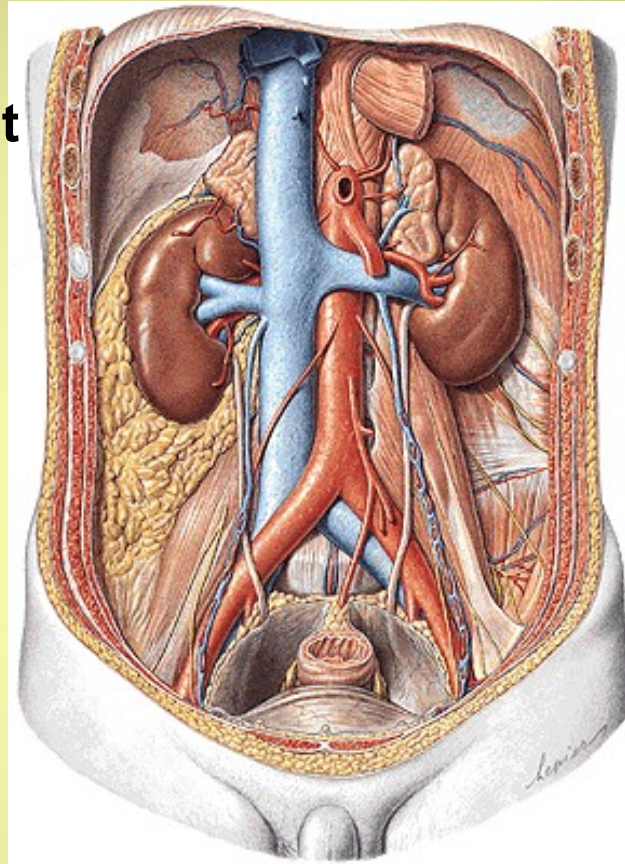


# **URINARY SYSTEM**

# **FUNCTIONS**

- **Removal of waste product from the body**
- **Regulation of electrolyte balance**
- **Regulation of acid-base homeostasis (blood pH)**
- **Controlling blood volume and maintaining blood pressure**



# **PARTS**

**Kidney (ren)**

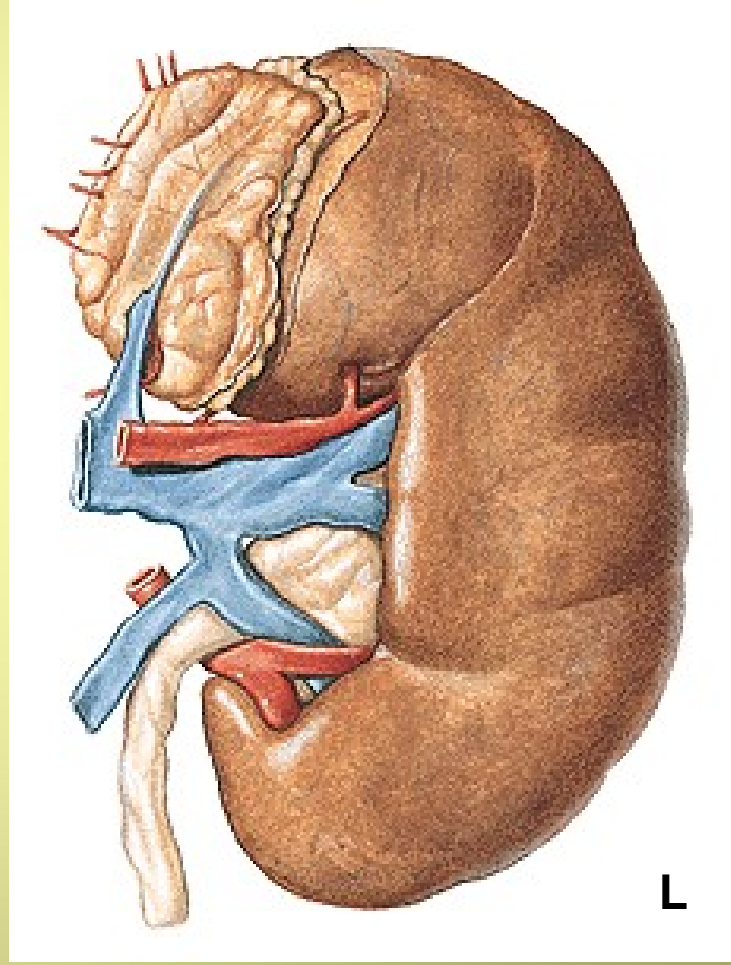
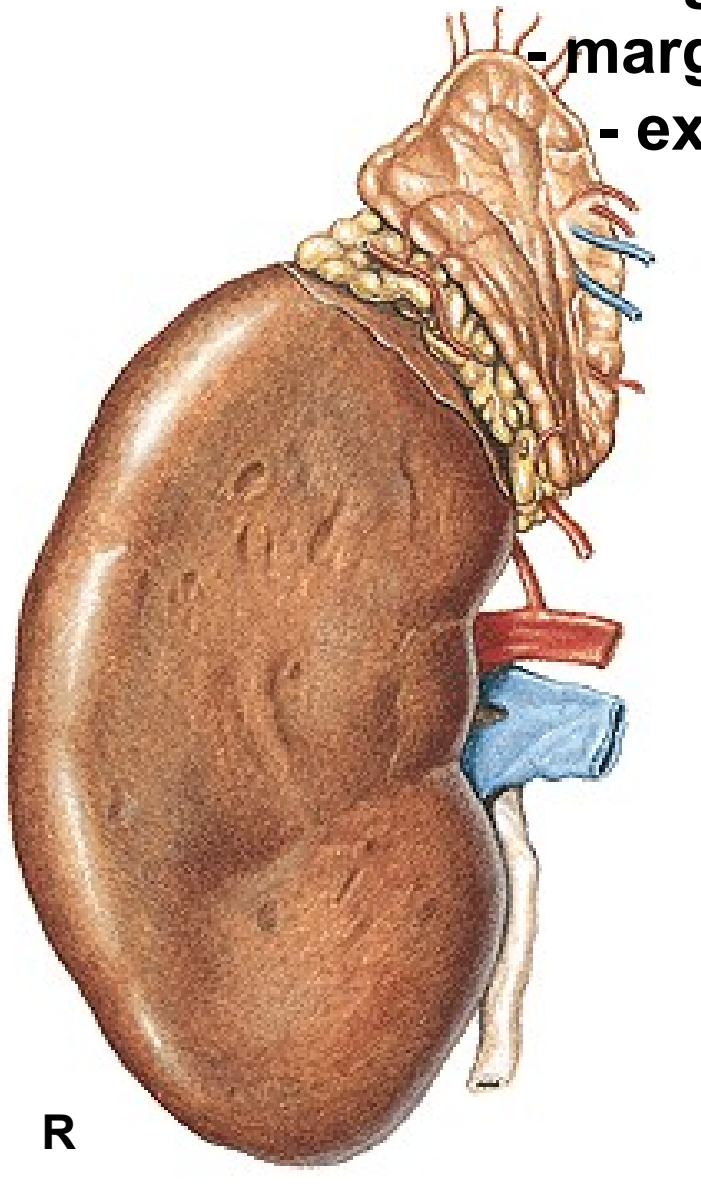
**Efferent urinary tract:**  
renal calices  
renal pelvis  
ureter  
urinary bladder  
urethra

# REN, NEPHROS - facies anterior et posterior

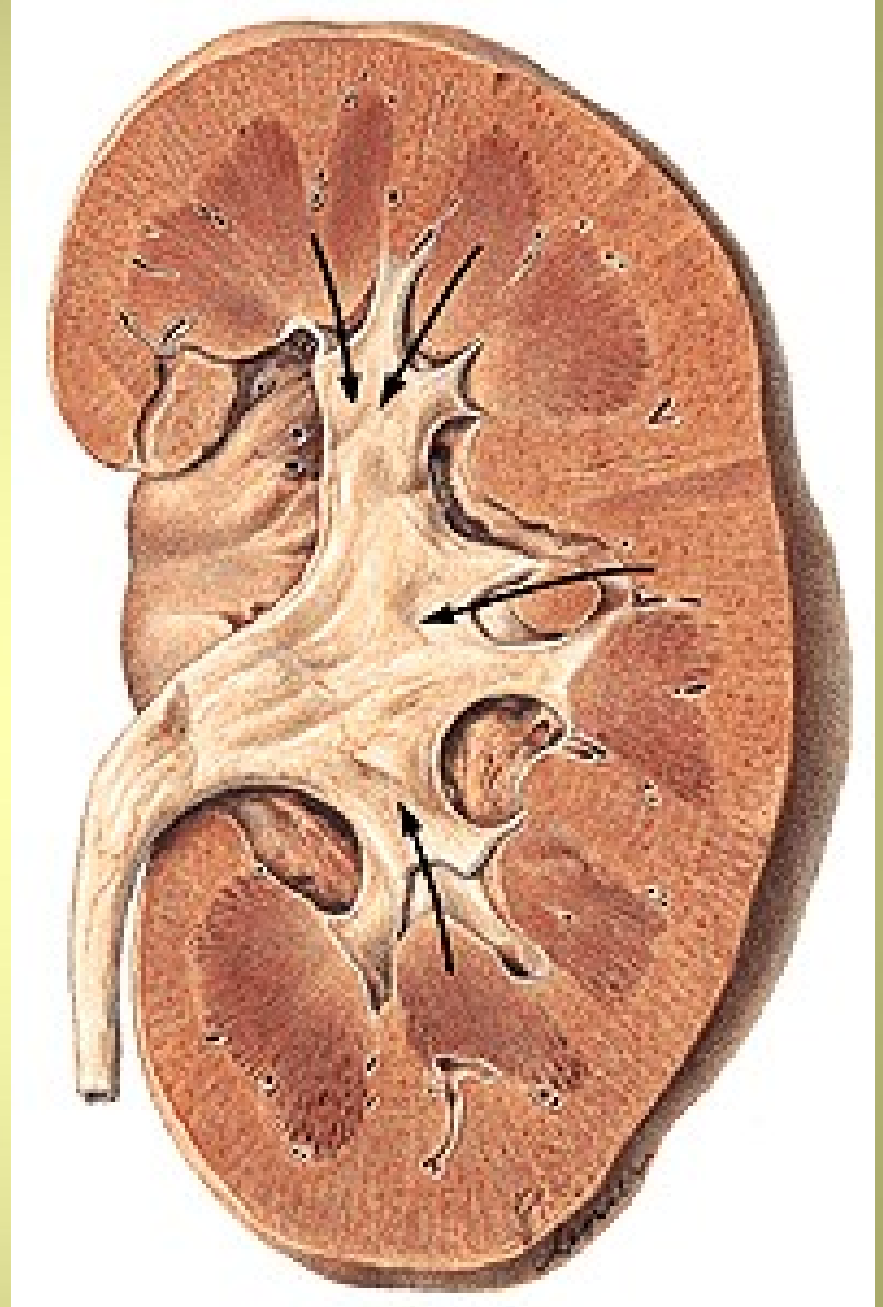
- margo medialis - hilum renale (sinus renalis)

- margo lateralis

- extremitas superior et inferior



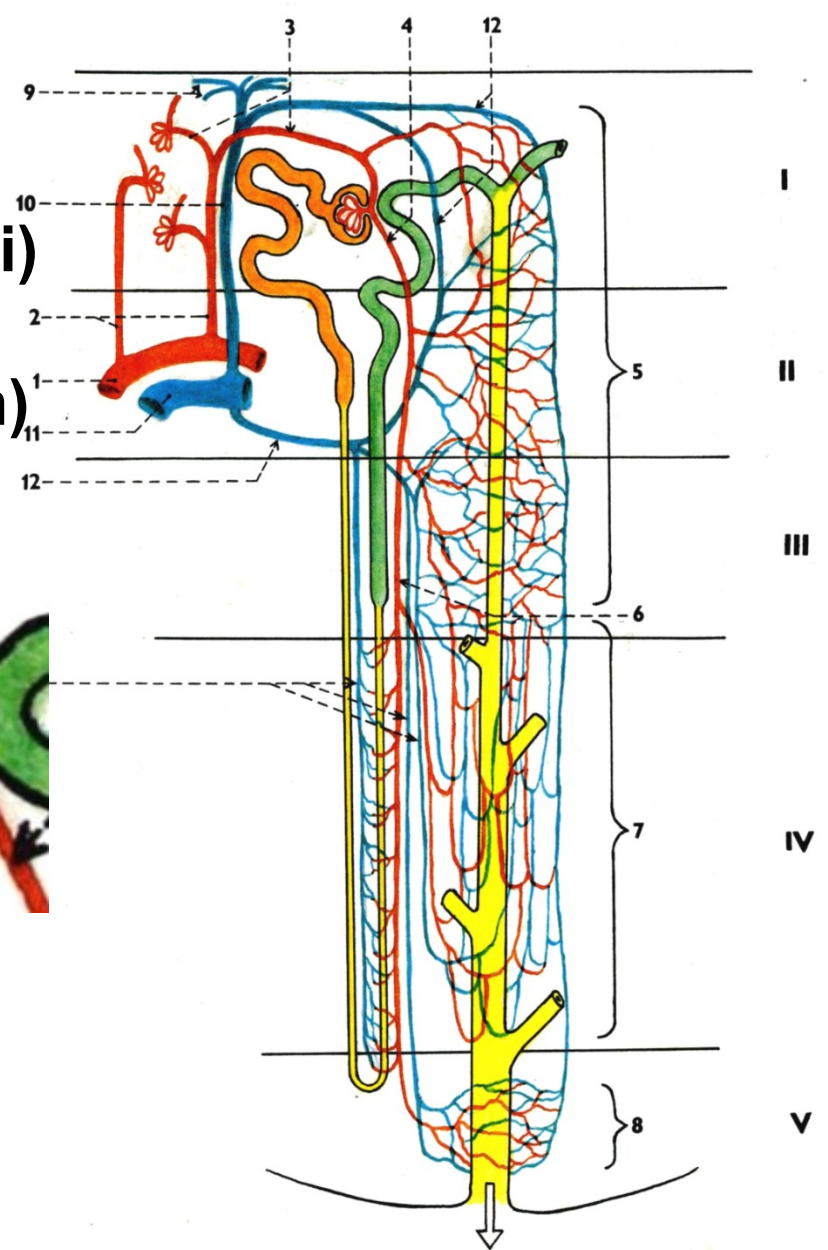
**Capsula fibrosa**  
**Sinus renalis**  
**Cortex renalis**  
**Medulla renalis**  
– 6-20 pyramides renales  
**Columnae renales**  
**Papilla renalis**  
**Ductus papillares**  
**Foramina papillaria**  
**Area cribrosa**  
**Lobus renalis**



# NEPHRON

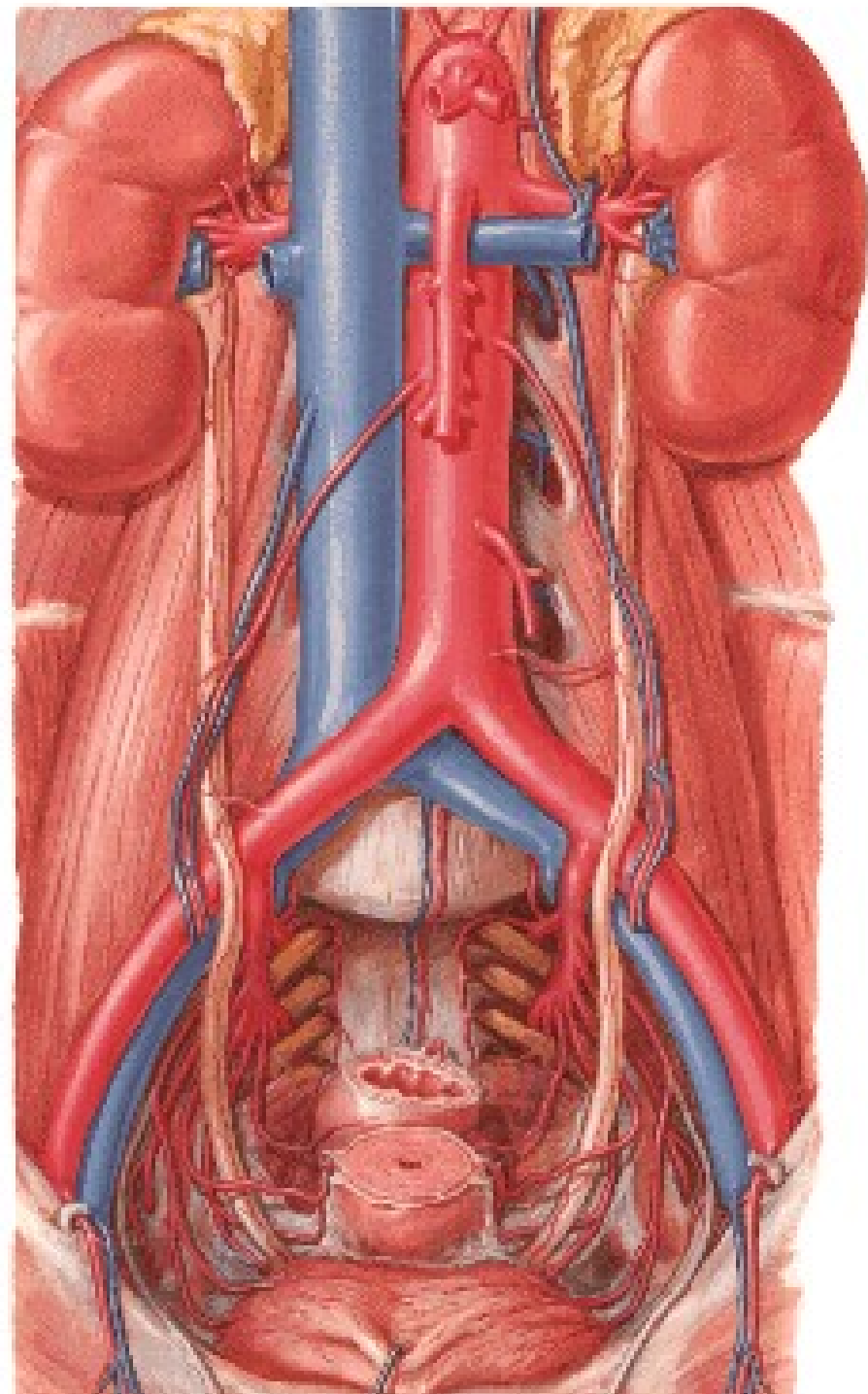
- Corpusculum renale (Malpighi)
  - Glomerulus
  - Capsula glomeruli (Bowman)
- Tubulus proximalis
- Henle's loop
- Tubulus distalis

Tubulus colligens  
Ductus papillaris  
Foramen papillare



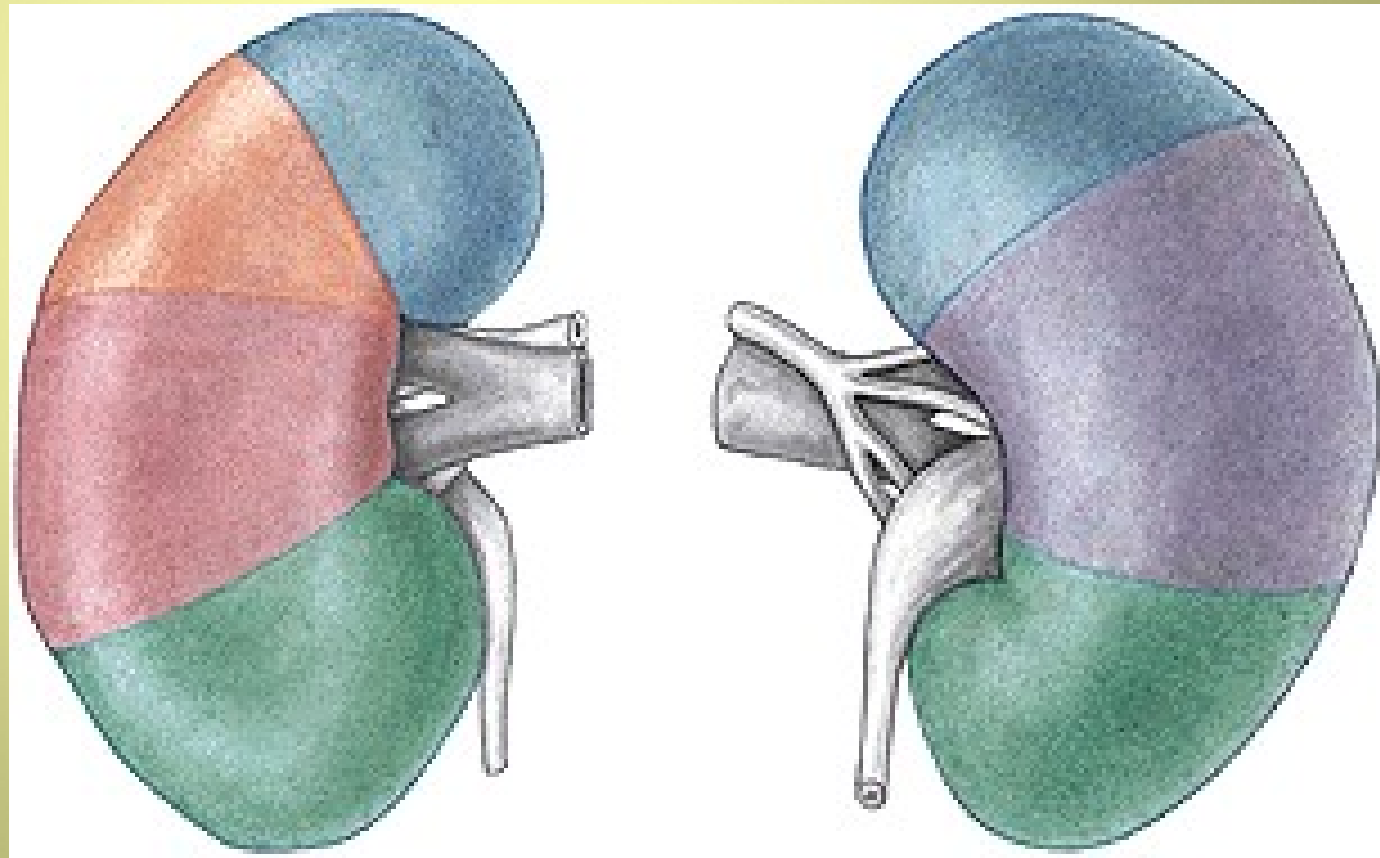
renalis

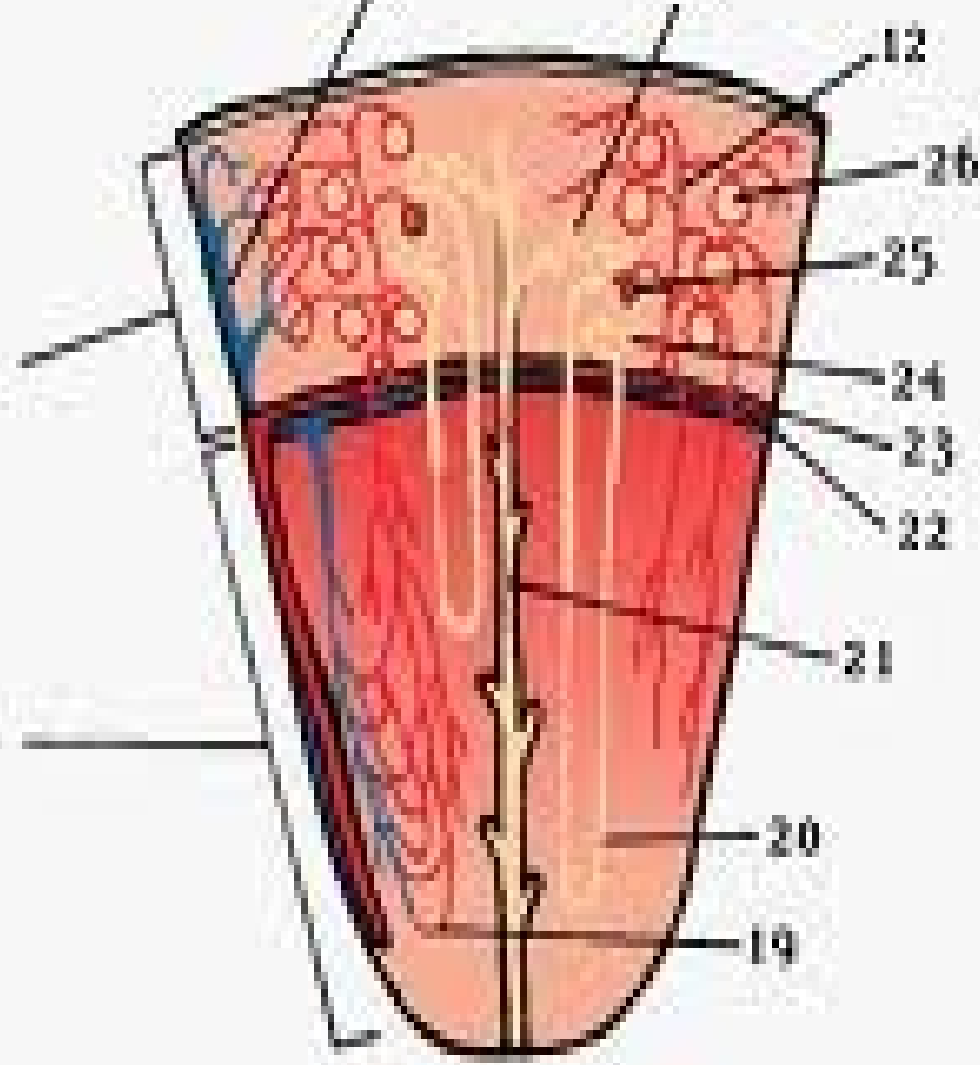
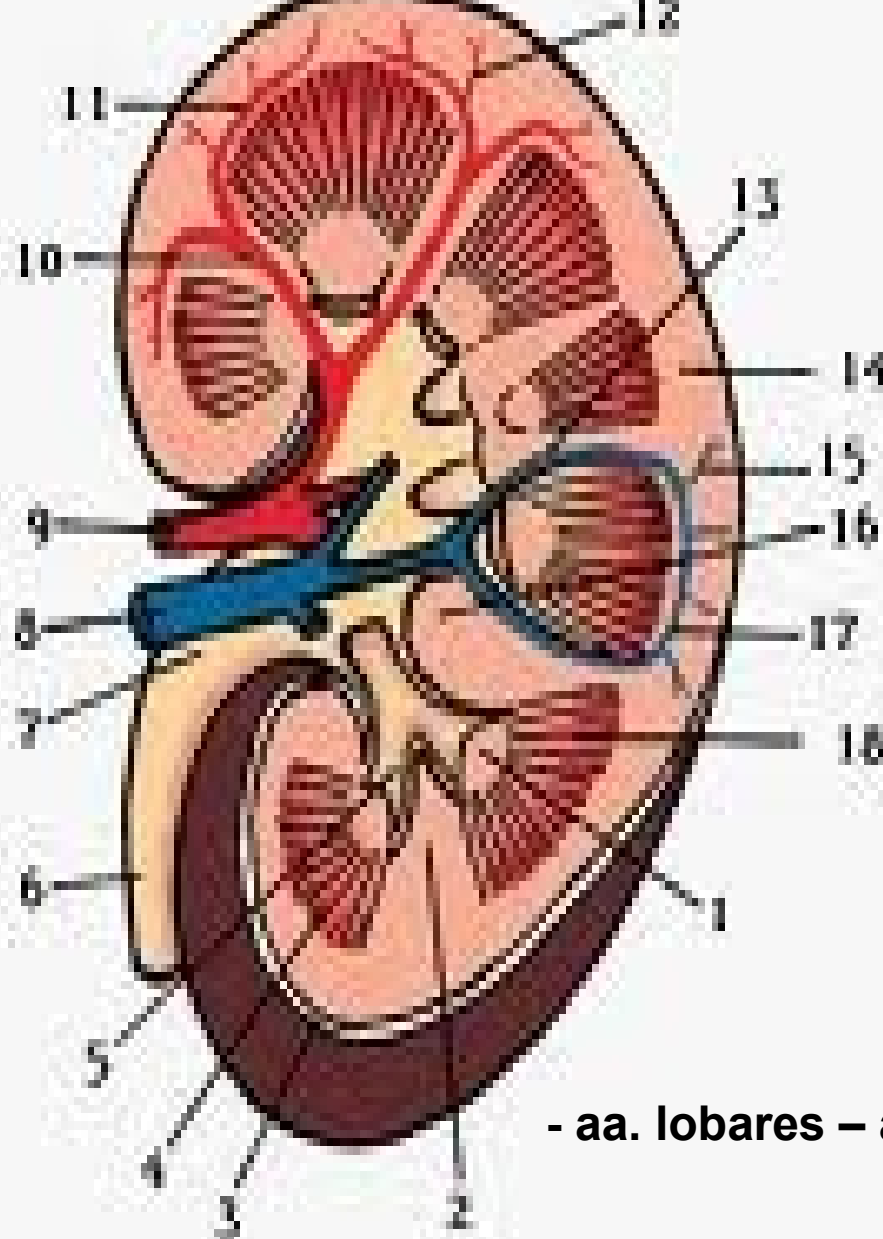
- r. anterior – 4 rr. praepelvici
- r. posterior – r. retropelvicus



## Segmenta renalia – s. superius

- s. anterius superius
- s. anterius inferius
- s. inferius
- s. posterius



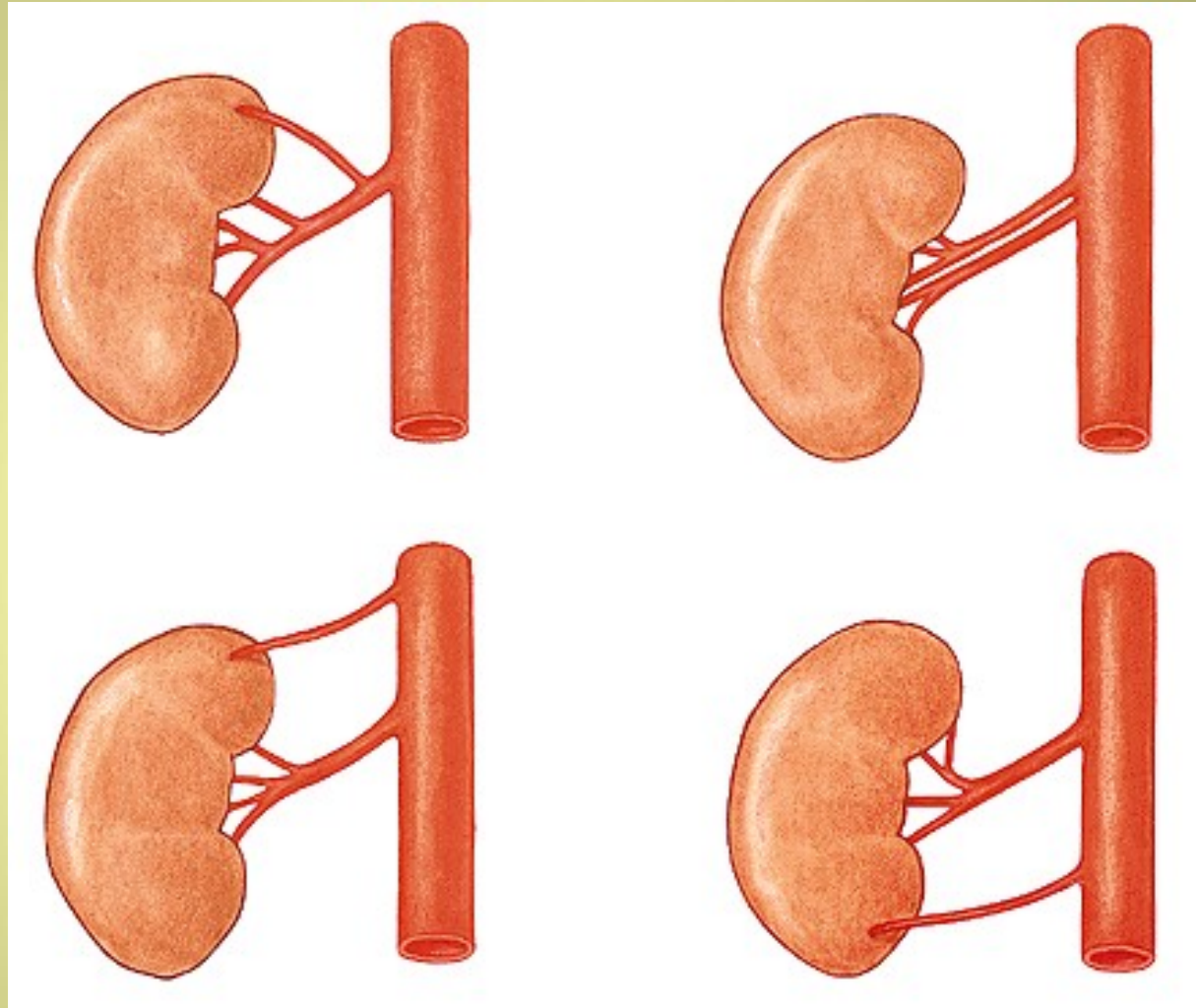


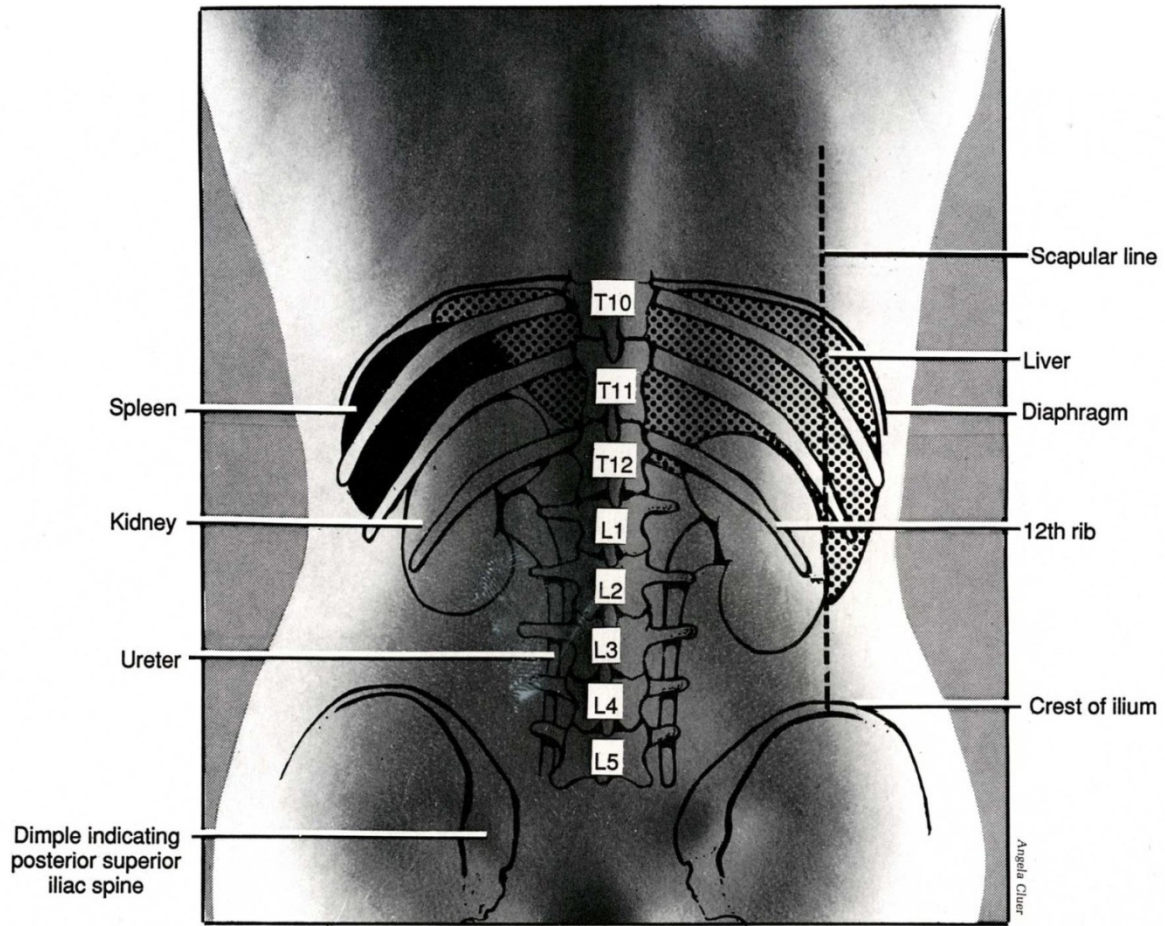
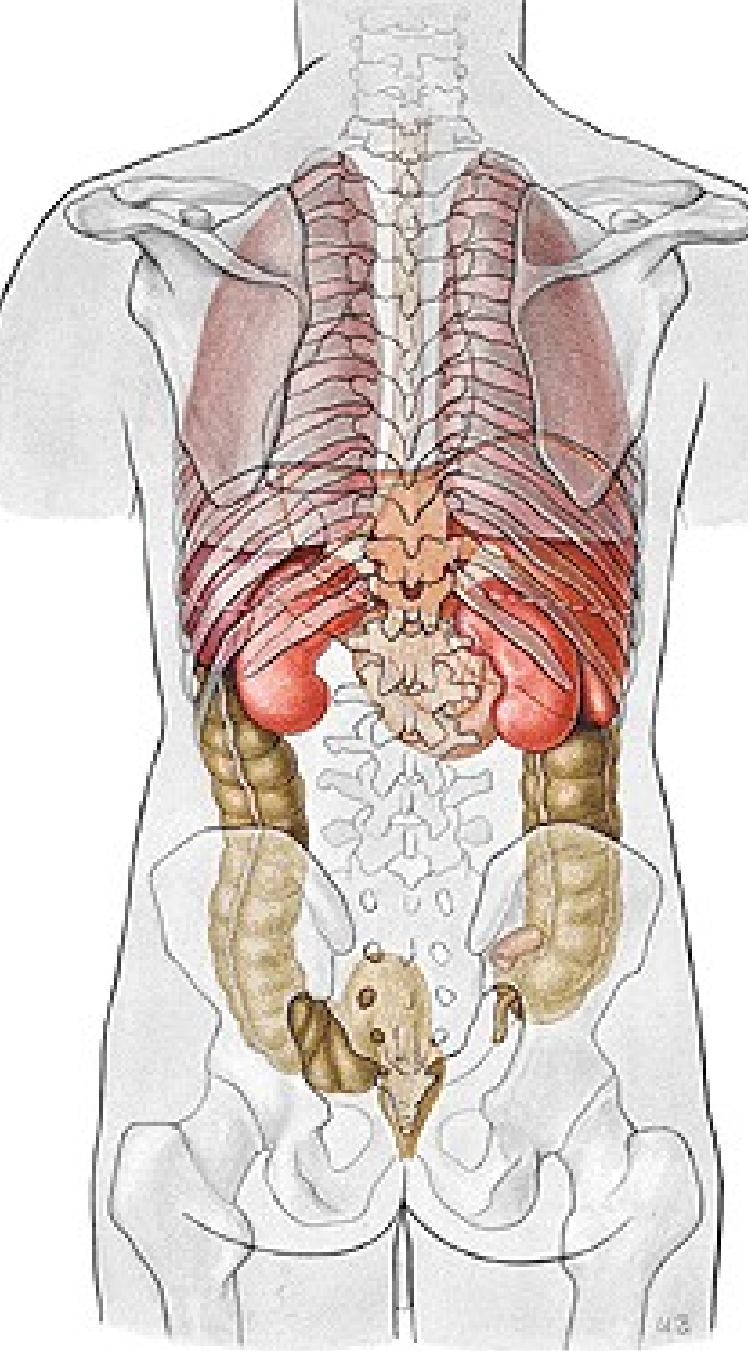
- aa. lobares – aa. interlobares – aa. aruateae





