«Male reproductive system»

Male reproductive system. Overall structure

Male reproductive system includes organs which perform reproductive and endocrine functions. The organs of male reproductive are divided into the internal and external ones.

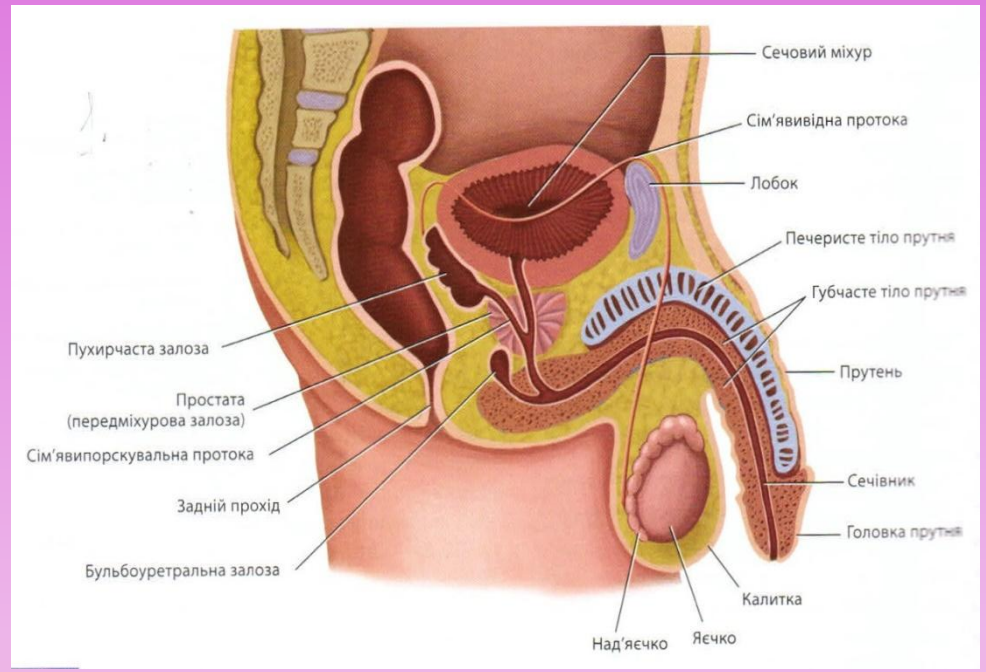
The internal male reproductive organs:

- testis and epididymis
- ductus deferens
- ejaculatory duct
- urethra
- accessory glands (seminal vesicles, prostate, bulbourethral glands)

The external male reproductive organs:

- penis
- scrotum

- The testis (seminiferous tubules) is the site of formation of spermatozoa. The interstitial (Leydig) cells of the testis produce male sex hormone - testosterone.



Morphology of testis

Testis– paired parenchymal organ which contains numerous tubular structures:

1. Seminiferous tubules
2. Excurrent duct system

-Straight tubules

-Rete testis

-Efferent ductules

-Duct of epedidymus

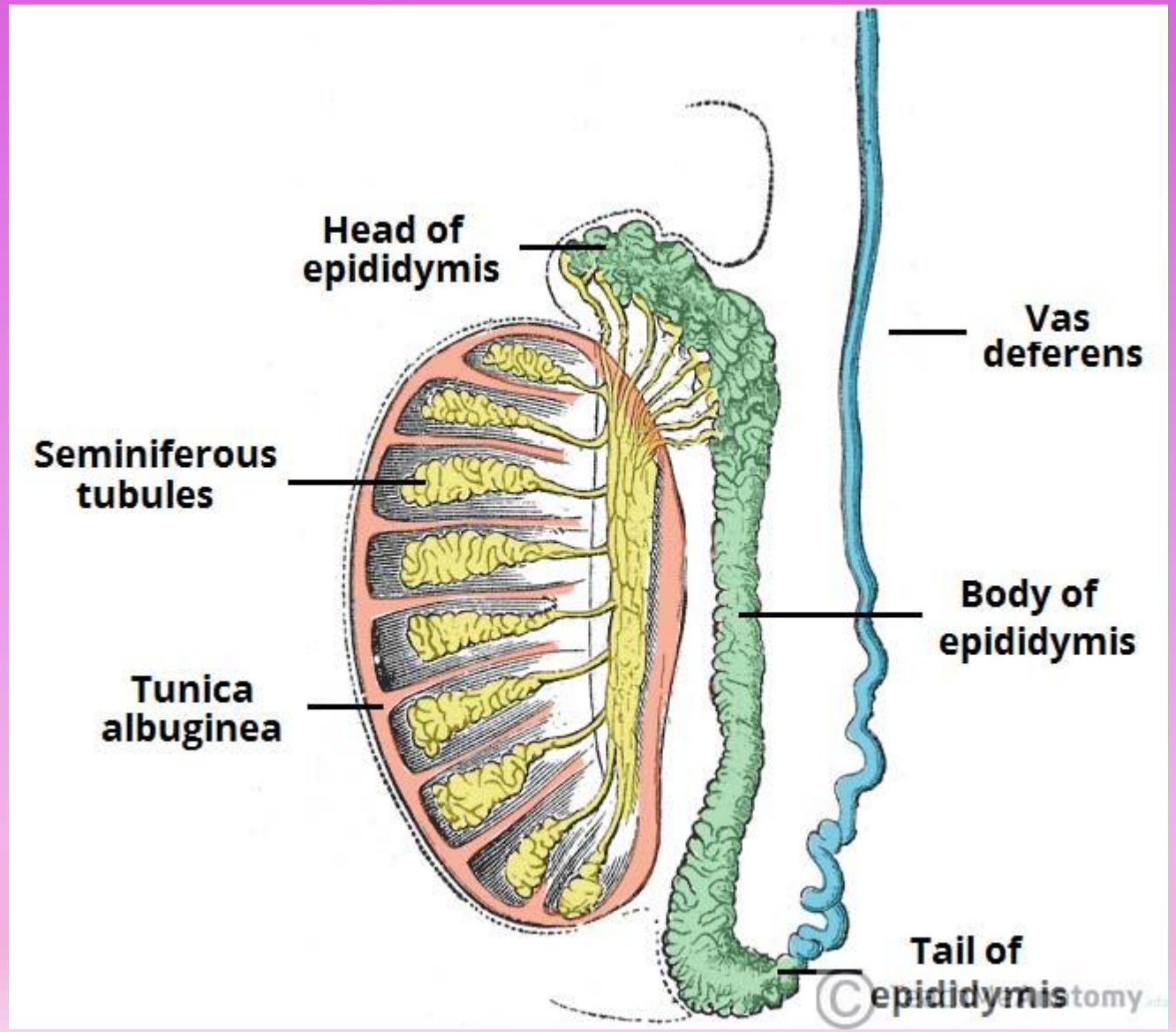
-Ductus deferens

-The ejaculatory duct

-Urethra

Seminiferous tubules is the site of spermatogenesis (process of formation of spermatozoa); other tubular structures are responsible for deposition and excretion of spermatozoa and constitute excurrent duct system.

Structural and functional unit of the testis– lobule, which contains (1-4) seminiferous tubules



Seminiferous tubules

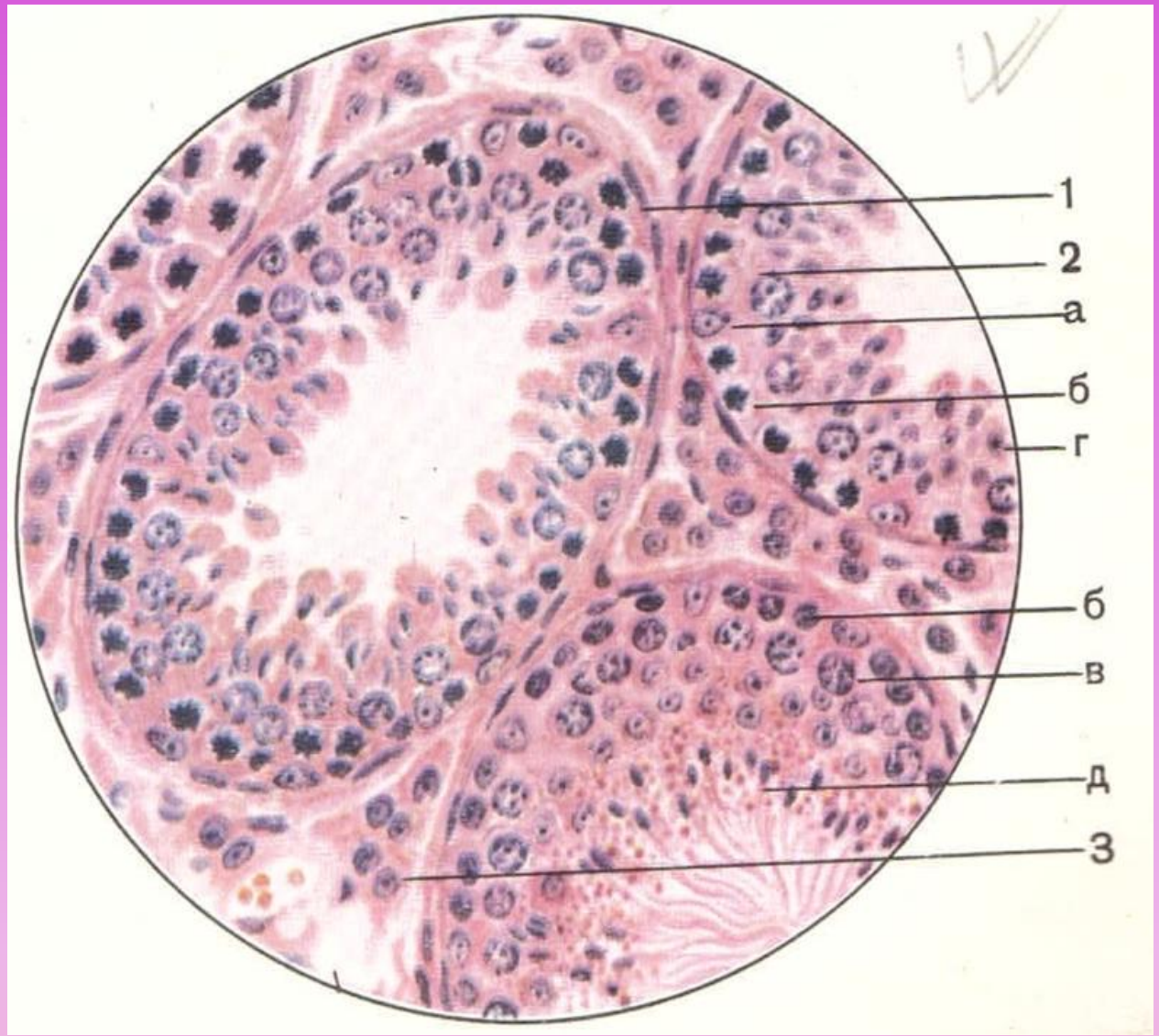
1.Germ epithelium – simple columnar epithelium with basal lamina

2.Tunica propria. Layers:

- basal layer-collagen fibers
- myoid layer – contractive (smooth muscle)
- fibrous layer:

a) Acellular layer- basal lamina of the myoid cells+collagen fibers

b) Layer of fibroblast-like cells



(Hematoxylin-Eosin x 400)

Germ epithelium

Cells:

1-Supporting cells (sustentacular or Sertoli cells)

Functions:

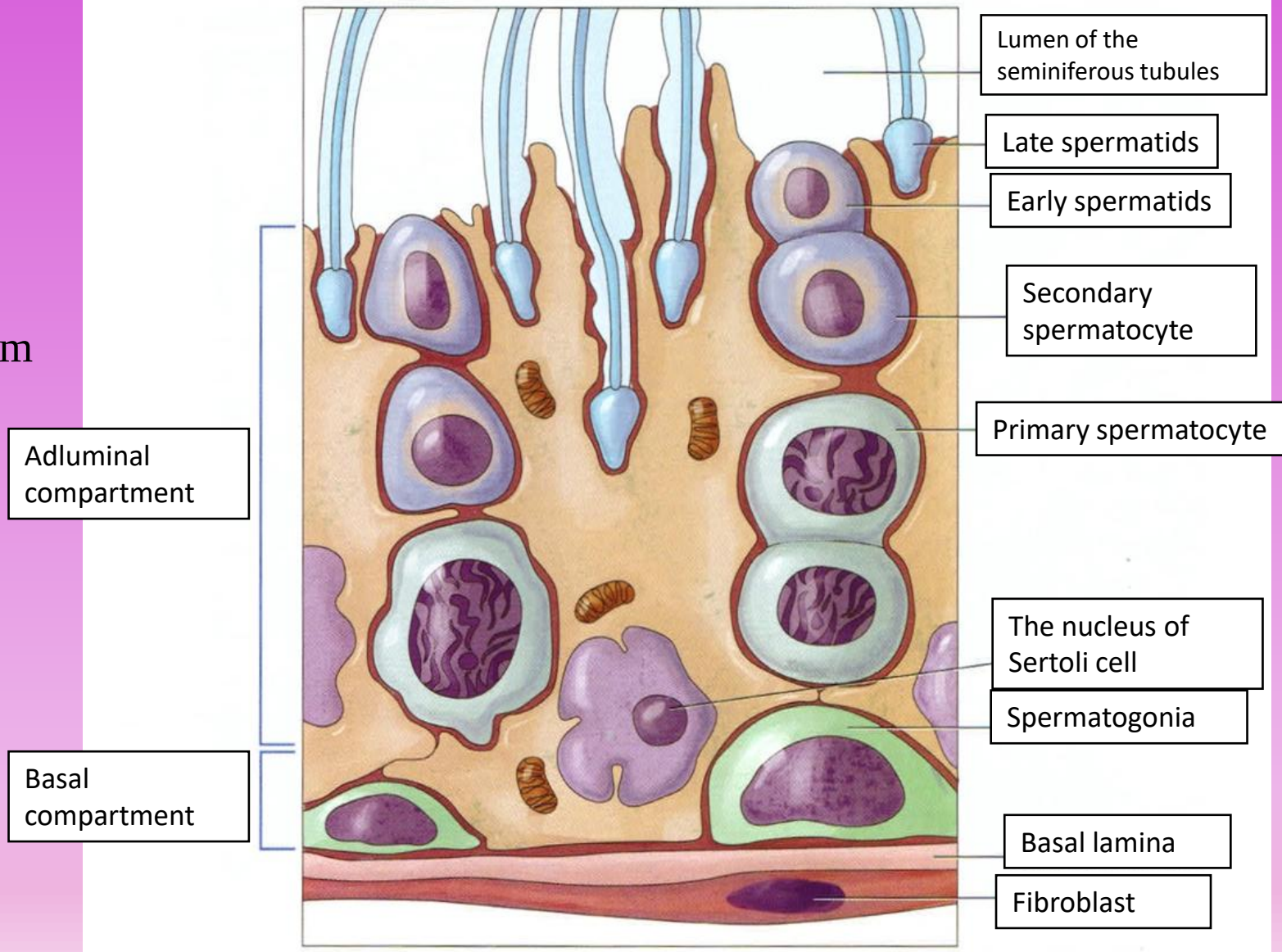
- Form the microenvironment for the developing spermatozoa protecting them from toxins and antigens
- Phagocyte defective germ cells
- Synthesize androgen-binding protein, inhibin (FSG), antimullerin hormone

2-Spermatogenic cells on different stages of development

Compartments of the germ epithelium:

1 basal (spermatogonia)

2 adluminal (spermatocytes, spermatids, spermatozoa)



Blood-testis barrier

Components:

- endothelium
- basal lamina of blood capillary
- tunica propria
- lamina propria of germ epithelium

