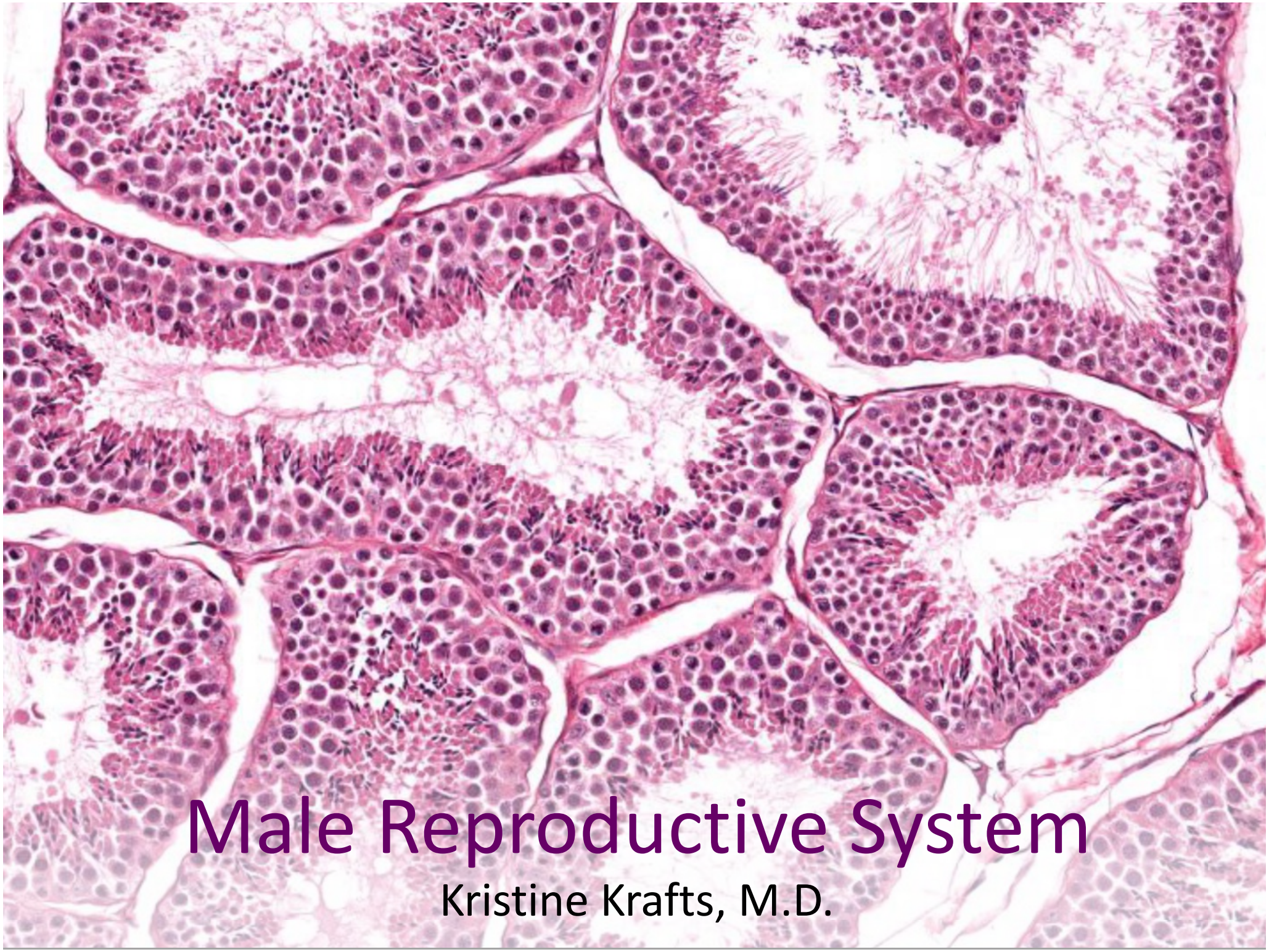


Male Reproductive System

Kristine Krafts, M.D.

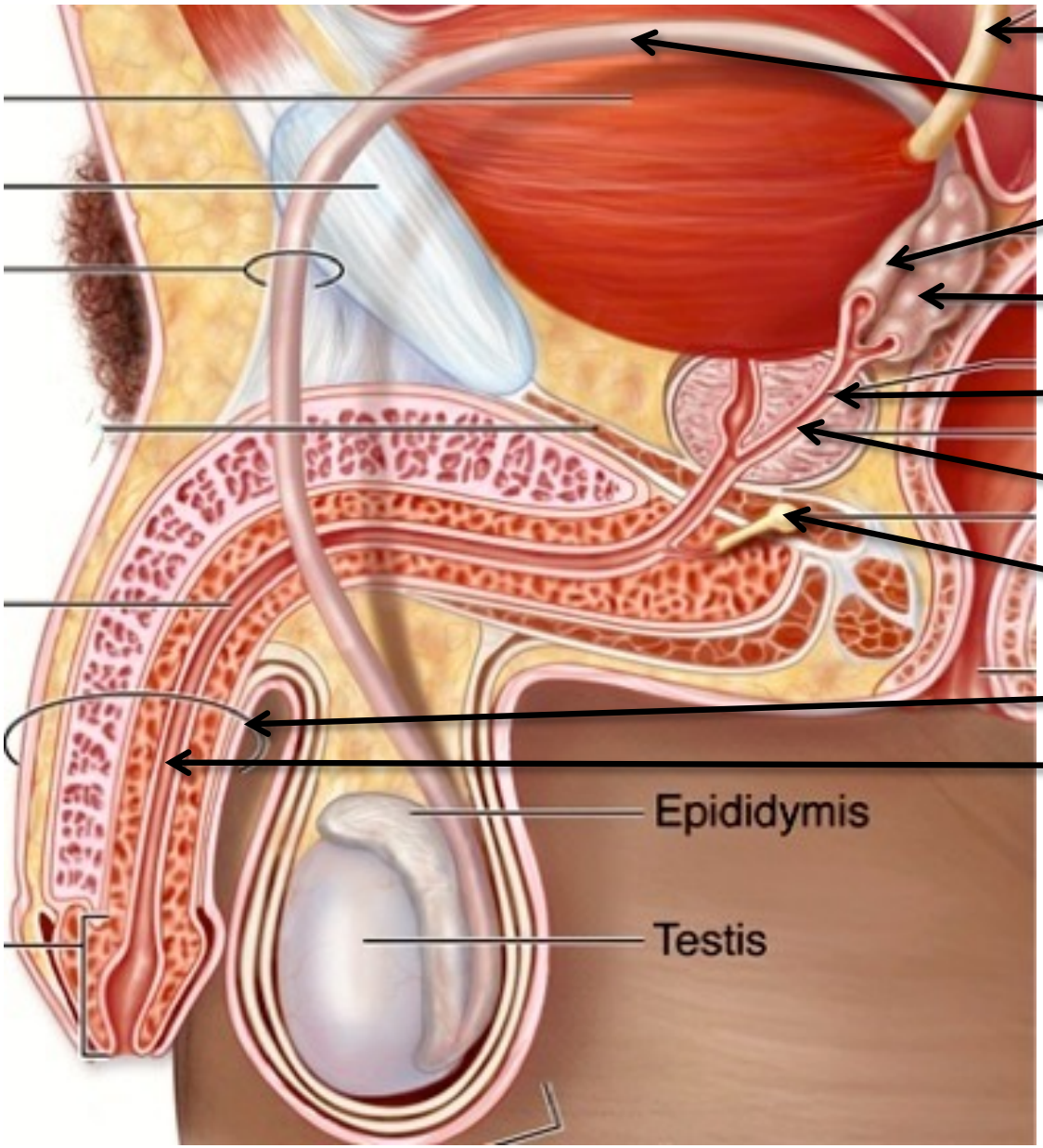
Male Reproductive System Objectives

- Describe and compare the characteristic microscopic features and functions of the following components of the male reproductive system:
  - Testes
  - Genital ducts, including straight tubules, rete testis, efferent ductules, epididymis, ductus deferens and urethra
  - Accessory genital glands, including seminal vesicle and prostate gland
  - Penis

Male Reproductive System Objectives

- Discuss and compare the characteristic microscopic features of the following cells of the male reproductive system: spermatogonia, primary and secondary spermatocytes, spermatids, spermatocytes, Sertoli cells, Leydig cells.
- Trace the path of sperm, in order, from seminiferous tubules to penile urethra.
- Discuss how the sperm fertilizes the egg.

The Male Reproductive System



Ureter

Ductus of vas deferens

Ampulla of vas deferens

Seminal vesicle

Ejaculatory duct

Prostate

Bulbourethral gland

Penis

Urethra

Male Reproductive System Lecture Outline

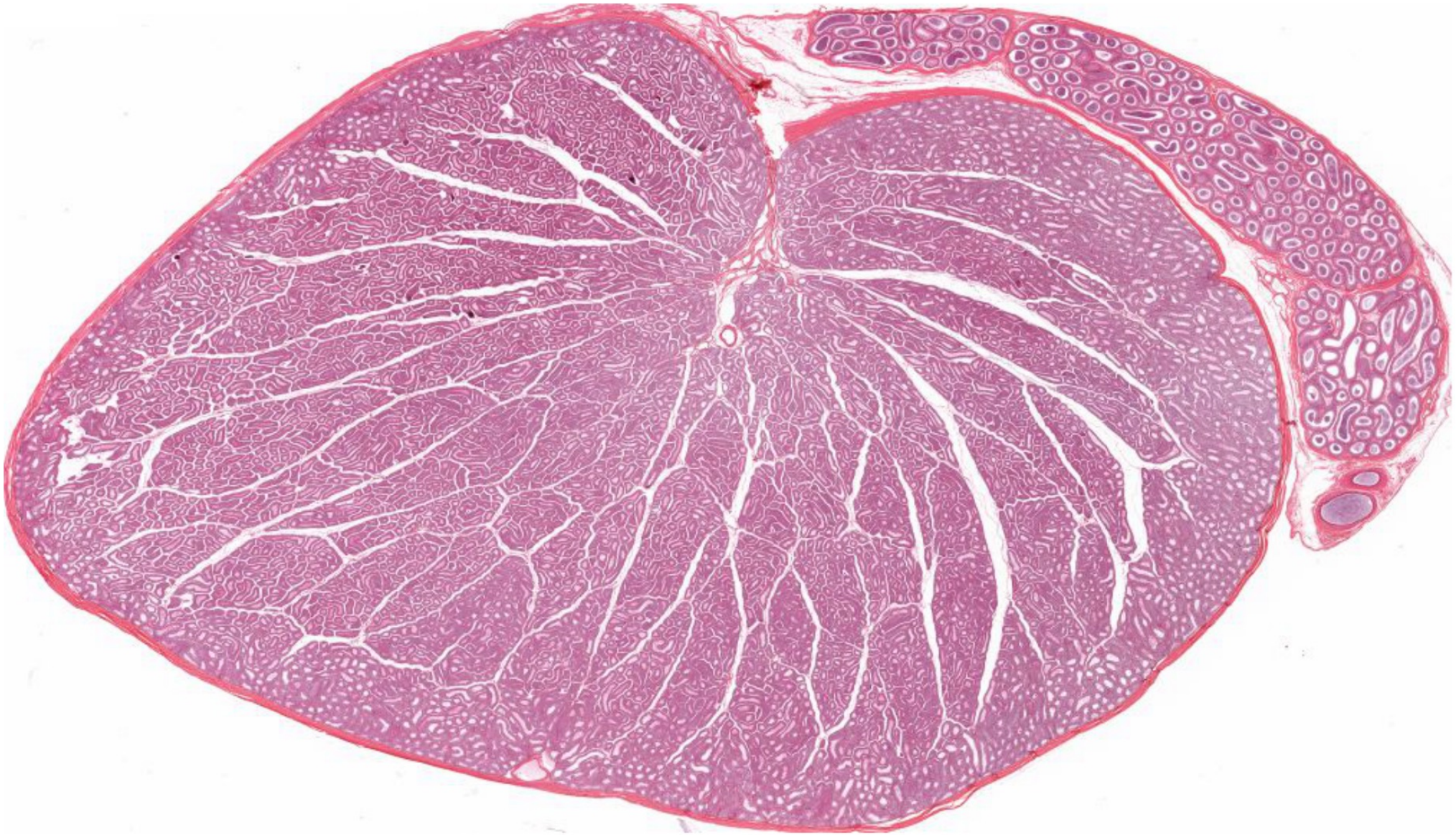
- Testis
- Genital ducts
- Accessory genital glands
- Penis

Male Reproductive System Lecture Outline

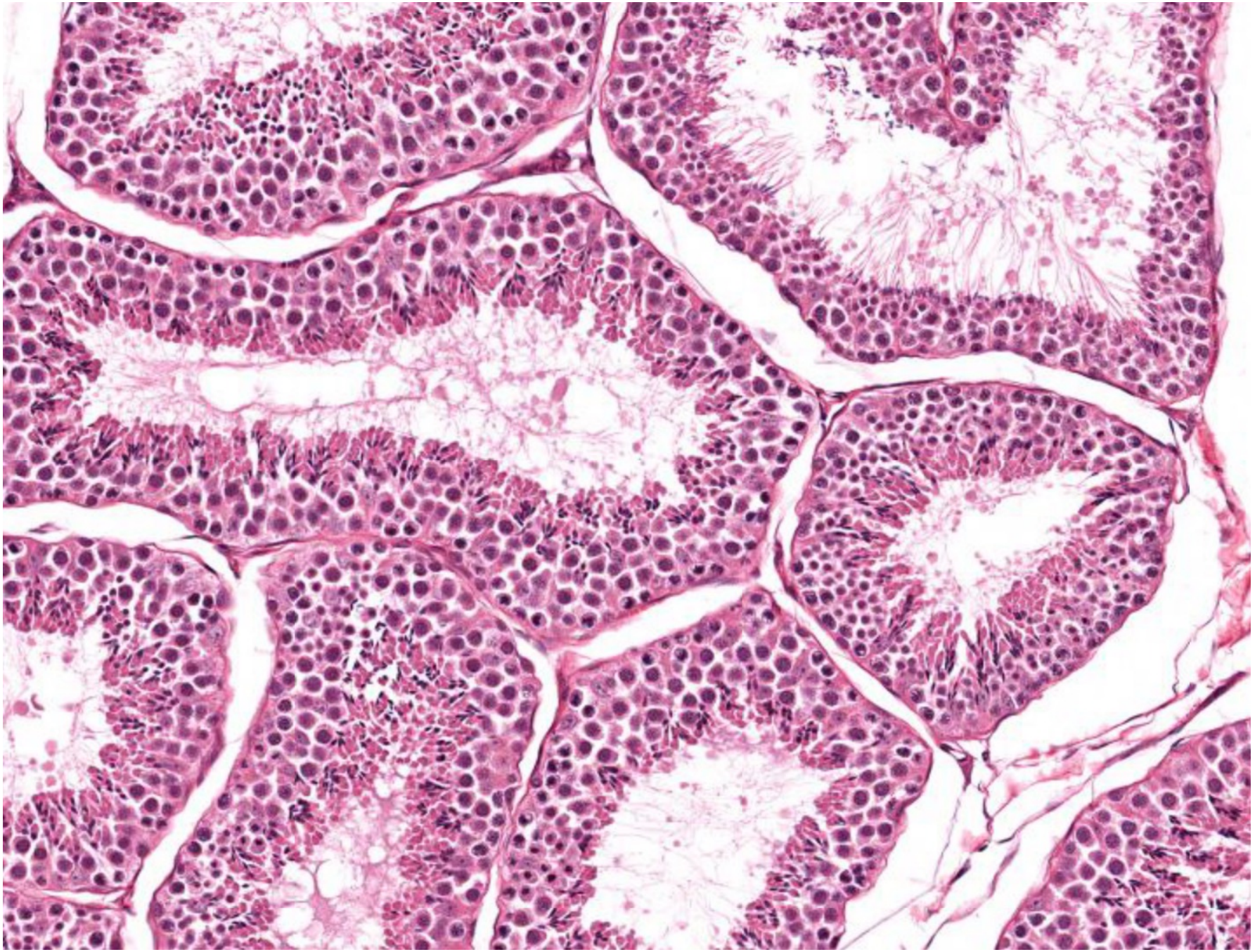
- Testis

Components of the Testis

- Tunica albuginea: thick capsule of dense connective tissue surrounding each testis
- Mediastinum testis: thickening of posterior part of tunica albuginea
- Seminiferous tubules: series of long tubules in which sperm are produced and mature
- Interstitial connective tissue: loose connective tissue that surrounds seminiferous tubules and contains blood, lymphatics and interstitial cells of Leydig