## Aa. renales accessoriae







1. Diaphragma

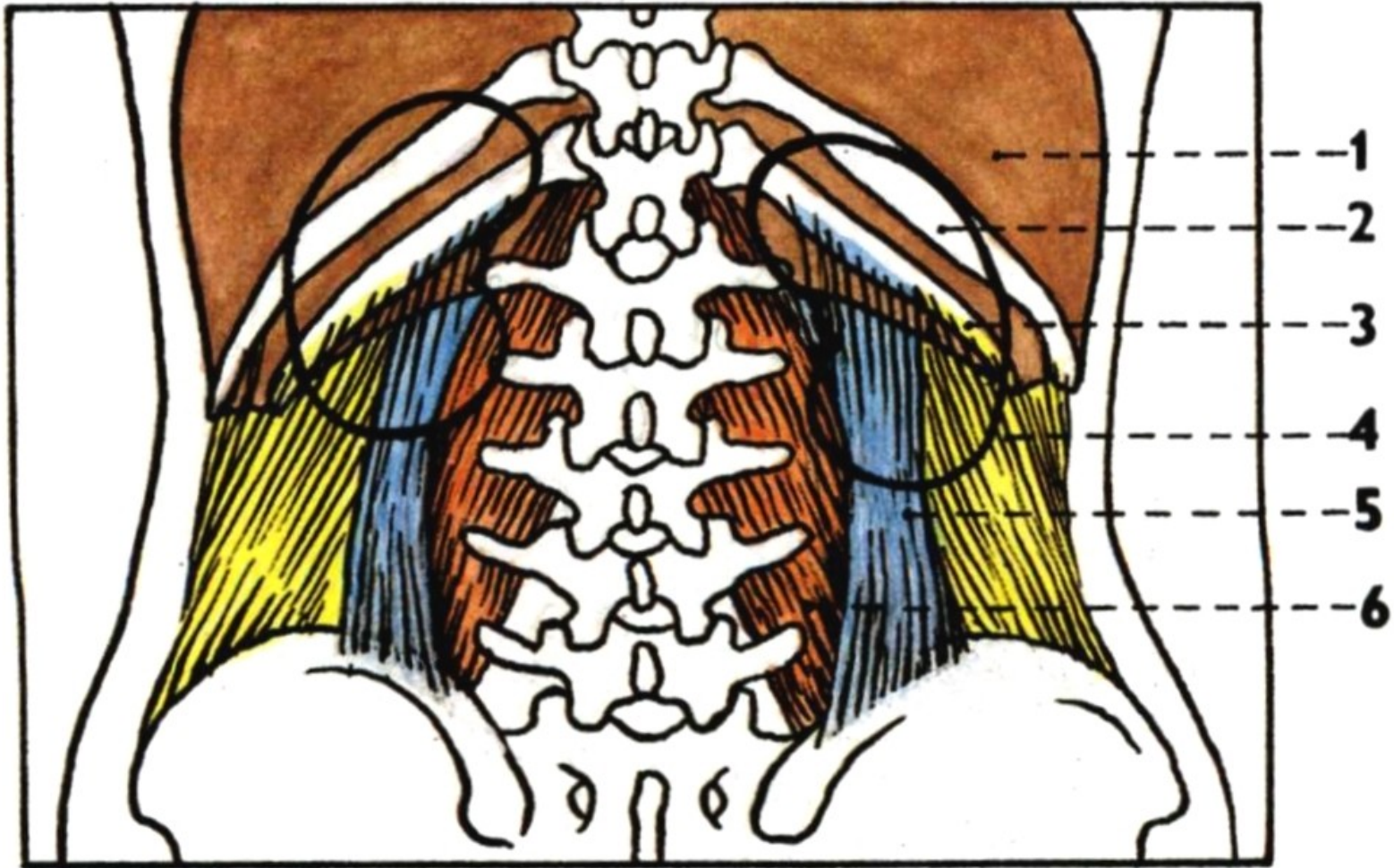
2. 11th rib

3. 12th rib

4. M. transversus abdominis

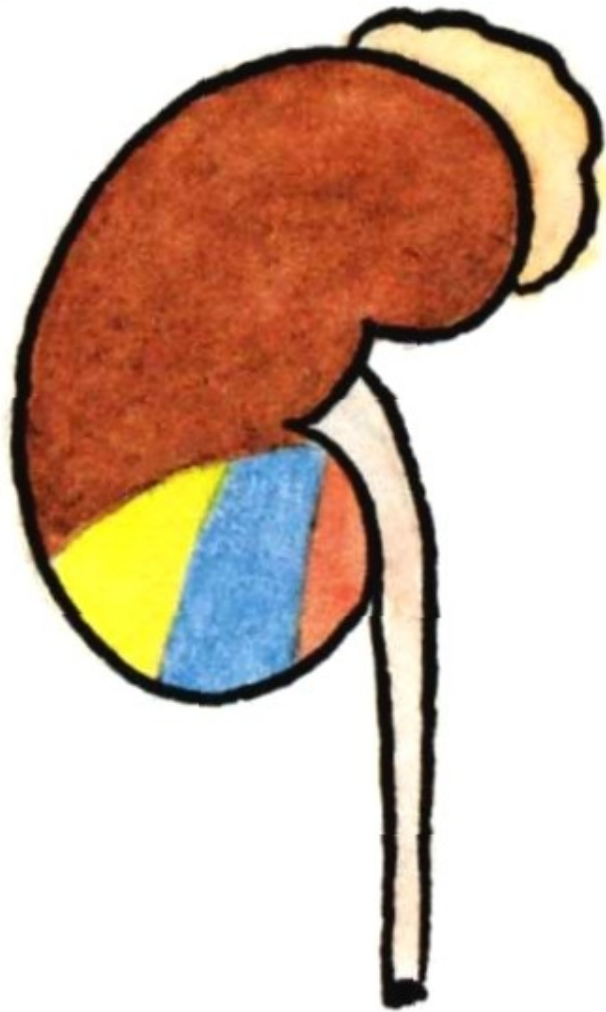
5. M. quadratus lumborum

6. M. psoas major

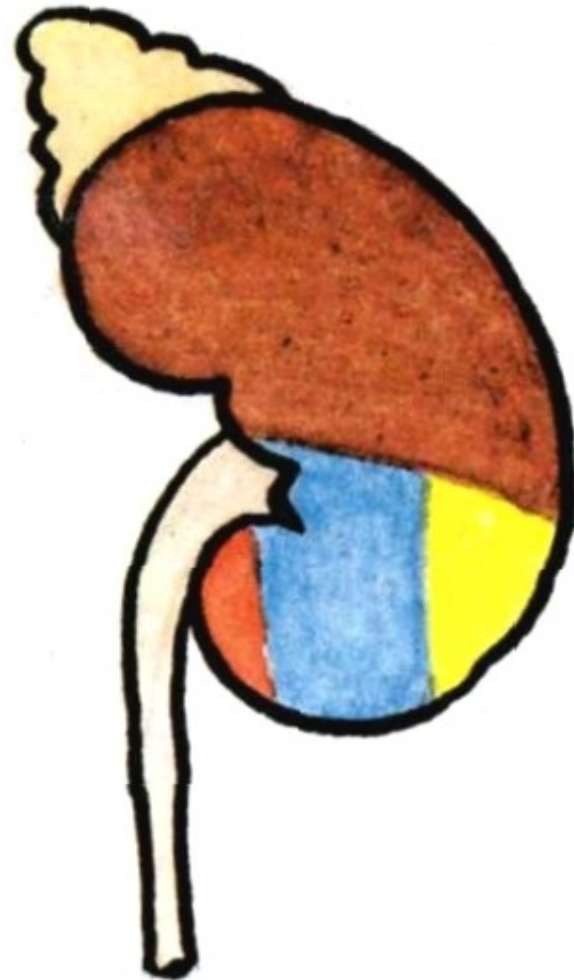


SIN.

DX.

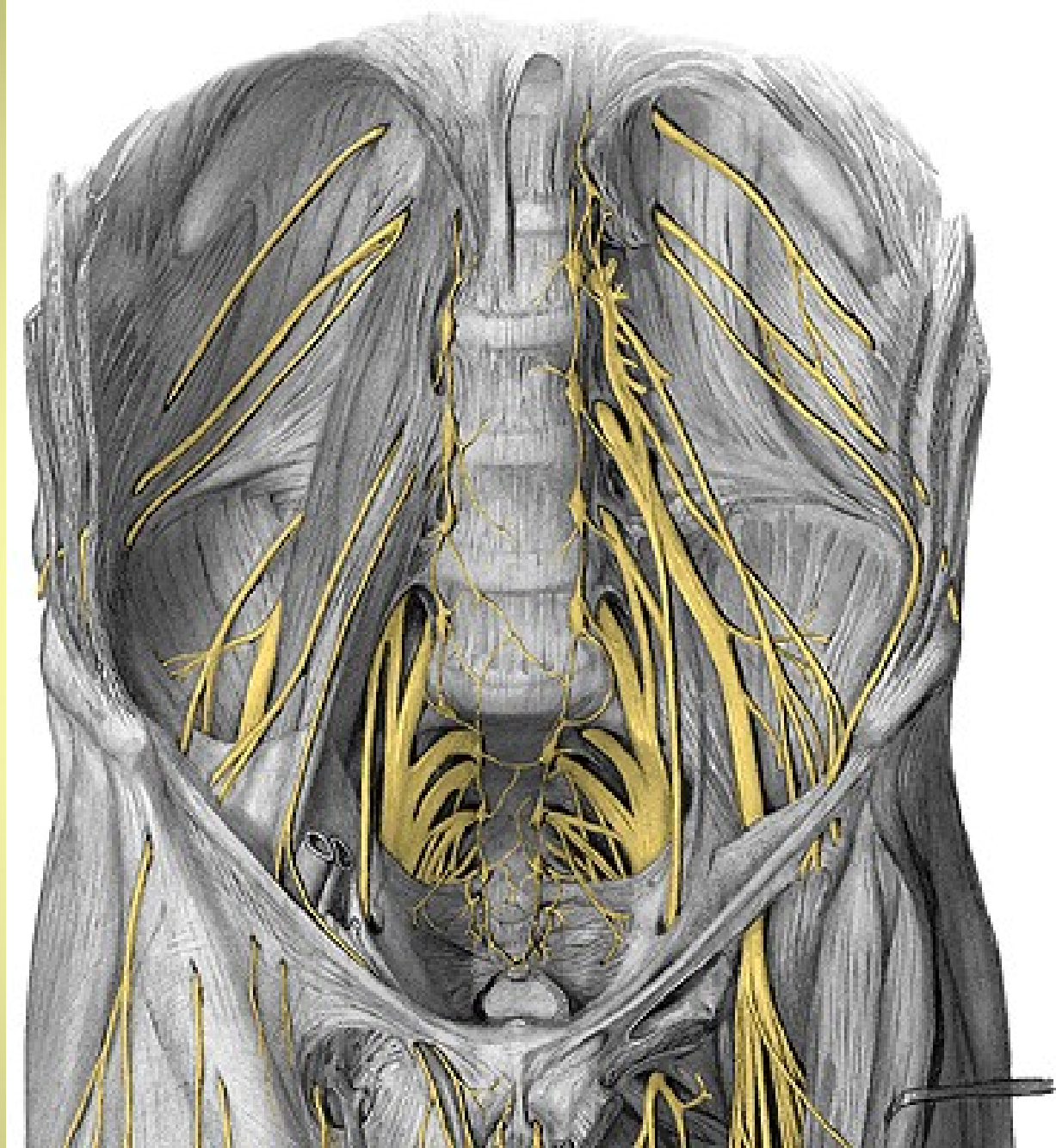


**SIN.**

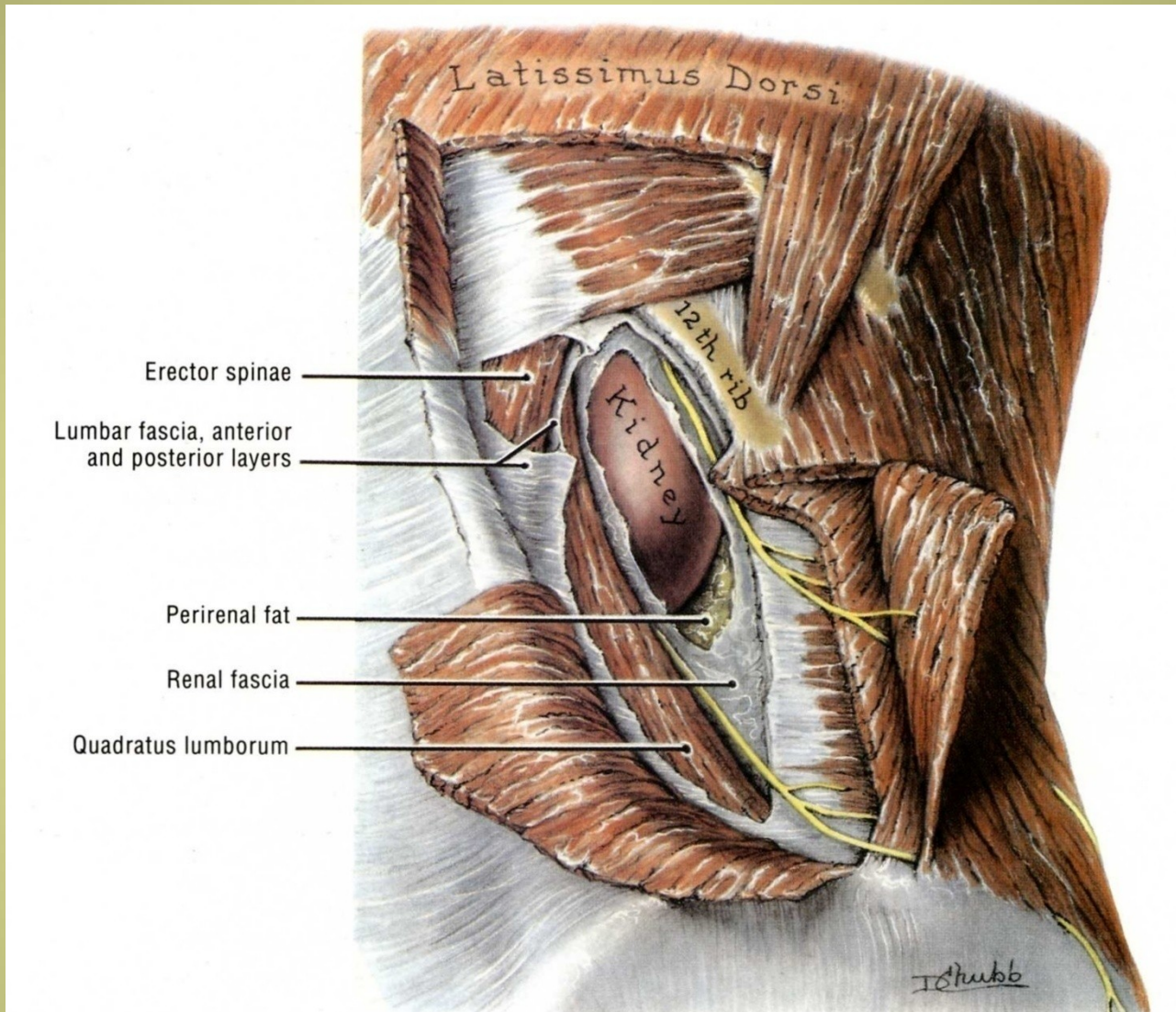


**DX.**

**N. subcostalis**  
**N. iliohypogastricus**  
**N. ilioinguinalis**

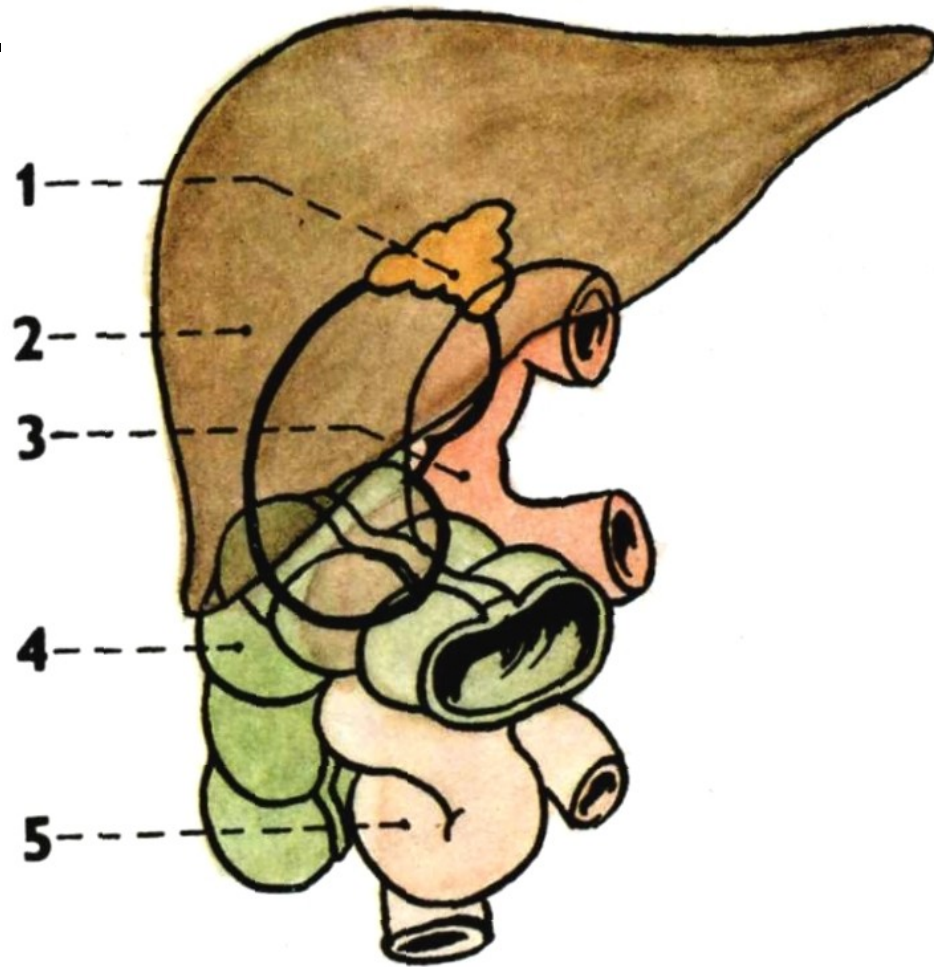




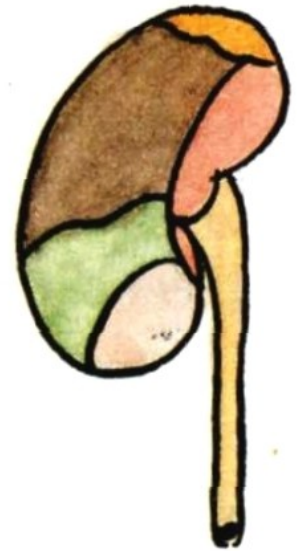


- Erector spinae
- Lumbar fascia, anterior and posterior layers
- Perirenal fat
- Renal fascia
- Quadratus lumborum

- .Gl. suprarenalis dx.
- .Liver
- .Duodenum
- .Flexura coli dx.
- .Jejunum



**DX.**



**DX.**



.Gl. suprarenalis sin.

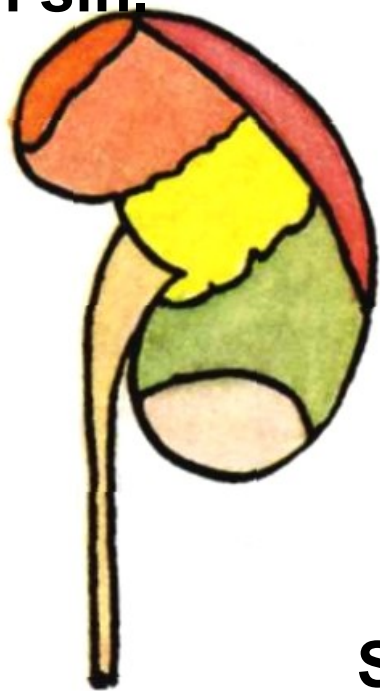
.Stomach

.Spleen

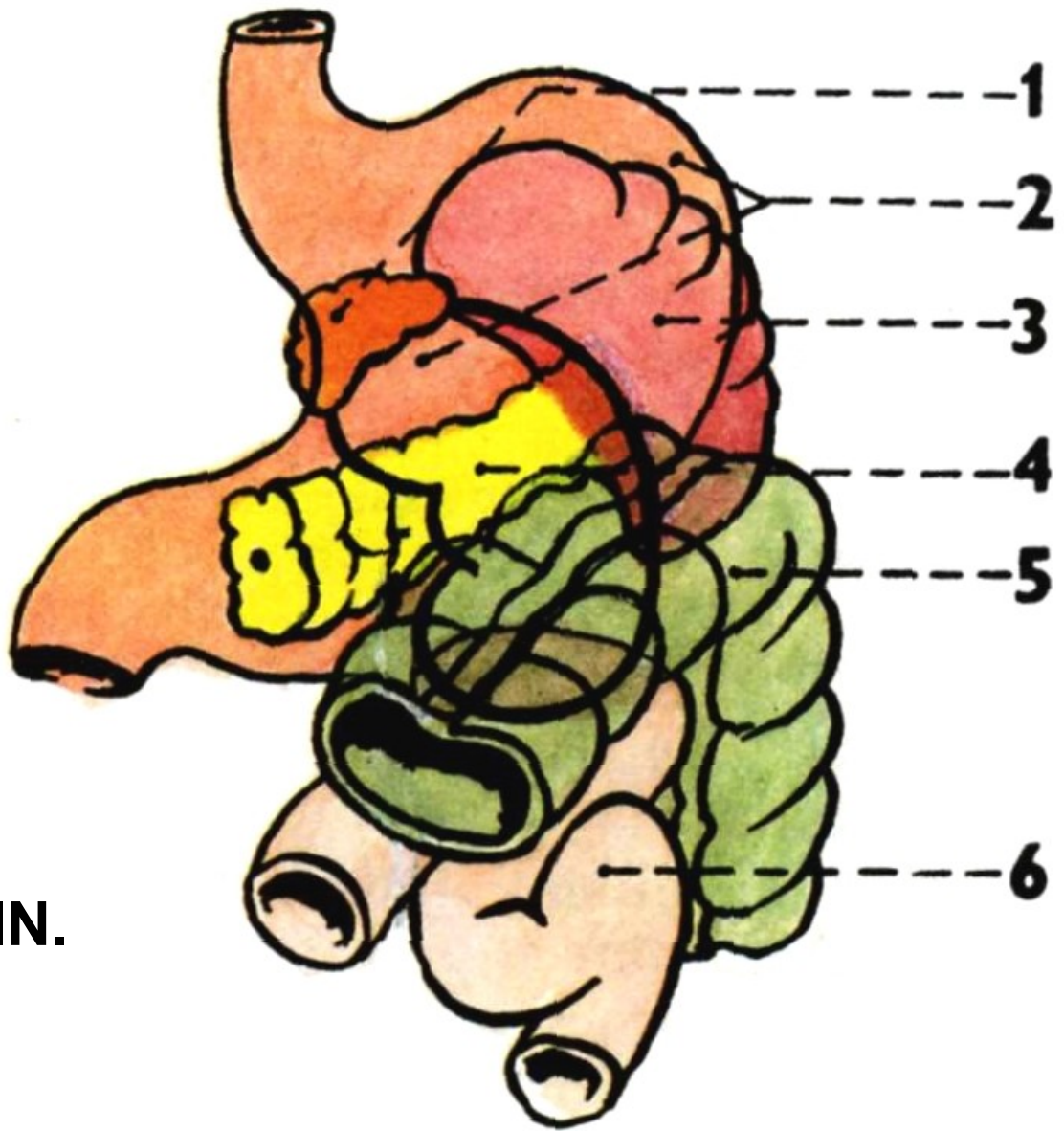
.Pancreas

.Flexura coli sin.

.Jejunum



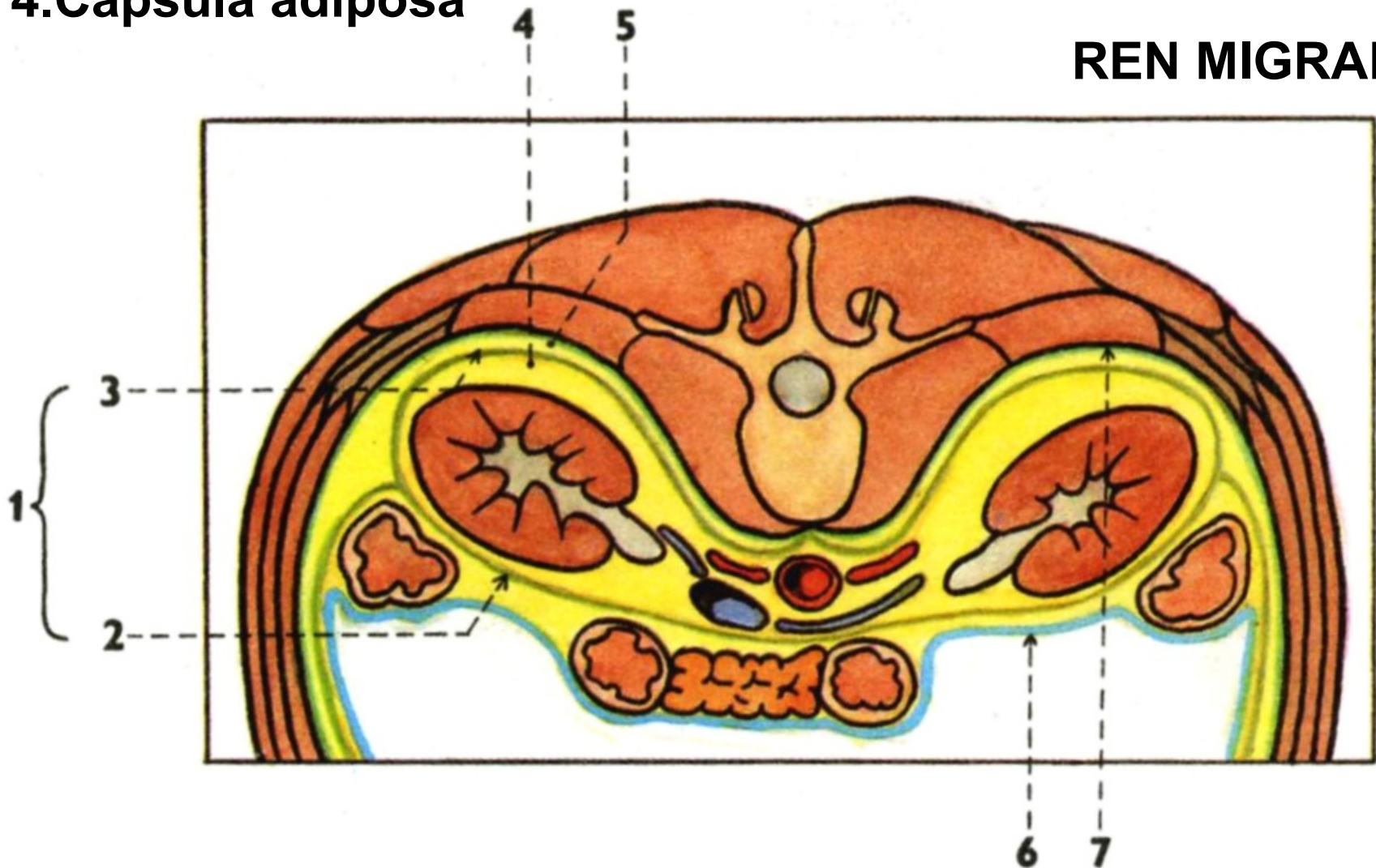
SIN.



1. Fascia renalis
2. Lamina praerenalis
3. Lamina retrorenalis
4. Capsula adiposa

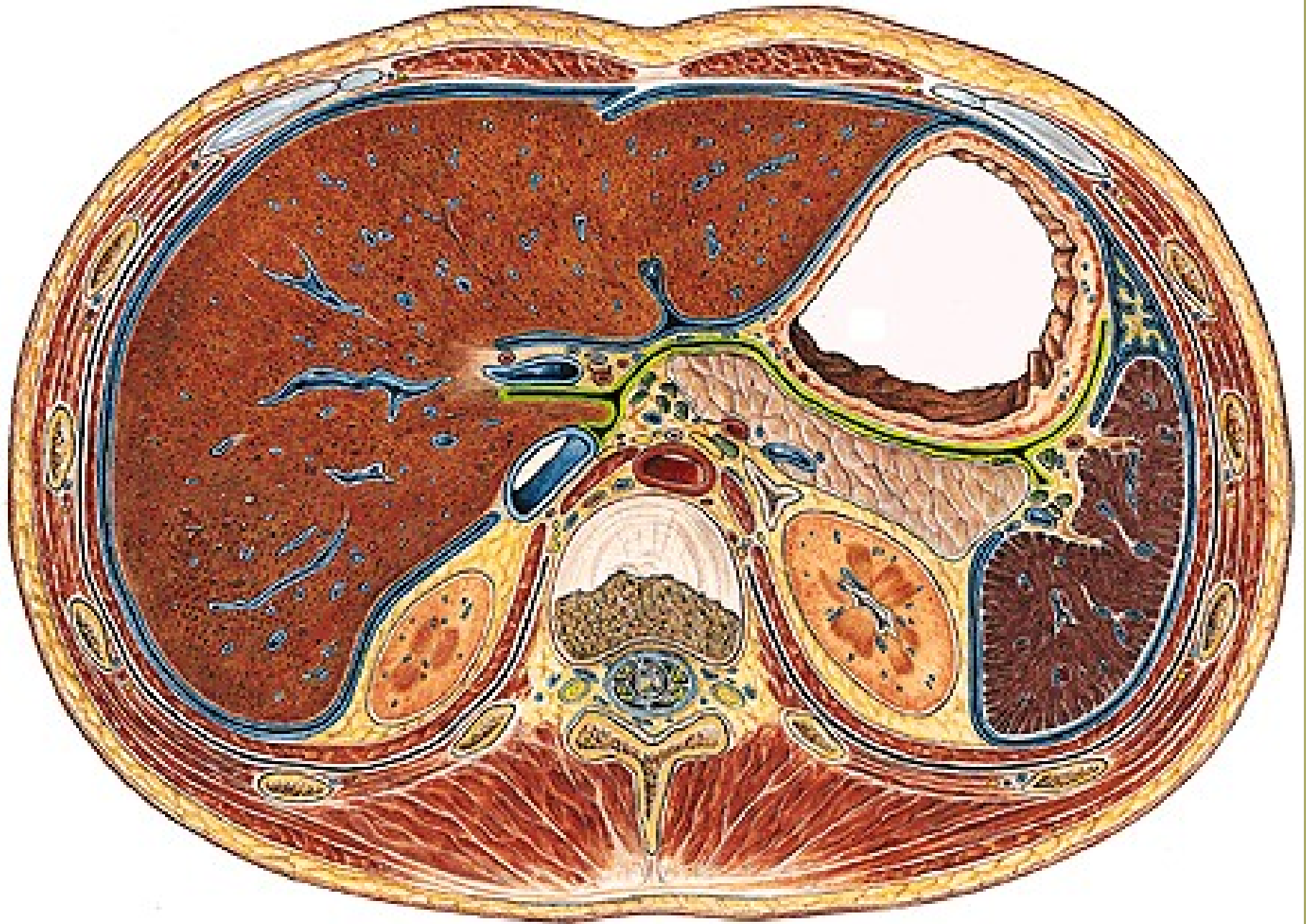
5. Corpus adiposum pararenale
6. Peritoneum
7. Fascia transversalis

## REN MIGRANS





**Cross-sectional image through the L1 obtained with CT**



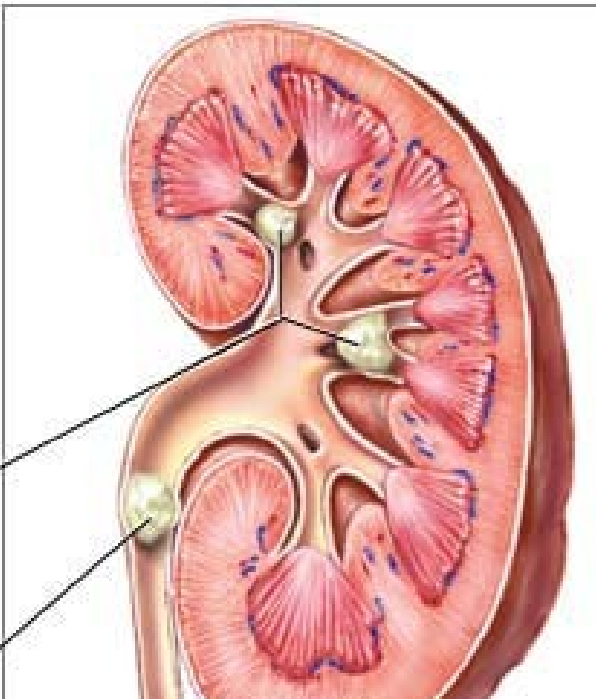
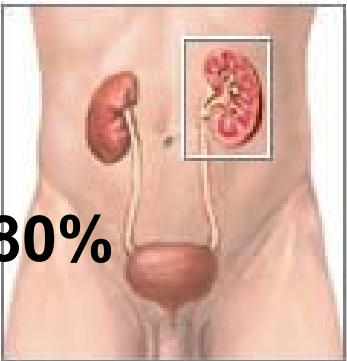
**Transverse section through the intervertebral disc between T12 and L1**



