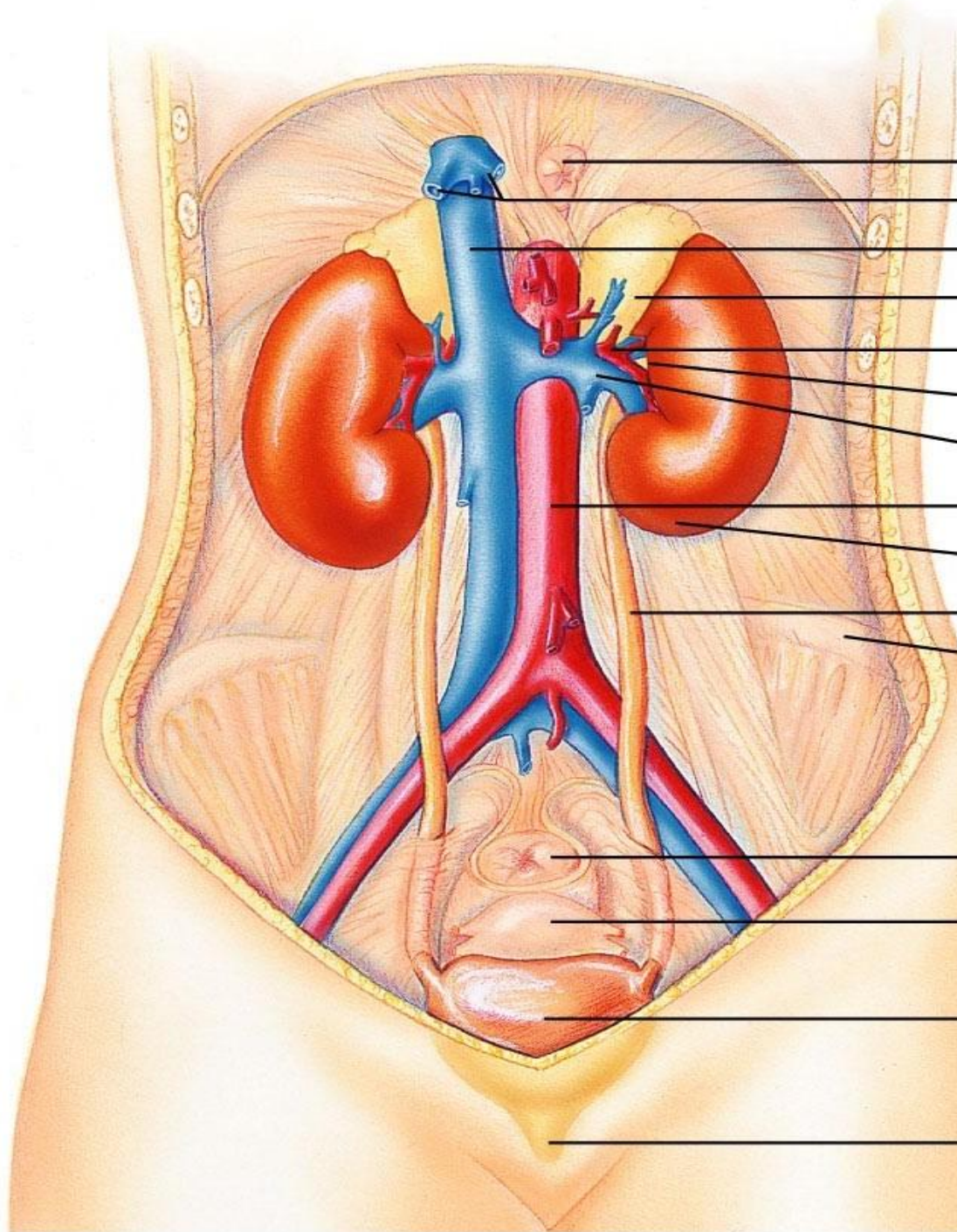


INTRODUCTION UROLOGY 2

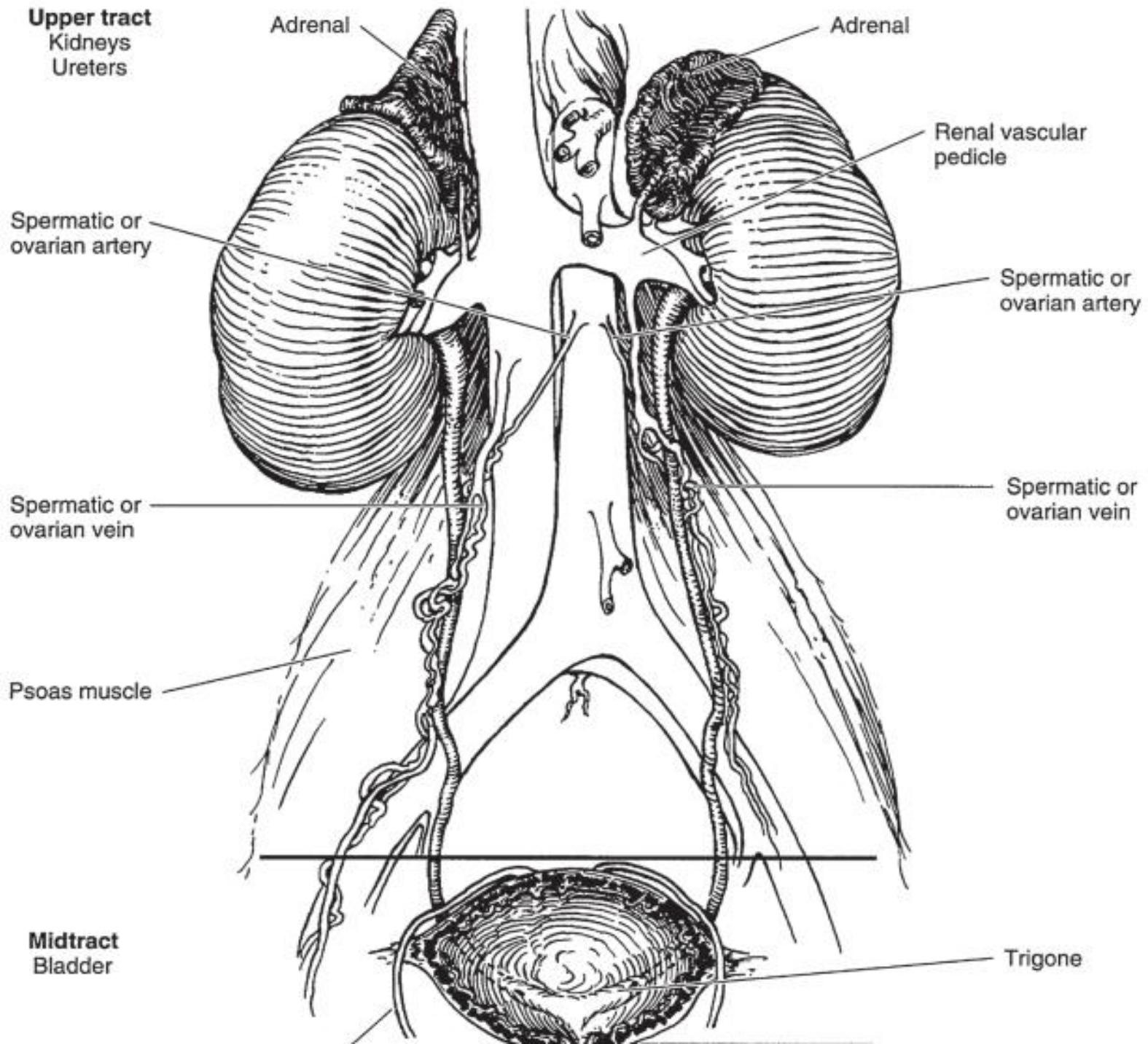
- **ANATOMY**
- **PHYSIOLOGY**
- **EMBRYOLOGY**



- Esophagus (cut)
- Hepatic veins (cut)
- Inferior vena cava
- Adrenal gland
- Renal artery
- Renal hilum
- Renal vein
- Aorta
- Kidney
- Ureter
- Iliac crest

- Rectum (cut)
- Uterus (part of female reproductive system)
- Urinary bladder
- Urethra

(a)



