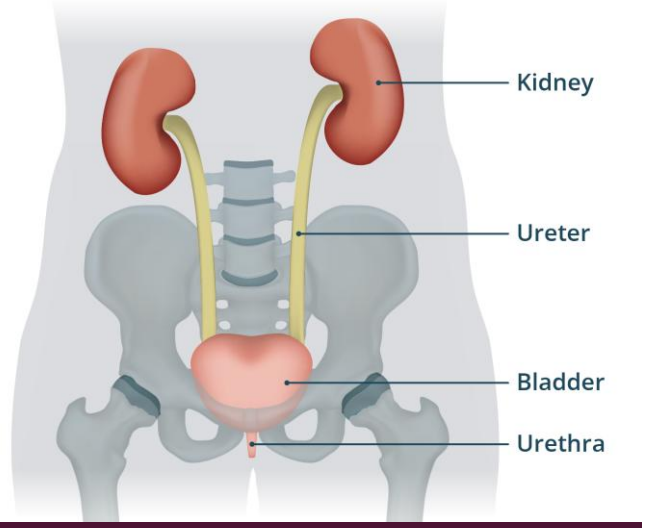


ANATOMY OF THE URINARY SYSTEM

HUMAN ANATOMY

College of Pharmacy

Dr. Abeer Abdullah

LEARNING OUTCOME

By the end of this session, students should be able to:

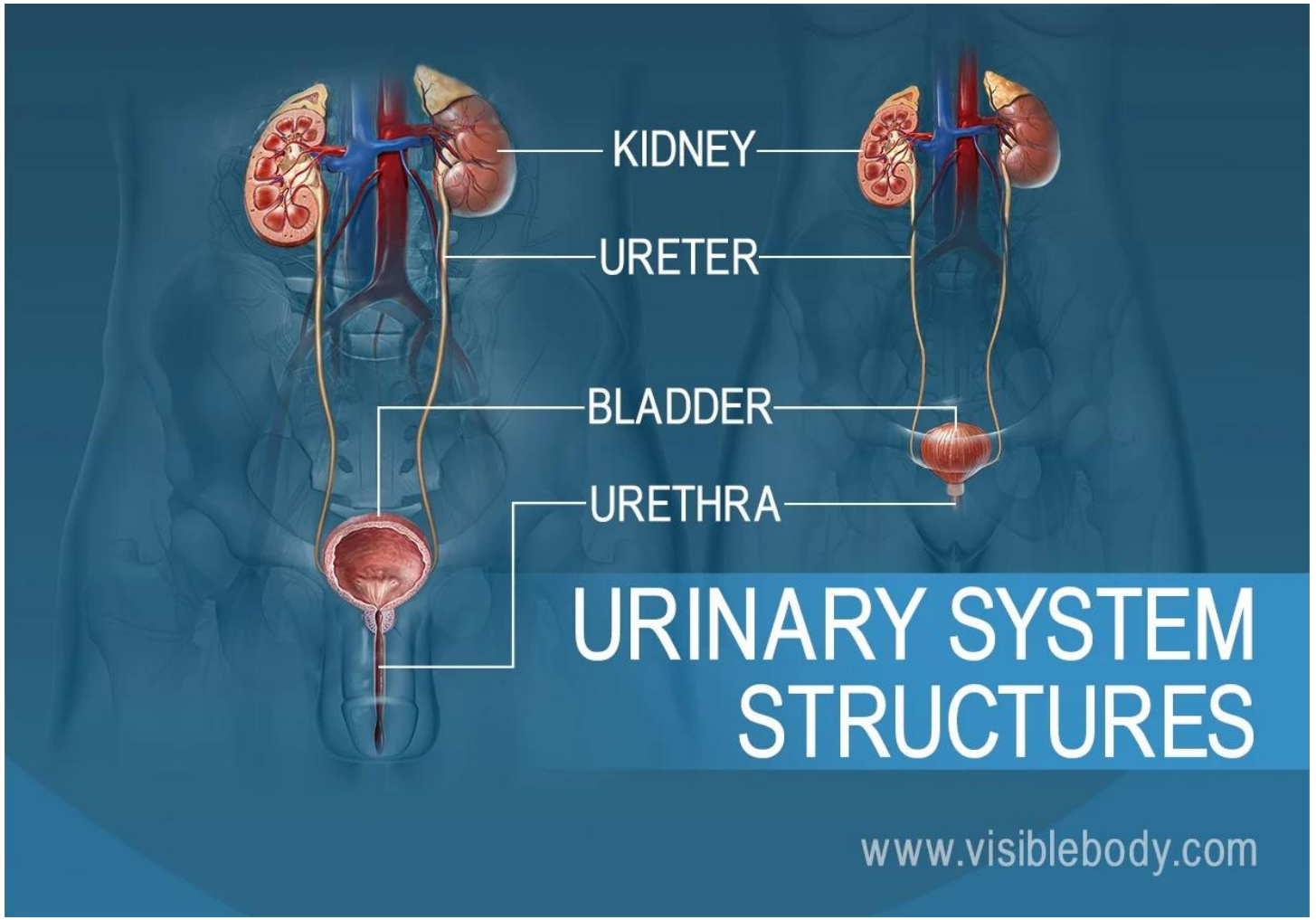
- Describe the major components of the urinary system and their anatomical relationships
- Explain the key functions of the kidneys
- Identify the anatomical features of the kidneys
- Compare and contrast the male and female urethra