# Nephrolithiasis

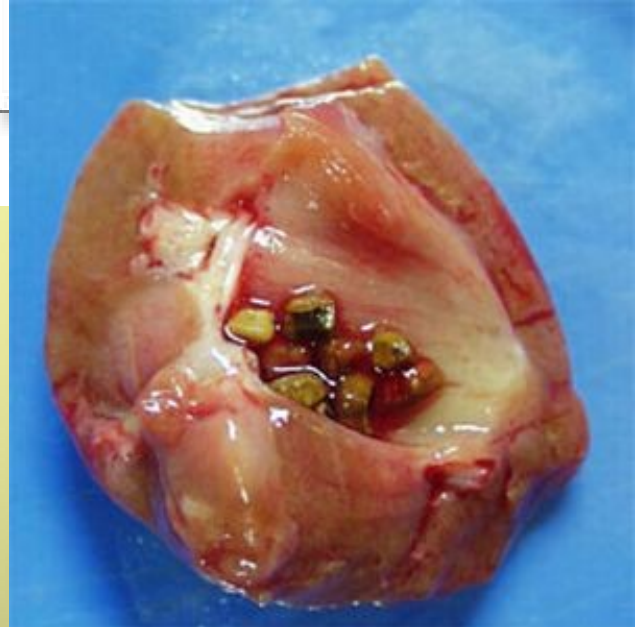
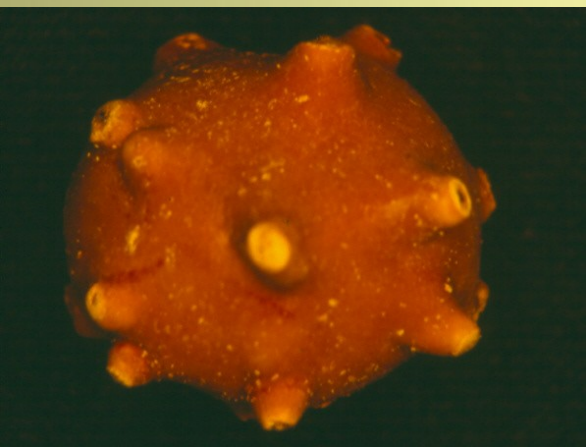
Calcium oxalate crystals – 80%

Uric acid – 5 - 10%



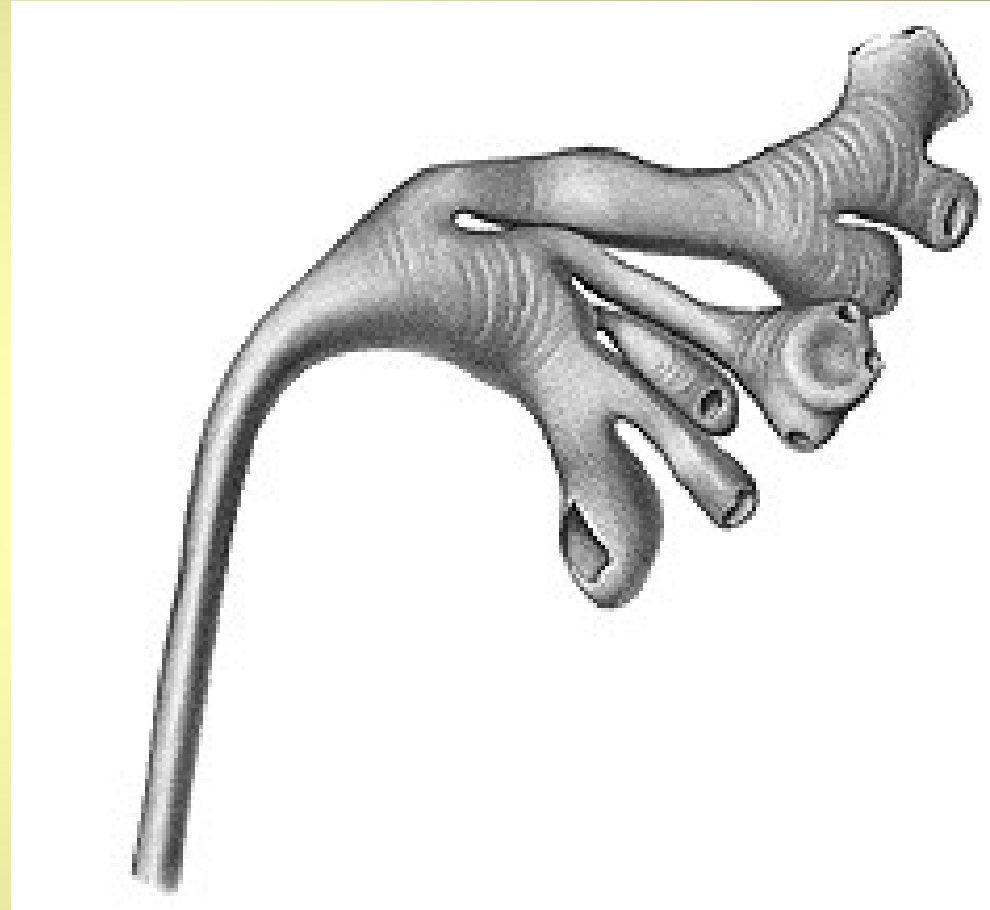
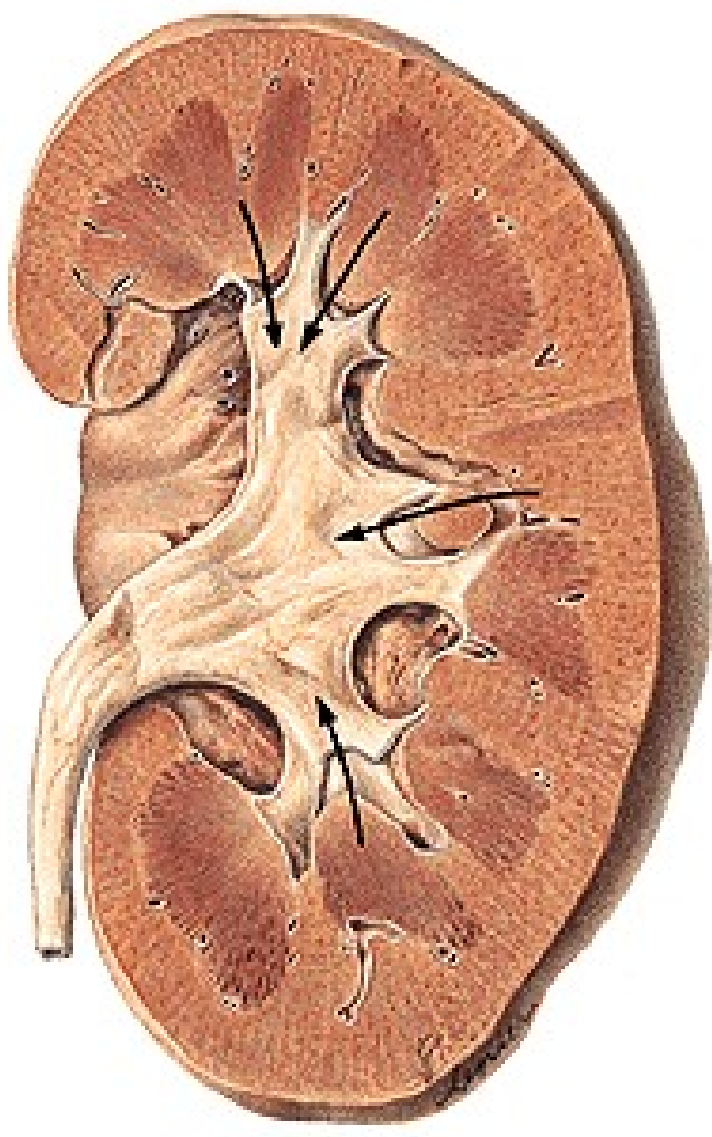
Kidney stones in the minor and major calyces of the kidney

Kidney stone in the ureter



# CALICES RENALES – minores et majores

## PELVIS RENALIS (PYELUM)



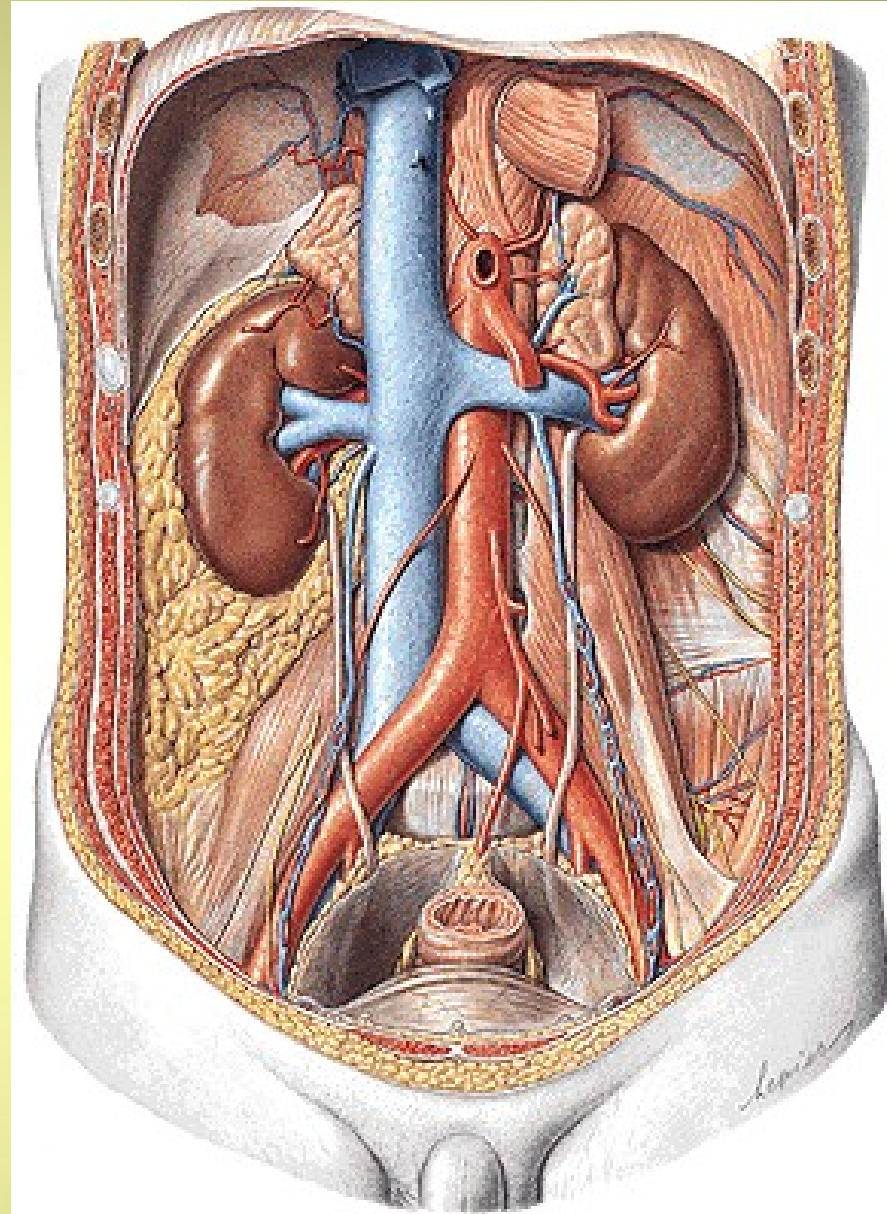
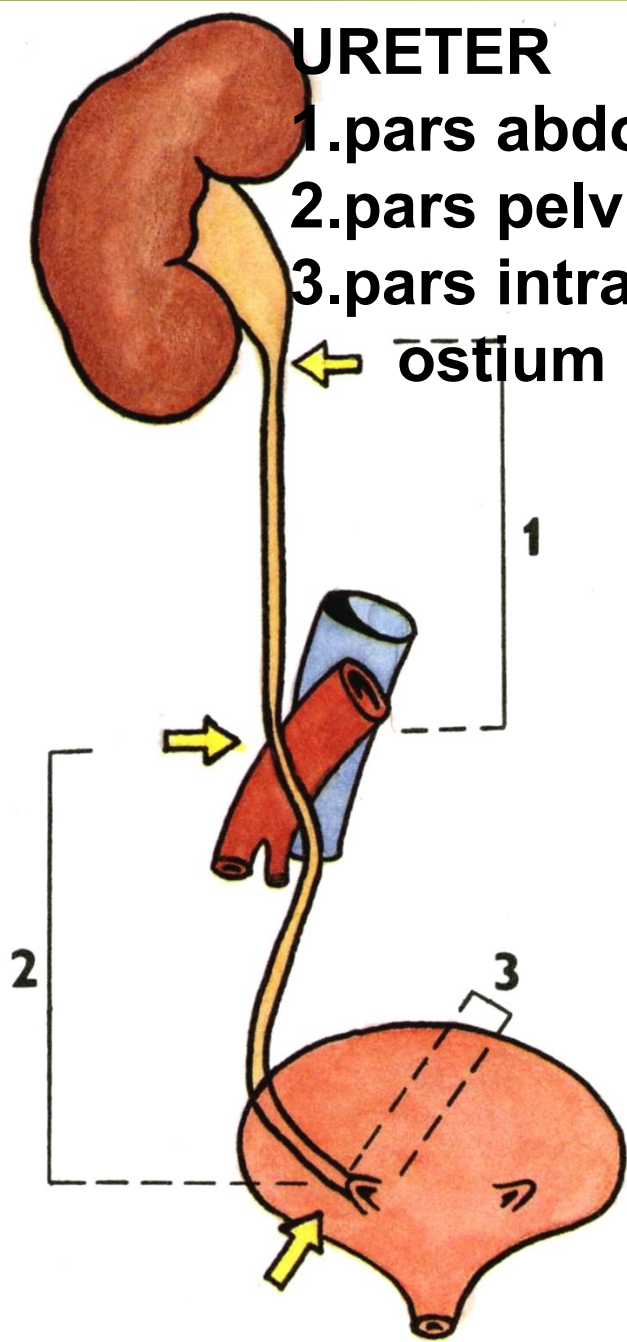
# URETER

1.pars abdominalis

2.pars pelvina

3.pars intramuralis

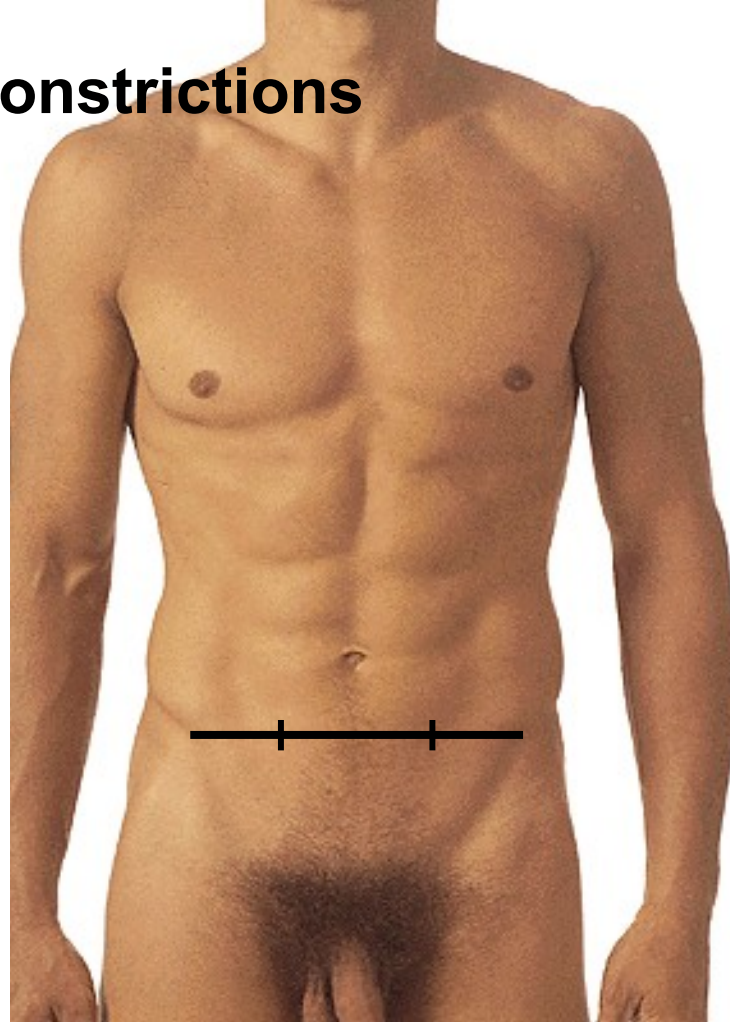
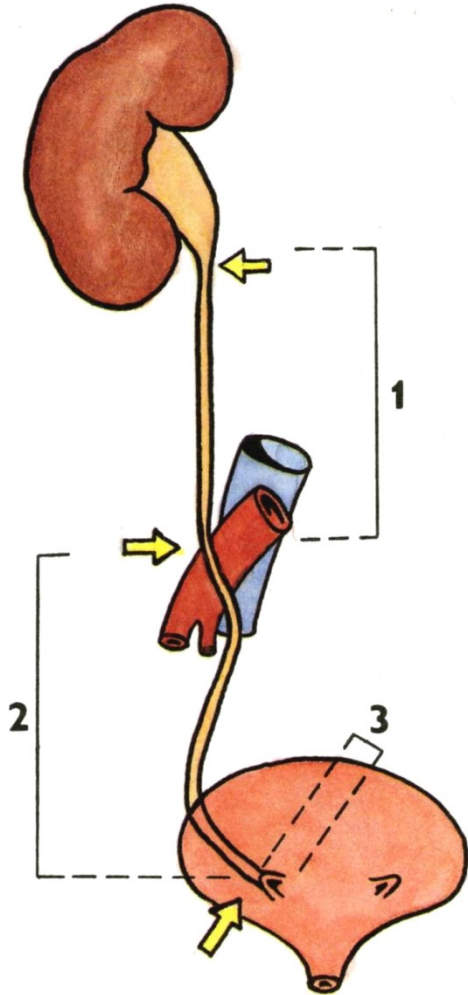
← ōstium ureteris



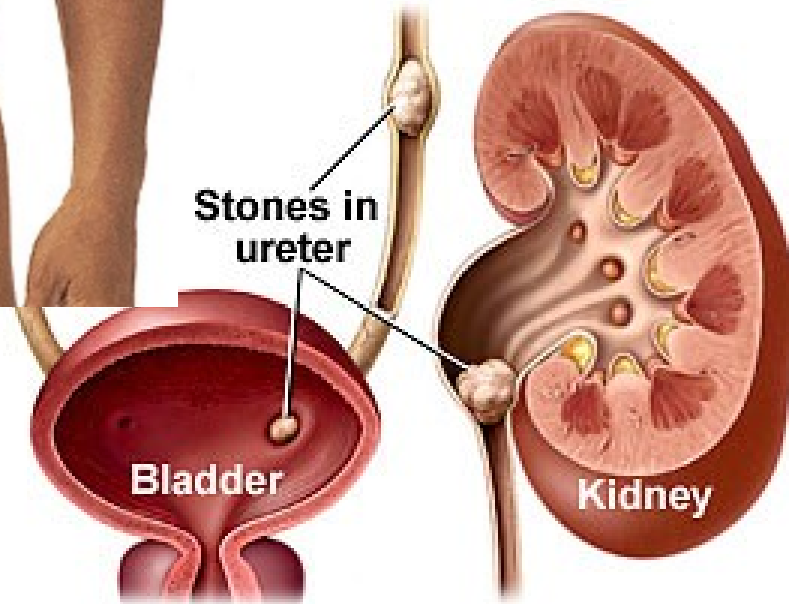




# 3 physiological constrictions



**Point of LANZ**





Adventitia

*Fibrous tissue*

*Longitudinal  
muscular fibers*

*Circular muscular  
fibers*

*Subepithelial  
connective tissue*

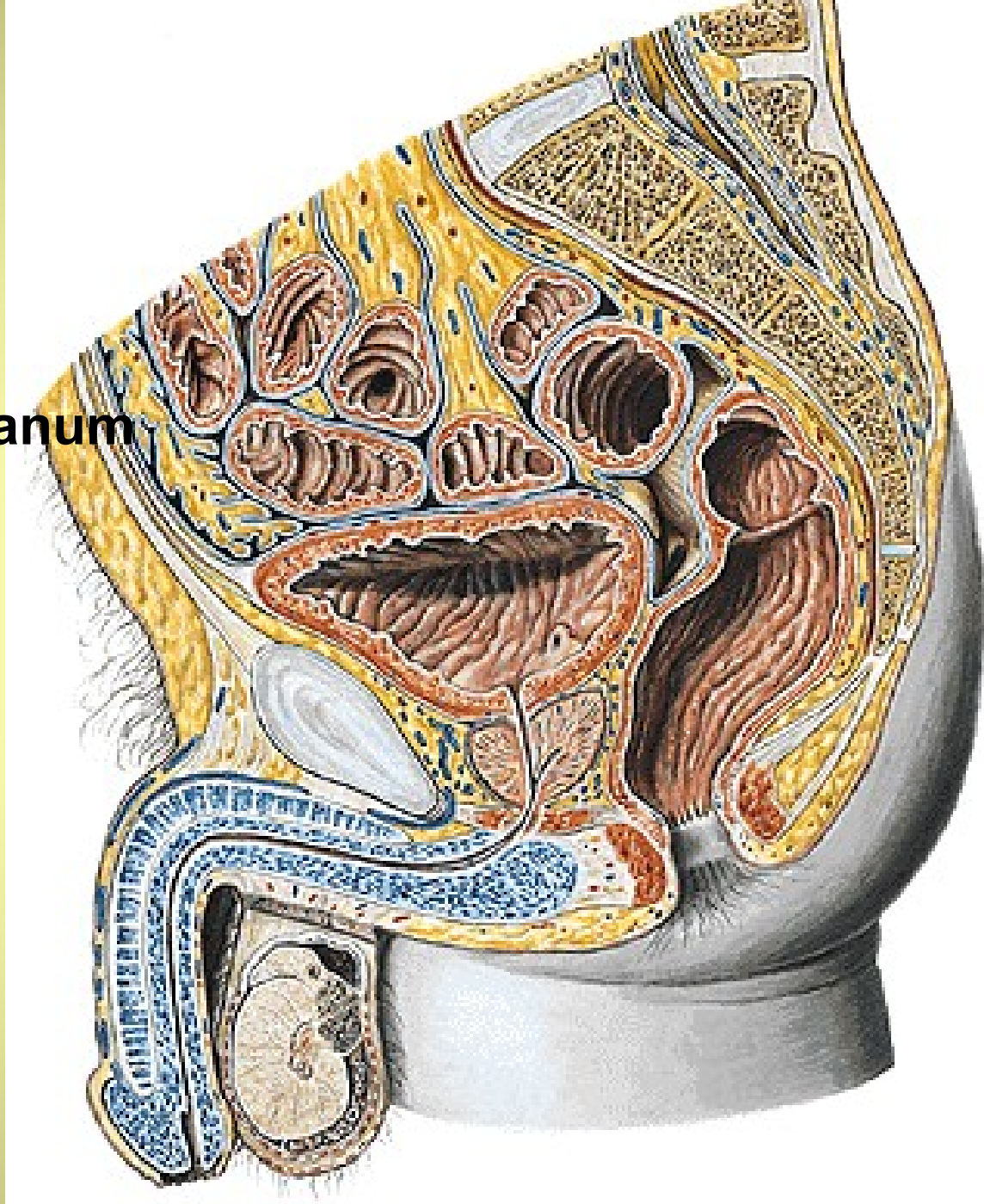
*Transitional  
epithelium*

Plicae longitudinales



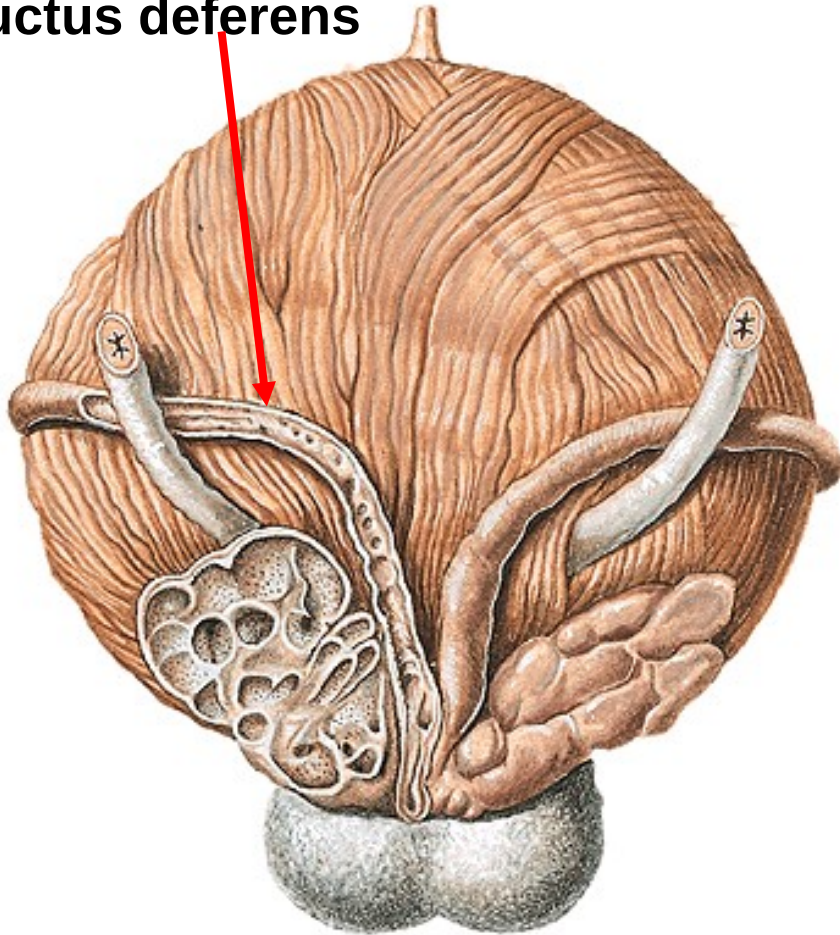
# VESICA URINARIA

- fundus vesicae
- corpus vesicae
- apex vesicae
  - lig. umbilicale medianum
- cervix vesicae

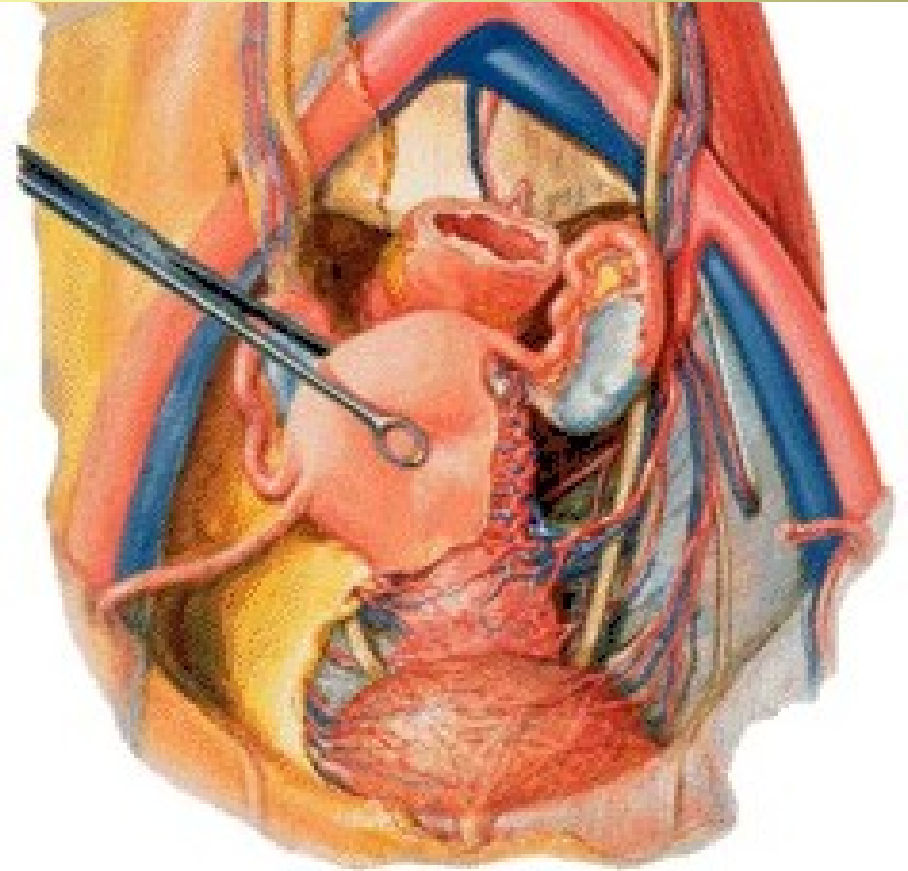


Male - dorsal aspect of urinary bladder

Ductus deferens

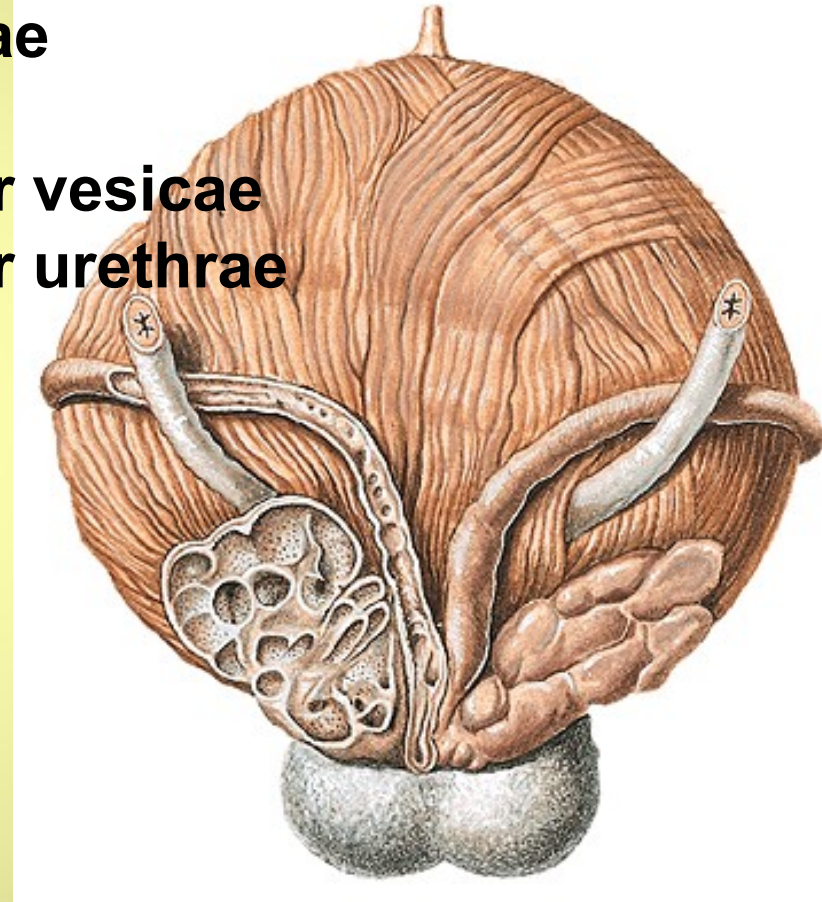
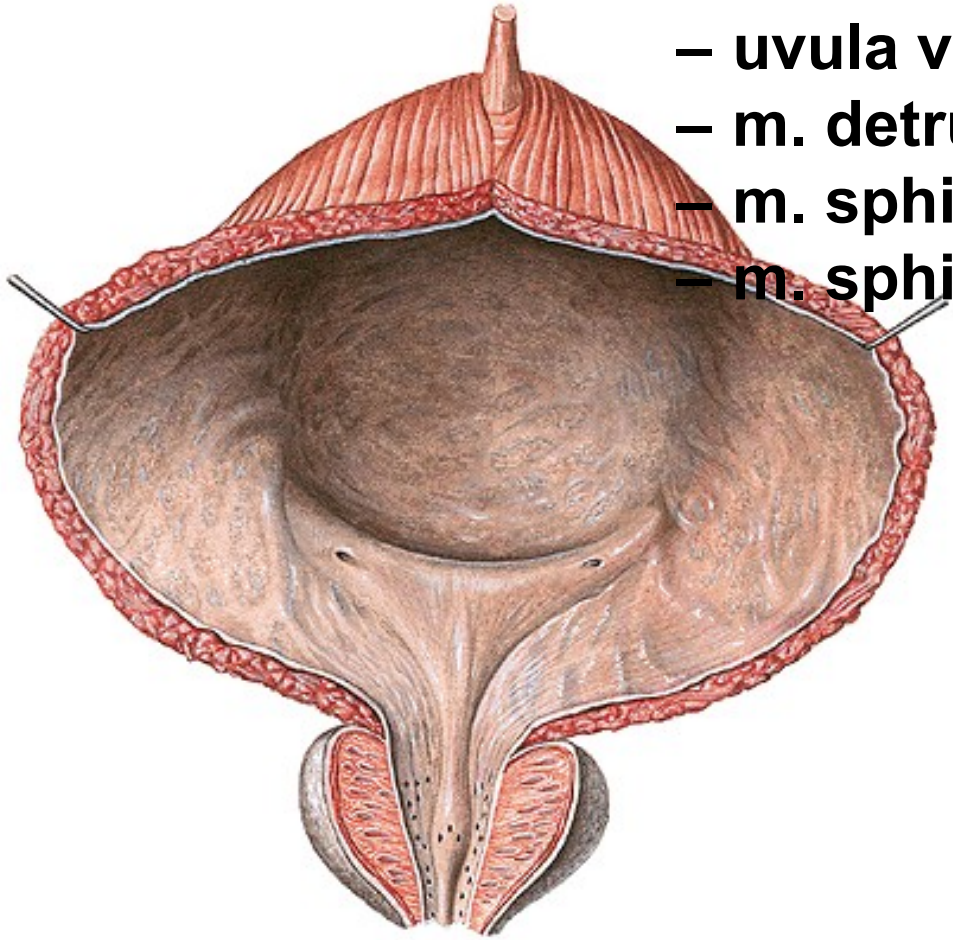


Female – superior view



# Trigonum vesicae – ostia ureterum

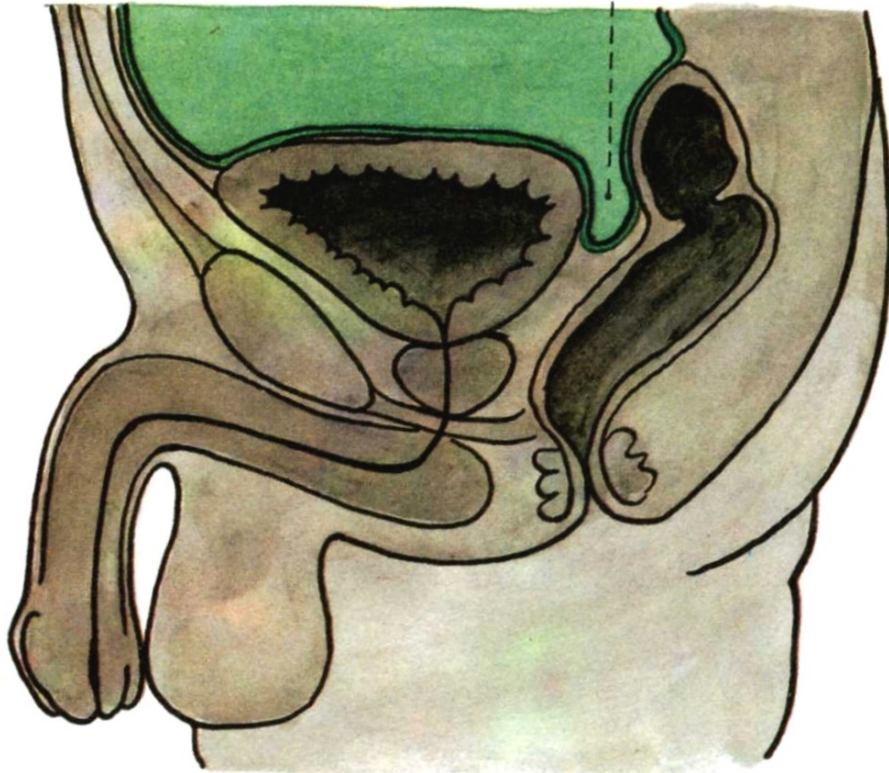
- ostium urethrae internum
- plica interureterica
- fossa retrotrigonalis
- uvula vesicae
- m. detrusor
- m. sphincter vesicae
- m. sphincter urethrae