Upper tract
Kidneys
Ureters

Adrenal

Adrenal

Renal vascular
pedicle

Spermatic or
ovarian artery

Spermatic or
ovarian artery

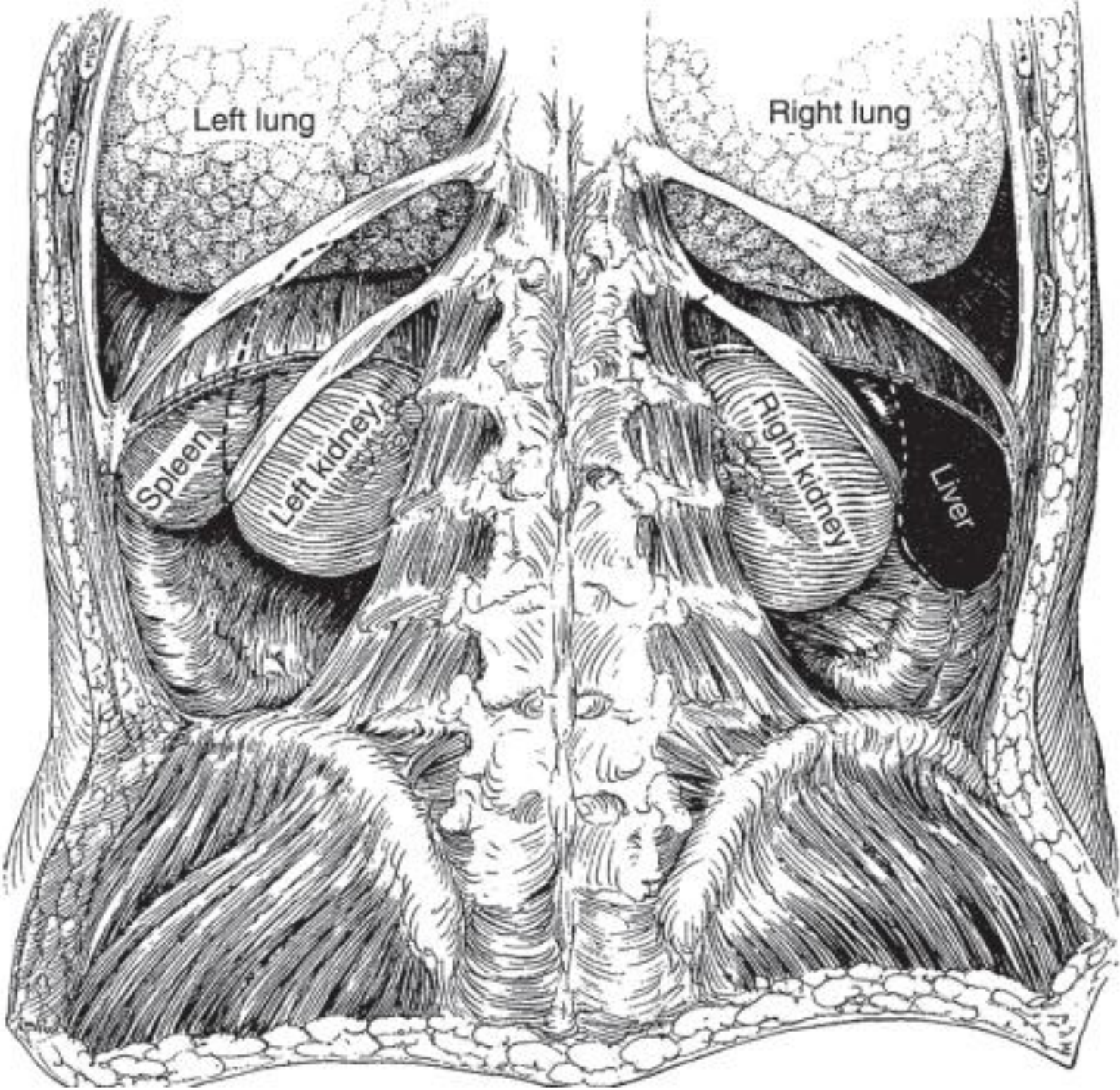
Spermatic or
ovarian vein

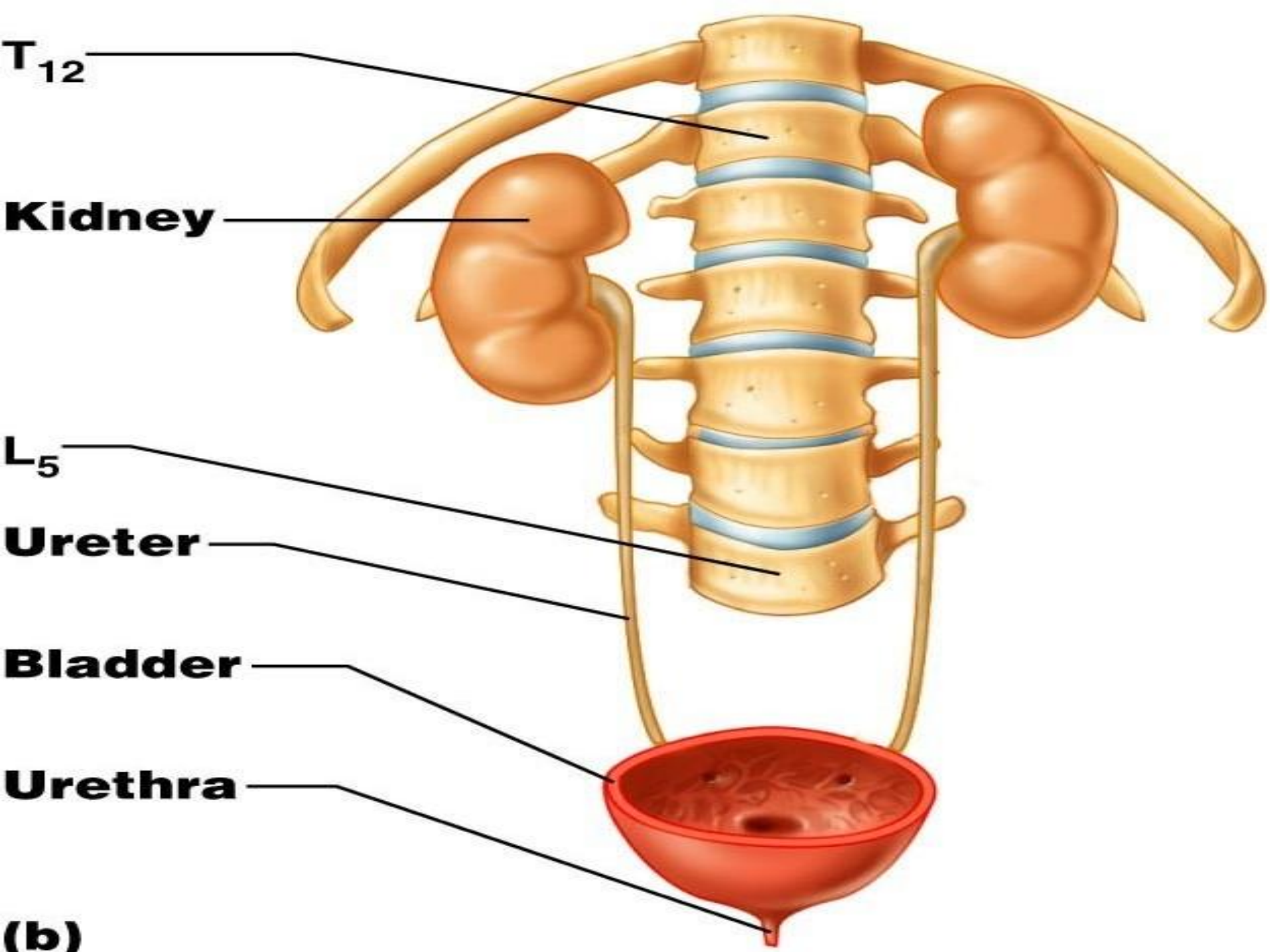
Spermatic or
ovarian vein

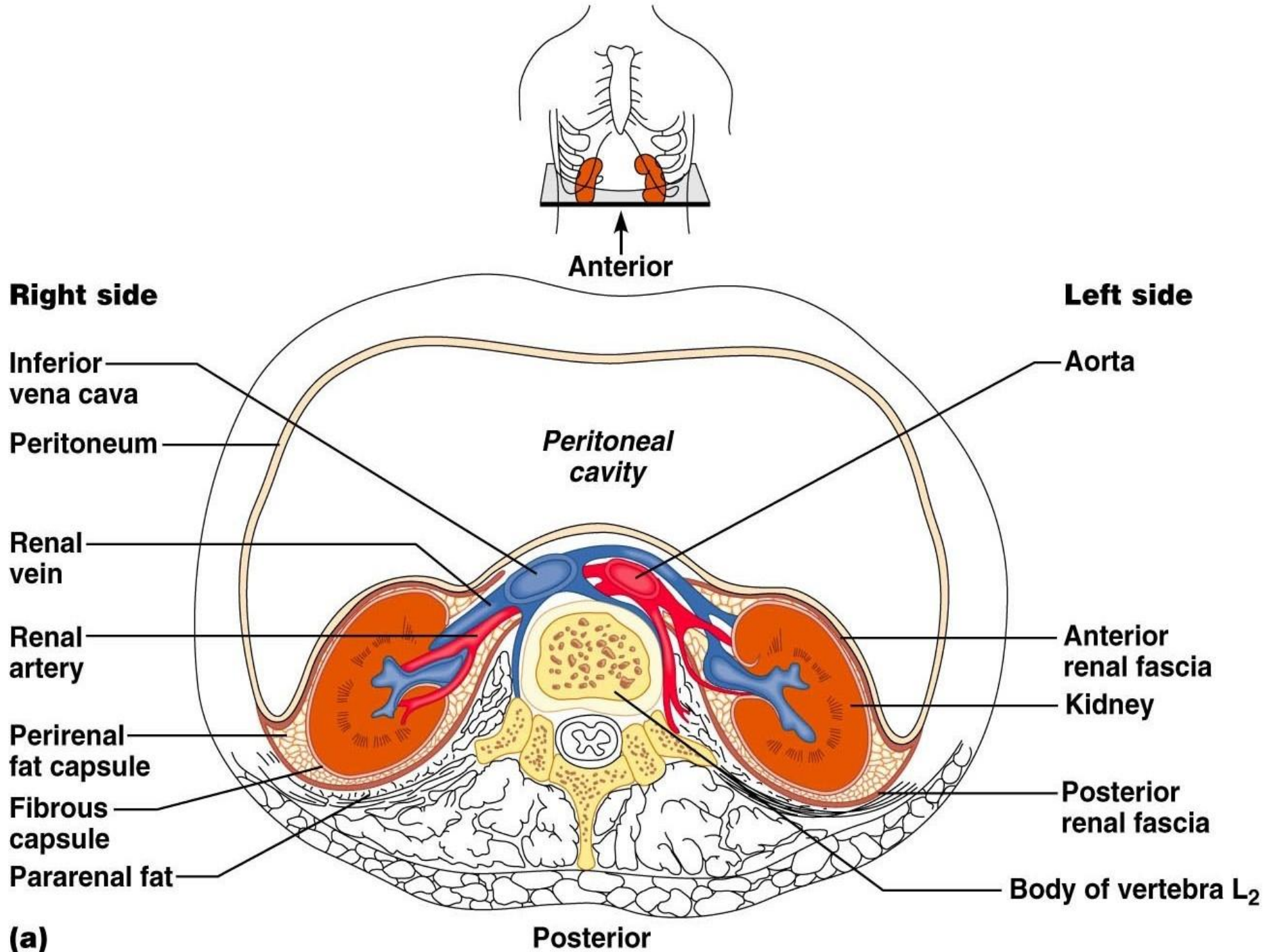
Psoas muscle

Midtract
Bladder

Trigone







Peritoneum

Ureter

Rugae

Detrusor muscle

Ureteric orifices

Bladder neck

Internal urethral sphincter

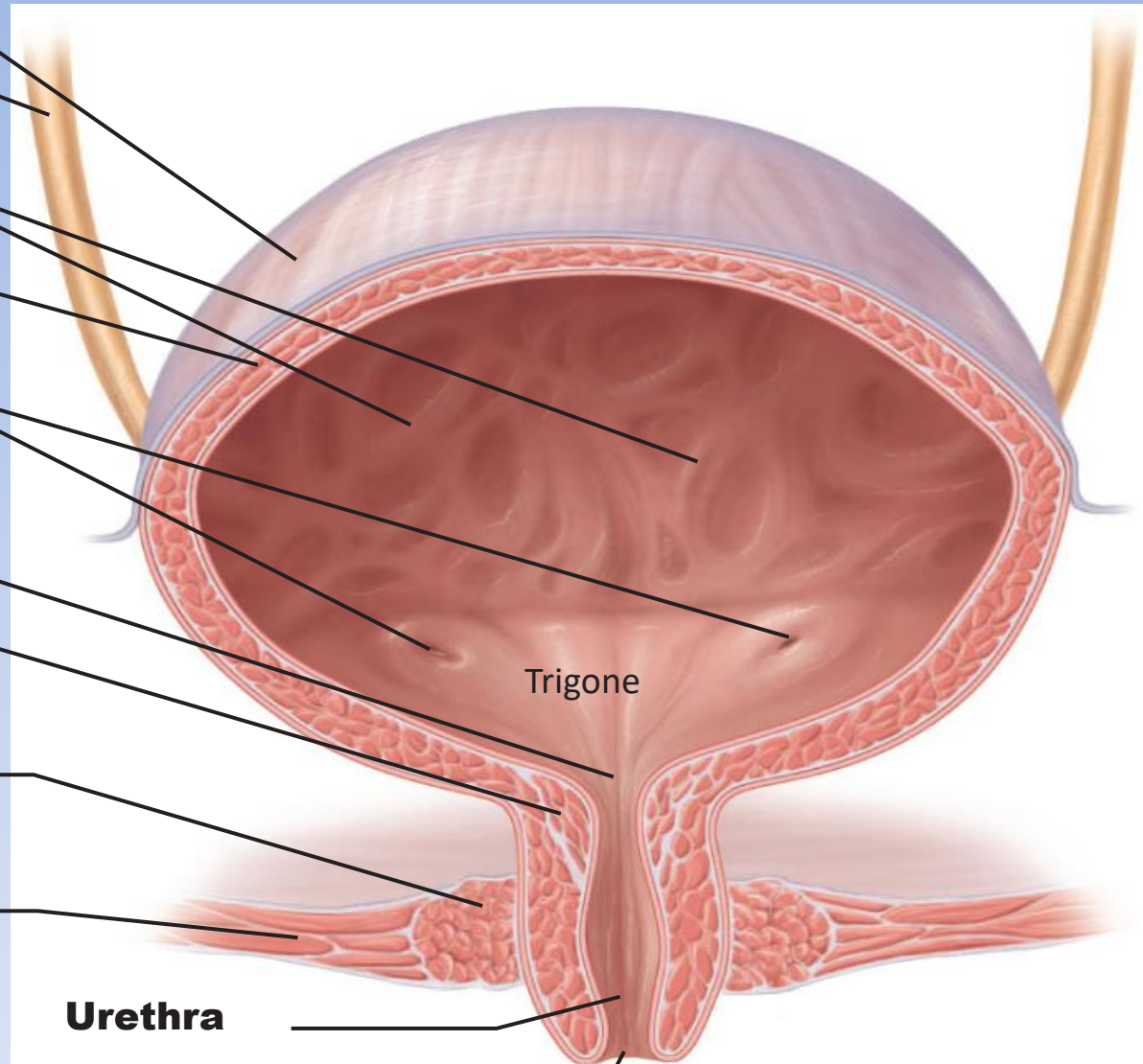
External urethral sphincter

Urogenital diaphragm

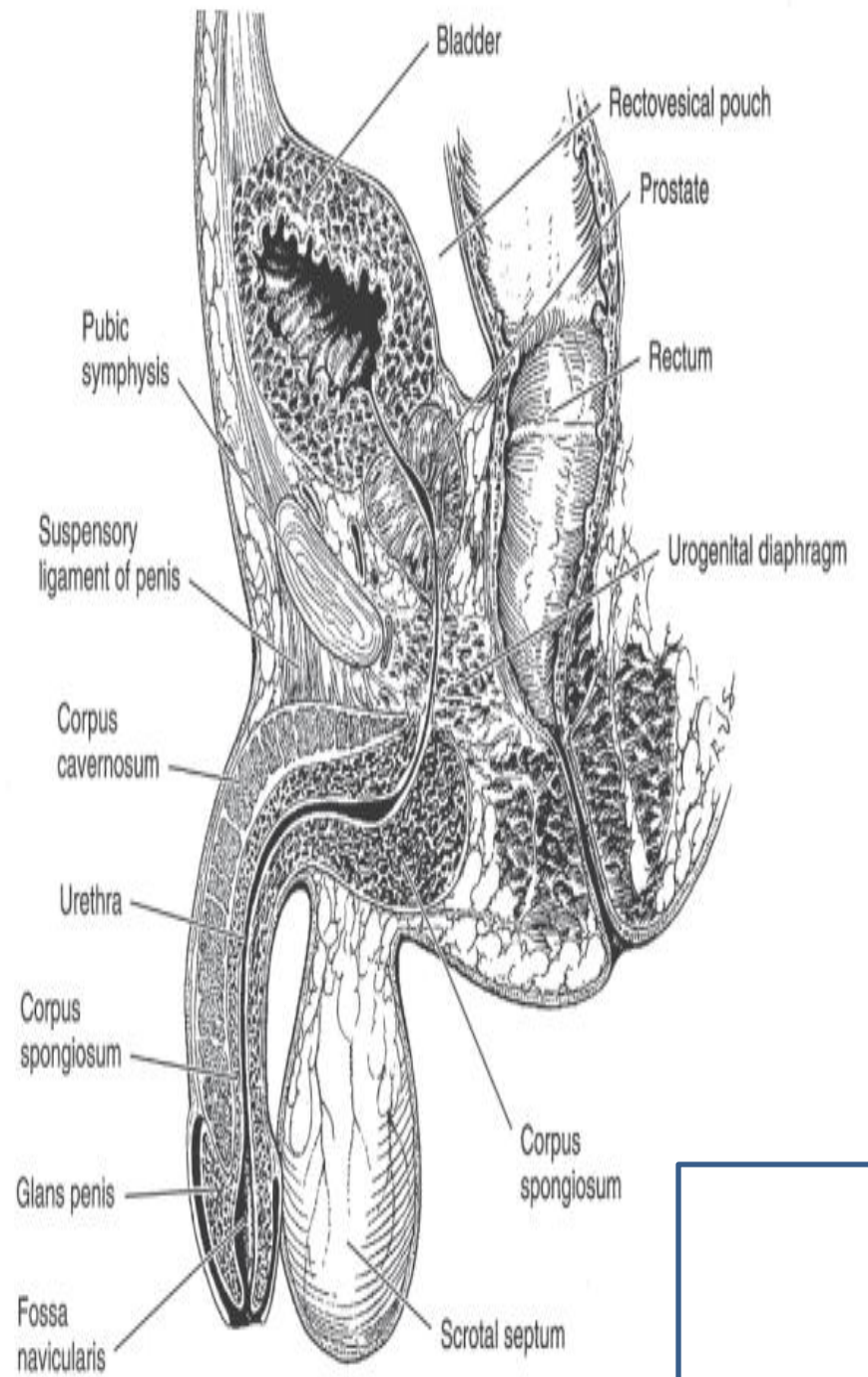
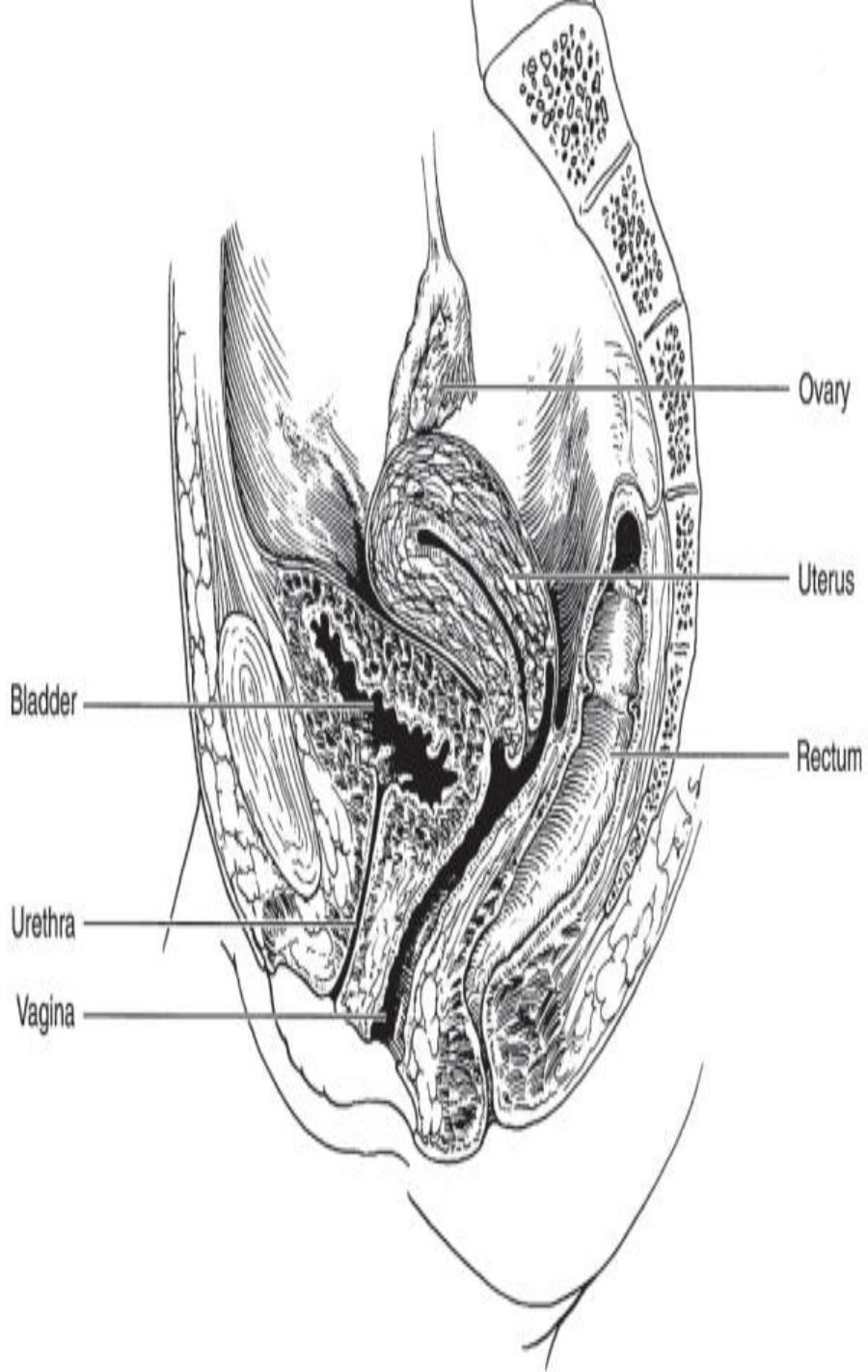
Urethra

External urethral orifice

Trigone



(b) Female



ANATOMY

- **URINARY TRACT:**
- **Upper tract: kidneys
ureters**
- **Lower tract: urinary bladder
urethra**

KIDNEY

- Well protected retroperitoneal organ
- Capped by an adrenal gland
- Lateral to T₁₂–L₃ vertebrae
- 12 cm, 6 cm, 3 cm
- The adult kidney weighs between 125 and 170 g in men and 115 and 155 g in women
- Fibrous renal capsule
- Perirenal fat
- Gerotas fascia is an important structure.
- Pararenal fat

KIDNEY

RENAL HILUM: Renal vein
Renal artery
Renal pelvis and ureter
Nerves and Lymphatics

KIDNEY: Cortex (outer part)... columns of Bertin
Medulla (central part)... renal papillae