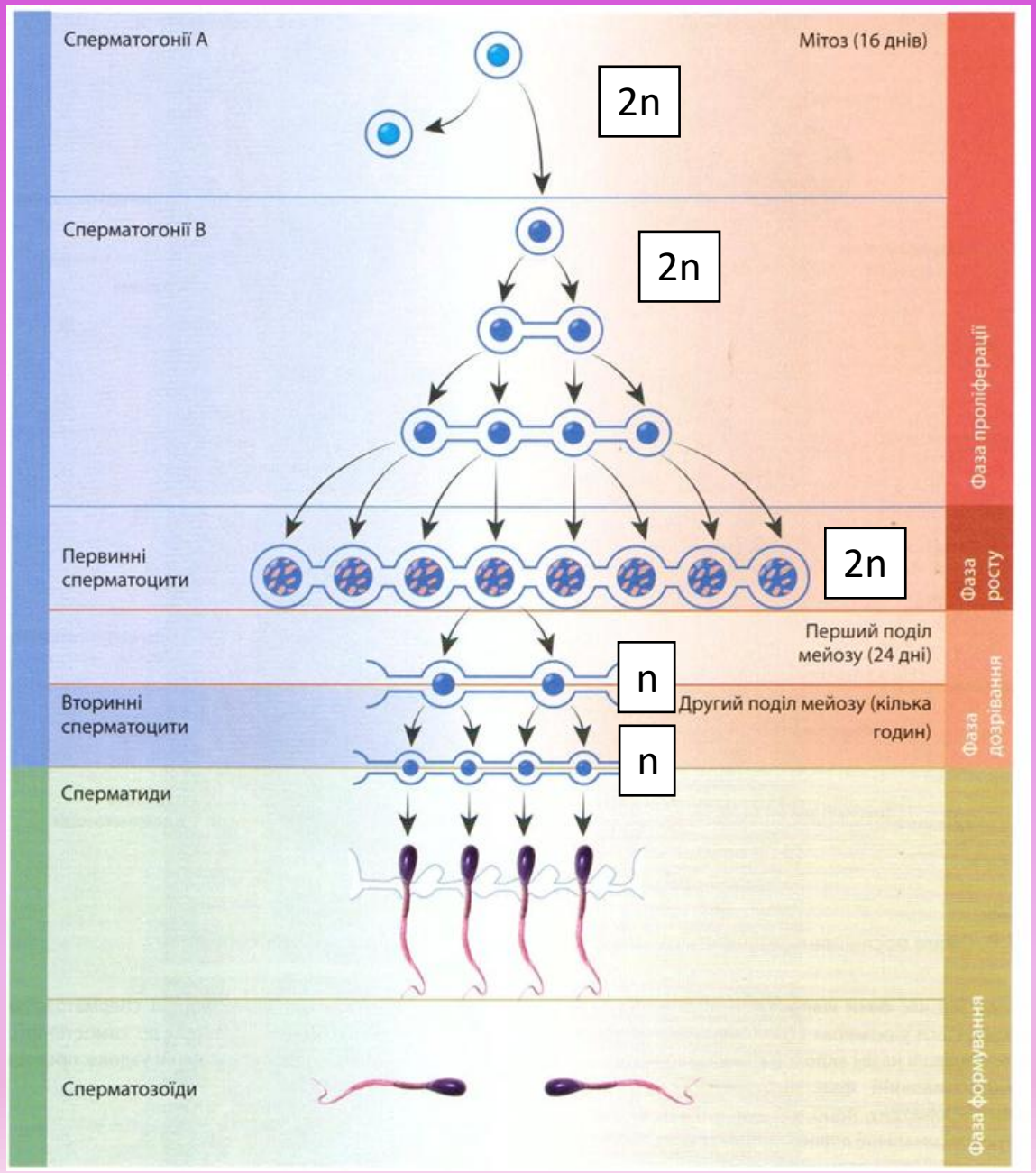
Functions:

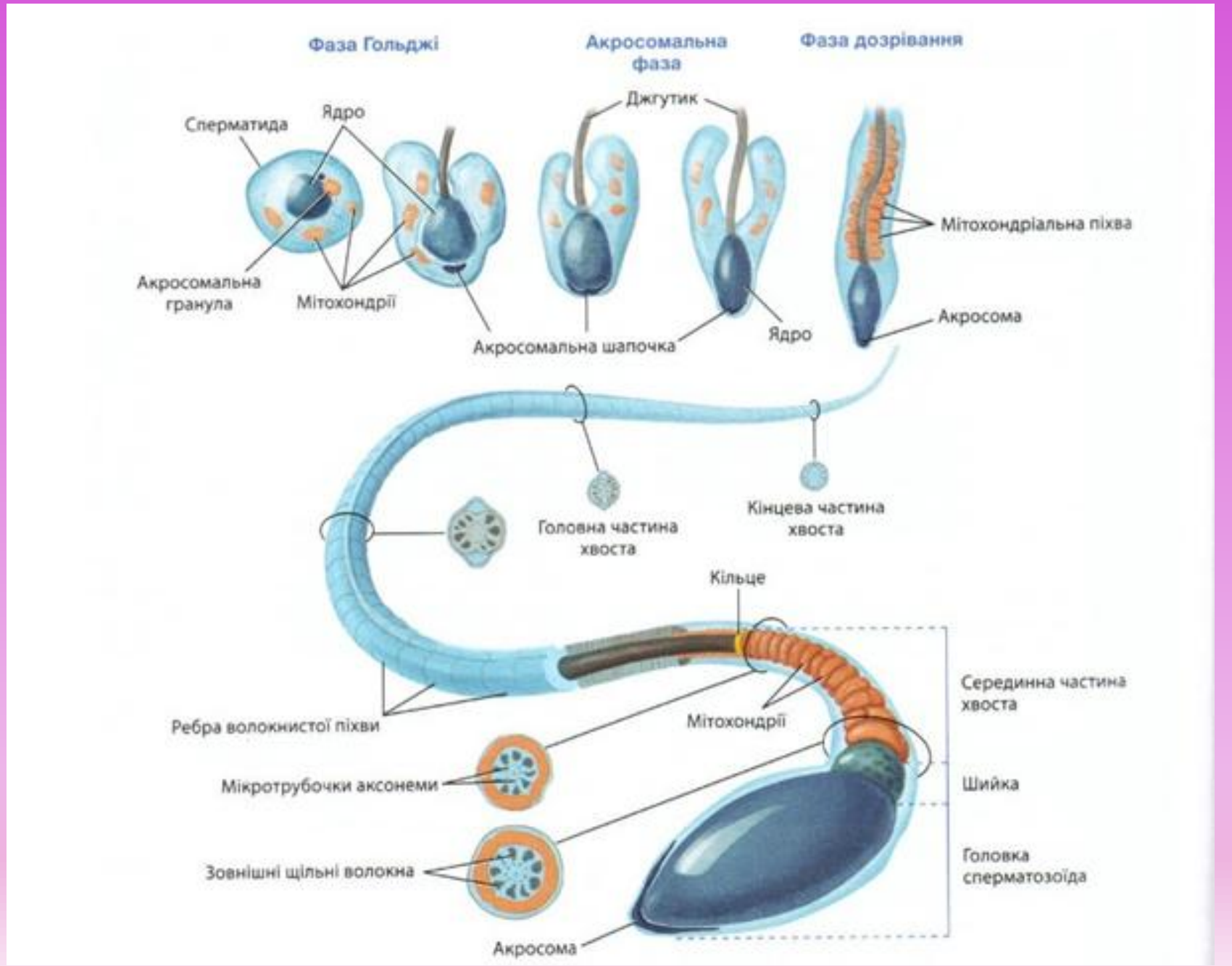
- maintains constant concentration of nutrients and hormones essential for spermatogenesis;
- prevents passage of anti-sperm antibodies to the developing sperm cells
- protection from toxins and antigens