Testis



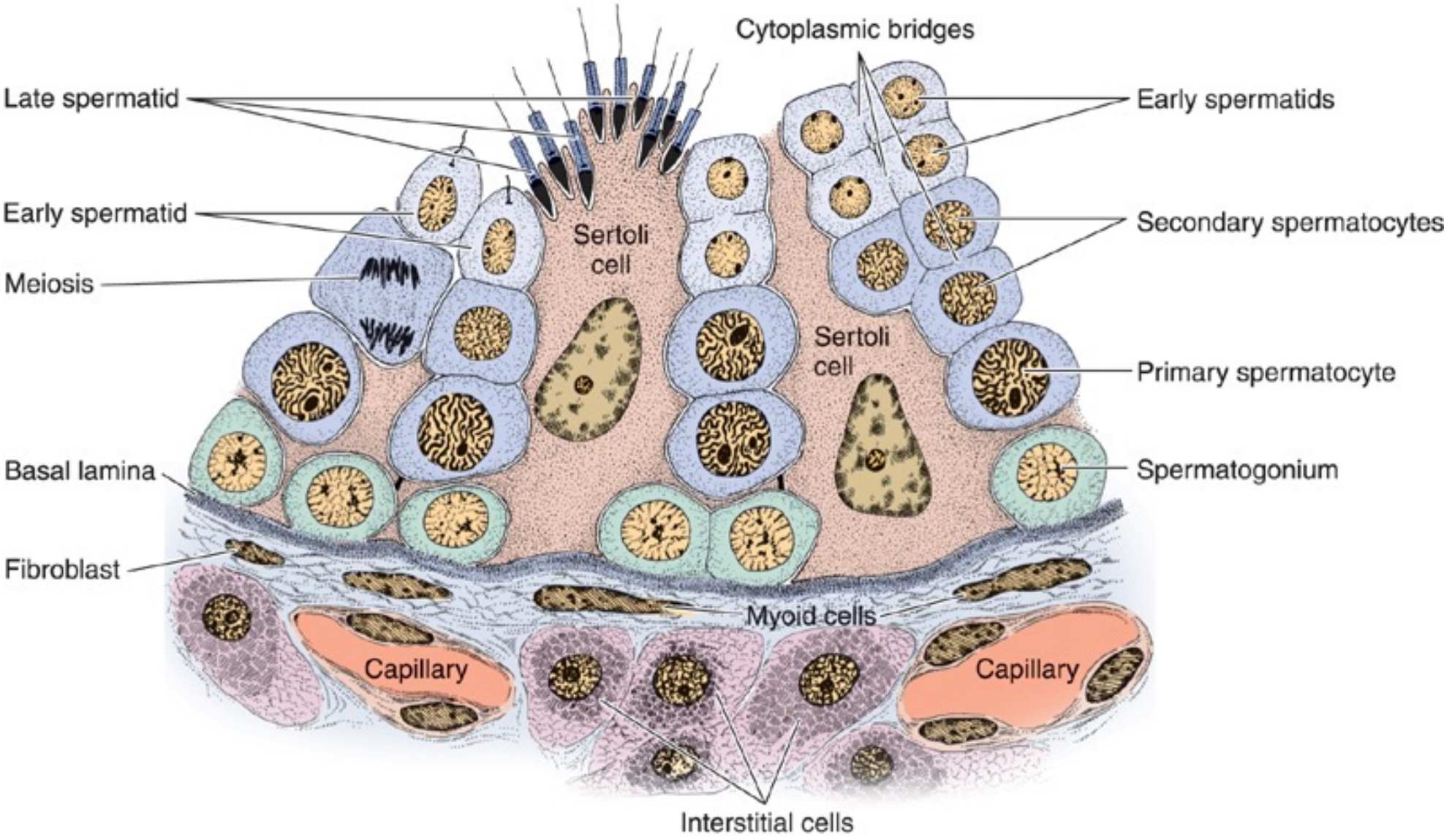
Seminiferous tubules

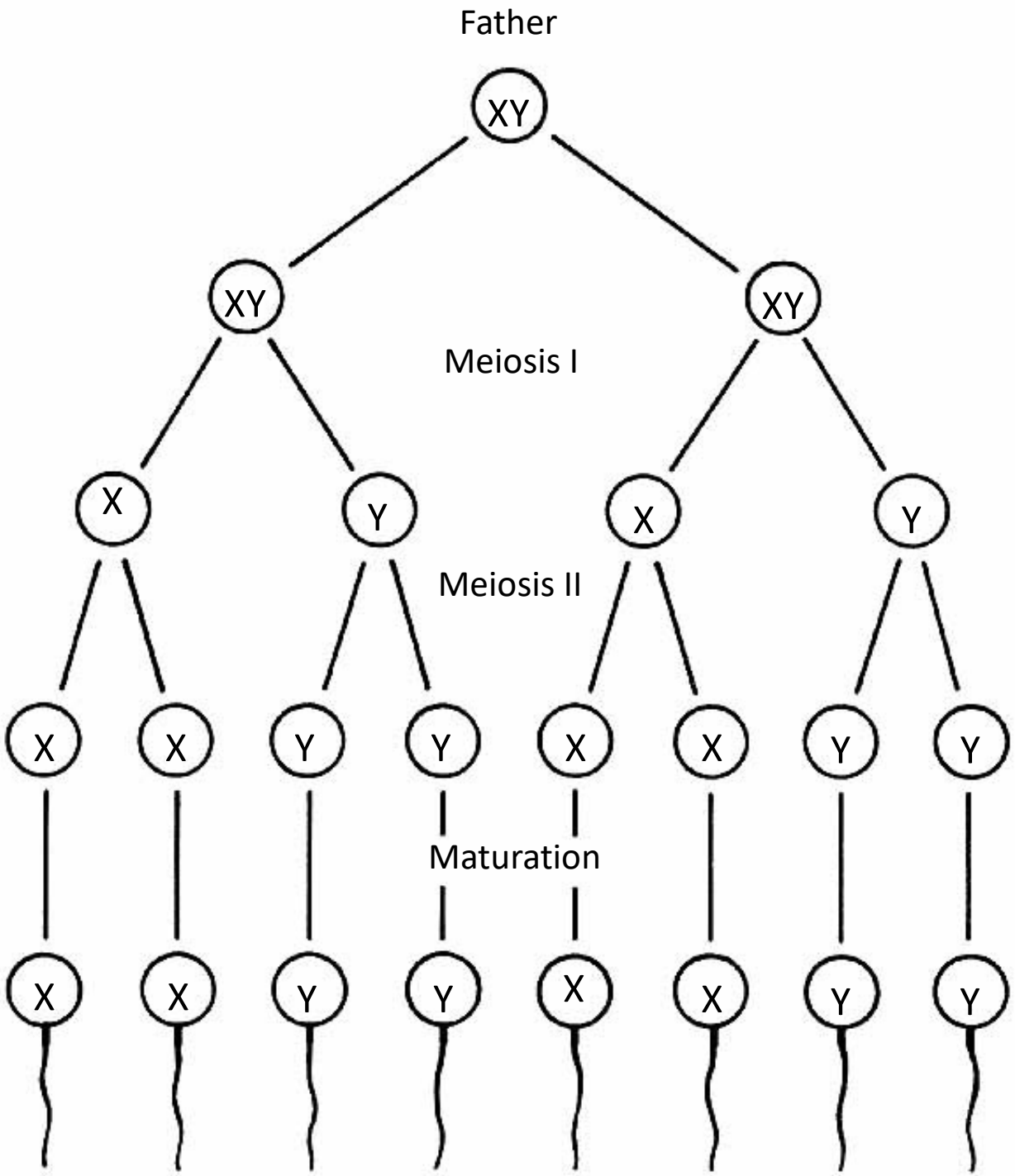
Seminiferous tubule

Spermatogenesis

- Spermatogonia: small, round stem cells located next to basal lamina.
- Primary spermatocytes: larger, located more towards lumen.
- Secondary spermatocytes: short-lived; hard to see.
- Spermatids: Close to lumen. Sperm precursors.

Seminiferous Tubule and Epithelium





Spermatogonia
(44 + X + Y) = 46

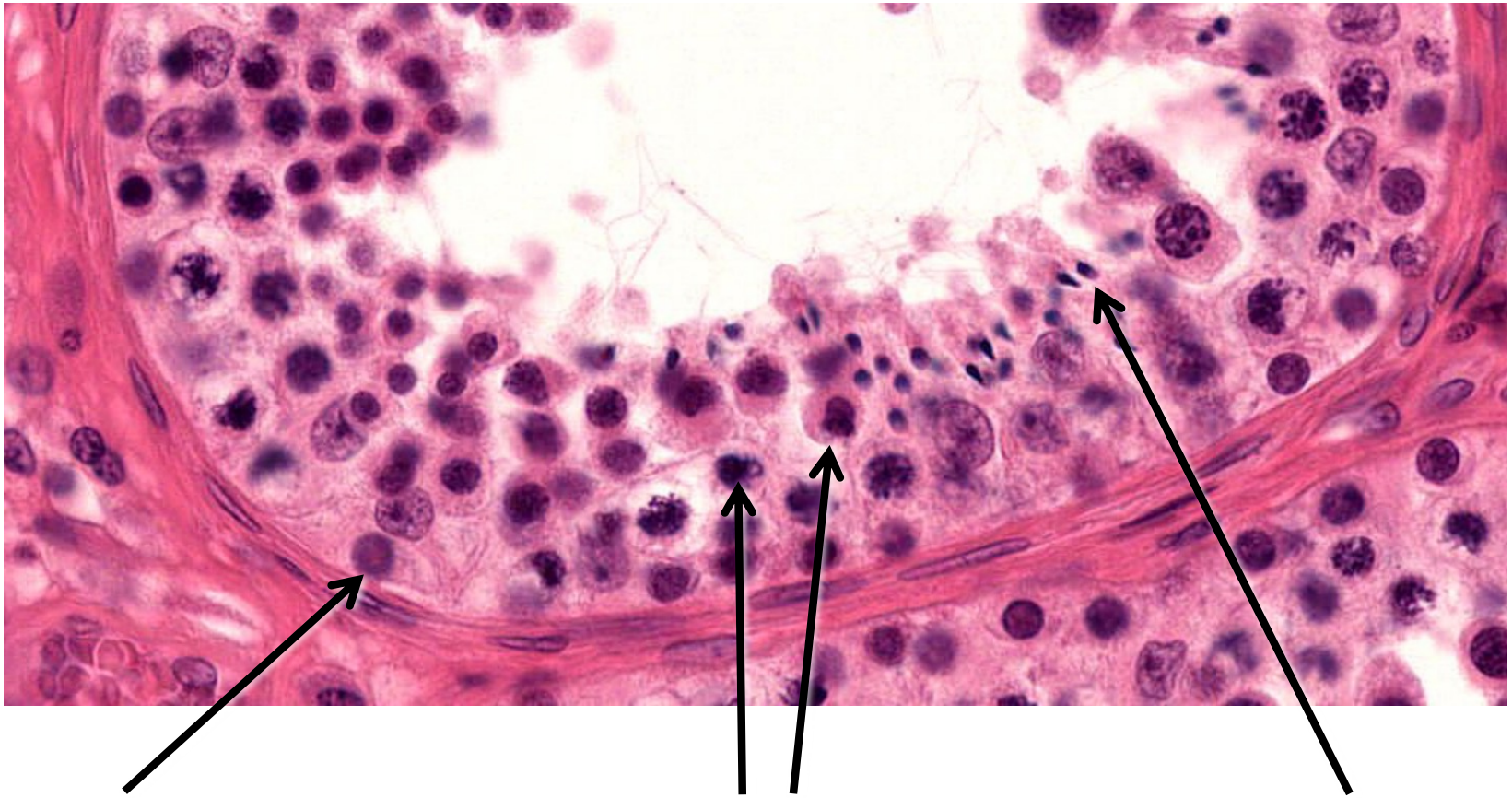
Primary spermatocytes
(44 + X + Y) = 46

Secondary spermatocytes
(22 + X; or 22 + Y) = 23

Spermatids
(22 + X; or 22 + Y) = 23

Spermatozoa
(22 + X; or 22 + Y) = 23

Spermatogenesis



Spermatogonium

Primitive germ cell next to basal lamina.

Primary spermatocytes

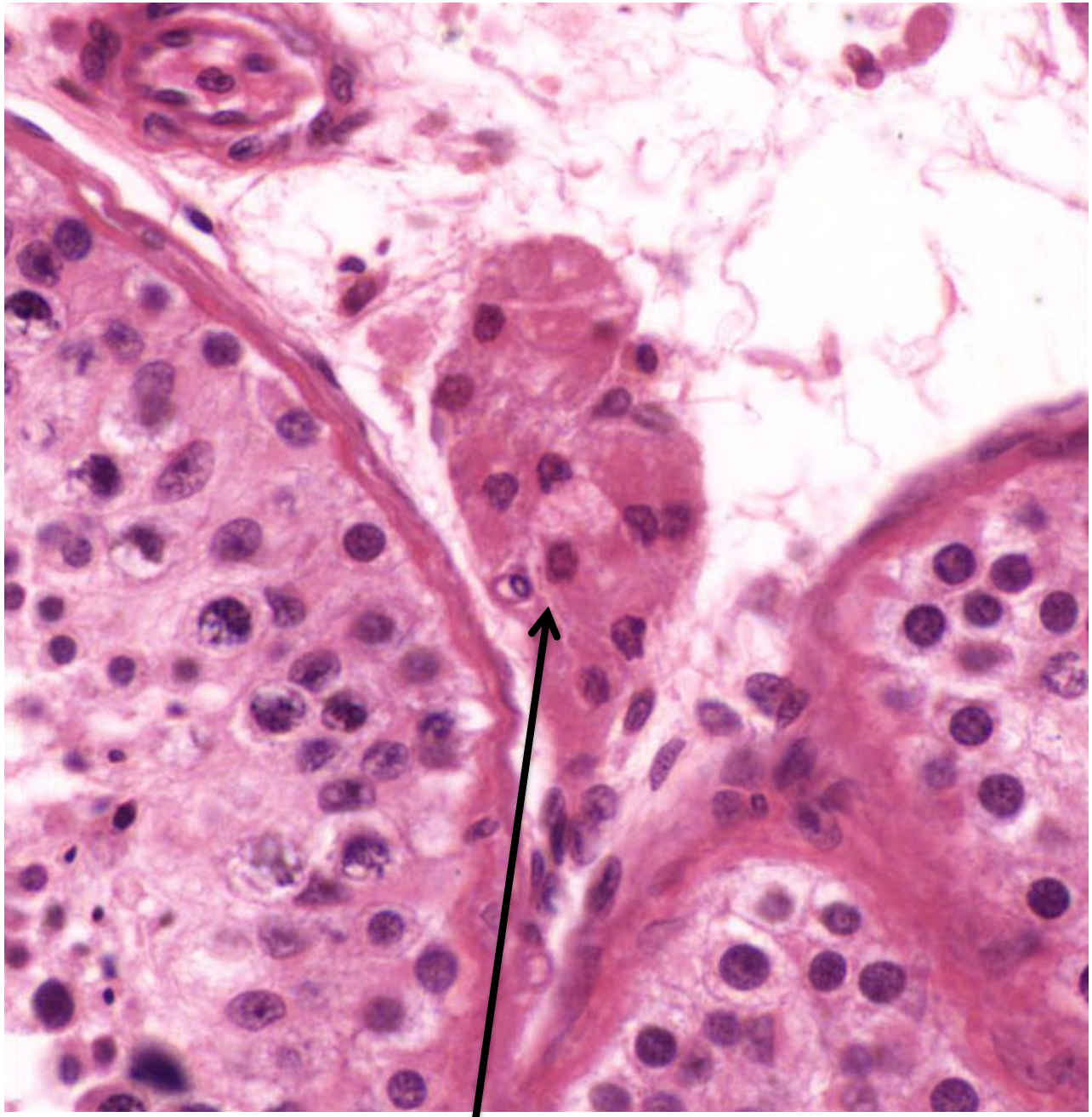
More mature. Very large; dark nuclei.

