

Urinary System Anatomy

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Introduction

- The urinary system consists of two **kidneys**, two **ureters**, one **urinary bladder**, and one **urethra**
- After the kidneys **filter** blood plasma, they return most of the water and solutes to the bloodstream.
- The remaining water and solutes constitute urine, which passes through the ureters and is stored in the urinary bladder
- Then it is **excreted** from the body through the urethra

Function

- regulate blood volume and composition
- help regulate blood pressure
- synthesize glucose
- Release erythropoietin
- participate in vitamin D synthesis
- excrete wastes by forming urine.

Kidney

- The kidneys are pair of excretory organs situated on the posterior abdominal wall on either side of the vertebral column.
- The kidneys are reddish brown in color.
- They are **retroperitoneal** organs.
- The right kidney lies slightly lower than the left.
- The left is a little longer and narrower than the right

Hepatic artery proper
Hepatic portal vein
Suprarenal gland

Bile duct

Duodenum, descending part

Head of pancreas,
uncinate process

Inferior vena cava
Testicular artery and vein

Common iliac artery
and vein
Femoral nerve

External iliac artery and vein

Inferior epigastric artery
and vein

Stomach, cardia
Coeliac trunk
Left suprarenal gland

Splenic artery and vein

Inferior mesenteric vein

Superior mesenteric
artery and vein

Left kidney

Ureter
Abdominal aorta

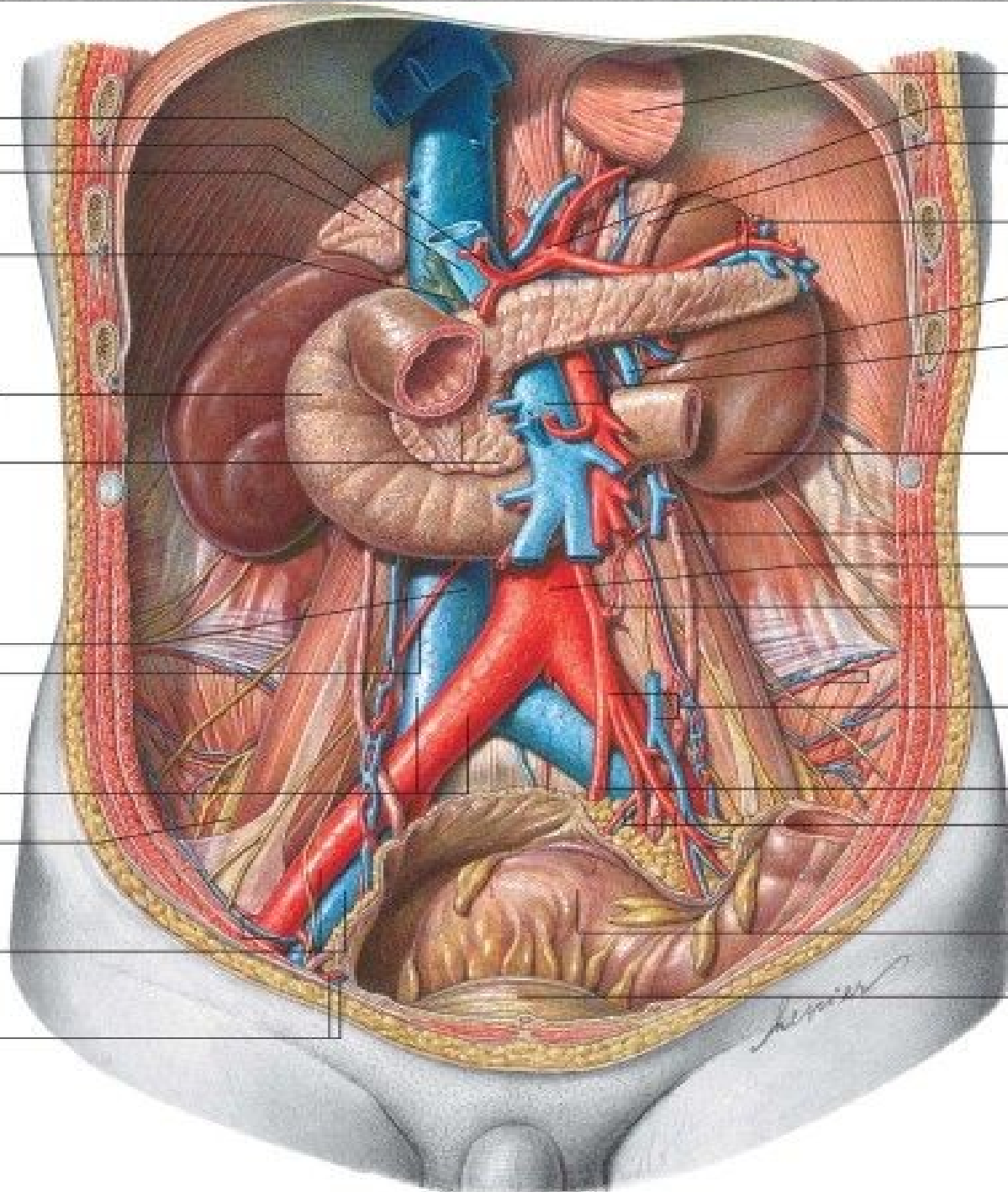
Left colic artery

Inferior mesenteric artery and vein

Superior rectal artery
Sigmoid arteries and veins

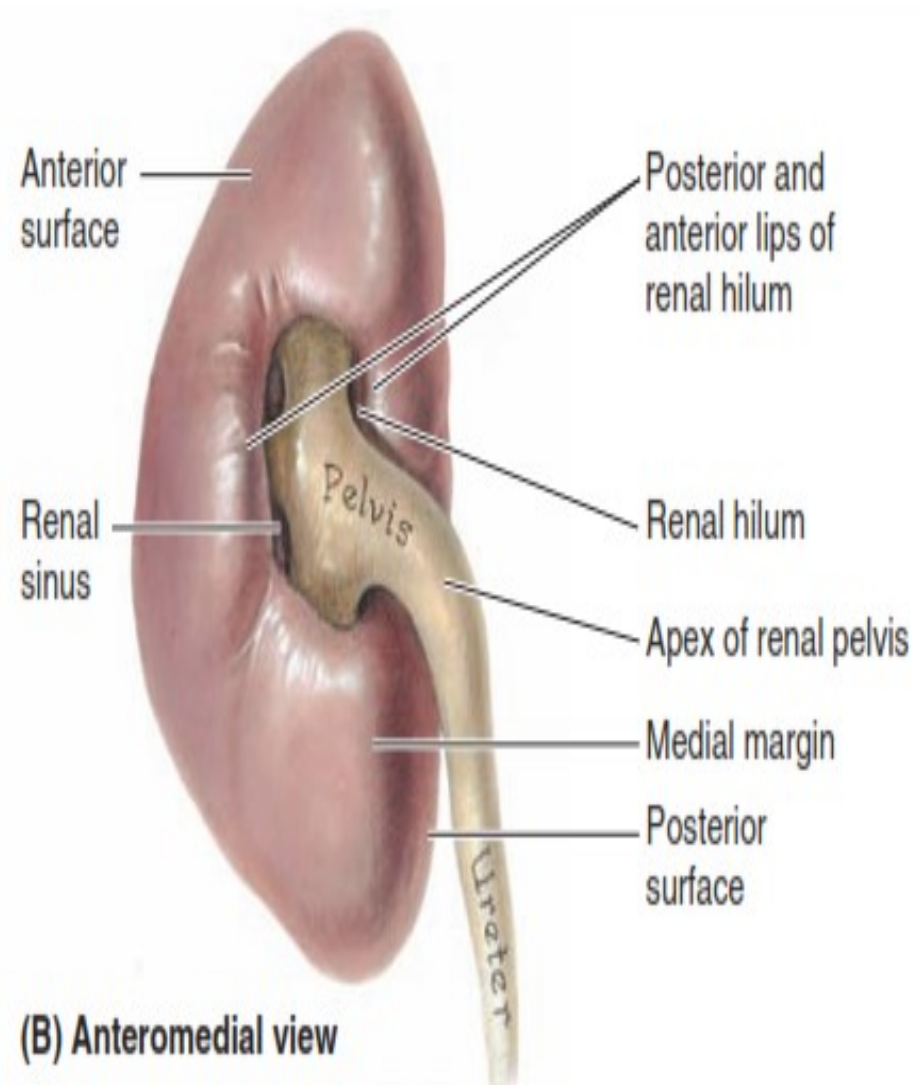
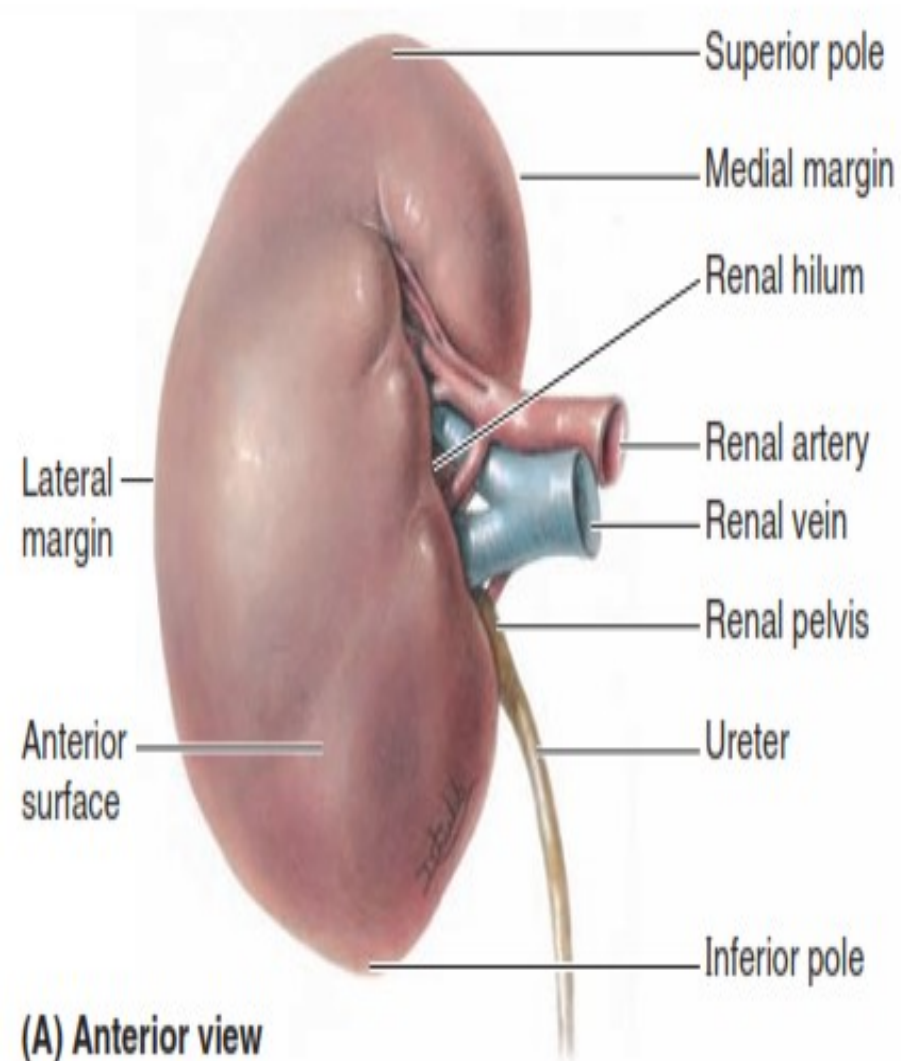
Sigmoid colon

Urinary bladder



Each kidney has

- **Two poles** – Upper & lower poles
- **Two borders** – Medial & lateral borders.
- **Two surfaces** – Anterior & posterior surfaces.
- The **suprarenal glands** rests on the upper poles.
- The medial border is concave & there is a vertical slit in the middle and is called as the **hilum**.
- The lateral border is **convex**.



Hilum of kidney

- extends into a large cavity called the **renal sinus**.
- The structures passing through the hilum from the front backwards are the **renal vein**, two branches of the **renal artery**, the **ureter**,
- **Lymph vessels** and **sympathetic** fibers also pass through the hilum

Kidney coverings

- The kidneys have the following coverings from **inside** out:

Fibrous capsule

- This surrounds the kidney and is closely applied to its outer surface.

Perirenal fat:

- This is a thin layer of fat which covers the fibrous capsule.

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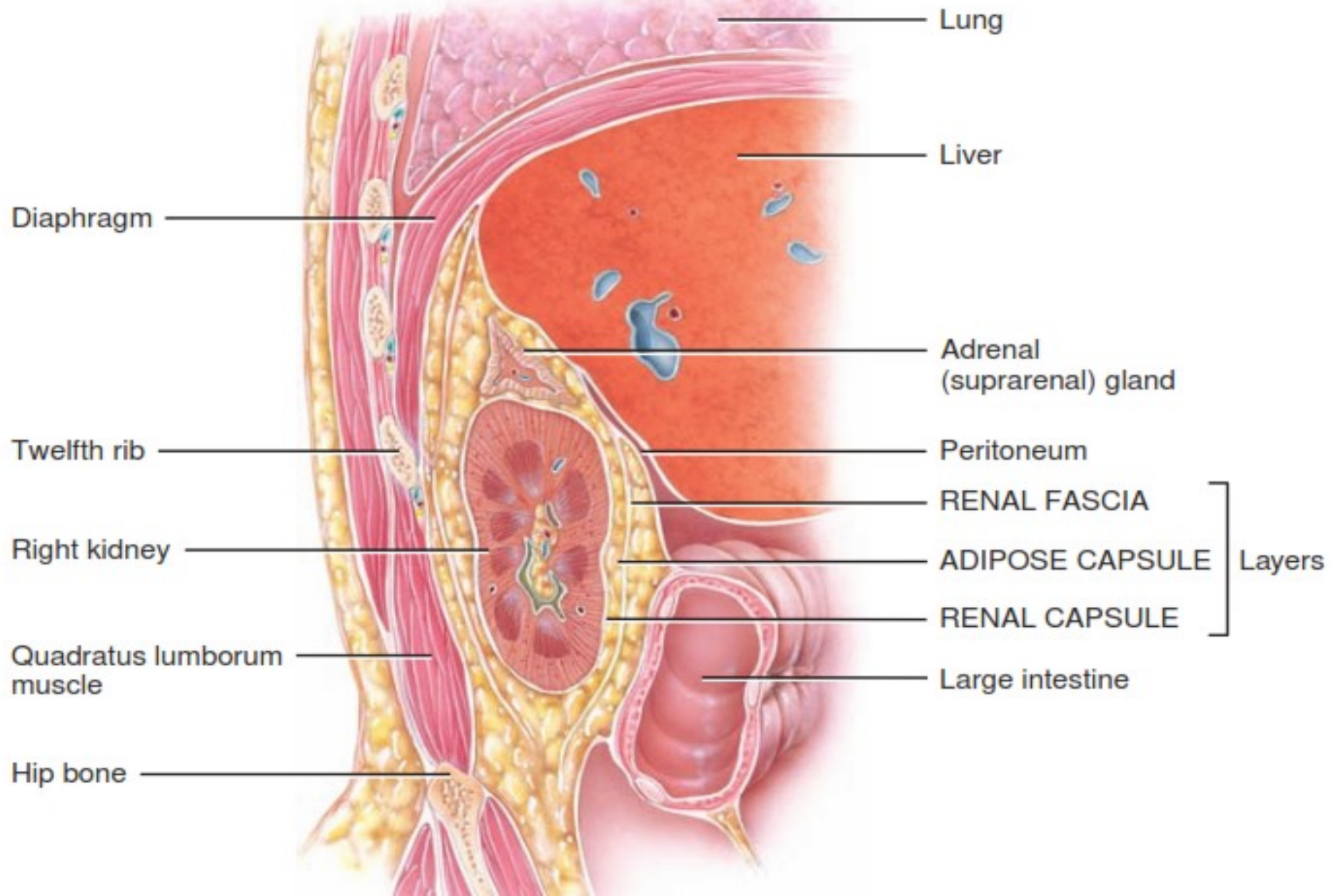
Renal fascia

