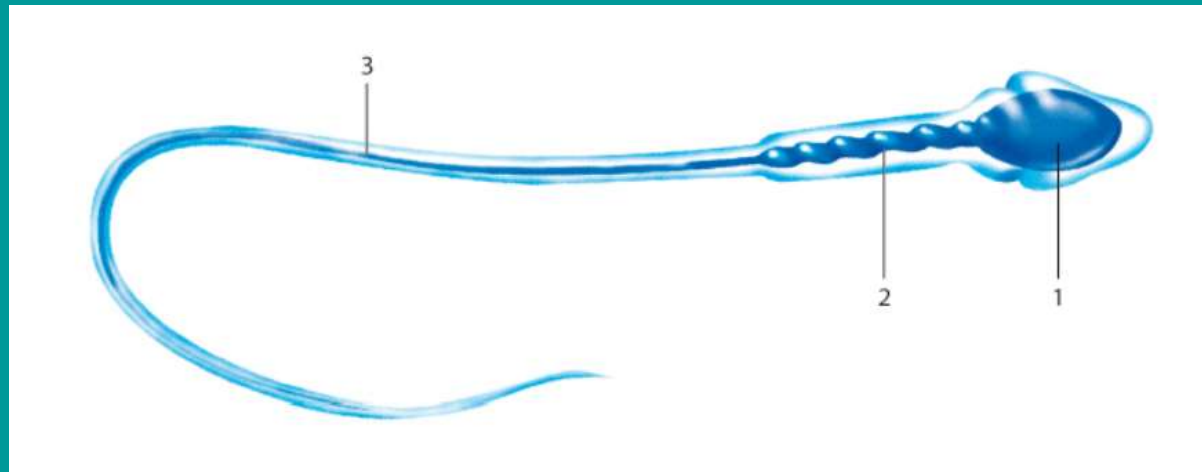


# Male genital system



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**Institute of Anatomy, First Faculty of Medicine**

**Summer semester**

**2020 / 2021**

# Genital/reproductive organs external and internal

## Organa genitalia masculina et feminina

**GONAD** – reproductive gland

gametogenesis (spermatozoa, oocytes)

endocrine function (testosterone, estrogens, progesterone)

**reproductive DUCTS** - passageways

transport of gametes

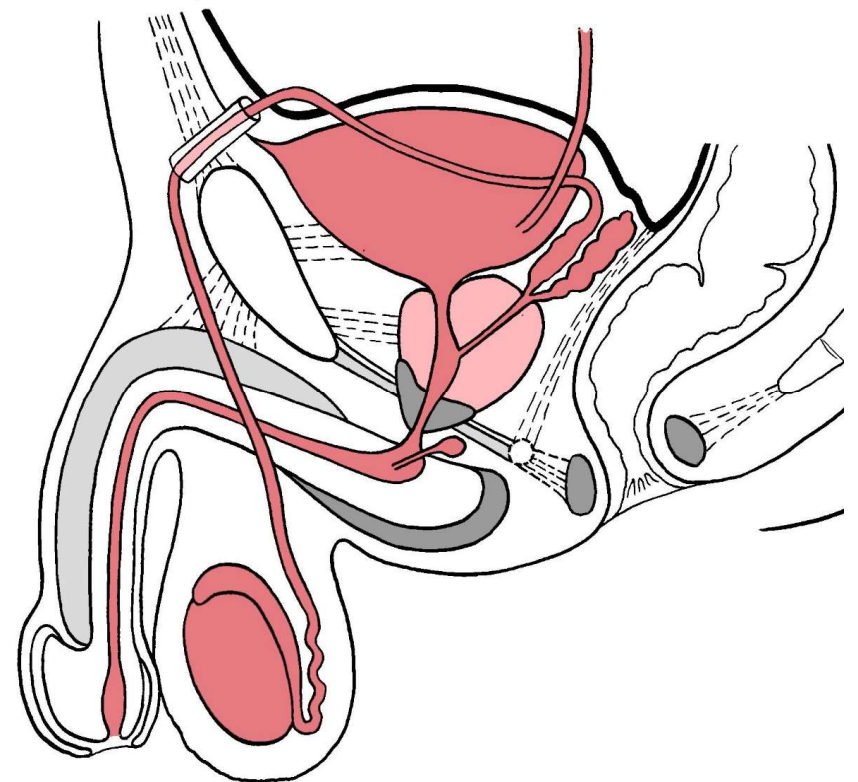
retention and nutrition of foetus

**copulatory ORGANS**

penis, vagina – internal fertilisation

**accessory GLANDS**

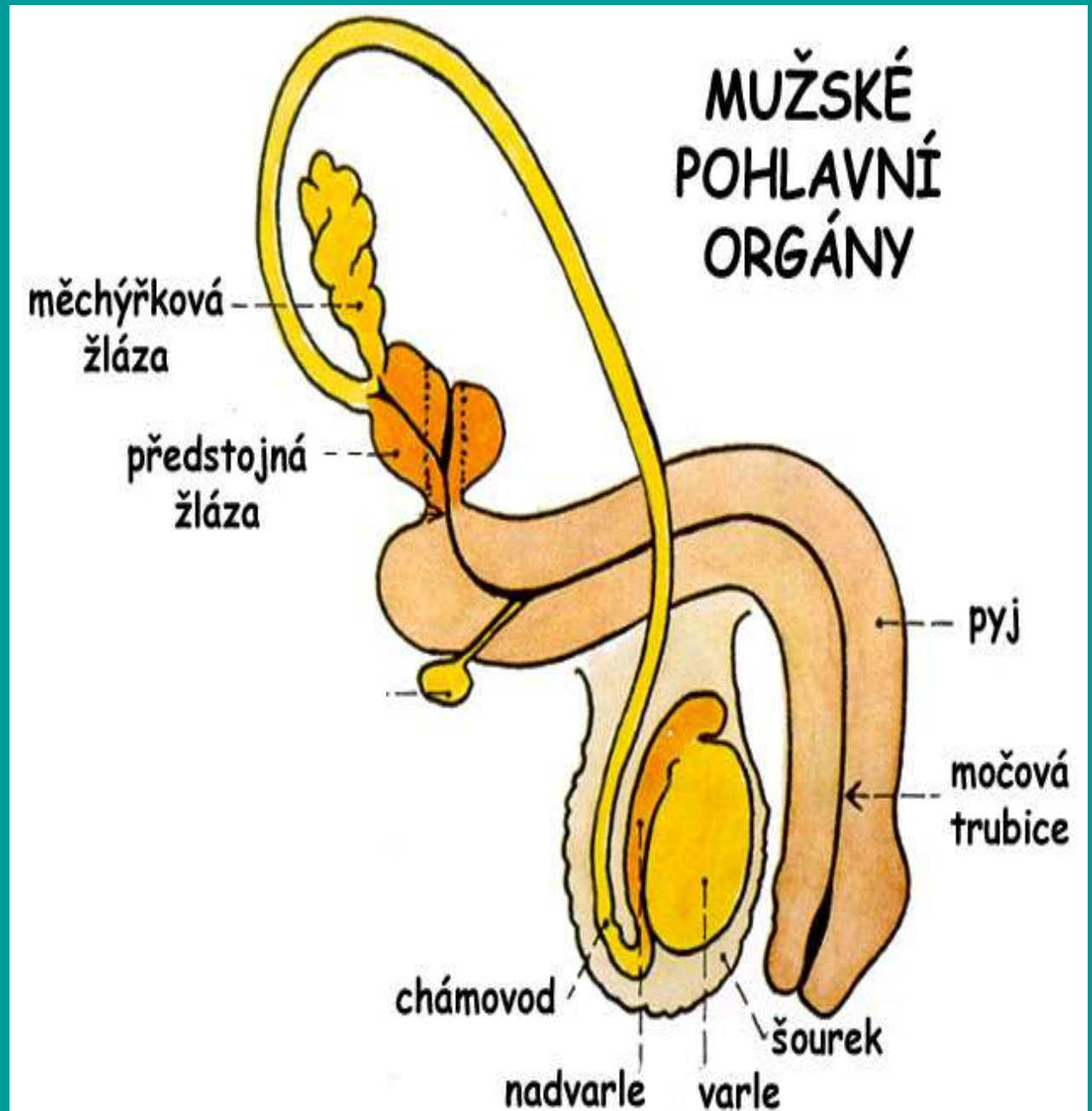
specific secretions

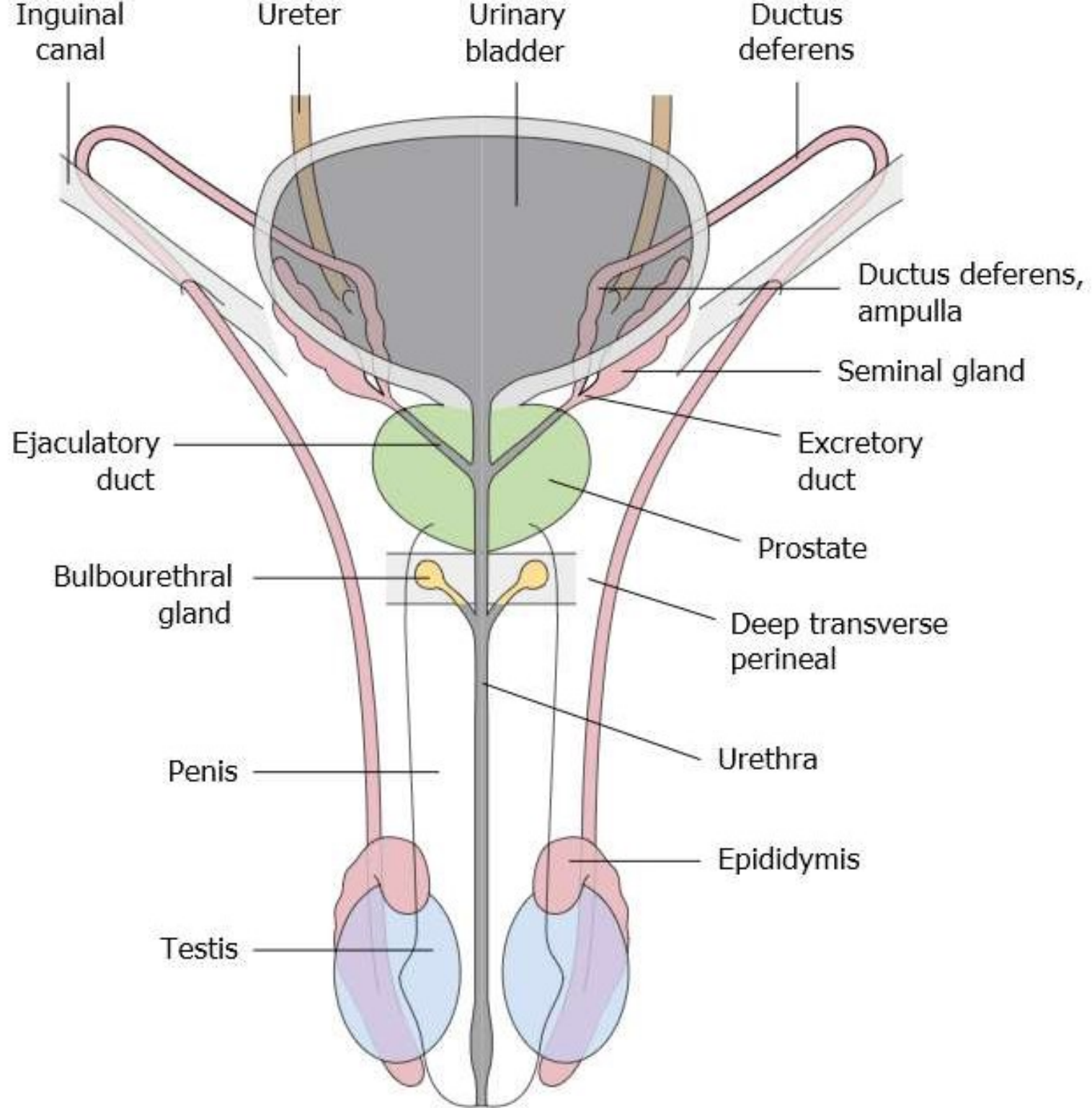




# Organa genitalia masculina externa

- Penis = pyj
- Urethra masculina = mužská močová trubice
- Scrotum = šourek





# Male genital system, organa genitalia masculina

Testis (orchis)

Epididymis

Vas (ductus)  
deferens  
ejaculatory duct

Seminal gland  
(vesicle)

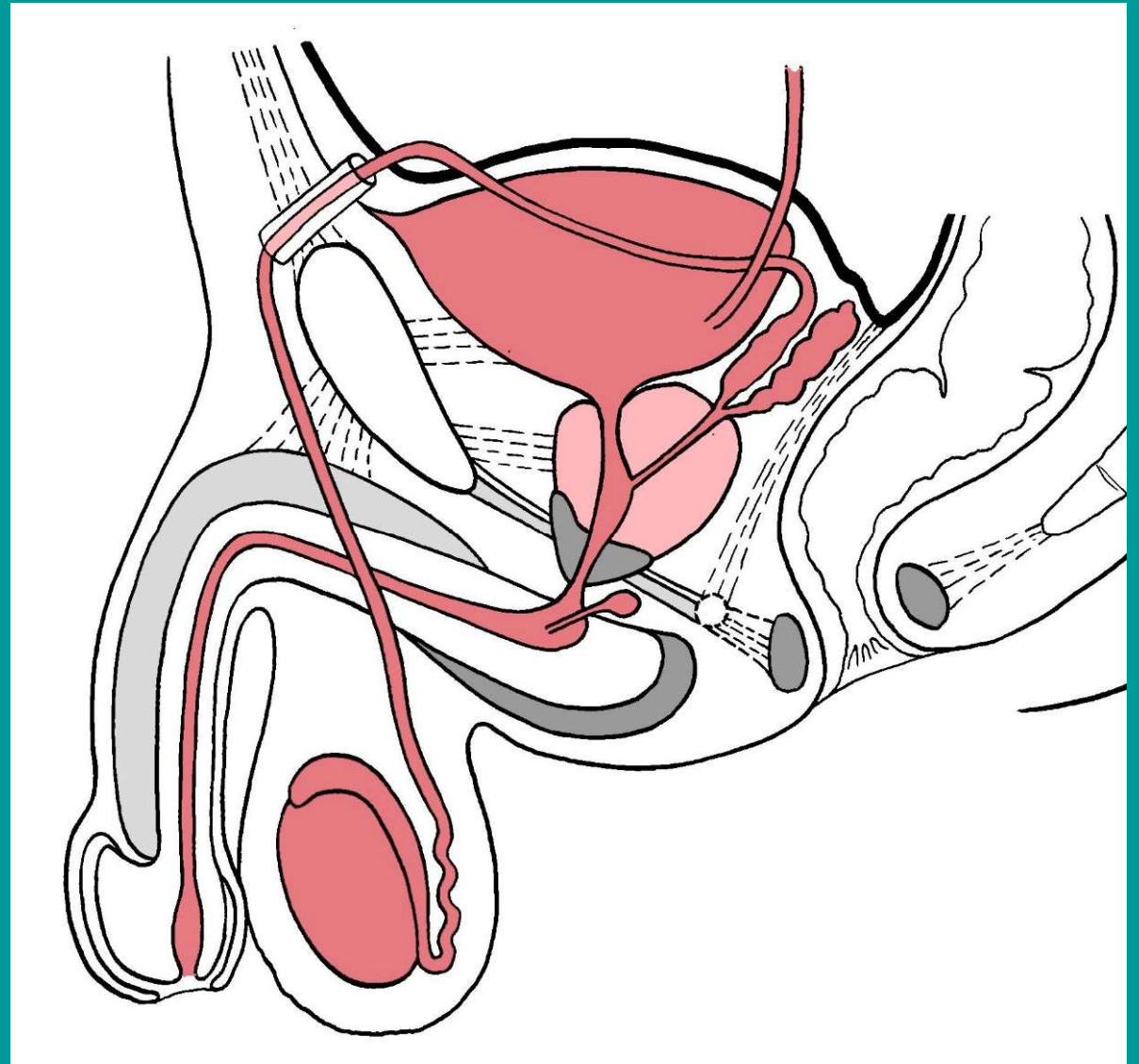
Prostate

Bulbo-urethral  
gland

Penis

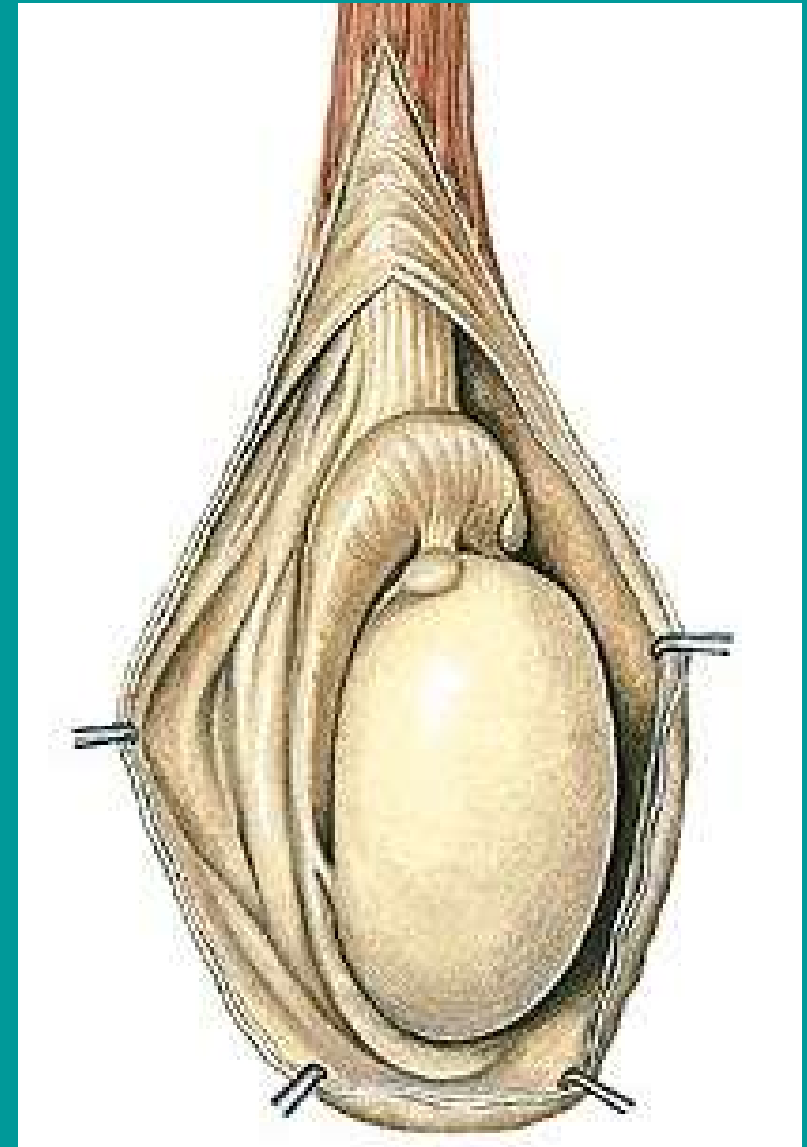
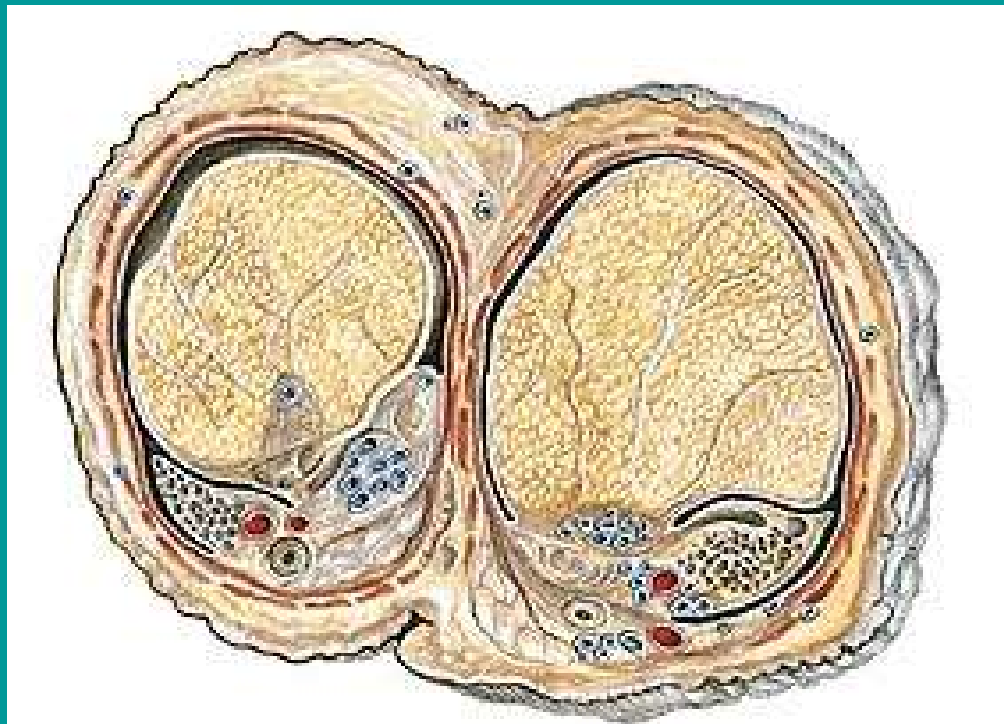
Scrotum