Spermatids

Soon-to-be sperm.

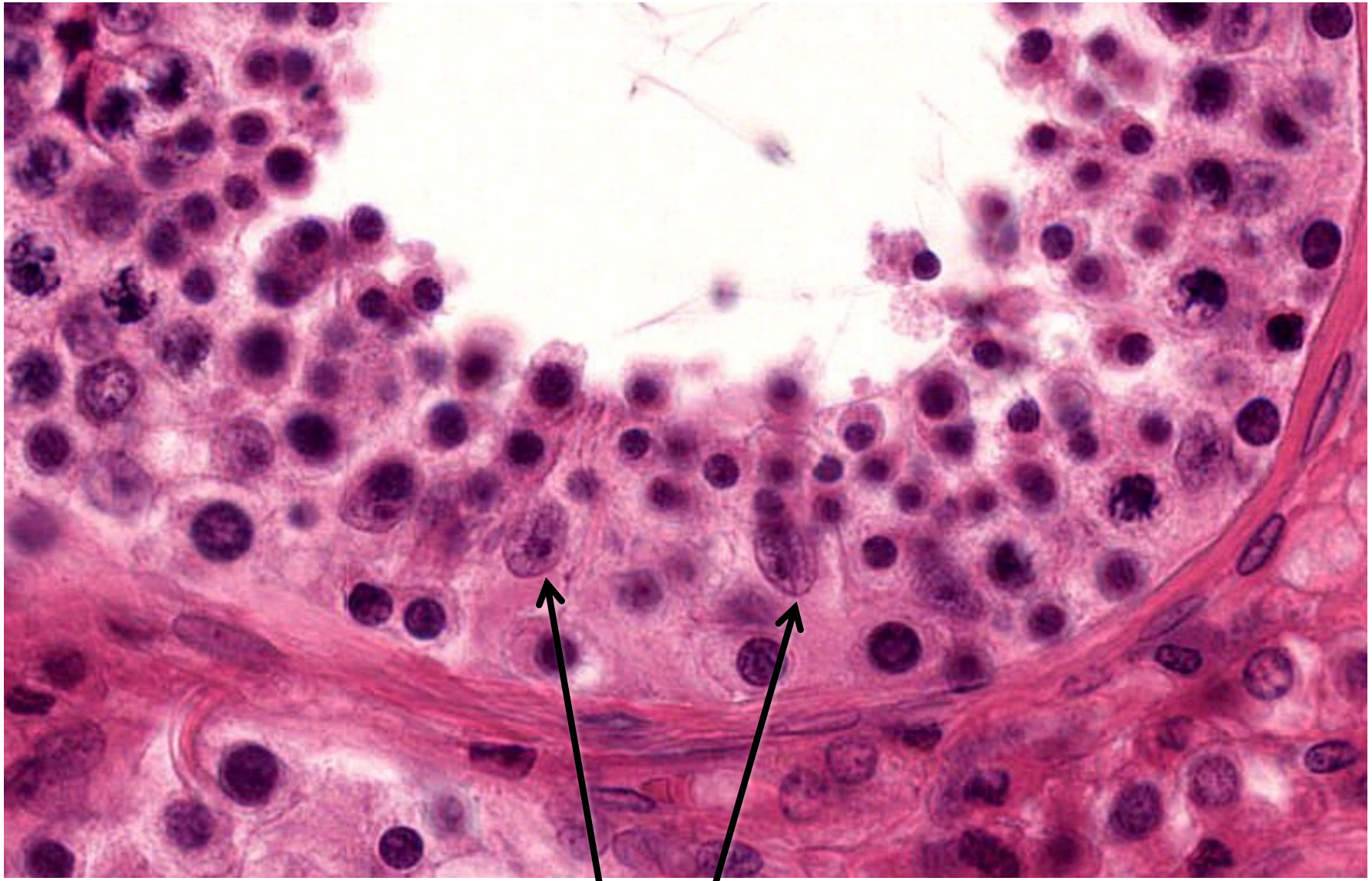
Interstitial Cells of Leydig

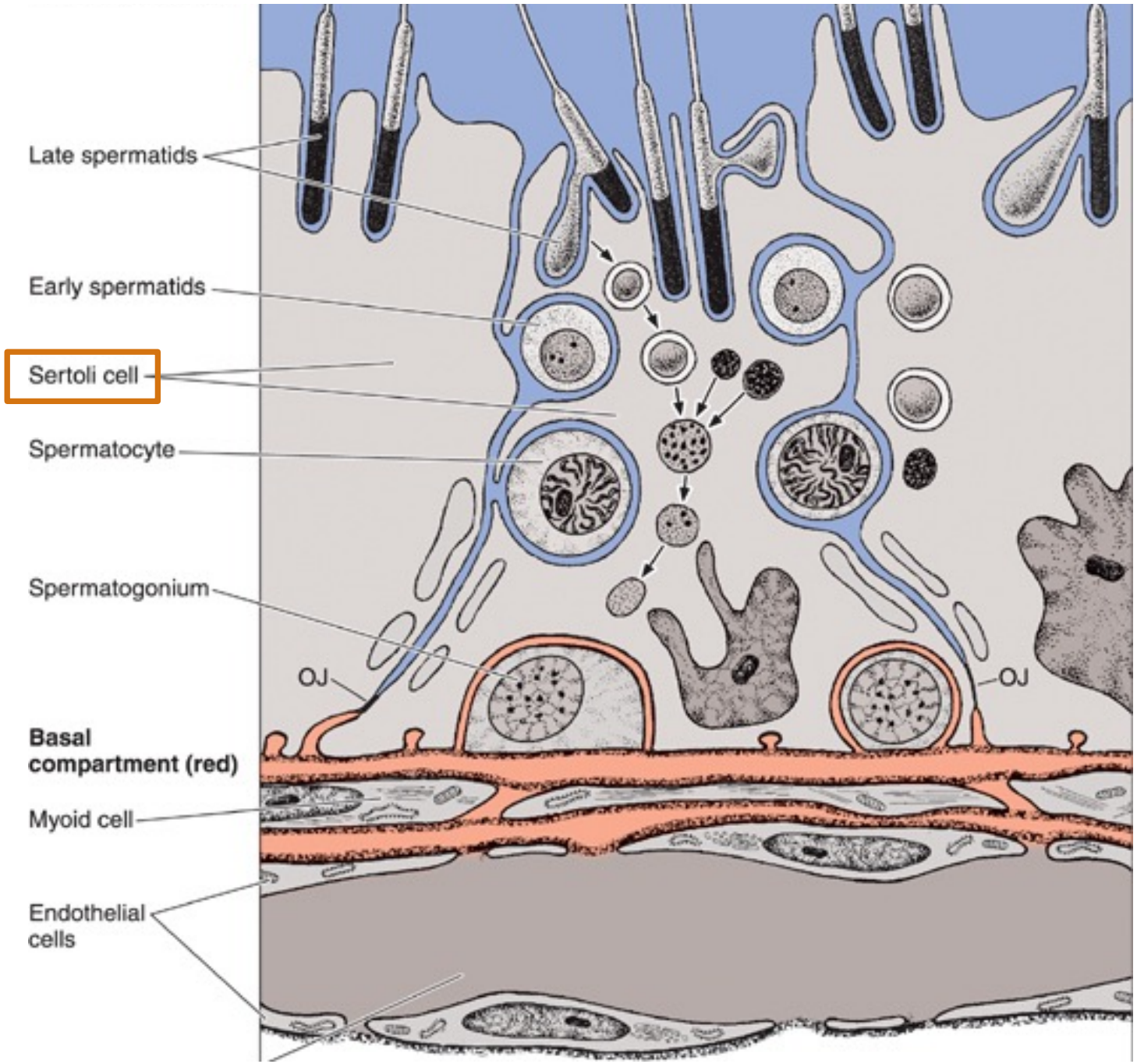
- In connective tissue between seminiferous tubules.
- Usually present in clusters.
- Produce testosterone.


Leydig cells

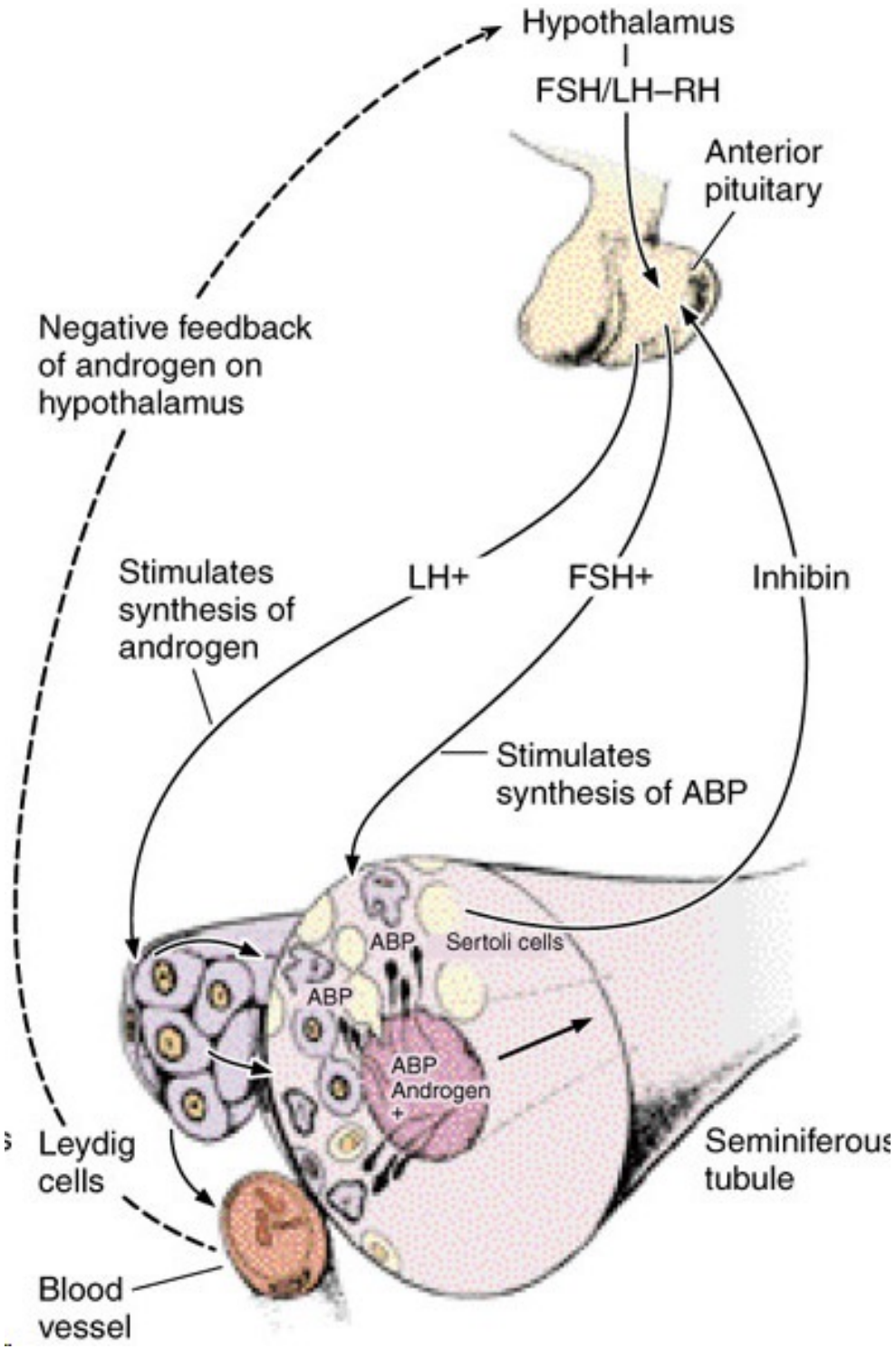
Sertoli Cells

- Form tight junctions: “blood-testis barrier.”
- Provide support, protection, and nutrition for developing sperm.
- Produce fluid in lumen of seminiferous tubules.
- Secrete hormones that facilitate spermatogenesis.