THE URINARY SYSTEM

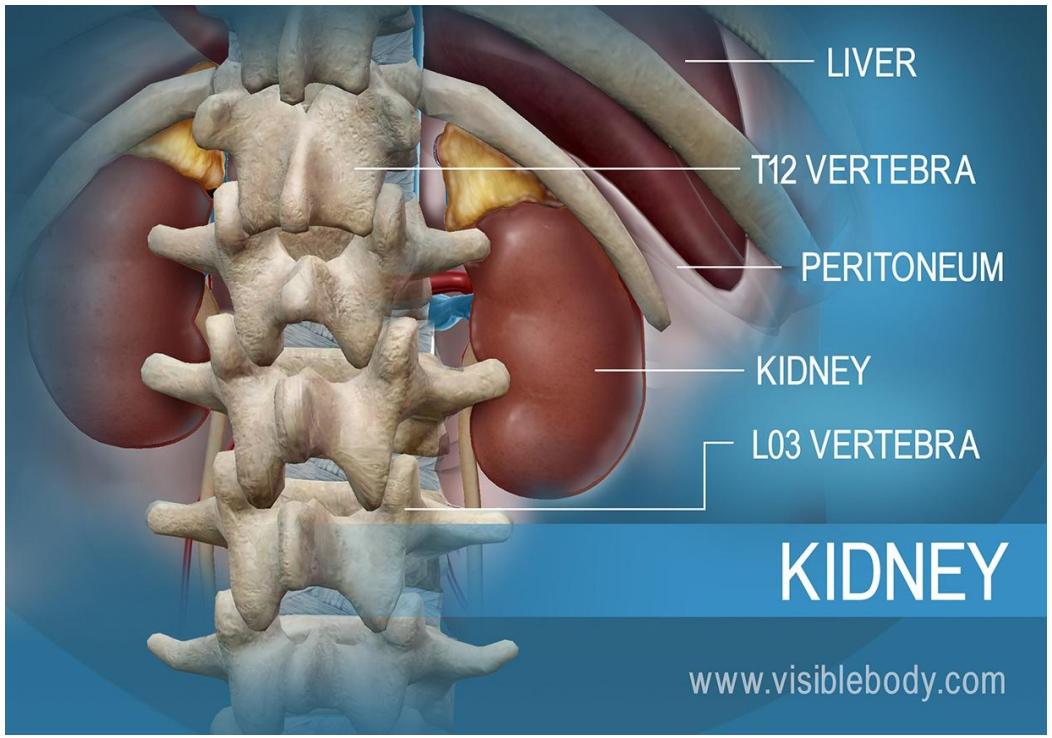
- The urinary system is a group of organs that filter blood, remove waste products, and regulate fluid, electrolyte, and acid-base balance in the body

Components:

- Two **kidneys,** two **ureters,** one urinary **bladder**, and one **urethra**

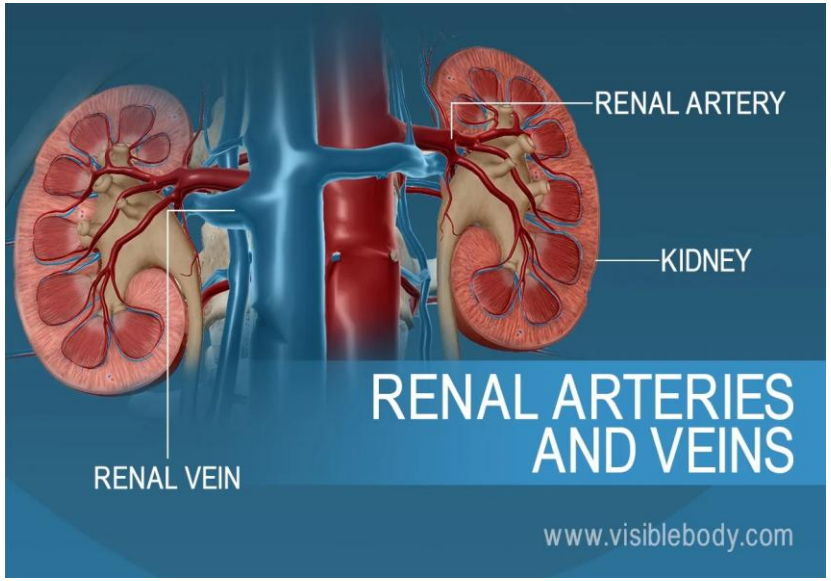


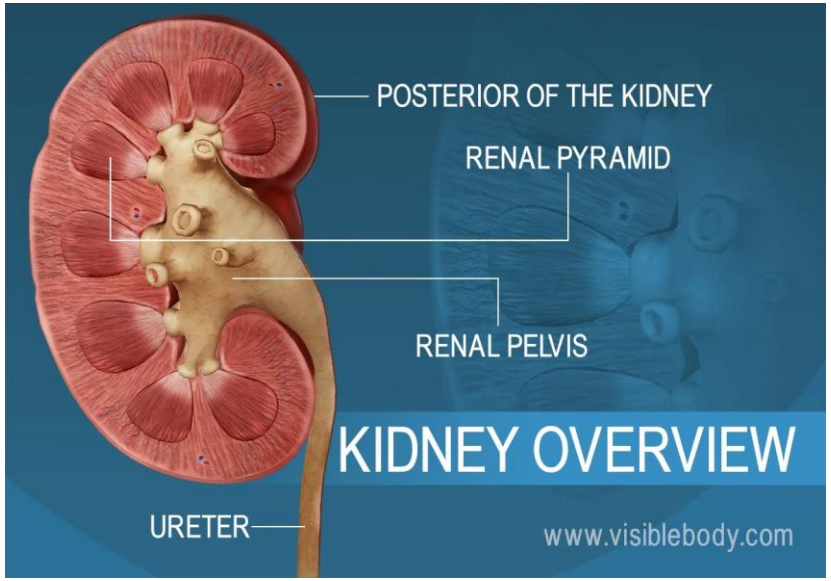
KIDNEYS

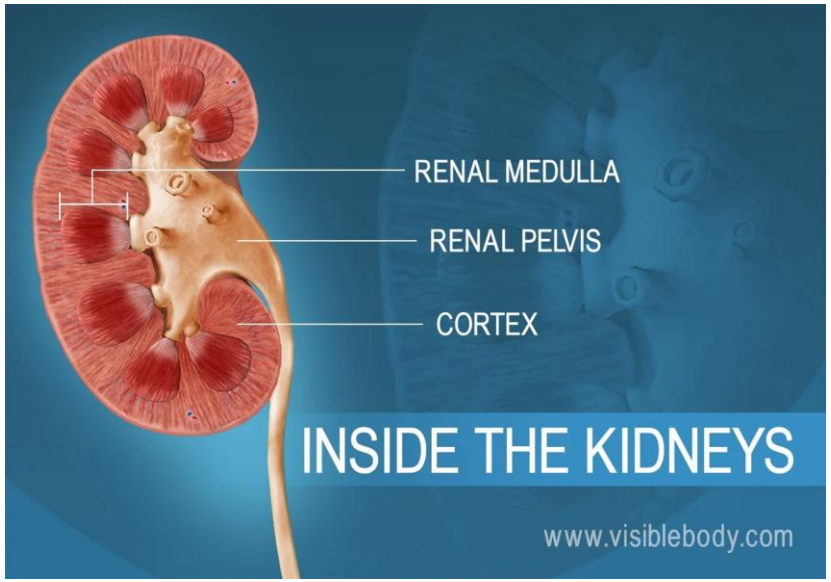


- **The kidneys are vital retroperitoneal organs that filter blood and maintain homeostasis**
- Paired, bean-shaped organs located **just above the waist**, on either side of the vertebral column
- Positioned between the **T12 (last thoracic) and L3 (third lumbar) vertebrae**
- Partially protected by **ribs 11 and 12**
- **Right kidney sits slightly lower** than the left due to the liver's presence
- A typical kidney in an adult is 10–12 cm long, 5–7 cm width, and 3cm thick and has a mass of 125–170g
- The each of kidney have anterior and posterior surface
- **Borders:**
  - **Lateral border:** Convex (outward curve)
  - **Medial border:** Concave (inward curve), includes the **renal hilum** (entry point for vessels/ureter)

KIDNEYS


RENAL ARTERY
KIDNEY
RENAL VEIN
RENAL ARTERIES AND VEINS
www.visiblebody.com

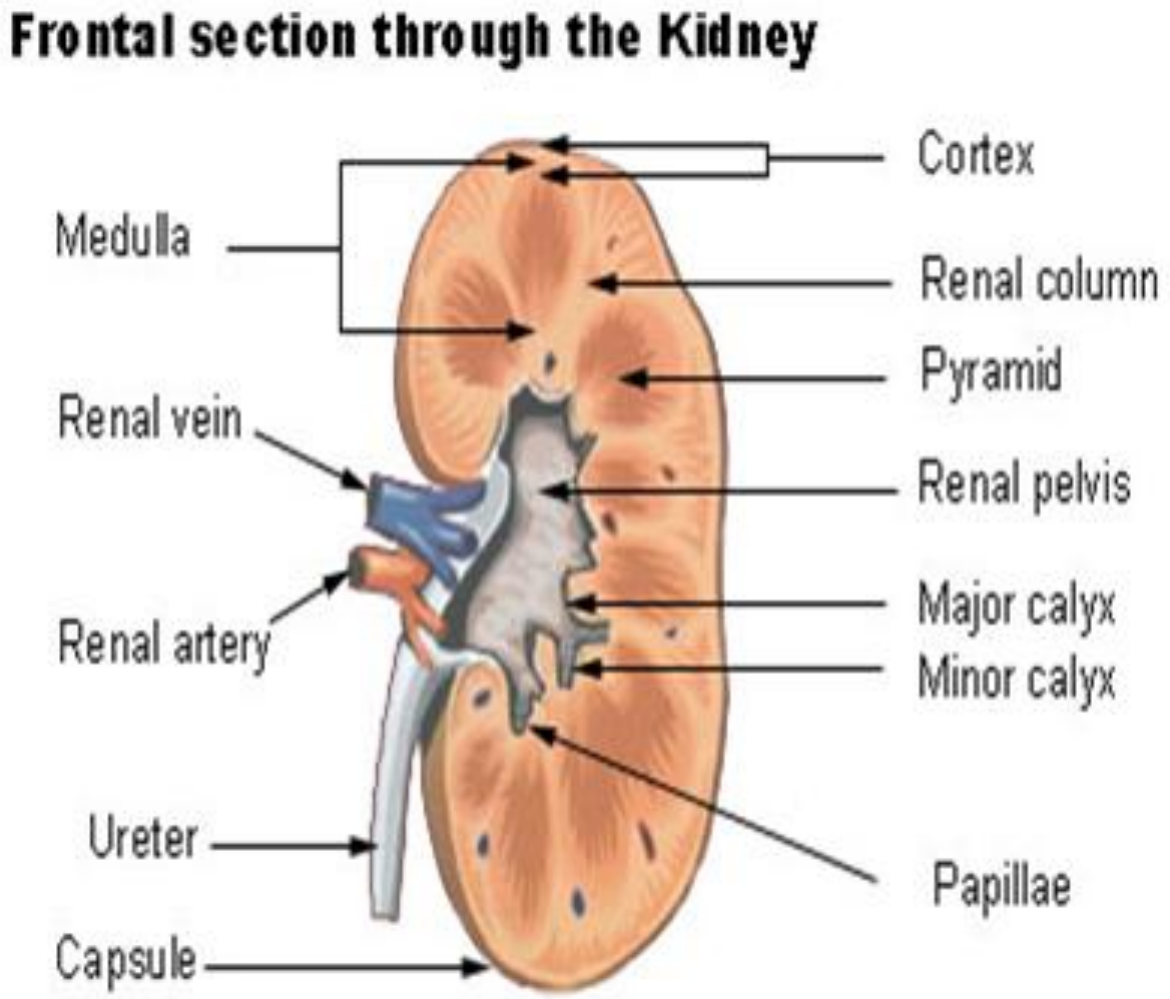

POSTERIOR OF THE KIDNEY
RENAL PYRAMID
RENAL PELVIS
KIDNEY OVERVIEW
URETER
www.visiblebody.com


RENAL MEDULLA
RENAL PELVIS
CORTEX
INSIDE THE KIDNEYS
www.visiblebody.com

KIDNEYS

Functions of the Kidneys:

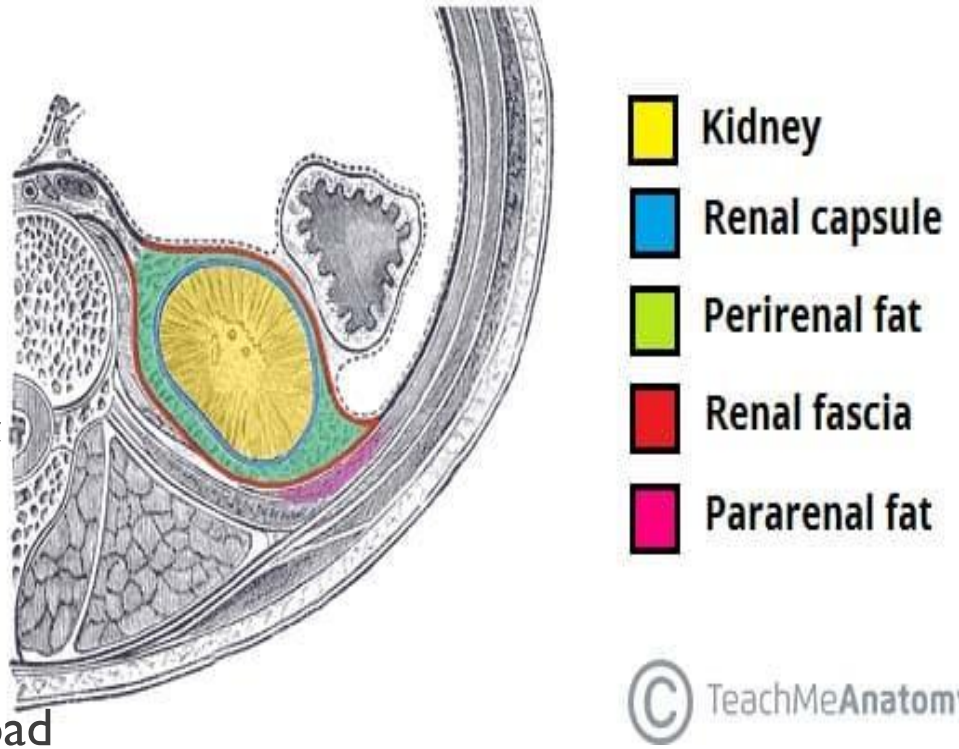
1. **Regulation of blood composition:**
   - Blood ionic composition, blood pH, blood volume, blood glucose level
2. **Blood pressure control:**
   - Enzymatic regulation (renin-angiotensin system) & fluid volume adjustment
3. **Hormone production:**
   - Erythropoietin & Calcitriol**
4. **Excretion:**
   - Metabolic wastes (urea, creatinine), toxins, and foreign substances