Spermatic cord



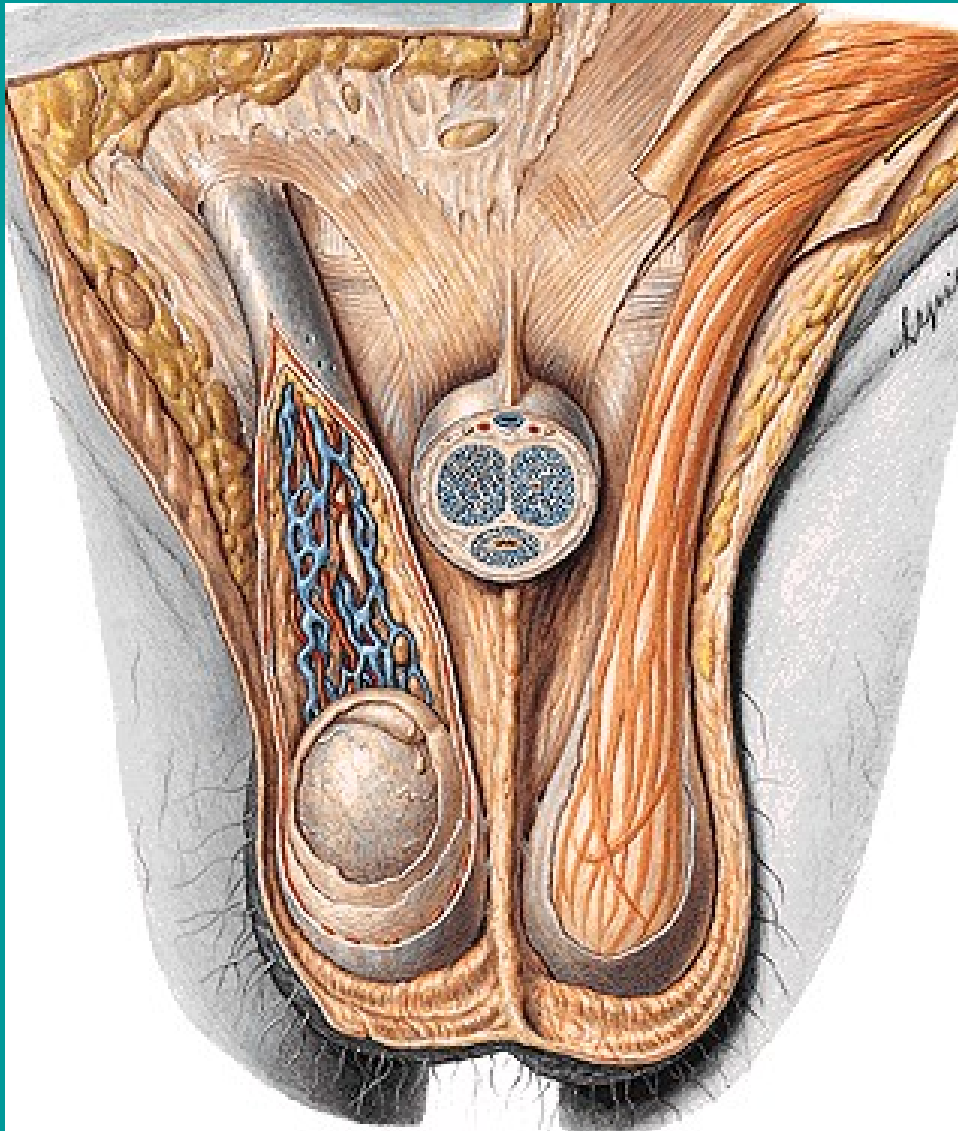
## Testis (orchis)

Upper, lower pole,  
lateral, medial surface,  
anterior, posterior border,  
Tunica vaginalis – parietal  
(periorchium) & visceral  
layer (epiorchium), sinus  
of epididymis



## Epididymis

Head, body, lobules, tail,  
duct of epididymis



**Testes in scrotum** – elimination of intraabdominal pressure, lower temperature than 37°C term baby



## **Spermatic cord:**

**testicular a. + v.**

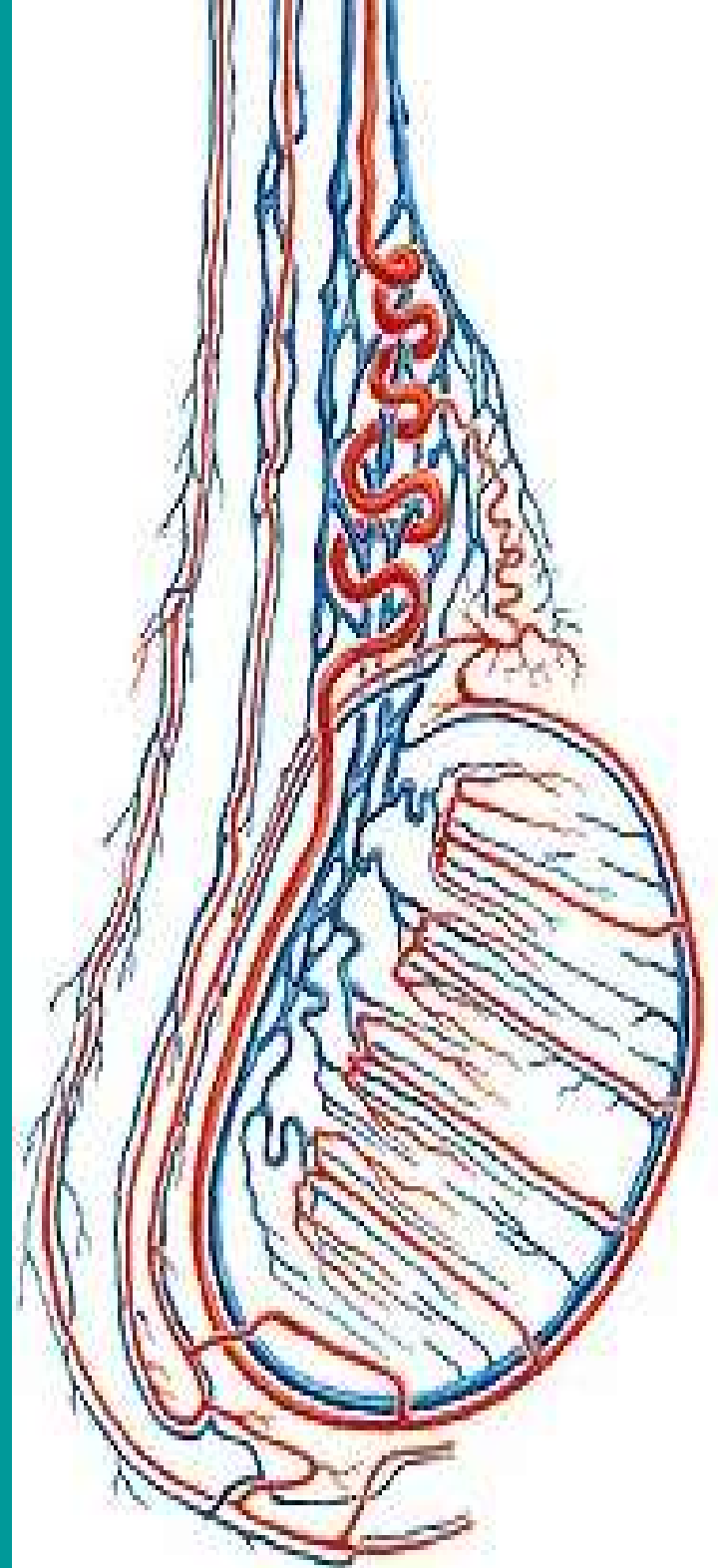
**pampiniform venous plexus**

**vas deferens**

**a.+ v. of deferent duct**

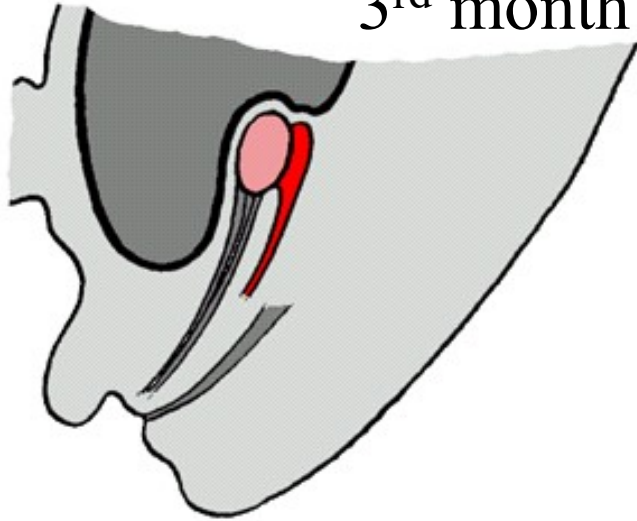
**plexus testicularis (n.X...)**

**counterflow cooling mechanism**

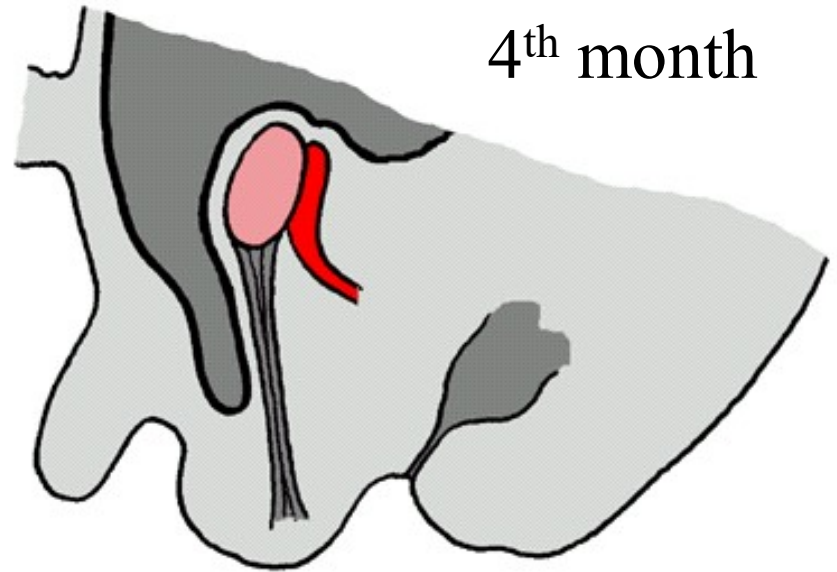


# Descent of the testes: the role of the gubernaculum testis

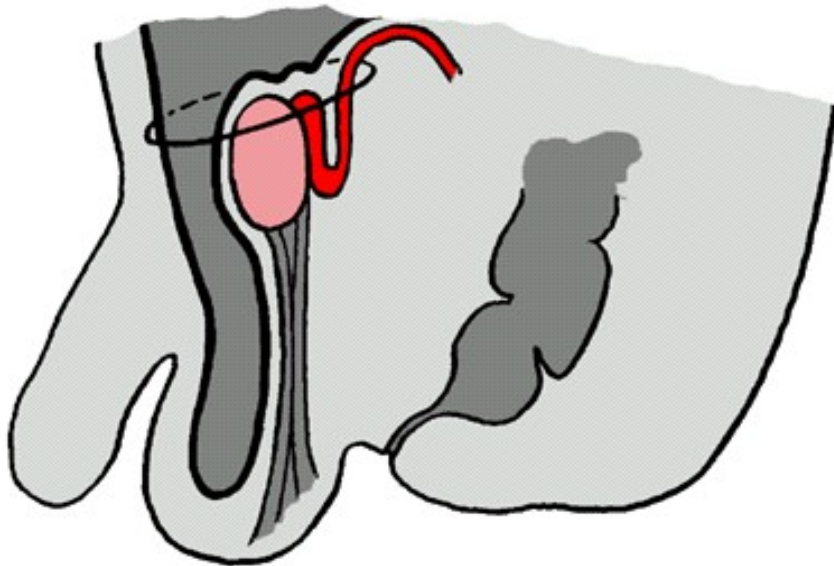
3<sup>rd</sup> month



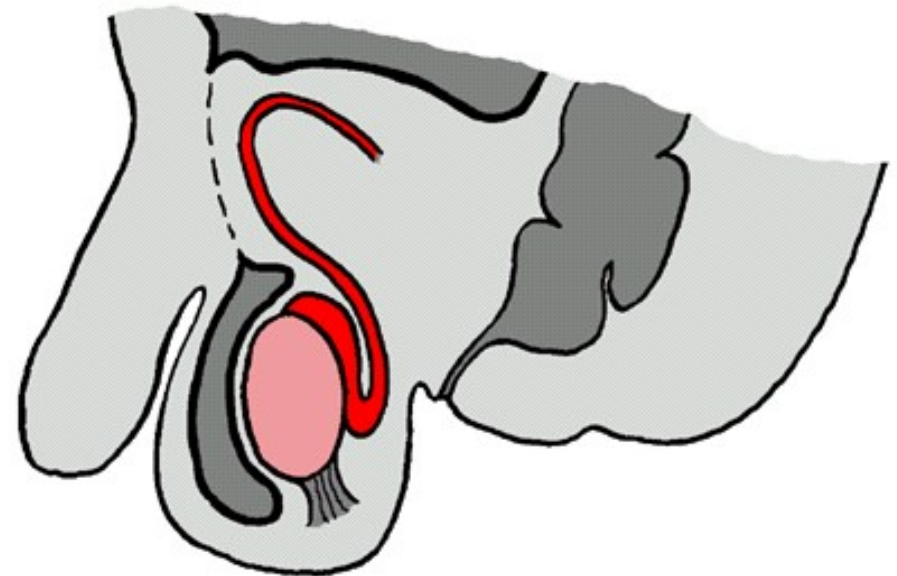
4<sup>th</sup> month



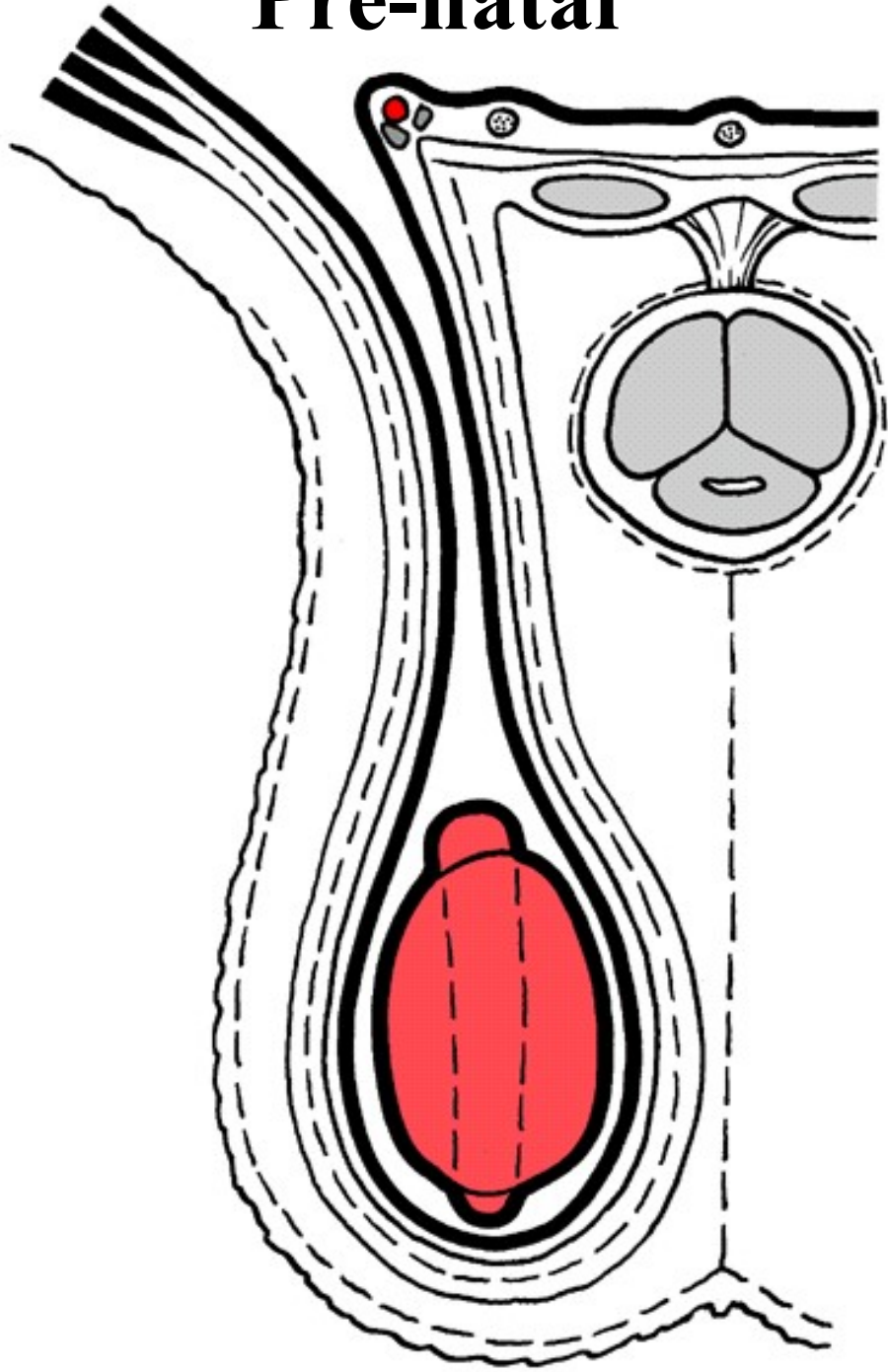
7<sup>th</sup> month



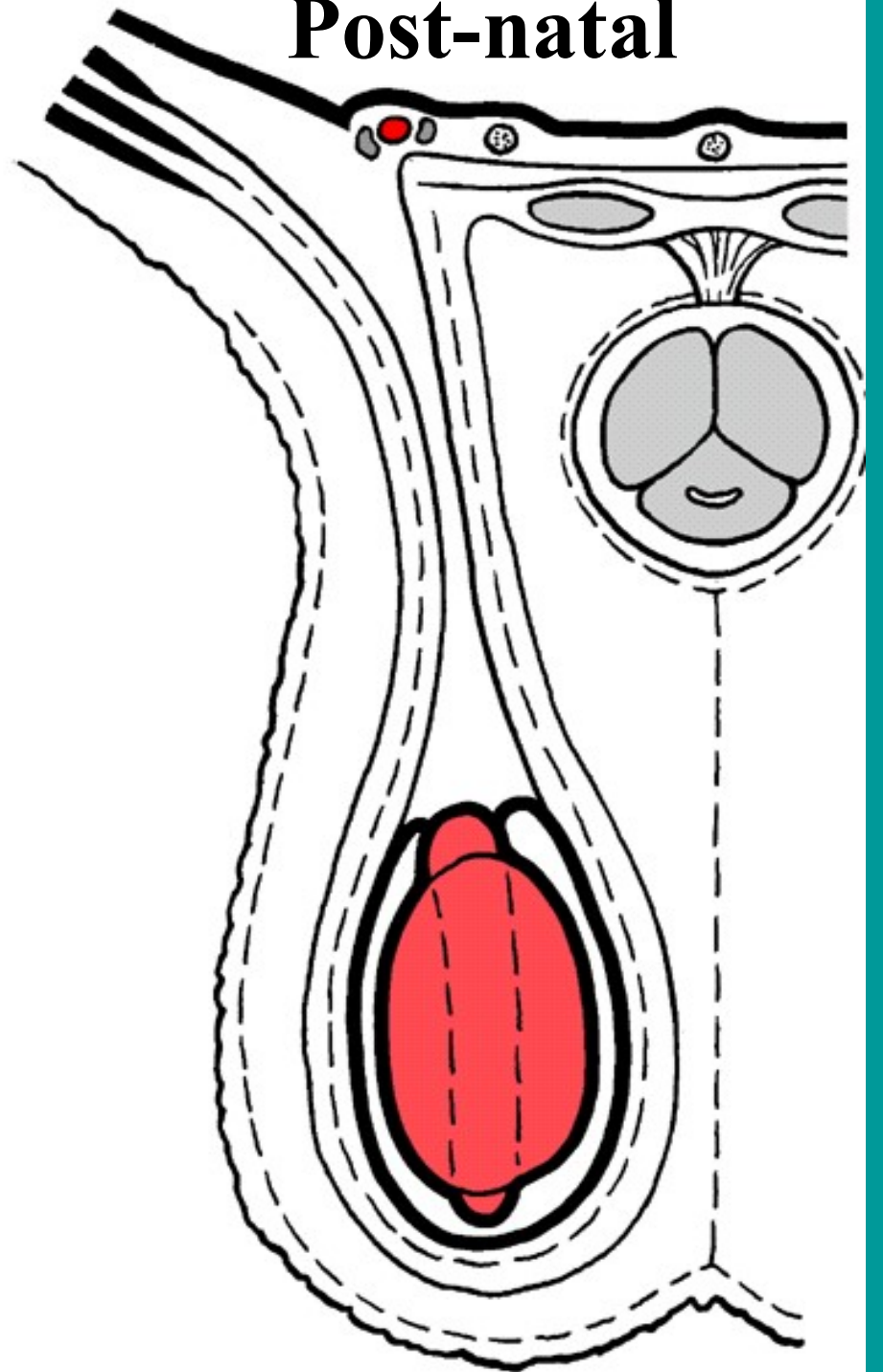
8-10<sup>th</sup> month



**Pre-natal**



**Post-natal**



# Scrotum vs. Abdominal wall layers

skin

smooth tunic dartos muscle = fascia Scarpae

external spermatic fascia = superficial abdominal fascia

**cremaster muscle** = int. obl.+trans. abdominal mm.

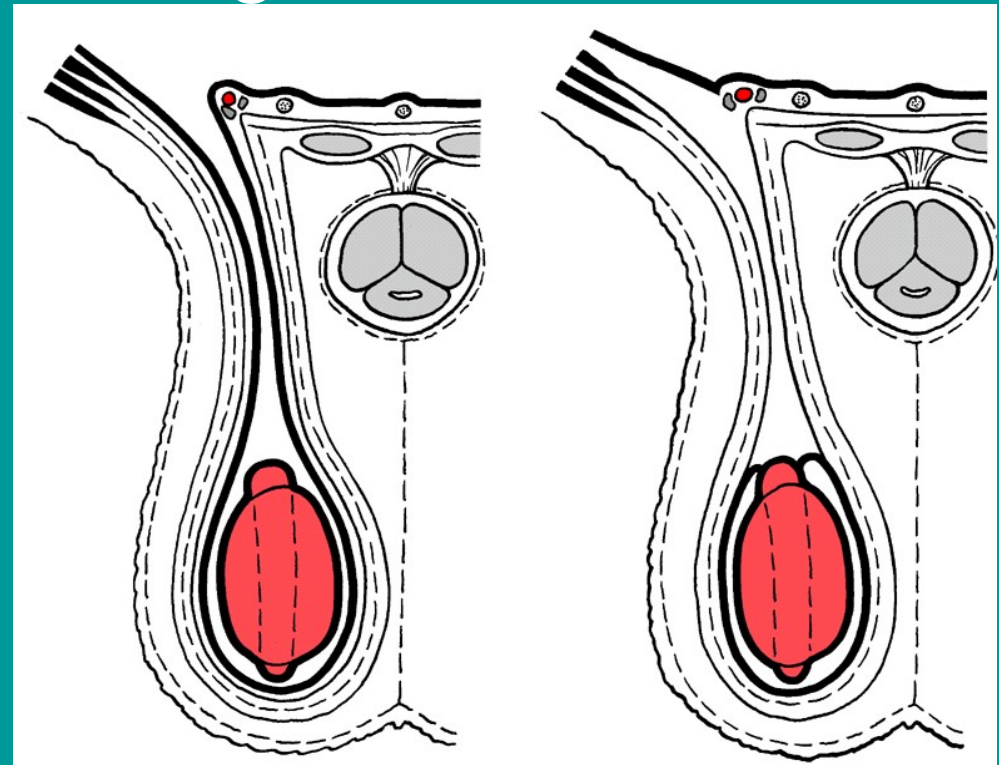
internal spermatic fascia = transversal fascia

rudiments of vaginal process: tunica vaginalis testis

Parietal lamina (periorchium)