PELVICALYCEAL SYSTEM: Minor calyces
Major calyces
Renal pelvis

Renal cortex

Renal medulla

Major calyx

Papilla of pyramid

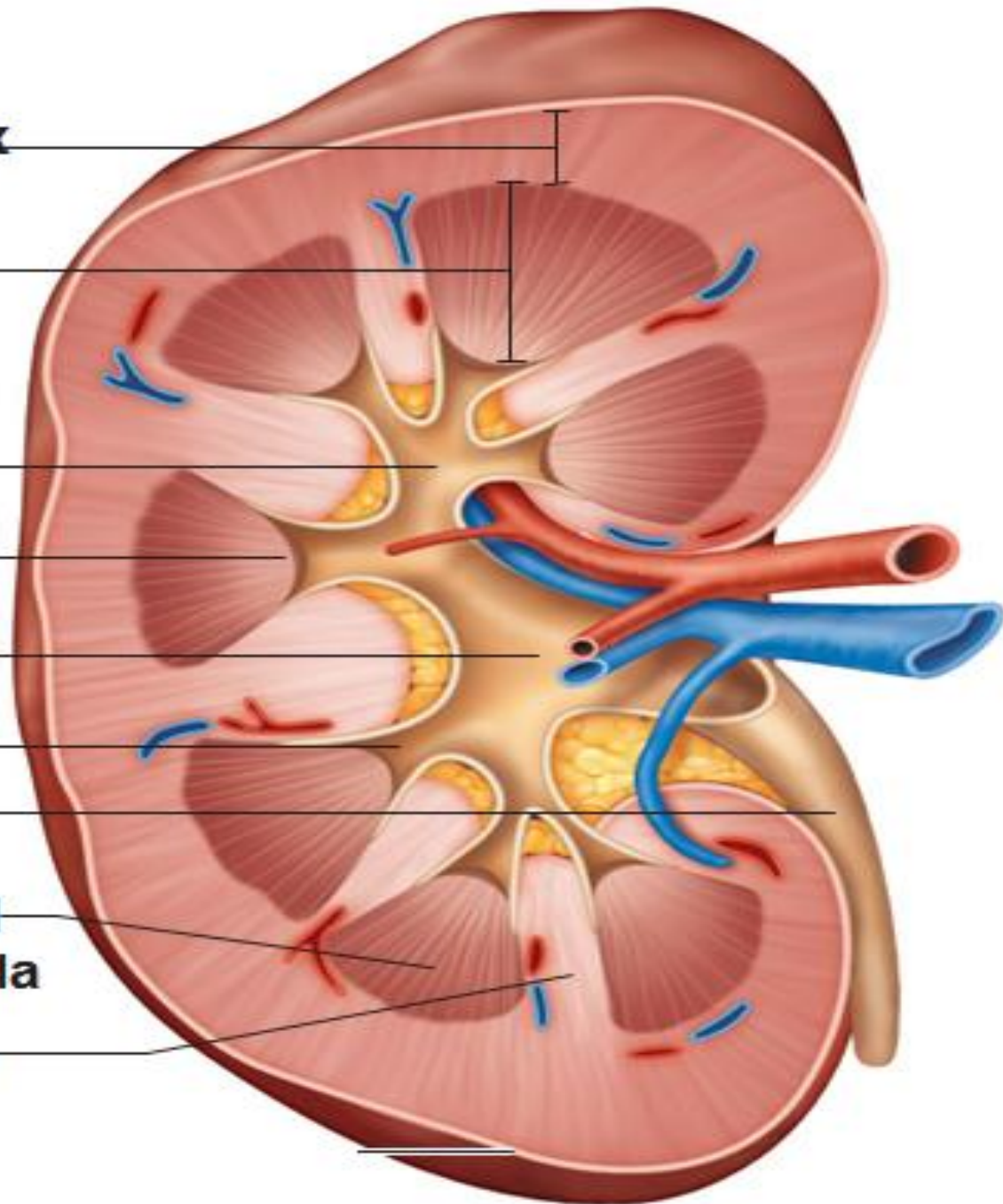
Renal pelvis

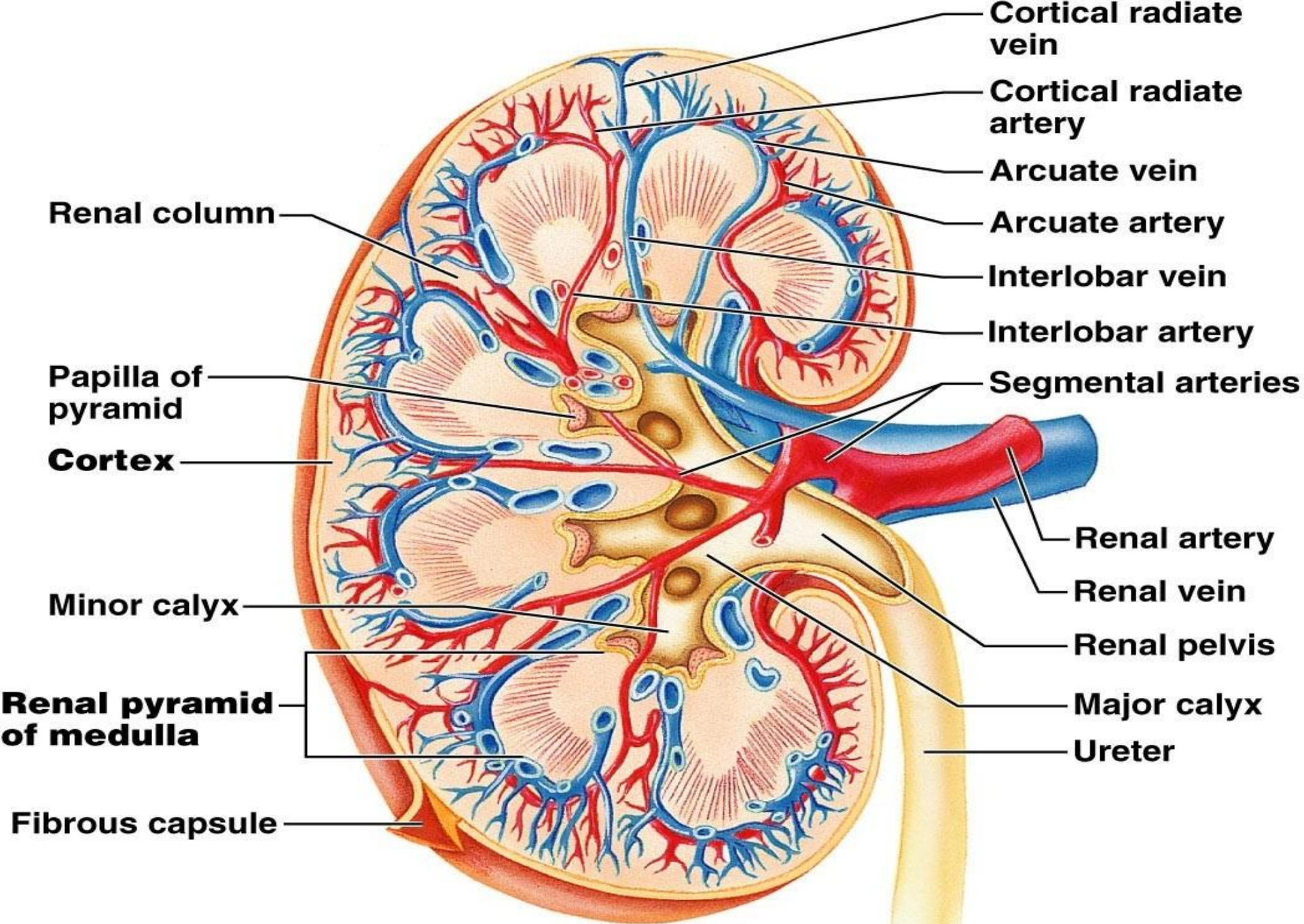
Minor calyx

Ureter

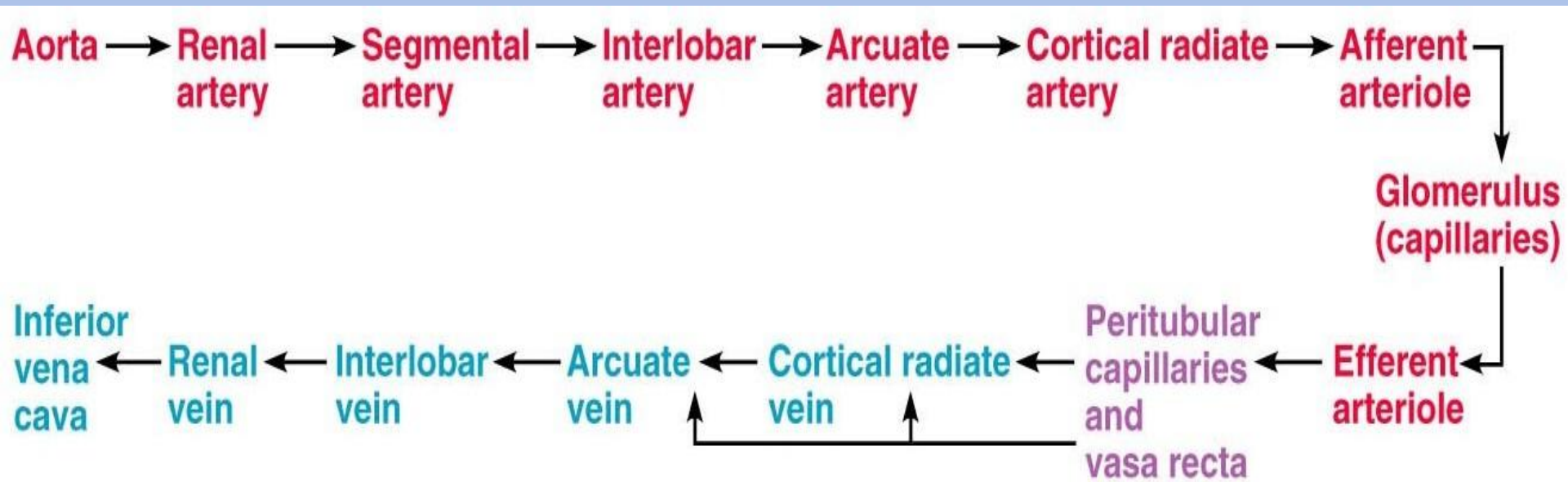
Renal pyramid in renal medulla

Renal column





(b)



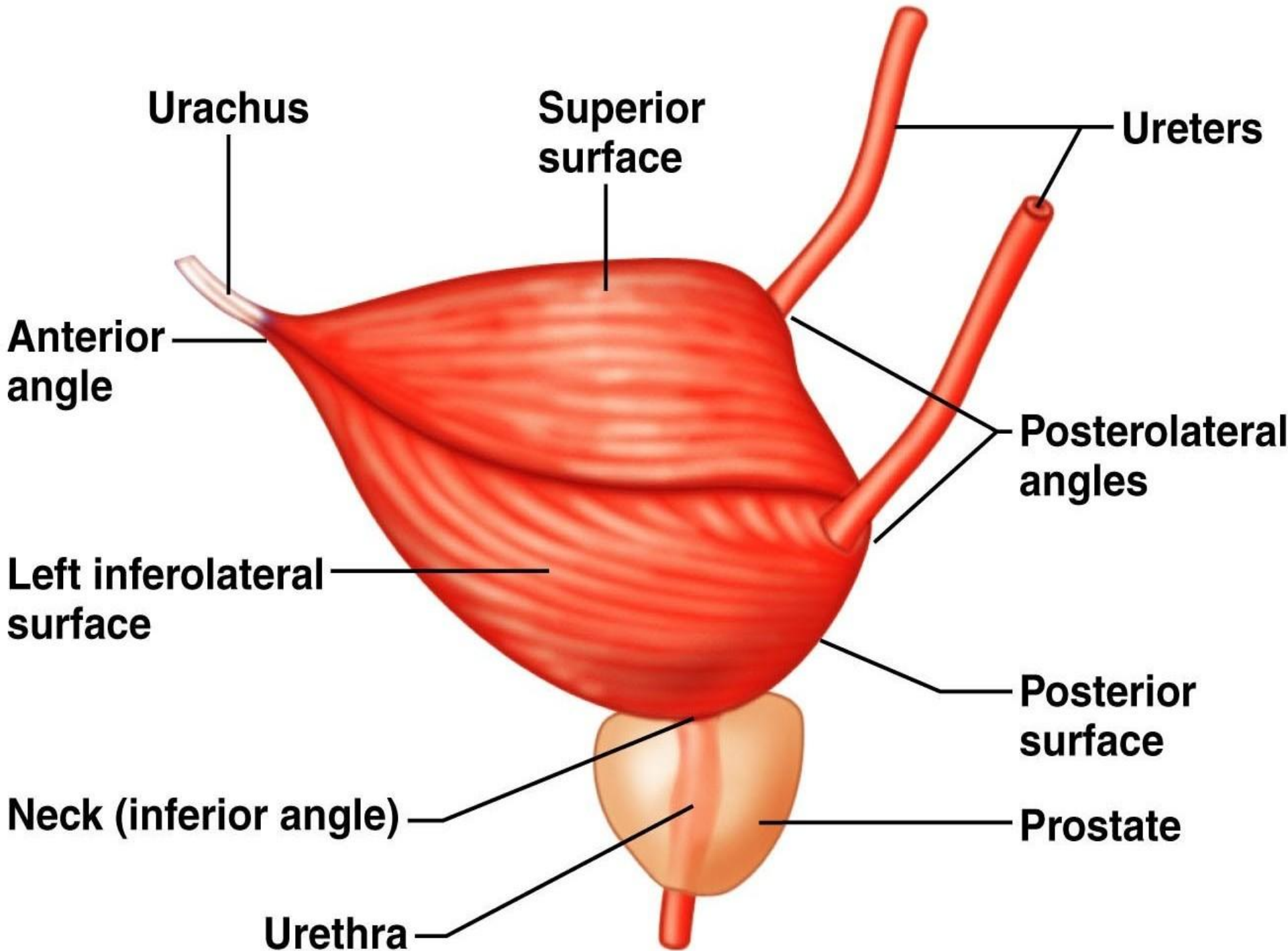
(c)

URETER

- The renal pelvis tapers to join the ureters (pelvi-ureteric junction PUJ).
- 30 cm long.
- Oblique entry into the bladder (VUJ) to prevent reflux.
- Lies on the psoas muscle.
- Areas that stones are often impacted are
 - (a) at the pelvi-ureteric junction.
 - (b) where the ureter crosses over the iliac vessels.
 - (c) where it courses through the bladder wall.

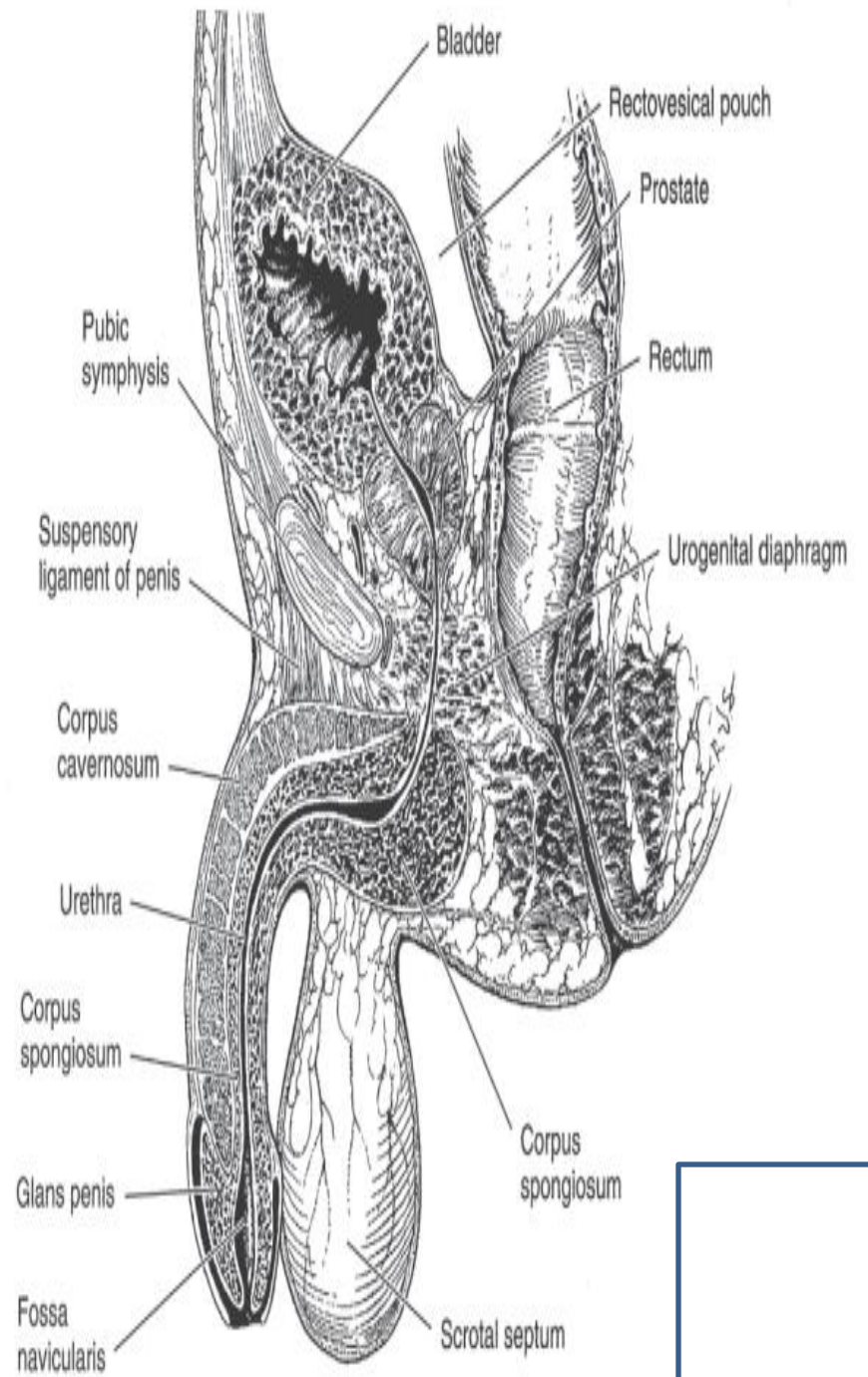
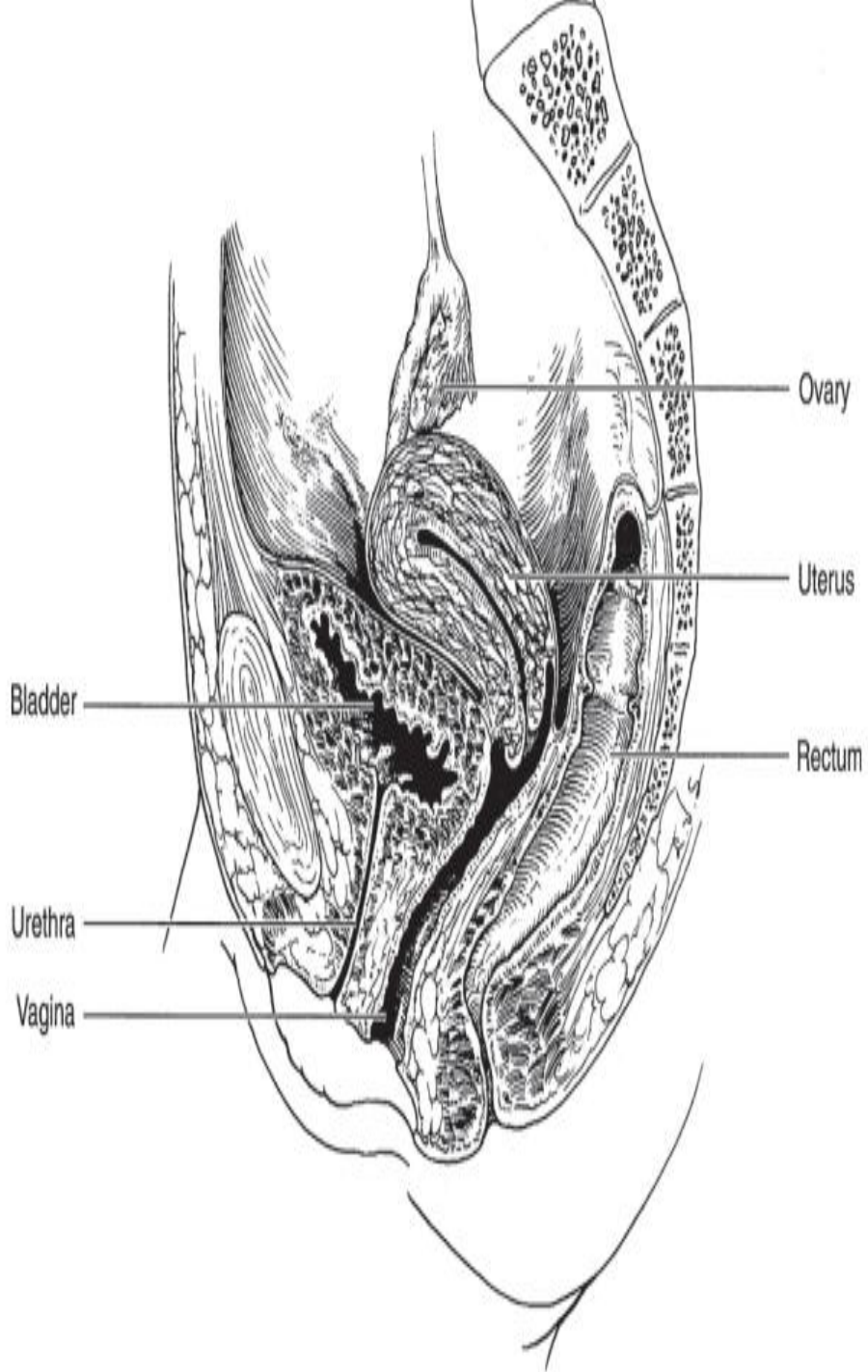
URINARY BLADDER

- The bladder is a hollow muscular organ that lies in the pelvis and serves as a reservoir for urine.
- The adult bladder normally has a capacity of 400–500 mL.
- The wall of the bladder is about 3–5 mm in thickness; it is thinner when it is distended.
- The median umbilical ligament, which represents the obliterated urachus extends from the dome of the bladder to the umbilicus.