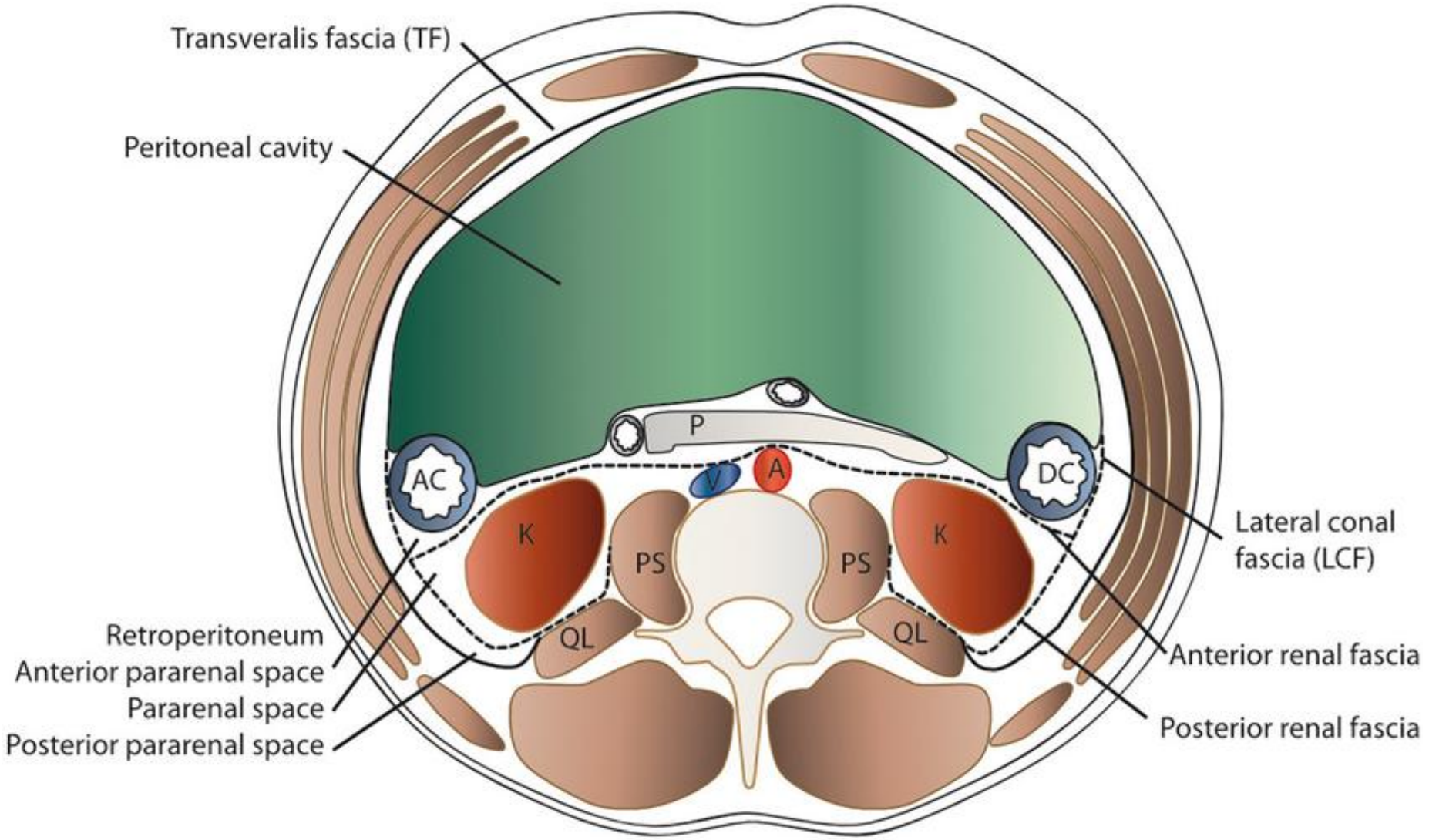


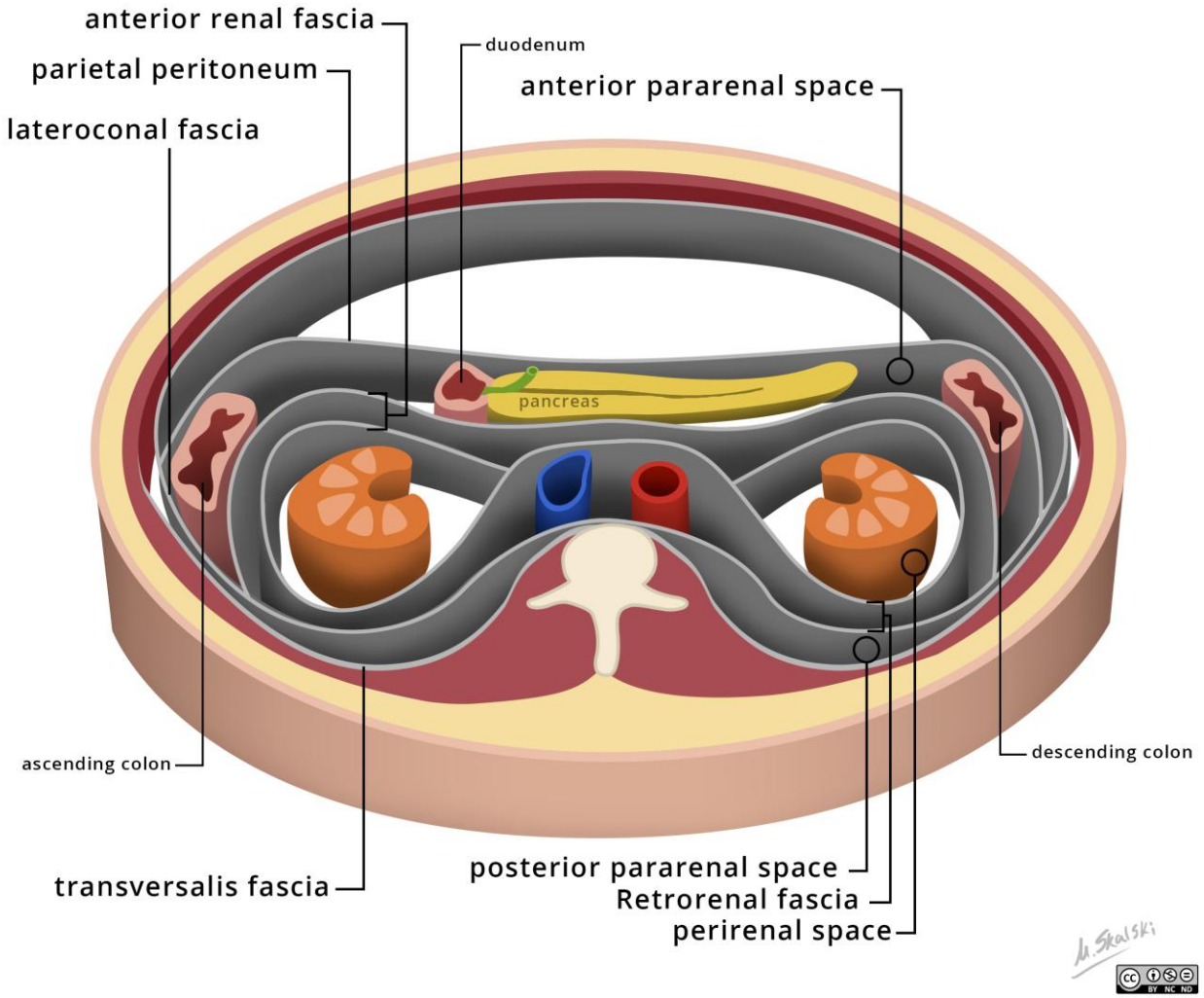
KIDNEY COVERINGS

- The kidneys are protected by four concentric tissue layers that provide structural support and cushioning

1. **Fibrous Capsule**
   - Surrounds the kidney tightly adhered to the outer surface
2. **Perirenal Fat**
   - Adipose layer surrounding the fibrous capsule
3. **Renal Fascia**
   - Strong condensation of connective tissue enclosing: **Kidneys & Suprarenal (adrenal) glands**
   - Laterally continuous with *fascia transversalis* (abdominal lining)
4. **Pararenal Fat**
   - Outermost adipose layer and a part of the retroperitoneal fat pad
   - Abundant quantity for additional protection