Visceral lamina (epiorchium)

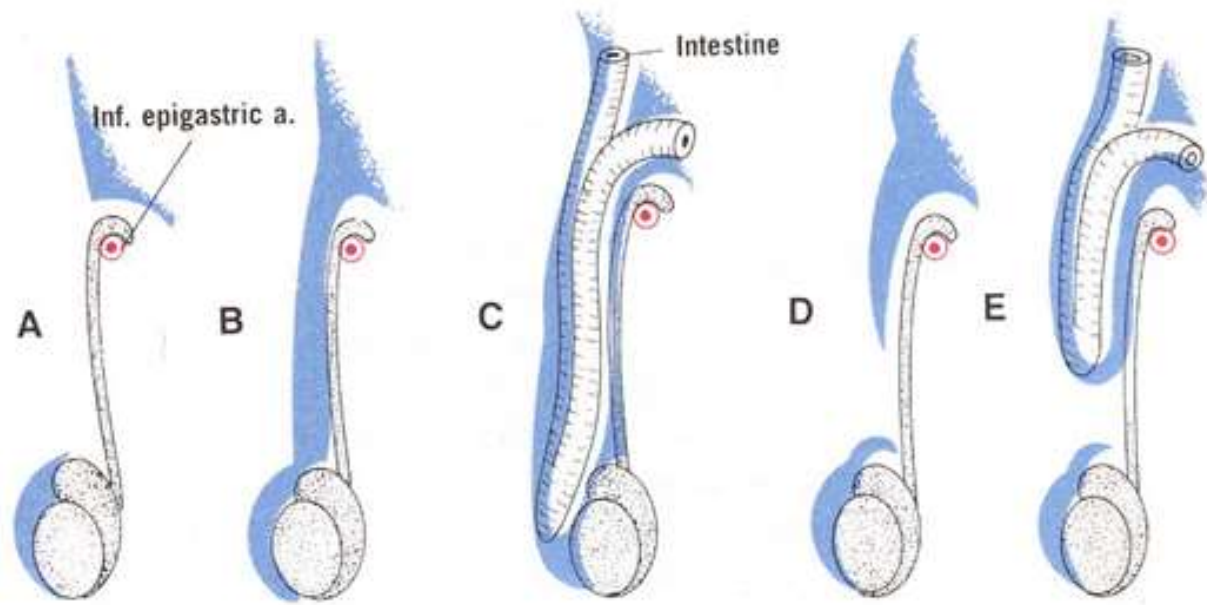
**Testicular torsion**



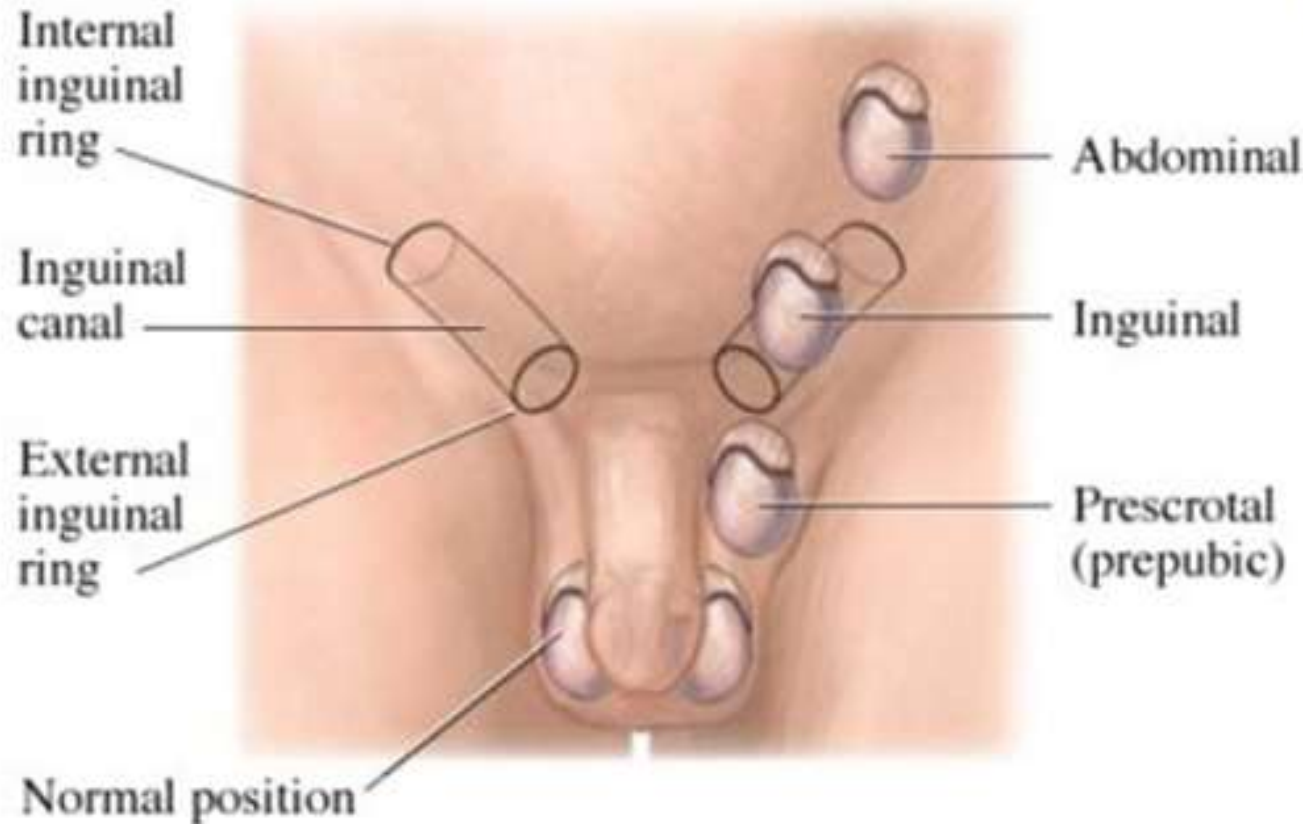
# Břišní stěna x Vrstvy šourku

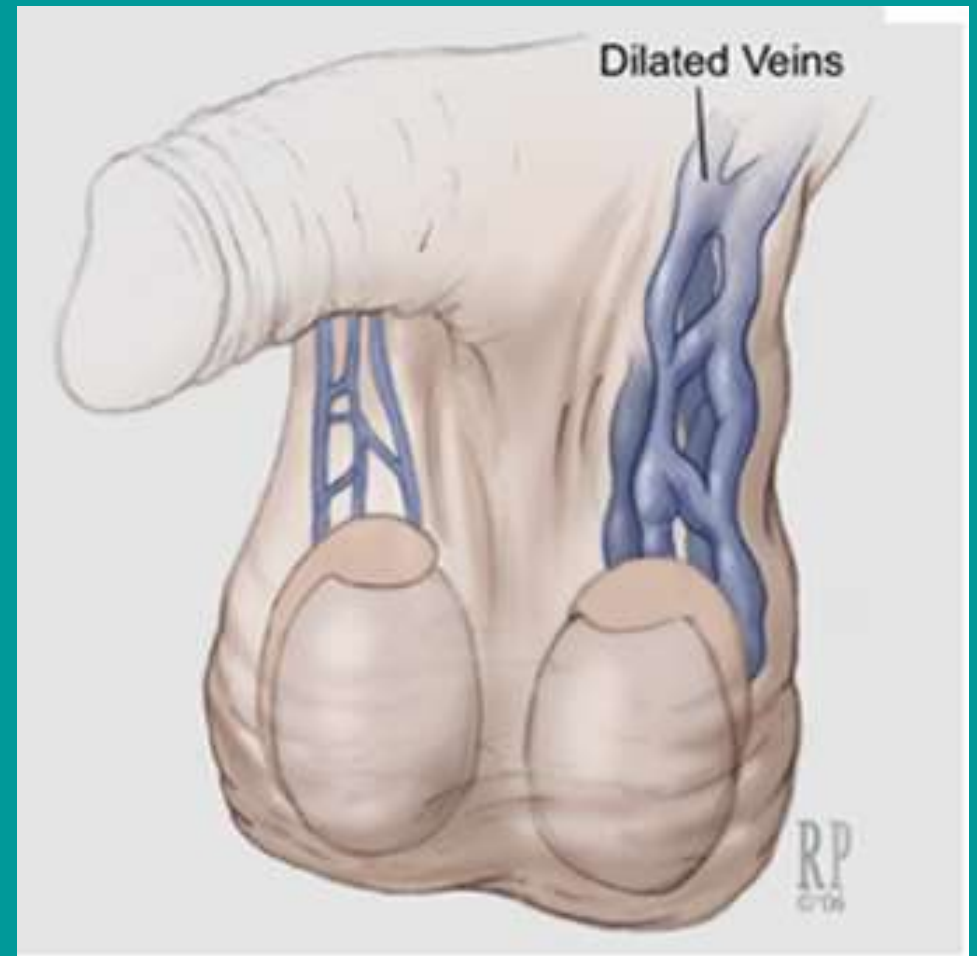
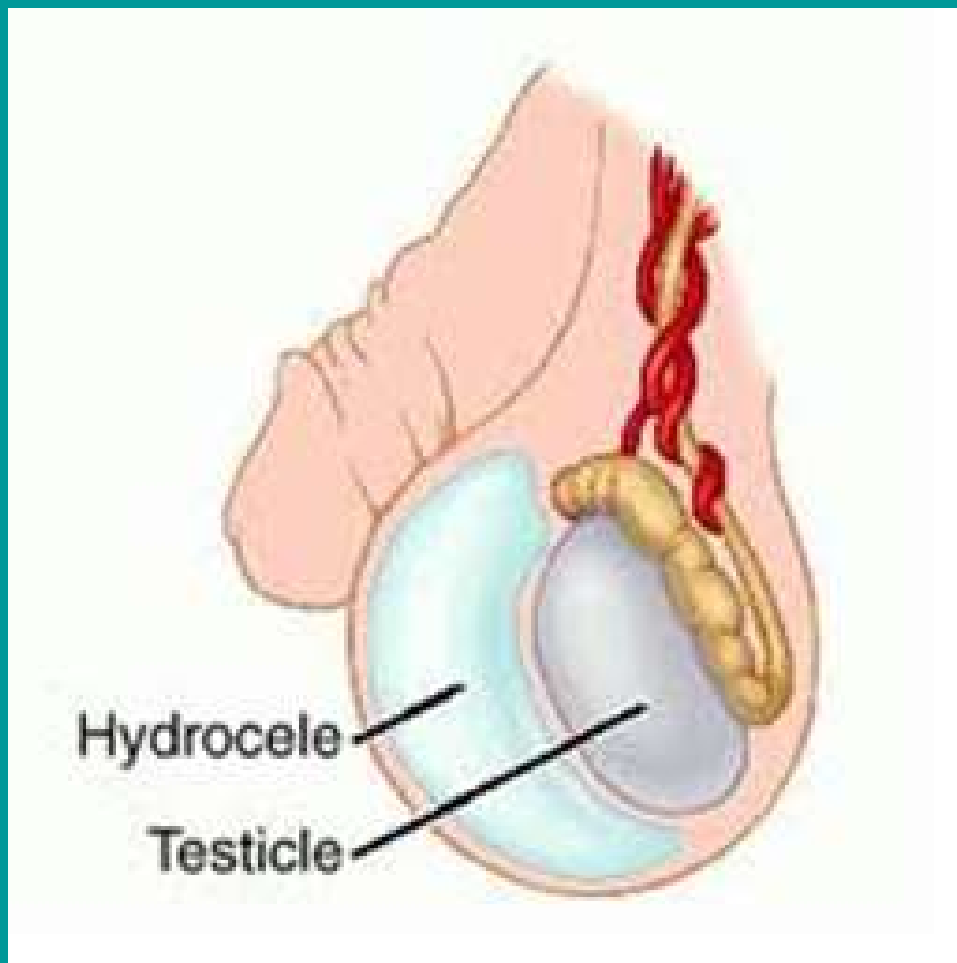
- kůže
  - Camperova vazivová vrstva
  - fascia abd. subcutanea /*Scarpae*/
  - fascia abd. superficialis
  - mm. abdominis
  - fascia transversalis
  - peritoneum
- kůže
  - tunica dartos
  - fascia spermatica ext.
  - m. cremaster
  - fascia spermatica int.
  - tunica vaginalis testis

# Congenital inguinal hernia „indirect“



# Cryptorchism= Retention of testis= Ectopia testis





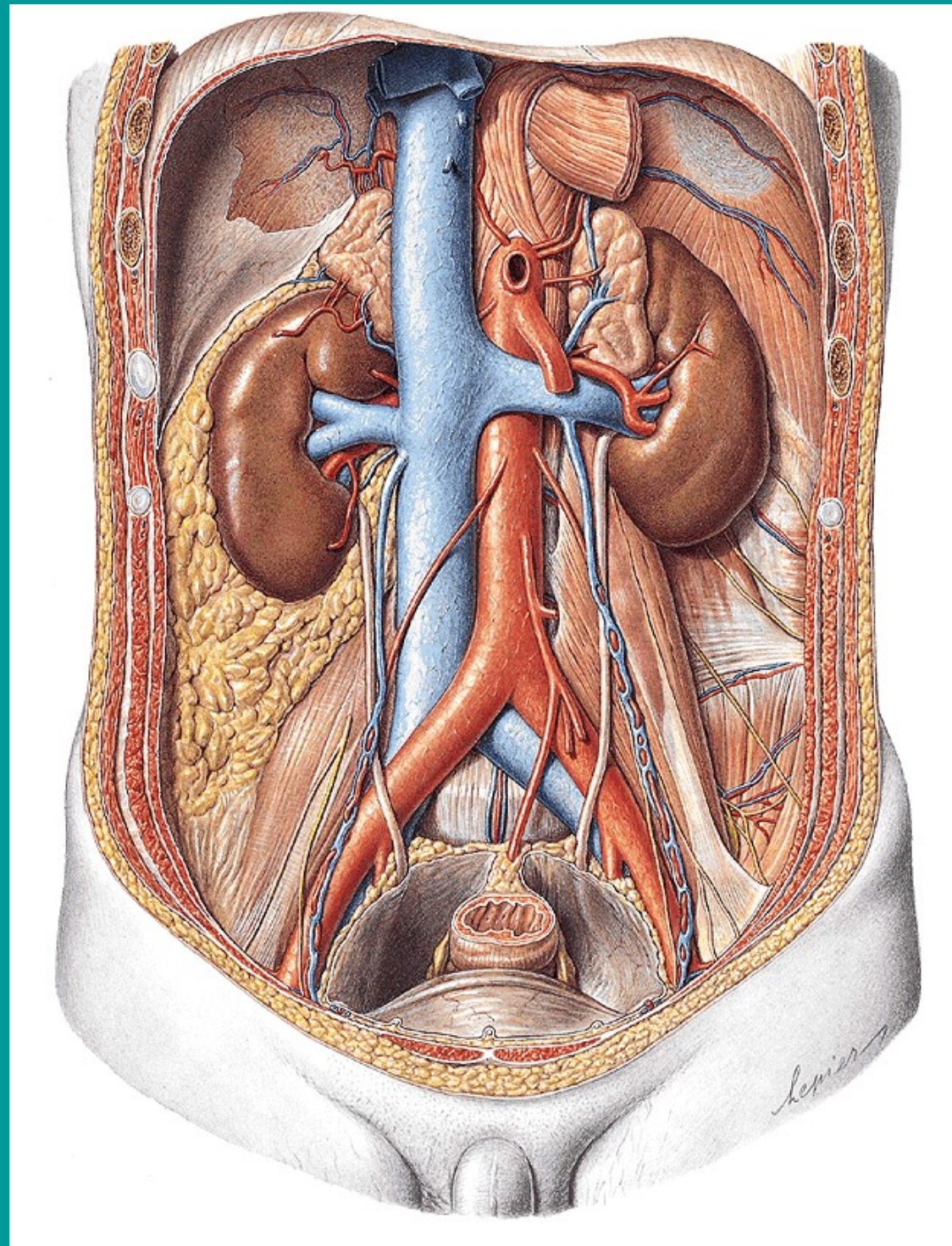
**Hydrocele** – the cavity of the scrotum filled by pathological serous effusion

**Varicocele** – “bag of worms” varicose condition of pampiniform plexus – alteration of spermatogenesis **95% on left side**

**Varicocele** –  
varicosities of  
testicular veins

Worse venous  
return.

Problems with  
spermiogenesis,  
fertility.