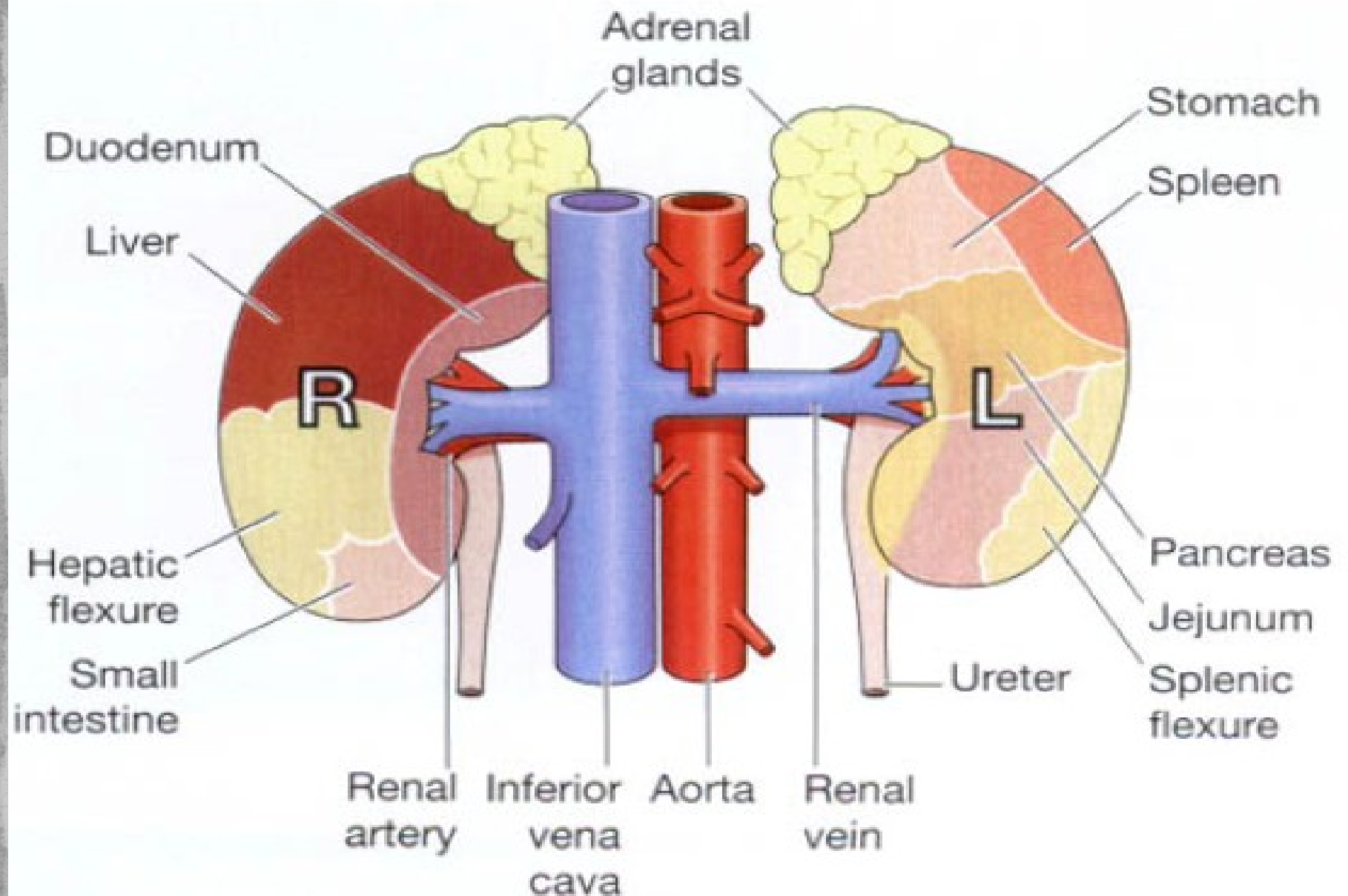
- connective tissue that lies outside the perirenal fat
- encloses the kidneys and suprarenal glands;

Pararenal fat:

- This is a pad of fat that lies external to the renal fascia

SUPERIOR





Structure of kidney

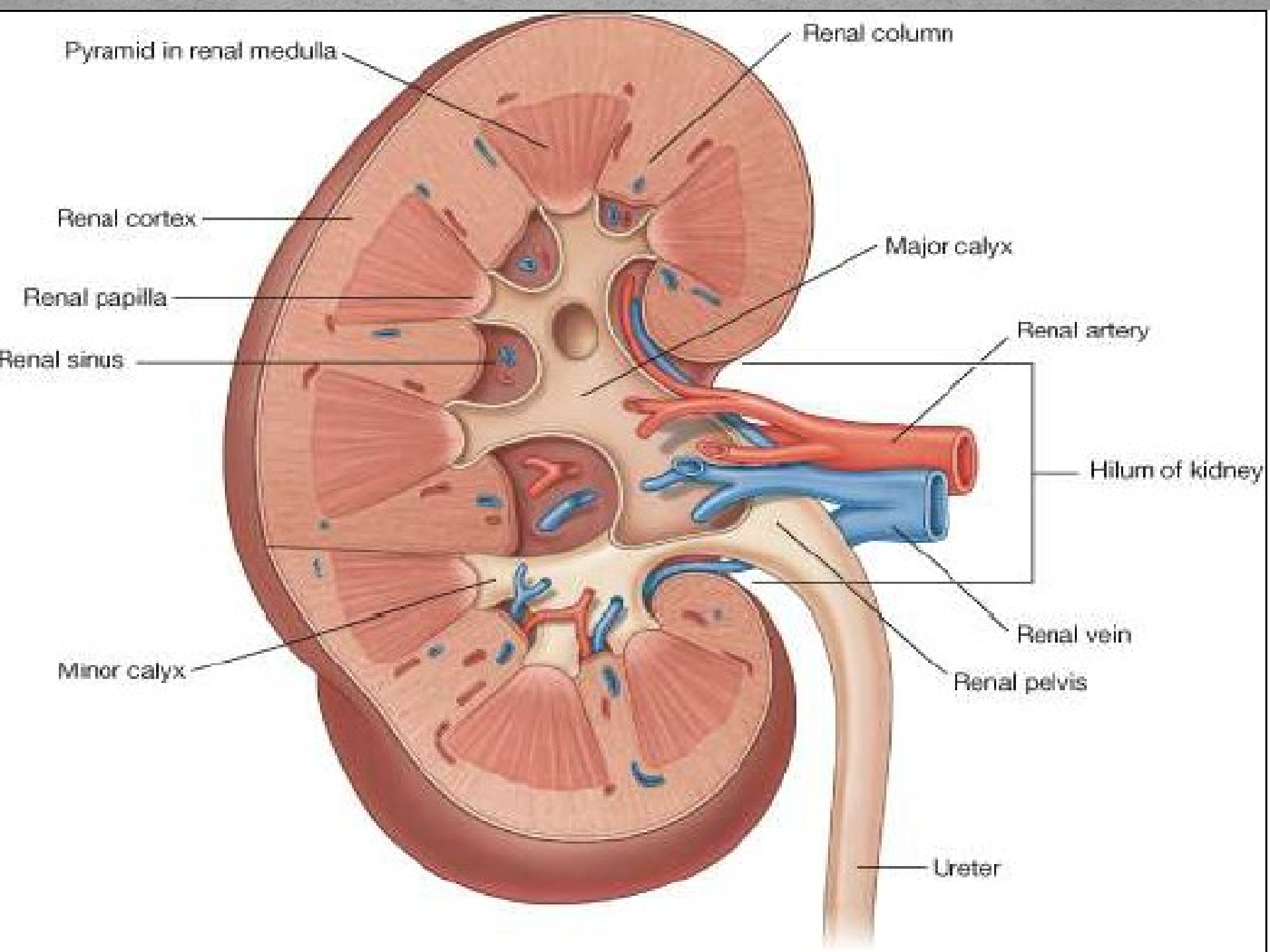
The kidney can be divided into an internal medulla and external cortex.

Renal medulla

- consists of conical masses called **renal pyramids**.
- renal pyramids apices converging to the **renal sinus**.
- At the renal sinus they project into **calyces as papillae**.

Renal cortex

- Subcapsular
- arching over the bases of the pyramids and extending between them towards the renal sinus are the **renal columns**.
- **Cortical arches** are the part of cortex that seen capping the pyramids.