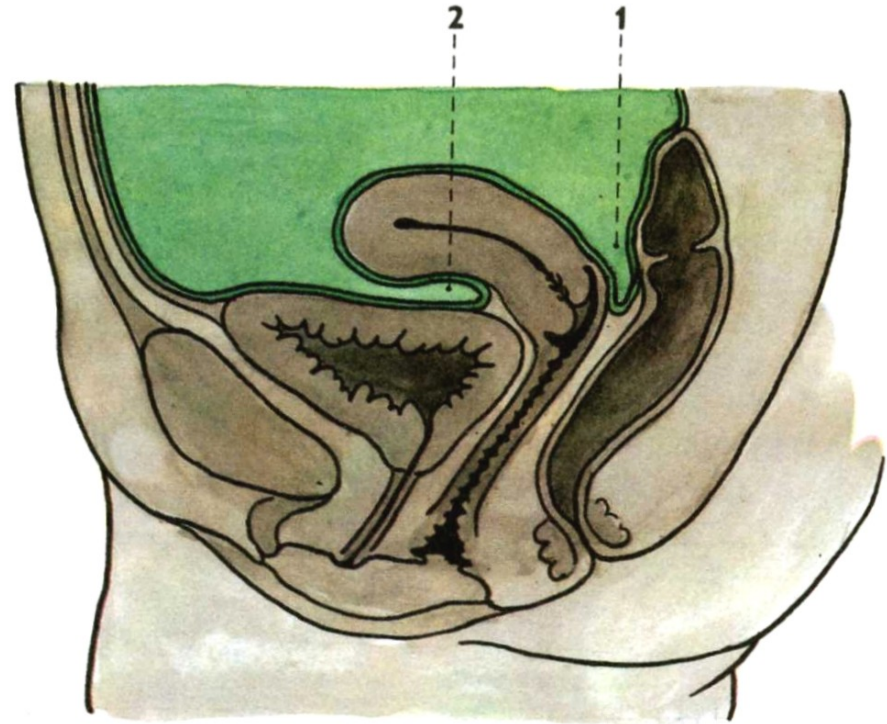
## Median section through the male pelvis

1. Excavatio rectovesicalis



## Median section through the female pelvis

1. Excavatio rectouterina  
2. Excavatio vesicouterina



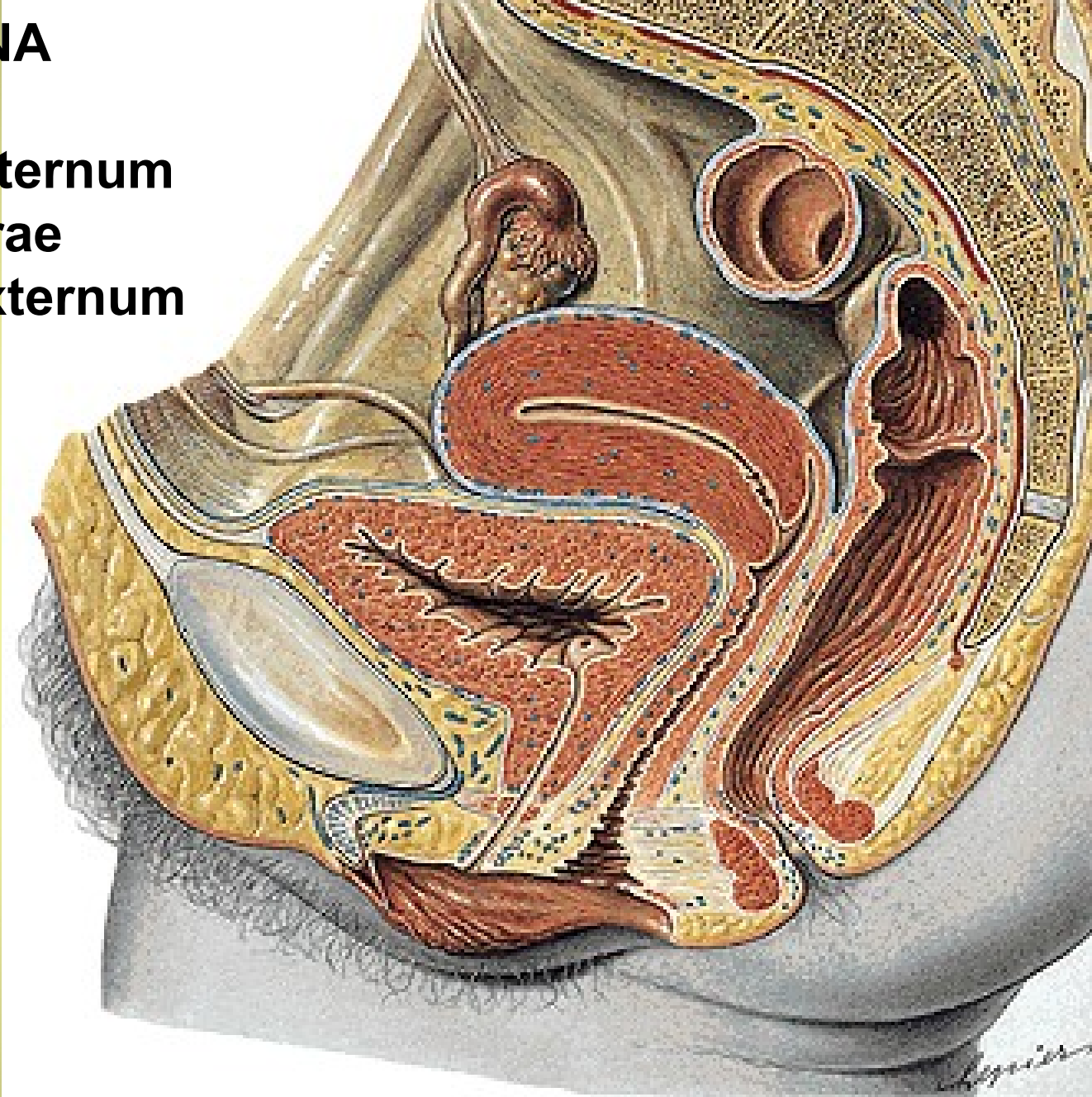
**Paracystium**

# URETHRA FEMININA

Ostium urethrae internum

M. sphincter urethrae

Ostium urethrae externum



IVU





# Retrograde pyelography

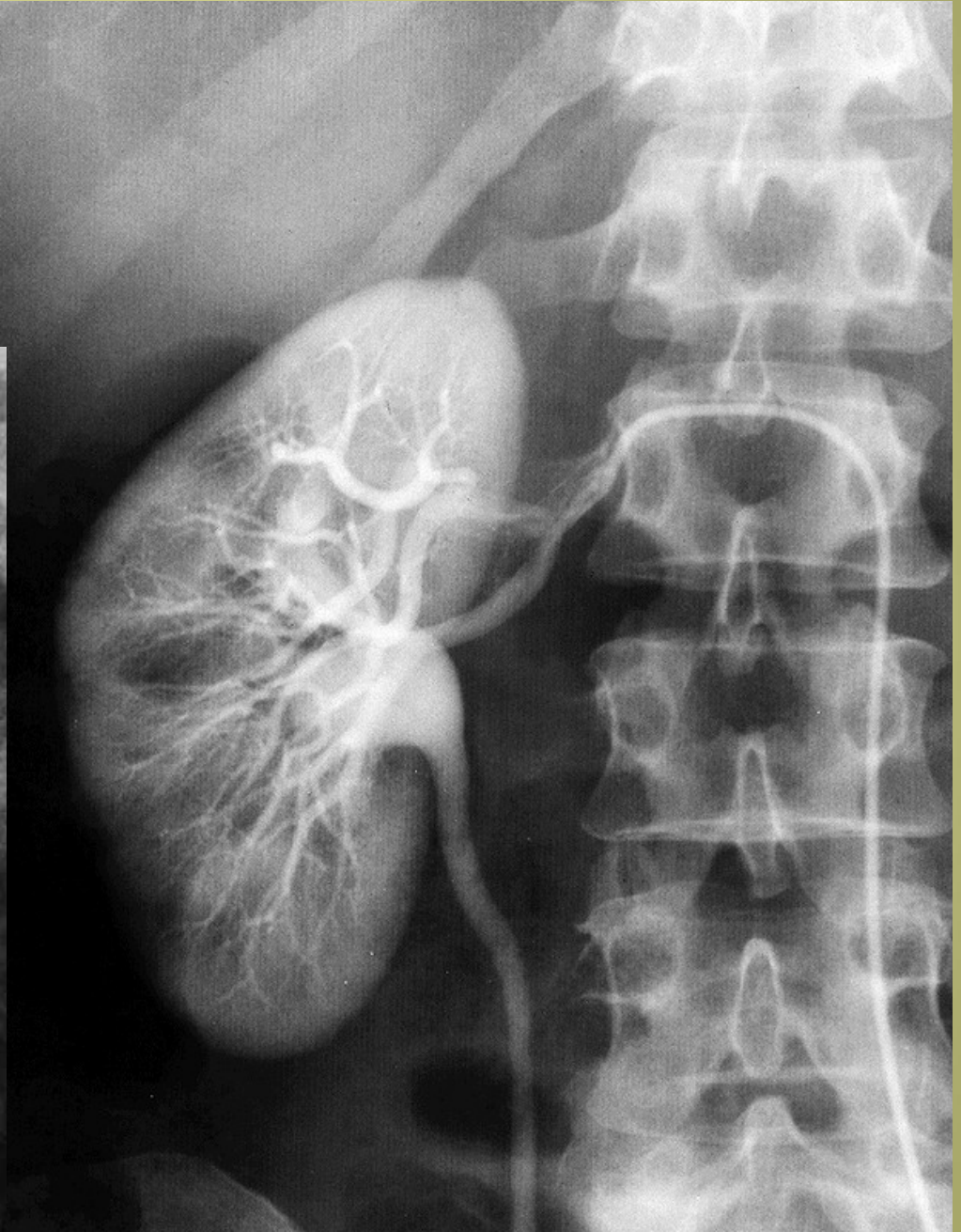
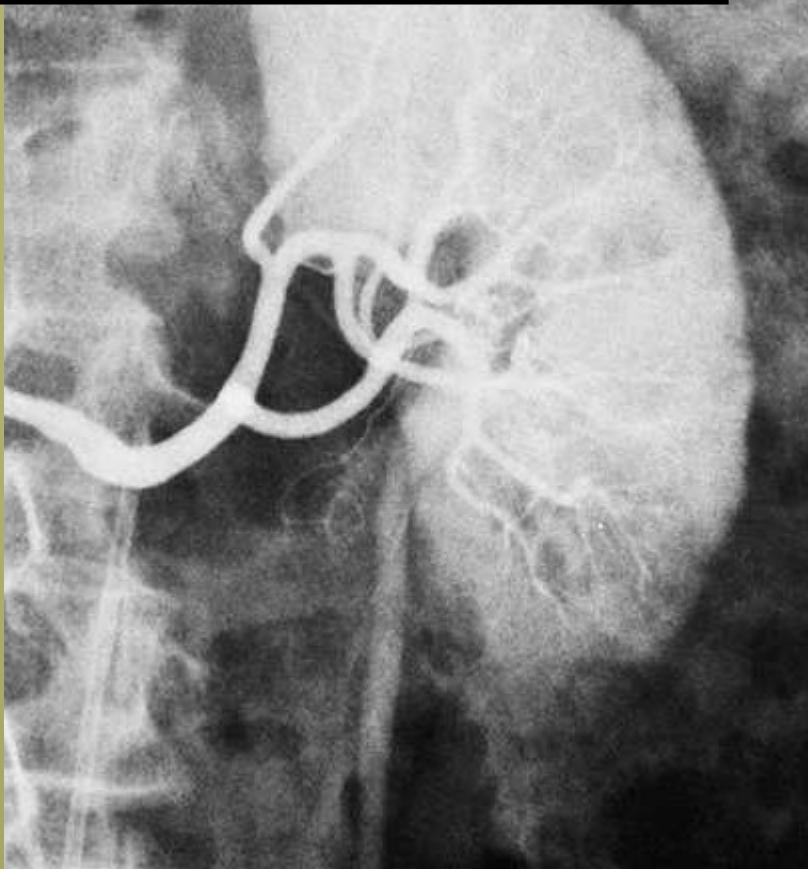
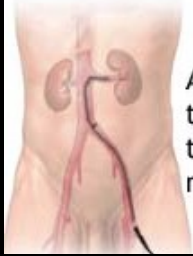


ASHMOLE, IN  
DR. S. COMITER  
M-F

Renal artery



A catheter is inserted into the artery and threaded through until it is placed in the renal (kidney) artery. The contrast medium is then injected into the artery





**MALE GENITAL ORGANS  
(ORGANA GENITALIA  
MASCULINA)**

**Organa genitalia interna:**

**Testis**

**Epididymis**

**Ductus deferens**

**Urethra masculina**

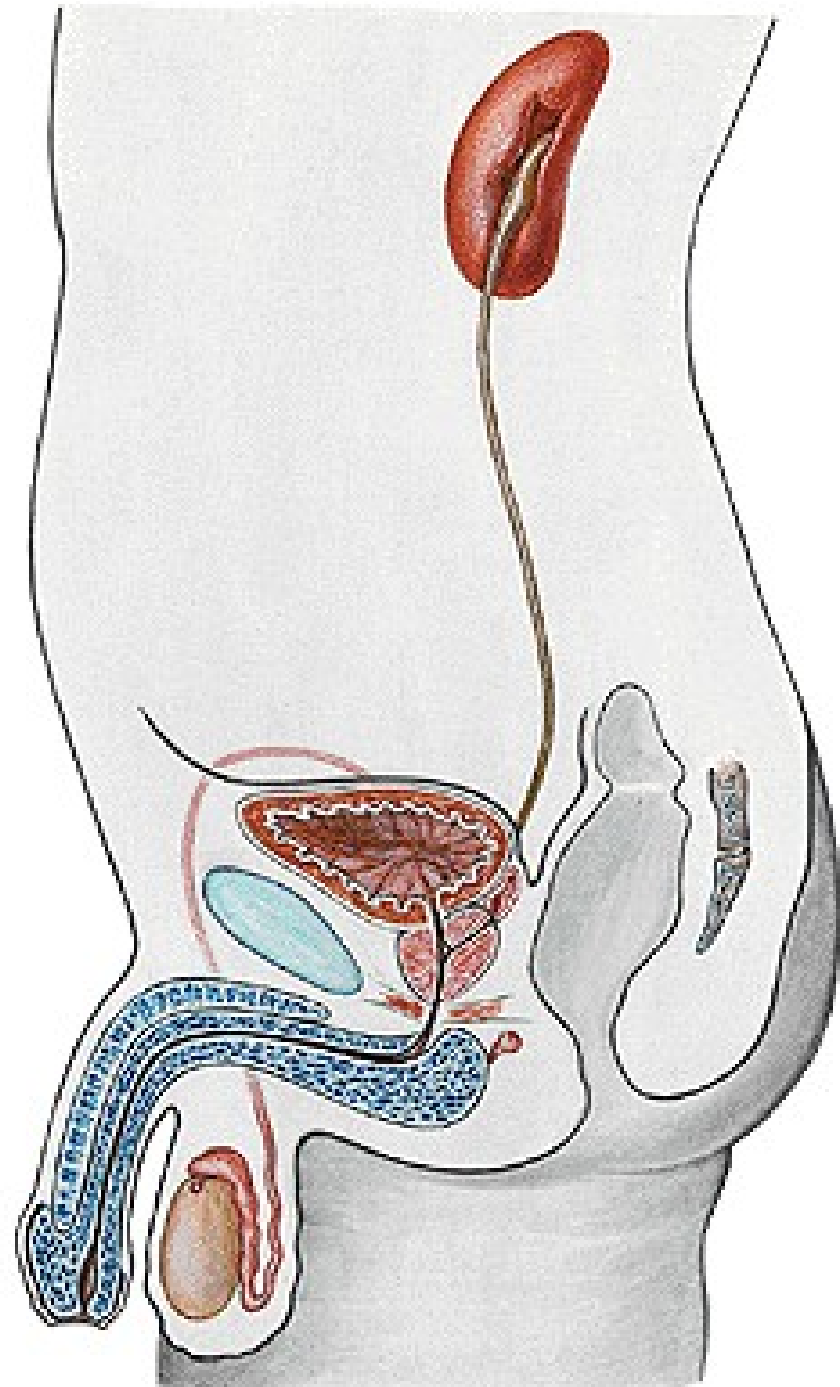
**Vesicula seminalis**

**Prostata**

**Organa genitalia externa:**

**Penis**

**Scrotum**



# TESTIS

**Facies medialis**

**Facies lateralis**

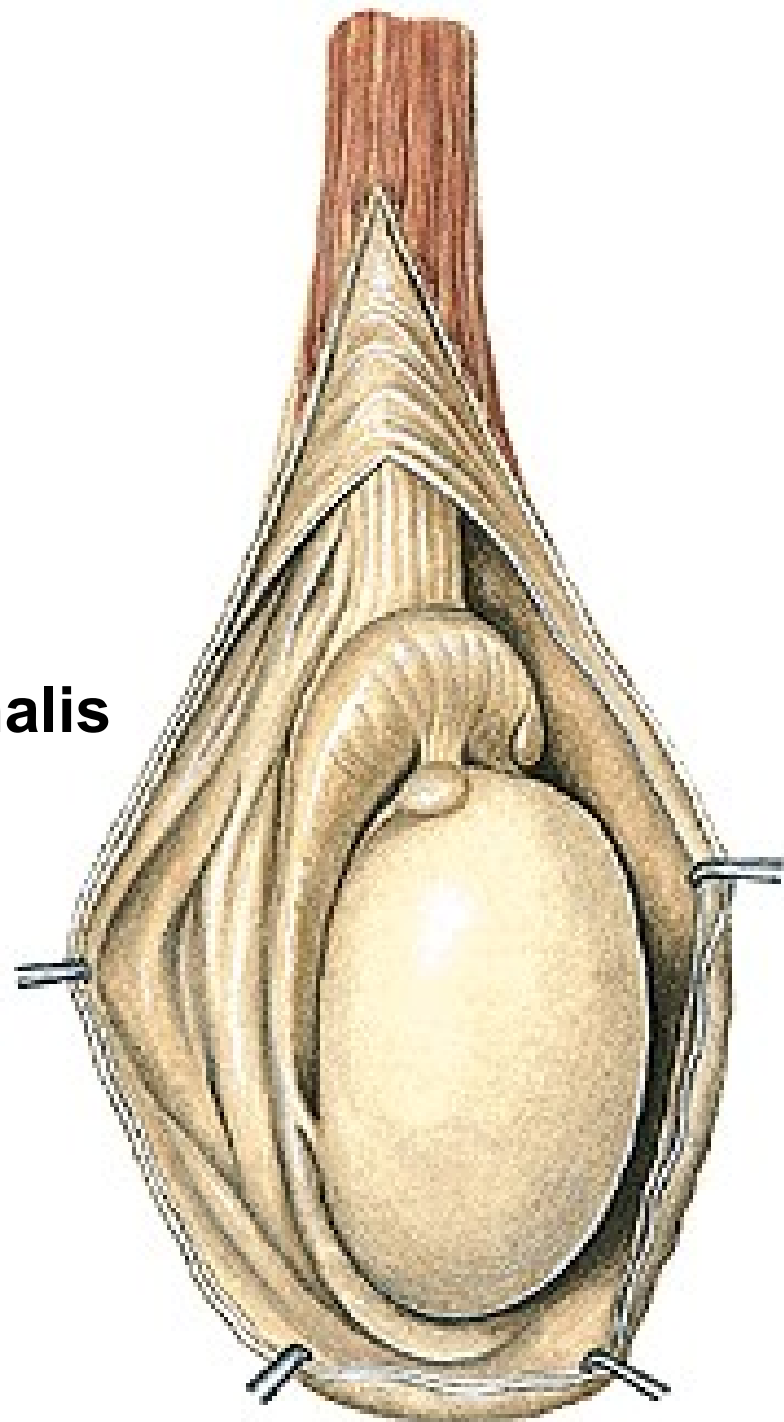
**Extremitas superior**

**Extremitas inferior**

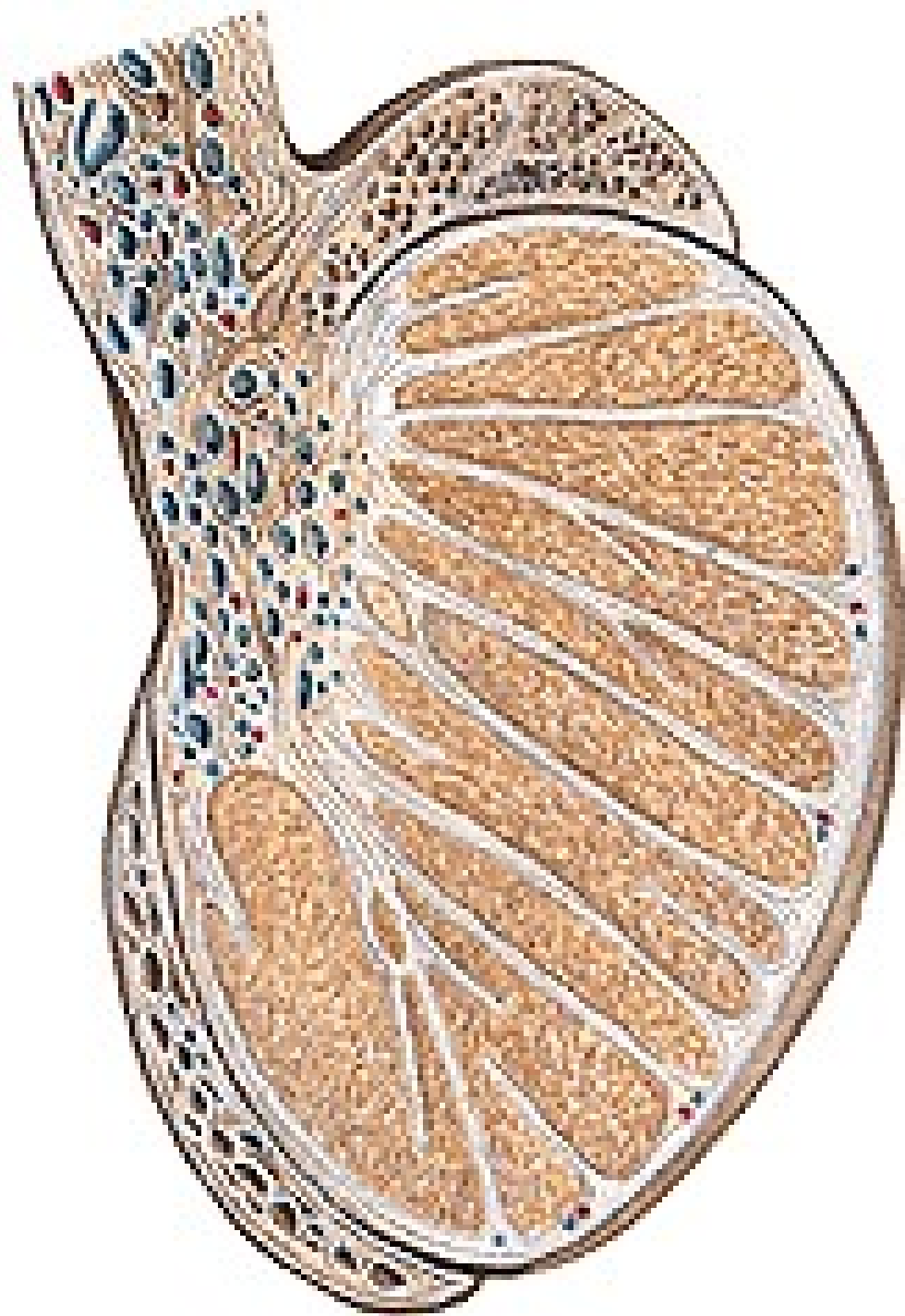
**Margo anterior**

**Margo posterior**

**Lamina visceralis tunicae vaginalis  
(Epiorchium)**



**Tunica albuginea**  
**Mediastinum testis**  
**Septula testis**  
**Lobuli testis**  
**Hilum testis**  
**Tubuli seminiferi contorti**  
**Spermatozoa**  
**Interstitial cells of Leydig**  
**Tubuli seminiferi recti**  
**Rete testis**  
**Ductuli efferentes testis**



# EPIDIDYMIS

Caput epididymidis

Corpus epididymidis

Cauda epididymidis

Sinus epididymidis

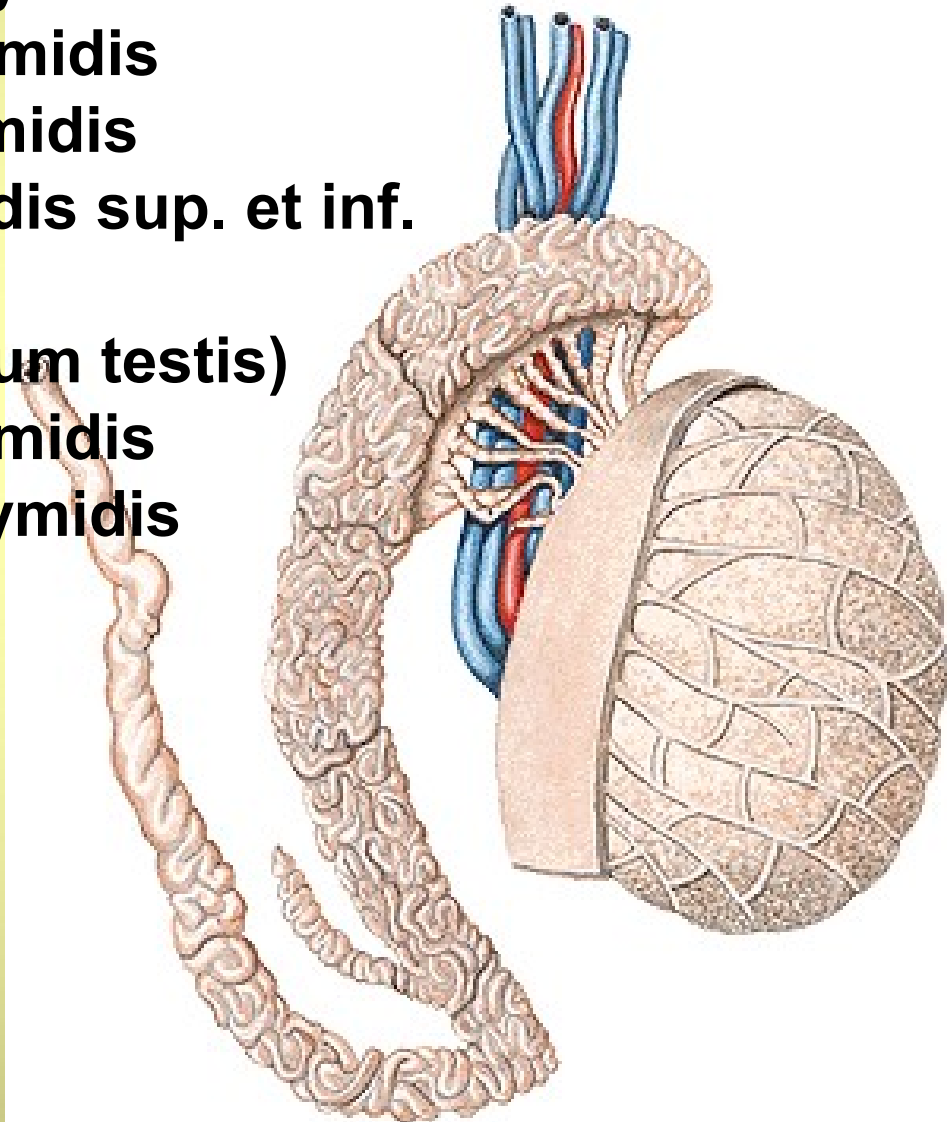
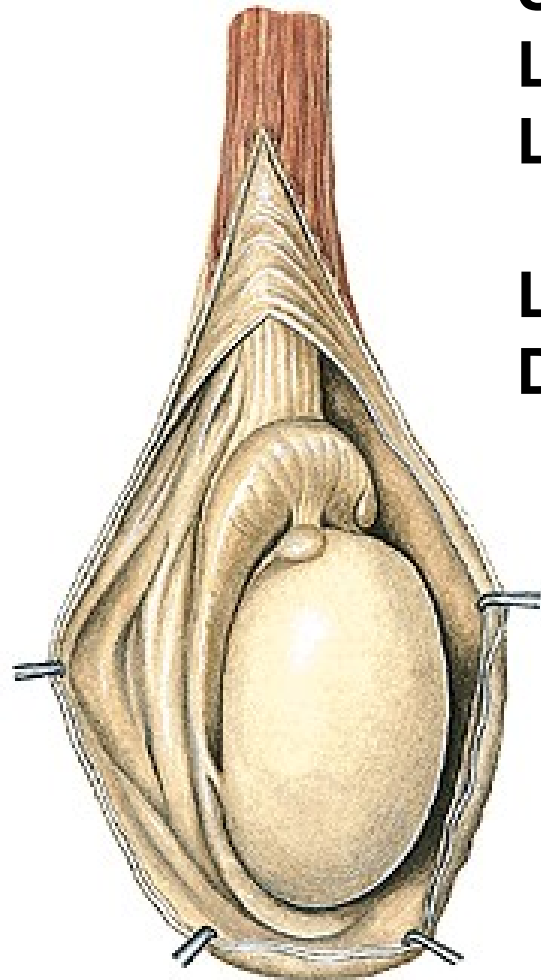
Lig. epididymidis sup. et inf.

Lig. scrotale

(Gubernaculum testis)

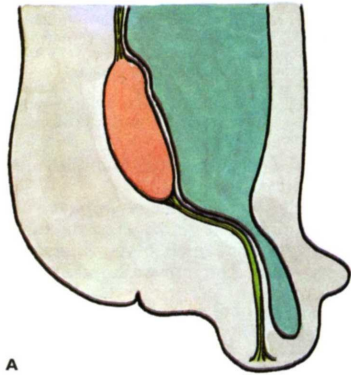
Lobuli epididymidis

Ductus epididymidis

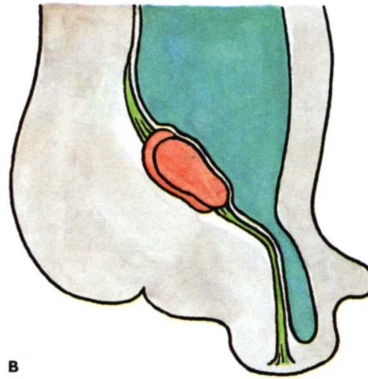


# DESCENSUS TESTIUM

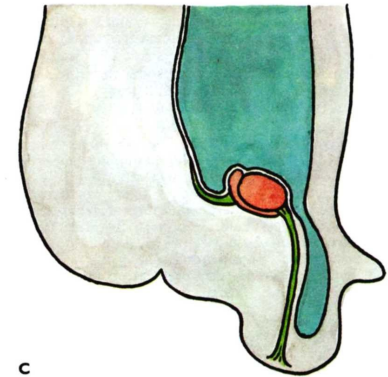
Gubernaculum testis → Lig. scrotale  
Processus vaginalis → Tunica vaginalis



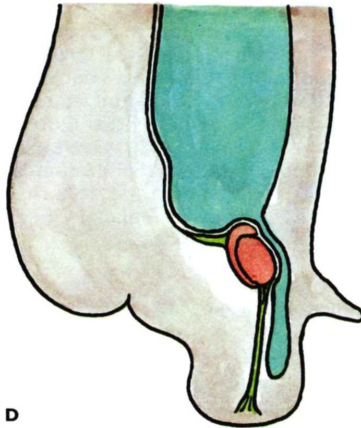
A



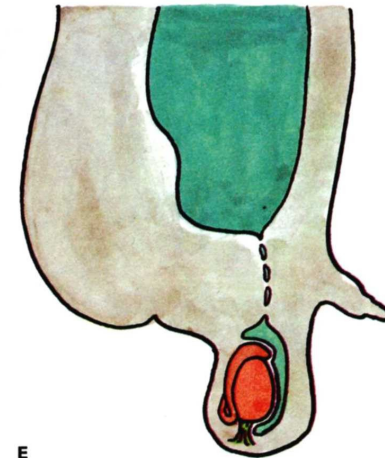
B



C



D



E

**Retentio testis (cryptorchidism). Ectopia testis.**



# DUCTUS DEFERENS (VAS DEFERENS)

Pars epididymica

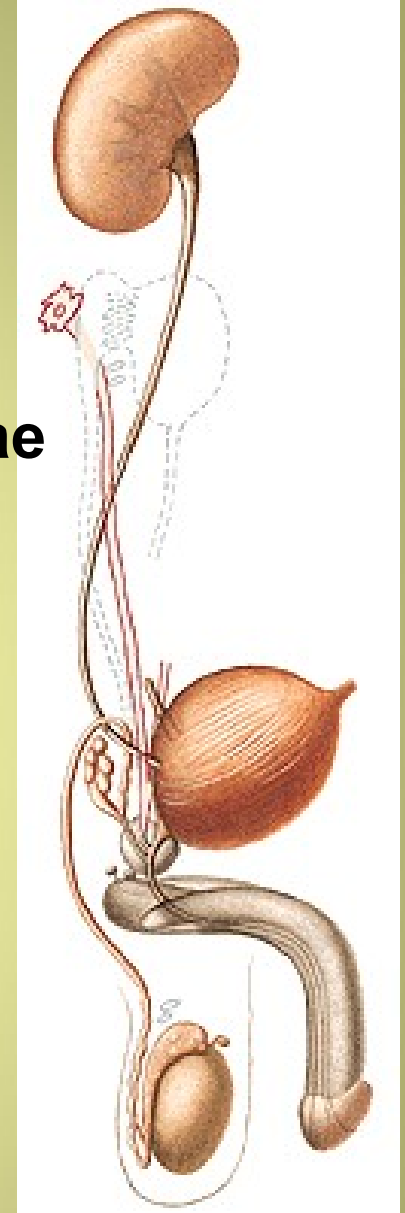
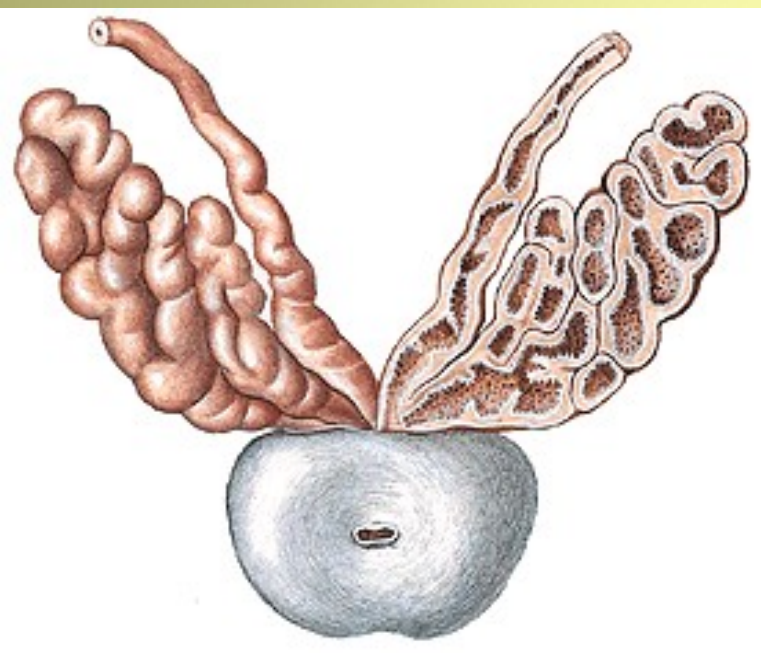
Pars funicularis