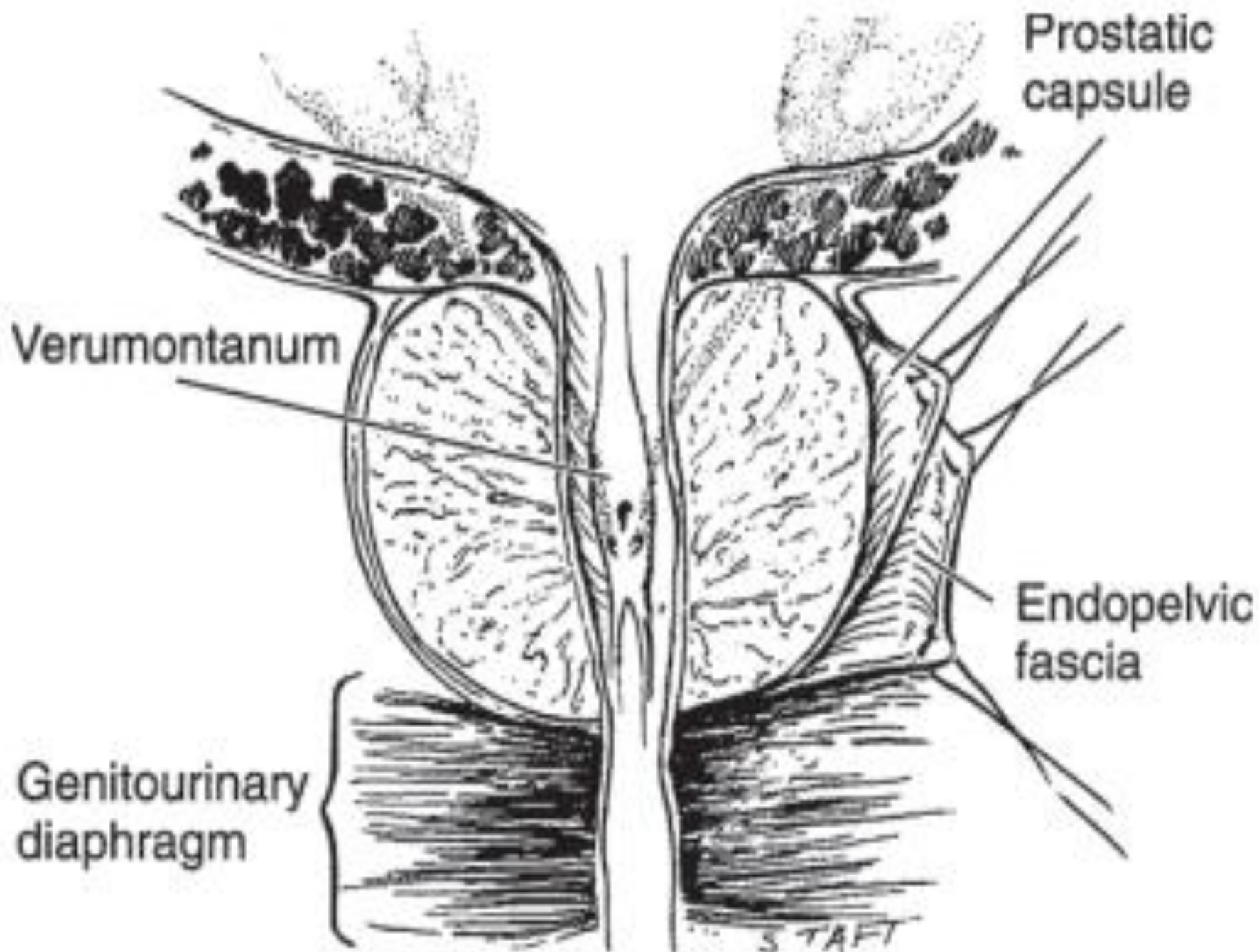
URETHRA

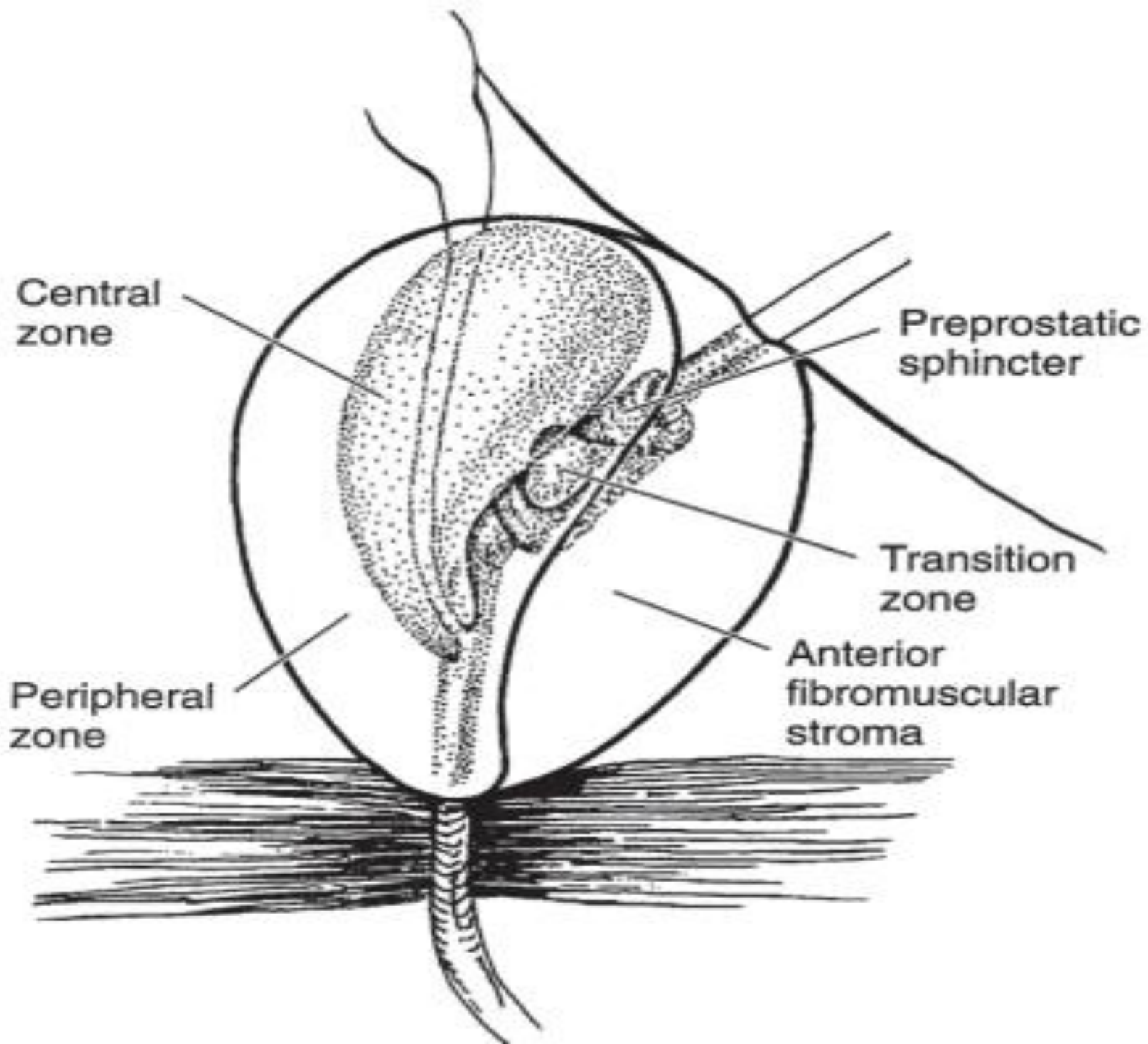
- **Internal urethral sphincter (bladder neck): involuntary smooth sphincter.**
- **External urethral sphincter: voluntary sphincter.**
- **In female: short 3-4 cm**
- **In male: 16-20 cm , prostatic urethra, membranous urethra, spongy (penile) urethra**