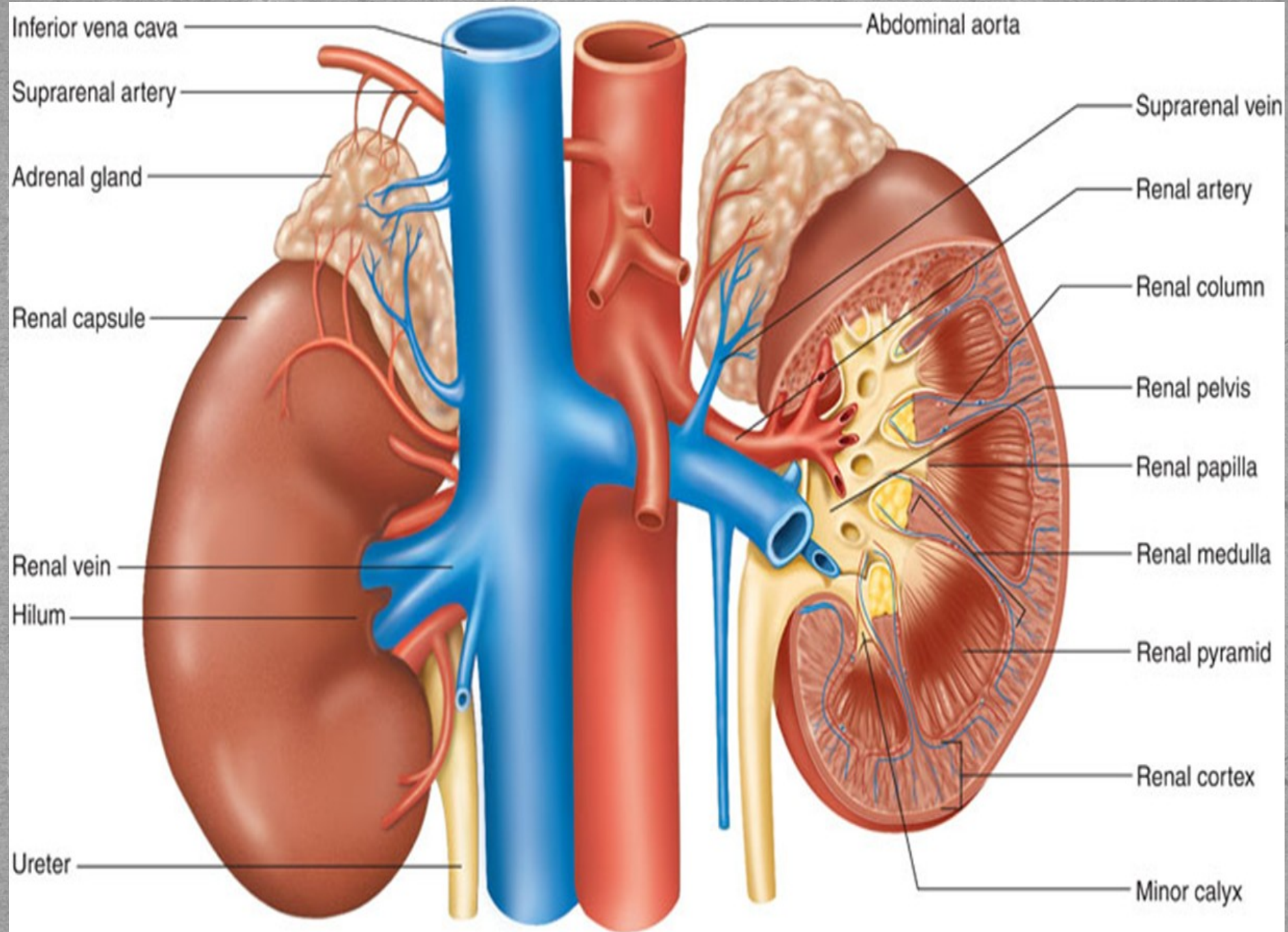
Vessels and nerves

Arteries

- The **renal artery** arises from the **aorta**

Veins

- The **renal vein** emerges from the hilum in front of the renal artery and drains into the **inferior vena cava**



Lymph Drainage

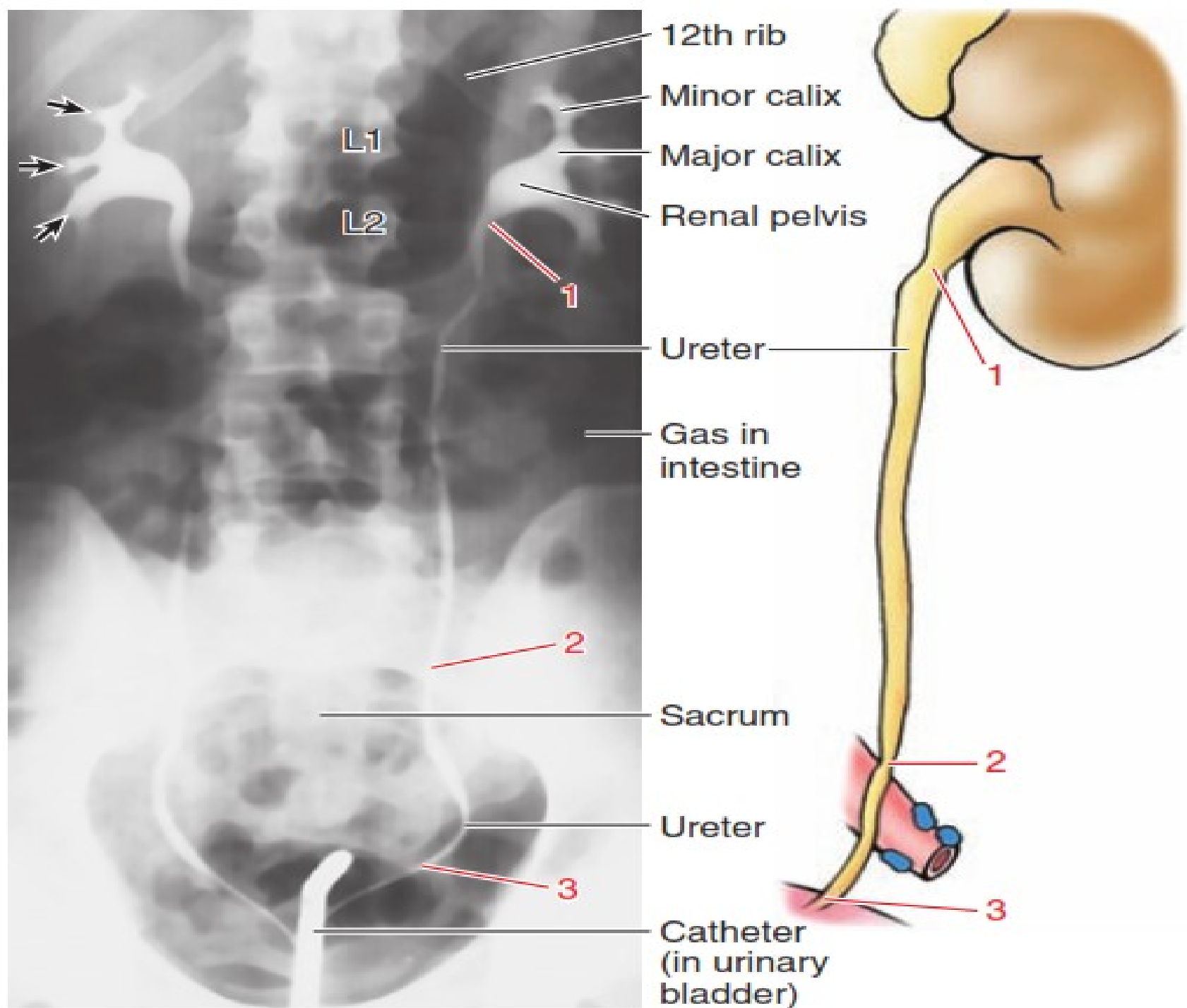
- Lymph drains to the **lateral aortic lymph nodes** around the origin of the renal artery.

Nerve Supply

- The nerve supply is by the **renal sympathetic plexus**.
- The afferent fibers that travel through the renal plexus enter the spinal cord in the **10th, 11th, and 12th thoracic nerves**.