Sertoli cells

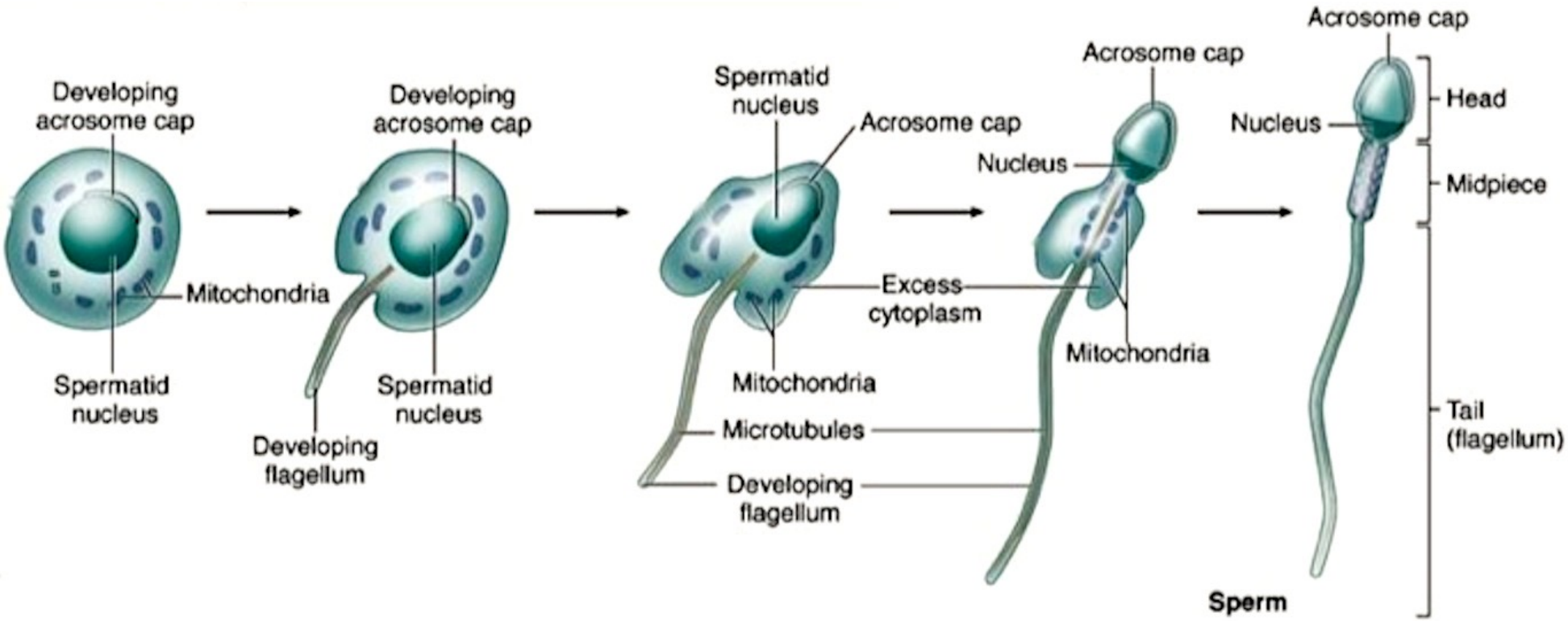


Sertoli cells form the blood-testis barrier

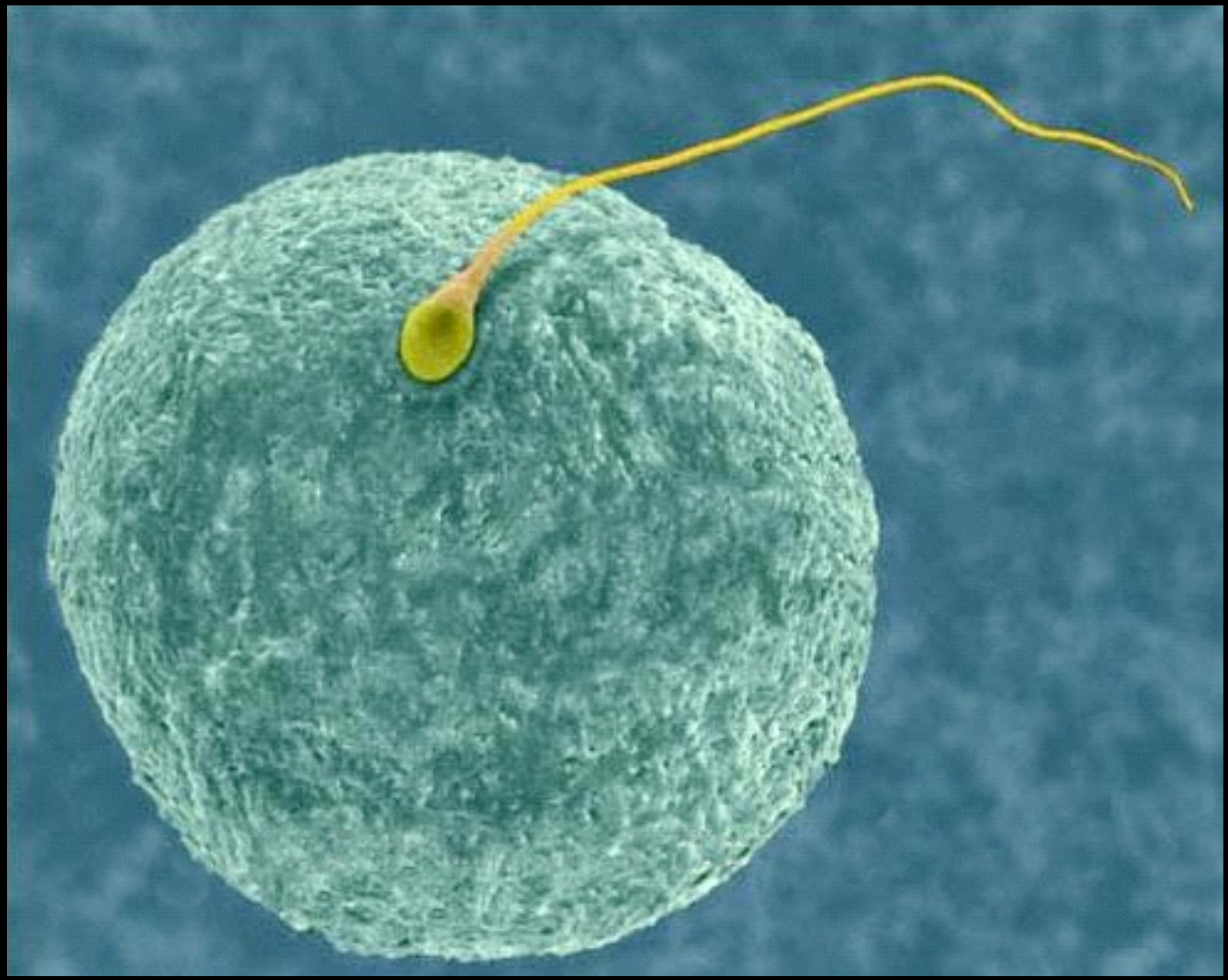


Pituitary control of spermatogenesis

- FSH stimulates Sertoli cells to secrete ABP
- LH stimulates Leydig cells to secrete androgen (testosterone)
- Inhibin (from Sertoli cells) inhibits FSH
- Androgen (from Leydig cells) inhibits LH



Spermatid maturing into sperm

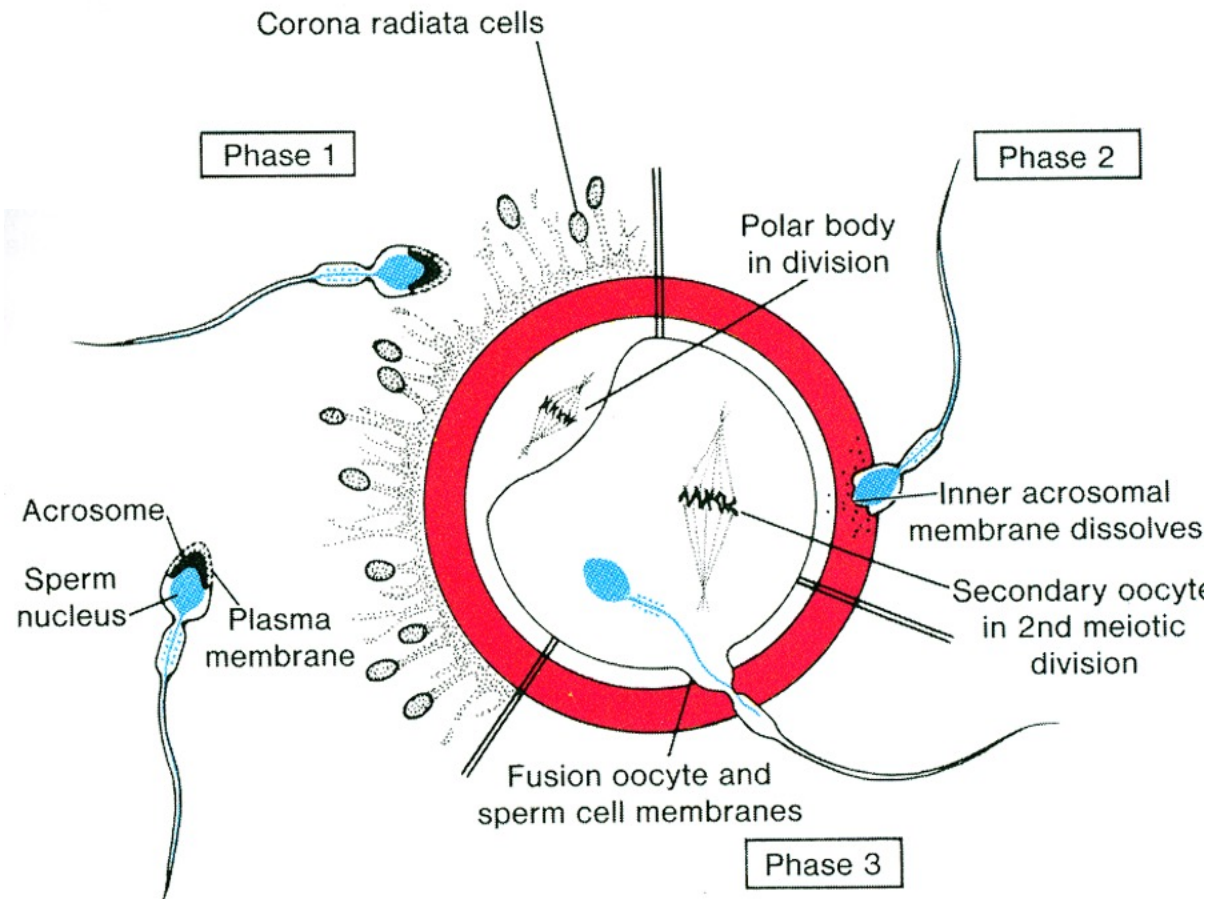


Human egg (oocyte) and sperm (spermatozoon)

Fertilization

The acrosome contains hydrolytic enzymes.

During fertilization the acrosomal reaction causes dissociation of cells of corona radiata and digestion of zona pellucida surrounding the oocyte.



Male Reproductive System Lecture Outline

- Testis
- Genital ducts
  - Intratesticular ducts
  - Excretory genital ducts

Male Reproductive System Lecture Outline

- Testis
- Genital ducts
  - Intratesticular ducts
    - Straight tubules
    - Rete testis
    - Efferent ductules