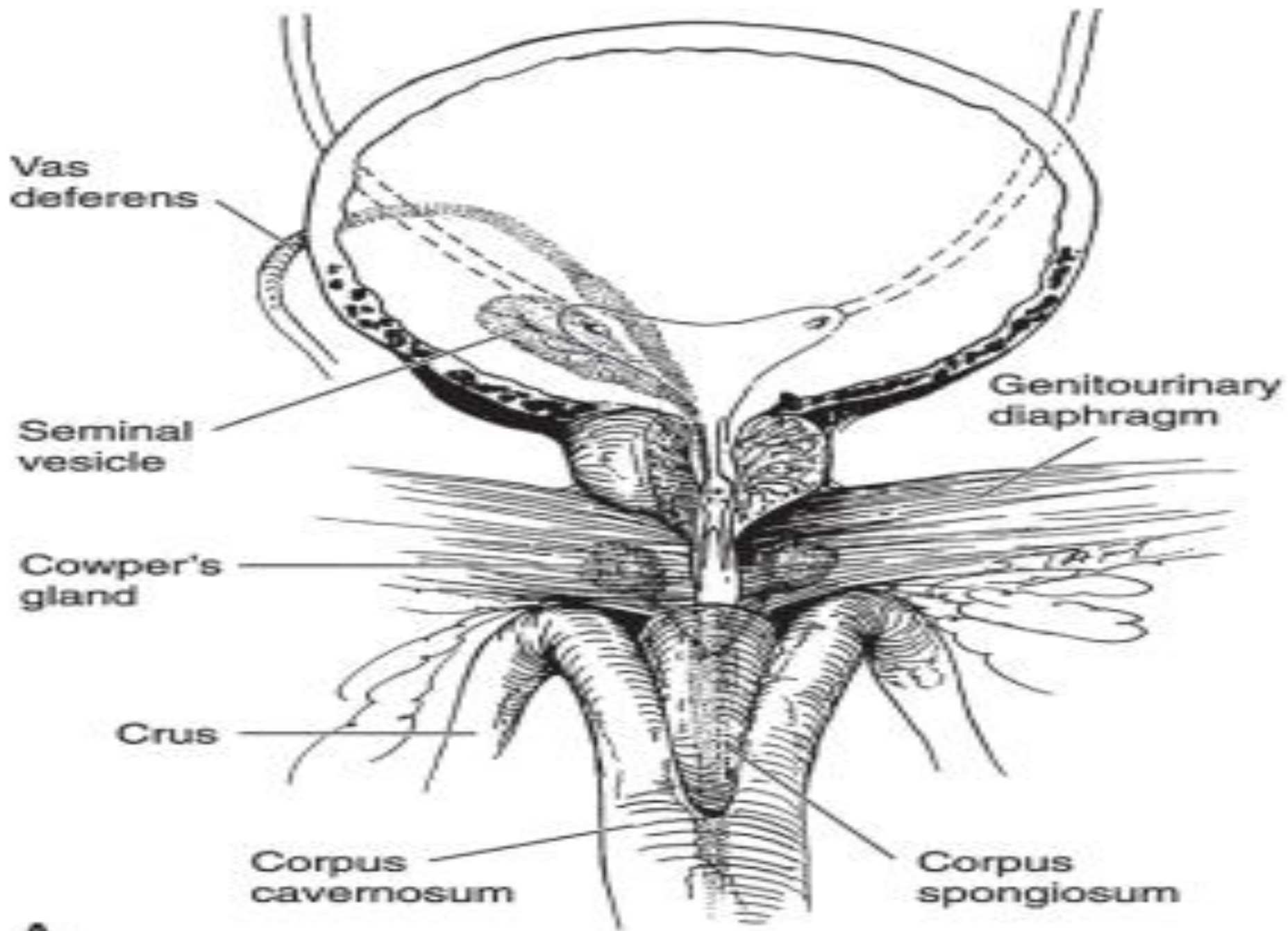


PROSTATE

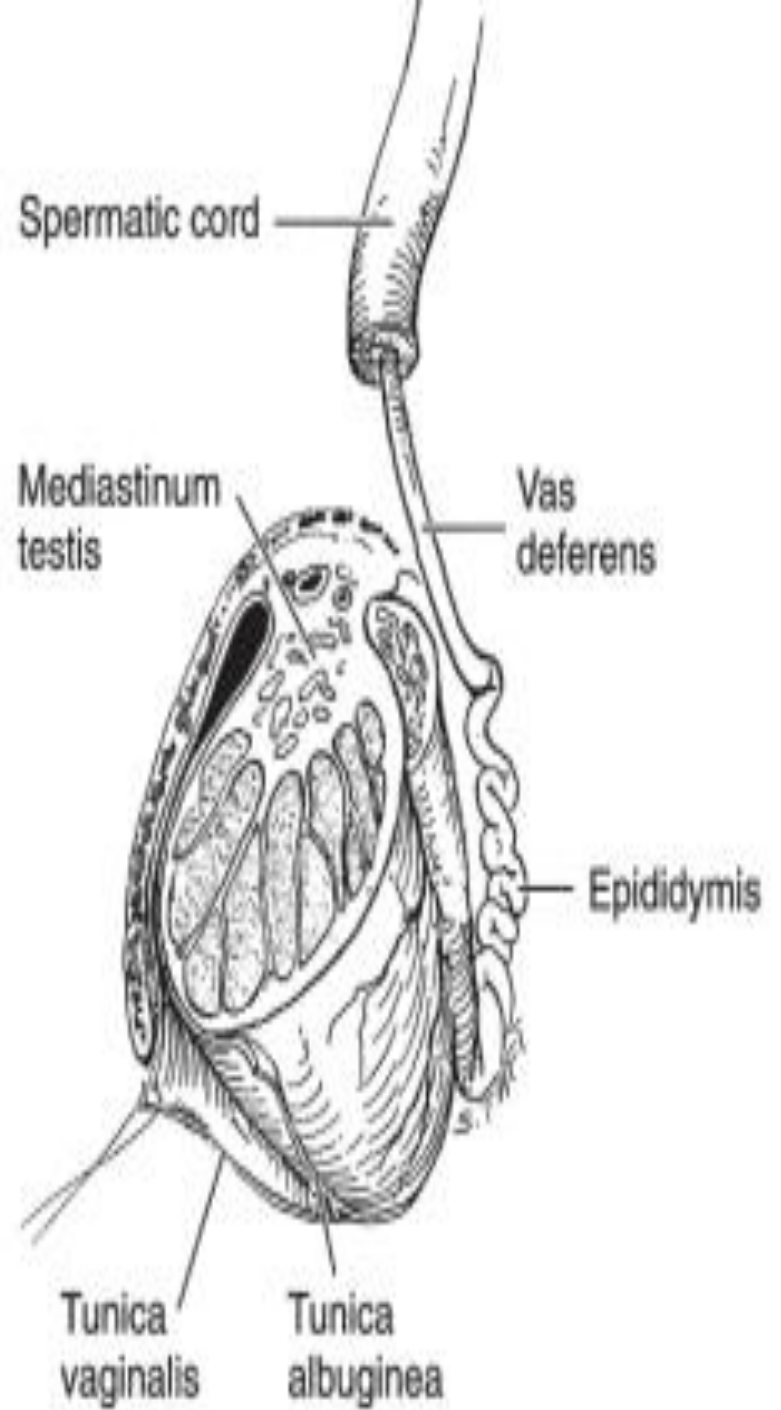
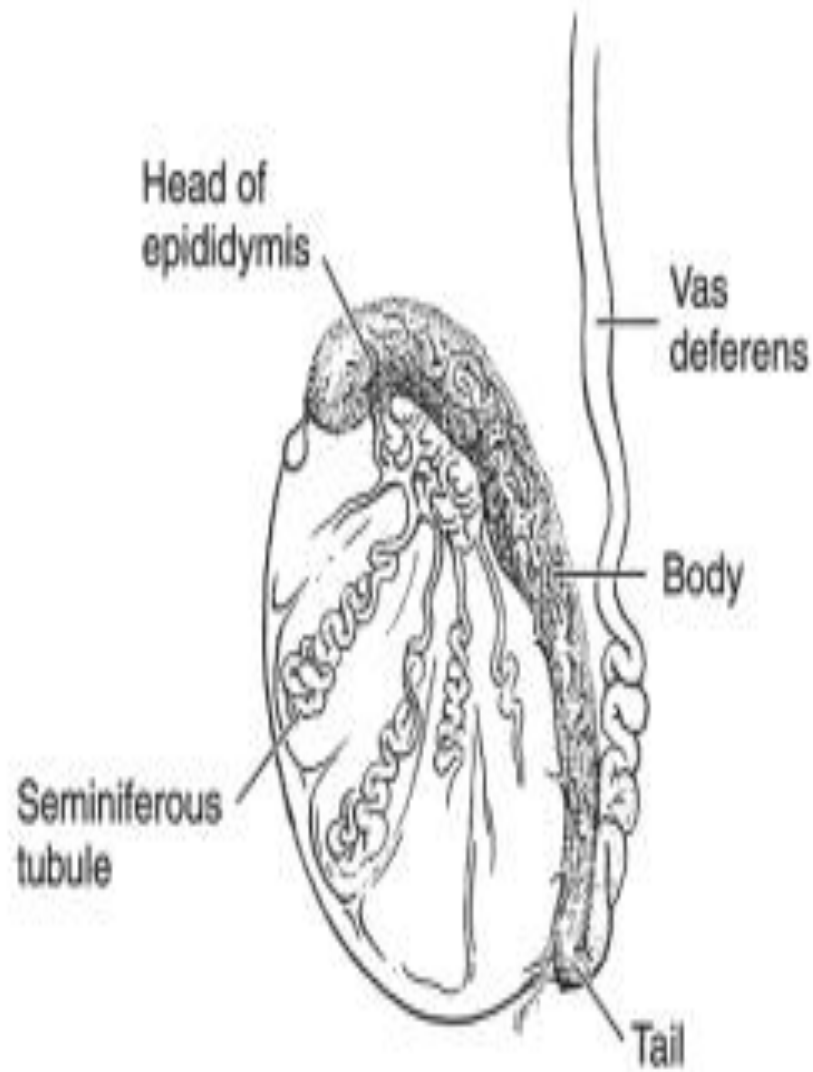
- a fibromuscular and glandular organ lying just inferior to the bladder.
- weighs about 20 g.
- perforated posteriorly by the ejaculatory ducts, which pass obliquely to empty through the verumontanum on the floor of the prostatic urethra just proximal to the external external sphincter.
- Lobes or zones.
- Five lobes: anterior, posterior, median, right lateral, and left lateral.
- Four zones: peripheral zone, central zone (surrounds the ejaculatory ducts), transitional zone (surrounds the urethra), and anterior fibromuscular zone.



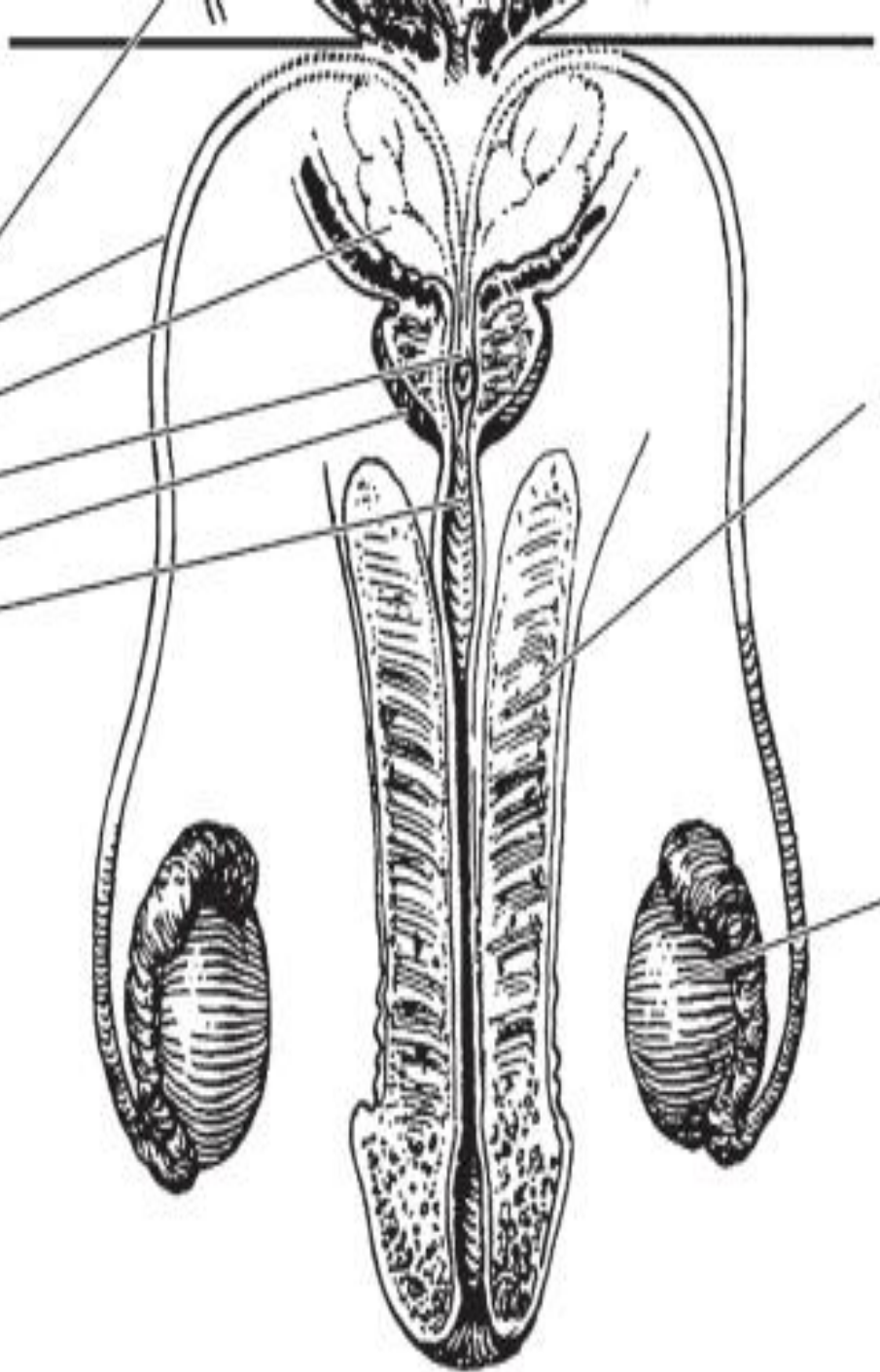




A



Lower tract
Vas deferens
Seminal vesicles
Verumontanum
Prostate
Urethra



Corpus cavernosum

Testicle

RENAL PHYSIOLOGY

1. Excretion & Elimination: removal of organic waste products from body fluids (urea, creatinine, uric acid...).

2. Homeostatic regulation:

Water - Salt Balance

Acid - base Balance

3. Endocrine function:

Productions of hormones (erythropoietin, renin and prostaglandin).

4. Vit D production.

RENAL PHYSIOLOGY

- **Urine production: the nephron is the functional unit of the kidney**

Three important processes:

1. Filtration

2. Reabsorption

3. Secretion: Active process

NEPHRON

Renal corpuscle

Glomerulus and glomerular capsule

#Glomerulus – tuft of fenestrated capillaries

#Glomerular capsule (Bowman's capsule)

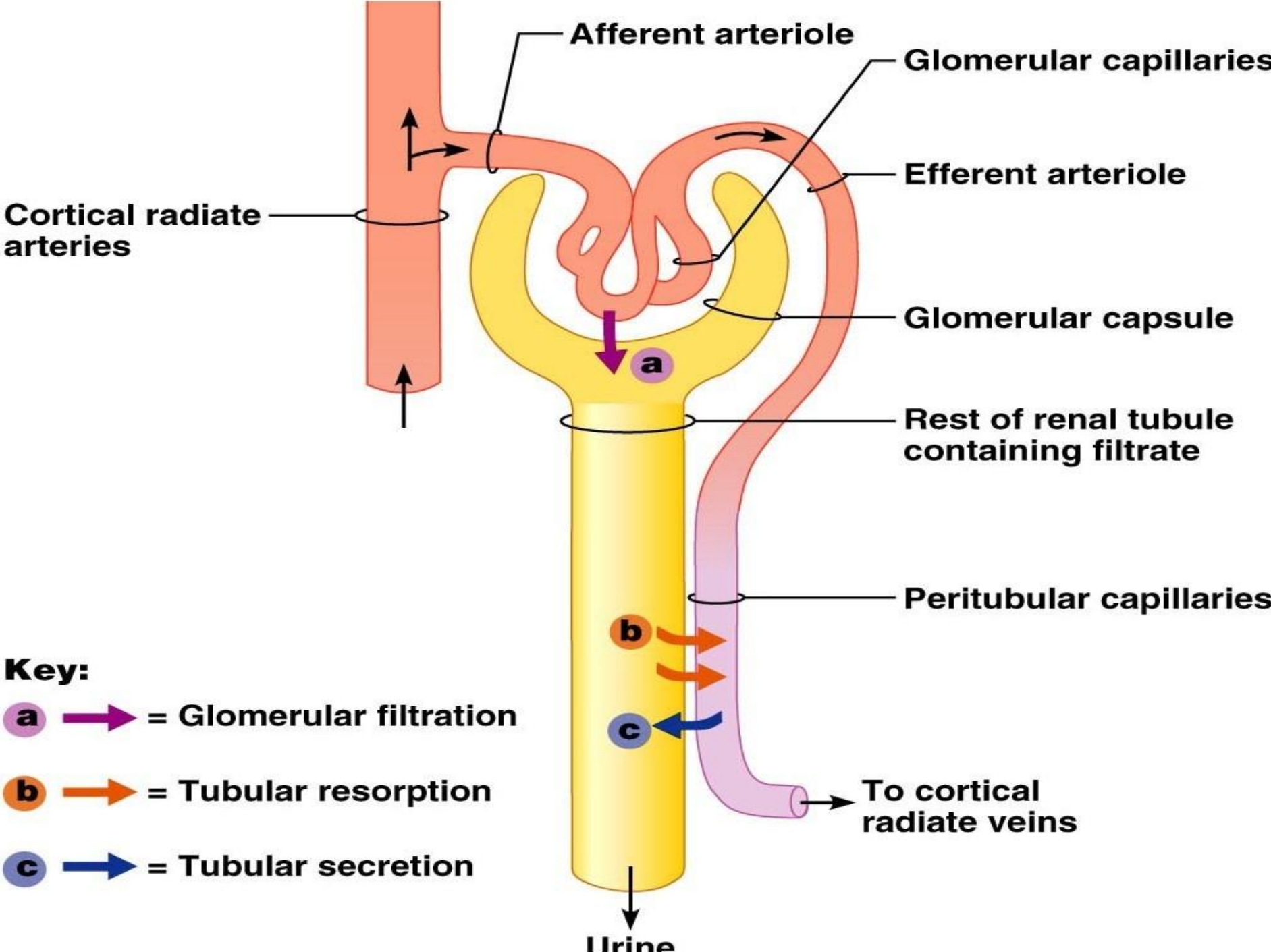
Parietal layer – simple squamous epithelium