Ureter

- The ureters are **muscular tubes** that extend from the kidneys to the posterior surface of the urinary bladder.
- Each ureter measures about 25 cm long



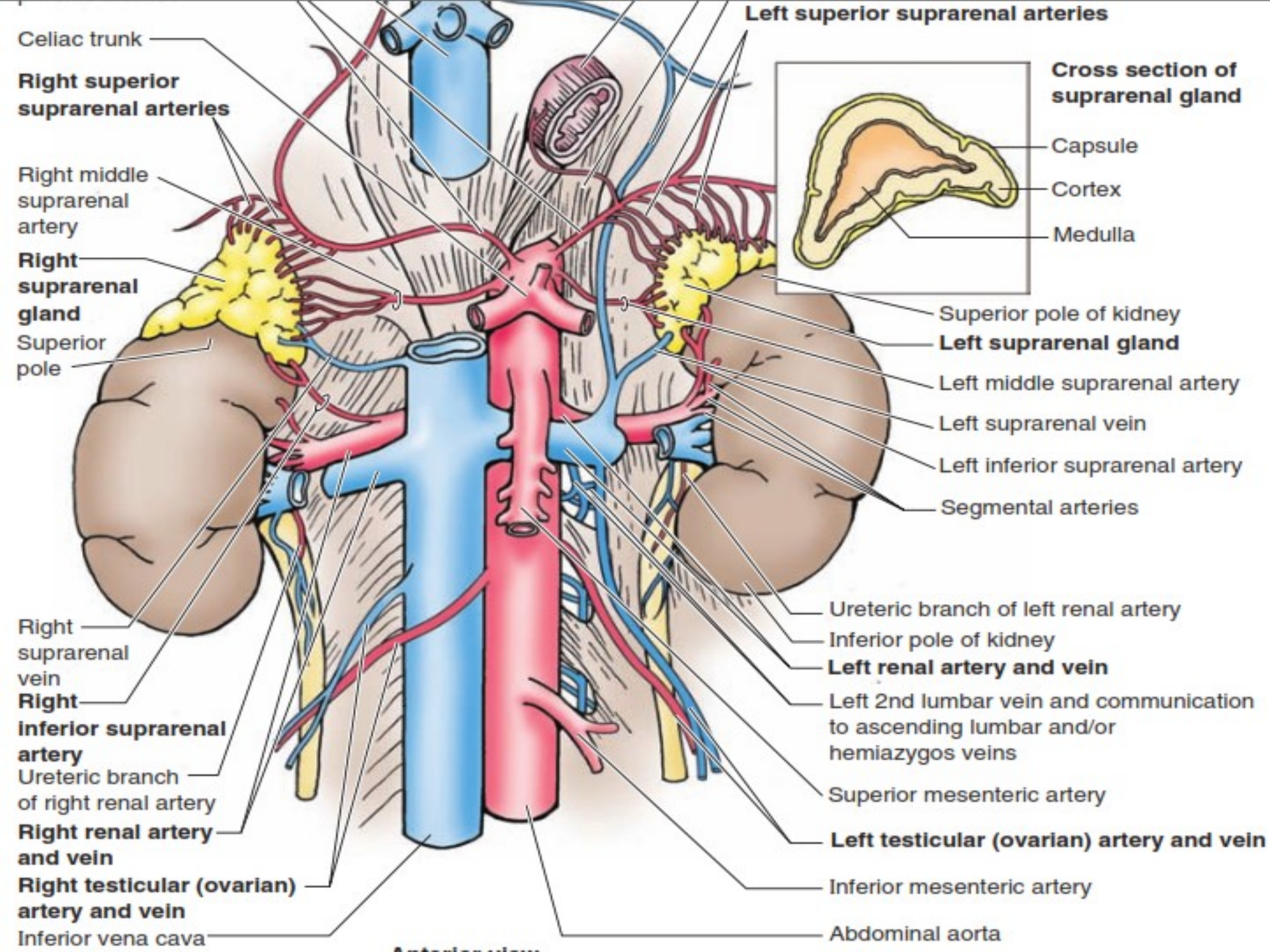
Vessels and nerve

Arteries

- The upper part of ureter is supplied by the **renal artery**
- middle portion by the **testicular or ovarian artery**
- lower part in the pelvis by the **superior vesical artery**.

Veins

- Venous blood drains into **renal, testicular or ovarian & superior vesical veins**.



Lymph Drainage

- The lymph drains to the **lateral aortic nodes** and the **iliac nodes**.

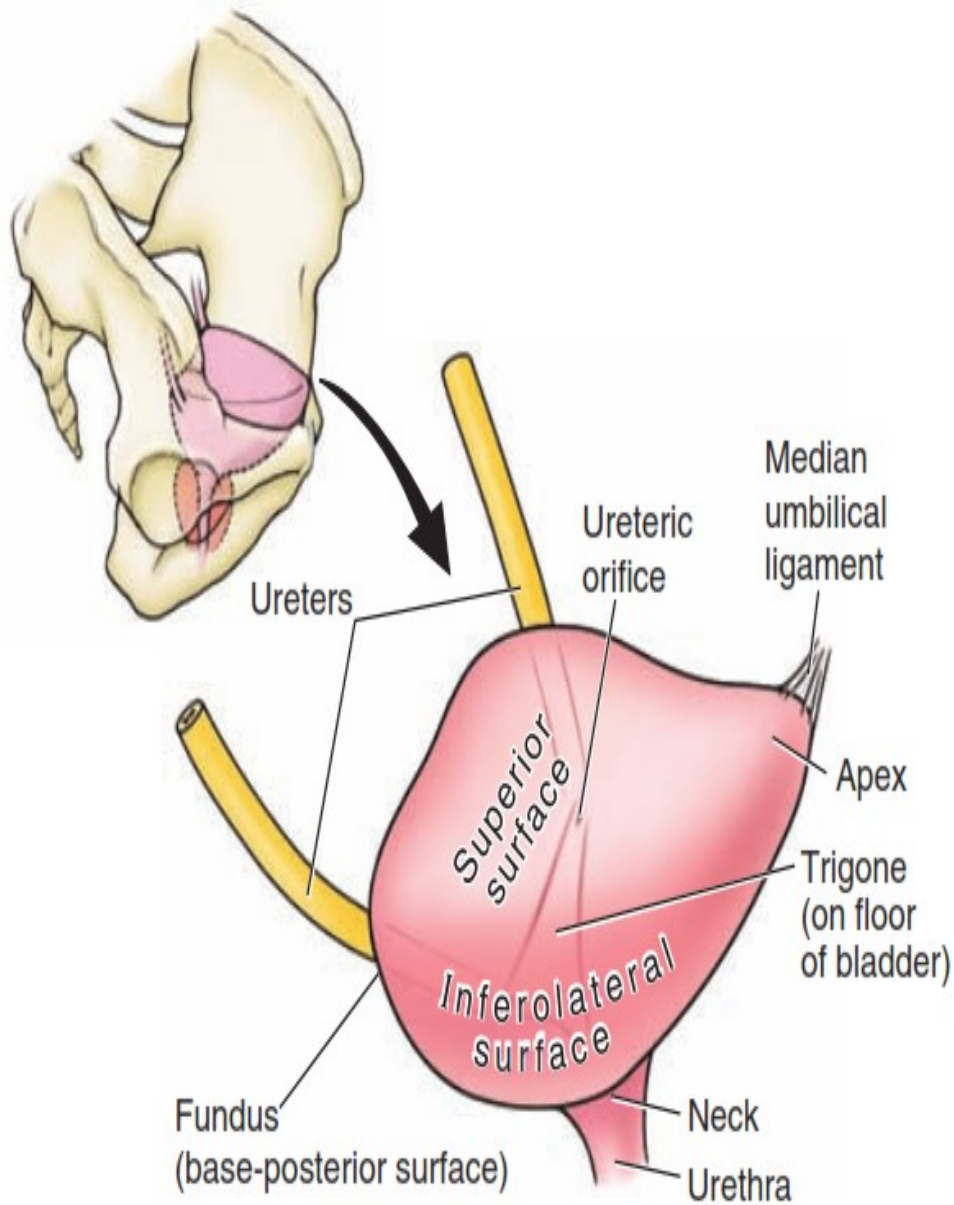
Nerve Supply

- The nerve supply is the **renal**, **testicular** (or ovarian), and **hypogastric** plexuses (in the pelvis).
- Afferent fibers travel with the sympathetic nerves and enter the spinal cord in the first and second lumbar segments.