Spermatogenesis

Spermatogenesis – process of formation of male germ cells. Takes place in seminiferous tubules and includes 4 stages:

- Proliferations
- Growth
- Maturation
- Differentiation




Фаза Гольджі
Акросомальна фаза
Фаза дозрівання
Сперматида
Ядро
Акросомальна гранула
Мітохондрії
Акросомальна шапочка
Джгутик
Ядро
Мітохондріальна піхва
Акросома
Головна частина хвоста
Кінцева частина хвоста
Кільце
Ребра волокнистої піхви
Мітохондрії
Мікротрубочки аксонеми
Зовнішні щільні волокна
Акросома
Серединна частина хвоста
Шийка
Головка сперматозоїда

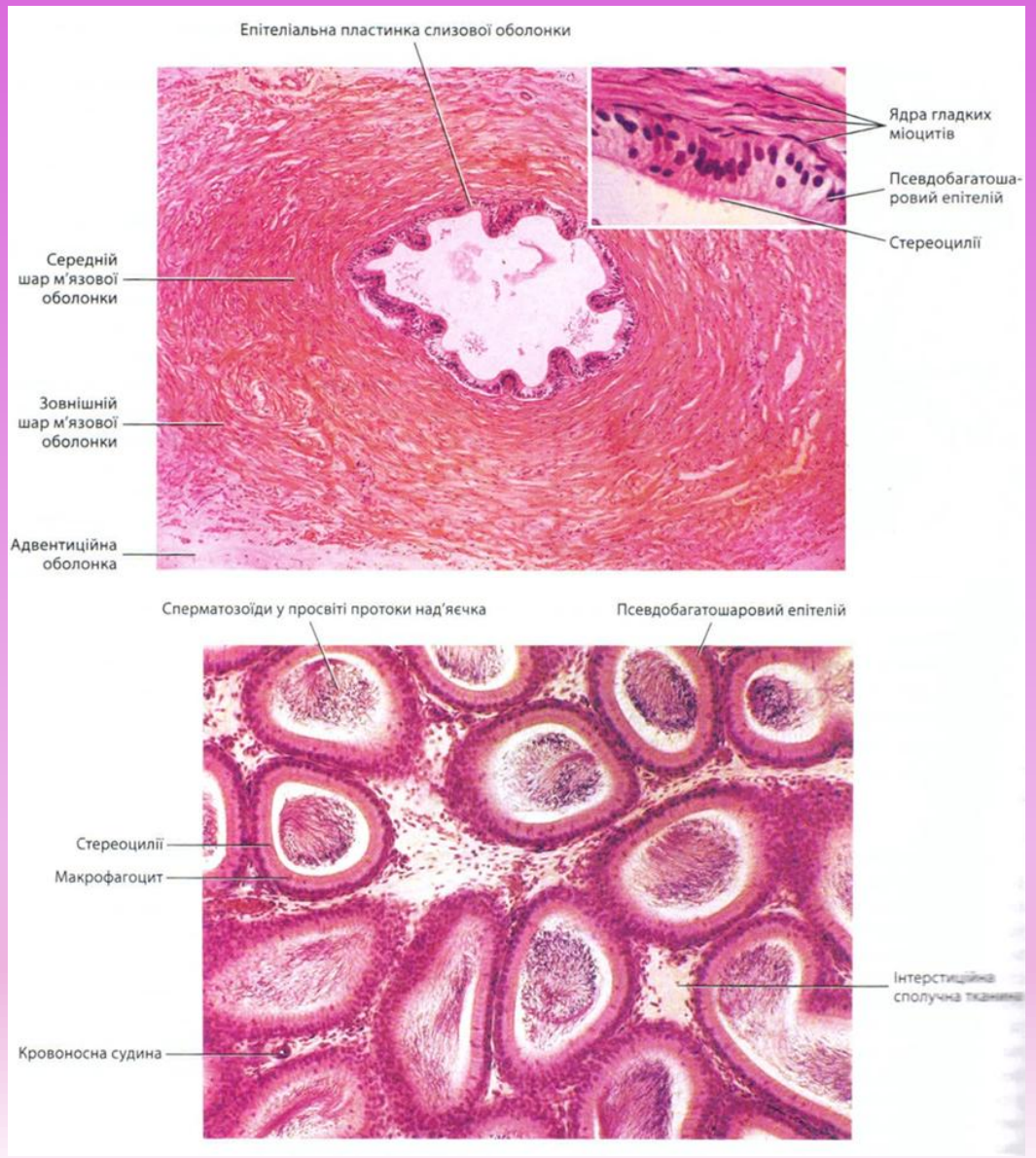
Excurrent ducts

Excurrent duct system includes:

- straight tubules
- rete testis
- efferent ductules
- duct of epididymus
- ductus deferens
- ejaculatory duct
- urethra

All excurrent ducts have similar structures and contain three tunics:

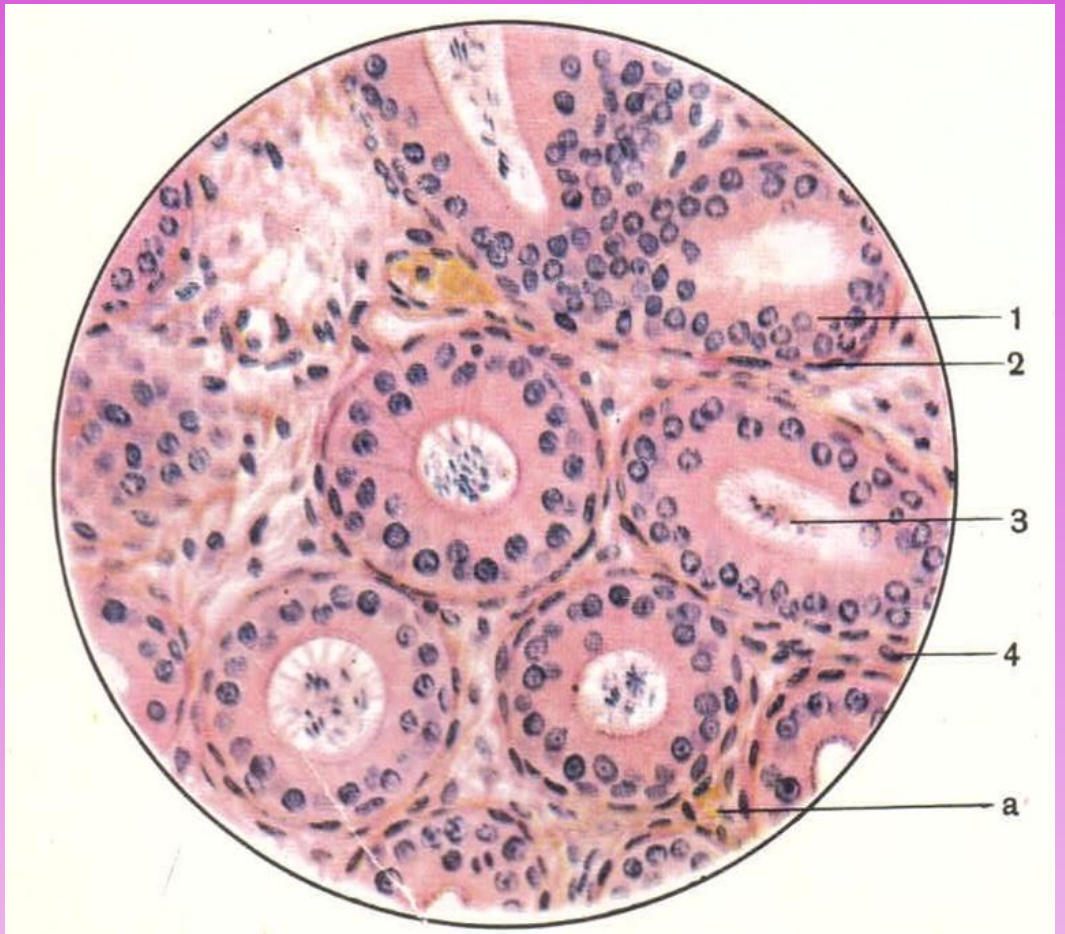
- mucosa
- muscularis
- adventitia



	Structure	Tunica mucosa (epithelium+tunic propria)	Tunica muscularis	Tunica externa
1	Straight tubules	Simple cuboidal or columnar	Circular layer of smooth muscles	Adventitia – loose connective tissue
2	Rete testis	Simple cuboidal or squamous	Circular layer of smooth muscles	Adventitia - loose connective tissue
3	Efferent ductules	Simple columnar Ciliated cells Glandular cells macrophages	Circular layer of smooth muscles	Adventitia - loose connective tissue
4	Duct of epididymis	Pseudostratified (2 layers) columnar Chief (with stereocilia) Basal Macrophages	Circular layer of smooth muscles	Serosa – loose connective tissue covered by mesothelium
5	Ductus deferens	Pseudostratified (2 layers) columnar Chief (with stereocilia) Basal	3 layers of smooth muscles -internal-longitudinal -middle-circular -external-longitudinal	Adventitia - loose connective tissue
6	Ejaculatory duct	Double-layered columnar Chief (with stereocilia) Basal	Muscles are absent	Adventitia - loose connective tissue fused with the stroma of prostate

Functions of epididymis

- The packaging of enzymes in the into acrosome
- Secretion of liquid that dilute the sperm
- Depot of spermatozoa



Duct of the epididymis (Hematoxylin-Eosin x 280)
1-pseudostratified epithelium (2 layers)
2-lamina propria with smooth muscle cells
3-spermatozoa in the lumen
4-fibrous connective tissue
a-blood vessel

Testis with epididymis
(Hematoxylin-Eosin, small magnification)