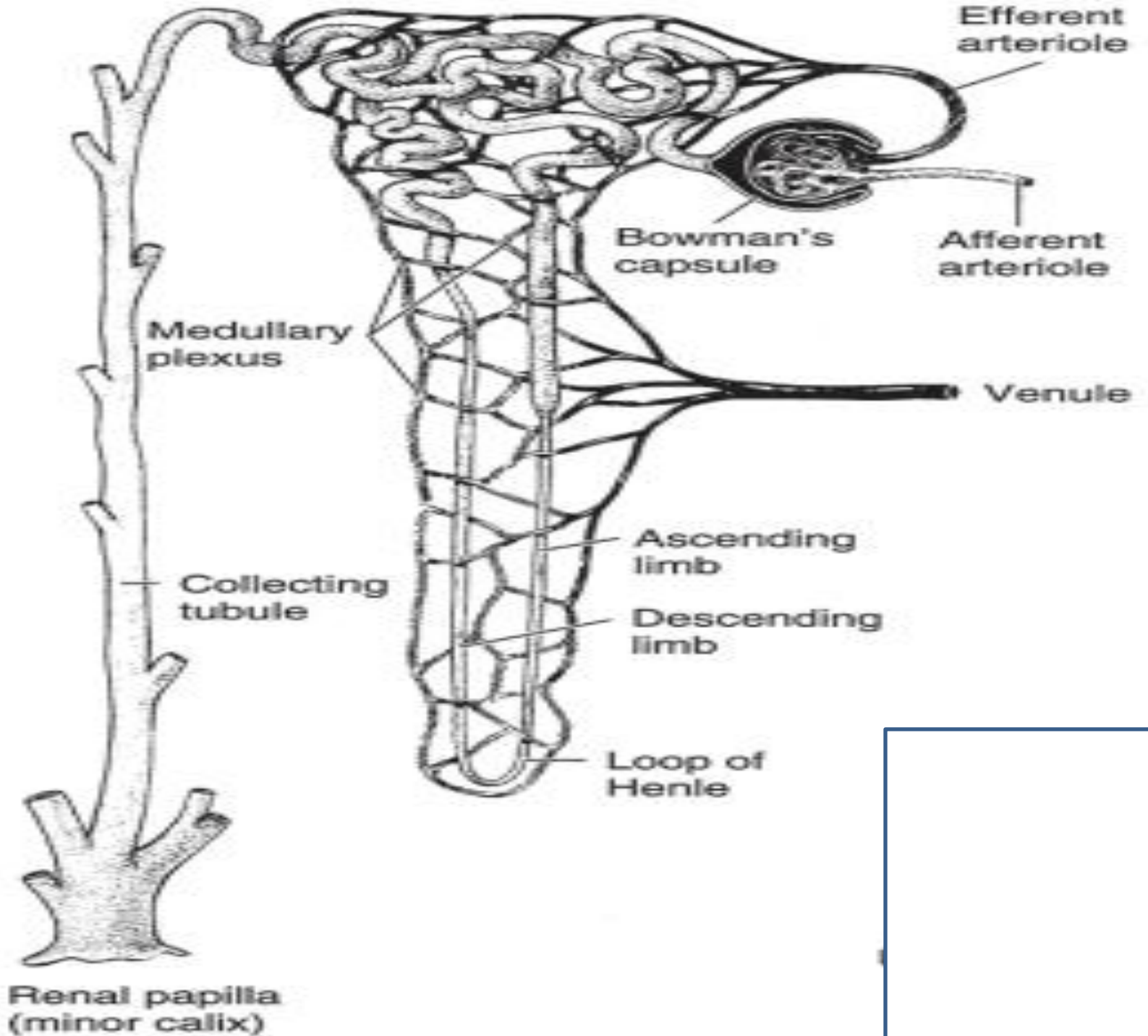
Visceral layer – consists of podocytes

NEPHRON

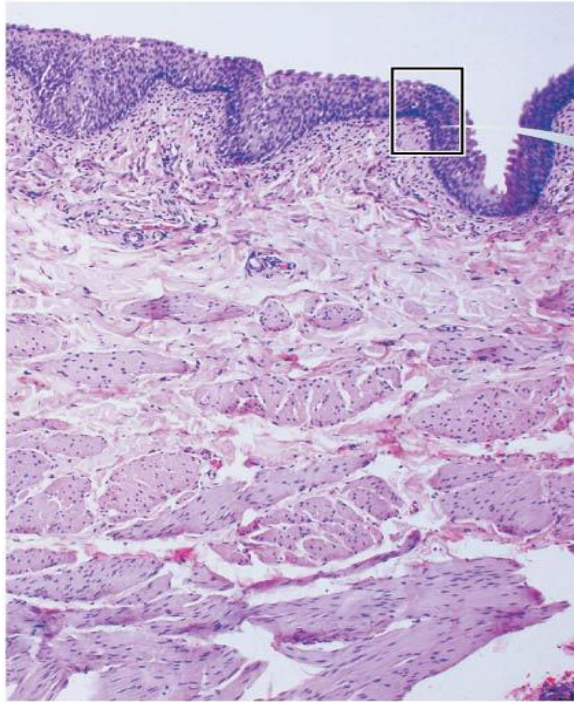
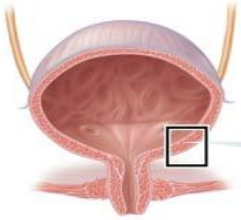
Filtrate proceeds to renal tubules from glomerulus

- Proximal convoluted tubule
- Loop of Henle
 - Descending limb
 - Thin segment
 - Thick segment
- Distal convoluted tubule
- Collecting tubules

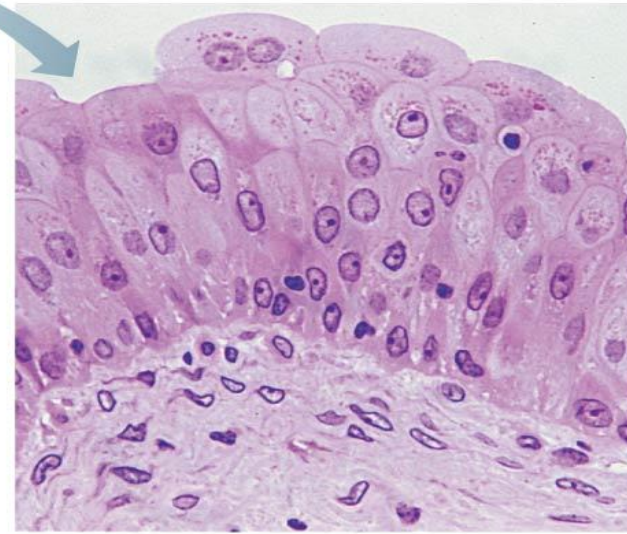




HISTOLOGY OF THE BLADDER



(a)



(b)

HISTOLOGY OF THE BLADDER

- **Mucosa**
 - **Transitional epithelium**
 - **Basement membrane**
 - **Lamina propria**
 - **Submucosa of connective and elastic tissue**
- **Muscular layer**
 - **Detrusor muscle : smooth-muscle fibers arranged at random in a longitudinal, circular, and spiral manner**
- **Adventitia**

HISTOLOGY OF THE URETER



Lumen

Adventitia

Circular layer

Longitudinal layer

Transitional epithelium

Lamina propria

Mucosa
Muscularis

EMBRYOLOGY

- Embryo develops three pairs of kidneys
 - Pronephros
 - Mesonephros
 - Metanephros
 - Only metanephros persists to become the adult kidneys
 - Metanephric kidney produces urine by fetal third month and **C**ontributes to the volume of amniotic fluid.

EMBRYOLOGY

- The urinary tract develops from the 3rd week of the embryonic period from the intermediate mesoderm as well as from the urogenital sinus. The kidneys develop from the 4th week in three steps:
- As a first one, the pronephros, forms and later atrophies in the 8th week and is never active functionally.
- It is followed by the mesonephros, that is formed between the 6th and 10th weeks, but is only transitory.
- The definitive kidneys develop from metanephros (mesodermal origin) and the ureter bud (that has its origin in the caudal part of the wolffian duct)

EMBRYOLOGY

- The urine-excreting part of the kidneys, the nephron, mainly arises from the metanephros (glomerulus, proximal, intermediate and distal tubules), while the rest of the upper urinary tract (collecting ducts, calices, renal pelvis and ureter) develop from the ureteric bud.

EMBRYOLOGY

- The numerous induction mechanisms between ureter bud and metanephric mesenchyma during the development of the renal system, as well as the ascent of the kidneys, originating at the level of the sacrum and moving up to the diaphragm at the end of the development, make it possible for a large number of abnormalities to arise. Many remain asymptomatic.

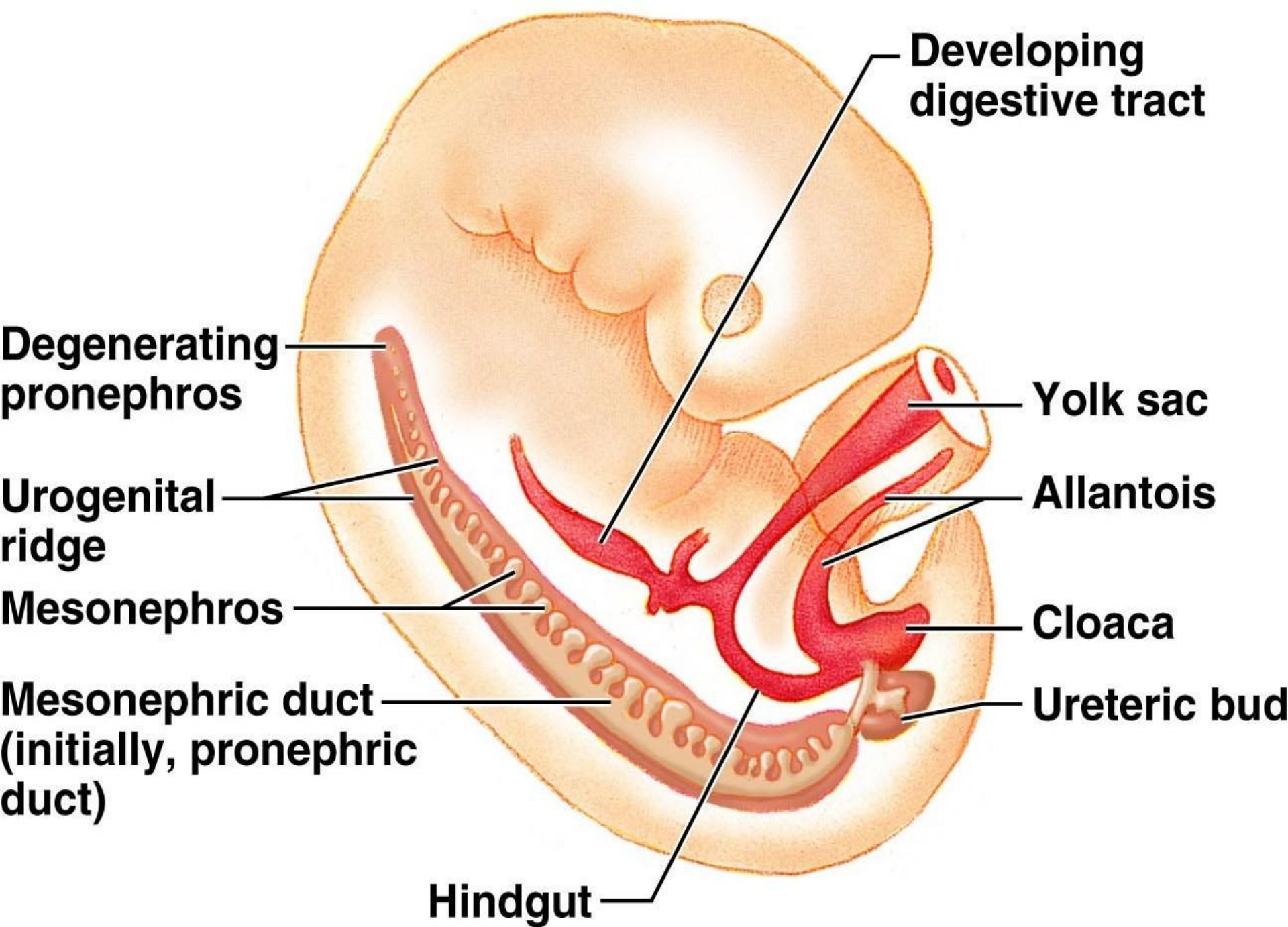
EMBRYOLOGY

- In males the internal sex organs come from the mesonephric duct (Wolff) that differentiates itself into the epididymis, deferent duct, seminal vesicle and the ejaculatory duct.
- The paramesonephric duct (Müller) atrophies. It leaves behind embryonic remnants such as the testicular appendage and parts of the prostatic utricle.