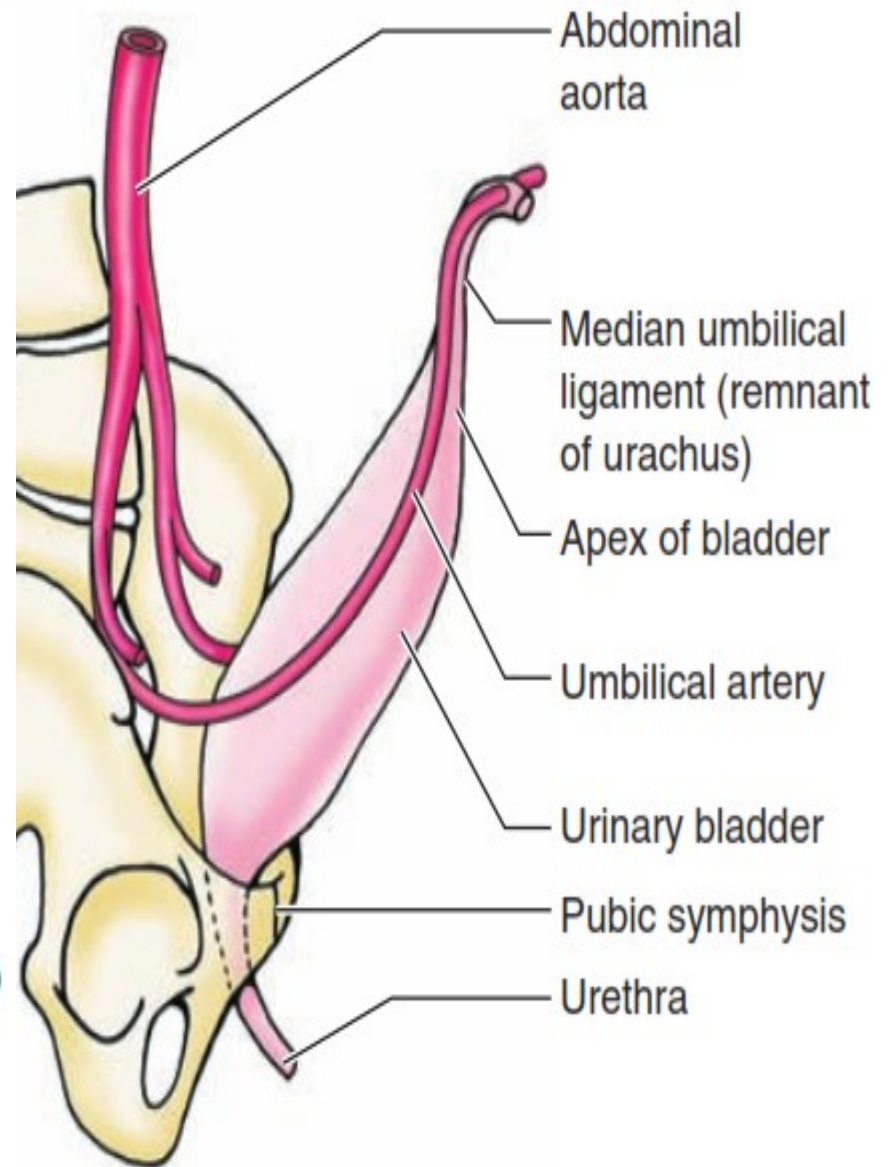
Urinary Bladder

- The urinary bladder is a **reservoir of urine**.
- Its size, shape, position and relations all vary according to its **content** and the state of neighbouring viscera.
- When the bladder is **empty**, it lies entirely in the lesser pelvis
- but as it **distends** it expands anterosuperiorly into the abdominal cavity.
- situated behind the pubic bones .
- In the adult has a maximum capacity of about **500 mL**.

- The empty bladder is **tetrahedral** in shape
- has **apex**, **base**, and **neck**
- **Three surfaces** - Superior and two inferolateral surfaces.
- **Three borders** - Right & left lateral & posterior borders.
- The **apex** of the bladder is directed forwards and lies behind the upper margin of the symphysis pubis.
- The **base** of the bladder is triangular and located posteroinferiorly.



(B) Lateral view



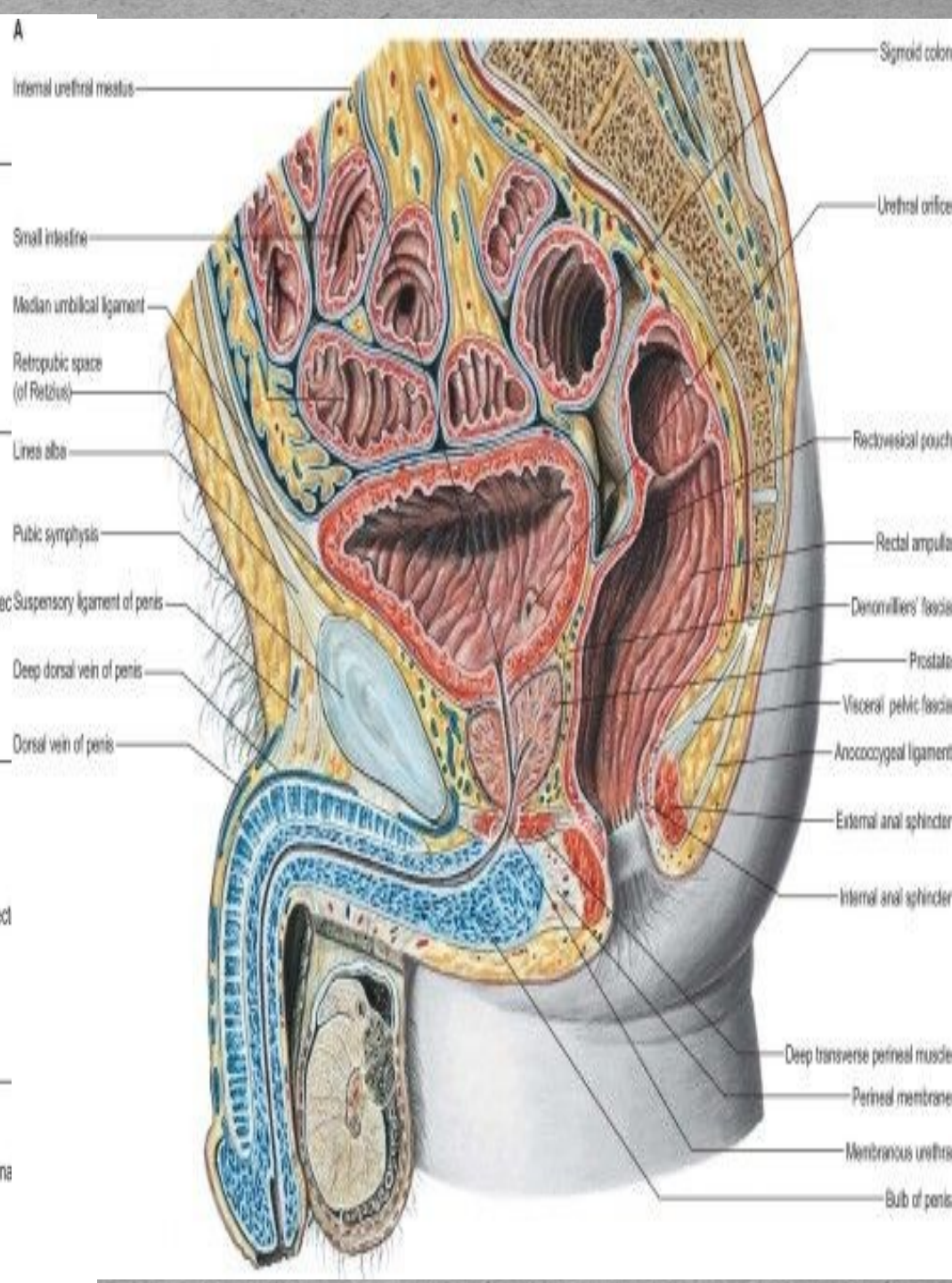
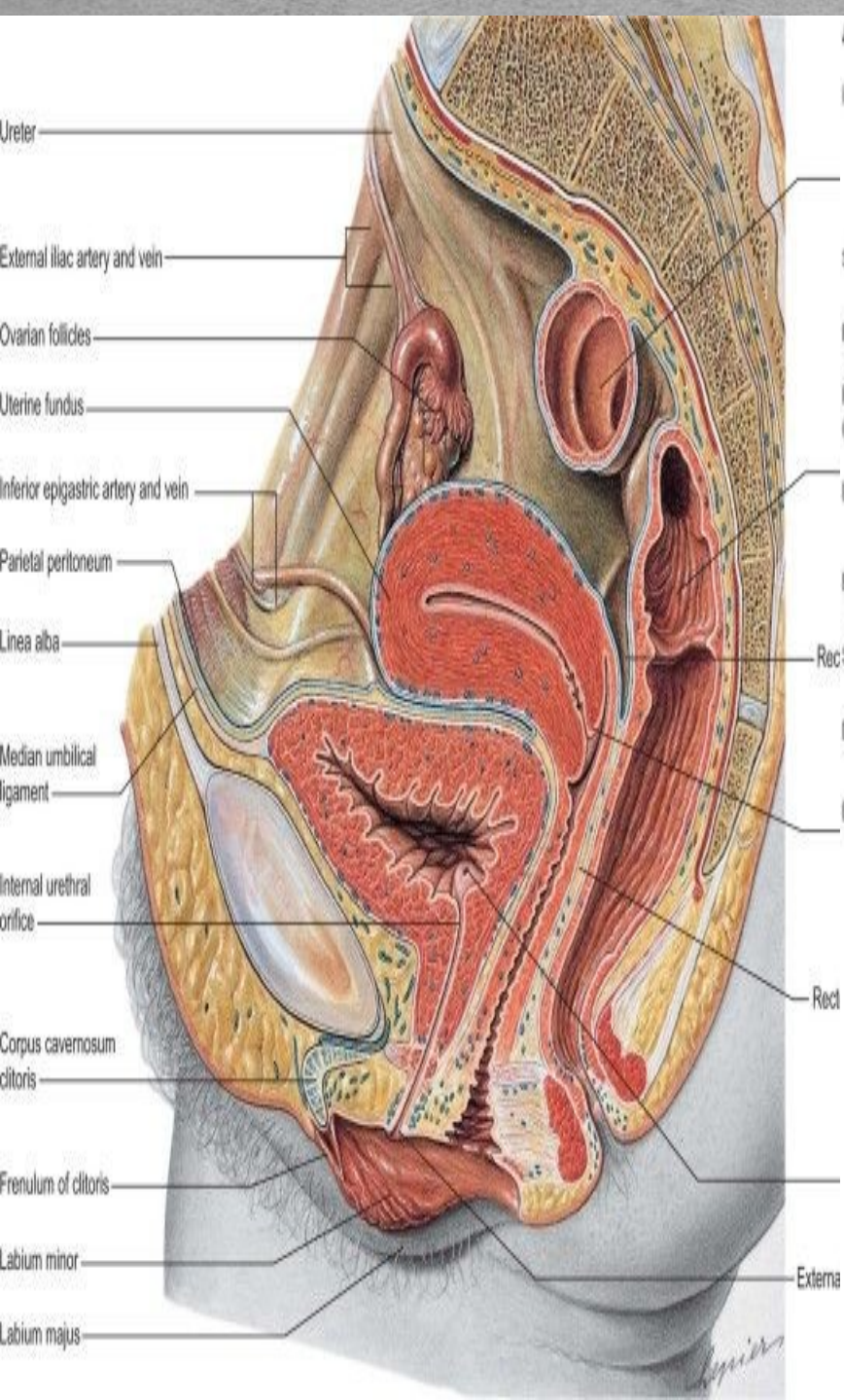
ht lateral view