## Structure of testis

tunica albuginea

vascular layer mediastinum

septa

lobules 300 each

seminiferous tubules

rete testis

efferent ductules

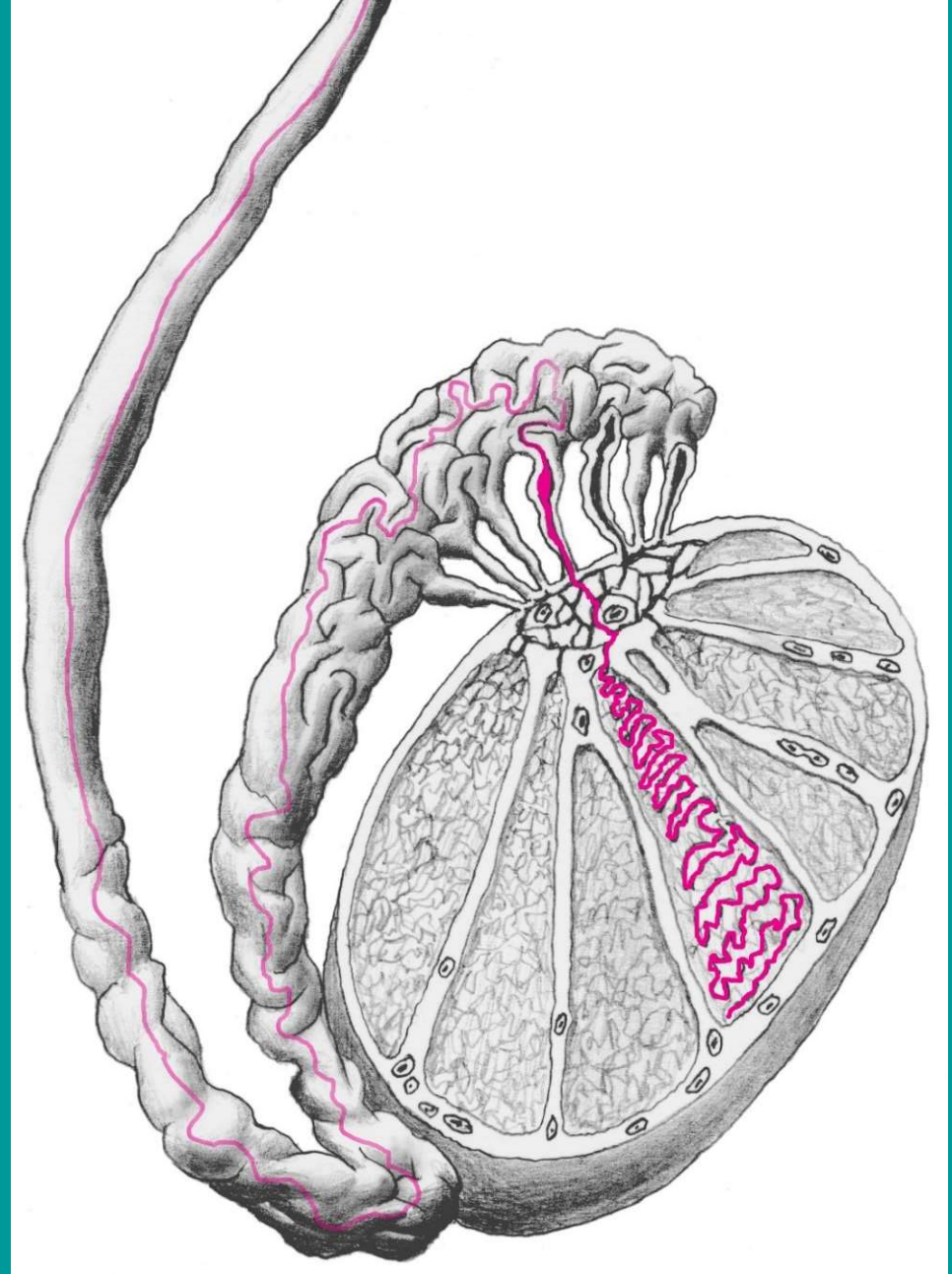
germinal spermatogenic epithelium

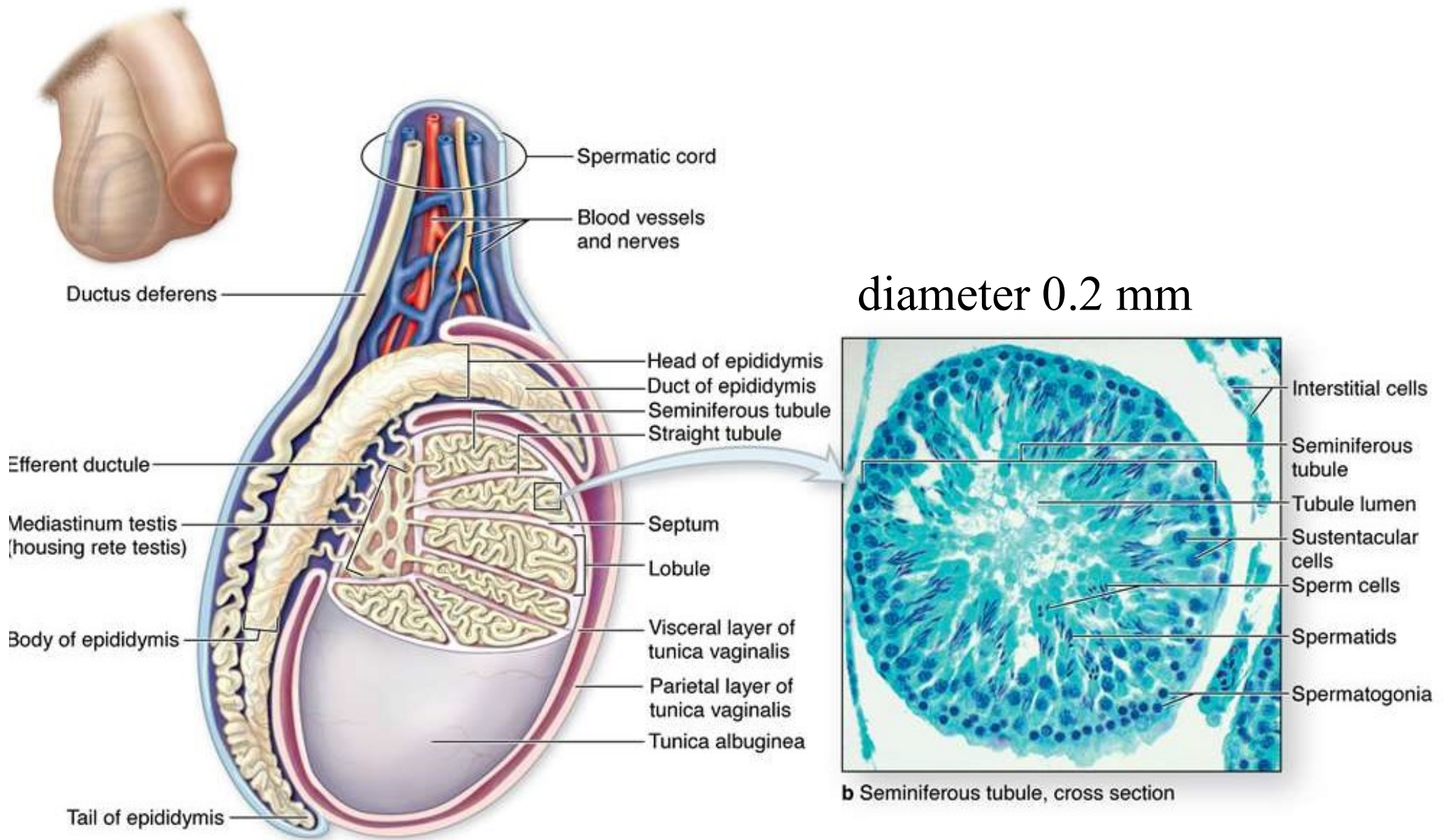
sustentacular cells of Sertoli

interstitial endocrine cells of Leydig

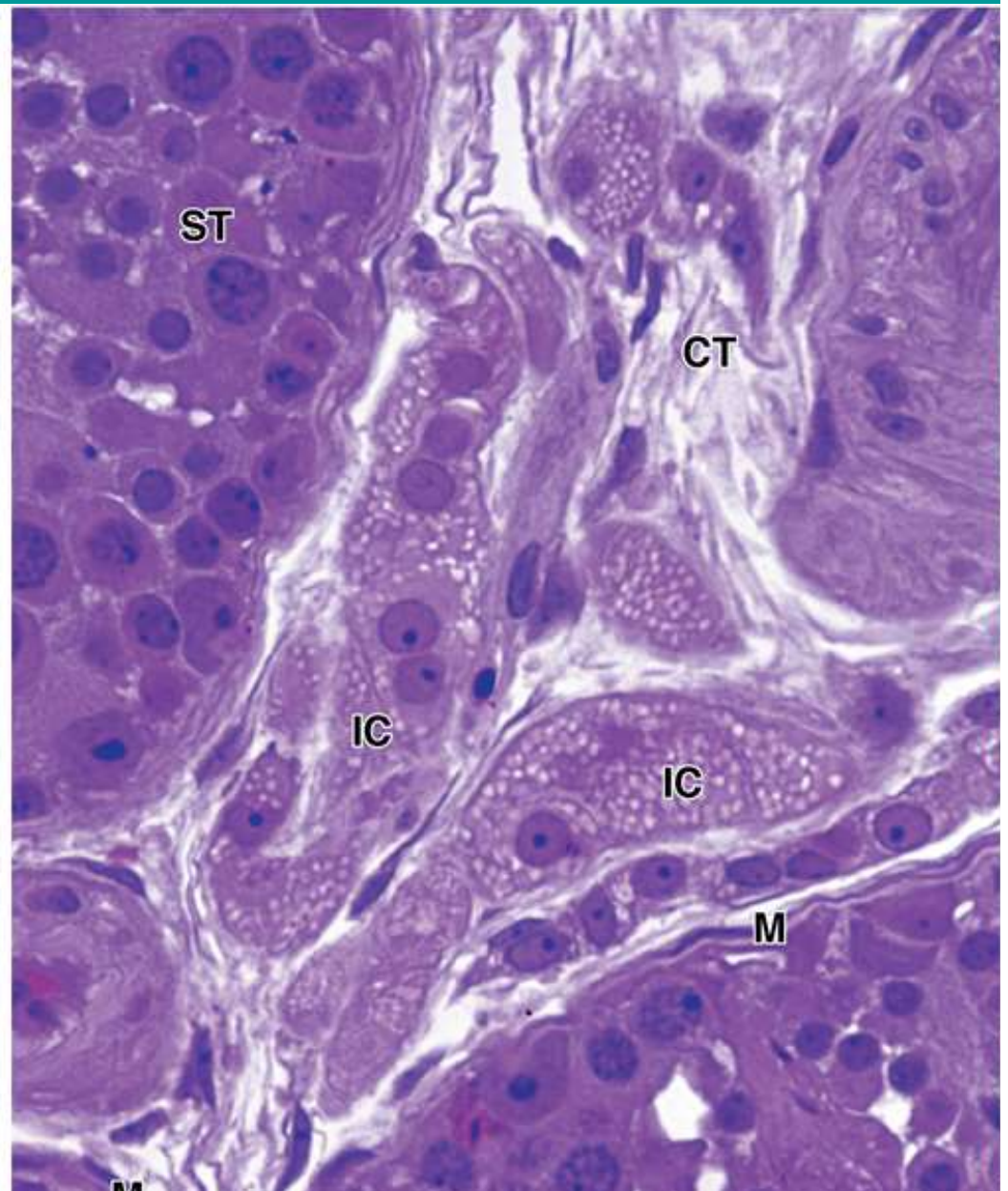
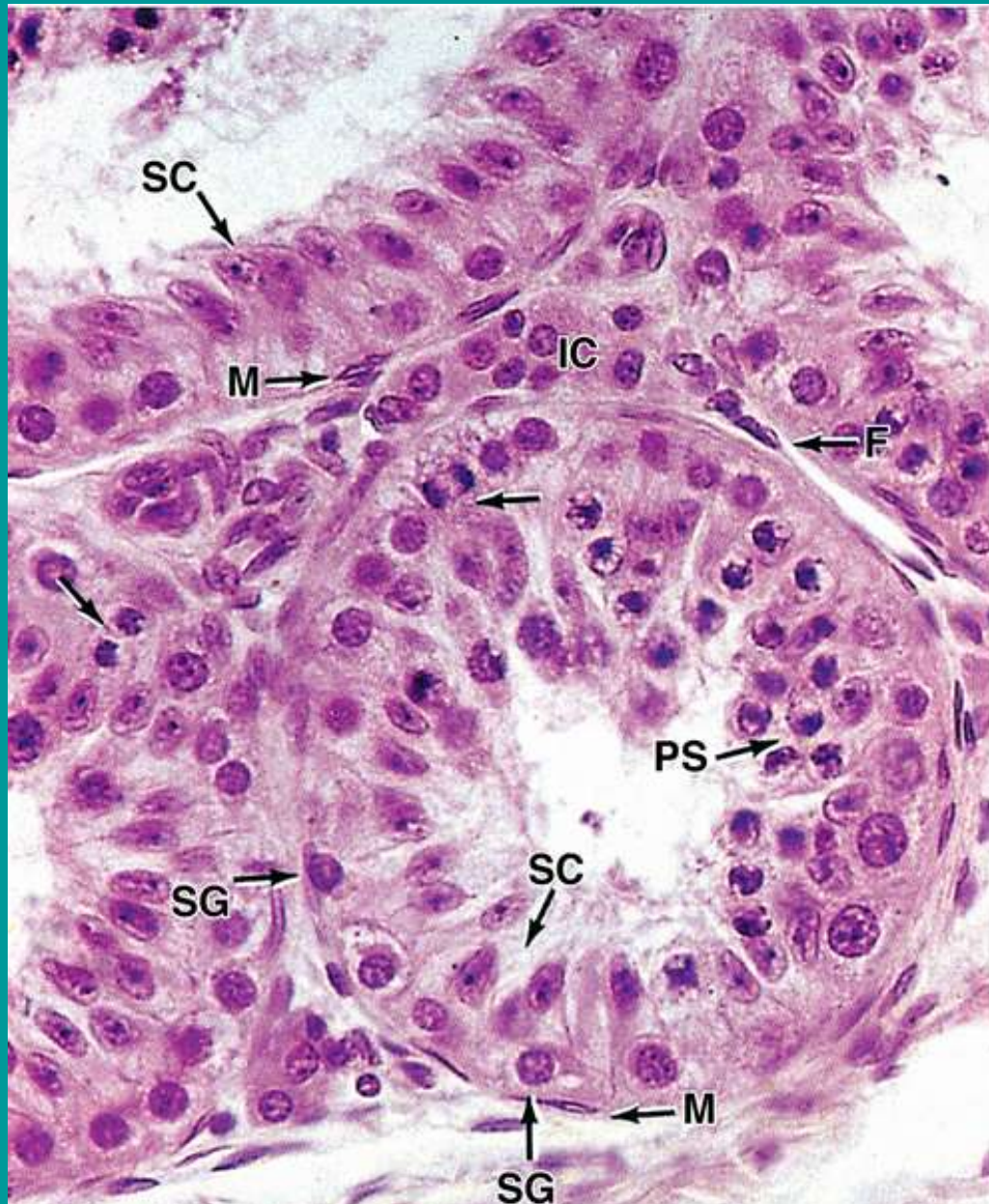
## Epididymis

duct of epididymis





Testis and seminiferous tubules  
 (individual length 30-70 cm, total length 2x150m)

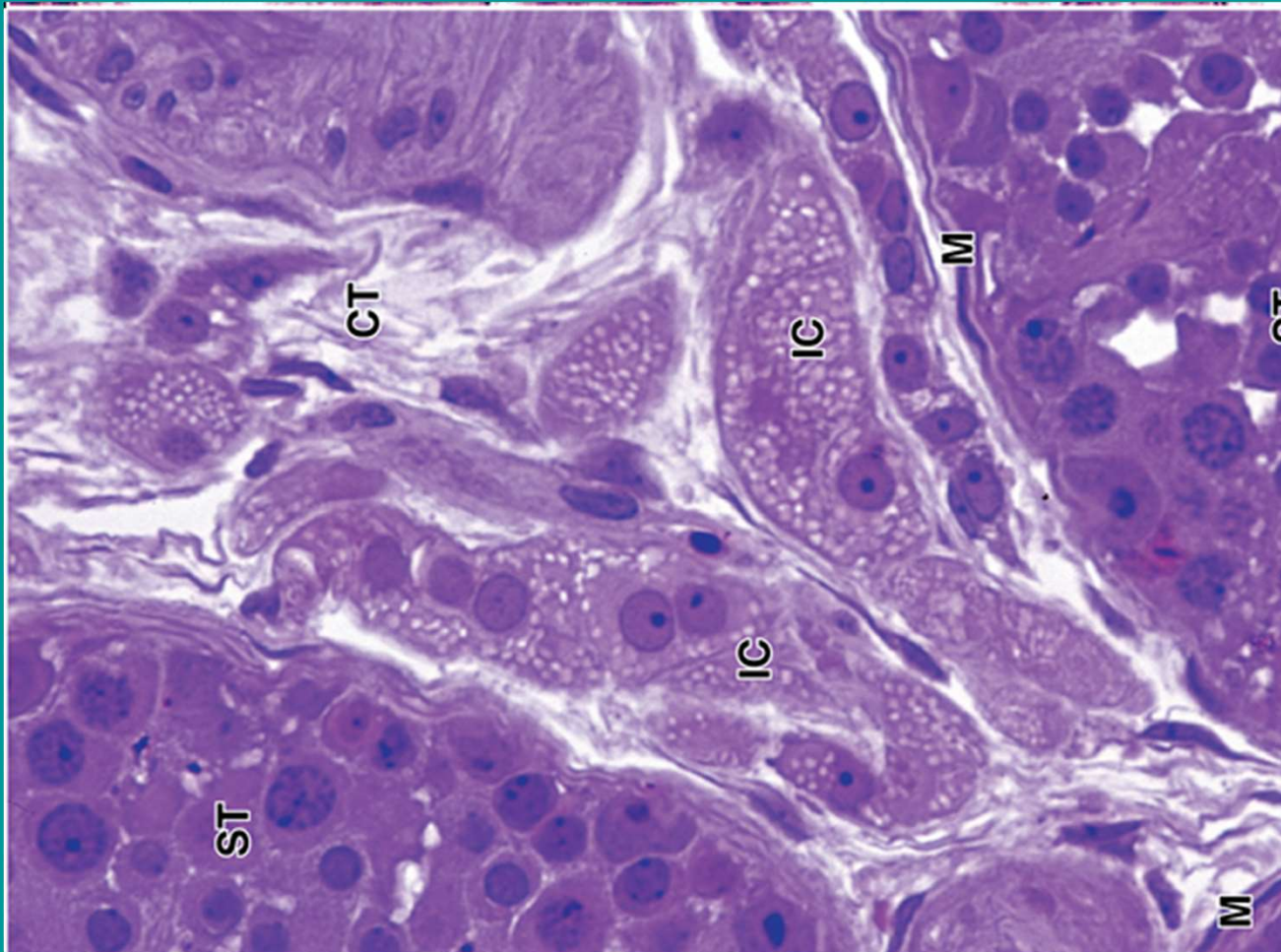


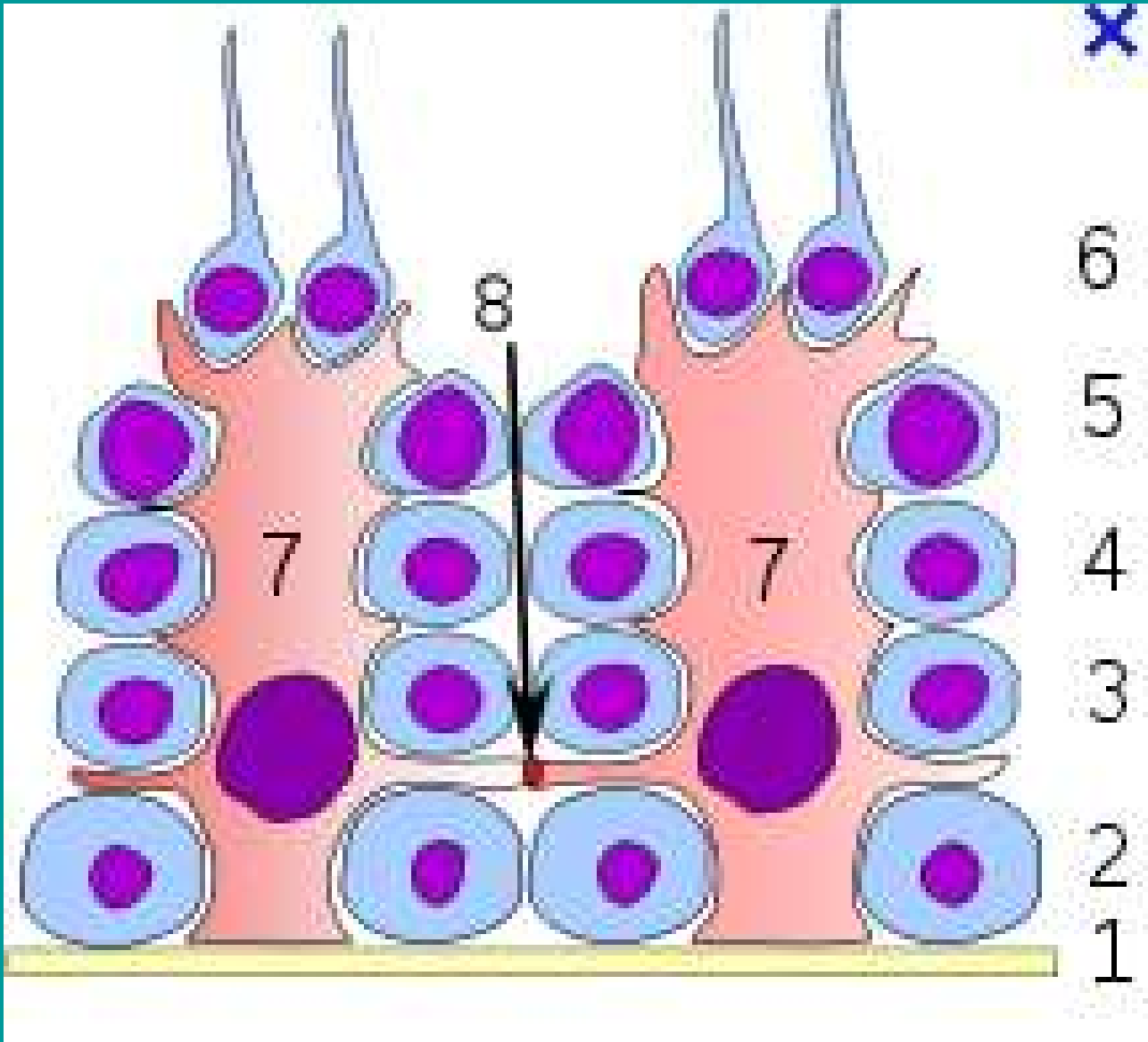
### **Seminiferous tubules**

**SC supporting (Sertoli) cells and SG germ cells of spermatogenic lineage); IC interstitial (Leydig) cells producing androgens**

**Leydig cells** produce testosterone

- a) in fetal weeks 8. - 14. – masculinization of genital tract
- b) from puberty to adulthood – growth of genital organs, secondary sexual features, spermatogenesis





- 1 - basal lamina
  - 2 - spermatogonia
  - 3 - spermatocyte I
  - 4 - spermatocyte II
  - 5 - spermatide
  - 6 - mature spermatozoa
  - 7 - Sertoli cell
  - 8 - tight junction**
- =immuno barrier***

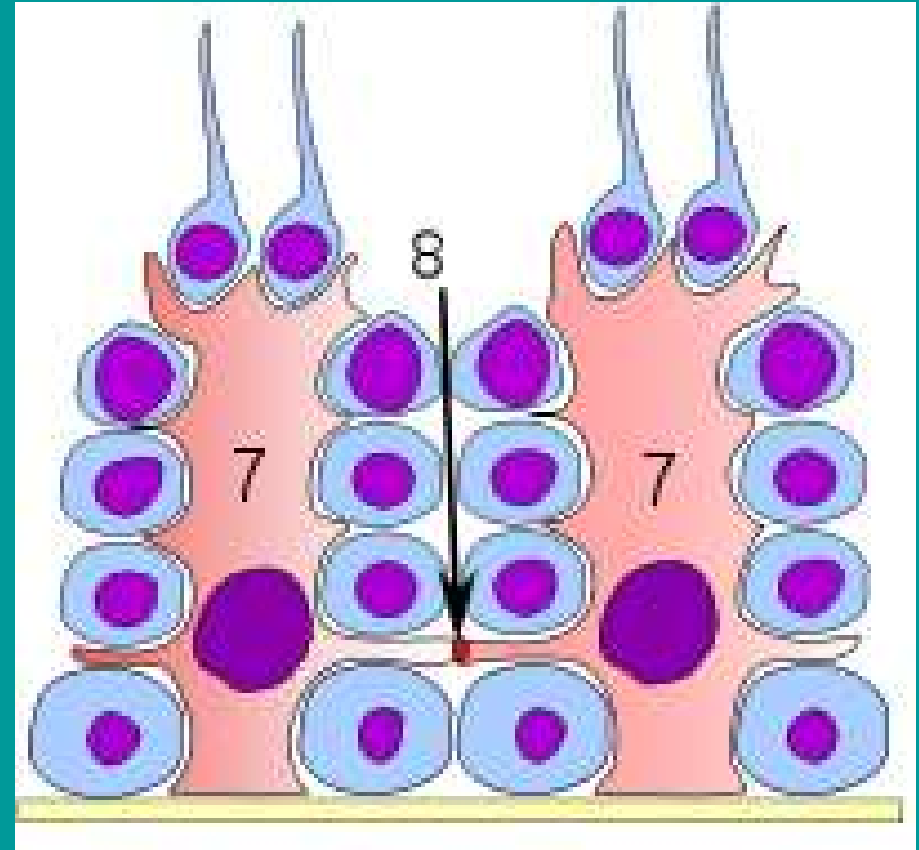
# Function of the Sertoli cells

Essential cells in the regulation of spermatogenesis

Blood-testis-barrier **immuno**

Production of the seminal fluid containing Androgen-binding protein

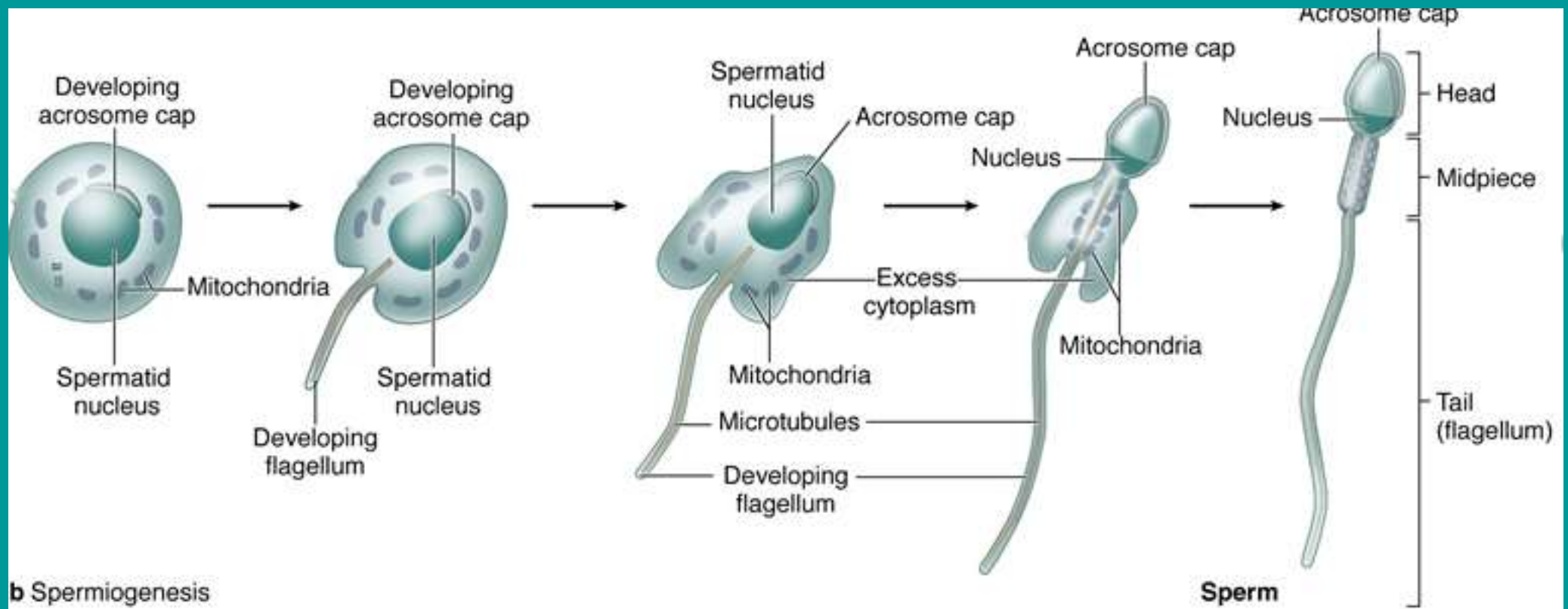
Production of **AMH** (Anti-Müllerian hormone) during development of the male phenotype