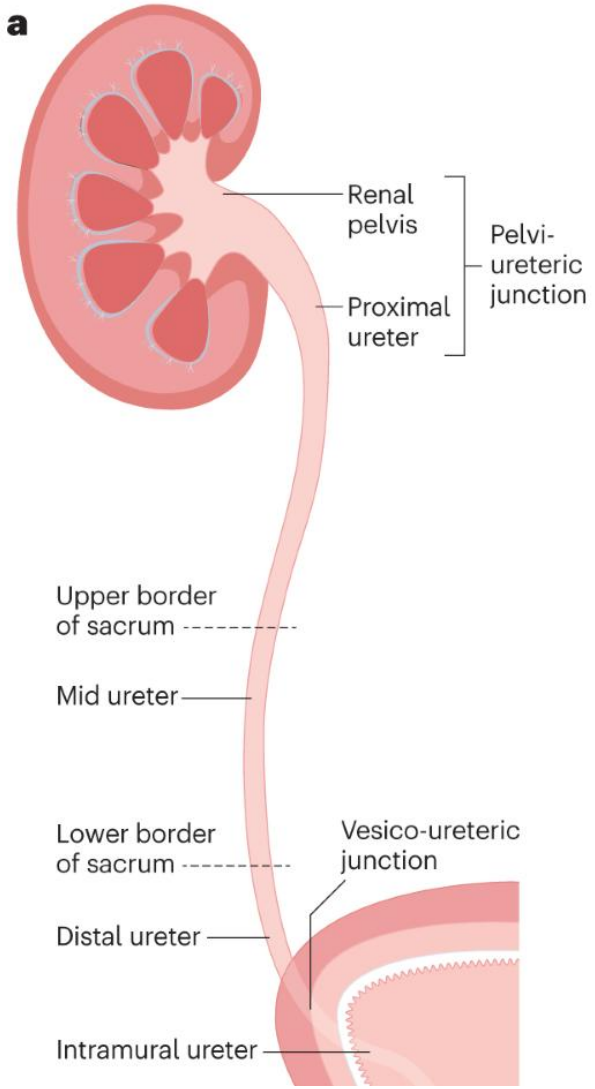


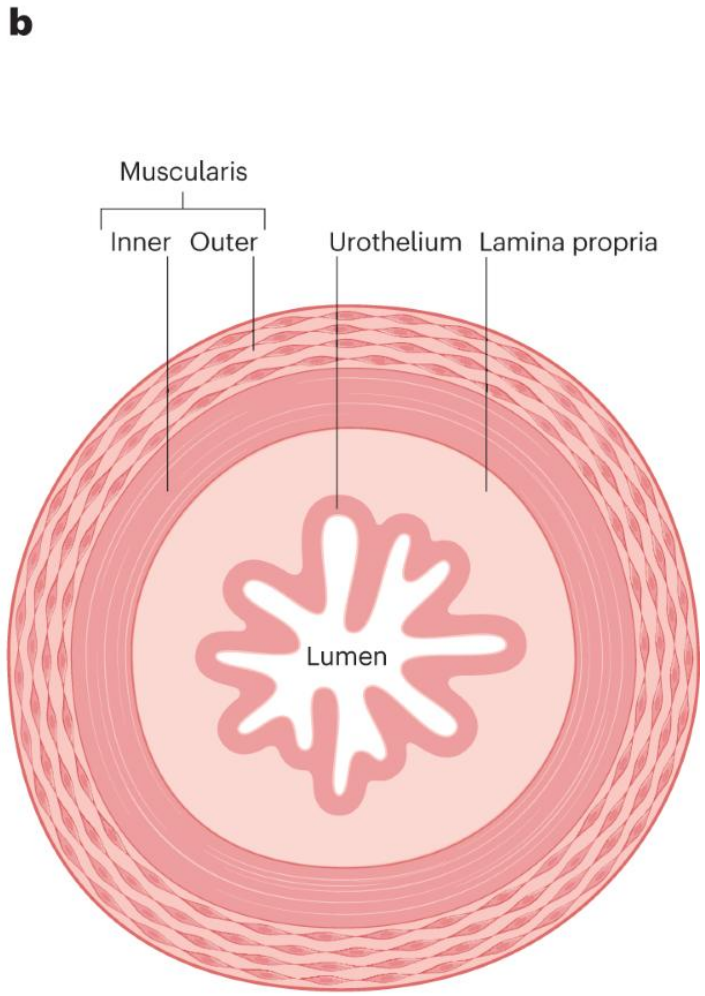

Transveralis fascia (TF)
Peritoneal cavity
P
AC
V
A
DC
K
PS
PS
K
QL
QL
Lateral conal fascia (LCF)
Retroperitoneum
Anterior pararenal space
Pararenal space
Posterior pararenal space
Anterior renal fascia
Posterior renal fascia


anterior renal fascia
parietal peritoneum
lateroconal fascia
duodenum
anterior pararenal space
pancreas
ascending colon
descending colon
transversalis fascia
posterior pararenal space
Retrorenal fascia
perirenal space

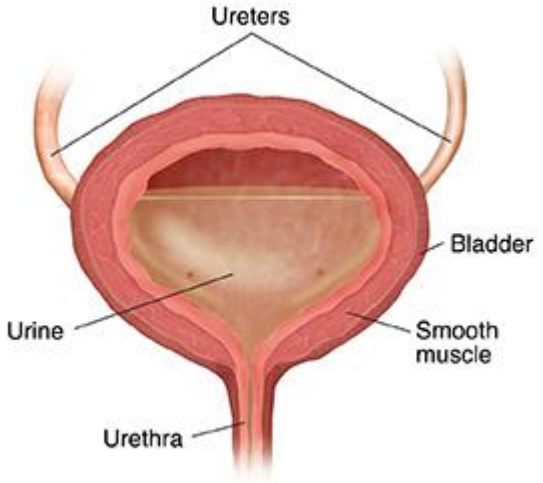
URETERS

- **Paired muscular tubes** that transport urine from the renal pelvis of kidney to the urinary bladder via peristaltic action
  - Extend from each renal pelvis to the posterior bladder wall
  - Oblique intramural passage (~1.9 cm) through bladder wall
  - Muscular coat with peristaltic capability
  - **No anatomical valves** at vesical openings
- **Urine Transport Mechanism:**
  - **Primary drive is peristaltic contractions, assisted by glomerular filtration pressure**
  - Physiological anti-reflux mechanism (**physiological valve**):
    - Bladder filling compresses oblique ureteral openings and prevents the backflow of urine