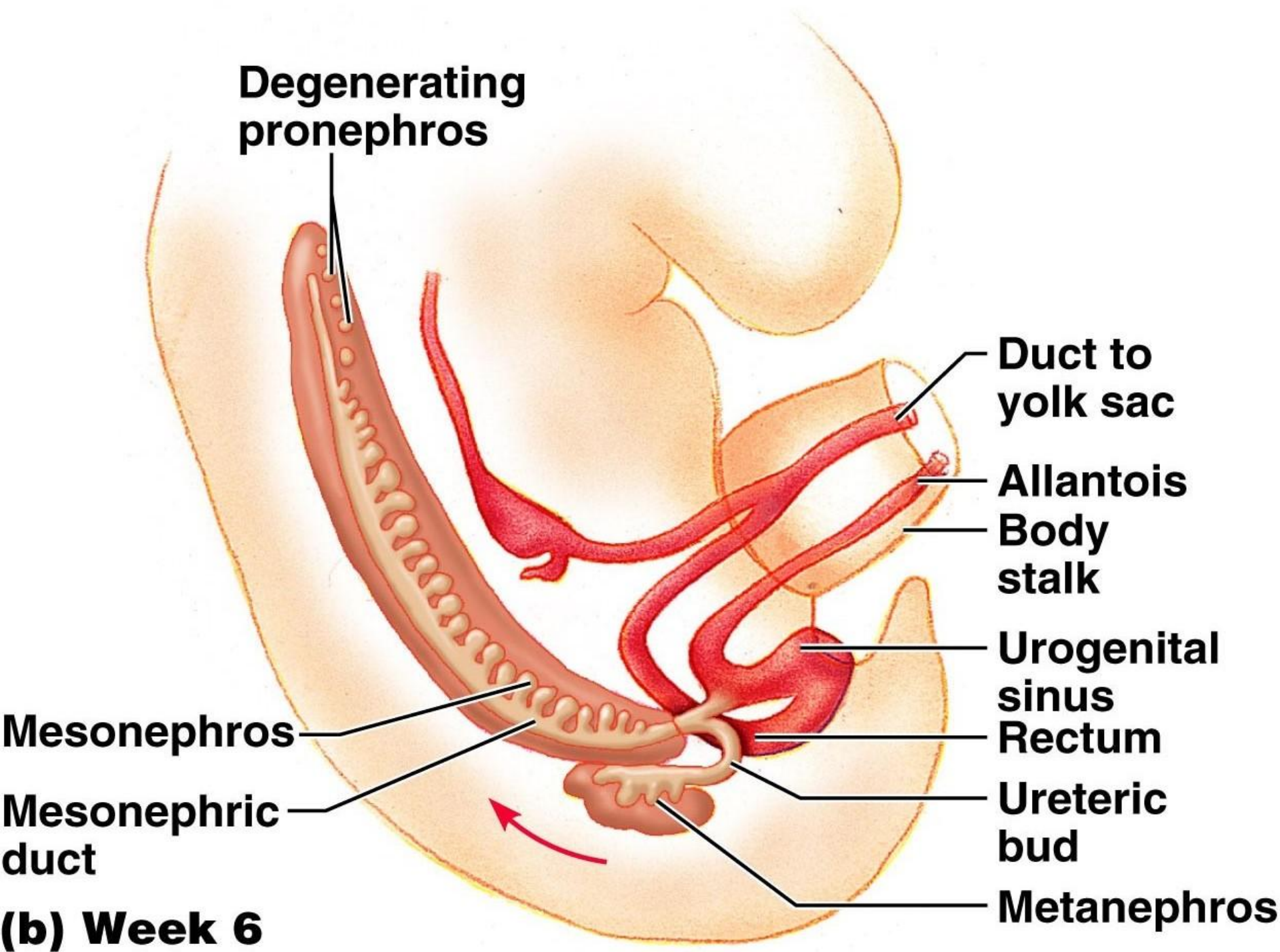
EMBRYOLOGY

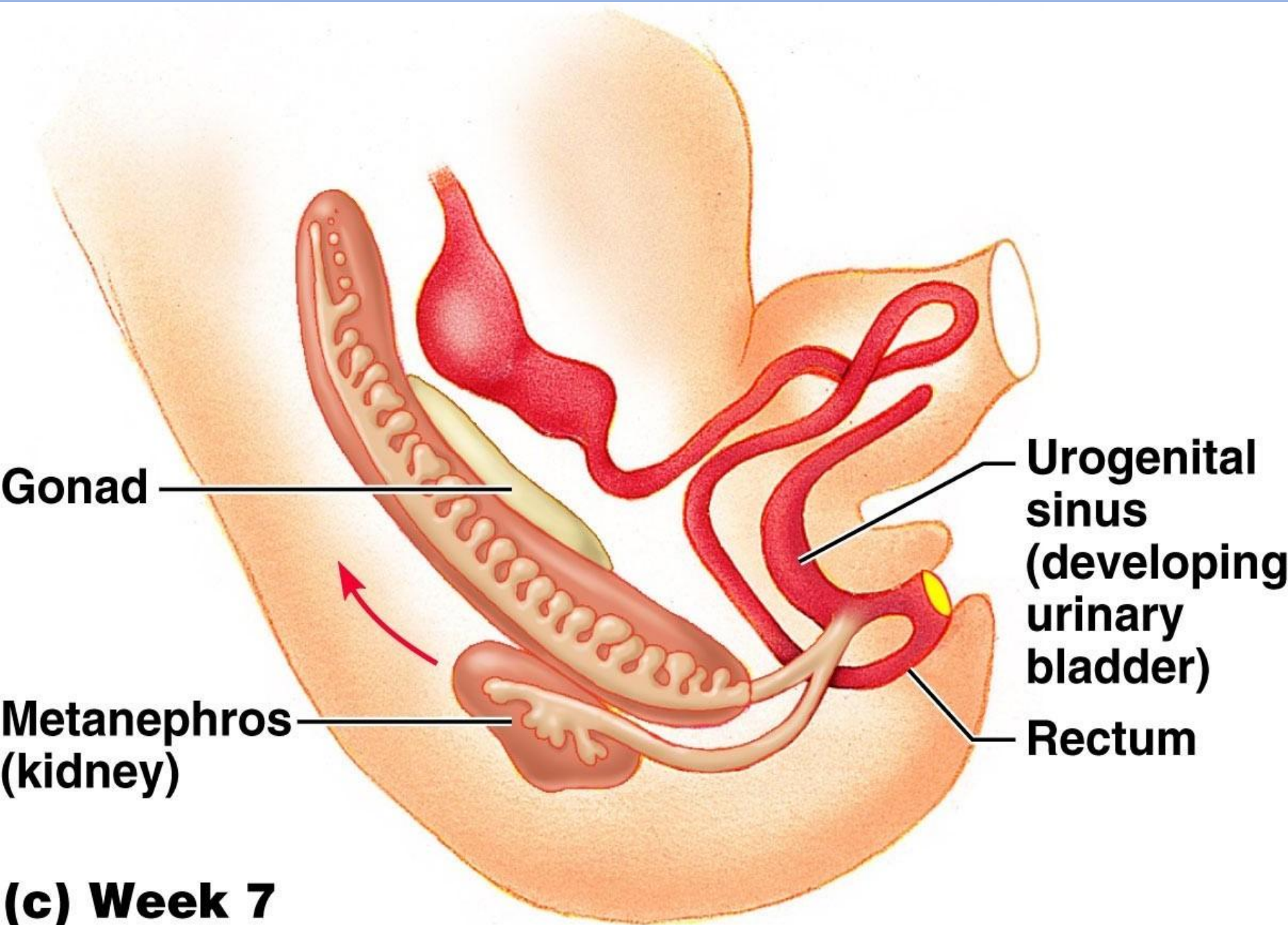
- In females the paramesonephric duct (Müller) remains in existence and differentiates itself into the fallopian tube with its ampullae and, following its fusion at the caudal end, into the uterus and the upper part of the vagina.

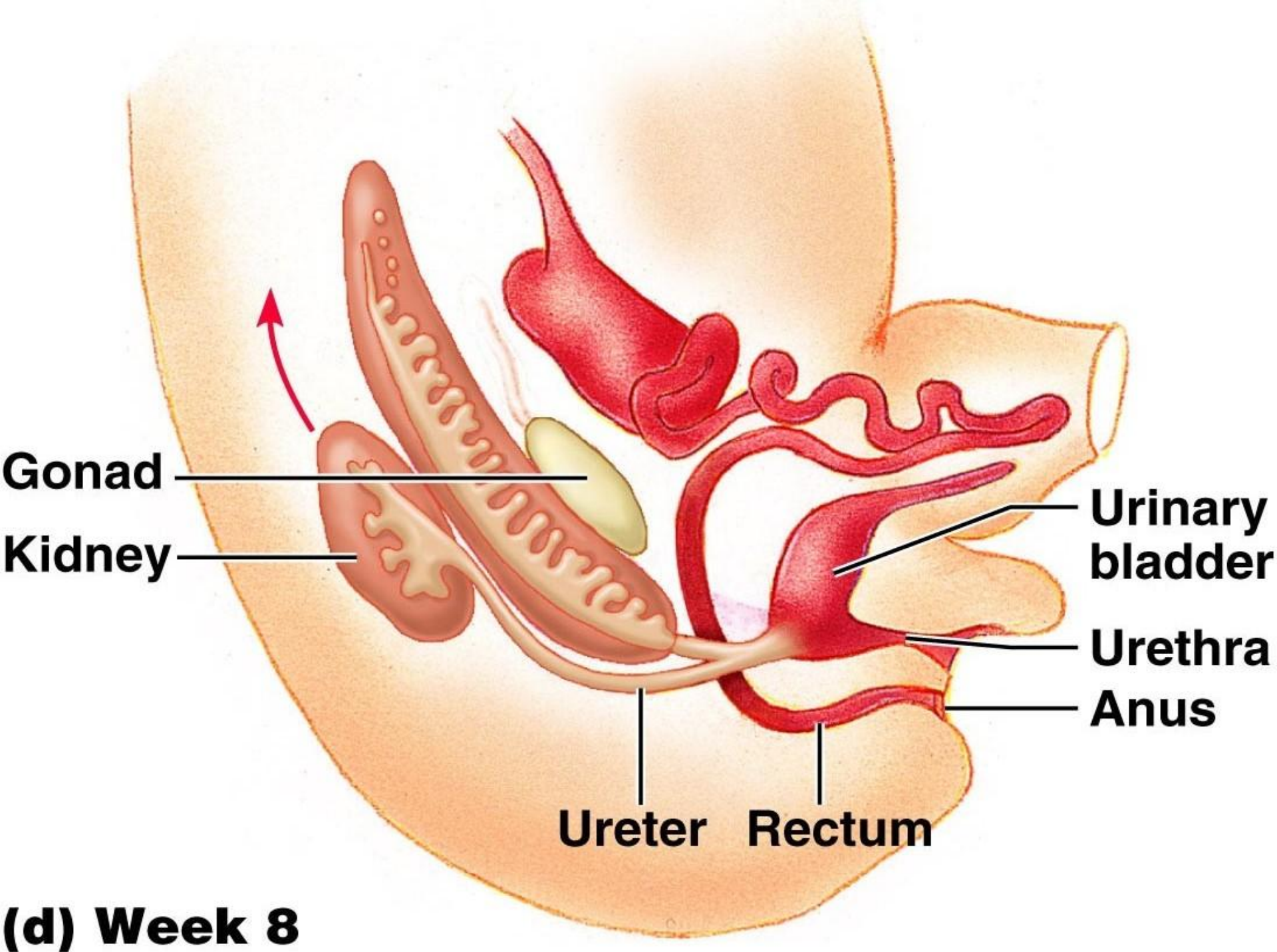
The mesonephric duct (Wolff) with its tubules atrophies and leaves embryonic remnants such as the ductus longitudinalis epoöphori (Gartner), epoöphoron and paroöphoron.



(a) Week 5







THANK YOU