# Spermiogenesis

Spermatides

Motile sperm

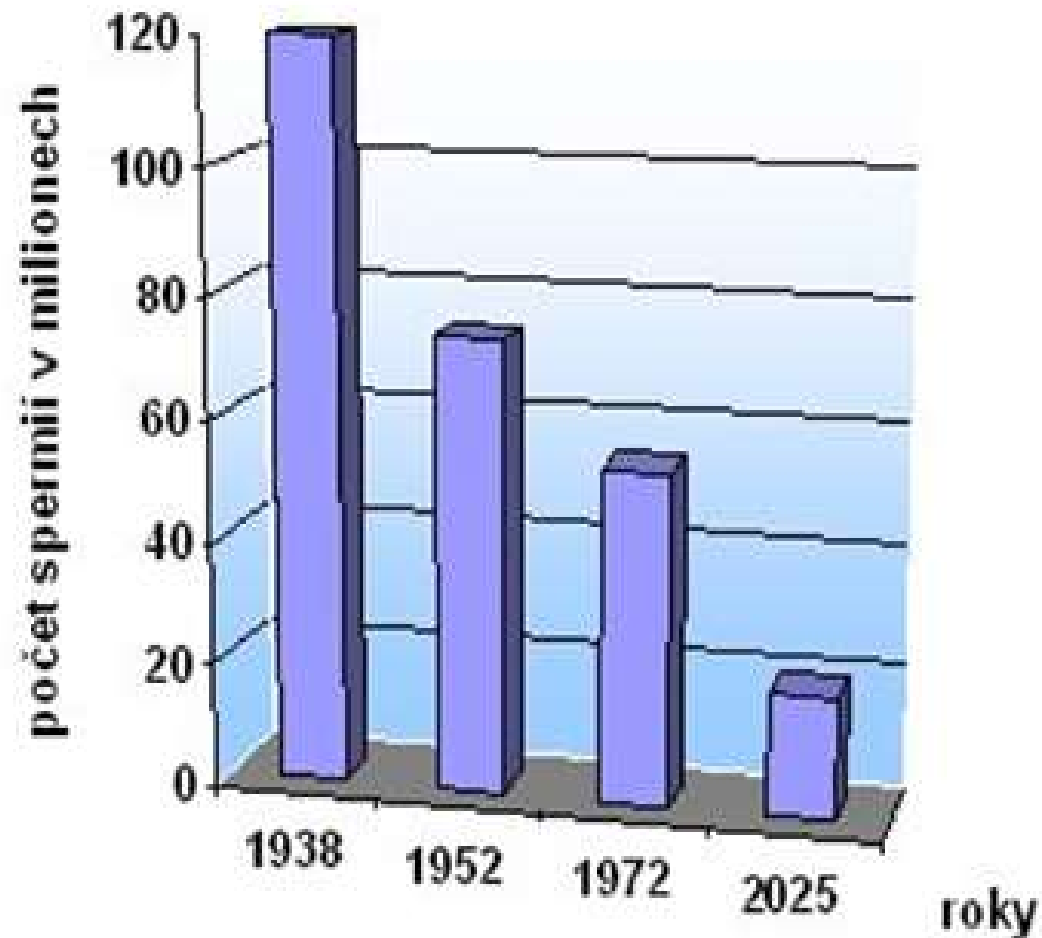


**Spermatogenesis:** 1 million of spermatozoa / 1h  
Differentiation and maturation lasted 82 days.

**Ejaculate, semen** (2–6 ml) 35 – 200 mil. spermatozoa  
Less than 10 mil / 1 ml = **oligospermia**, sterility

WHO 2006

Historical development of spermatozoa number  
in 1 ml of ejaculate (2006 – 20 000 000/1 ml)





## **Environmental effects on gonadal development**

Disorders of development of the testis and reproductive tract in the male fetuses are increasing in incidence. The most dramatic change that appears to have occurred over the past 60 years is a fall in sperm counts of around 40-50%.

These developmental disorders are attributed to feminising factors affecting prenatal development.

Feminising factors:

- exogenous estrogens produced by the pharmaceutical industry
- substances with estrogenic effects by binding to estrogen receptors: DDT, polychlorinated biphenyls, chlorinated hydrocarbons and detergents and cleaners

They are fat-soluble and accumulate in the food chain and in our body, which contains more fat than in the past.

It is therefore likely that the rising frequency of morphological and functional abnormalities of the male reproductive system, is the result of these changes (according to Gray's Anatomy, 38th edition)

Presl J: Prekoncepční volba pohlaví. Čs. Gynekologie  
47,3: 149 – 151, 1983

**Preconception choice of sex – based on varied vitality of X and Y sperms and changes of pH in vagina during the cycle.**

Rychlé a choulostivé Y spermie lépe penetrují a přežívají v době ovulace, kdy má cervikální sekret alkaličtější pH a je tak hojný, že neutralisuje kyselé pH v pochvě. To vytváří optimální podmínky pro migraci rychlých a choulostivých Y spermií. Naopak před ovulací jsou díky kyselému poševnímu a cervikálnímu prostředí vytvořeny hostilní podmínky pro přežití Y spermii a uplatní se spíše X spermie. Při koitu 1 den před a až 2 dny po ovulaci bylo zaznamenáno 87% porodu chlapců. Naopak po koitu 3 – 5 dní před ovulací byl zaznamenán porod 85% děvčátek. (zatím stále nemáme k dispozici jednopohlavní suspensi spermií pro arteficiální inseminaci).

Indian Med Trib. 1994 Jul 30;2(12):5.

**Planning sex of baby -- the Barthakur method.**

# Epididymis - head, body, lobules, tail, duct of epididymis



Epididymis: highly coiled duct with temporarily stored sperm

## **Vas (ductus) deferens**

30 cm

muscular layer, mucous membrane, adventitia

Emission - contraction waves during transportation of spermatozoa into urethra followed by ejaculation

Parts: scrotal, funicular, inguinal, pelvic, ampulla

## **Seminal gland (vesicle)**

excretory duct

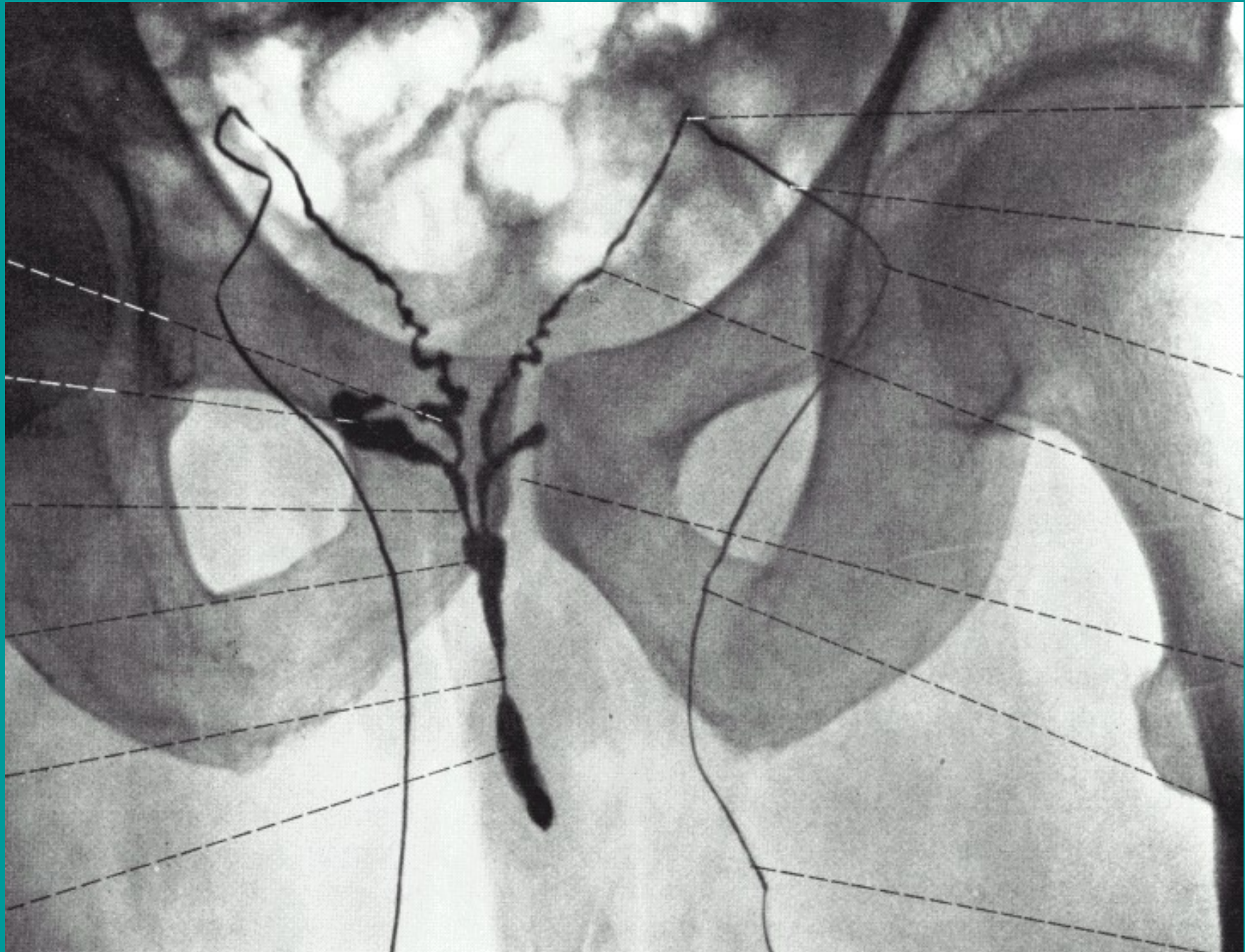
## **Ejaculatory duct**

## **Spermatic cord**

testicular a. + v., pampiniform plexus, vas deferens, a.+ v. of deferent duct

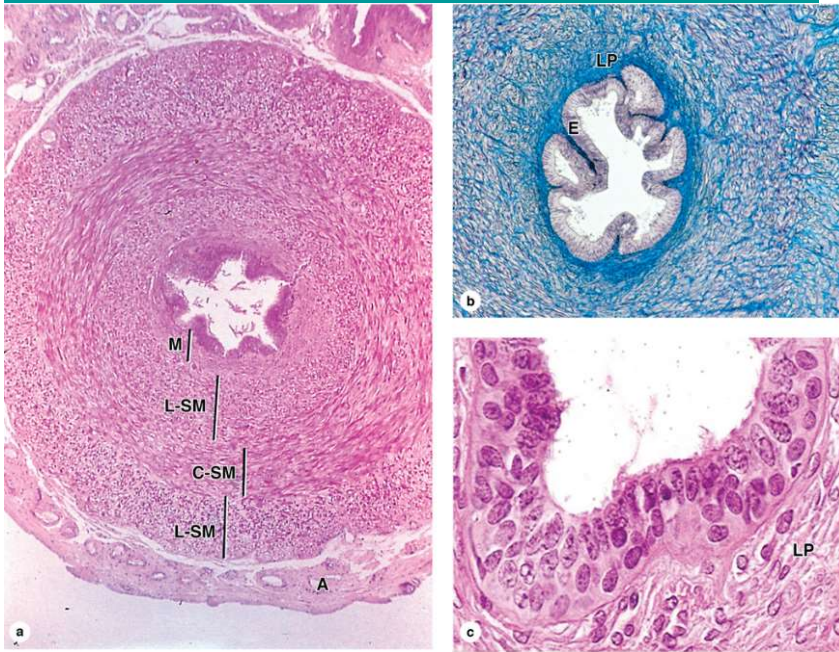
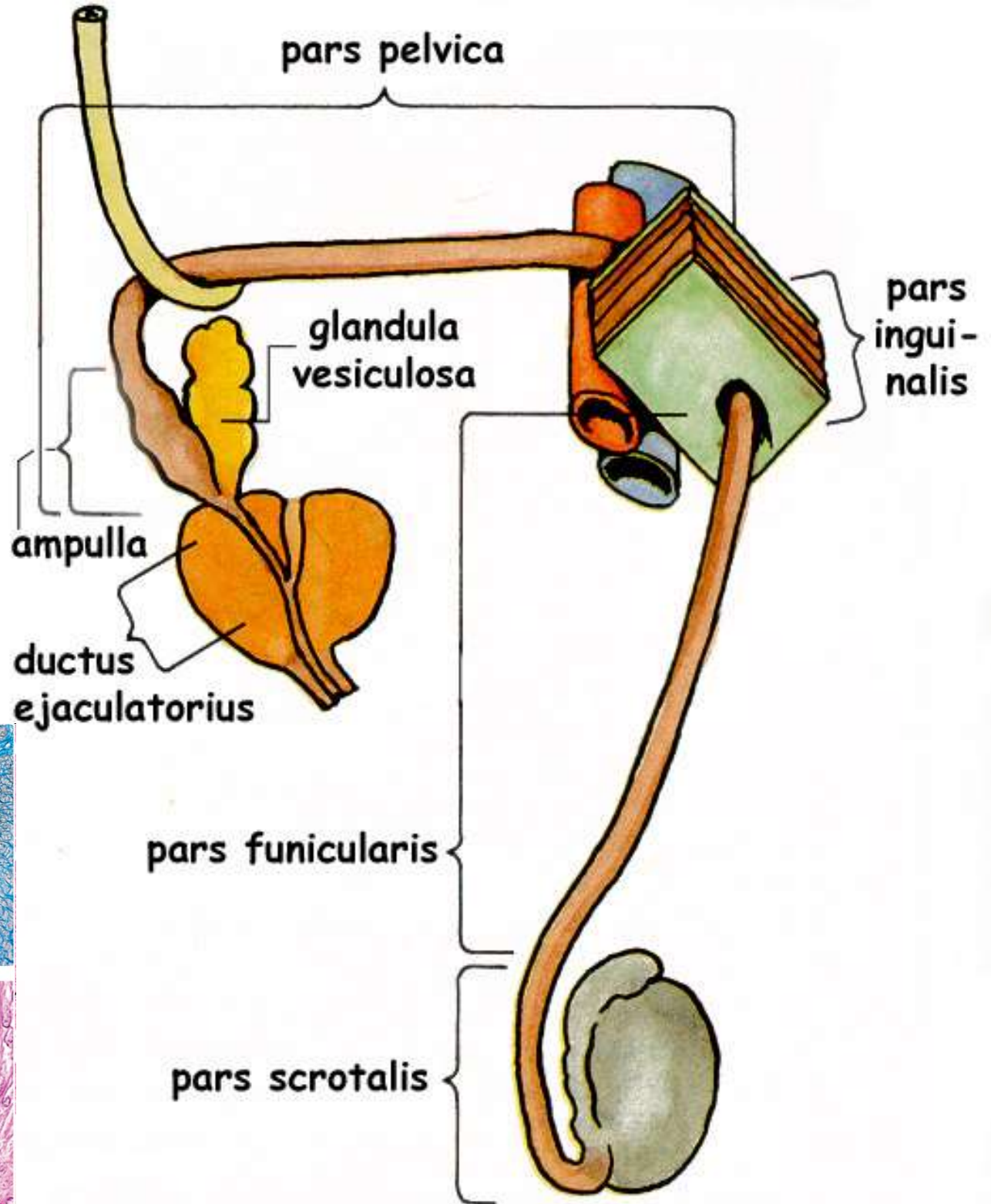
## Vas (ductus) deferens

scrotal, funicular, inguinal, pelvic part, ampulla

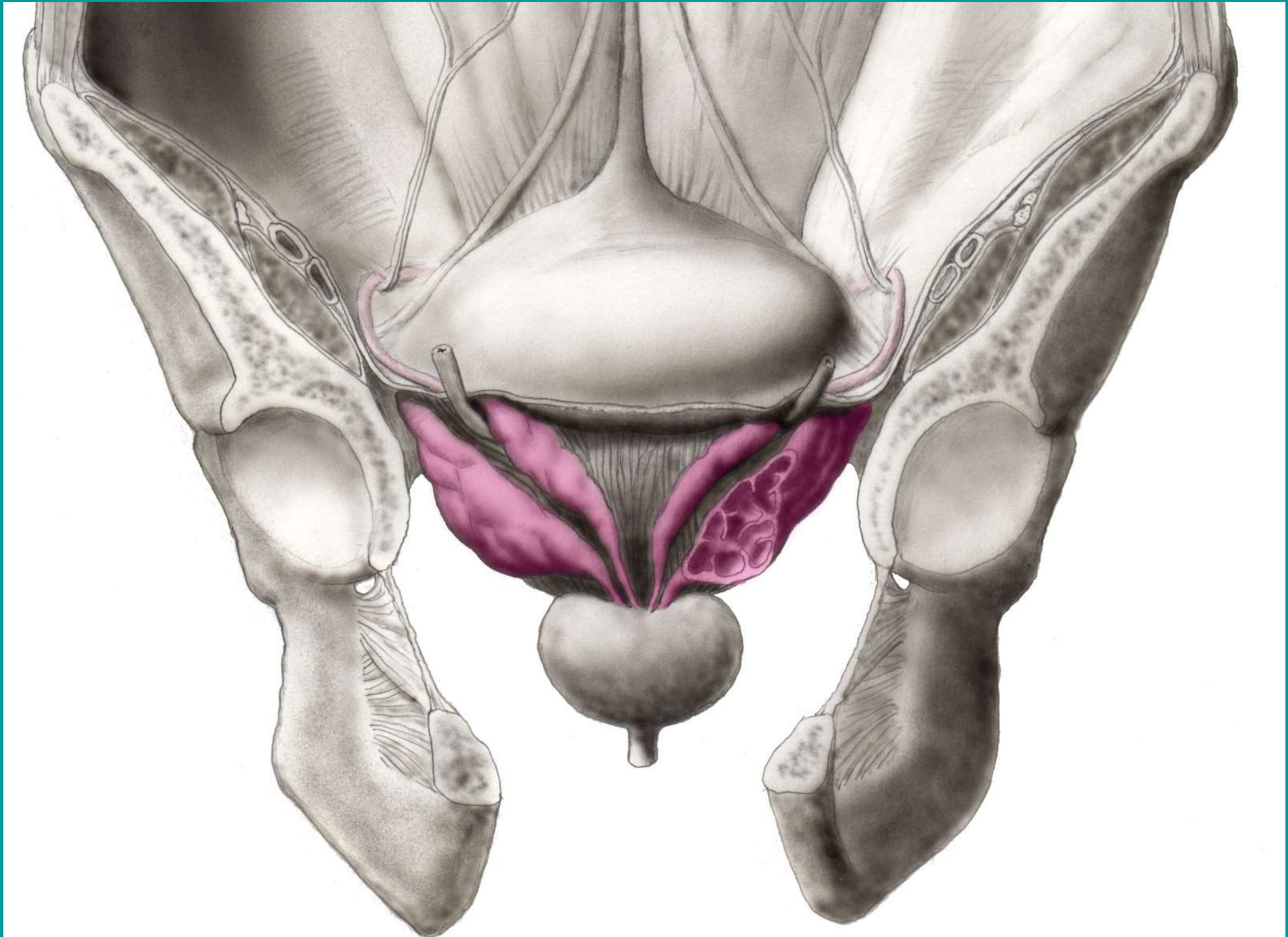


# Ductus deferens

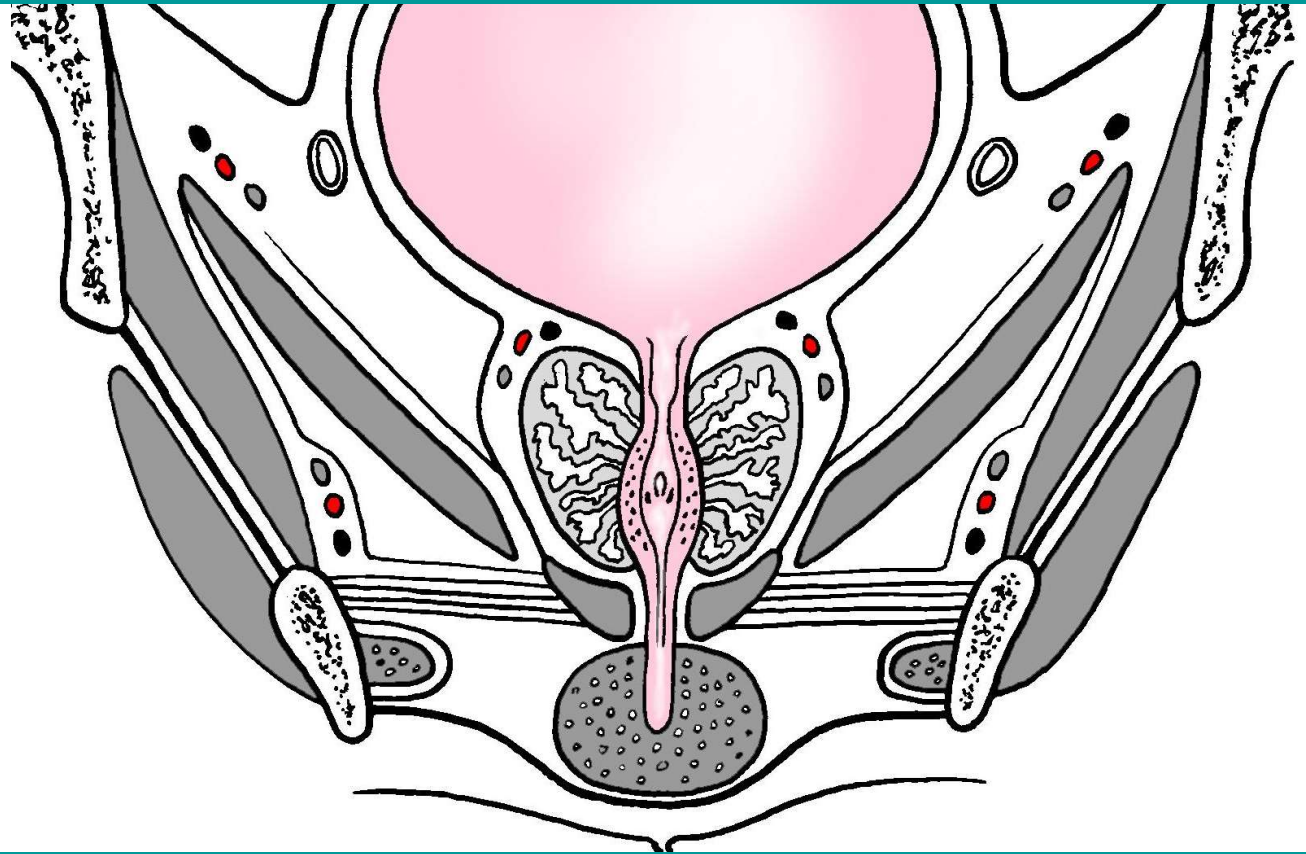
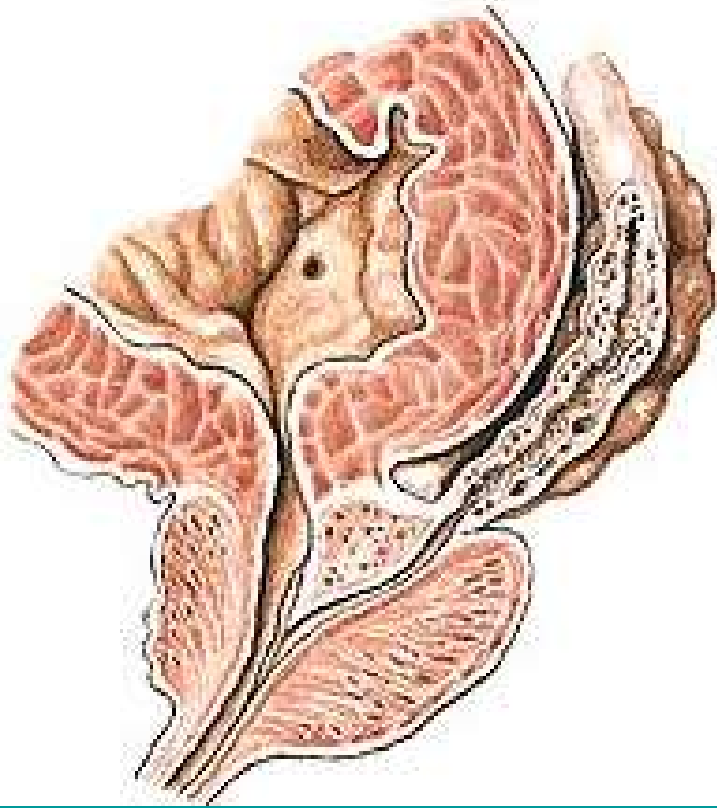
- pars scrotalis
- pars funicularis
- pars inguinalis
- pars pelvica (cum ampulla d.d.)