URINARY BLADDER



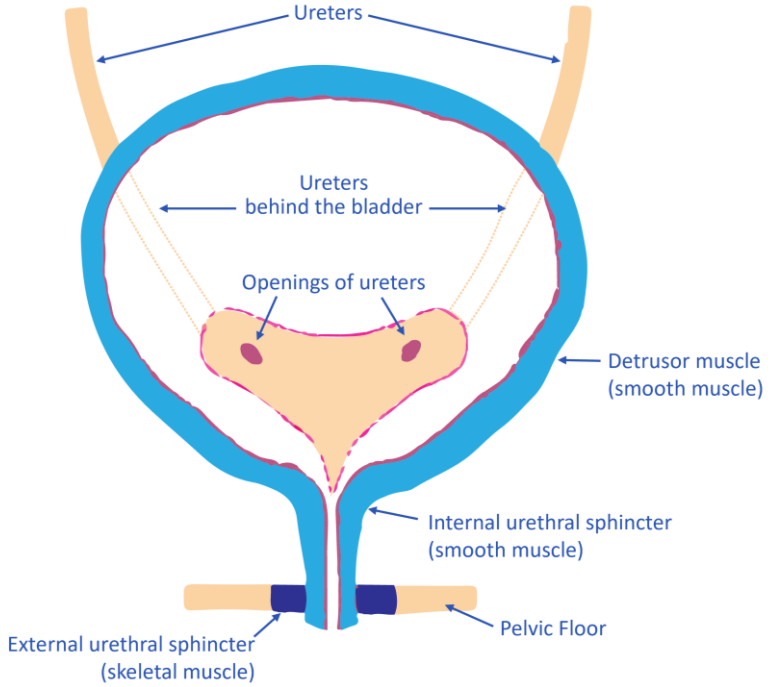
- Located in the pelvic cavity, behind the pubic bones within the pelvis
- Position varies slightly with urine volume and adjacent organ pressure
- Primary function is temporary storage of urine
  - Adult capacity: ~500 mL (maximum)

Wall Structure:

- Thick, muscular wall
- Highly distensible to accommodate filling

Features:

- Shape changes with urine volume: Pyramidal shape (empty) & Rounded oval shape (full)