Pars inguinalis

Pars pelvina

Ampulla ductus deferentis - diverticula ampullae

Ductus ejaculatorius – colliculus seminalis



# FUNICULUS SPERMATICUS: A. testicularis

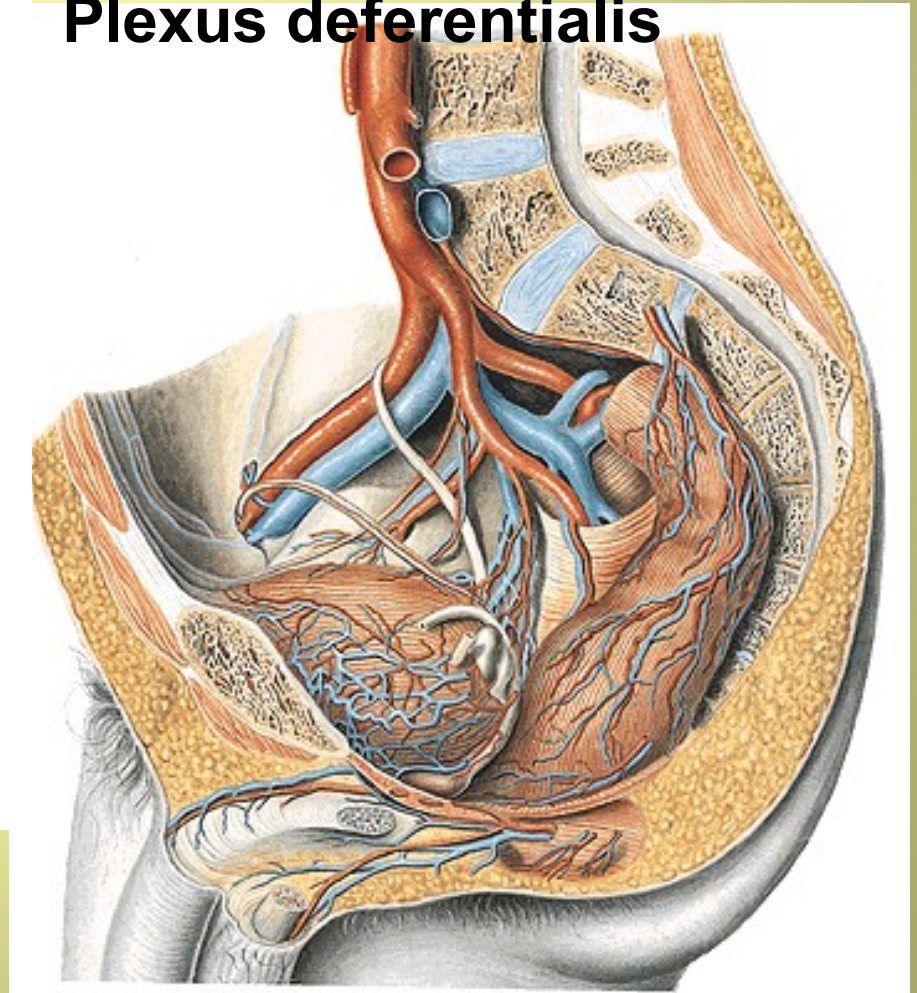
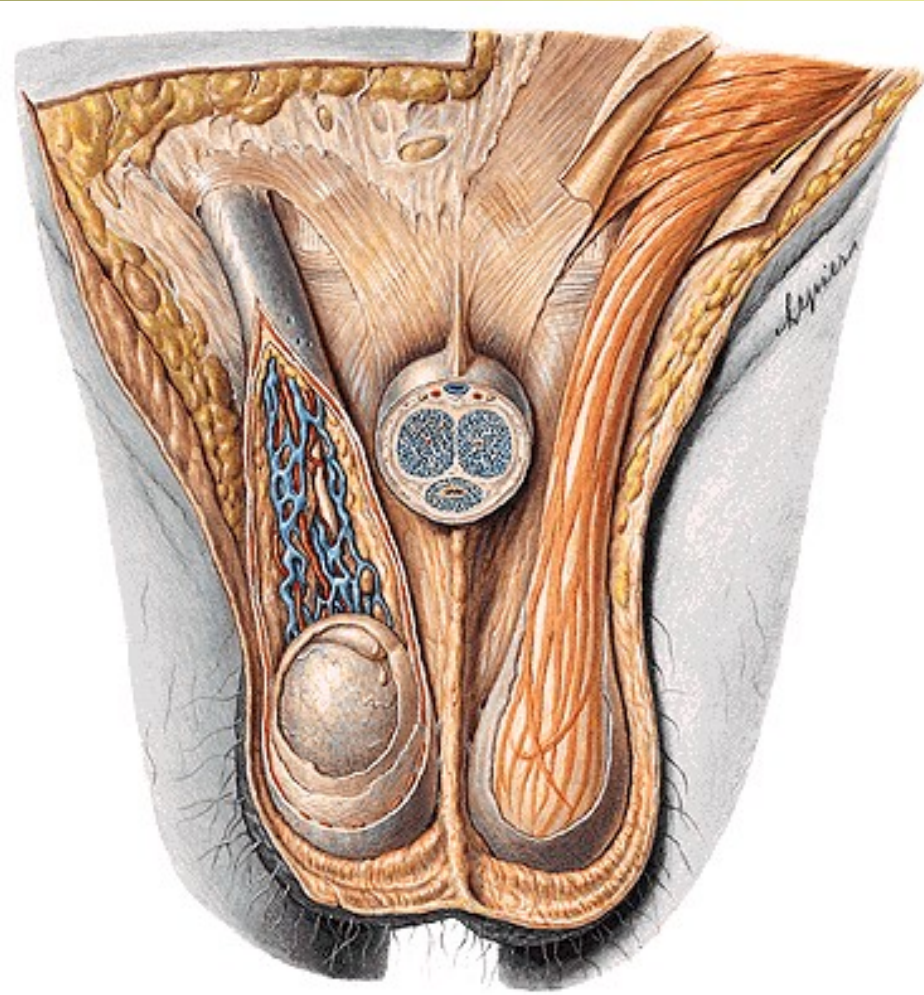
Plexus testicularis

Plexus pampiniformis

Ductus deferens

A. ductus deferentis

Plexus deferentialis

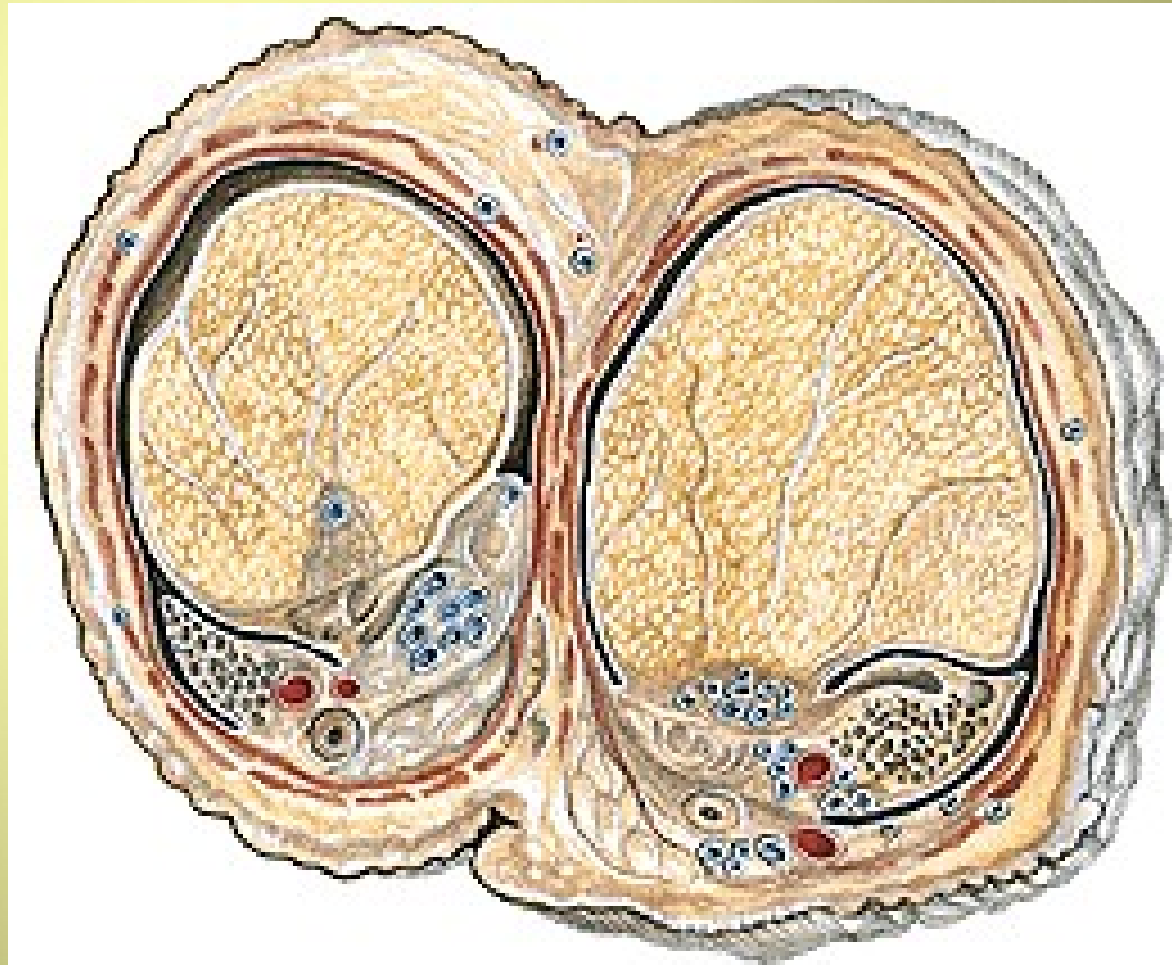


# COVERINGS OF THE TESTIS, EPIDIDYMIS AND SPERMATIC CORD

Epidiorchium (Lamina visceralis tunicae vaginalis)

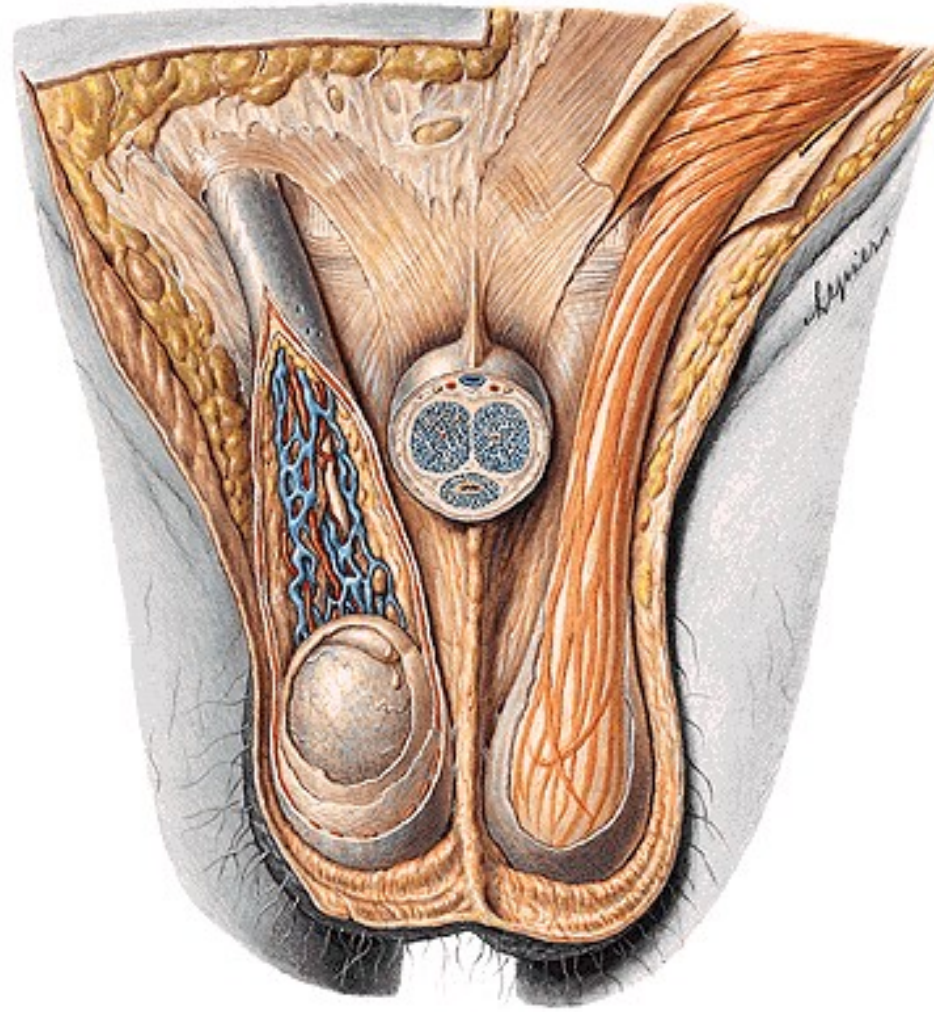
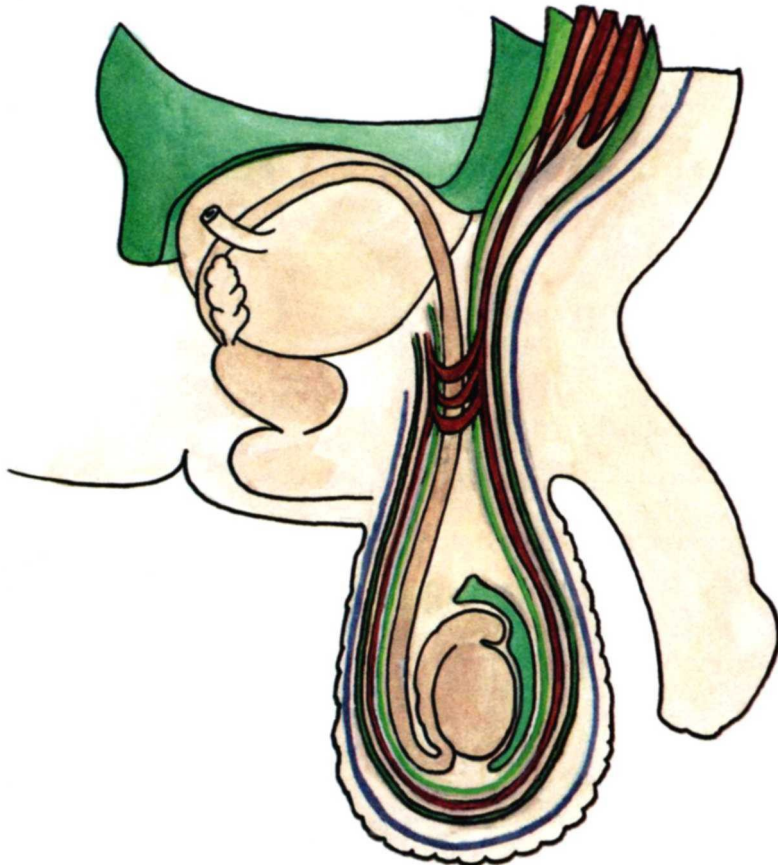
Periorchium (Lamina parietalis tunicae vaginalis)

Cavum serosum scroti





**Fascia spermatica interna (Fascia transversalis)**  
**Fascia cremasterica - M. cremaster**  
**(M. obliquus abdominis internus, M. transversus abdominis)**  
**Fascia spermatica externa (Fascia abdominis superficialis)**





# CANALIS INGUINALIS

*Posterior wall:*

**Fascia transversalis:**

**Falx inguinalis**

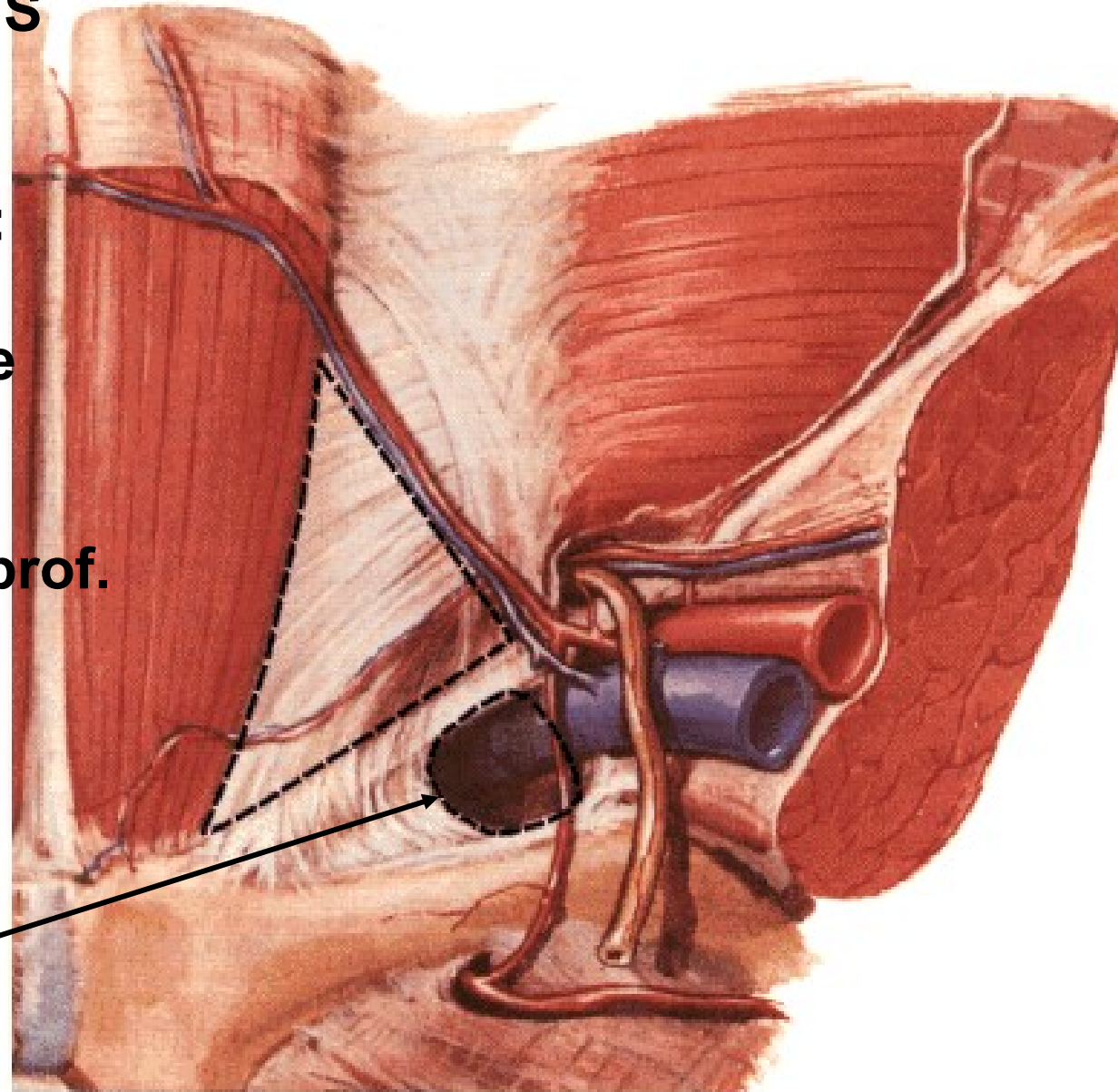
**Trigonum inguinale  
(Hesselbachi)**

**Lig. interfoveolare**

**Anulus inguinalis prof.**

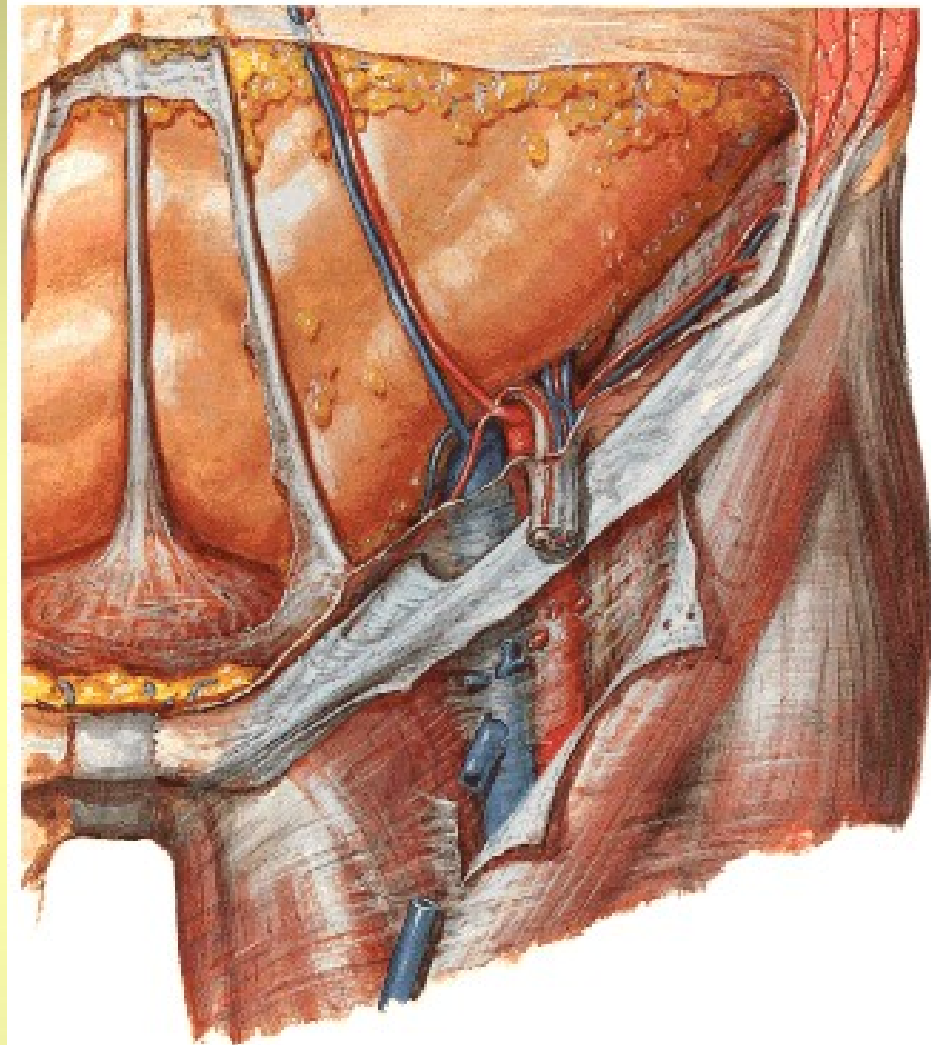
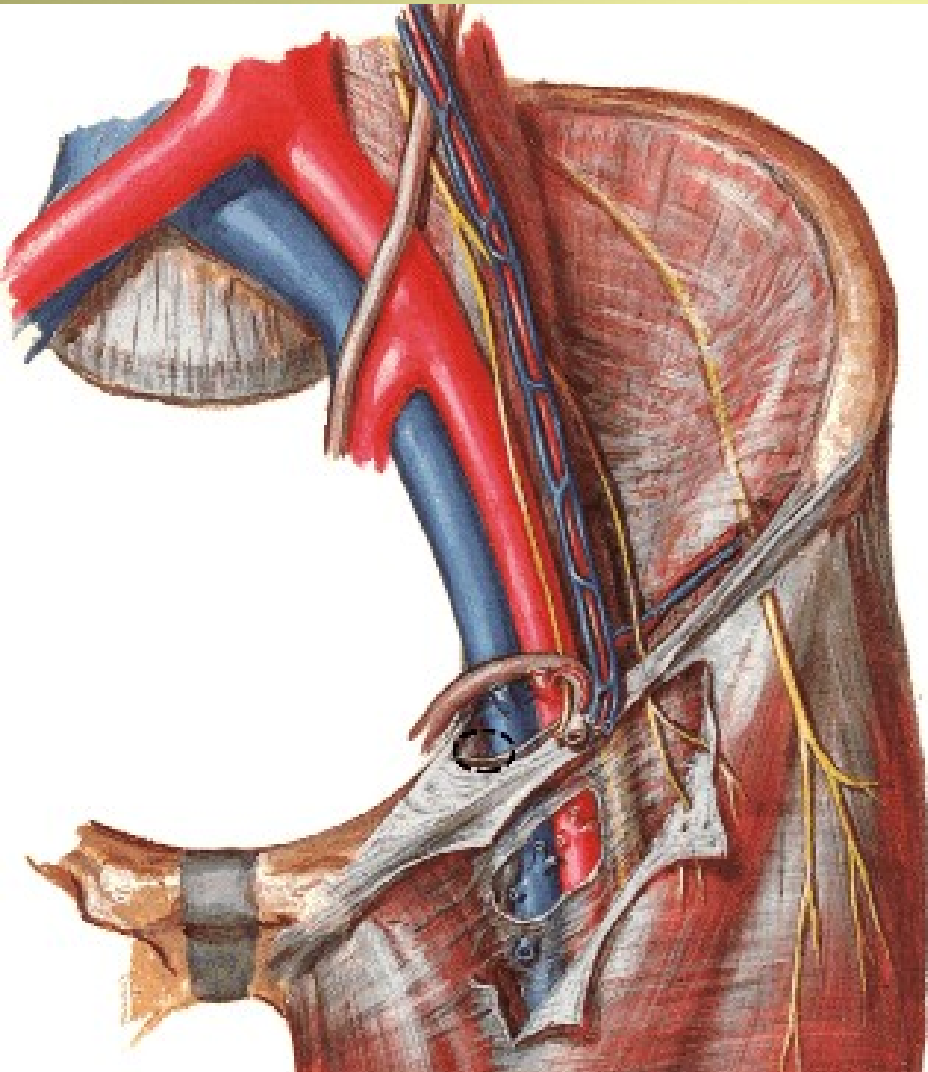
**Tractus iliopubicus**

**Anulus femoralis**



# CANALIS INGUINALIS

*Inferior wall:*  
**Lig. inguinale**



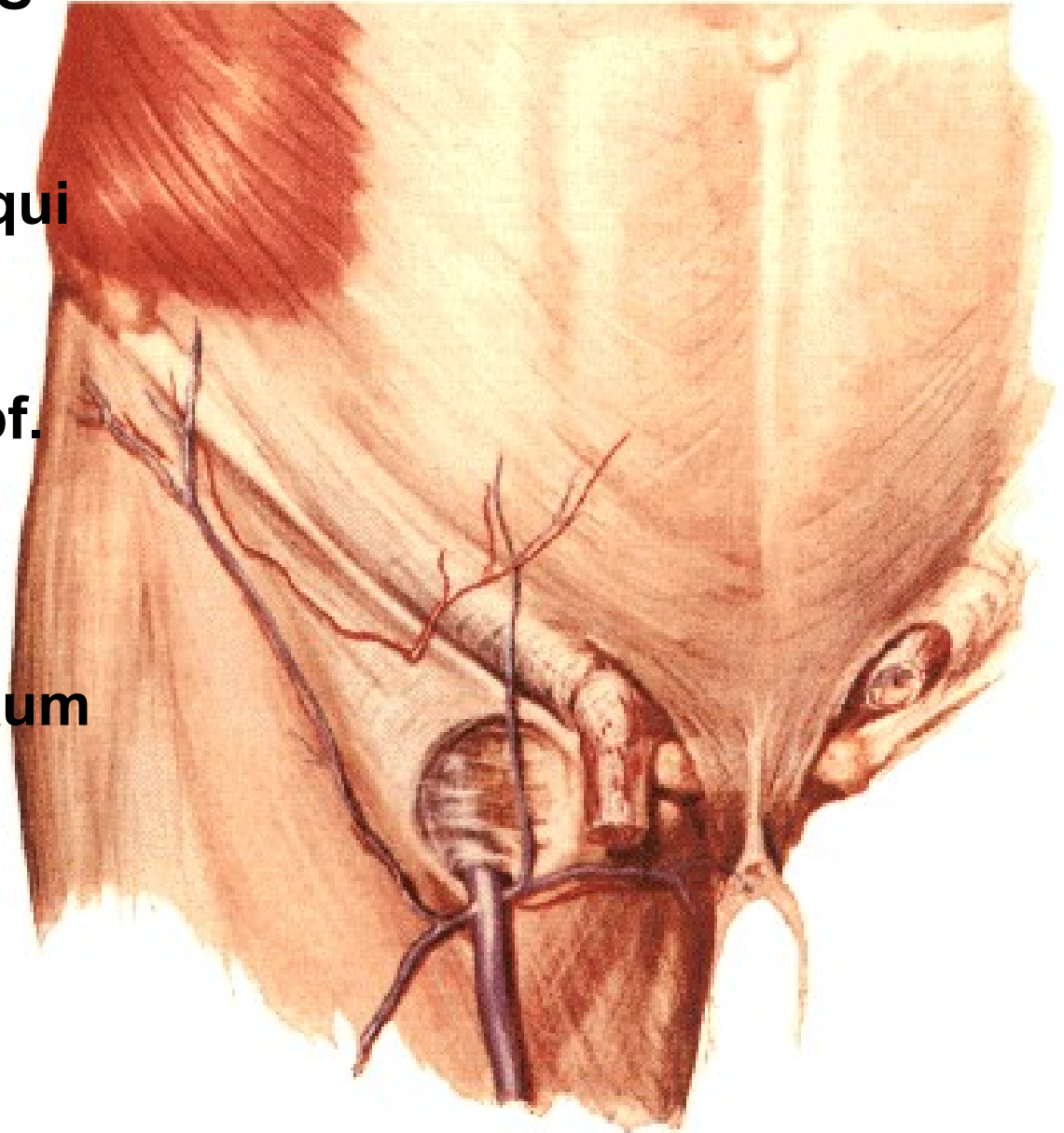
# CANALIS INGUINALIS

*Anterior wall:*

**Aponeurosis m. obliqui  
externi abdominis**

**Anulus inguinalis spf.**

- **crus mediale**
- **crus laterale**
- **fibrae intercrurales**
- **lig. inguinale reflexum**



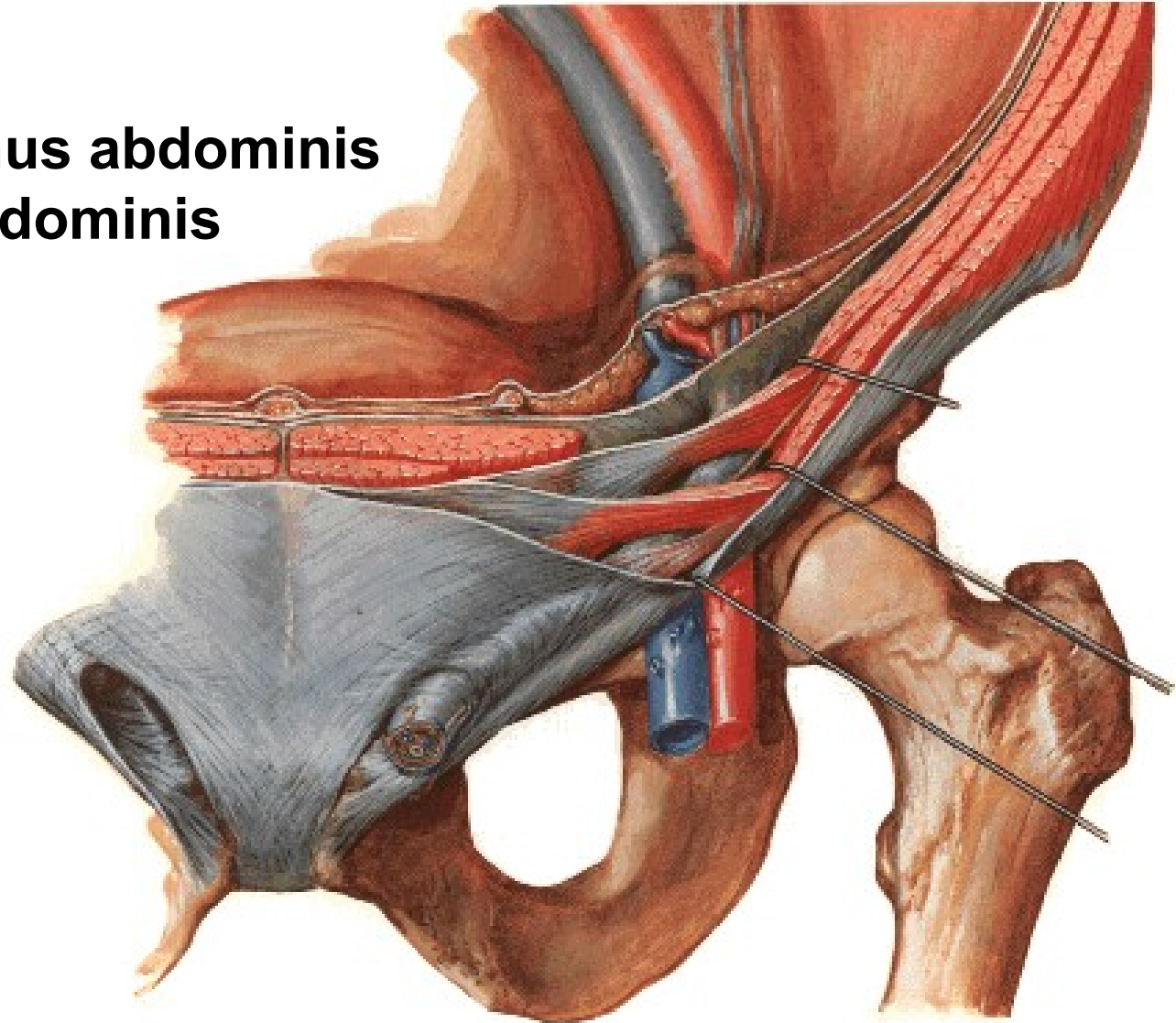
# CANALIS INGUINALIS

*Superior wall:*

**M. obliquus internus abdominis**

**M. transversus abdominis**

**- M. cremaster**





**Plica umbilicalis mediana**  
- lig. umbilicale medianum

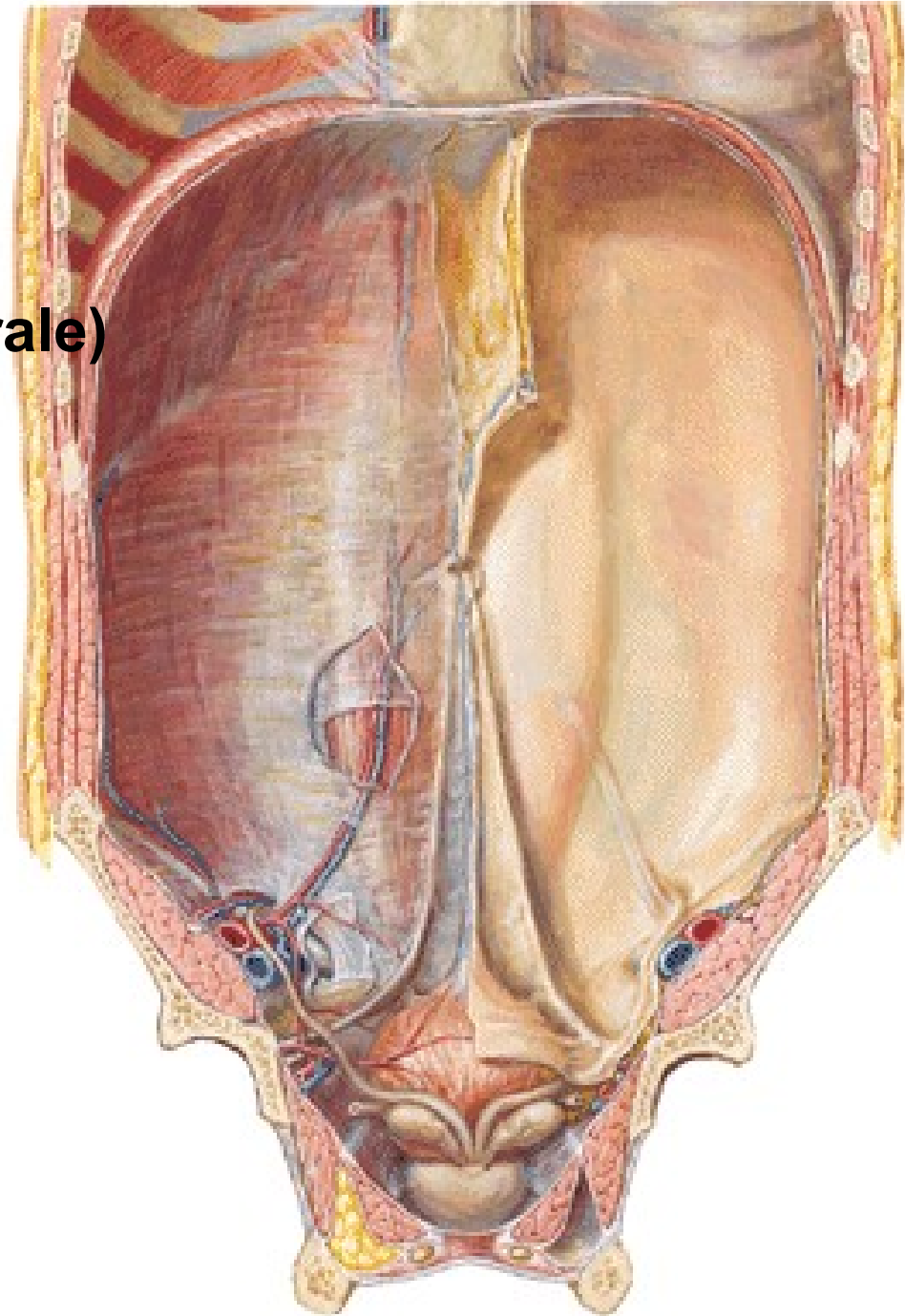
**Plica umbilicalis medialis**  
- lig. umbilicale mediale (laterale)  
(pars occlusa a. umbilicalis)

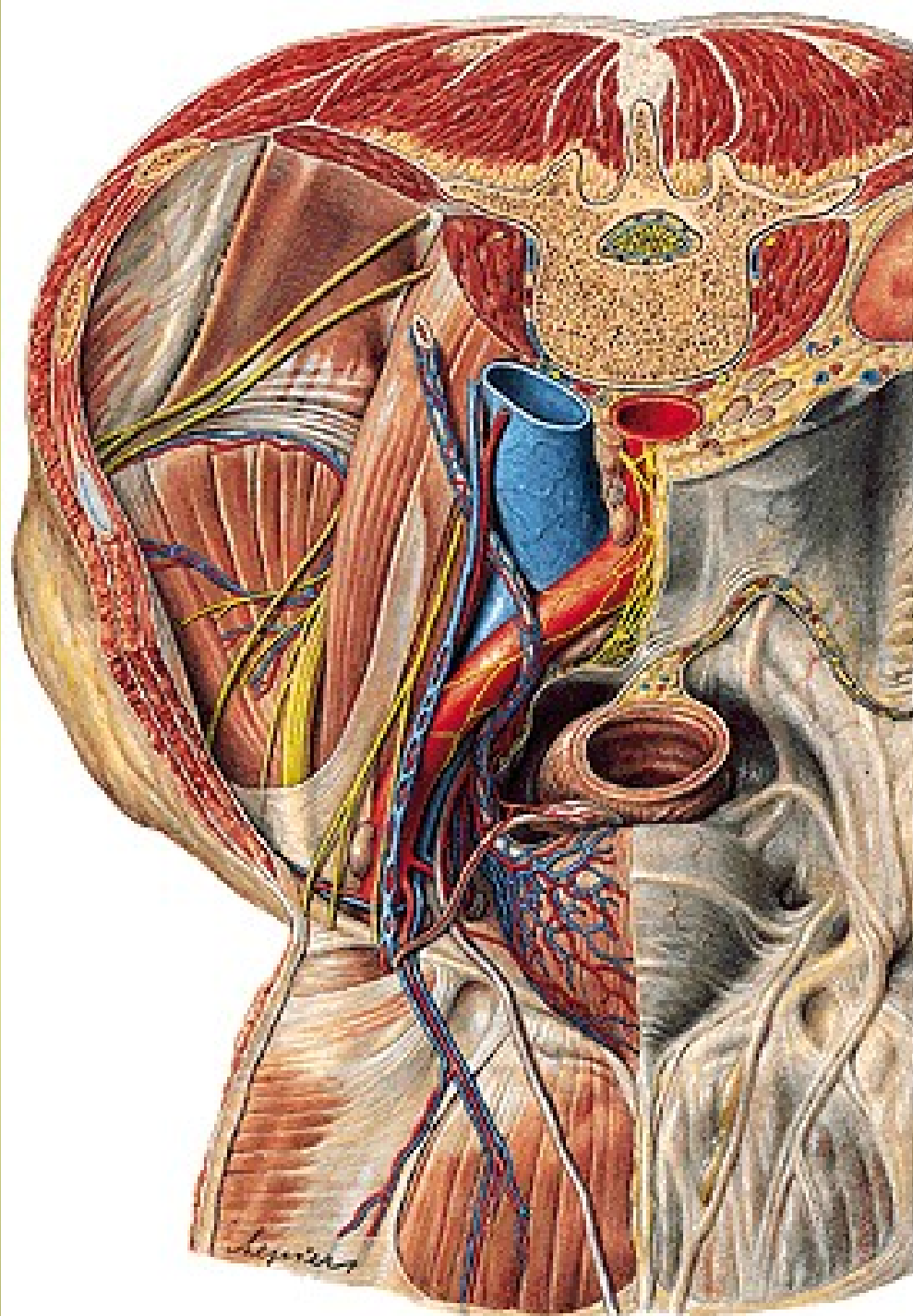
**Plica umbilicalis lateralis**  
- vasa epigastrica inf.