# Interampullar trigone

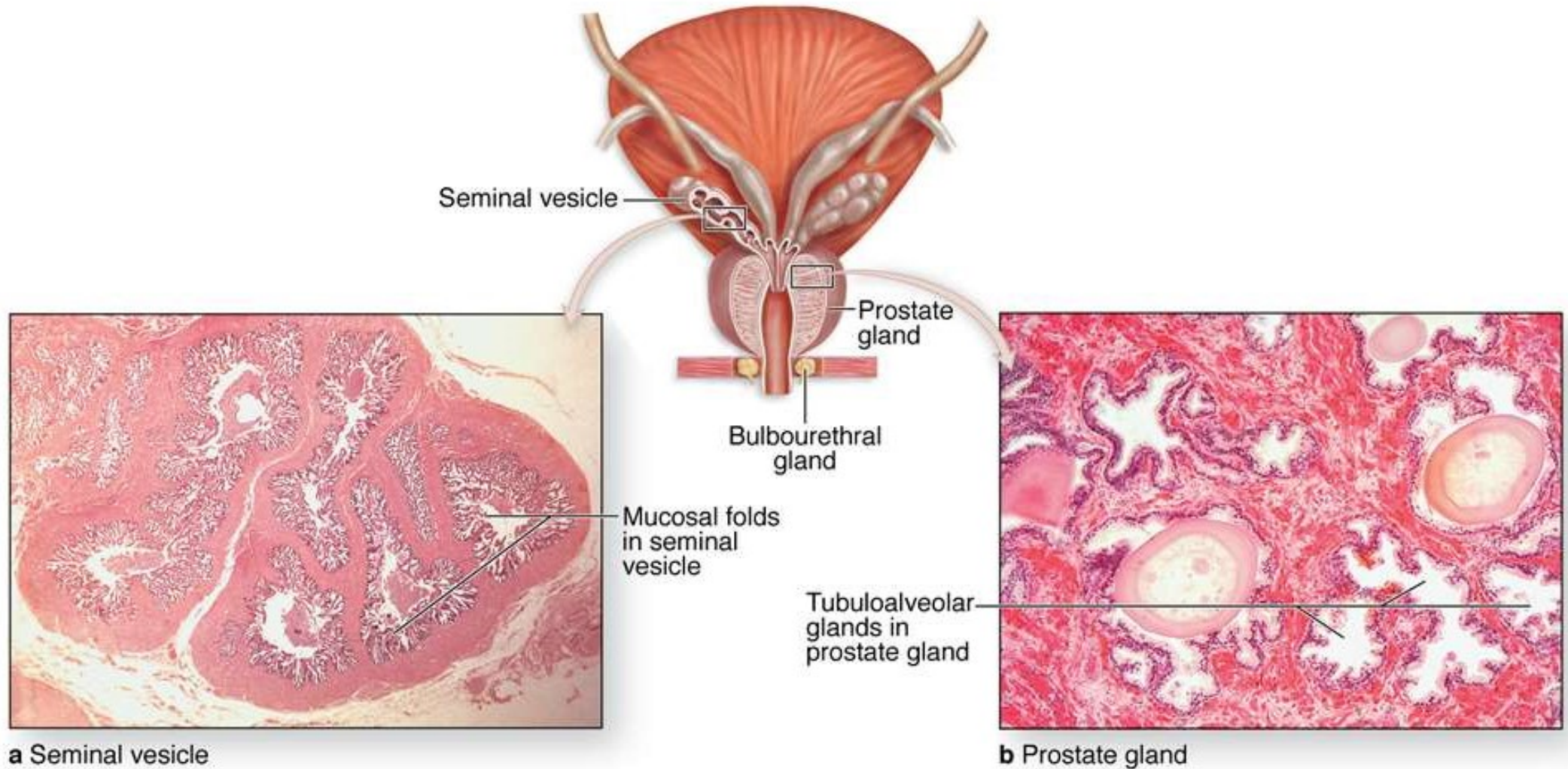




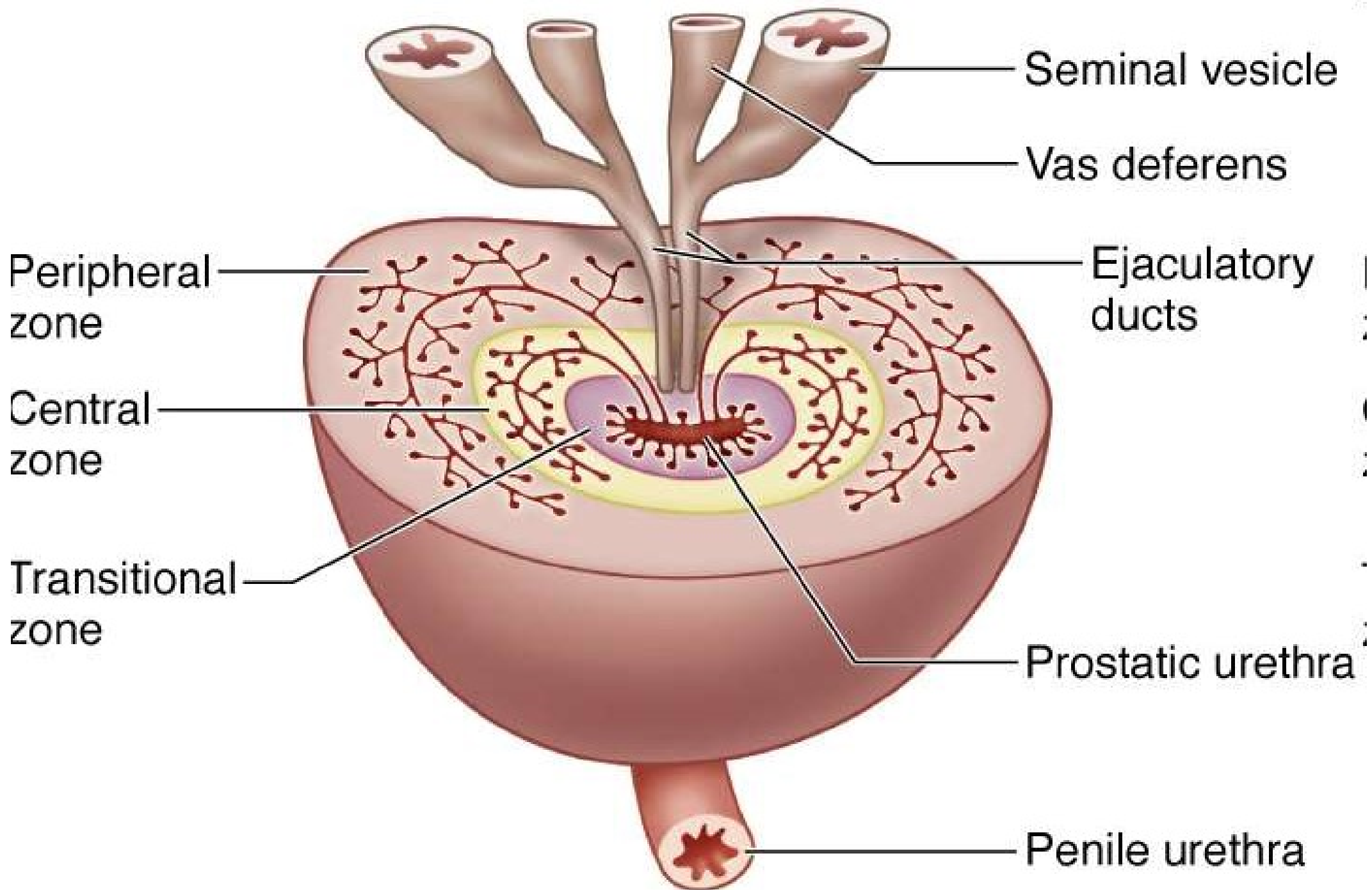


## Prostate

base, apex, anterior, posterior, inferolateral surface,  
capsule, **glandular parenchyme**, prostatic ducts,  
**muscular tissue**,  
right + left lobes, middle lobe,  
puboprostaticus, vesicoprostaticus mm.



Parenchyme of the prostate:  
dense fibromuscular stroma and tubuloalveolar glands



Organization of the prostate: mucosal glands, submucosal glands, main glands

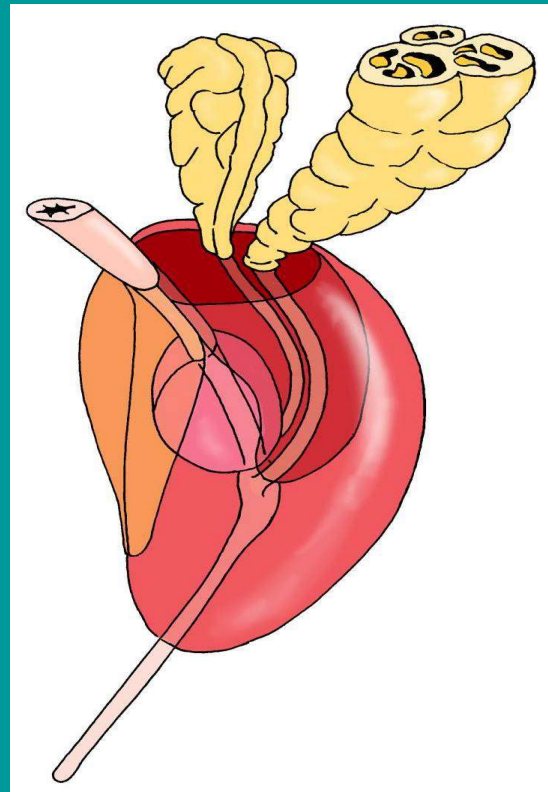
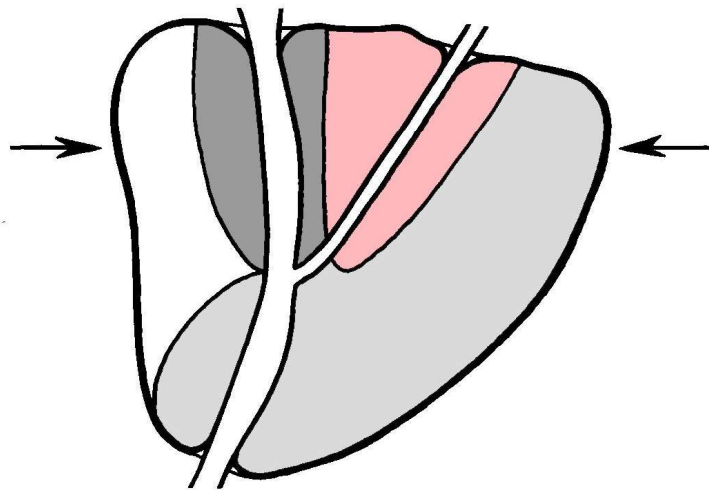
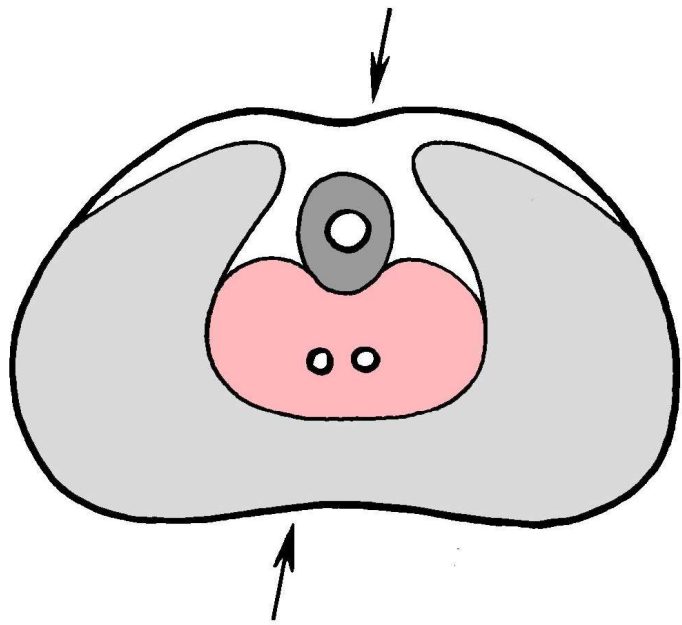
# Three zones of prostate McNeala (1968) transverse and oblique sagittal section:

Periurethral glands and transition zone GREY - hypertrophy

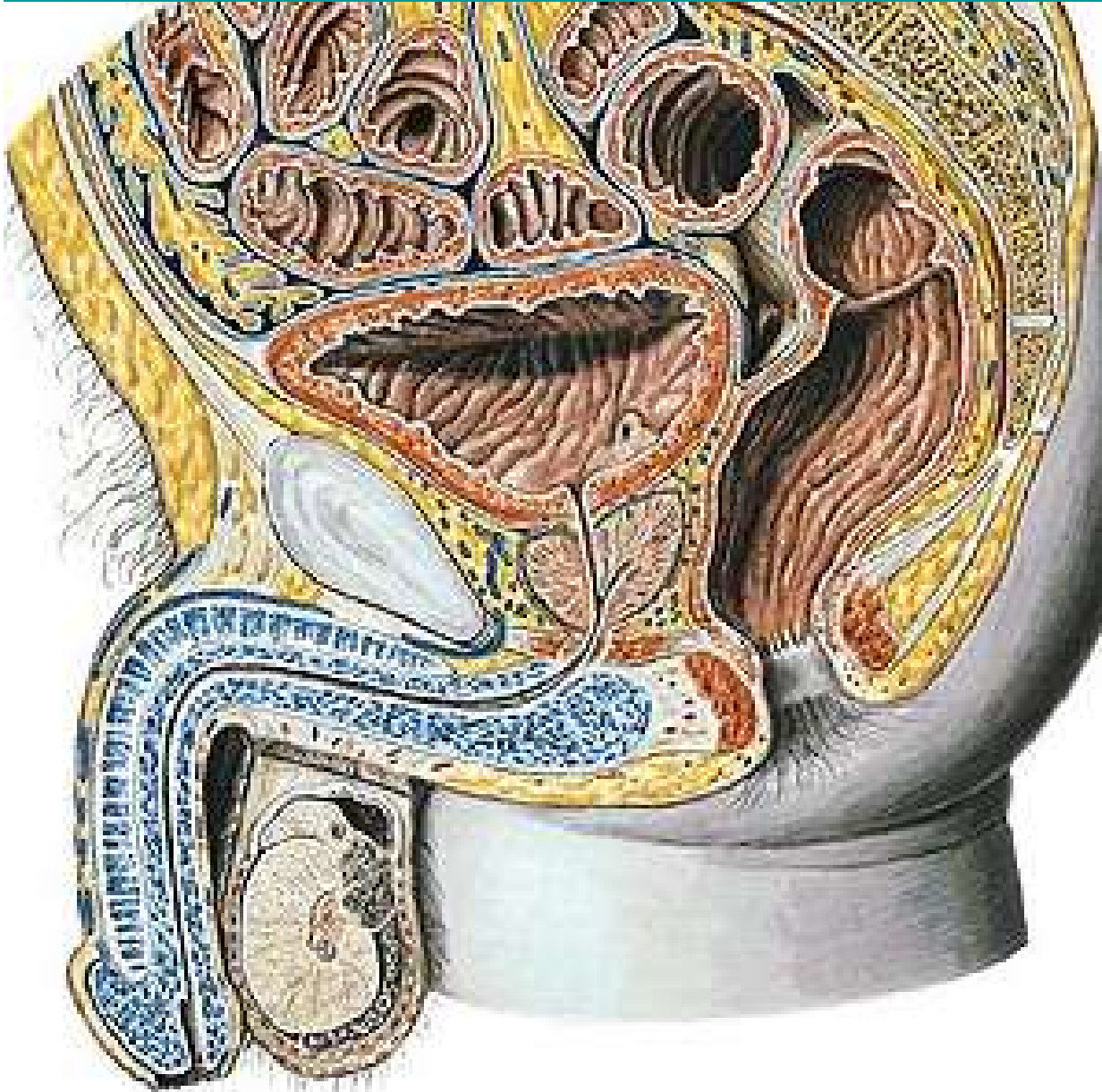
Peripheral zone PALE GREY – carcinoma

Central zone PINK – adenoma

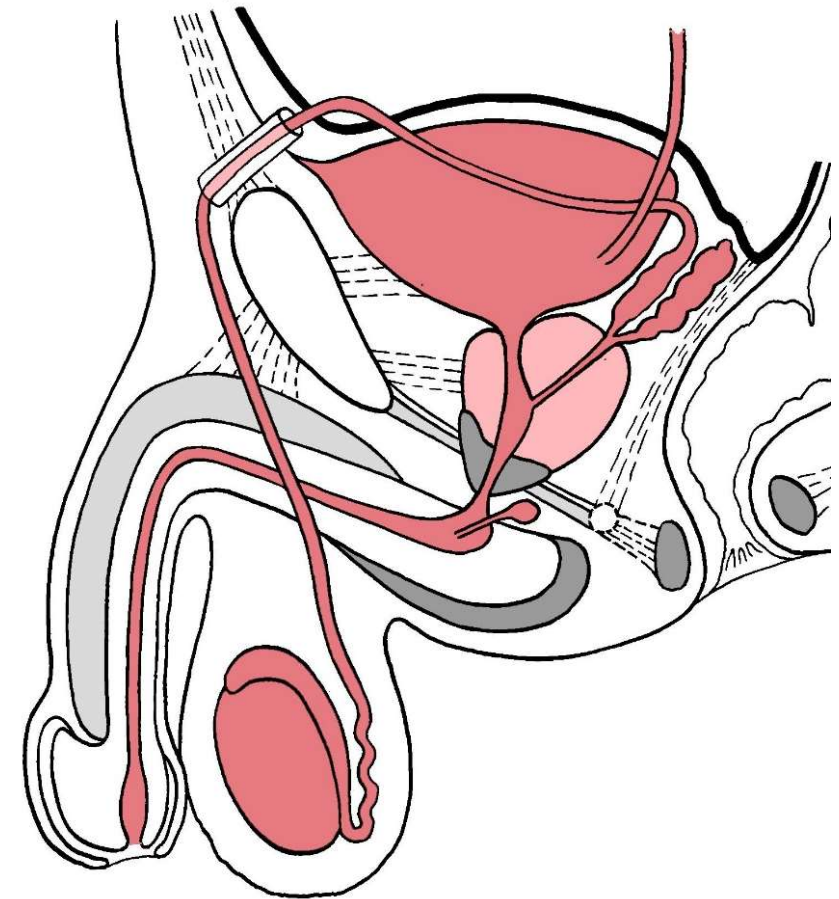
White – ventral portion connective tissue and smooth musculature