1-tunica albuginea

2- testis

а) seminiferous tubules

б) seminiferous (germ) epithelium

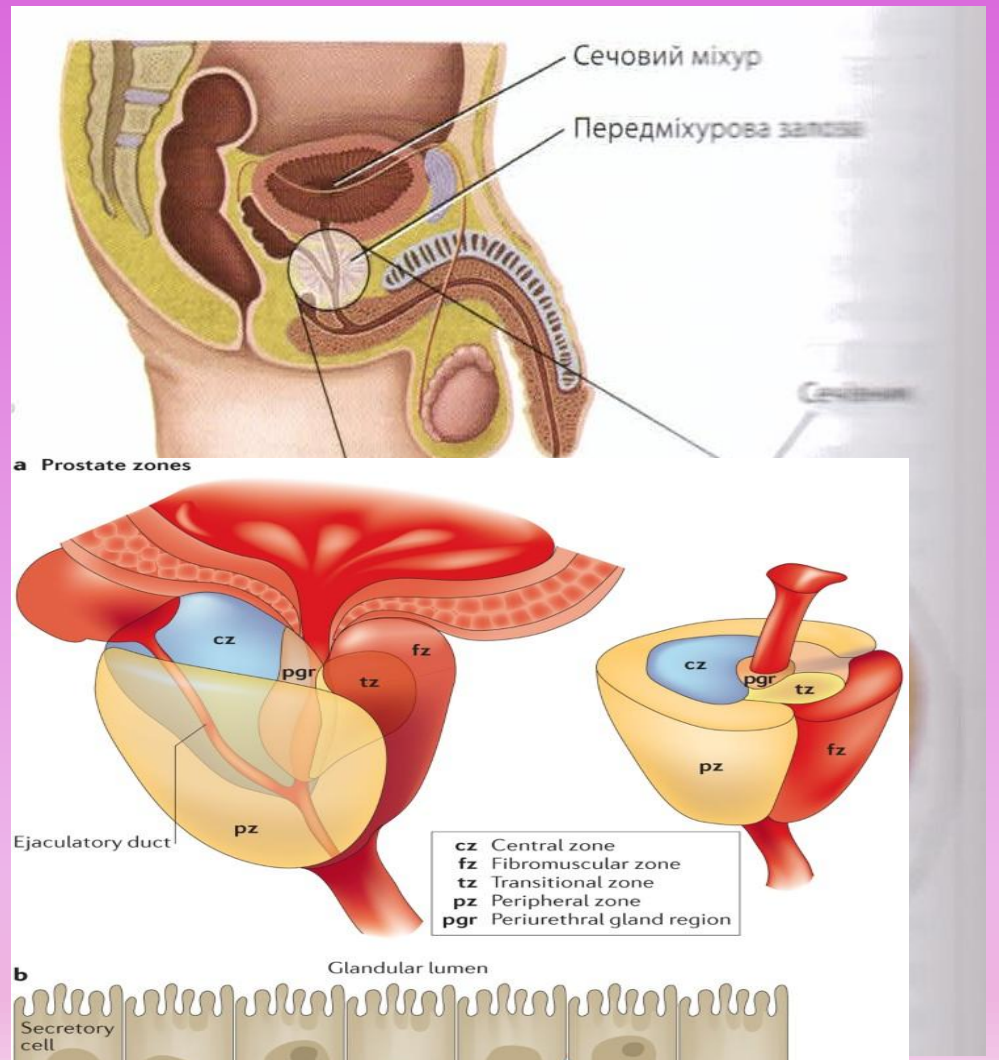
в) interstitial tissue

г) ductus deferens

д) ducts of the epididymis

Morphological and functional characteristics of the prostate

- Prostate – fibromuscular organ. Covered by connective tissue capsule
- 50% is composed of glandular parenchyma
- 50% is composed of smooth muscle cells and connective tissue
- Parenchyma is composed of branched tubo-alveolar glands
- *Central group of glands* surrounds urethra
- *Intermediate group of glands* – glands of the submucosa
- *Peripheral glands* – main glands of the prostate

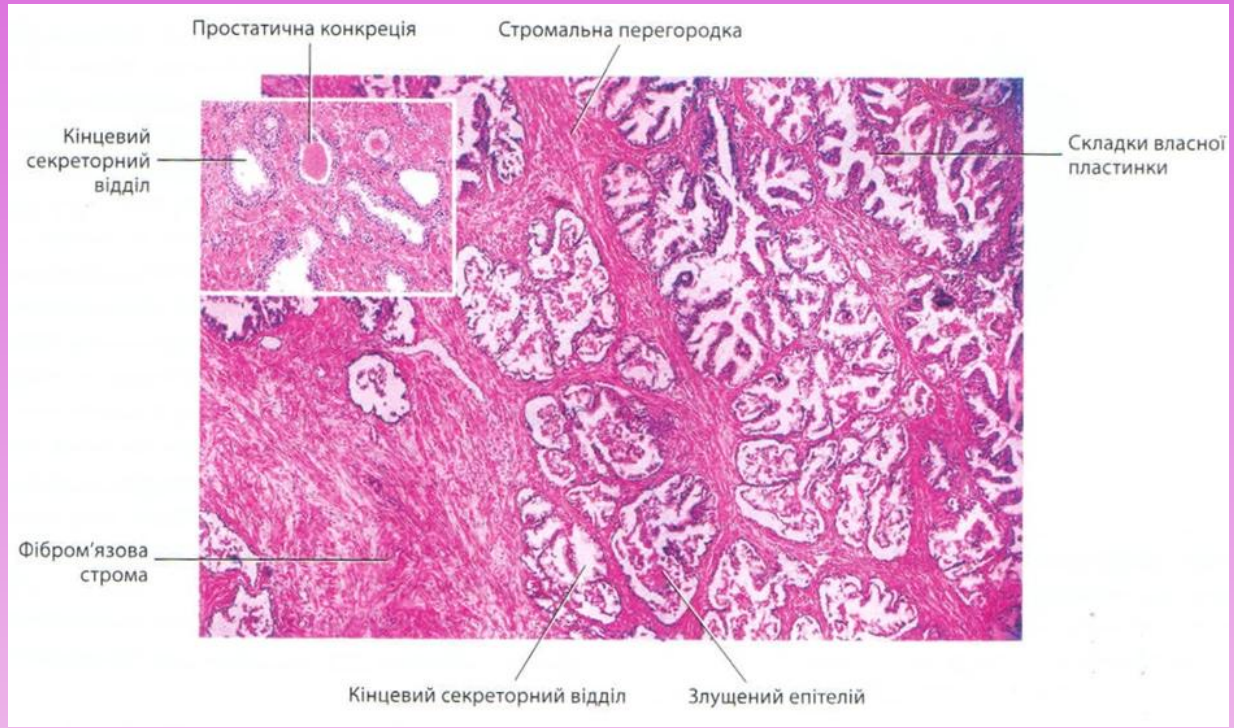


Cells of the secretory portions:

- exocrine cells of the prostate
- endocrine cells
- basal cells

Functions:

- synthesis of prostaglandins (biological active substances with multiple effects);
- production of alkaline secretion;
- regulation of sexual differentiation of hypothalamus



Prostate and urethra

(Hematoxylin-Eosin x 56)

1 – urethra (prostatic part)