**Fossa supravesicalis**

**Fossa inguinalis medialis**  
(trig. Inguinale)

**Fossa inguinalis lateralis**  
(anulus inguinalis prof.)





# Fossa supravesicalis

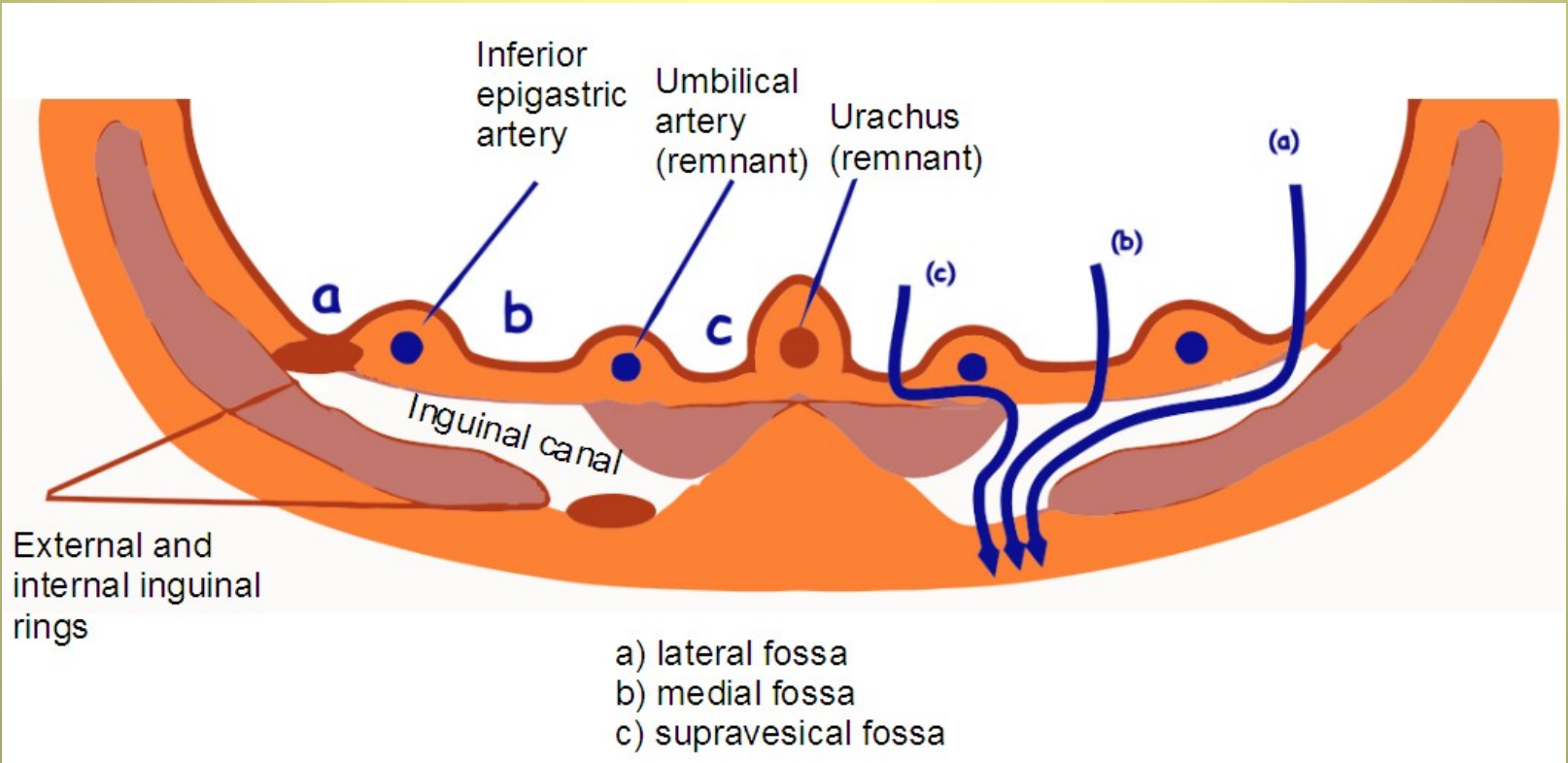
- hernia supravesicalis (c)

# Fossa inguinalis medialis

- hernia inguinalis directa (b)

# Fossa inguinalis lateralis

- hernia inguinalis indirecta (a)



# **VESICULA SEMINALIS**

**Ductus excretorius**

**Ductus ejaculatorius**

# **PROSTATATA**

**Basis**

**Apex**

**Facies anterior**

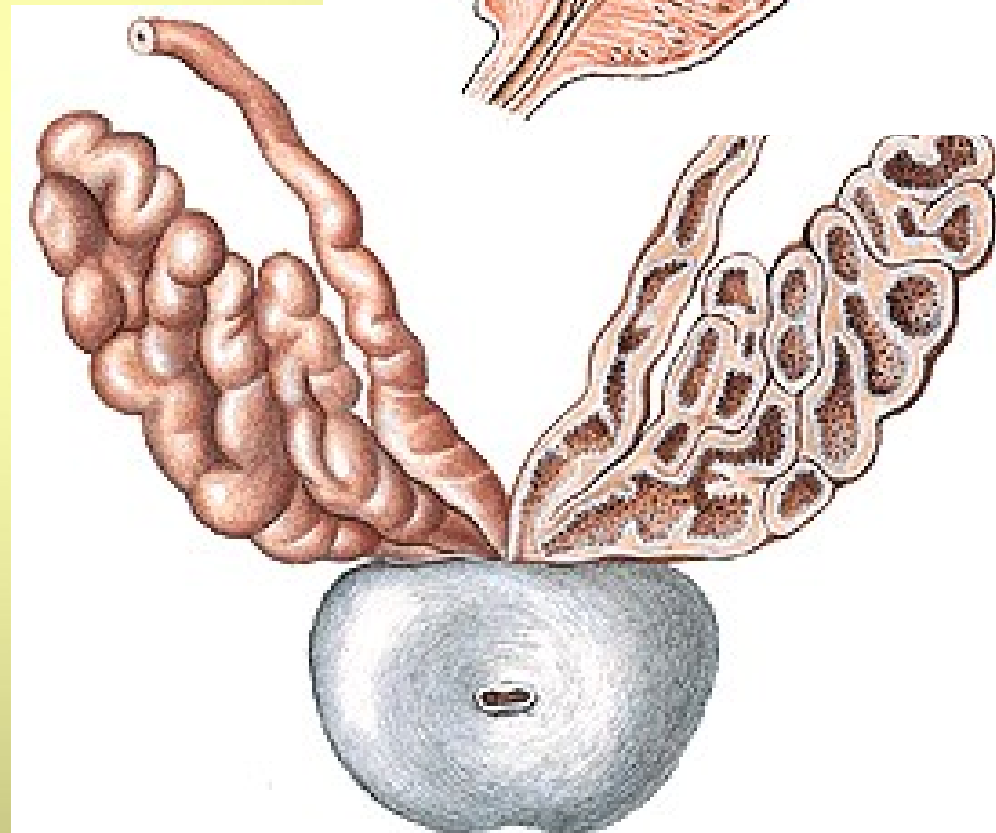
**Facies posterior**

**Facies inferolaterales**

**Lobus medius**

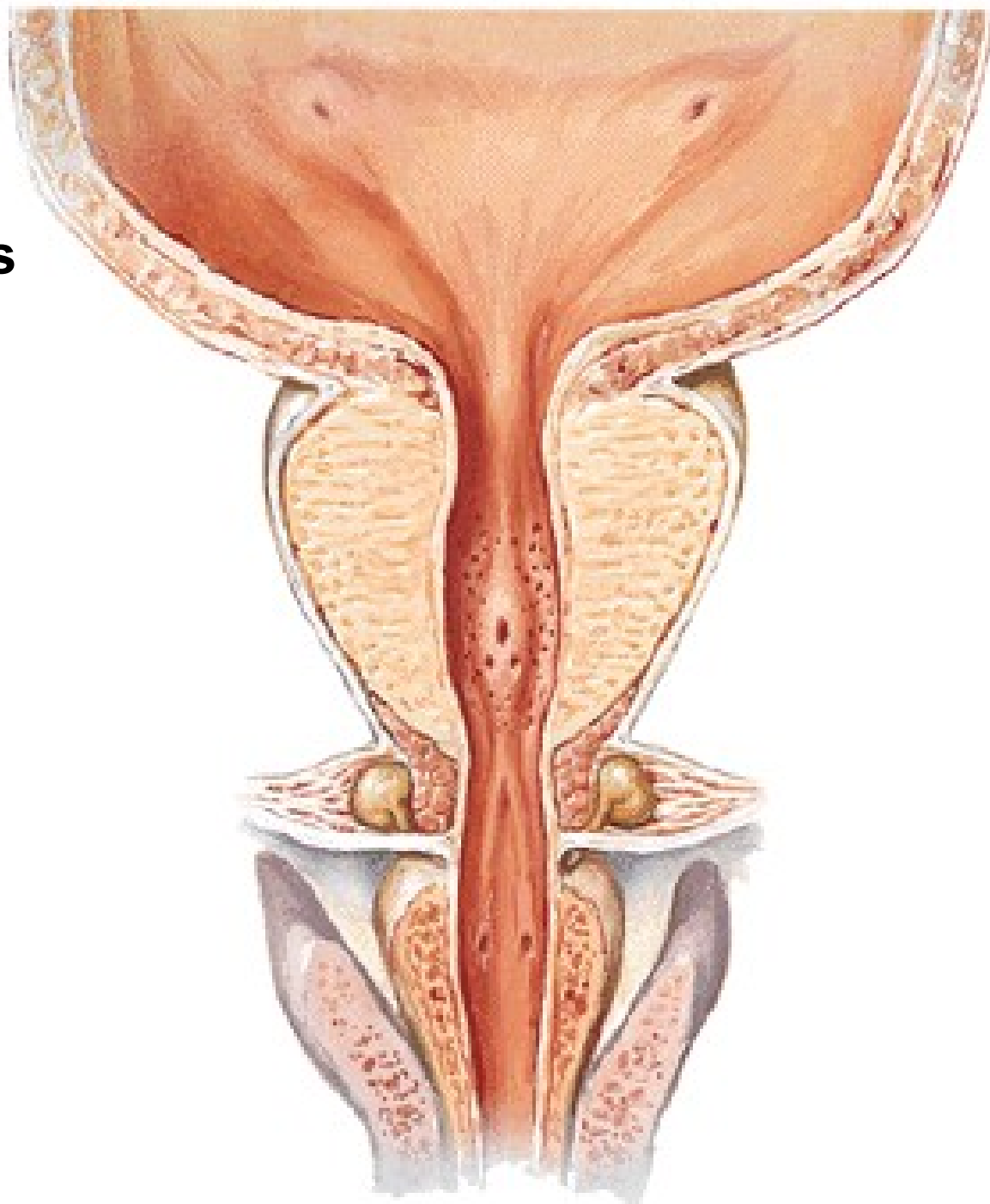
**Lobus dexter et sinister**

**Isthmus**

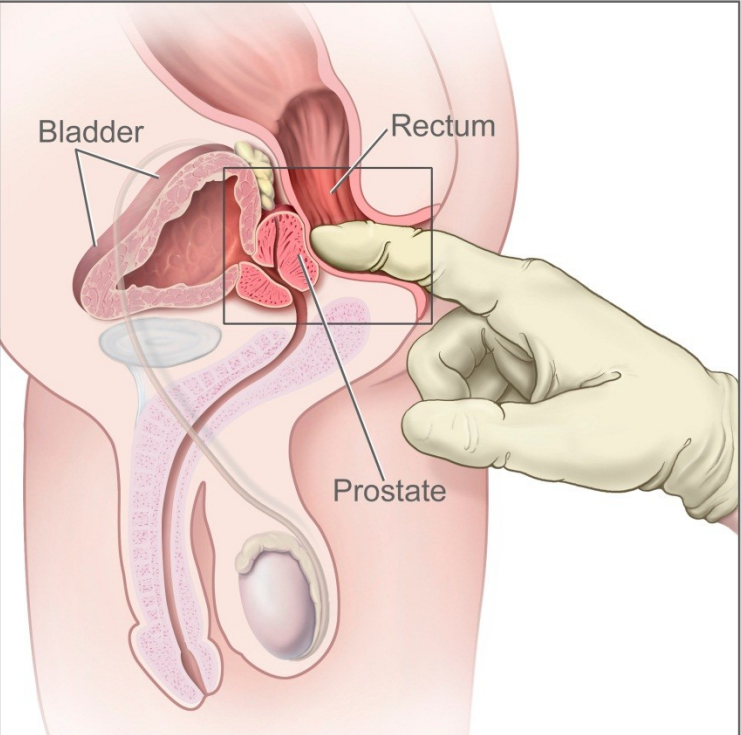
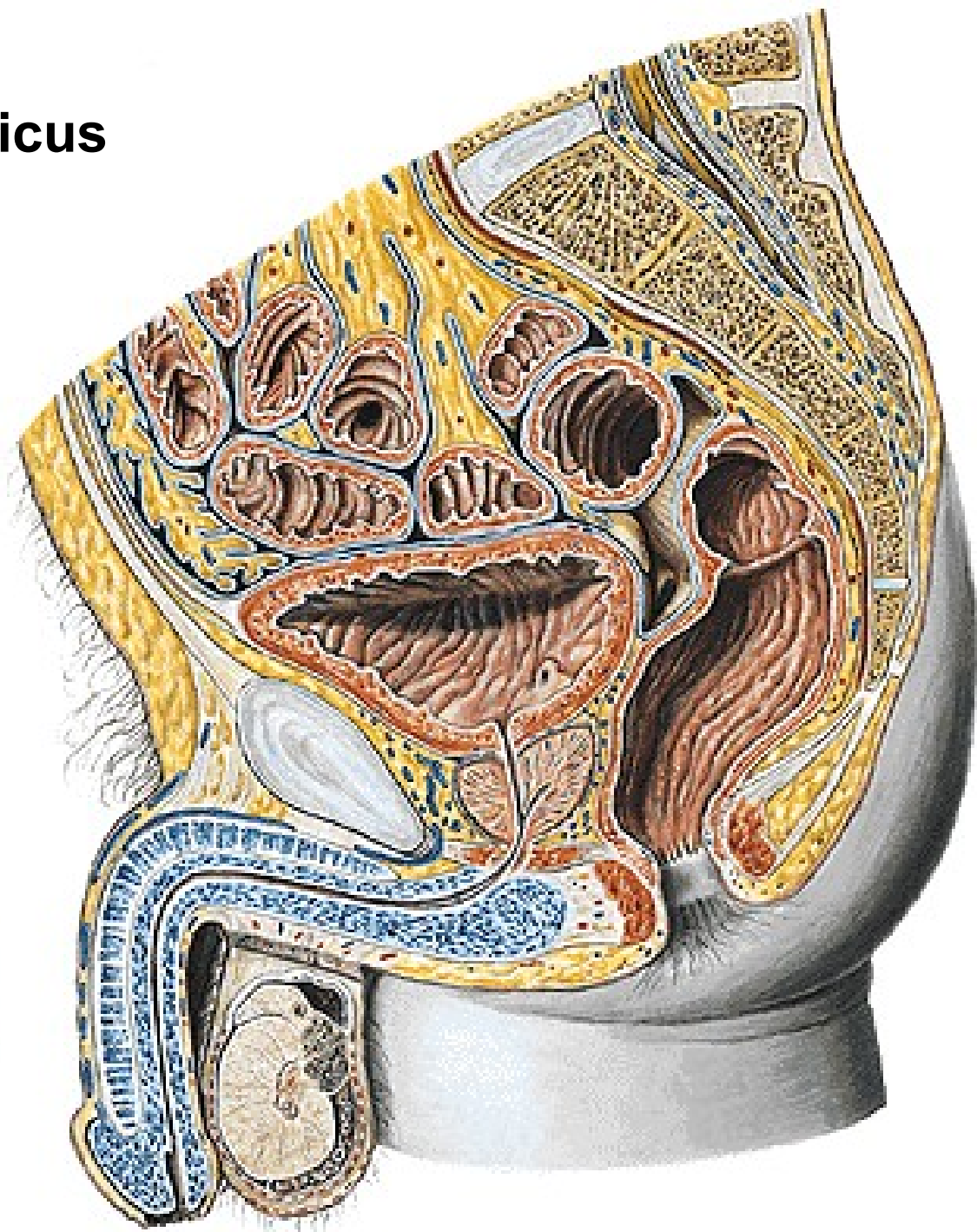


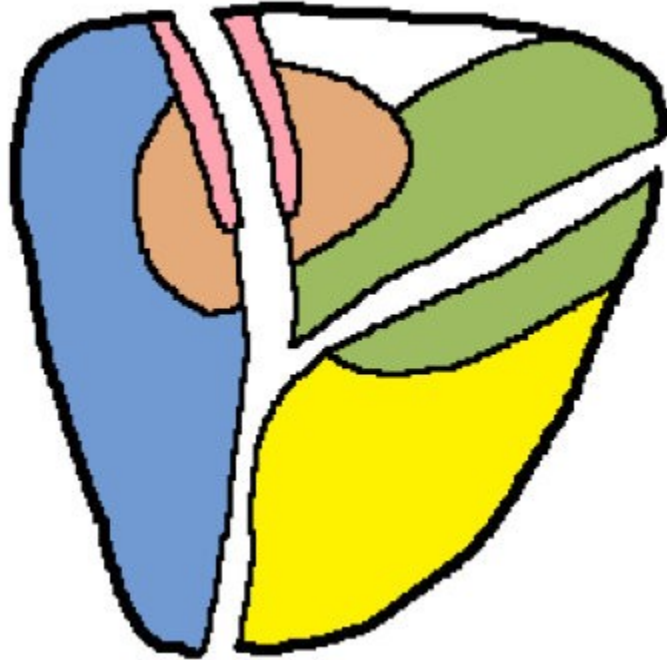


**Crista urethralis**  
**Colliculus seminalis**  
**Utriculus prostaticus**  
**Ductus ejaculatorii**  
**Sinus prostatici**

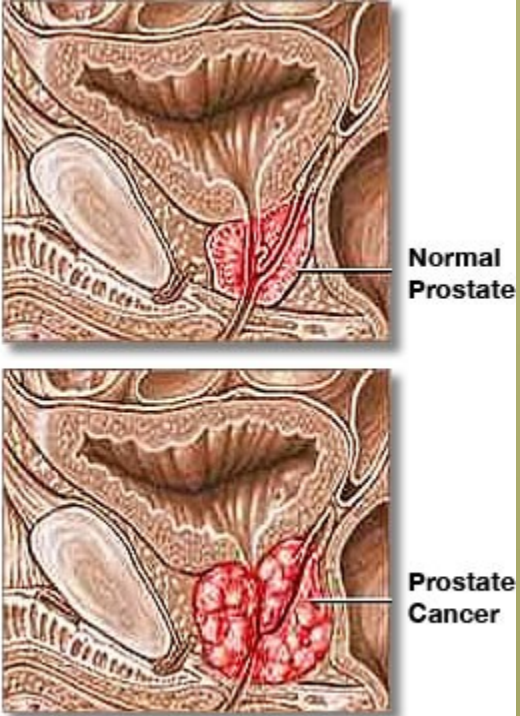
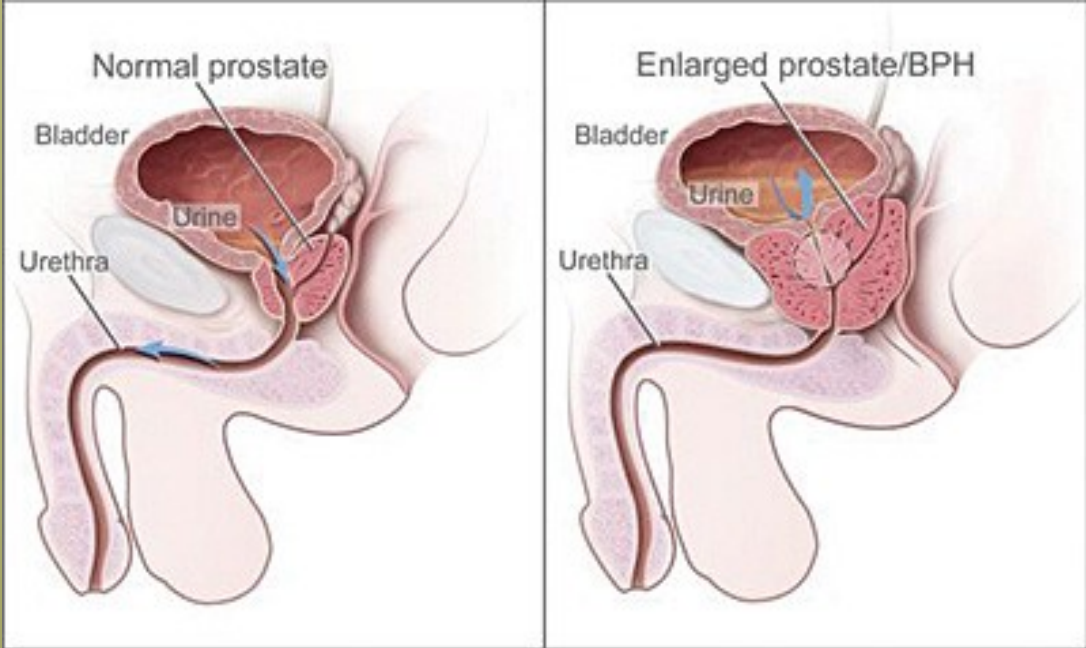


**Capsula propria**  
**Plexus venosus prostaticus**  
**Fascia periprostatica**  
**Lig. puboprostaticum**  
**Lig. sacrogenitale**  
**Septum rectovesicale**  
**(Denonvilliers' fascia)**





- Anterior Fibromuscular Zone
- Preprostatic Sphincter
- Transitional Zone
- Central Zone
- Peripheral Zone