The Path of Sperm

Seminiferous tubules

↓

Straight tubules

↓

Rete testes

↓

Efferent ductules

↓

Epididymis

↓

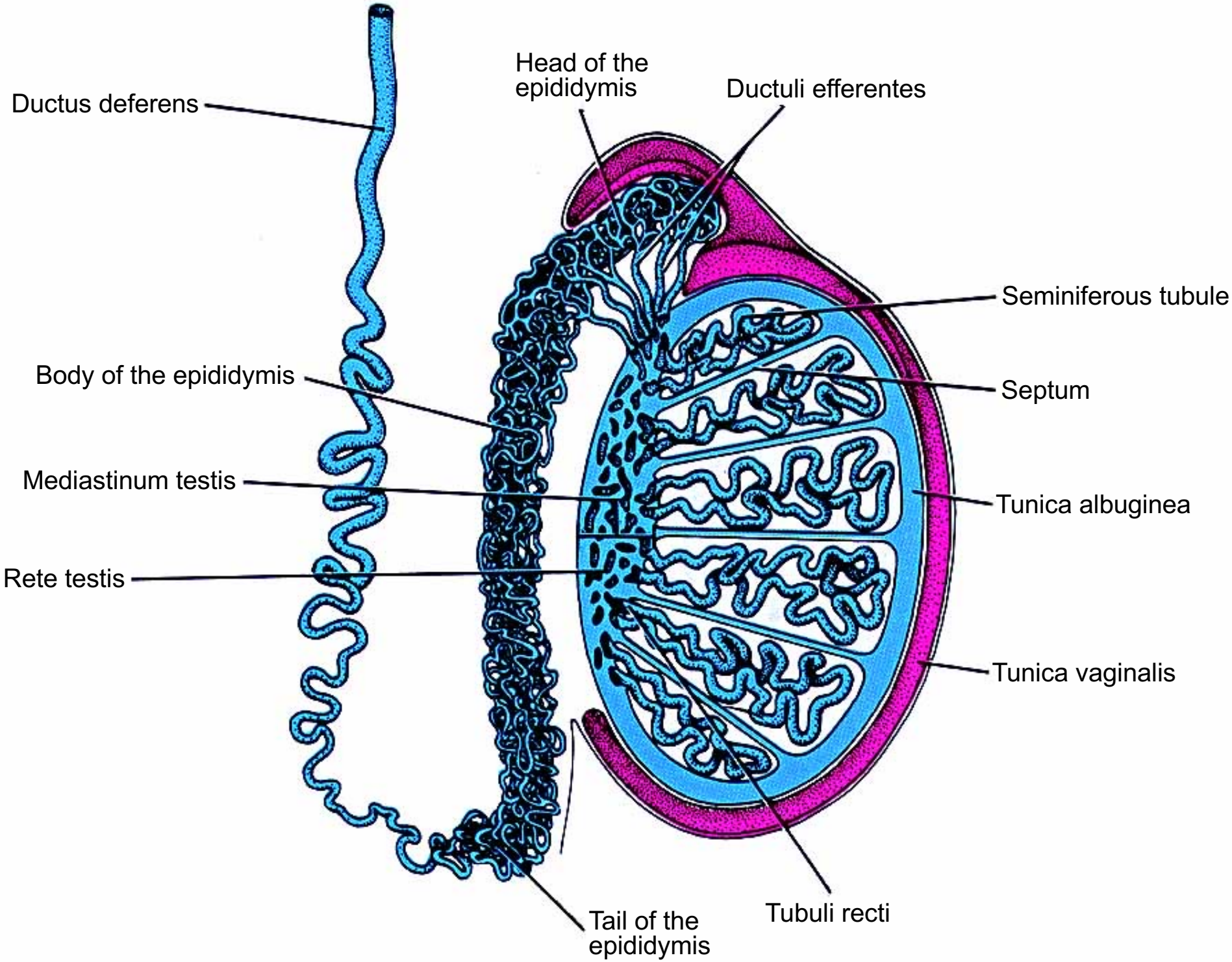
Ductus (vas) deferens

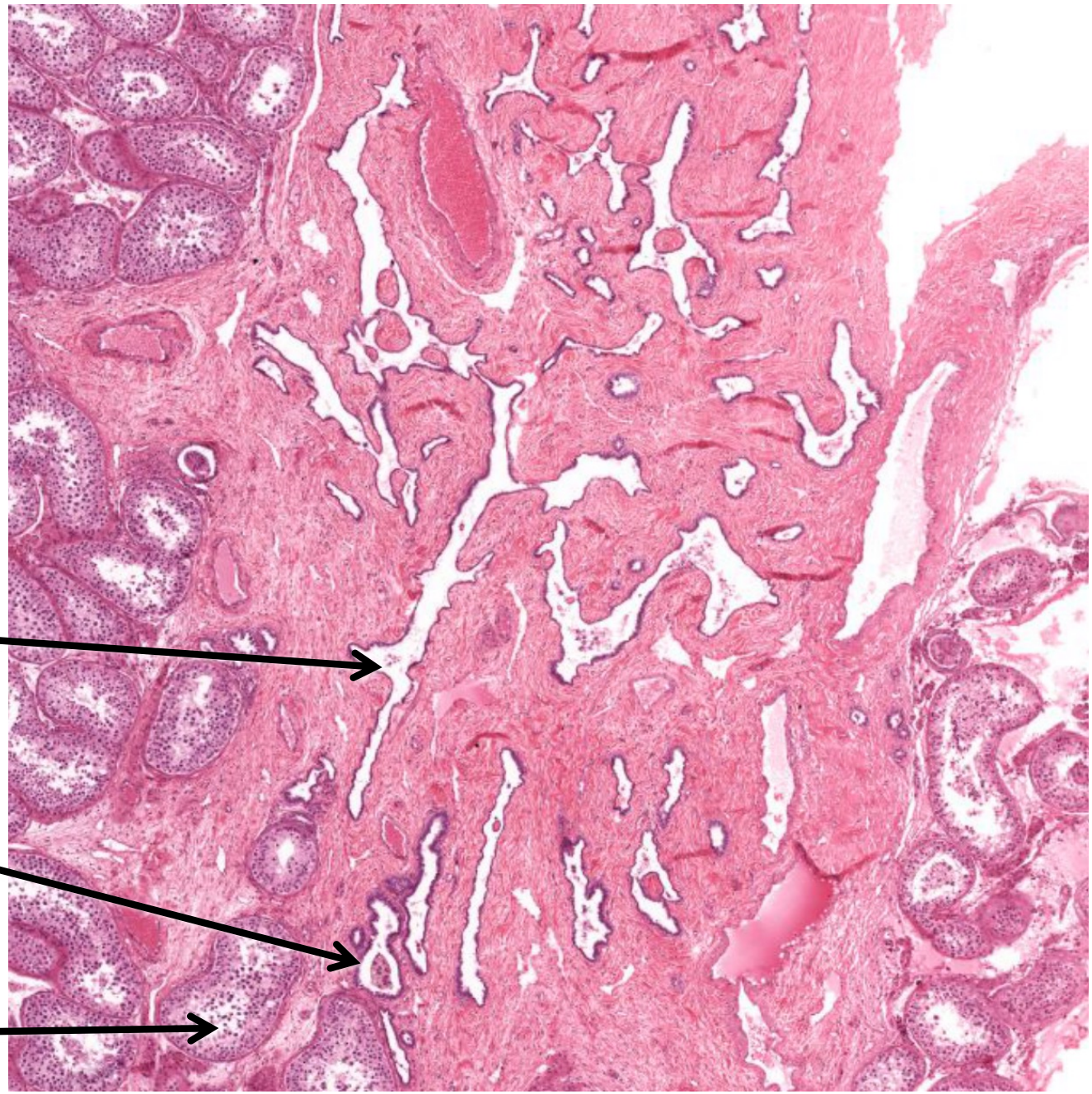
↓

Ejaculatory duct

↓

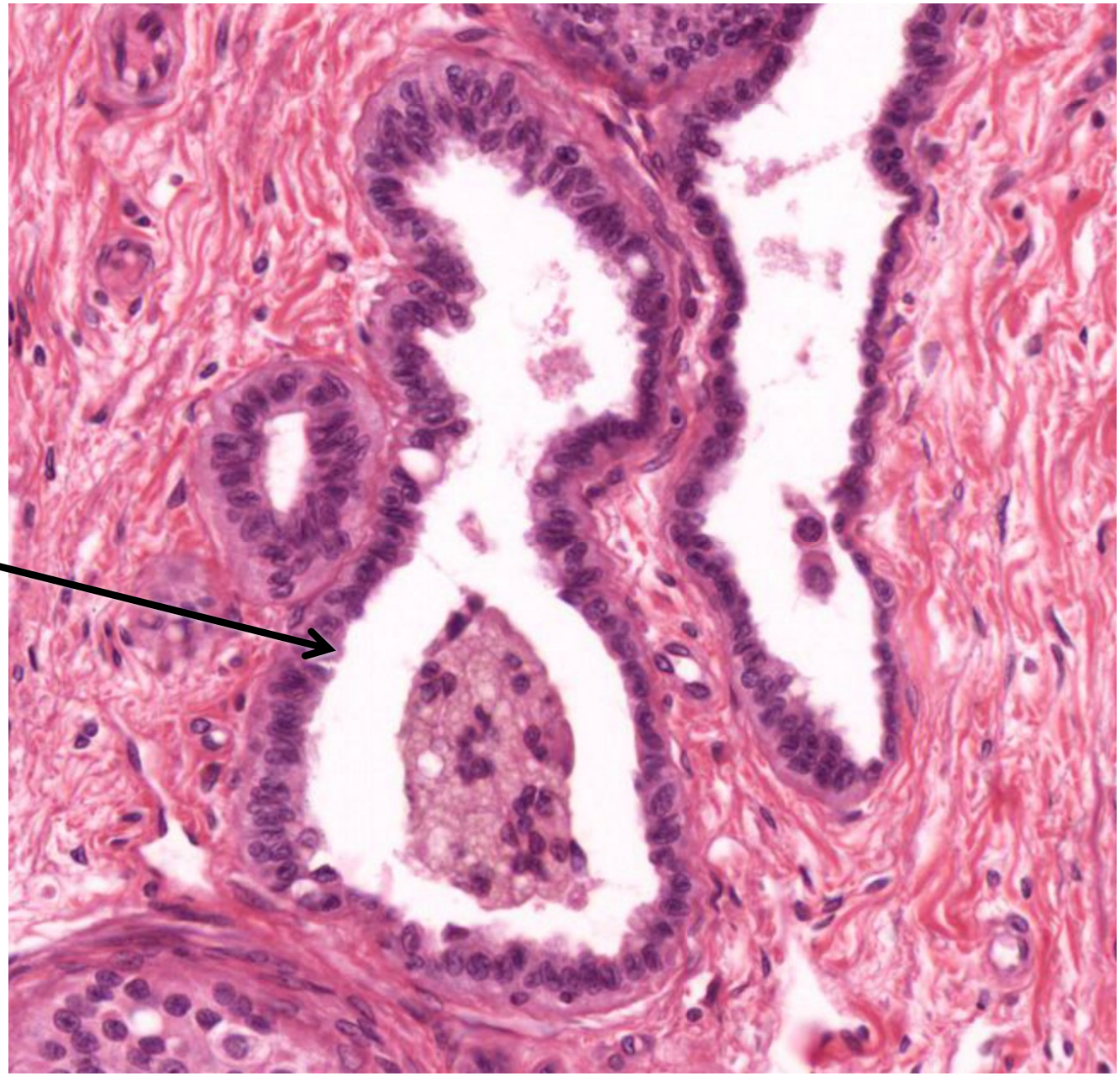
Prostatic urethra


Ductus deferens
Head of the epididymis
Ductuli efferentes
Seminiferous tubule
Body of the epididymis
Septum
Mediastinum testis
Tunica albuginea
Rete testis
Tunica vaginalis
Tail of the epididymis
Tubuli recti



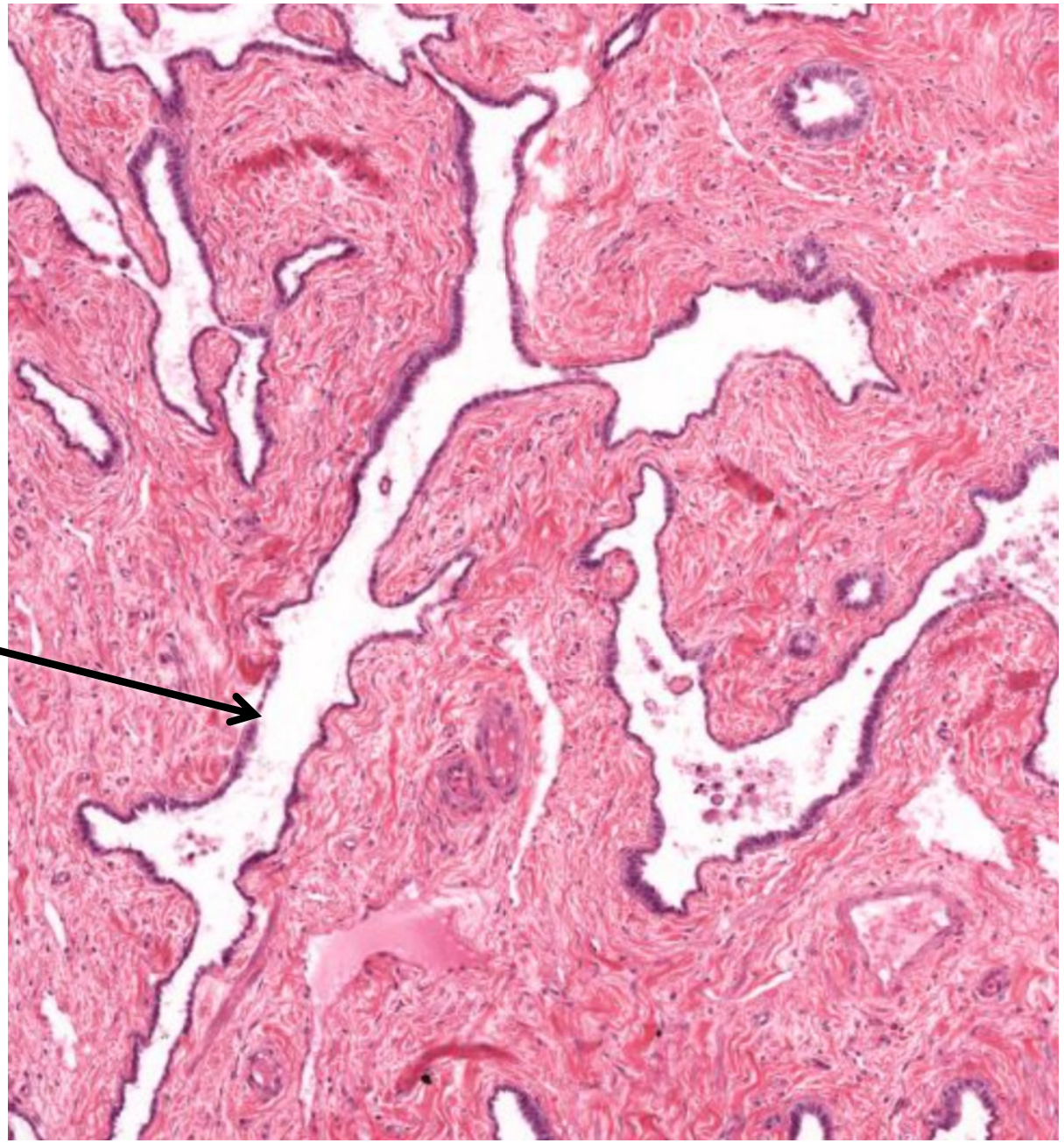
Mediastinum testis

Lined by Sertoli cells and cuboidal epithelium

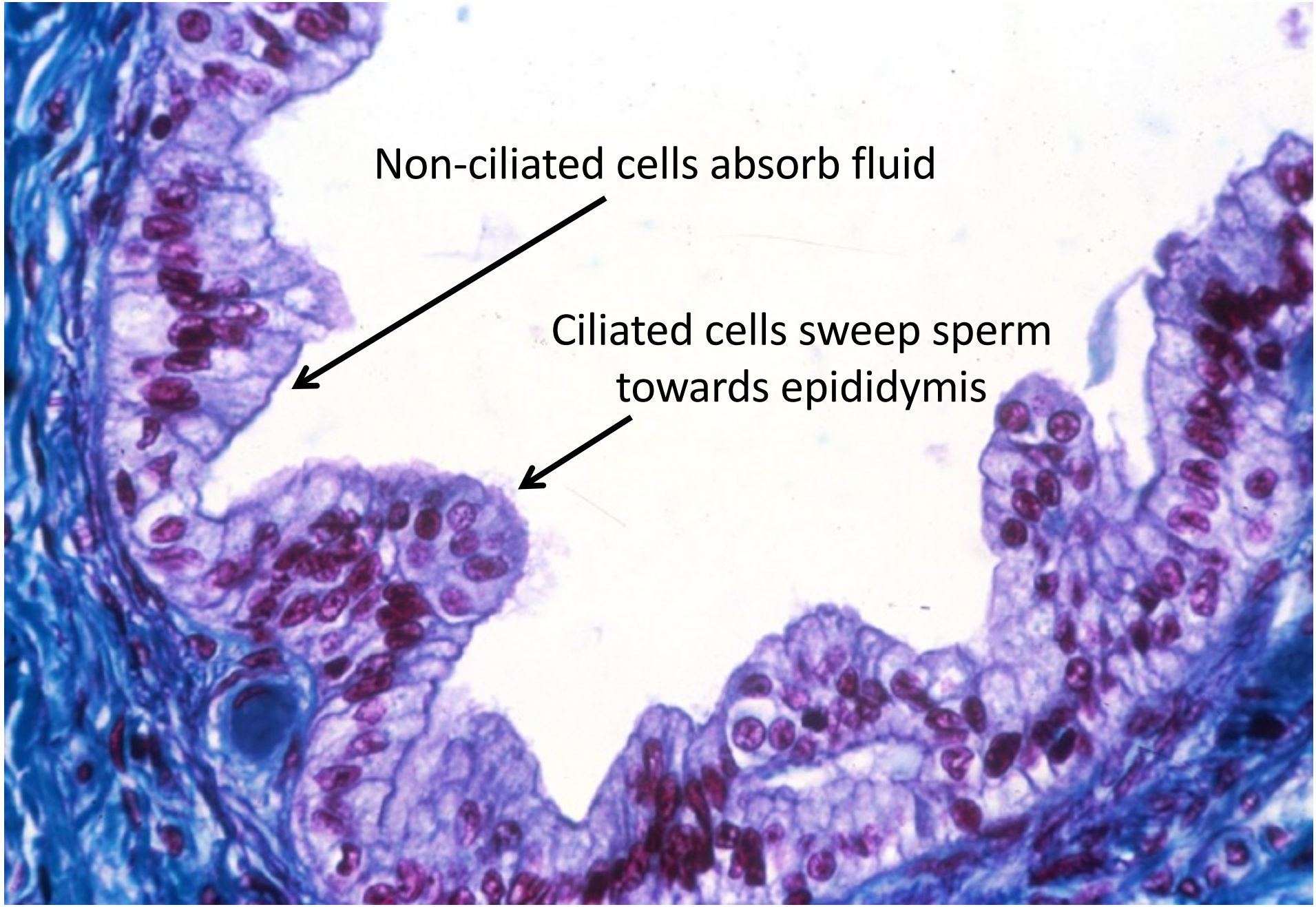


Straight tubules

Lined by cuboidal epithelium



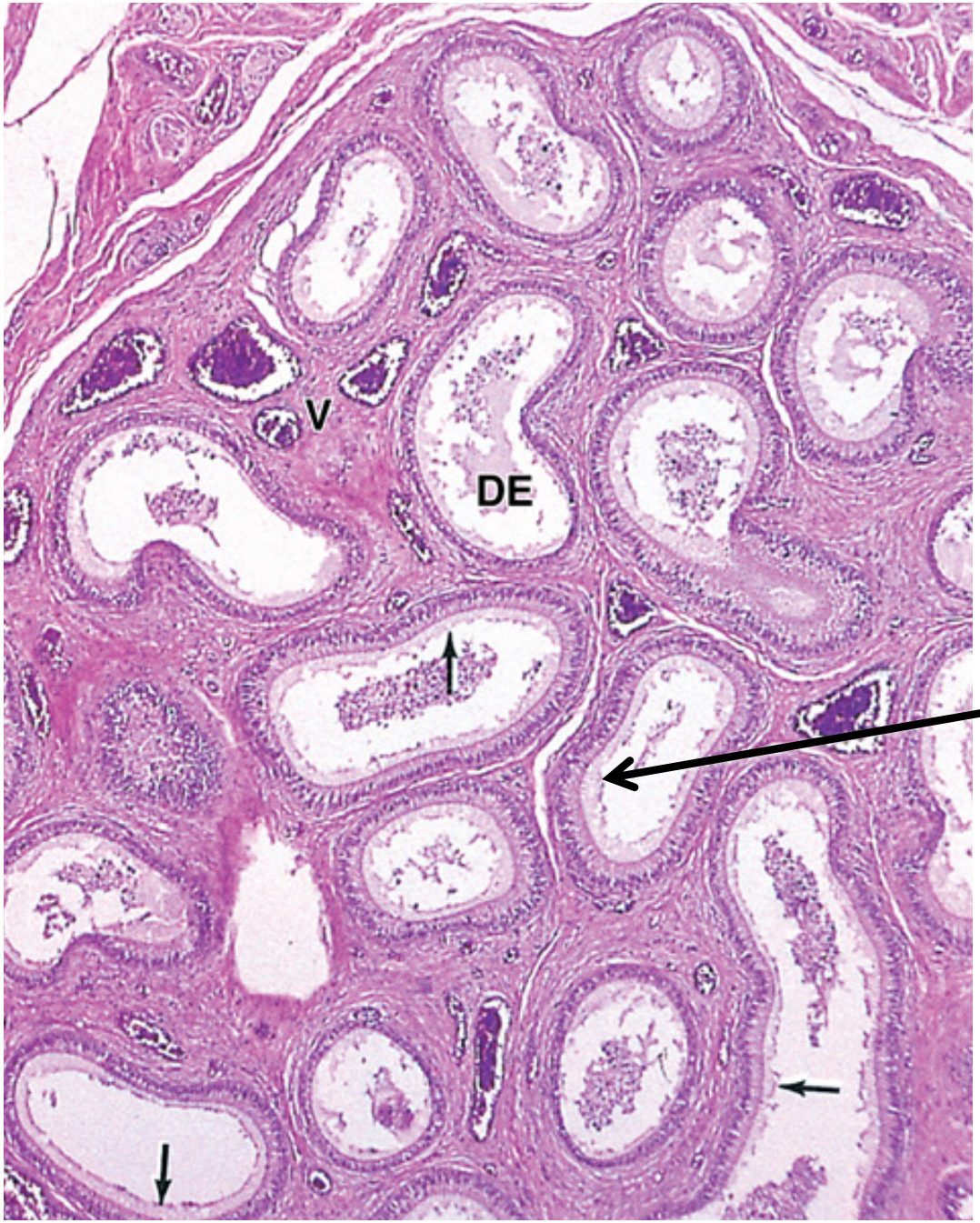
Rete testis



Efferent ductule

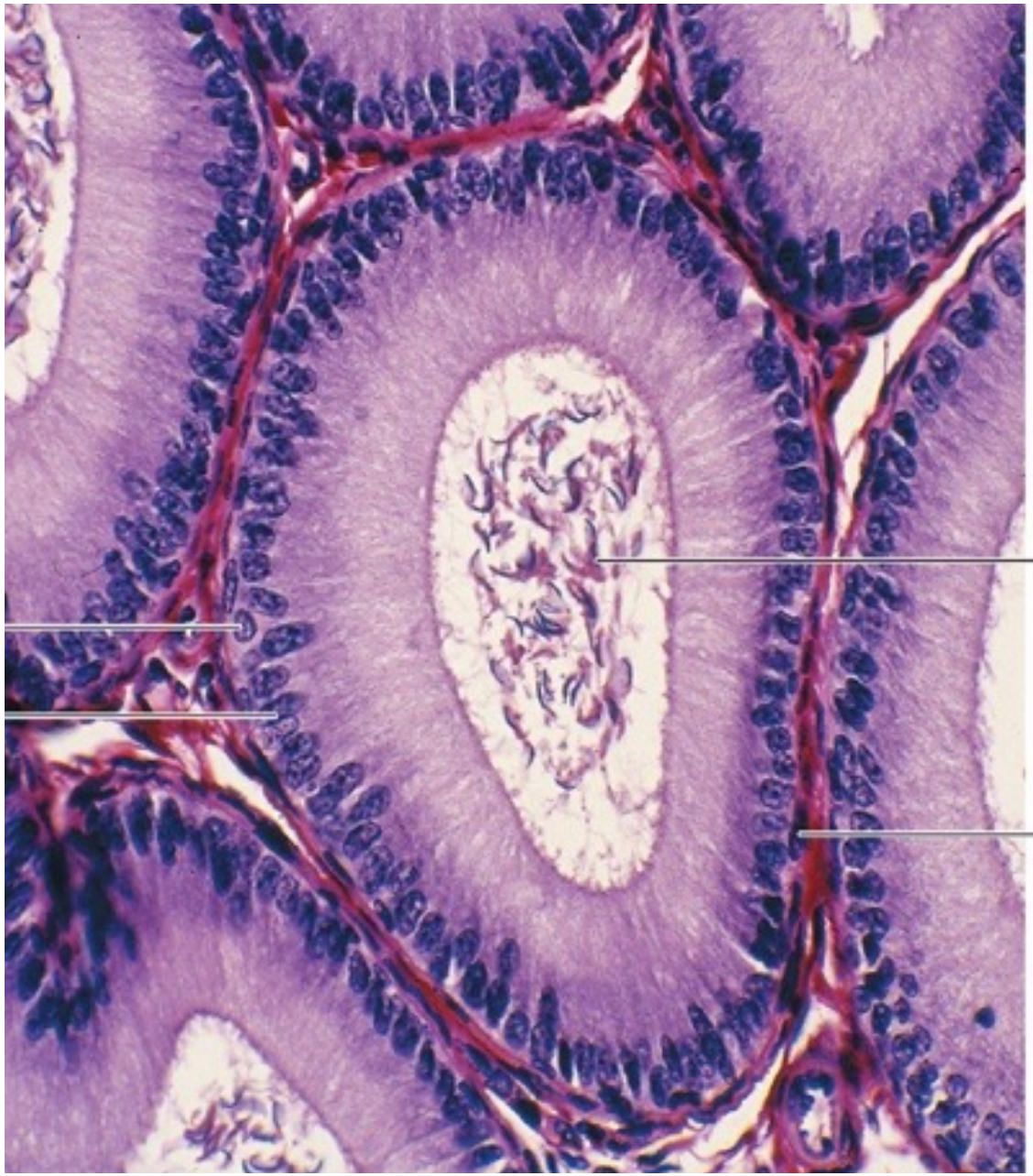
Male Reproductive System Lecture Outline