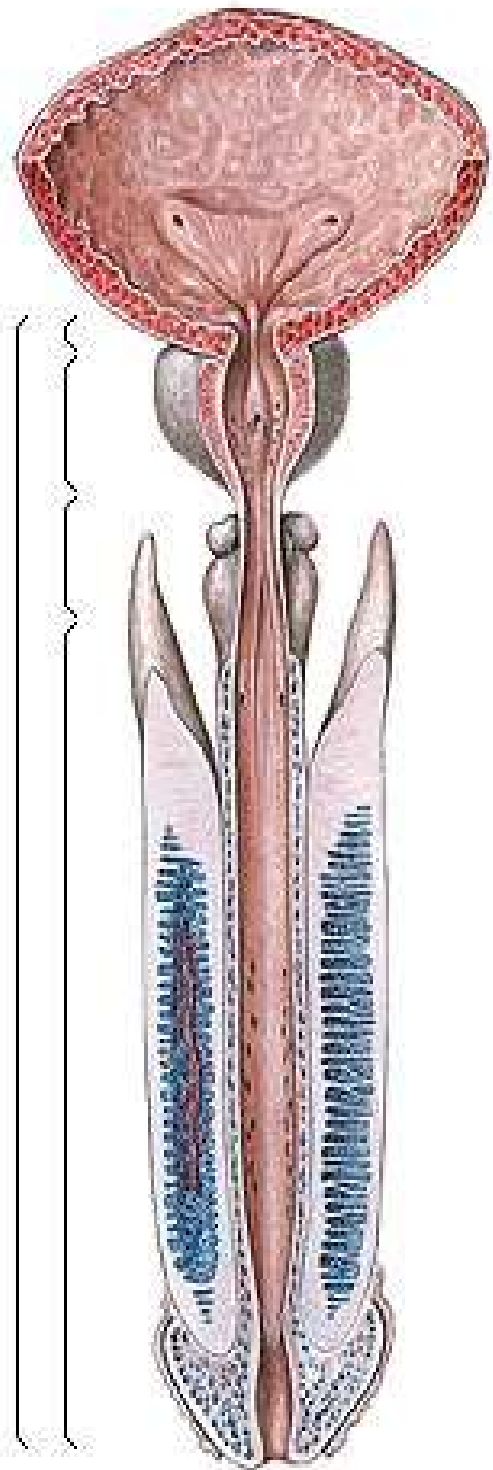


**Penis** - dorsum, urethral surface, root, body, raphe, suspensory lig., fundiform lig., subpubic + prepubic curve



corpus cavernosum  
corpus spongiosum  
bulb, glans, prepuce





## Male urethra (urinary + seminal duct)

internal orifice

intramural

prostatic

spongy part

external orifice

seminal colliculus

prostatic sinus

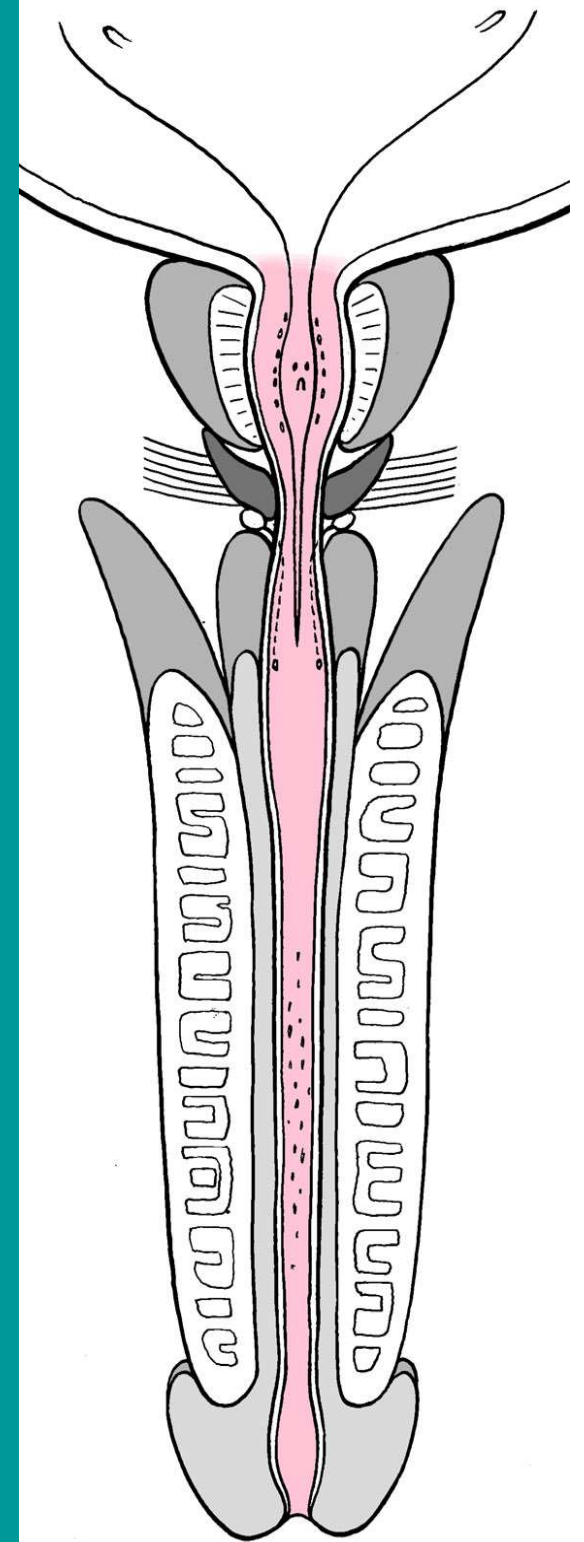
internal urethral sphincter

external urethral sphincter

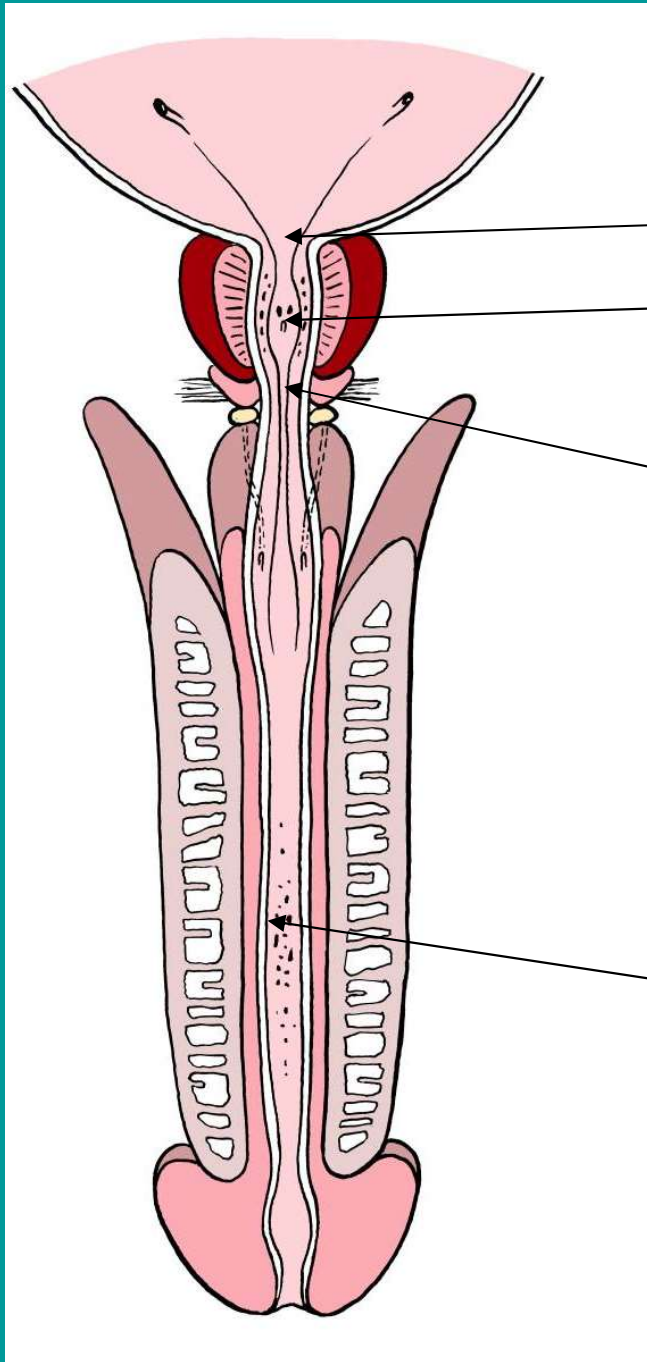
urethral glands

urethral lacunae

**navicular fossa – blind pocket  
dorsally**



# Mužská močová trubice



**Pars intramuralis**

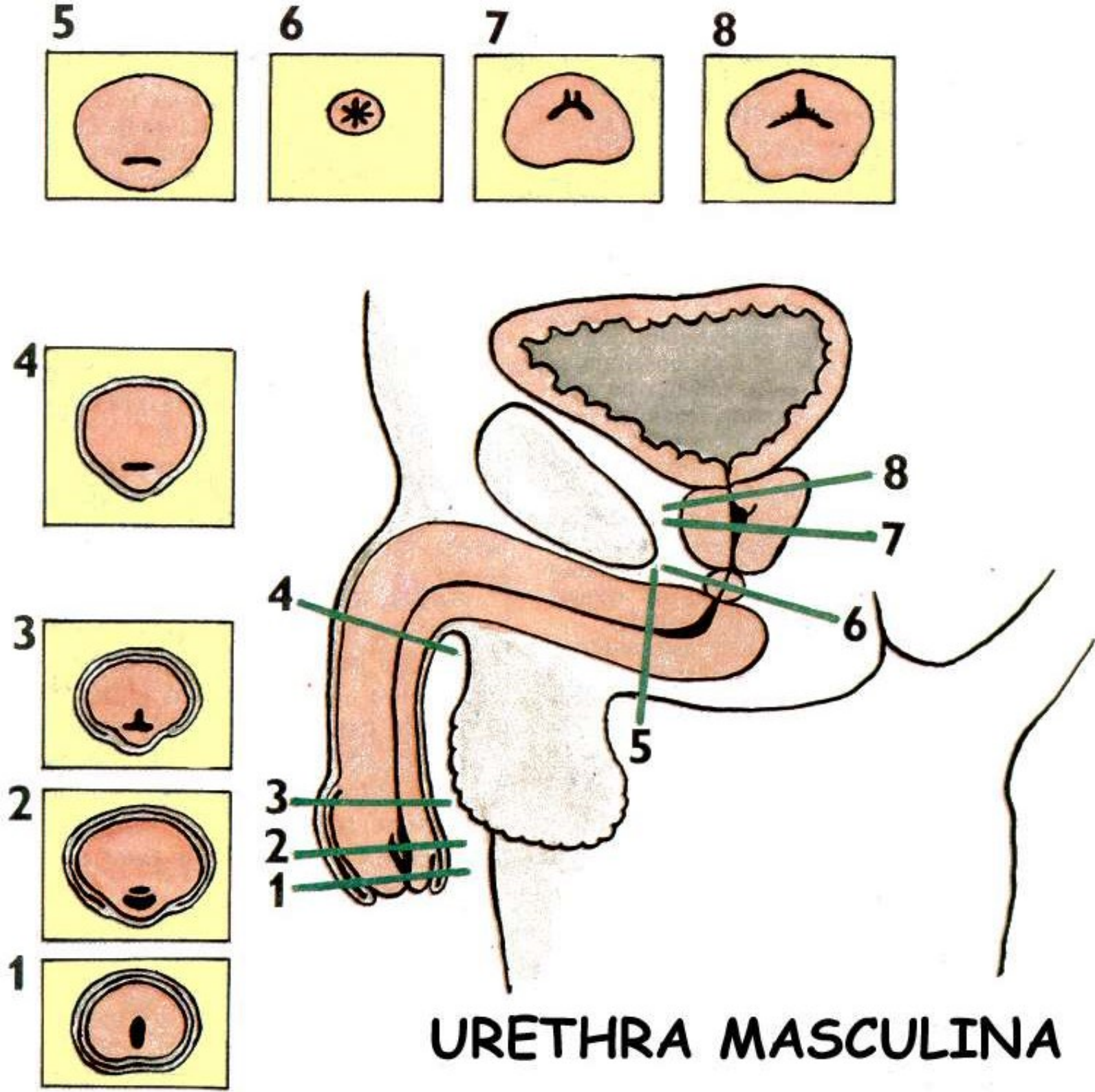
**Pars prostatica**

**Pars membranacea**

**Pars spongiosa**

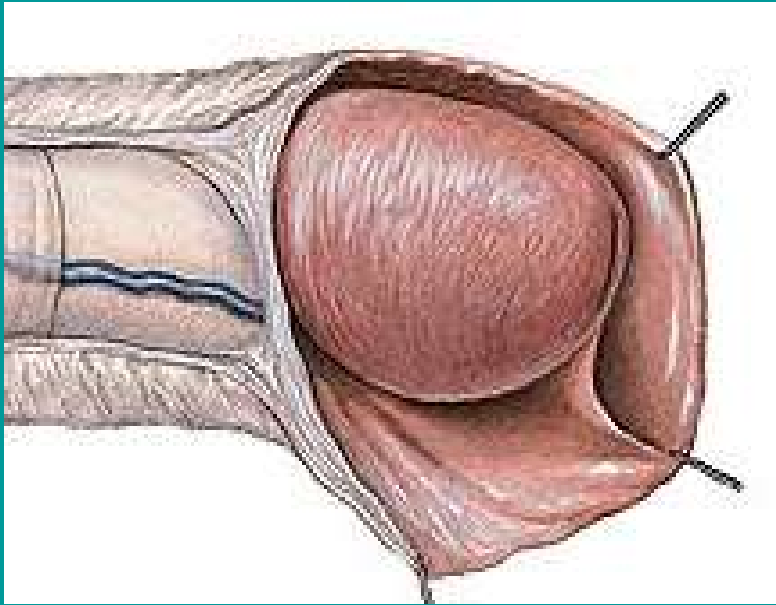


**lacuna magna/recessus fossae  
navicularis**



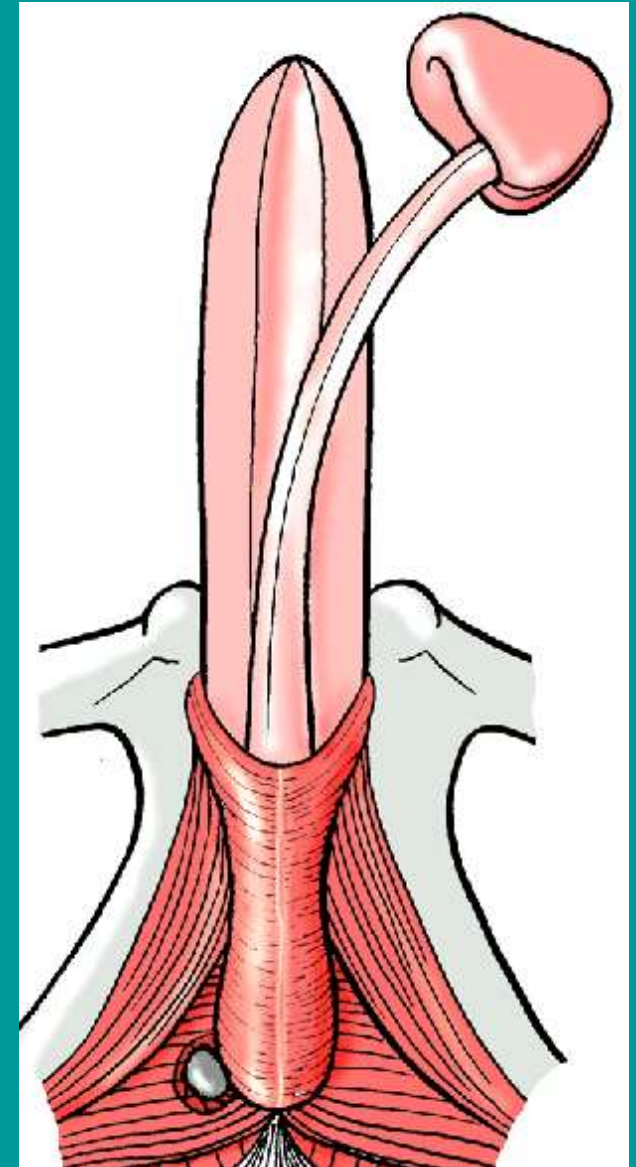


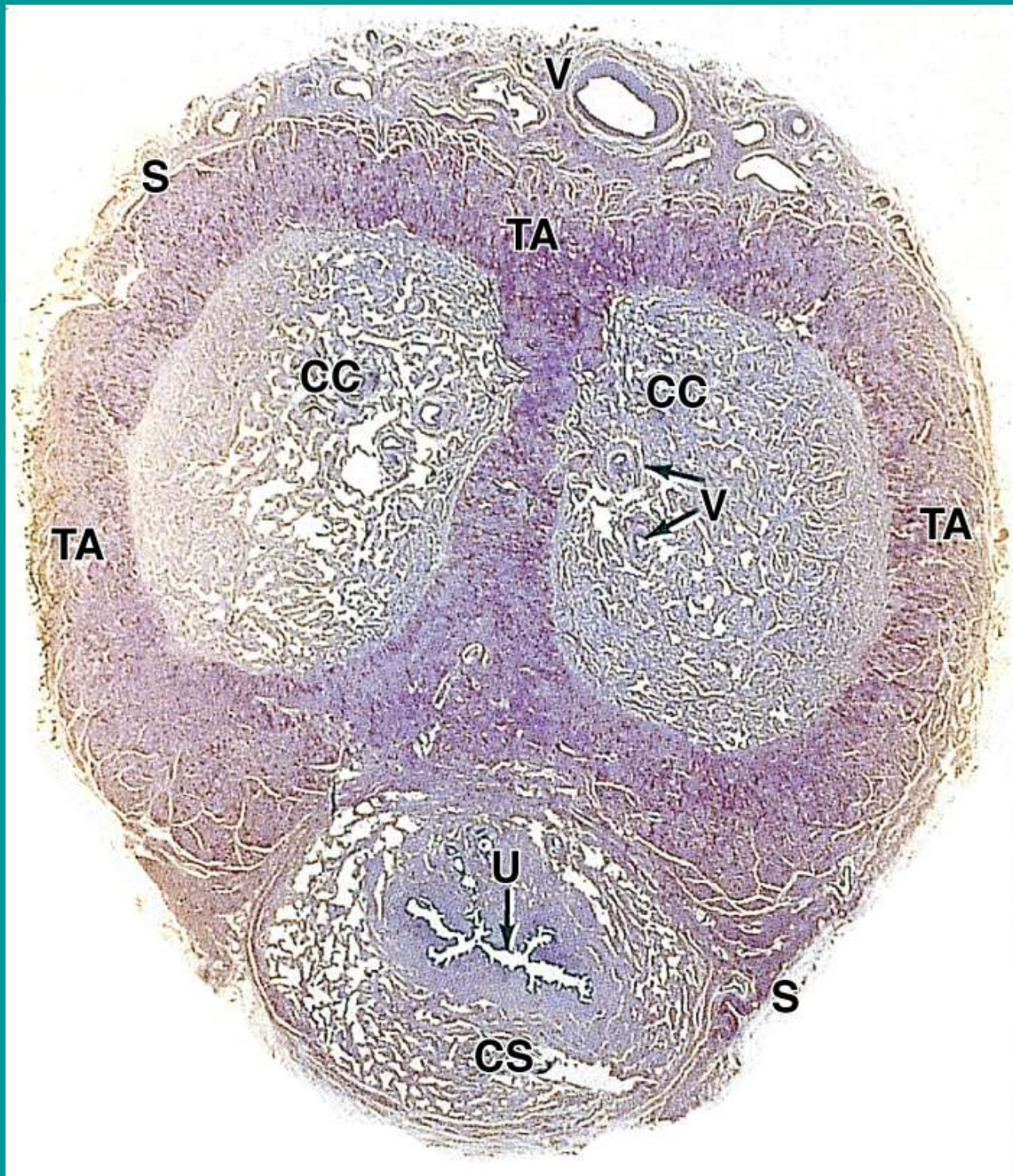
Corpus cavernosum penis, crus, corpus spongiosum, bulbus, m. ischiocavernosus, m. bulbospongiosus, glandula bulbourethralis



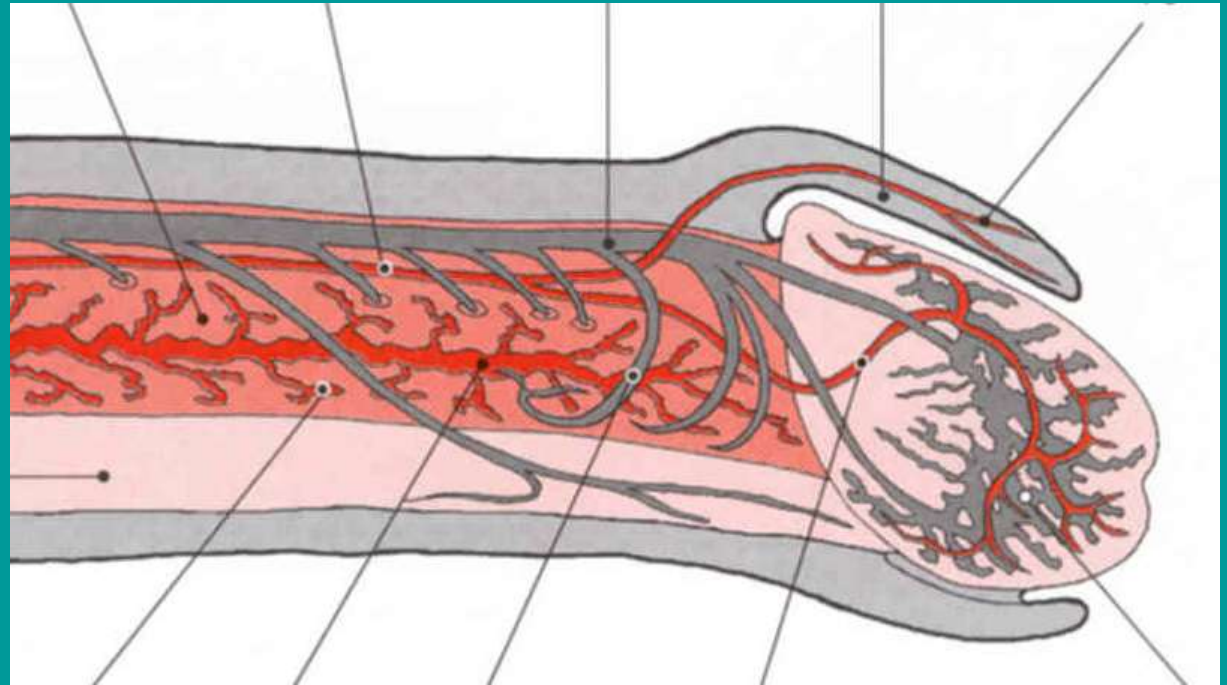
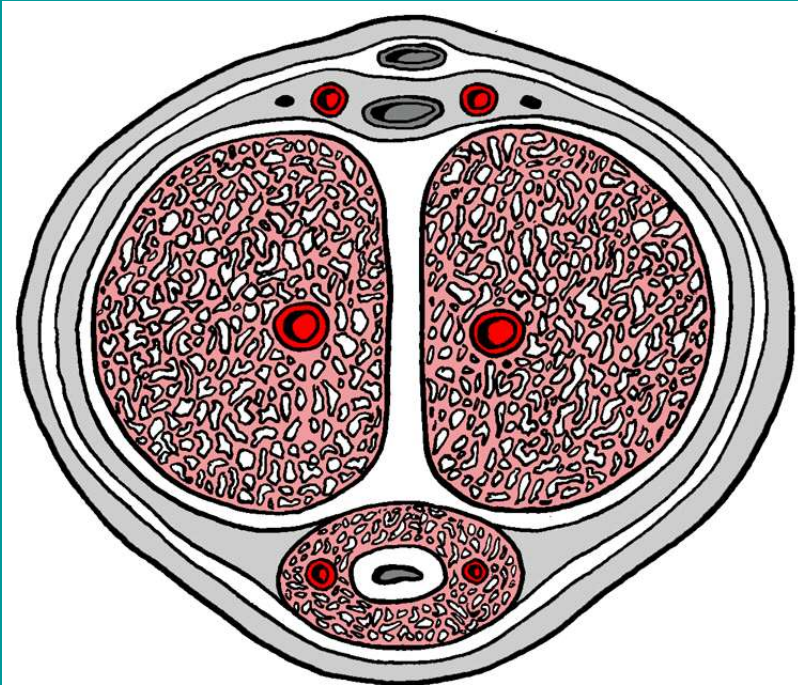
glans, corona glandis,  
preputium, frenulum

Separation of preputium  
from glans during 1.  
postnatal year,  
**circumcision, phimosis**





**Cross section of penis:** skin, tunica dartos, fascia penis superficialis, profunda, tunica albuginea, septum penis, trabeculae, cavernae



### **Blood vessels of penis**

**Arteries (paired) – branches of a. pudenda interna: a. dorsalis penis, a. profunda penis, aa. helicinae, a. bulbi penis, a. urethralis**

**Veins (unpaired) - v. dorsalis penis superficialis - vv. pudendae externae; vv. circumflexae, vv. cavernosae - v. dorsalis penis profunda — plexus venosus prostaticus**

**Erection**- hemodynamic process – dilatation of arterioles (aa. helicinae), accumulation of blood in cavernous bodies and restricted blood outflow through tunica albuginea. Prepubic curvature straightens.