Prostate Illustration courtesy MaleCare.com

# **GLANDULAE BULBOURETHRALES**

**Ductus gl. bulbourethralis**

## **URETHRA MASCULINA**

**Ostium urethrae internum**

**Ostium urethrae externum**

**Pars intramuralis – M. sphincter vesicae**

**Pars prostatica**

**Pars membranacea – M. sphincter urethrae**

**Pars spongiosa – Ampulla urethrae**

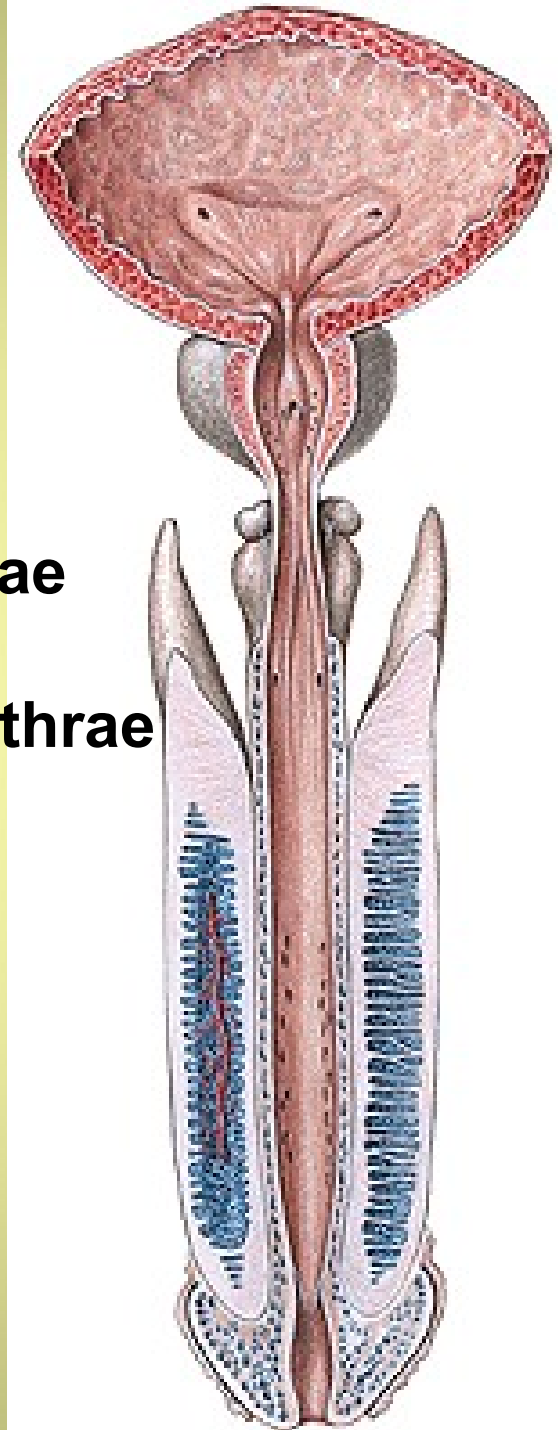
**Corpus spongiosum penis**

**Fossa navicularis**

**Valvula fossae navicularis**

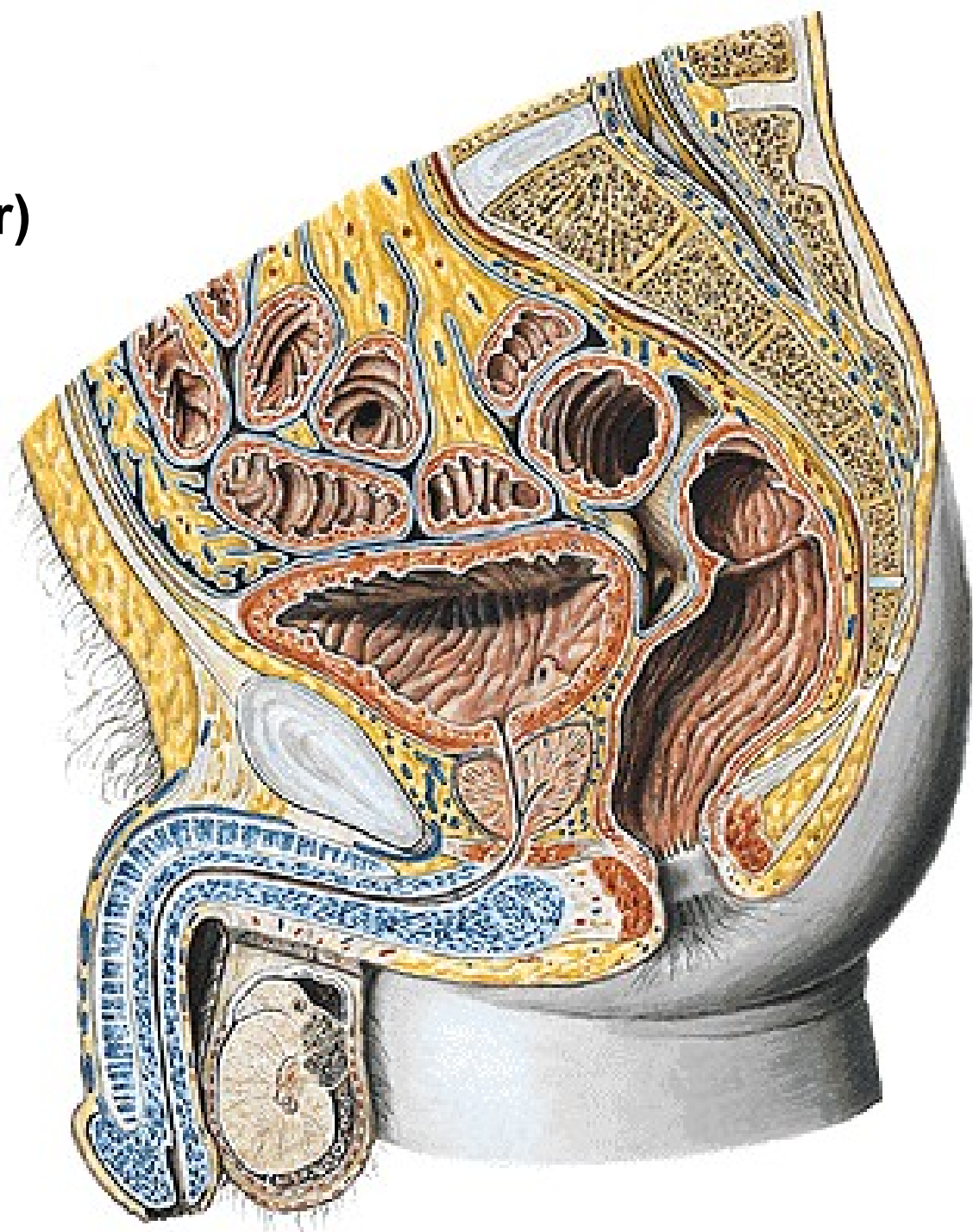
**Glandulae urethrales**

**Lacunae urethrales**





**Curvatura subpubica**  
**Curvatura praepubica**  
**Urethra mobilis (anterior)**  
**Urethra fixa (posterior)**



# EXTERNAL GENITAL ORGANS

**PENIS: Radix**

**Corpus**

**Glans**

**Praeputium**

**SCROTUM**



# PENIS

Glans penis

Collum glandis

Corona glandis

Dorsum penis

Facies urethralis

Raphe penis

Praeputium

Ostium praeputii

Glandulae praeputiales

Smegma praeputii

Frenulum praeputii

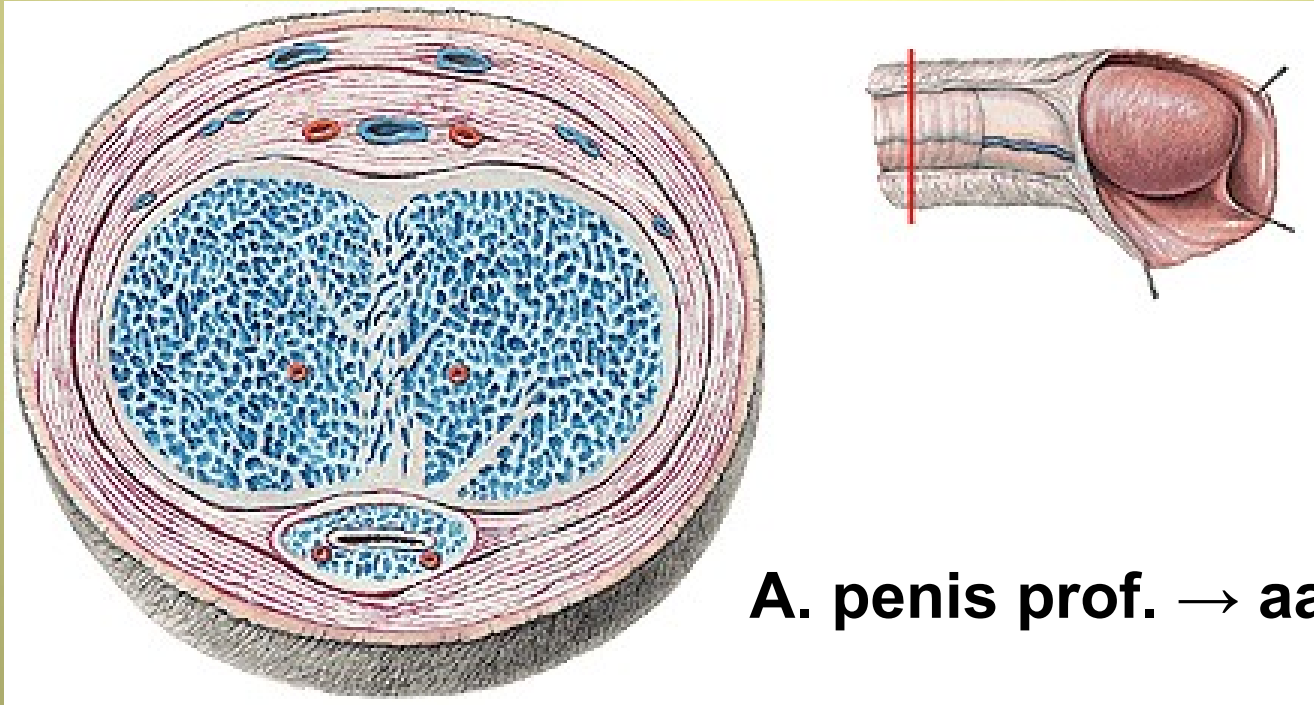
Corpus cavernosum

Corpus spongiosum

Tunica albuginea

Trabeculae

Cavernae



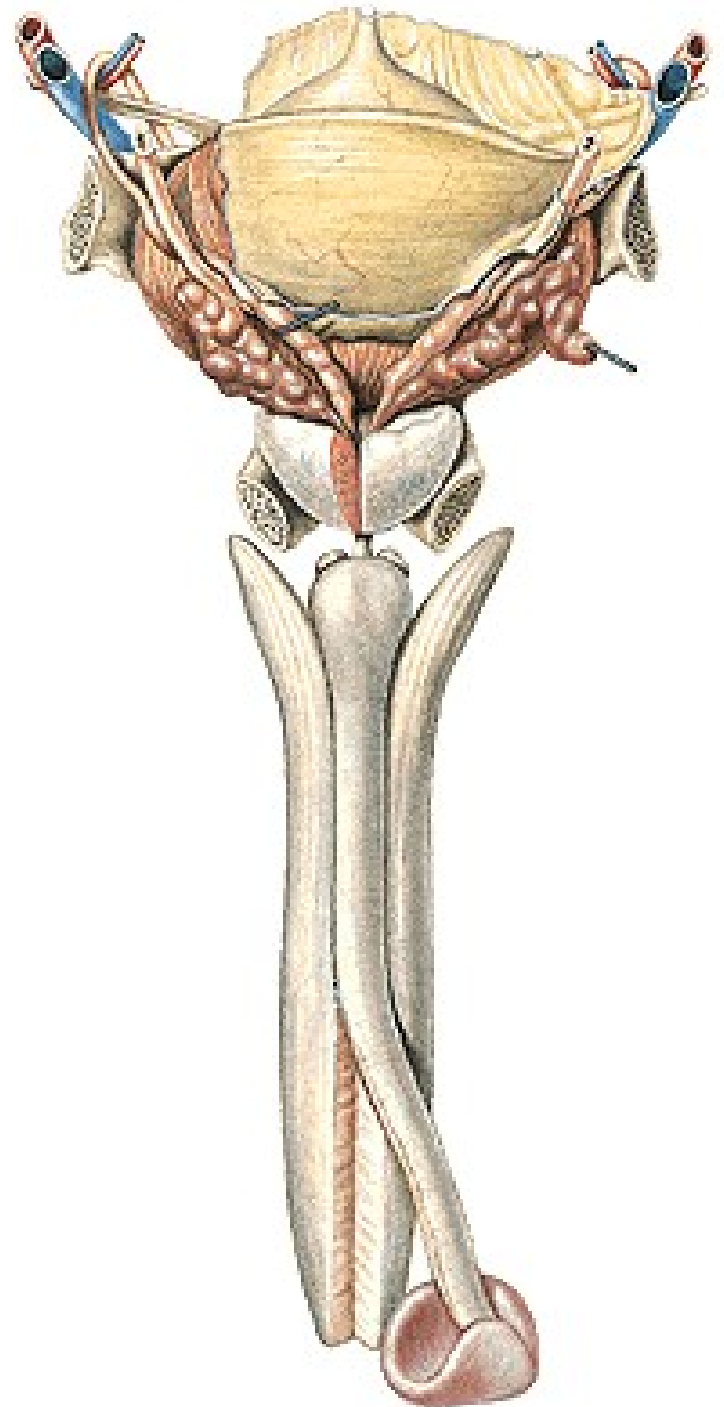
A. penis prof. → aa. helicinae

## **Corpus cavernosum**

- crura penis - crista phallica
- ### **A. profunda penis**

## **Corpus spongiosum**

- bulbus penis
- glans penis





# COVERINGS OF PENIS:

Fascia penis profunda

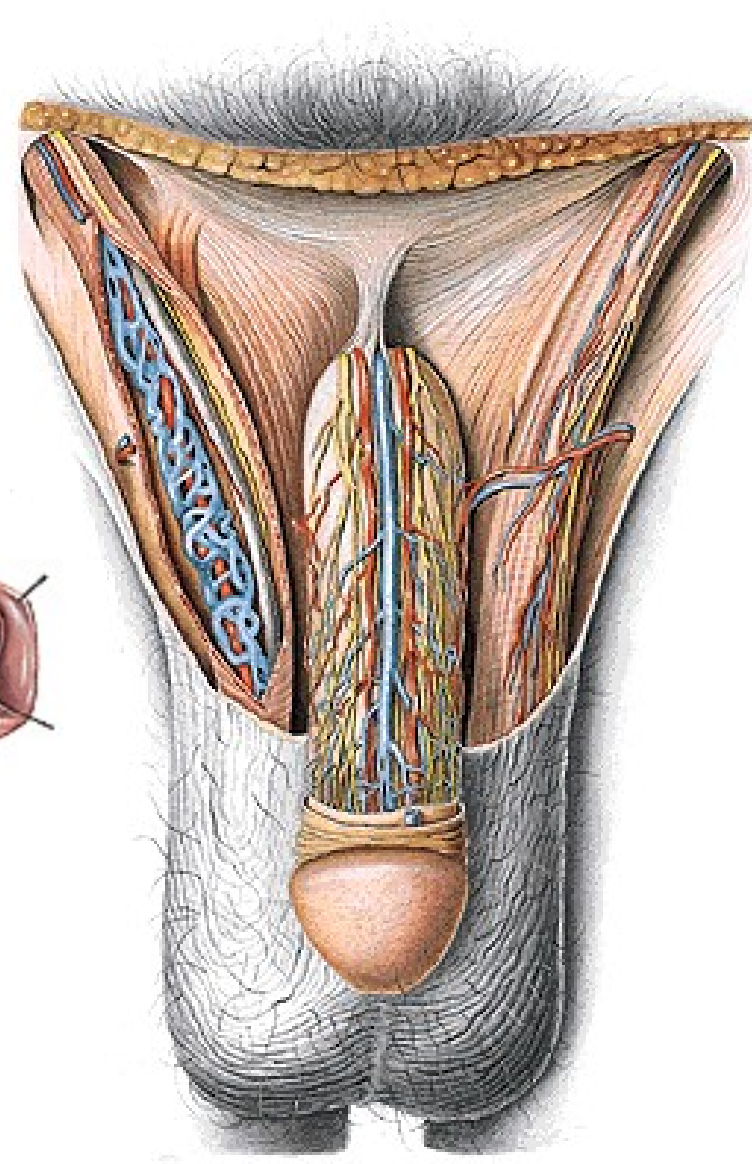
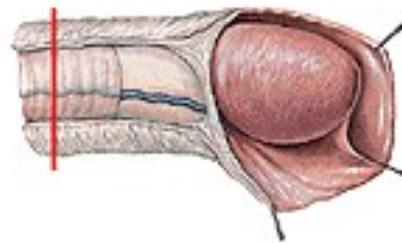
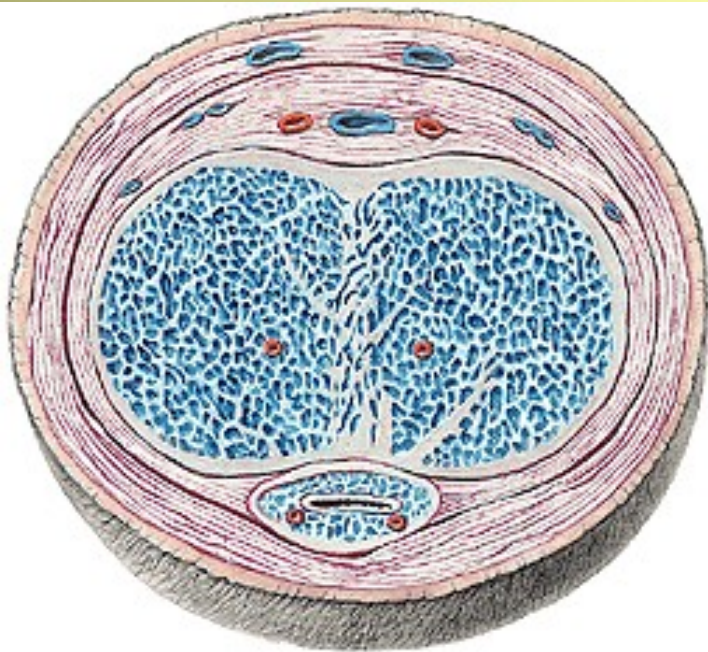
(Aa., Nn. dorsales penis, V. dorsalis penis profunda)

Fascia penis superficialis

(Vv. dorsales penis spf.)

Lig. fundiforme penis

Lig suspensorium penis



# SCROTUM

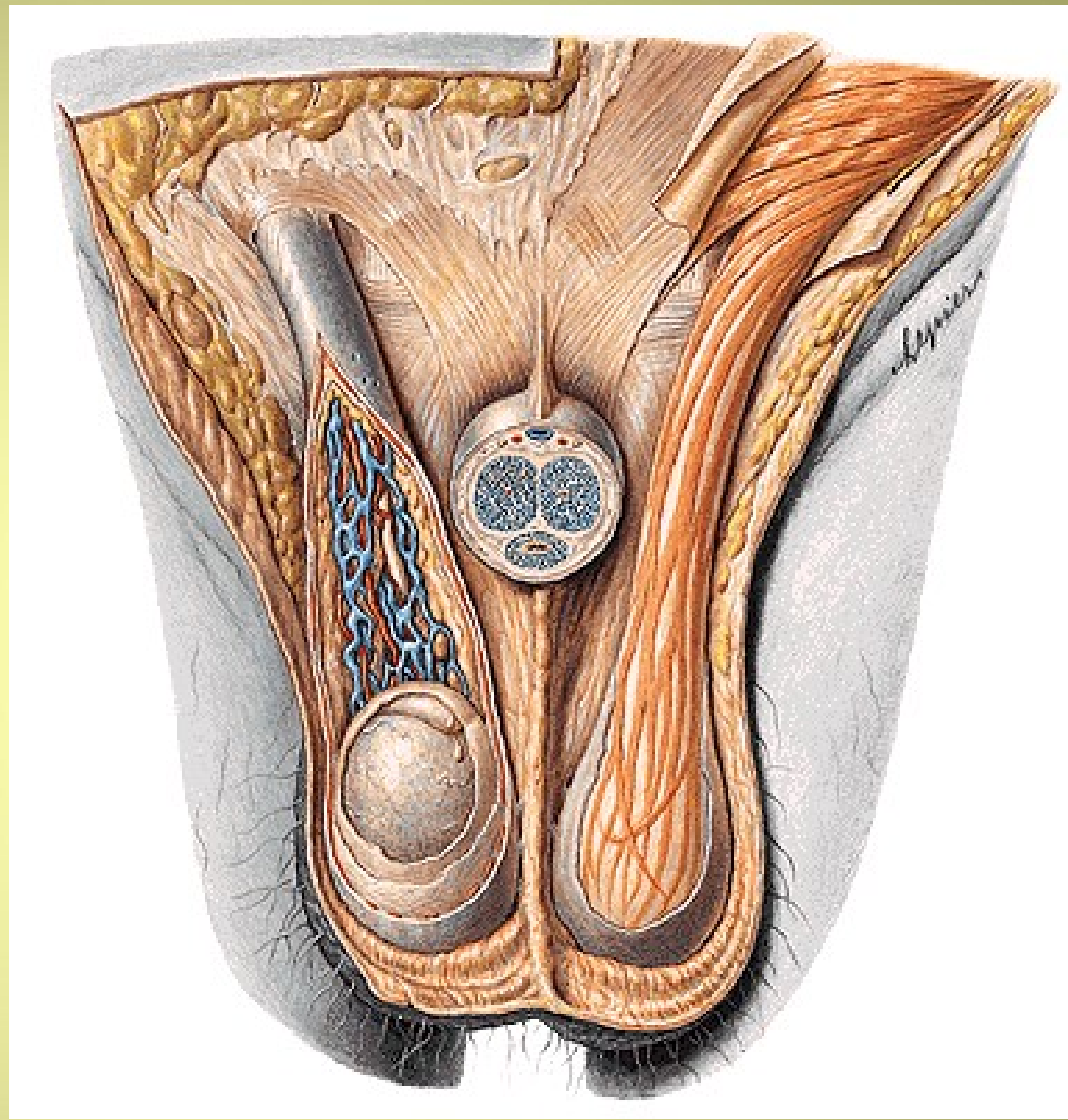
Raphe scroti

Pubes

Tunica dartos scroti

Septum scroti

Cavitas scroti



# **ANATOMICAL BASIS OF ERECTION**

## **Parasympathetic stimulation**

- relaxation of smooth muscle in cavernae and aa. helicinae, compression of venous plexuses by bulbospongious and ischiocavernous muscles → erection**

## **Sympathetic stimulation**

- contraction of smooth muscle of aa. helicinae, relaxation of bulbospongious and ischiocavernous muscles, drainage of blood into v. dorsalis penis prof. → detumescence**

# **EJACULATION OF THE SEMEN**

- 1. Emission of sperms and genital glands secretion  
- sympathetic stimulation**
- 2. Expulsion of the semen from the spongy urethra (ejaculation) – parasympathetic stimulation**

# PELVIC FLOOR

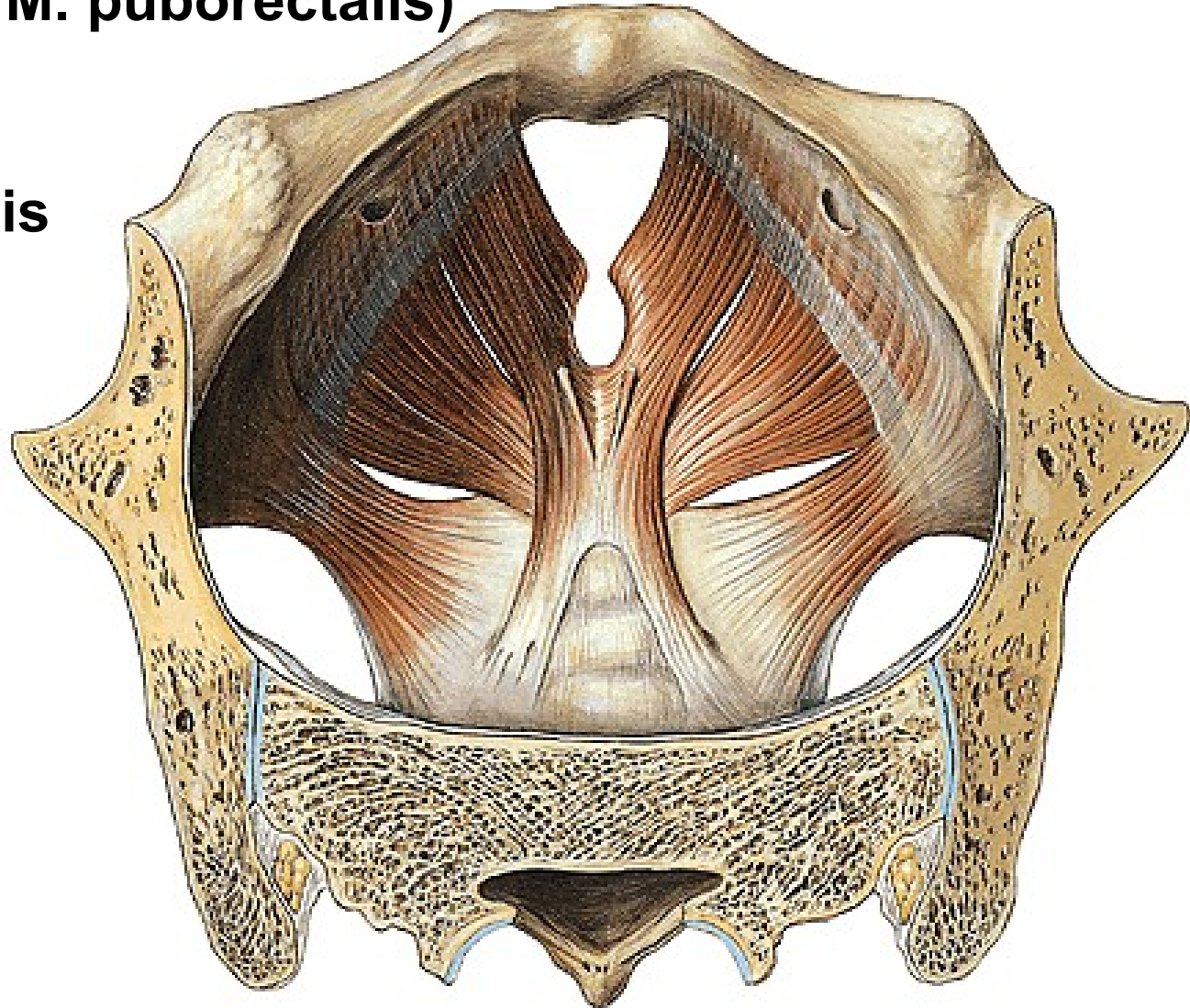


# DIAPHRAGMA PELVIS

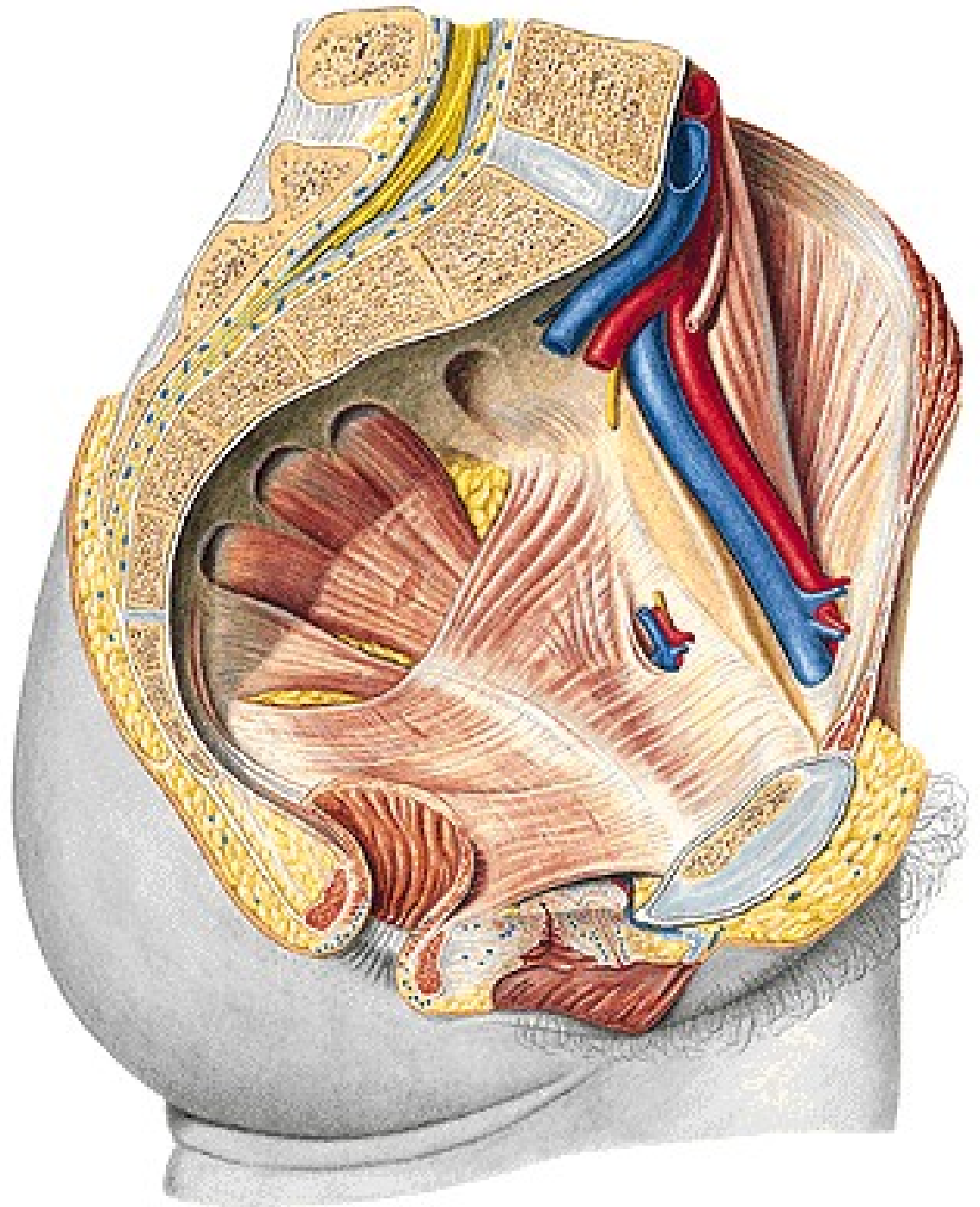
M. levator ani – pars iliaca (M. iliococcygeus)  
- pars pubica (M. pubococcygeus)  
(- M. puborectalis)

M. coccygeus

Hiatus urogenitalis



**Arcus tendineus m.  
levatoris ani**

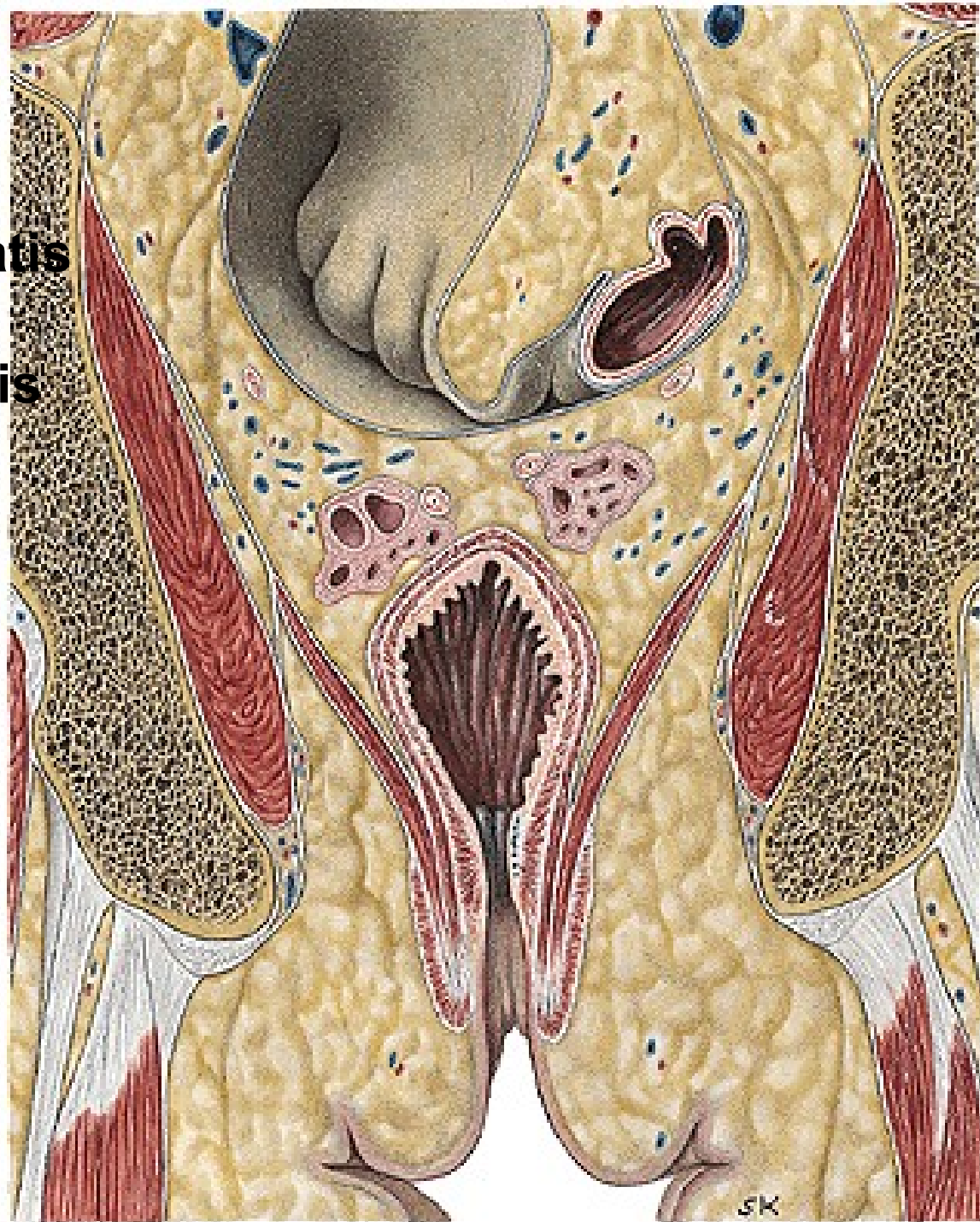


**Fascia obturatoria**  
**Canalis pudendalis**  
**(Alcock)**

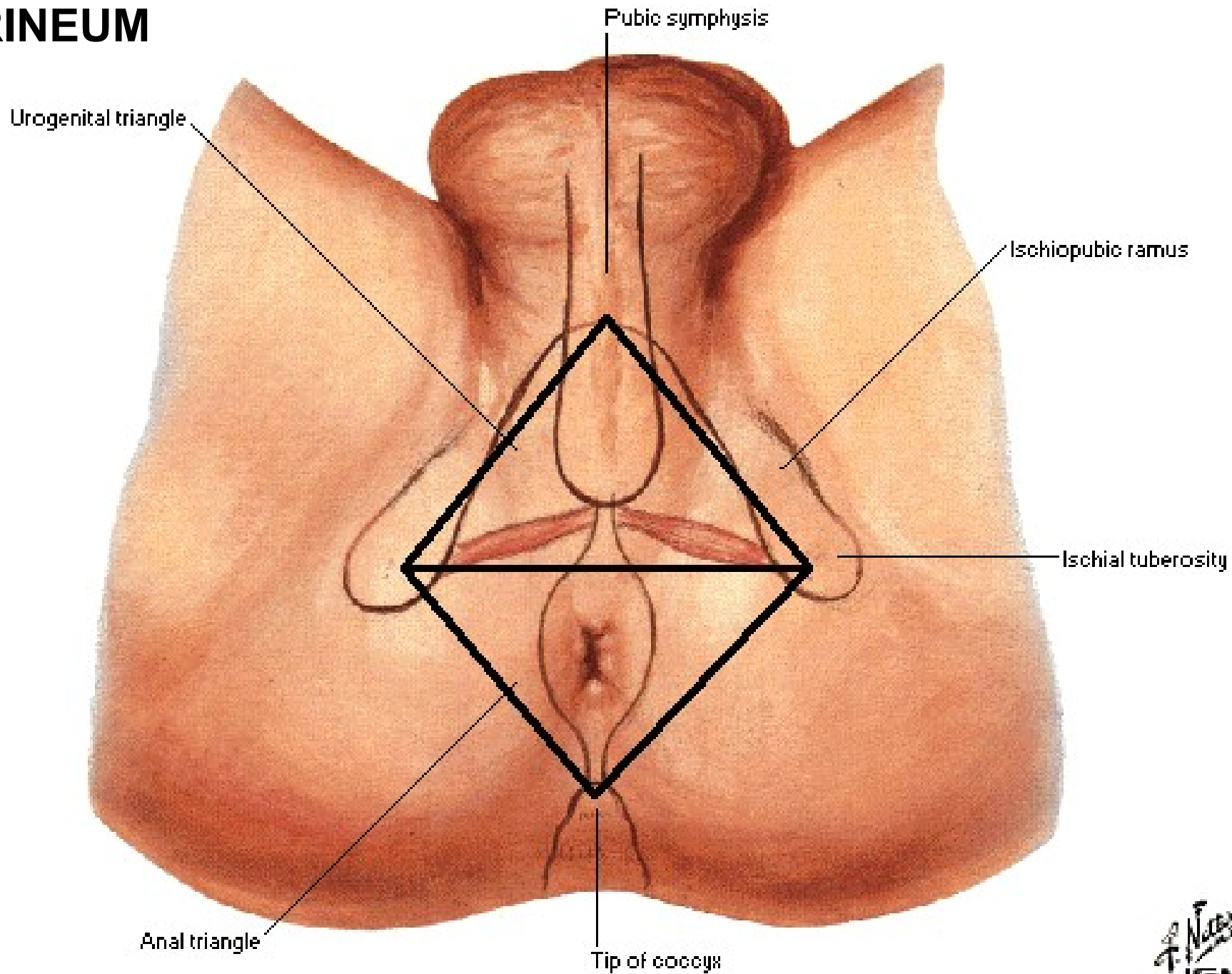
**Fascia sup. diaphragmatis**  
**pelvis**

**Fascia inf. diaphragmatis**  
**pelvis**

**Fossa ischioanalis/**  
**- rectalis**



# PERINEUM





# Fossa ischioanalis/-rectalis

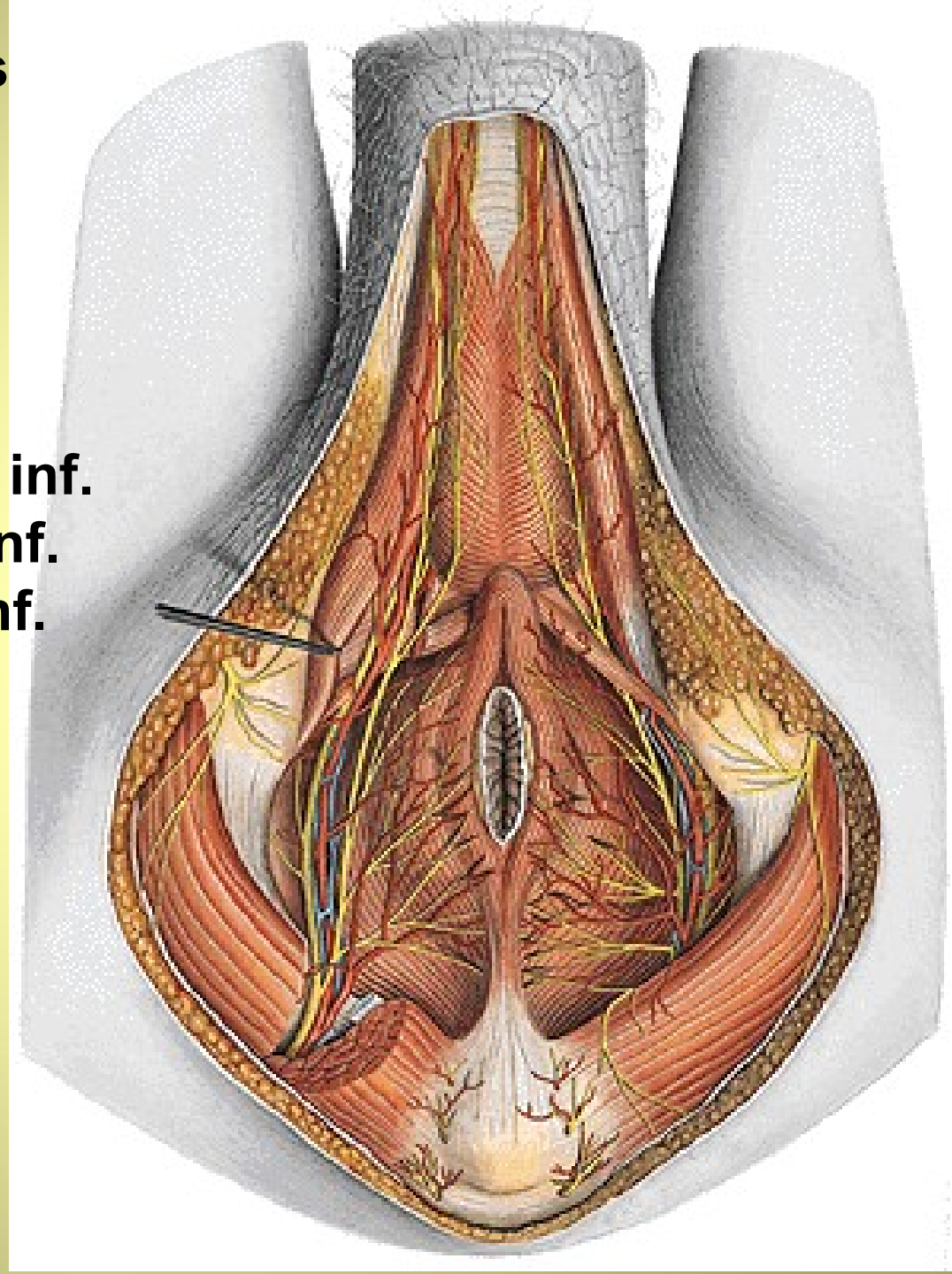
**M. sphincter ani externus**

**Lig. anococcygeum**

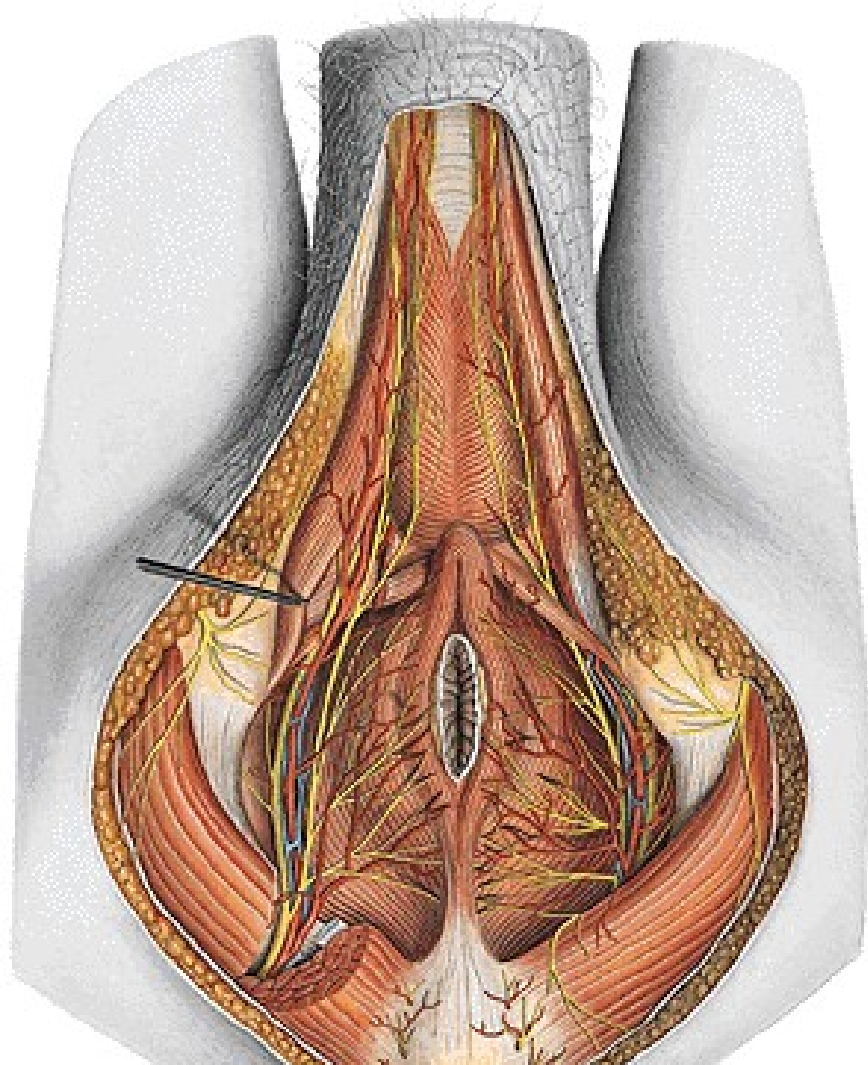
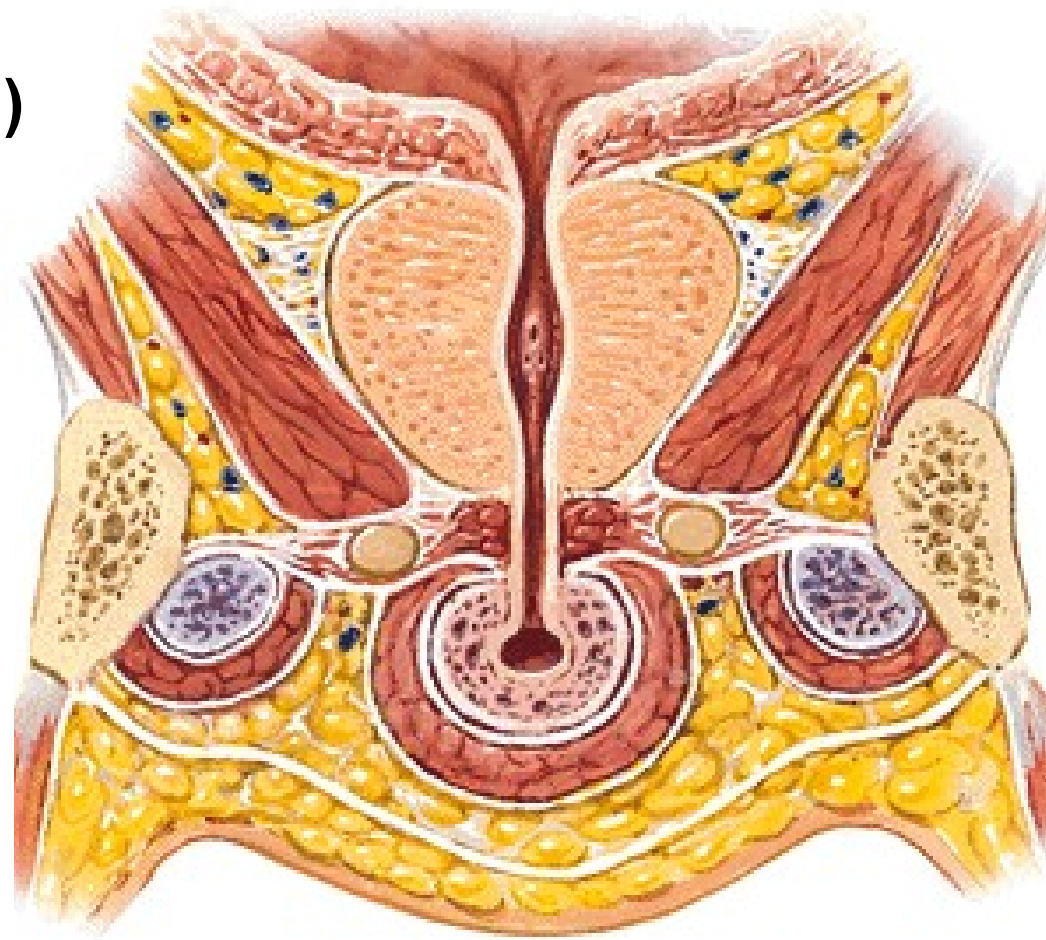
**N. pudendus – nn. rectales inf.**