In females

- closely related to the **anterior vaginal wall**.

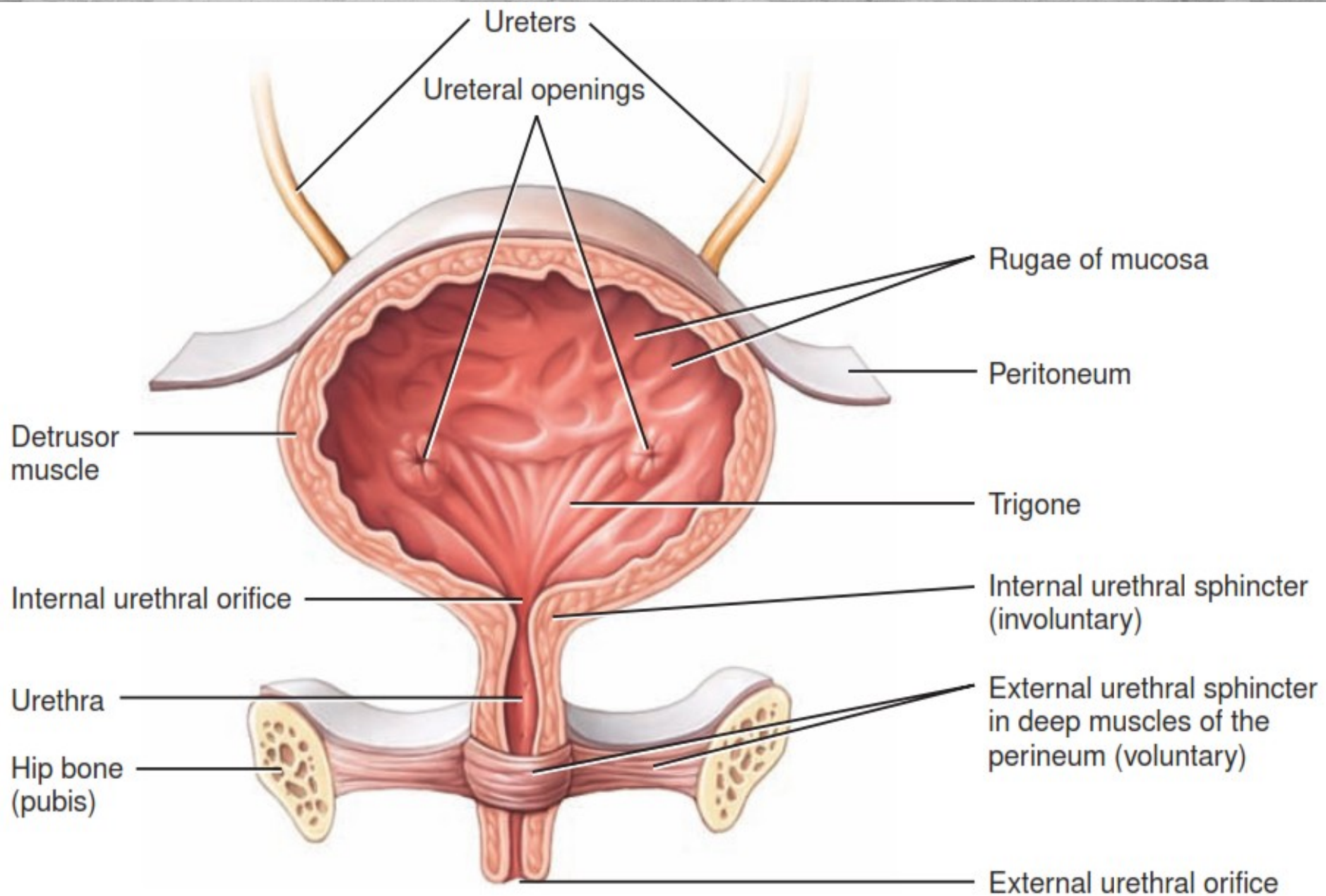
In males

- it is related to the **rectum**
- The base is in contact with the sigmoid colon and the terminal coils of the ileum.