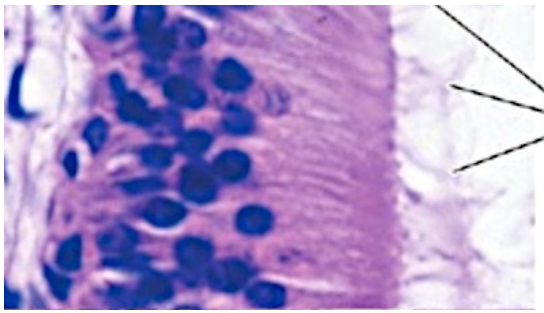
- Testis
- Genital ducts
  - Intratesticular ducts
  - Excretory genital ducts
    - Ducts of the epididymis
    - Ductus (vas) deferens
    - Urethra



- Highly coiled tube 4-6 meters long.
- Sperm undergo final maturation here.
- Epithelium lined by pseudostratified columnar epithelium with long stereocilia (microvilli) which absorb fluid.

Epididymis



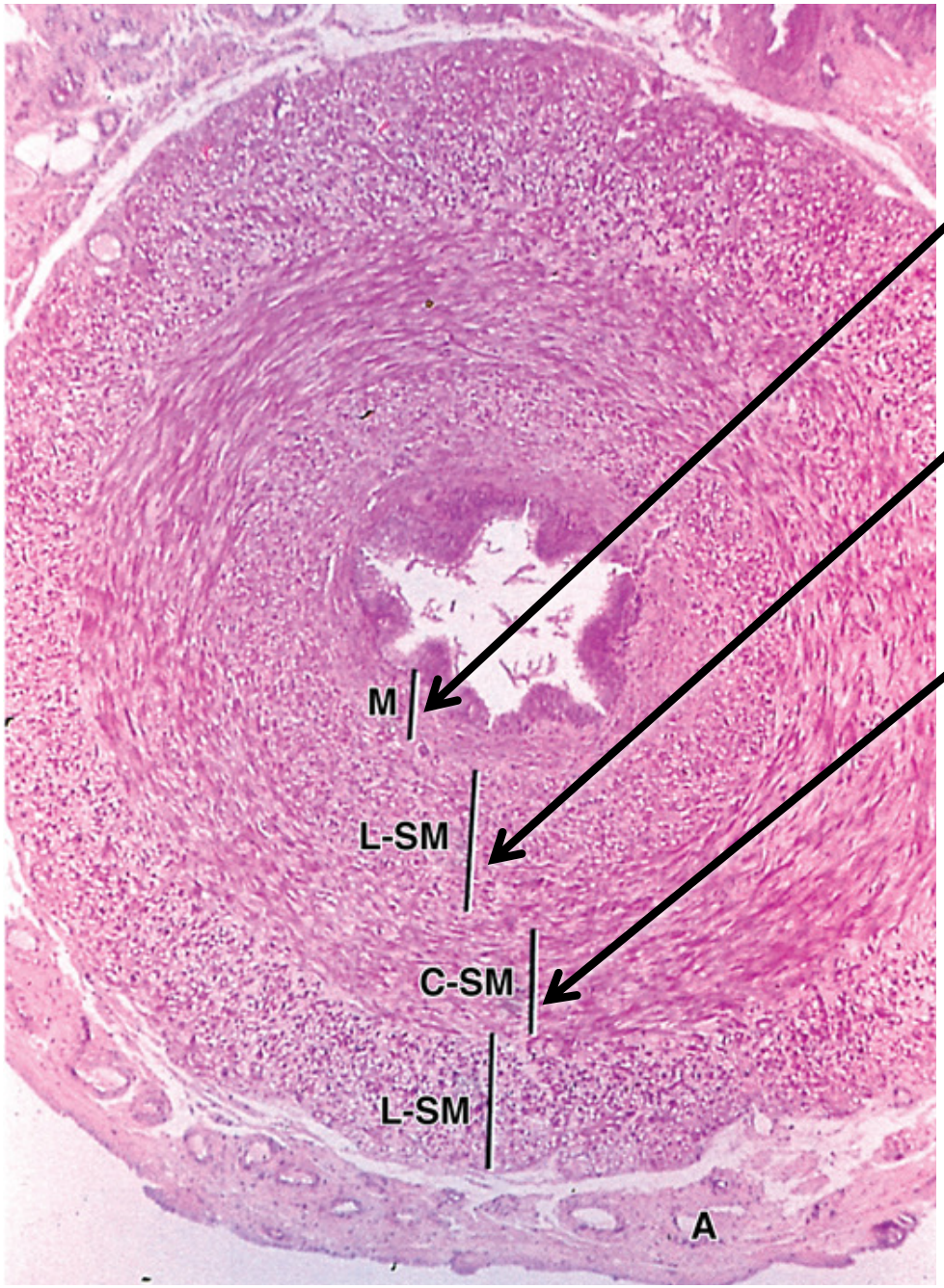


Microvilli

Spermatozoa

Smooth muscle
(causes peristalsis and
movement of sperm)

Epididymis



Mucosa (with pseudostratified columnar epithelium)

Longitudinal layer of smooth muscle

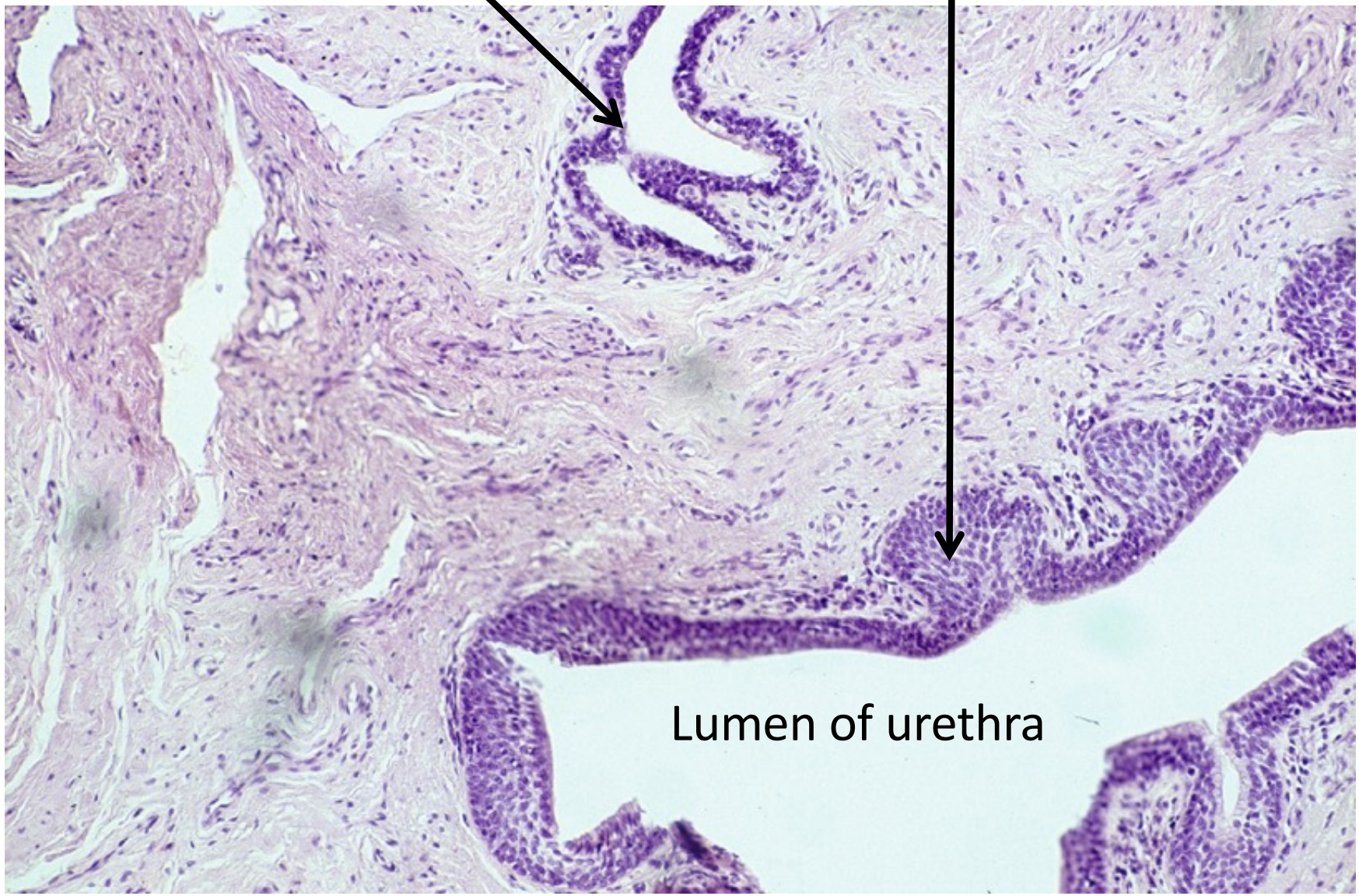
Circular layer of smooth muscle

Check out the relative thickness of the smooth muscle wall compared to the lumen! Lots of smooth muscle = strong peristaltic movement of sperm.

Ductus (vas) deferens

Urethral glands produce mucus to lubricate the urethra

Urethral epithelium varies from pseudostratified columnar to stratified squamous at the terminal end

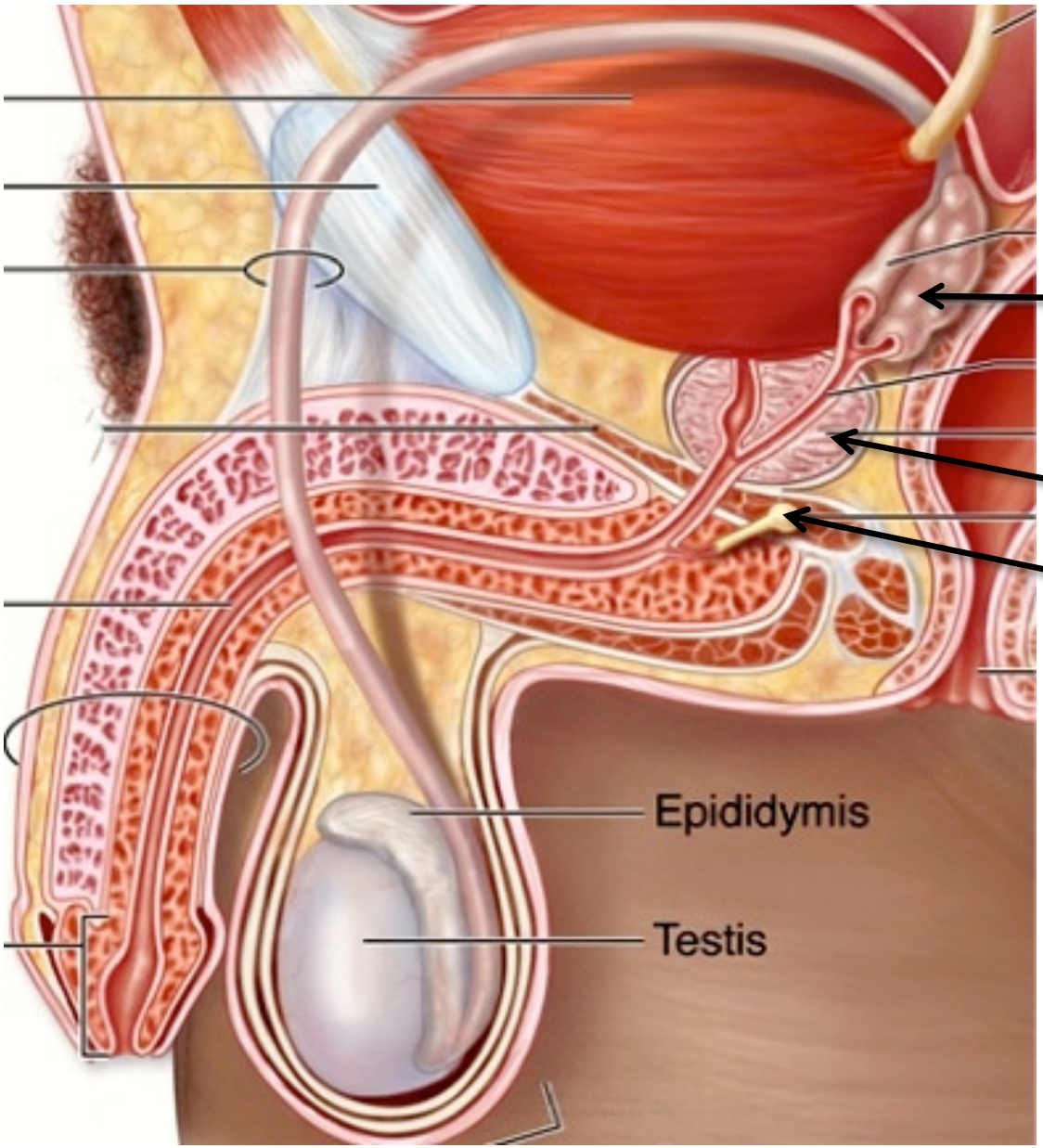


Urethra

Male Reproductive System Lecture Outline

- Testis
- Genital ducts
- Accessory genital glands
  - Seminal vesicles
  - Prostate
  - Bulbourethral glands

