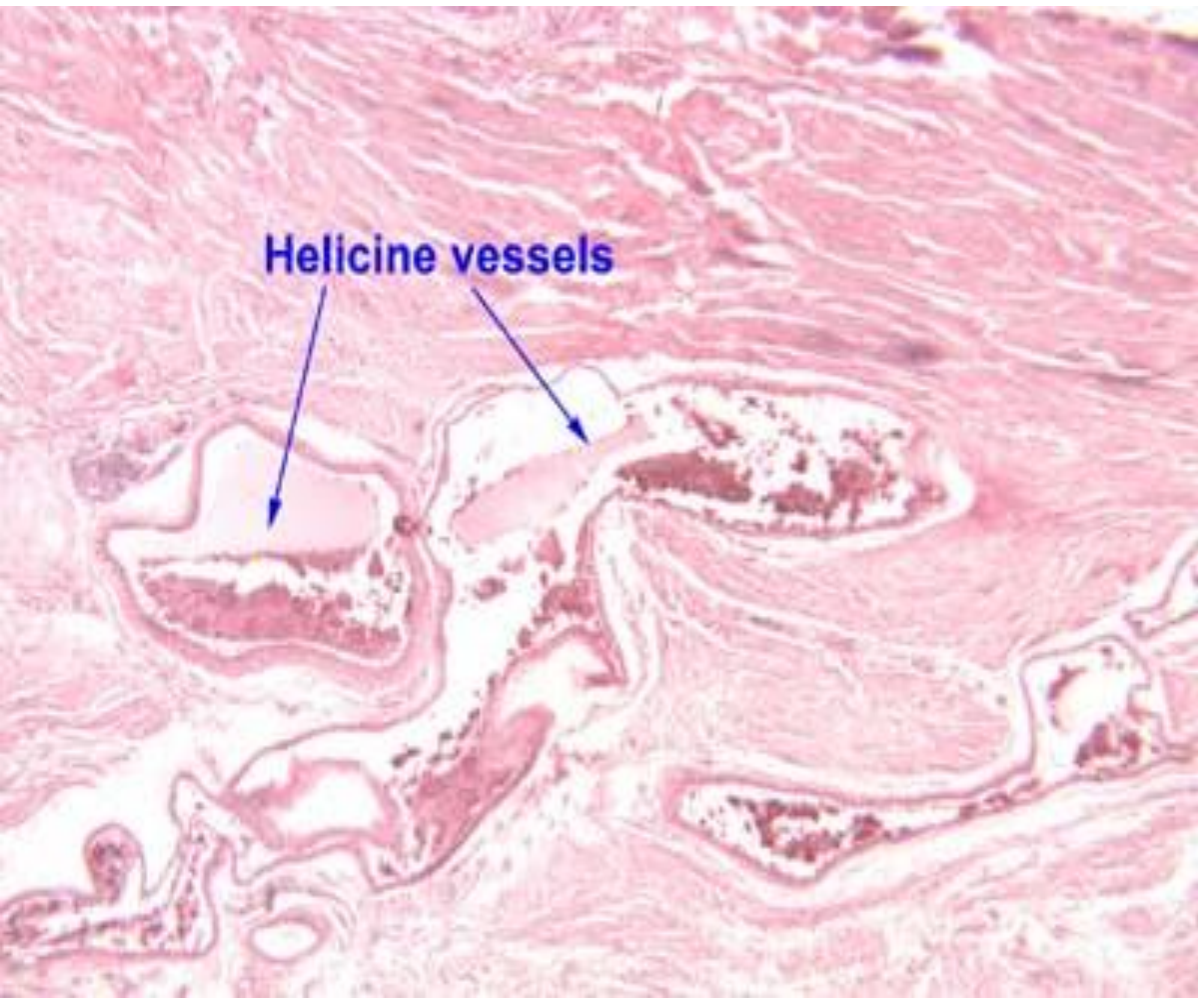
Pseudostratified columnar epithelium with stereocilia

3 muscular layer

Pseudostratified columnar epithelium with long stereocilia

Single circular muscle layer





*Thank  
you*