**A. pudenda int. – aa. rect. inf.**

**V. pudenda int. – vv. rect. inf.**

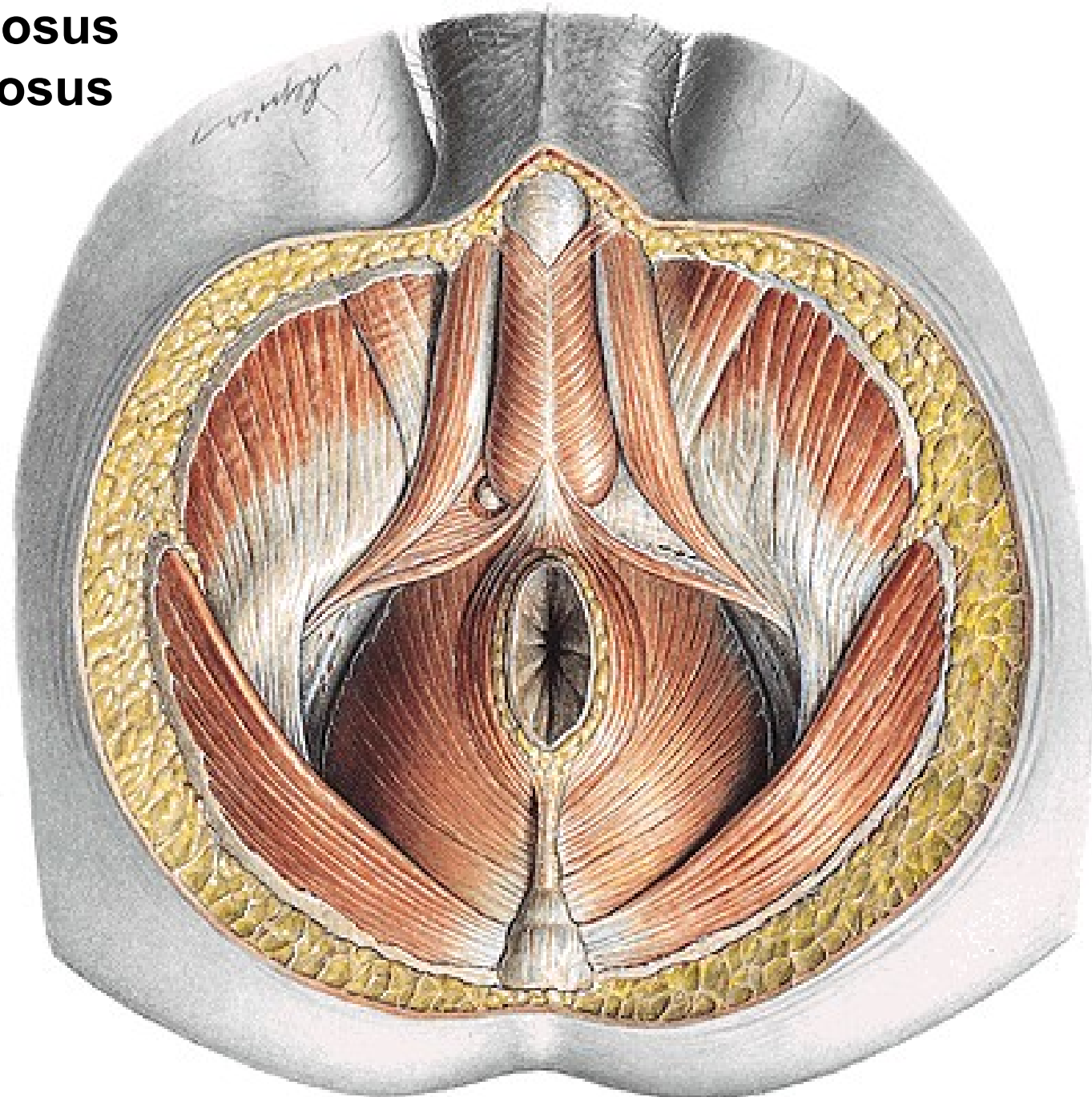


## Fascia perinei (superficialis)



**Spatium superficiale perinei**

**M. ischiocavernosus**  
**M. bulbospongiosus**



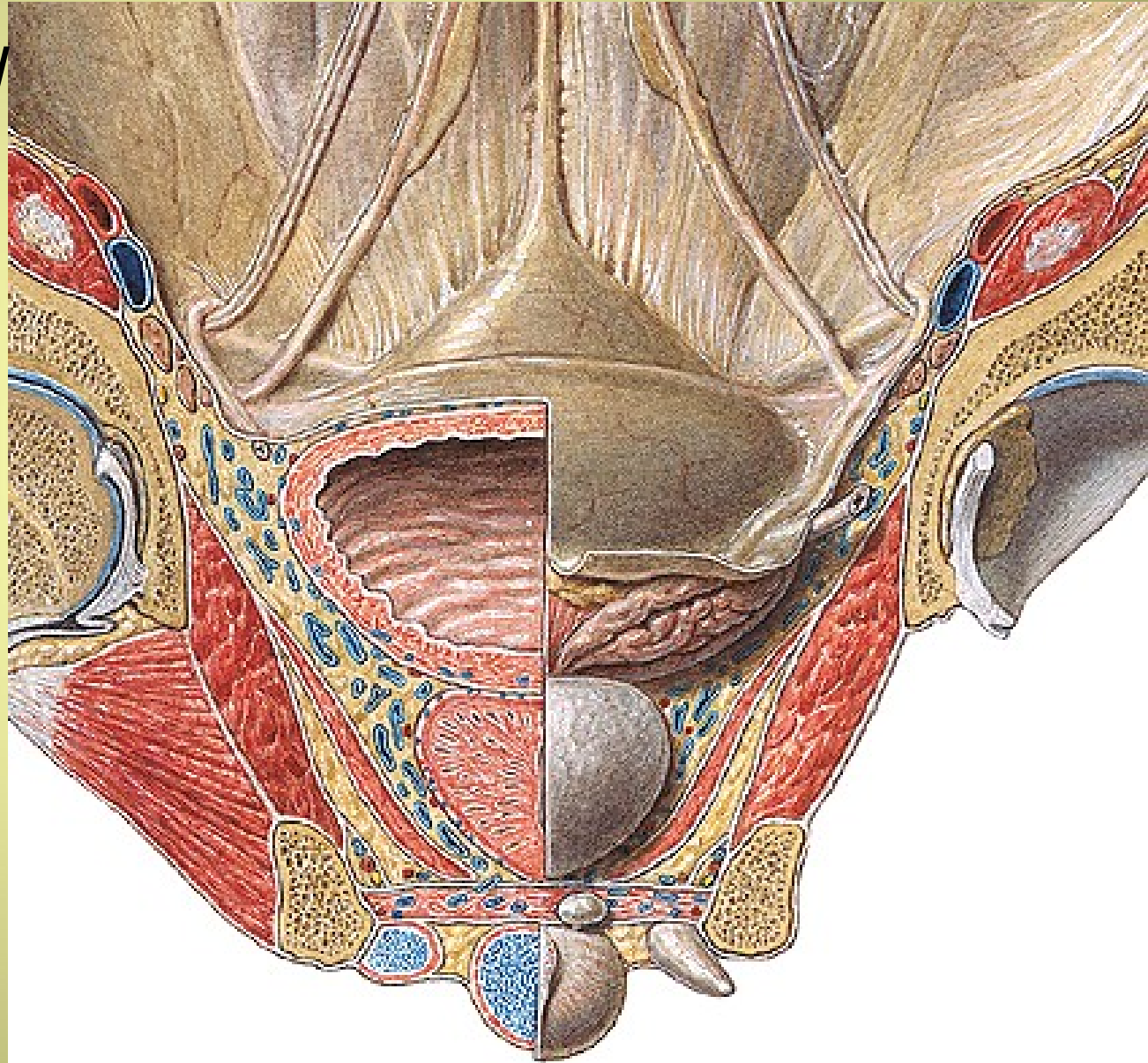
**Membrana perinei**

**Saccus profundus perinei/diaphragma urogenitale**

**Recessus pubicus**

**fossae ischioanalis/**

**- rectalis**

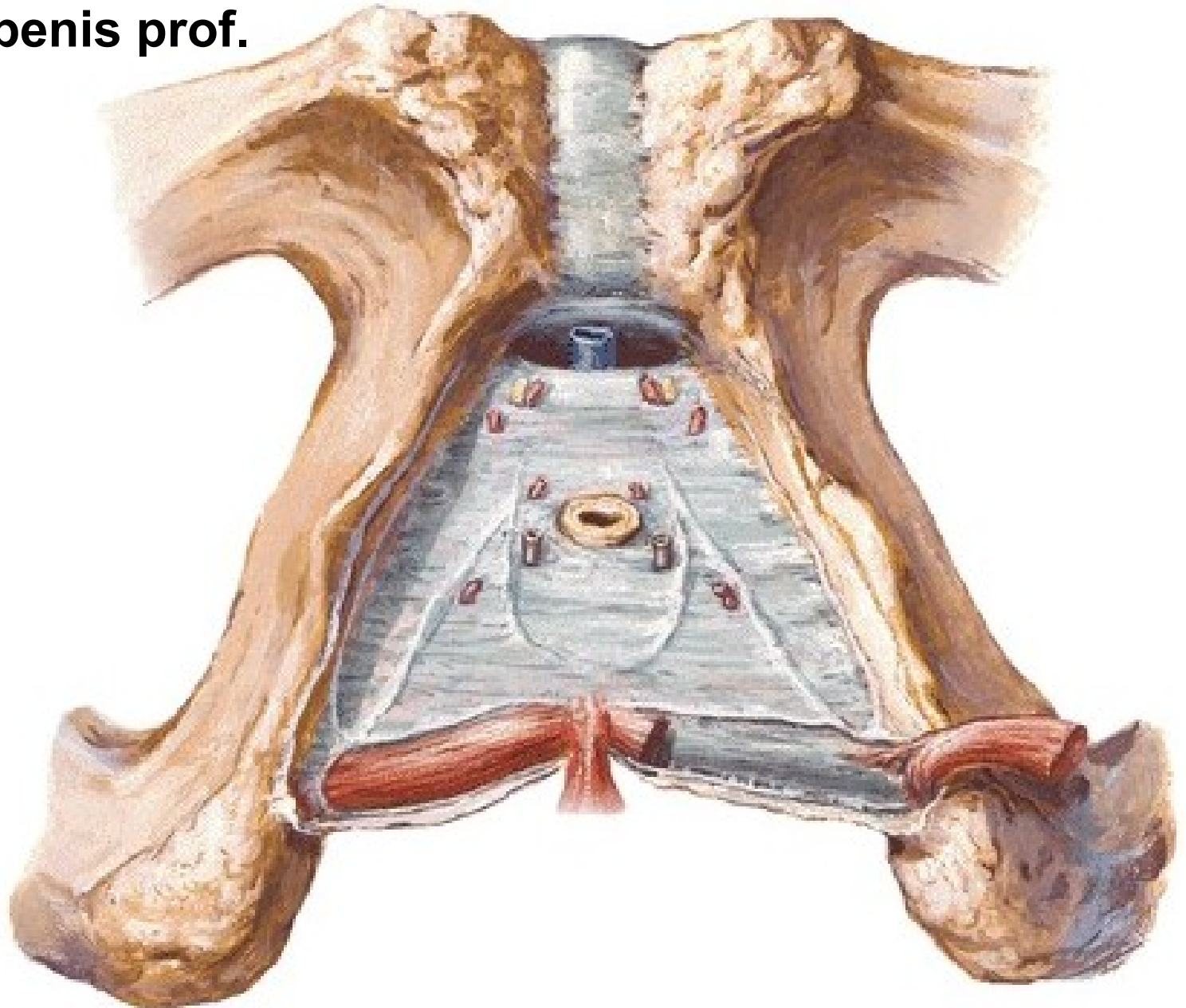




**M. transversus perinei spf.**

**Membrana perinei/Fascia inf. diaphragmatis urogenitalis**

**V. dorsalis penis prof.**



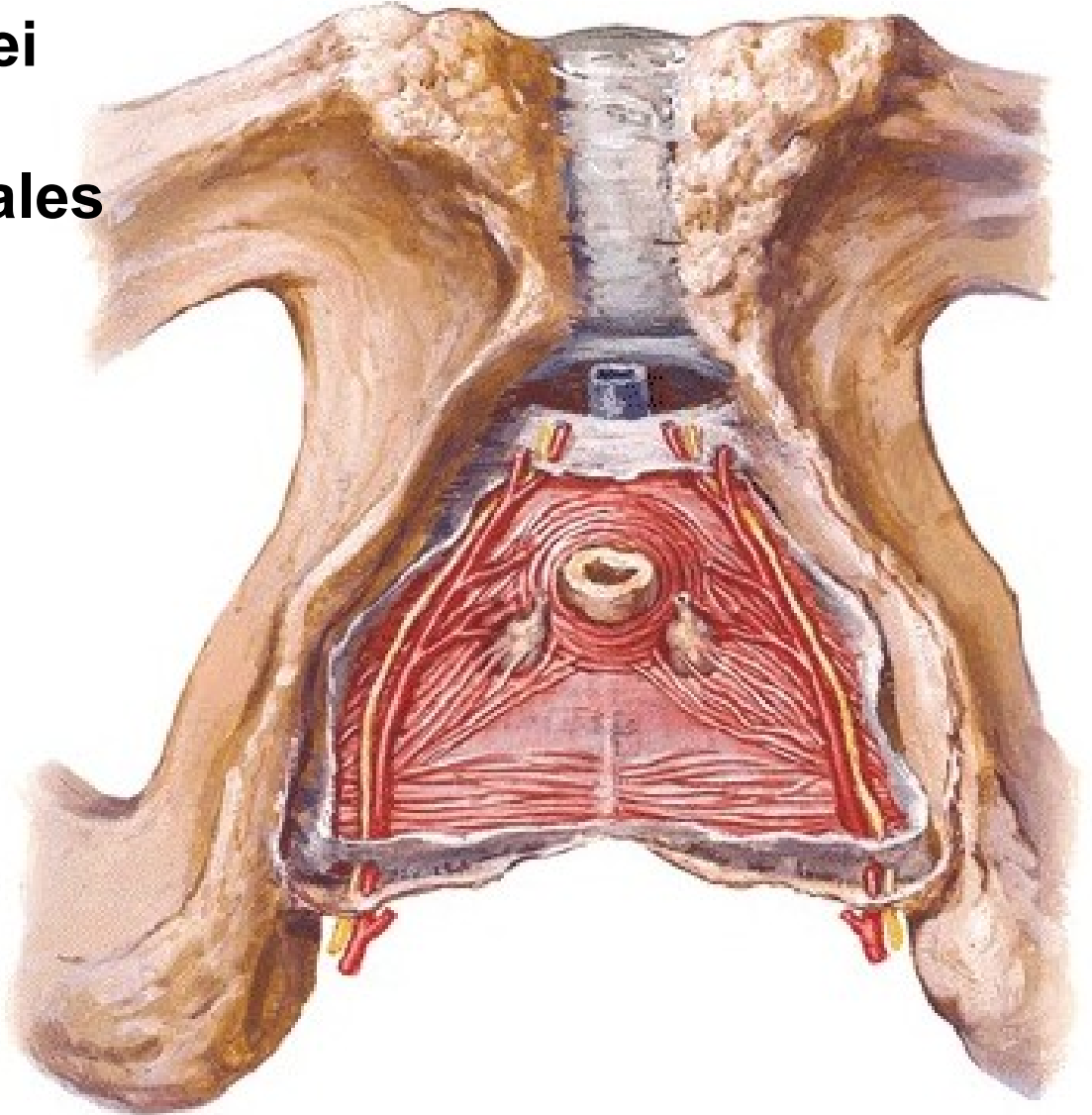
# SACCUS PROF. PERINEI

M. transversus perinei profundus – Centrum perineale

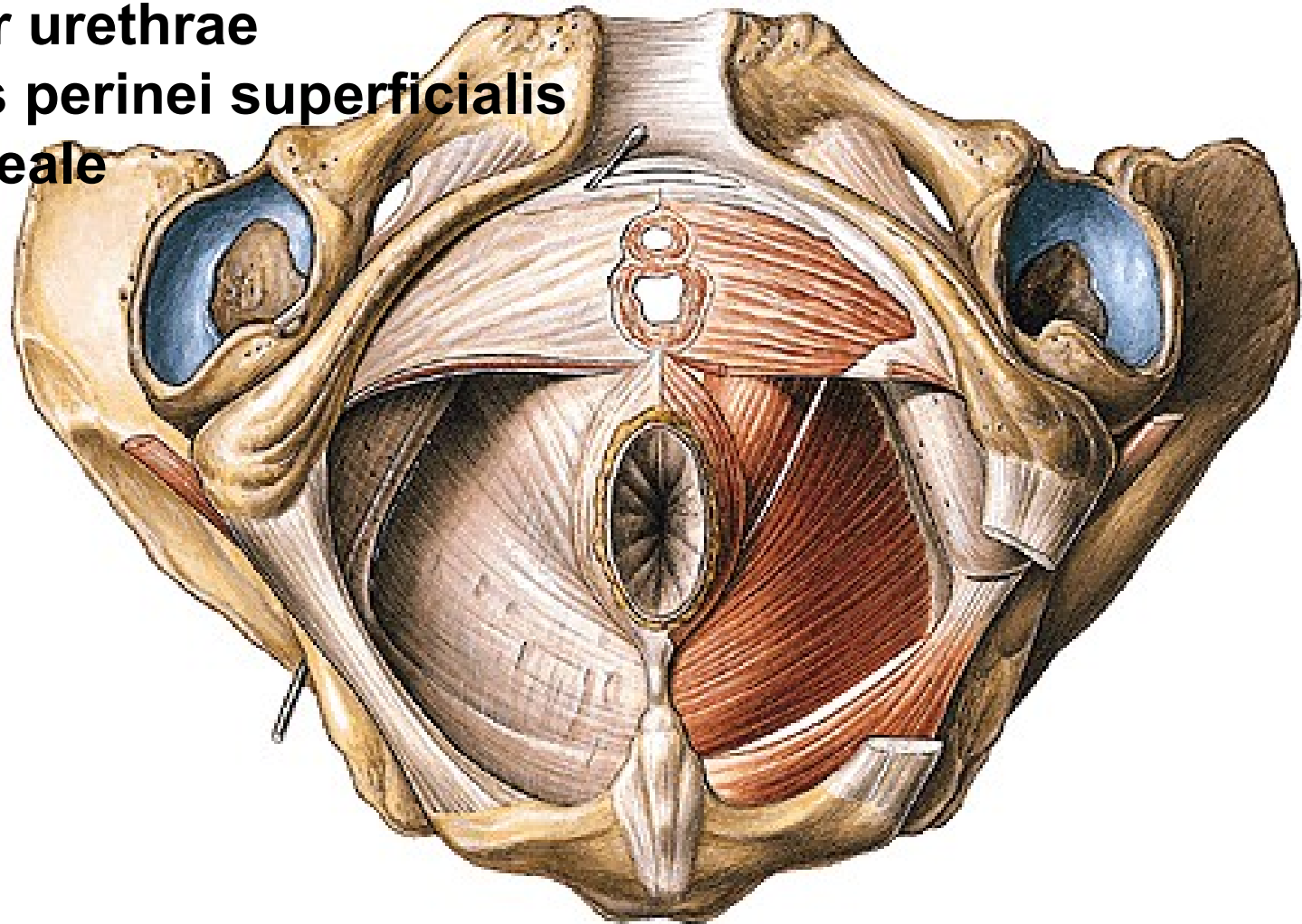
M. sphincter urethrae

Lig. transversum perinei

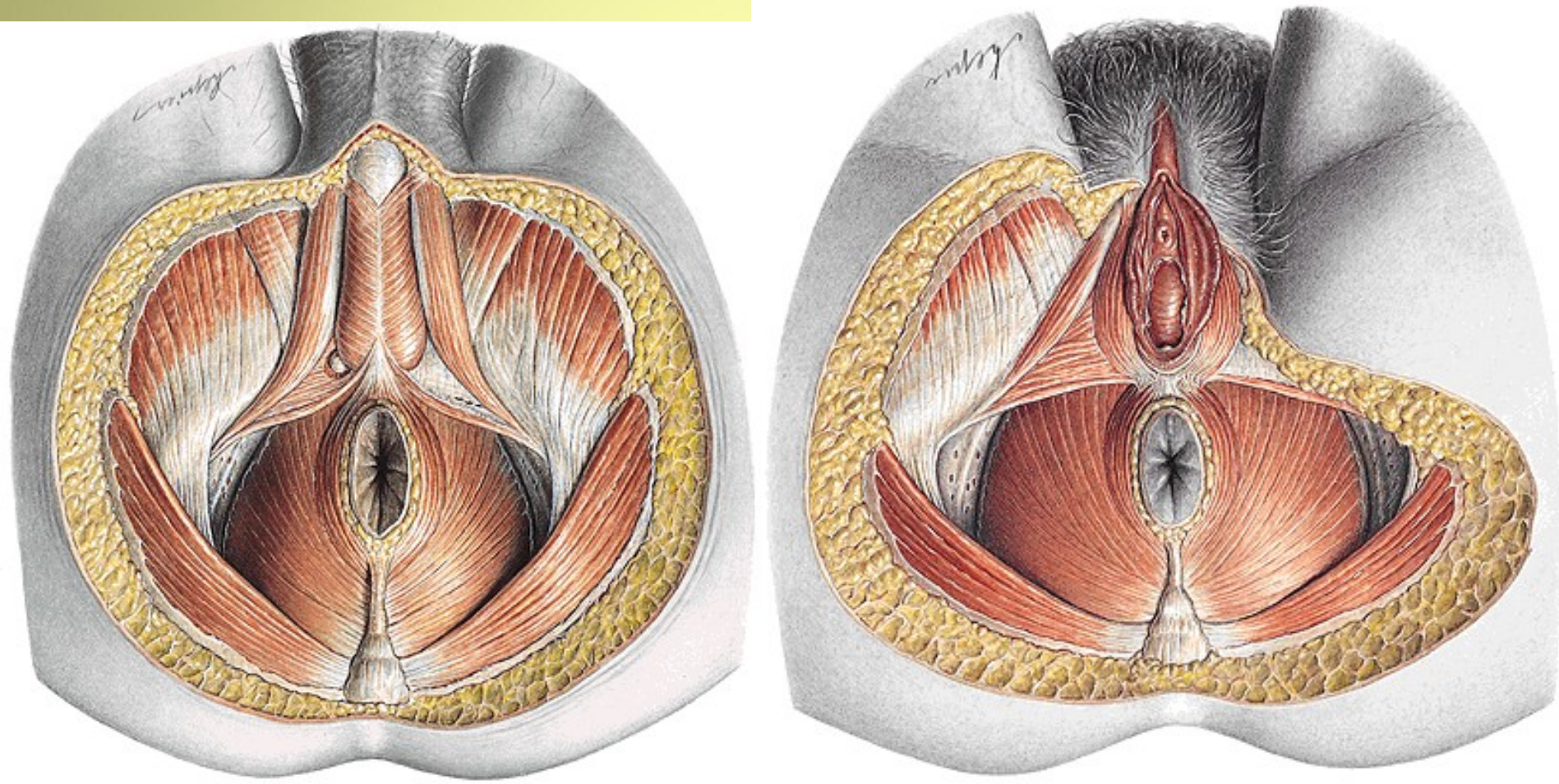
Glandulae bulbourethrales



**FEMALE SACCUS PROF. PERINEI**  
**(M. transversus perinei profundus)**  
**Lig. transversum perinei**  
**M. sphincter urethrae externus**  
**(M. sphincter urethrovaginalis)**  
**M. compressor urethrae**  
**M. transversus perinei superficialis**  
**Centrum perineale**

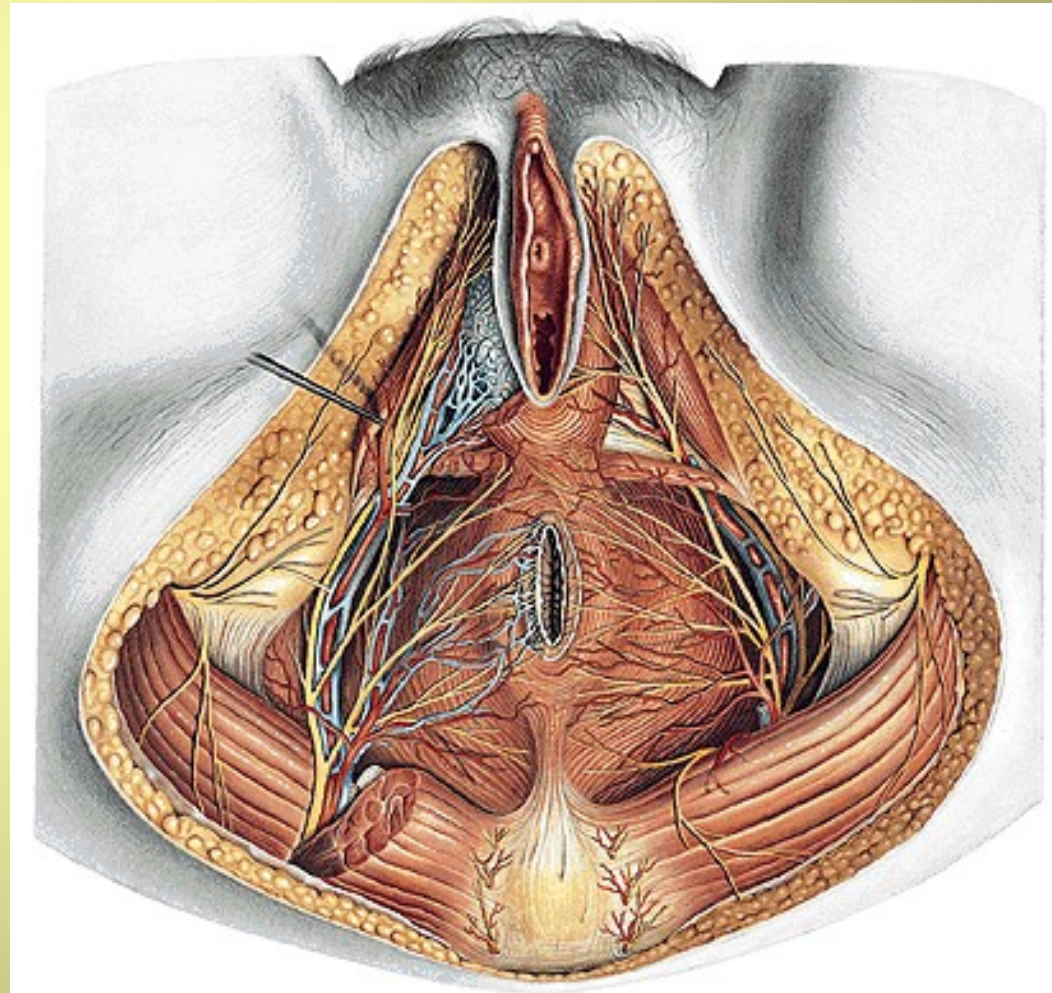
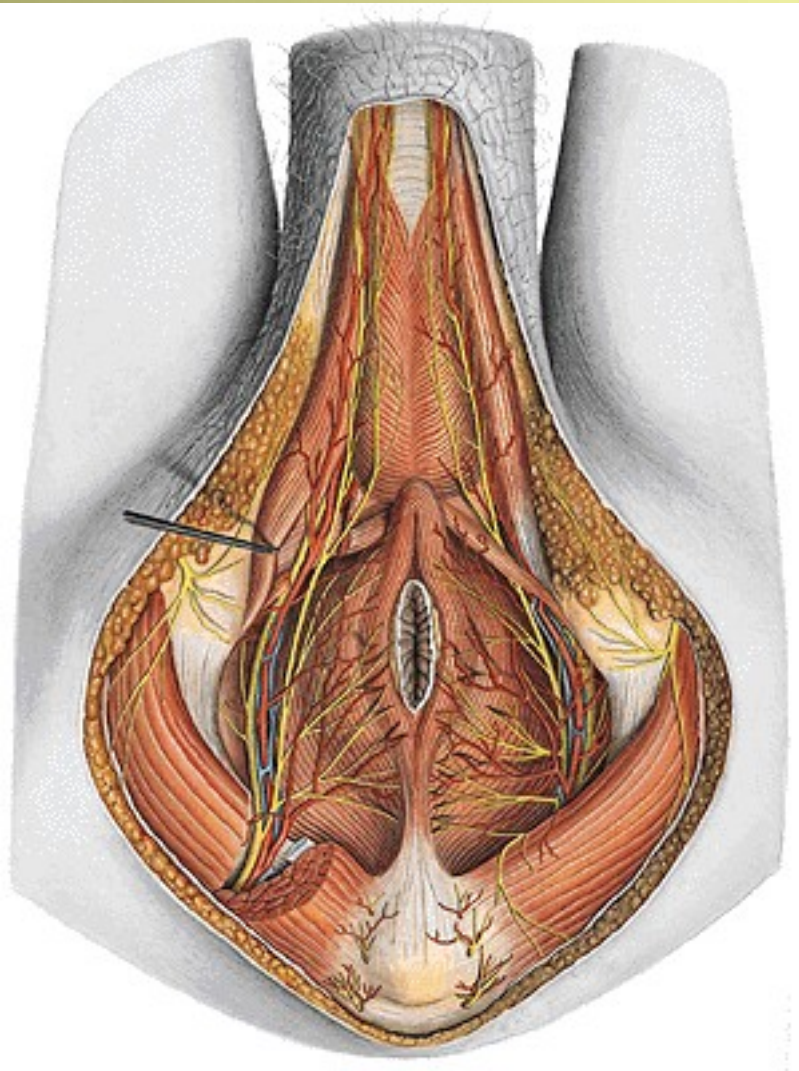


**M. ischiocavernosus**  
**M. bulbospongiosus (M. constrictor cunni)**  
**M. sphincter ani externus**  
**Lig. anococcygeum**



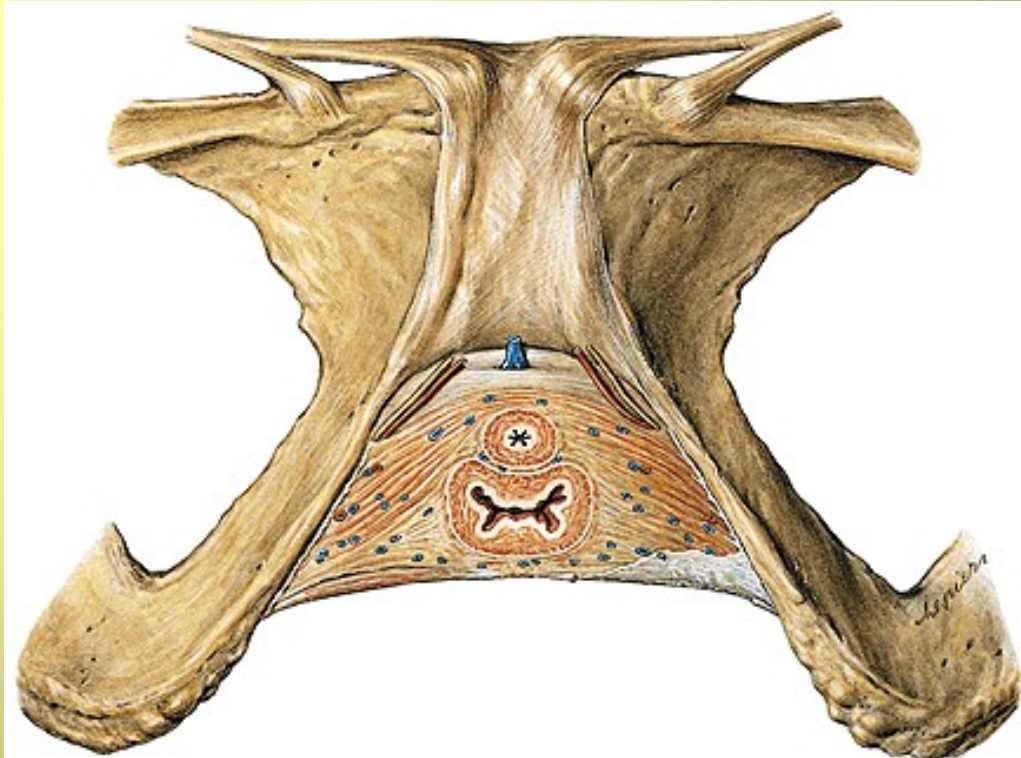
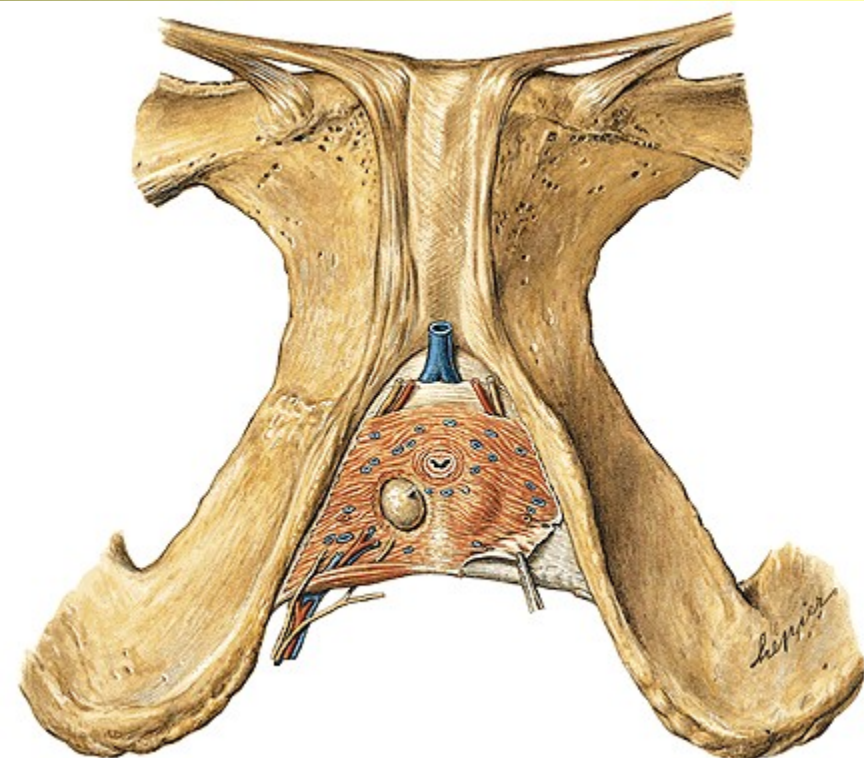


... et v. pudenda interna, n. pudendus – canalis pudendalis -  
... a., vv. et nn. rectales inf.





**A. dorsalis penis (clitoridis)**  
**N. dorsalis penis (clitoridis)**  
**V. dorsalis penis (clitoridis) profunda**  
**A.,v. et n. perinealis**  
**Gl. bulbourethralis**





Illustrations were copied from:

**Atlas der Anatomie des Menschen/Sobotta.  
Lutz,R., und Pabst,R. 20. Auflage. München:  
Urban & Schwarzenberg, 1993)**

**Letter: Interactive Atlas of Human Anatomy.  
Windows Version 2.0**

**Šihák R: Anatomie 2 (Splanchnologia). Avicenum,  
Lékařská a dravotnické nakladatelství, Praha, 1988.**