The Male Reproductive System

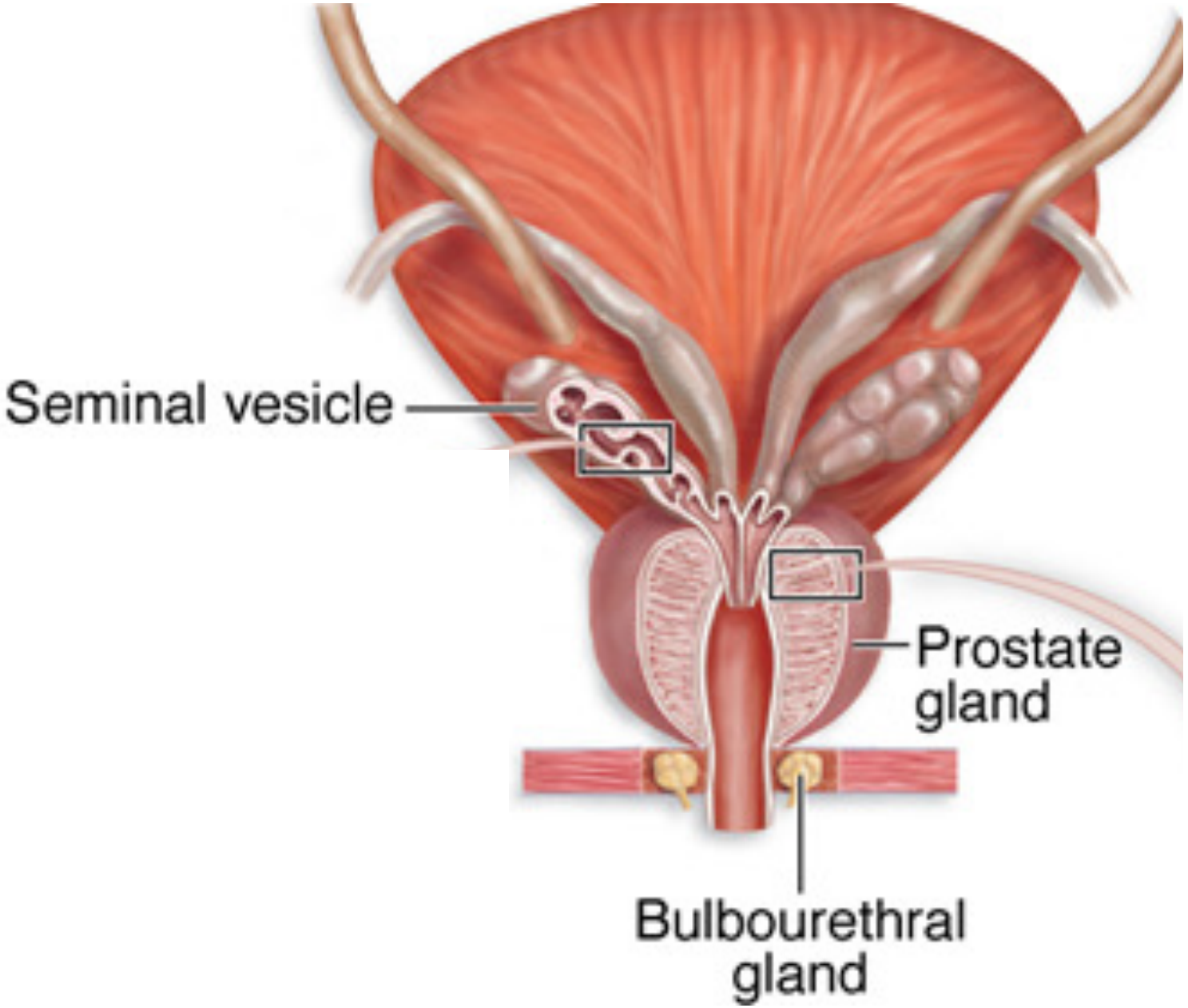


Seminal vesicle

Prostate

Bulbourethral gland

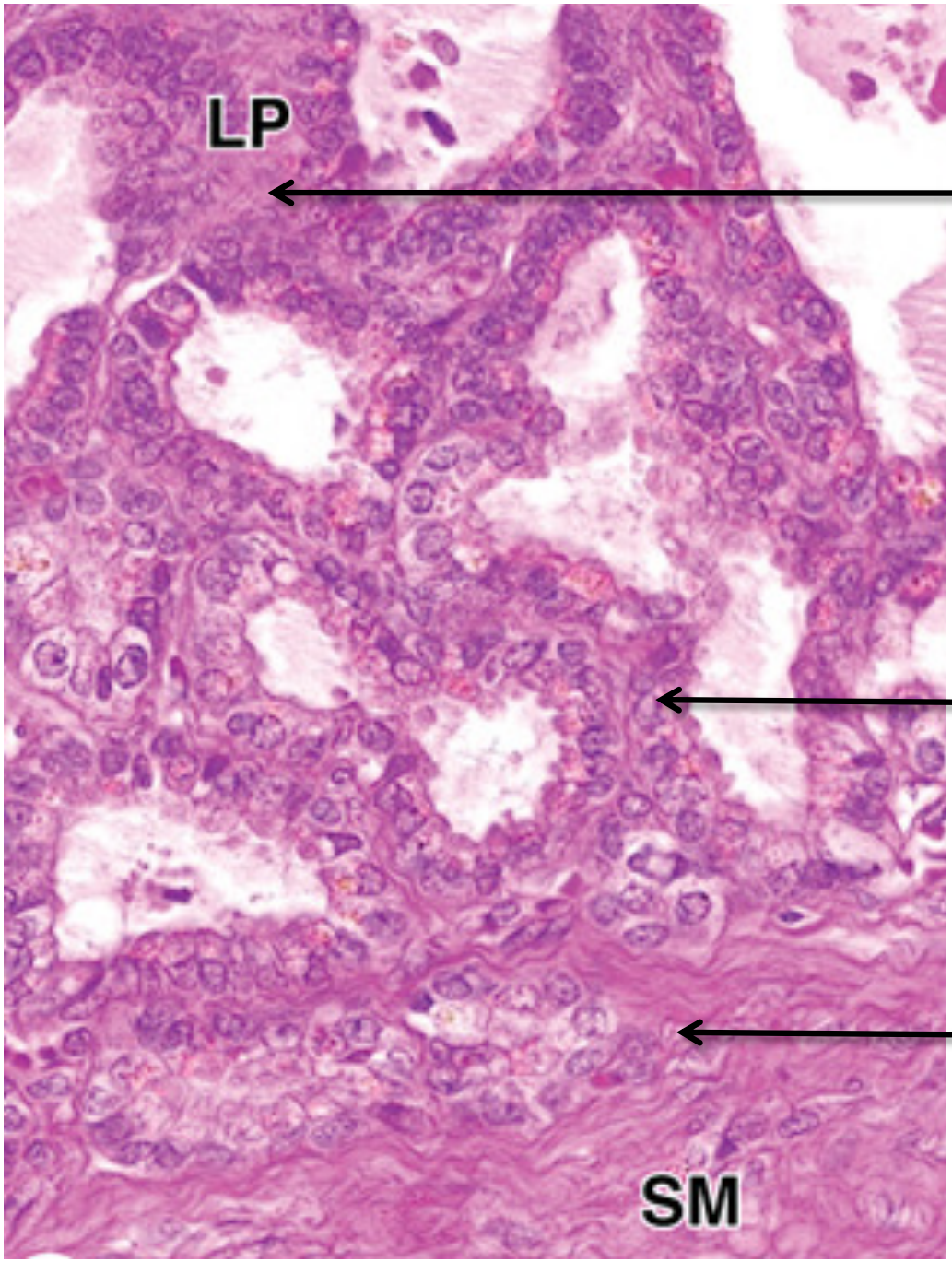
Accessory glands of the male reproductive tract



Seminal Vesicle

- Really a diverticulum of the distal end of the vas.
- Highly coiled duct surrounded by 2 layers of smooth muscle that expel luminal contents during ejaculation.
- Intricately folded mucosa with secretory vesicles that produce fluid comprising most of volume of ejaculate.
- Rich in fructose (energy drink for sperm).

Seminal vesicle



Lamina propria

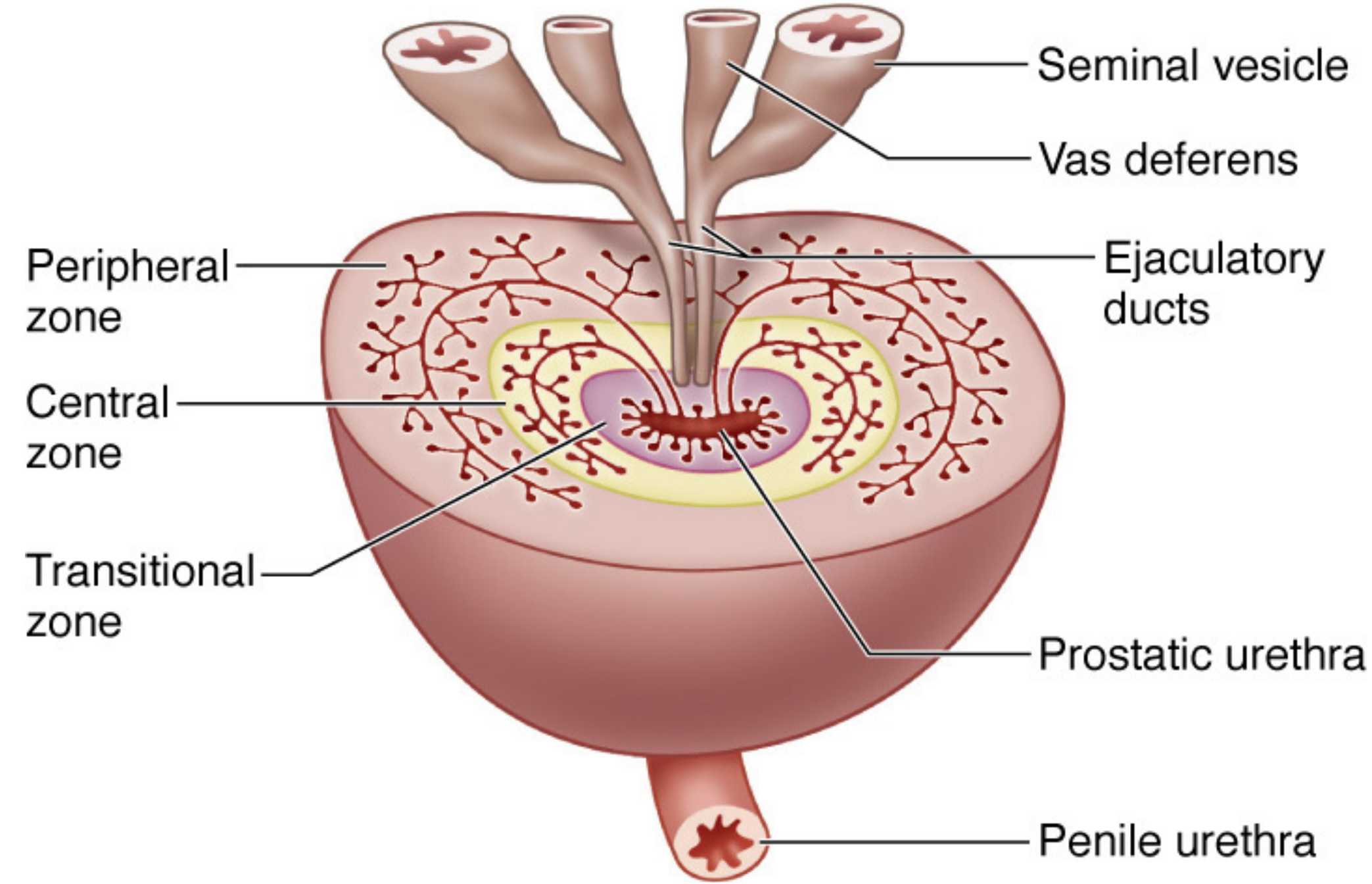
Epithelium is simple or pseudostratified columnar

Smooth muscle

Seminal vesicle

Prostate

- Produces thin, milky fluid containing lipids and enzymes.
- Fluid comprises about 25% of seminal fluid.
- Three zones of glands: peripheral, central and transitional (all empty into prostatic urethra).
- Peripheral zone is largest and most common site of prostatic carcinoma.


Seminal vesicle
Vas deferens
Peripheral zone
Ejaculatory ducts
Central zone
Transitional zone
Prostatic urethra
Penile urethra