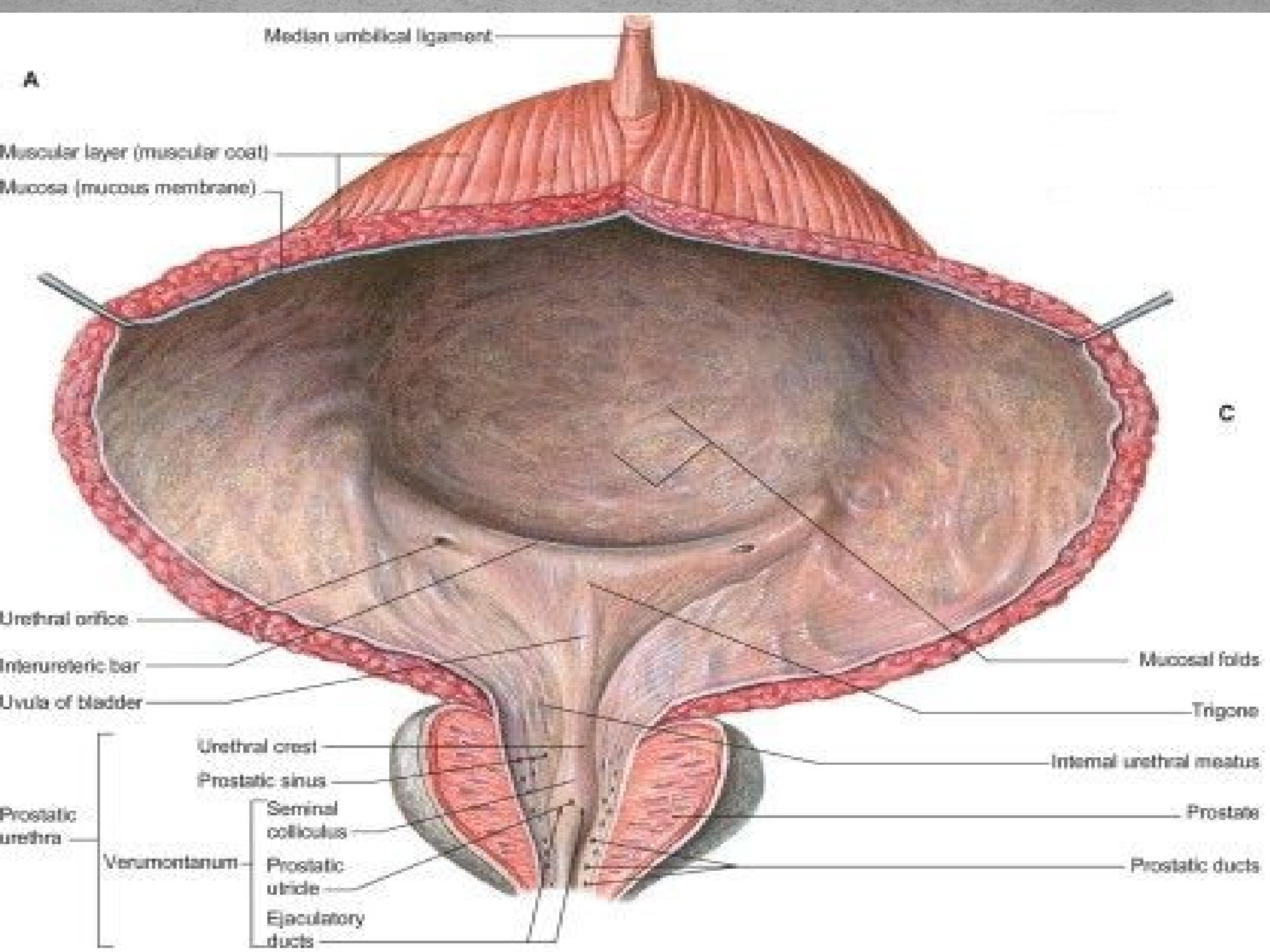


Interior of bladder

- triangular area near the lower part of base is called as the **trigone of the bladder**.
- The anteroinferior angle of the trigone is formed by the **internal urethral orifice**
- its posterolateral angles are formed by the **ureteric orifices**.



- The **muscular coat** of the bladder is composed of smooth muscle known as the **detrusor muscle**.
- At the **neck** of the bladder, the circular component of the muscle coat is thickened to form the **sphincter vesicae**.



Vessels and nerves

Arteries

- The superior and inferior vesical arteries, branches of the internal iliac arteries.

Veins

- The veins form the vesical venous plexus which drains into the internal iliac vein.

Lymph Drainage

- Internal and external iliac nodes.

Nerve Supply

- The **sympathetic** postganglionic fibers originate in the first and second lumbar ganglia and descend to the bladder via the hypogastric plexuses, **inhibit contraction**
- The **parasympathetic** preganglionic fibers arise as the pelvic splanchnic nerves from the second, third, and fourth sacral nerves
- Most afferent sensory fibers pass via the **pelvic splanchnic nerves**.

Urethra

Male urethra

- about **20 cm long**
- It is divided into three parts

Prostatic Urethra: about 3 cm long

- begins at the neck of the bladder.

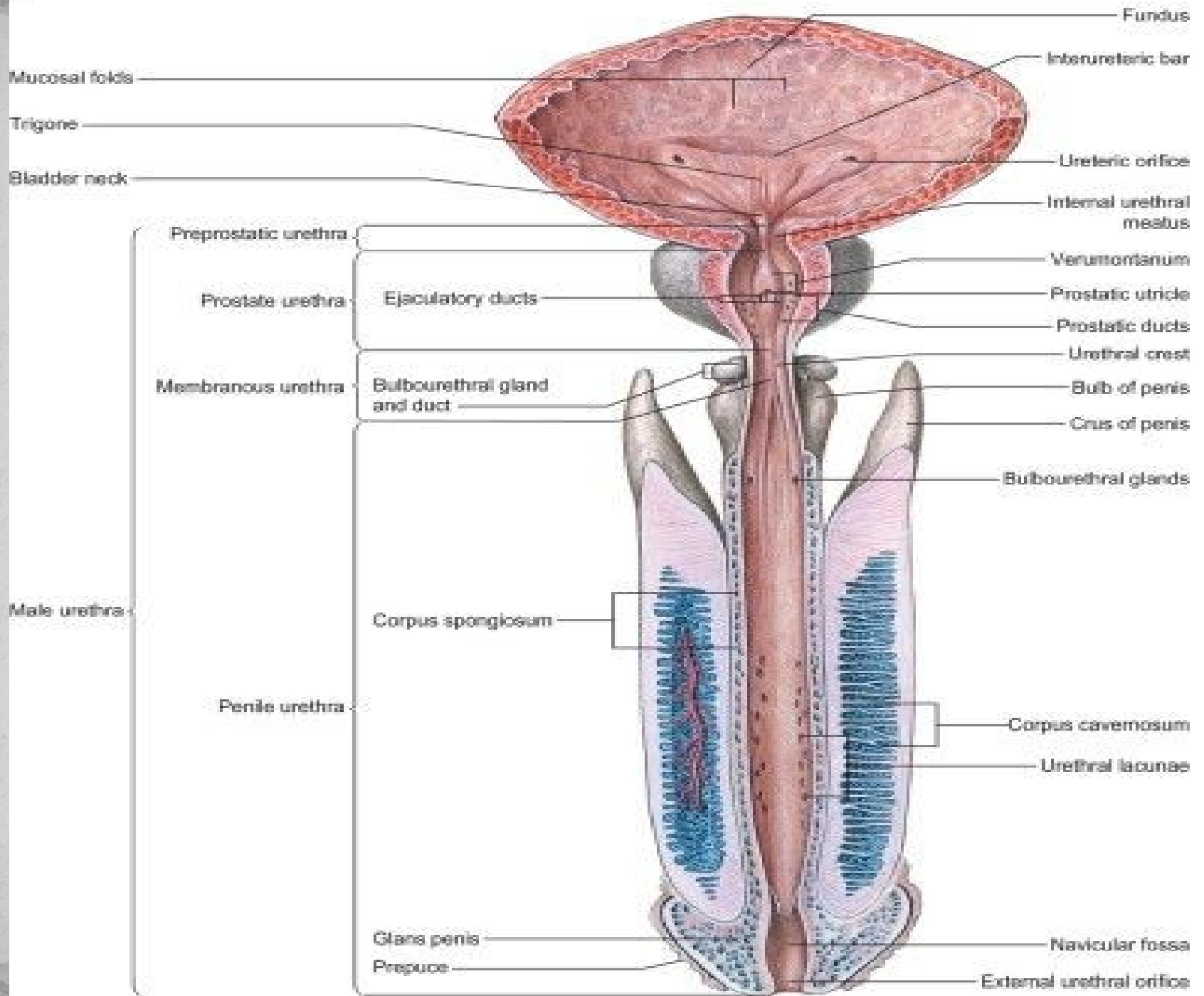
Membranous Urethra: about 1.5 cm long

- is surrounded by the **sphincter urethrae muscle**

Penile urethra: about 15 cm long

- enclosed in the bulb and the **corpus spongiosum** of the penis.

A



Sphincter Urethrae Muscle

- surrounds the urethra in the deep perineal pouch
- **Nerve Supply from** The perineal branch of the pudendal nerve supplies the sphincter.
- The muscle compresses the membranous part of the urethra and relaxes during micturition.
- It is the means by which micturition can be **voluntarily** stopped.

Female Urethra

- about **4cm long**.
- It traverses the **sphincter urethrae** and lies immediately in front of the vagina.
- It extends from the neck of the bladder to the external meatus, where it opens into the **vestibule** about 2.5 cm below the clitoris.

Thank You!