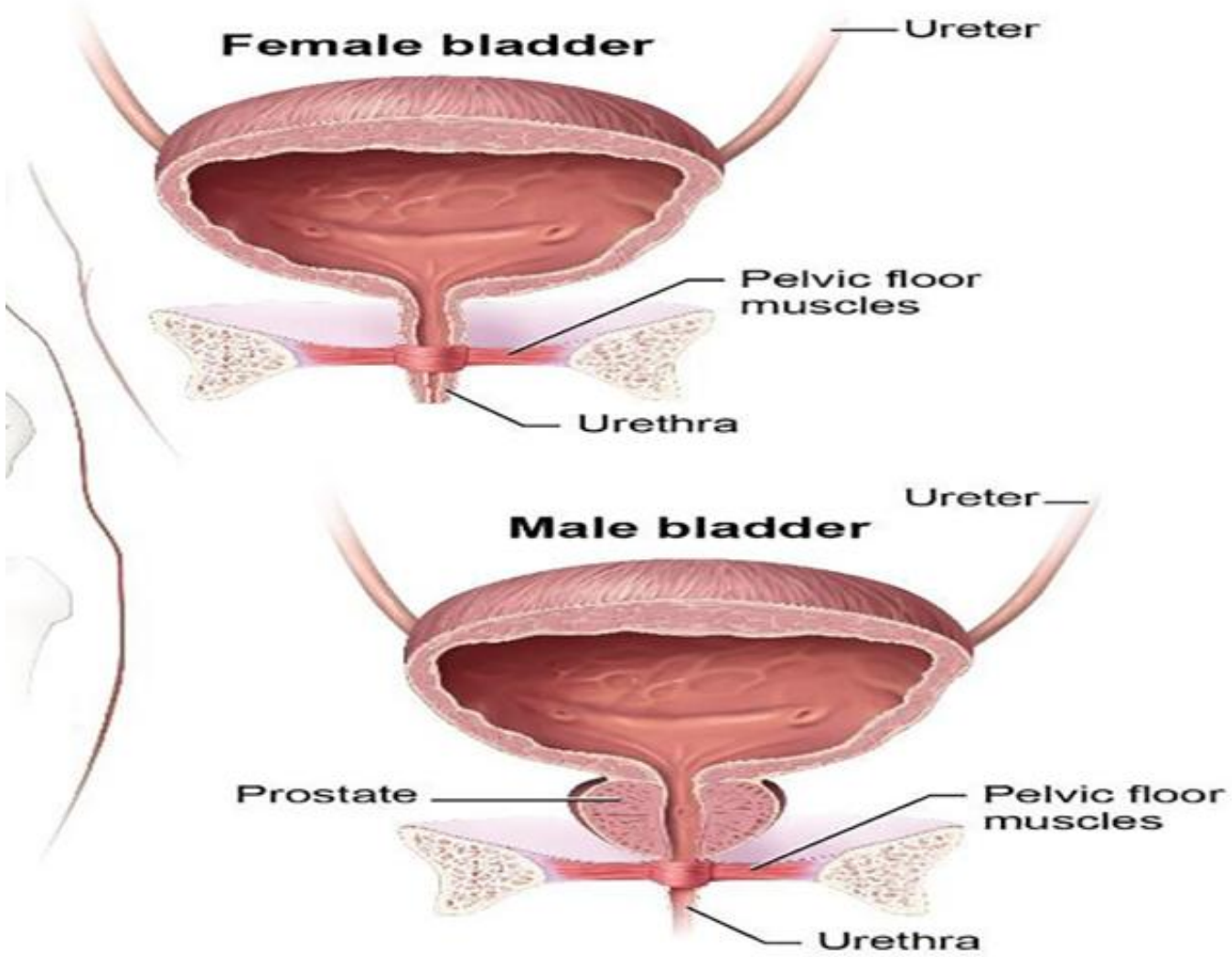


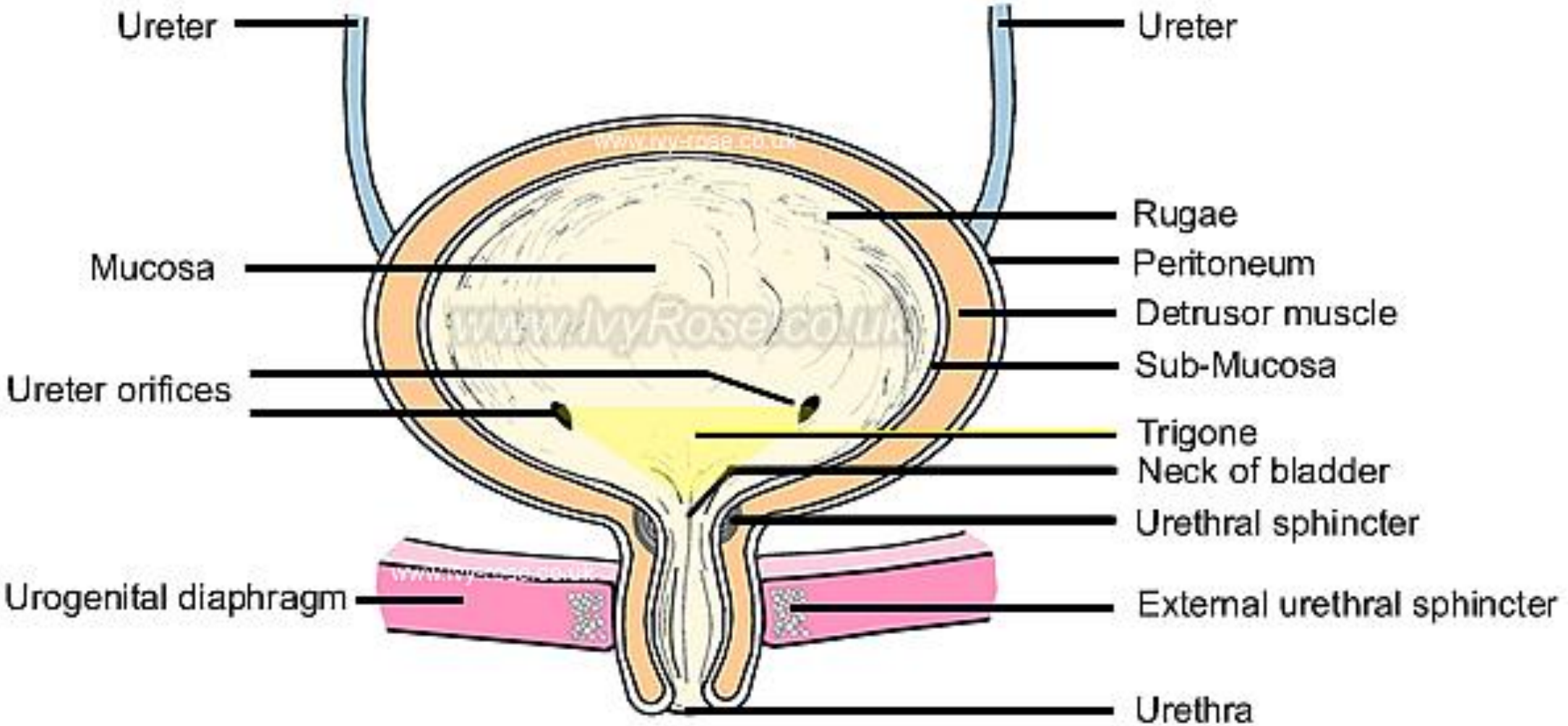
URETHRA

- The urethra is a tubular structure that transports urine from the bladder to the body's exterior. While functionally similar in both sexes, it shows significant anatomical differences between males and females

General Features:

- Serves as the **terminal pathway** of the urinary system
- Functions in both sexes:
  - Urine excretion
- Originates at the **internal urethral orifice** (bladder floor)




Ureter
Ureter
Rugae
Mucosa
Peritoneum
Detrusor muscle
Sub-Mucosa
Ureter orifices
Trigone
Neck of bladder
Urethral sphincter
Urogenital diaphragm
External urethral sphincter
Urethra
IvyRose Ltd. 2006, Online at www.Ivy-Rose.co.uk

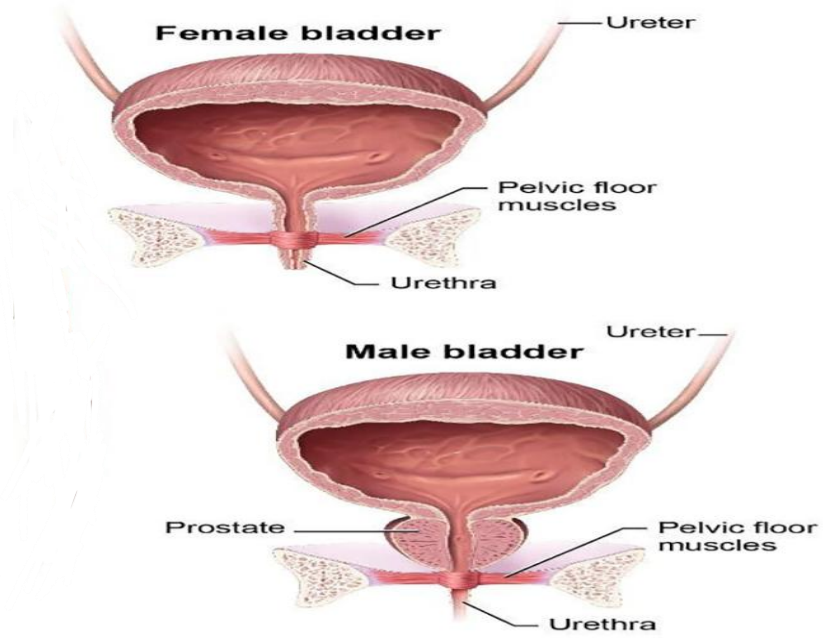
GENDER DIMORPHISM

Male Urethra:

- Longer (~20 cm)
- Complex pathway:
  - **Prostatic urethra** (through prostate)
  - **Membranous urethra** (through deep perineal muscles)
  - **Penile urethra** (through penis)
- Dual function:
  - Urine excretion
  - Semen passage

Female Urethra:

- Short (~4 cm)
- Straight course
- Exclusively urinary function



THANK YOU