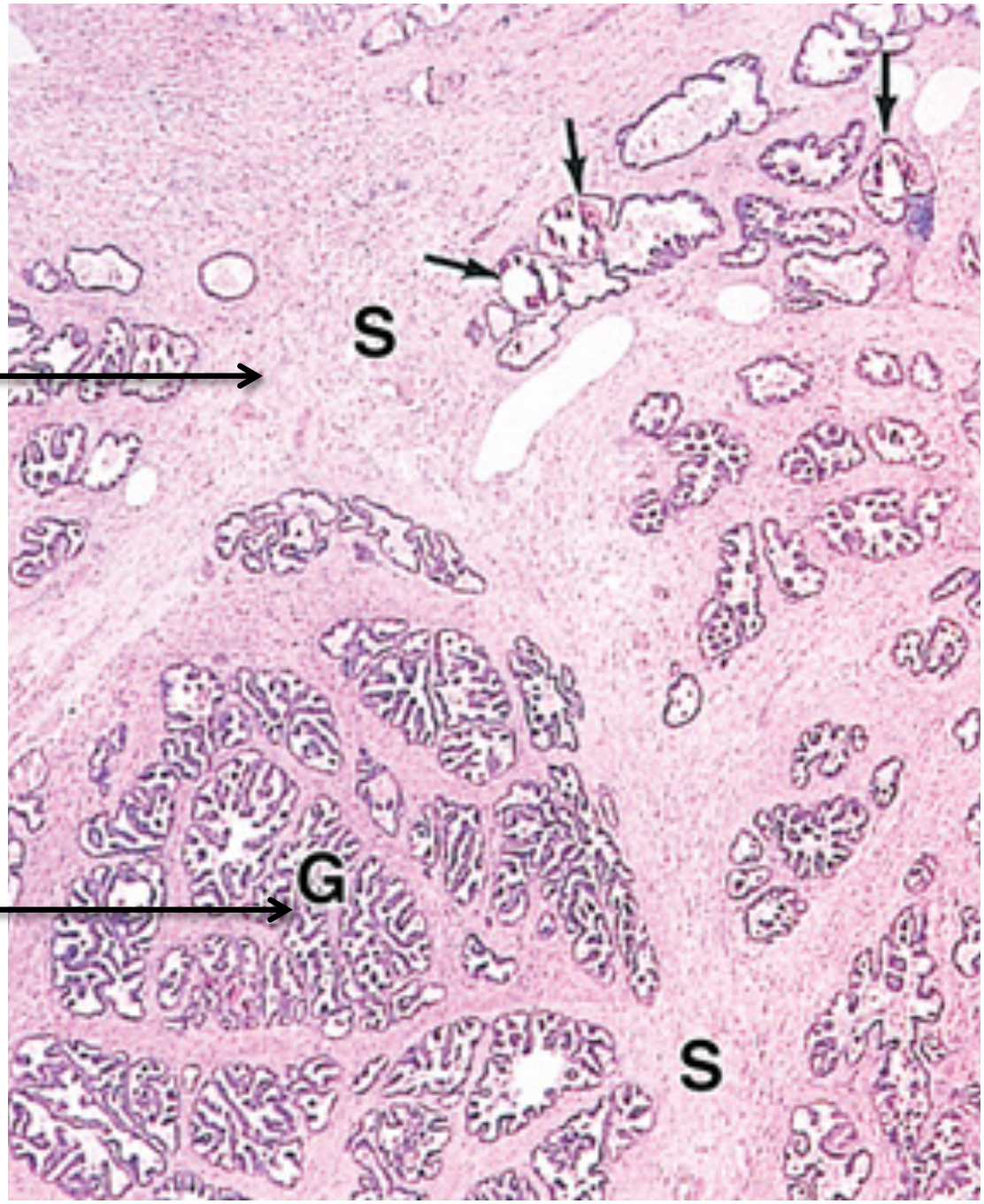
Prostate

Stroma

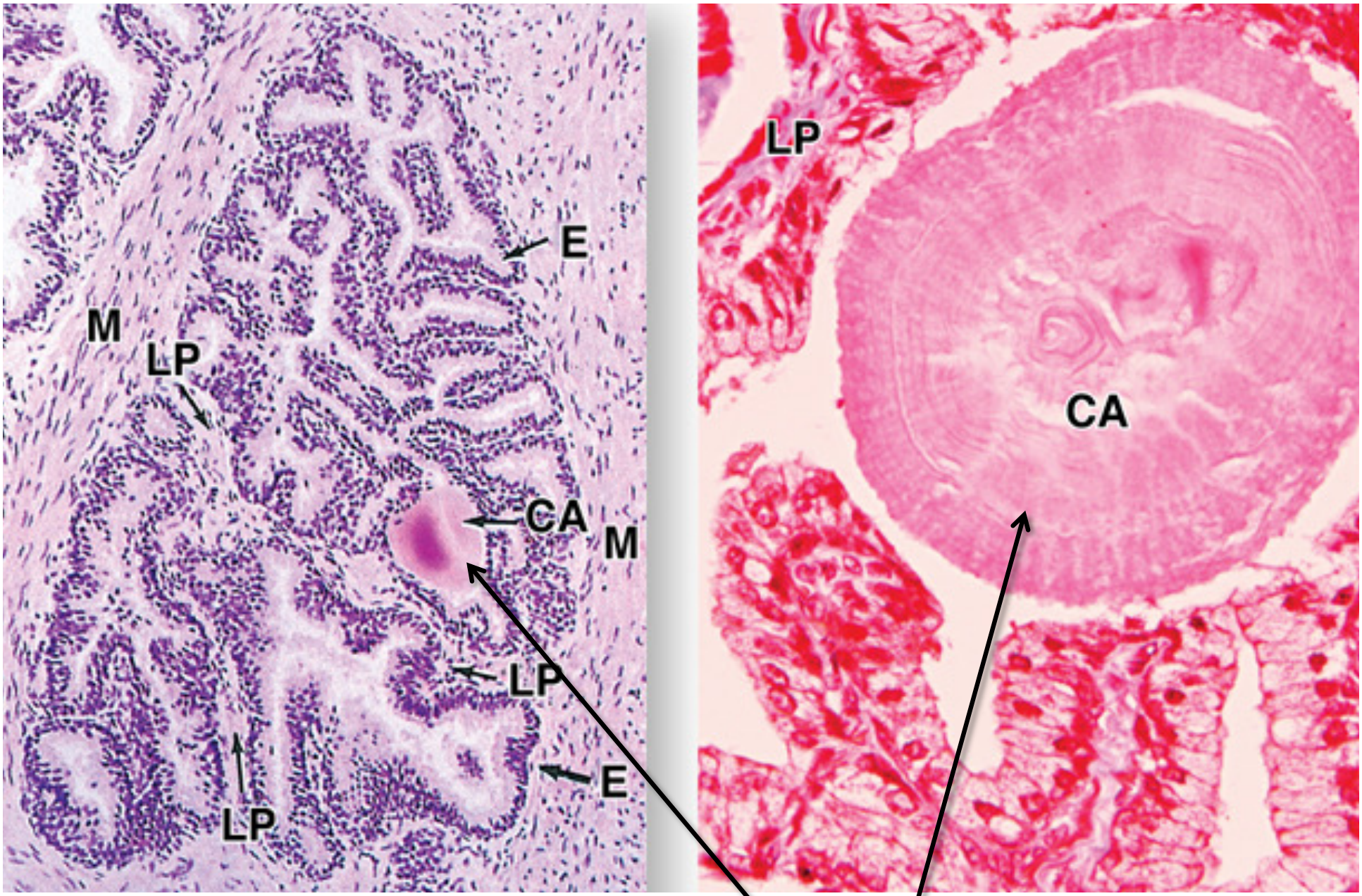
Fibrous tissue and smooth muscle

Glands

Simple or pseudostratified columnar epithelium



Prostate



Prostate gland with corpus amylaceum
(calcified concretion)

Bulbourethral Glands

- Paired glands also known as Cowper's glands.
- About the size of peas.
- Secrete clear viscous material to lubricate the penile urethra.

Semen

- 1.5 – 3 ml per ejaculate
- 40 – 300 MILLION spermatozoa per milliliter (<10 million considered poor)
- Epididymal, seminal vesicle and prostatic secretions

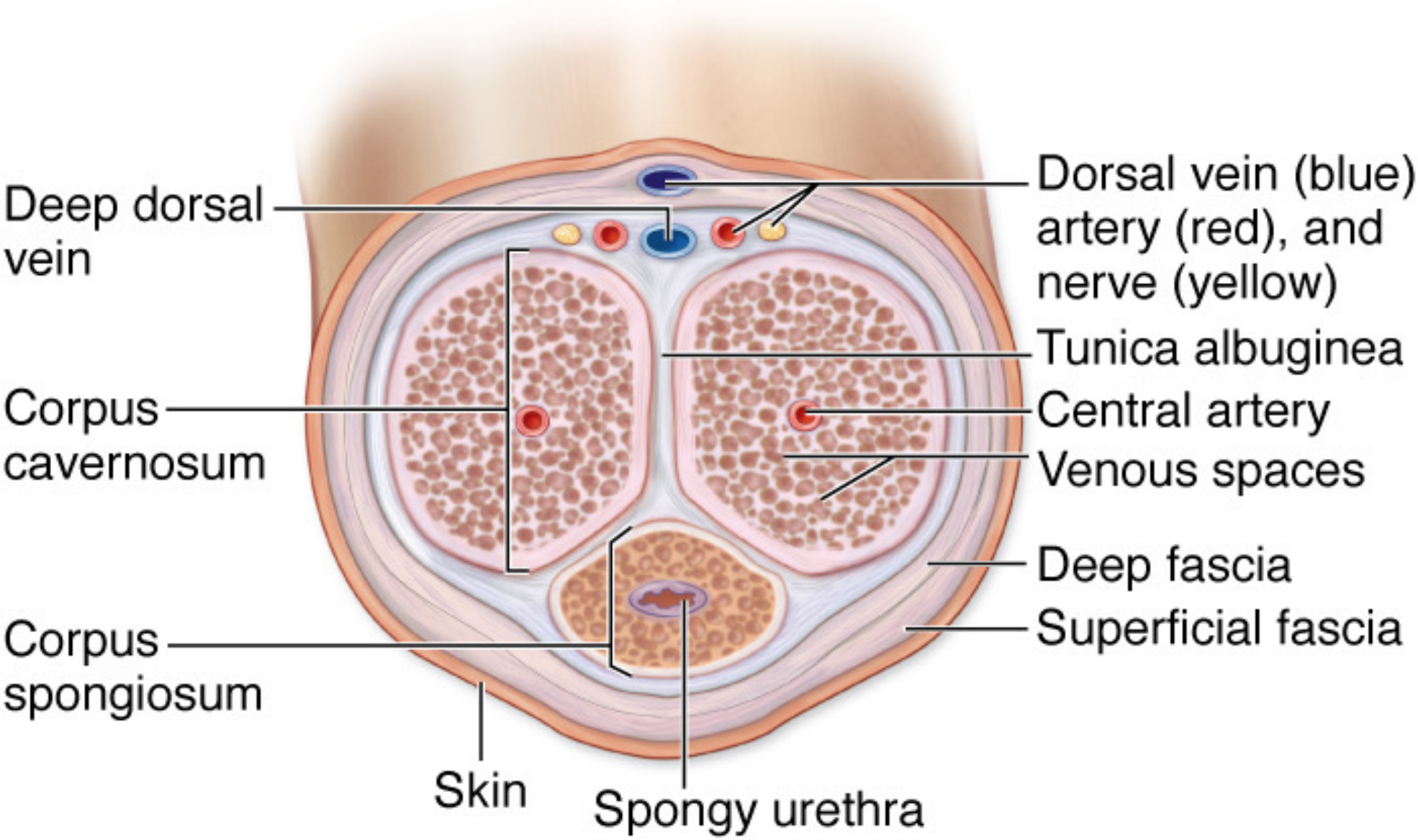
Male Reproductive System Lecture Outline

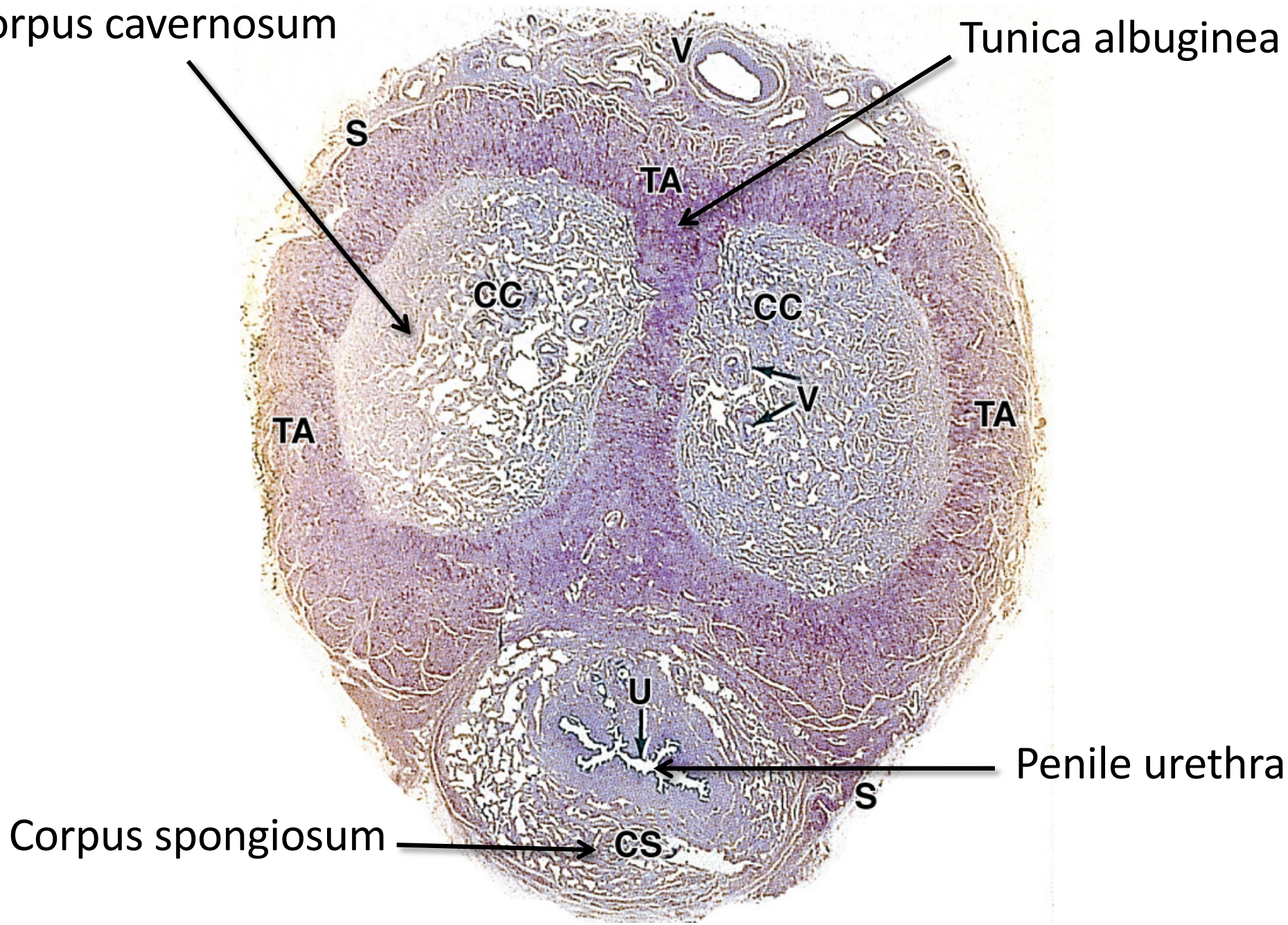
- Testis
- Genital ducts
- Accessory genital glands
- Penis

Penis

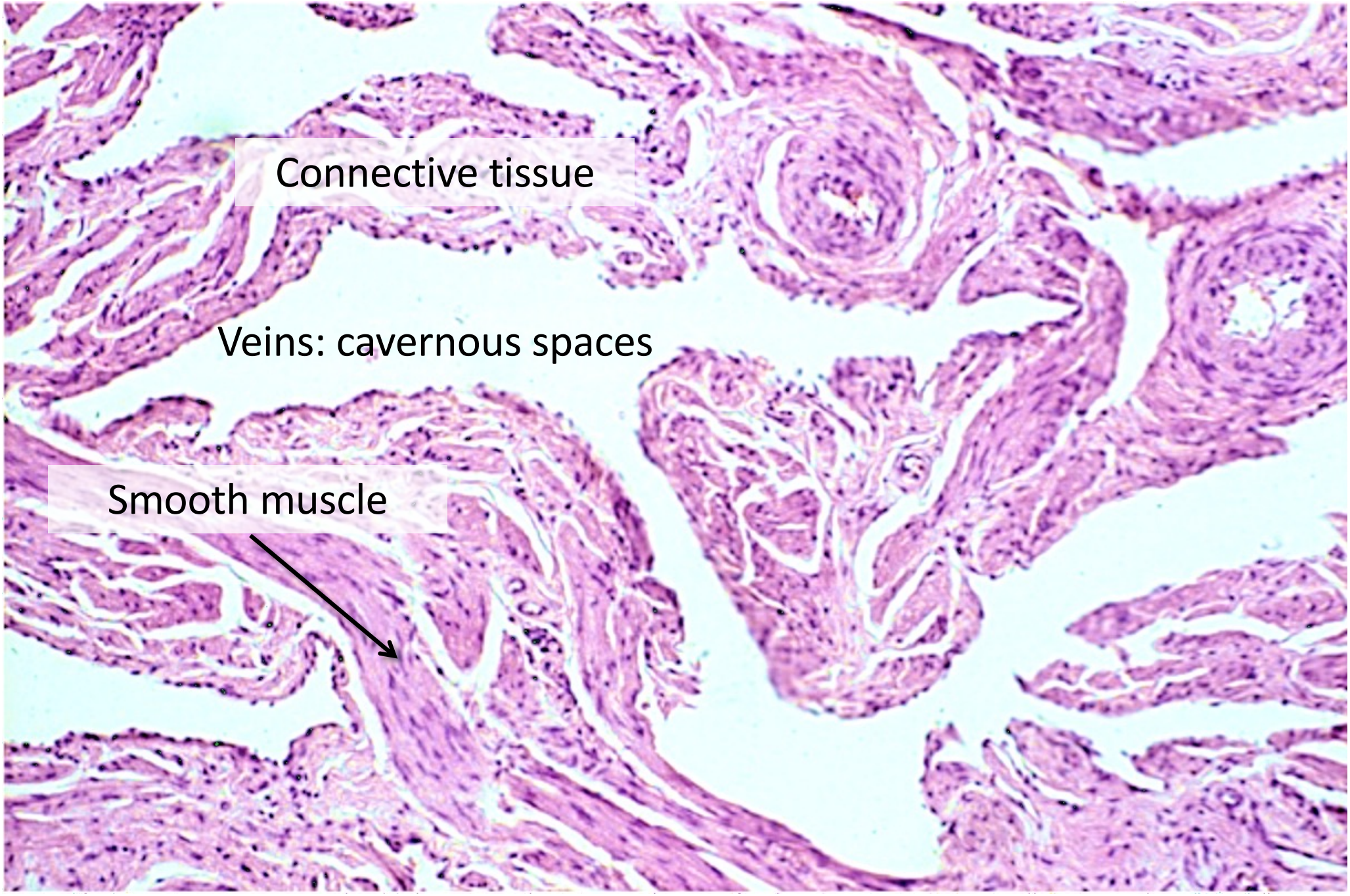
- Three cylindrical bodies of erectile tissue (irregular vascular spaces, collapsed in flaccid state)
  - Two corpora cavernosa (dorsally situated)
  - Corpus spongiosum (ventrally situated)
- Blood vessels
  - Arteries (smooth muscle occludes lumens when there is muscle tone) open into cavernous spaces
  - Venules drain cavernous spaces
- Tunica albuginea (sheath: fibrous around cavernosa, elastic around spongiosum)

Penis


Deep dorsal vein
Corpus cavernosum
Corpus spongiosum
Skin
Spongy urethra
Dorsal vein (blue) artery (red), and nerve (yellow)
Tunica albuginea
Central artery
Venous spaces
Deep fascia
Superficial fascia


Corpus cavernosum
Tunica albuginea
V
S
TA
CC
CC
V
TA
TA
U
Penile urethra
S
Corpus spongiosum
CS

Penis



Corpora cavernosum

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