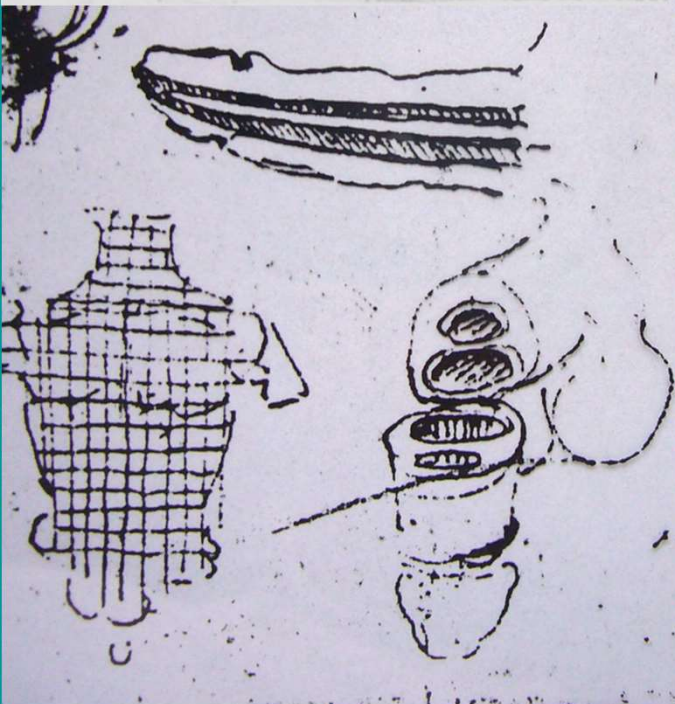
Vasodilation caused by **parasympathetic** nitrergic nerves – release of nitric oxide NO (sildenafil Viagra).

Reflex activation from sensory impulses and by supraspinal psychogenic mechanisms.

# Penis - supply

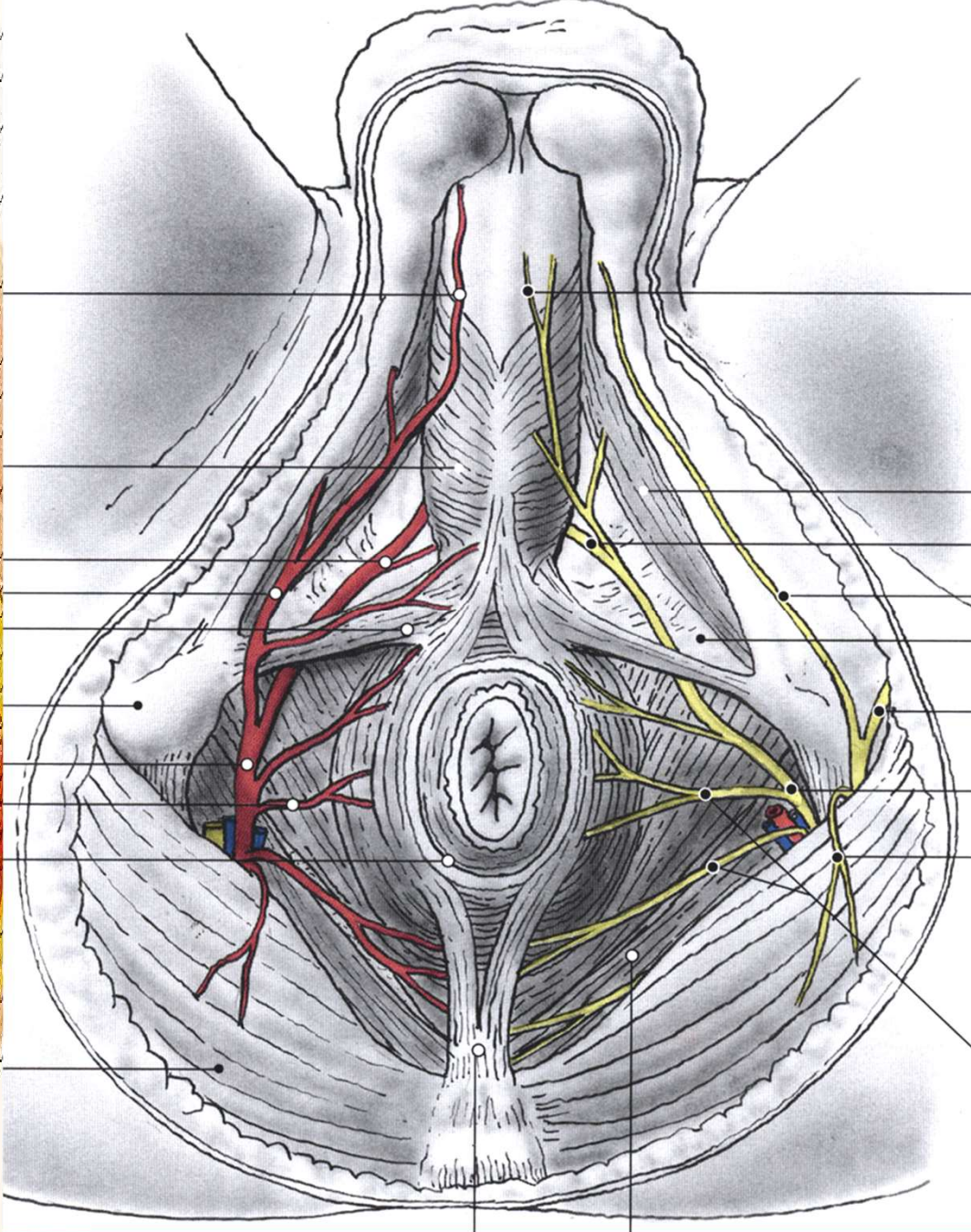
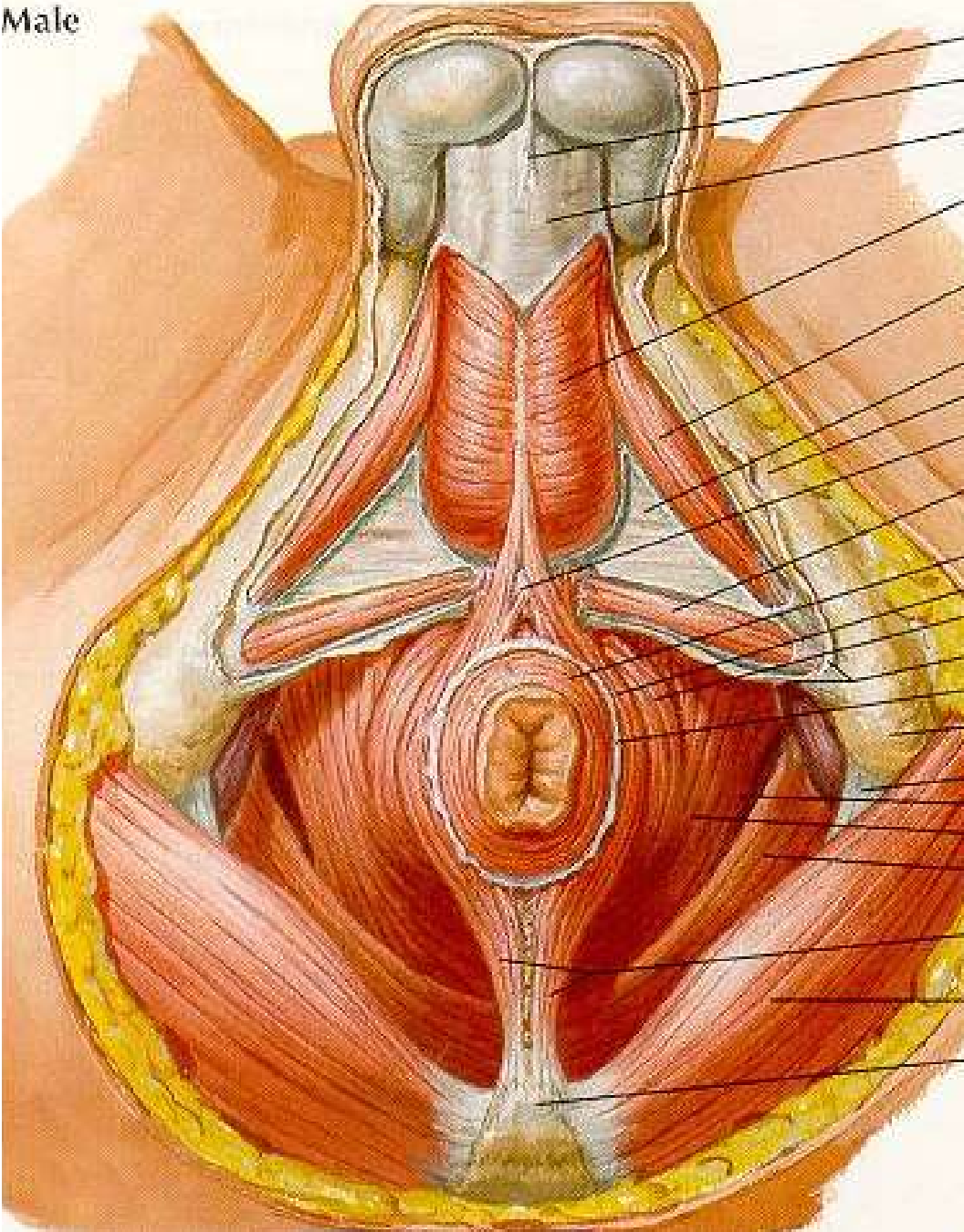
- **Tepny**: větve a. pudenda interna (a. dorsalis et profunda penis, a. urethralis, a. bulbi penis) → aa. helicinae → vv. cavernosae
- **Žíly**: v. dorsalis penis superf. → vv. pudendae ext. → v. femoralis  
v. dorsalis p. prof. + v. bulbi penis + v. urethralis → v. pudenda int. → v. iliaca int.
- **Míza**: n.l. inguinales superf. (kůže), prof.(glans) et iliaci interni (tělesa, urethra)
- **Nervy**: n. pudendus – n. dorsalis penis (*sympatikus*-plexus hypogastricus inf., *parasympatikus*- nn. splanchnici pelvici S2-4)  
– glans penis is the most sensitive skin part of the body!

Clark K, Pedretti C. *The drawings of Leonardo da Vinci in the collection of Her Majesty the Queen at Windsor Castle*. London: Phaidon, 1968

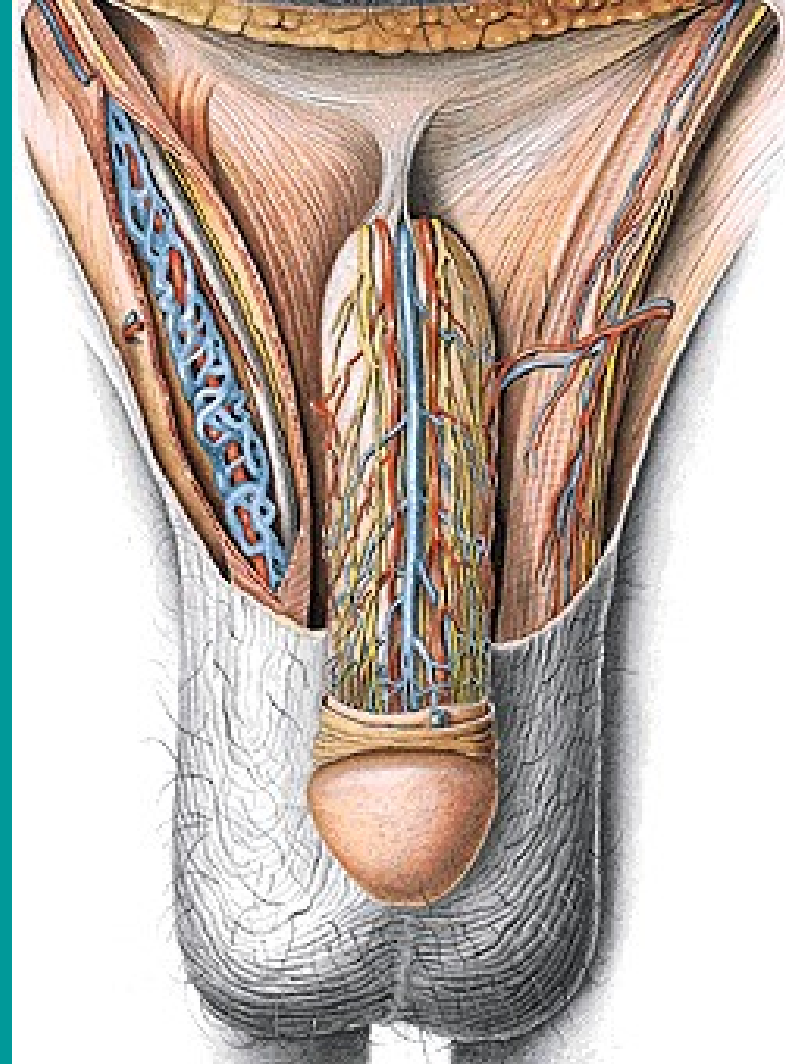
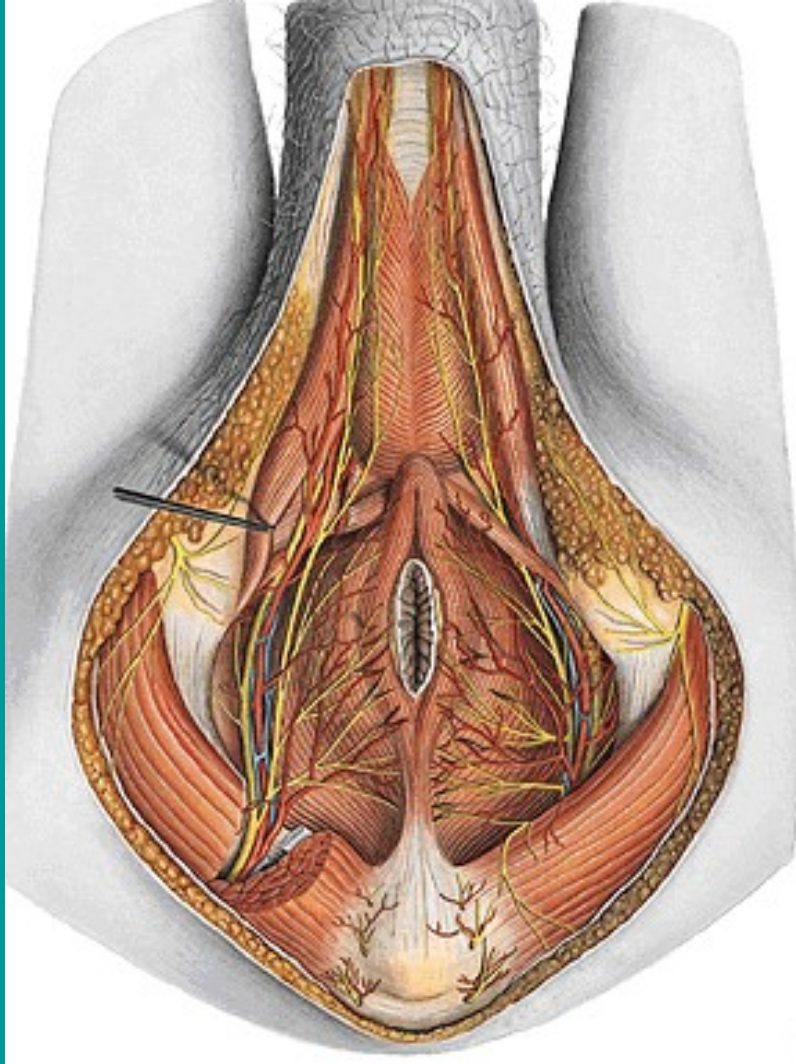


# Radix of penis, perineal muscles, blood supply, innervation

Male

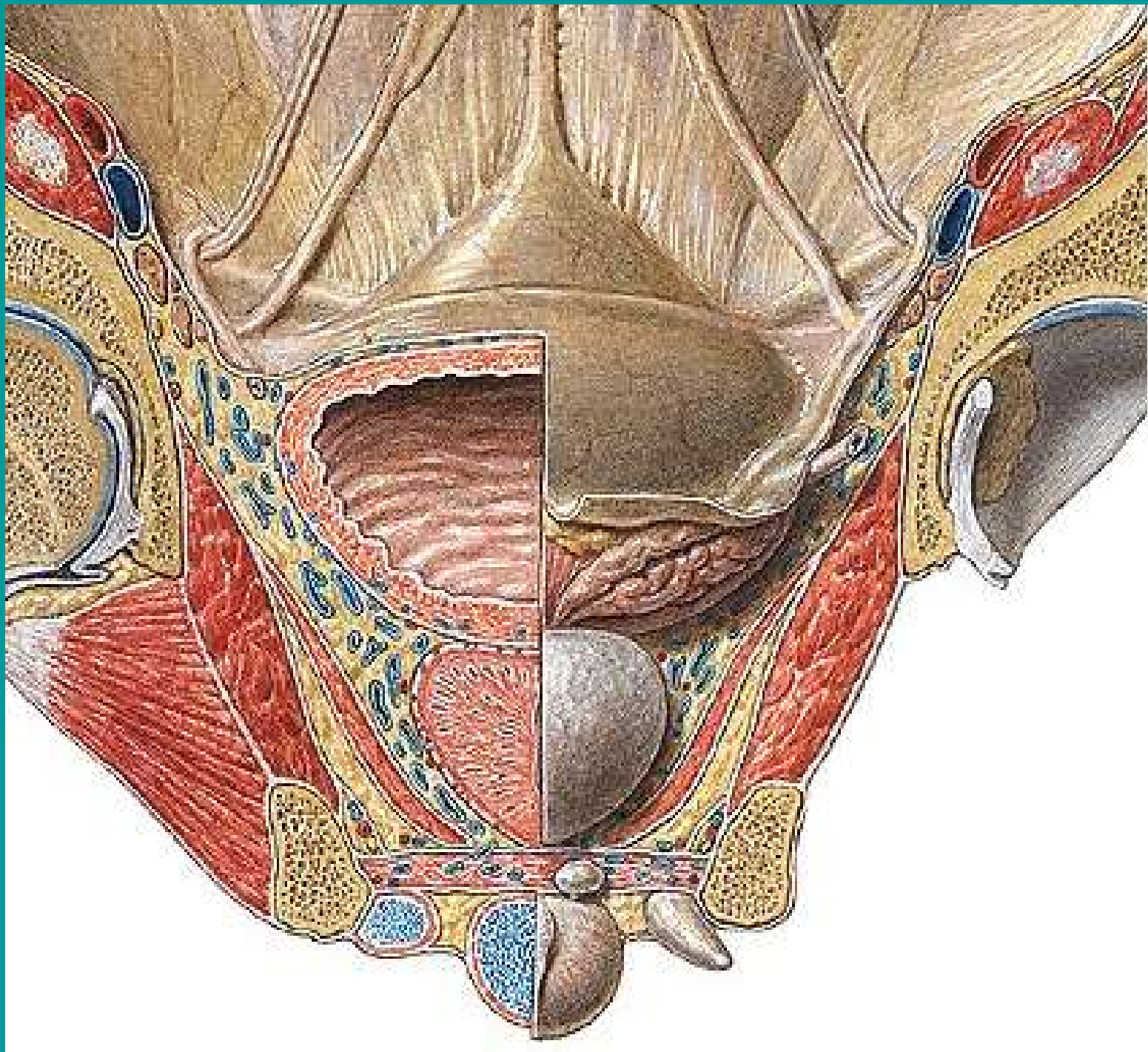


**N. pudendus – n. dorsalis penis (sensitive) regional anaesthesia**  
**Autonomous sympathetic L1-3 plexus hypogastricus inferior - nn. cavernosi along vessels**  
**Autonomous parasympathetic nn. erigentes from S3 around prostate(!).**



**A. pudenda interna:** a. dorsalis penis, a. profunda penis, a. urethralis, a. bulbi penis. **V. dorsalis penis superficialis**, v. dorsalis penis profunda





**Syntopy of prostate**

## Sources of illustrations used :

**Gray's Anatomy,**

**Sobotta: Atlas der Anatomie des Menschen**

**Grim, Druga: Regional Anatomy, Galen, Prague 2012**

**Benninghoff, Drenckhahn: Anatomie I., II.**

**Carlson, B.M.: Human Embryology and Developmental Anatomy**

## Recommended Textbooks:

**R. S. Snell: Clinical Anatomy. 7th Edition, Lippincott Williams & Wilkins, 2004, pp. 478 – 562**

or

**K. L. Moore: Clinically oriented Anatomy, 3rd Edition, Williams & Wilkins 1992, pp. 501 – 635**

and

**W. Kahle: Color Atlas/Text of Human Anatomy, Vol. 2 Internal organs. Thieme, 4th English Edition, 1993**

**Langman's Medical Embryology, 11th Edition, 2010**

**Junqueira's Basic Histology 12th Edition, 2010**

**Gilroy, MacPherson, Schuenke, Schulte, Schumacher: Atlas of Anatomy, 3rd edition, Thieme 2016**