а) transitional epithelium

б) lamina propria

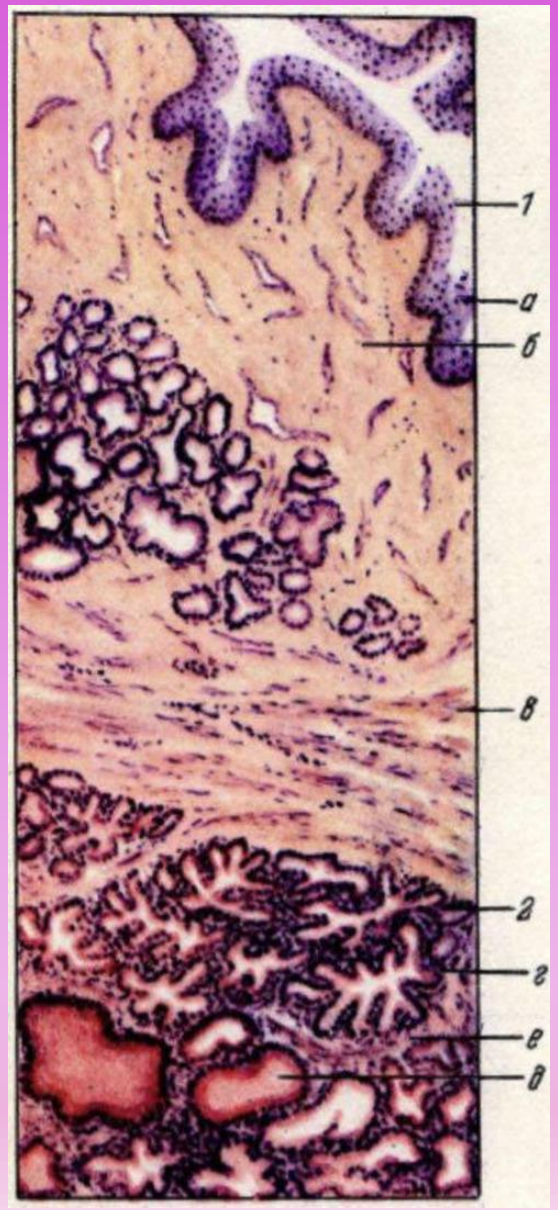
в) smooth muscle

2 – prostate gland

г) the acini of the prostatic glands

д) excretory ducts

г) smooth muscles



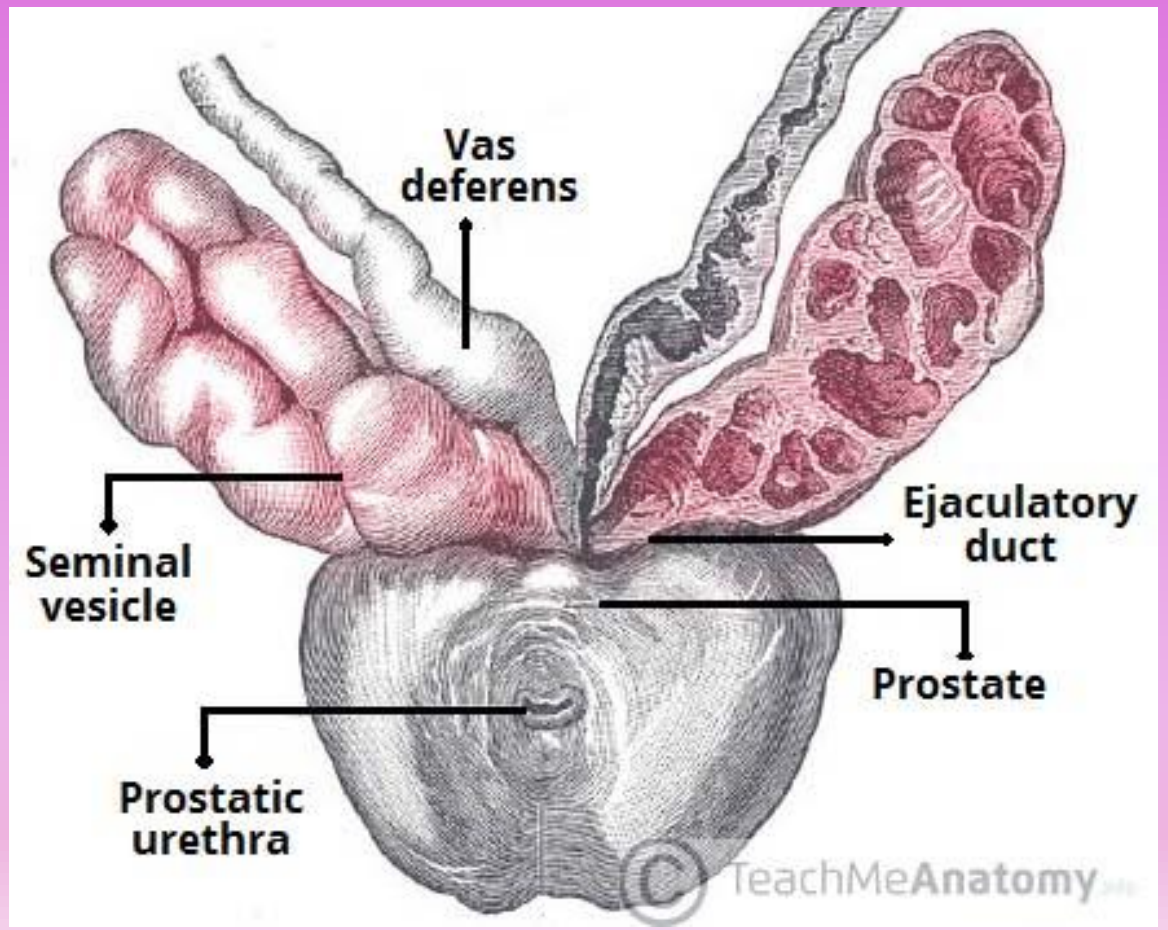
Seminal vesicles

- Paired glandular organs
- **Tunics of the seminal vesicles wall**

- mucosa – simple columnar epithelium on the basal lamina, lamina propria contains numerous elastic fibers and acini of the alveolar glands;

- muscularis – contains two layers of muscle cells (inner circular and outer longitudinal);

- adventitia – loose connective tissue with numerous elastic fibers



Bulbourethral glands

- Compound tubo – alveolar glands which empty into the upper part of the urethra
- Secretory portions are composed of mucous-secreting cells of flat, cuboidal and columnar cells. The cytoplasm contains droplets of mucoid and elongated inclusions.
- Secretory portions of the glands are surrounded by the layers of loose connective tissue which contains bundles of smooth muscle cells.