Anatomy of Urinary System

OBJECTIVES:

- By the end of this lecture, student should understand the anatomical structure of urinary system.

General Information

- Waste products of metabolism are toxic (CO_2, ammonia, etc.)
- Removal from tissues by blood and lymph
- Removal from blood by Respiratory system

  And Urinary system

Functions of the Urinary System

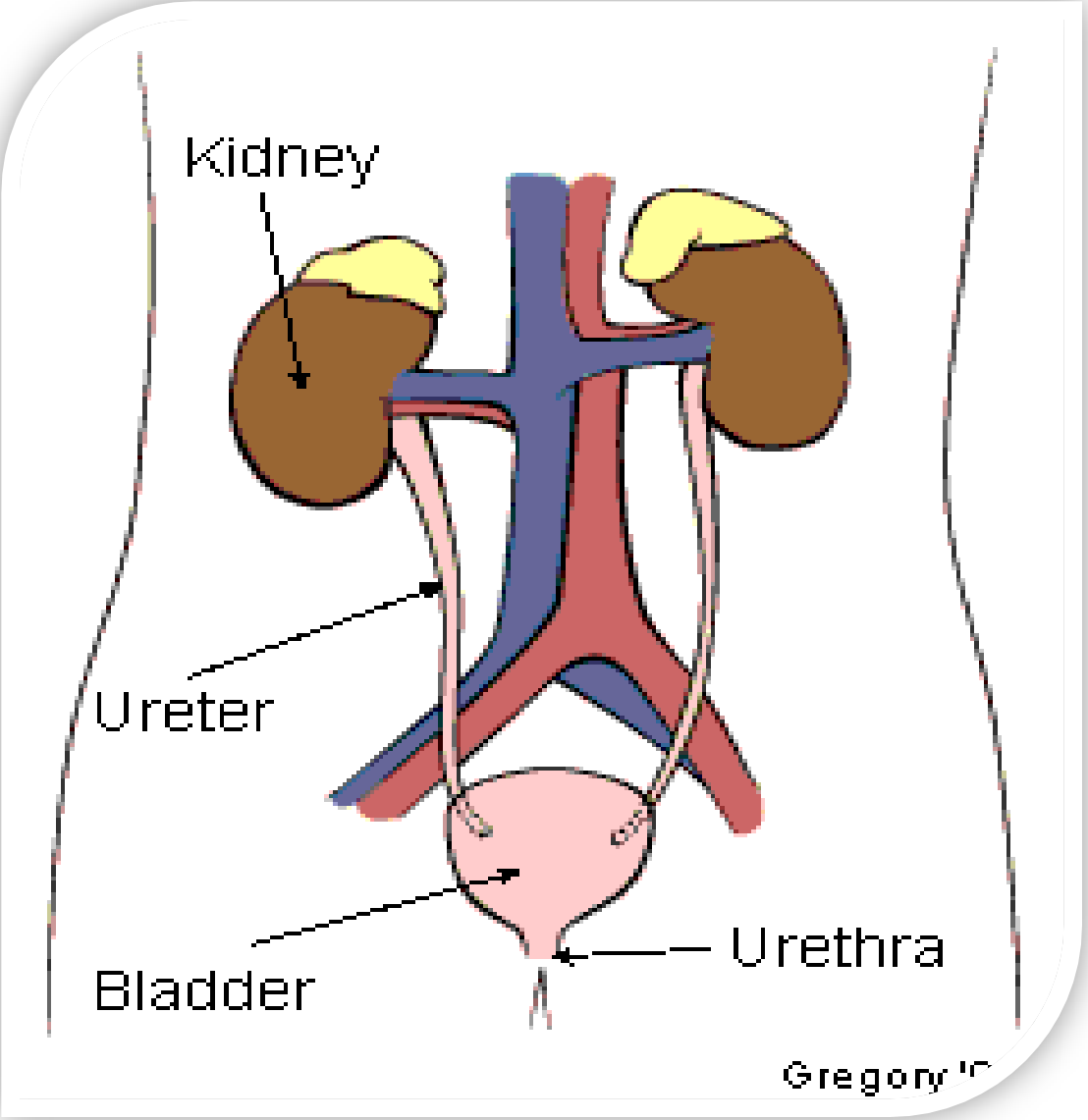
- Elimination of waste products
  - Nitrogenous wastes
  - Toxins
  - Drugs

Functions of the Urinary System

- Regulate homeostasis
  - Water balance
  - Acid-base balance in the blood
  - Electrolytes
  - Blood pressure

Organs of the Urinary system

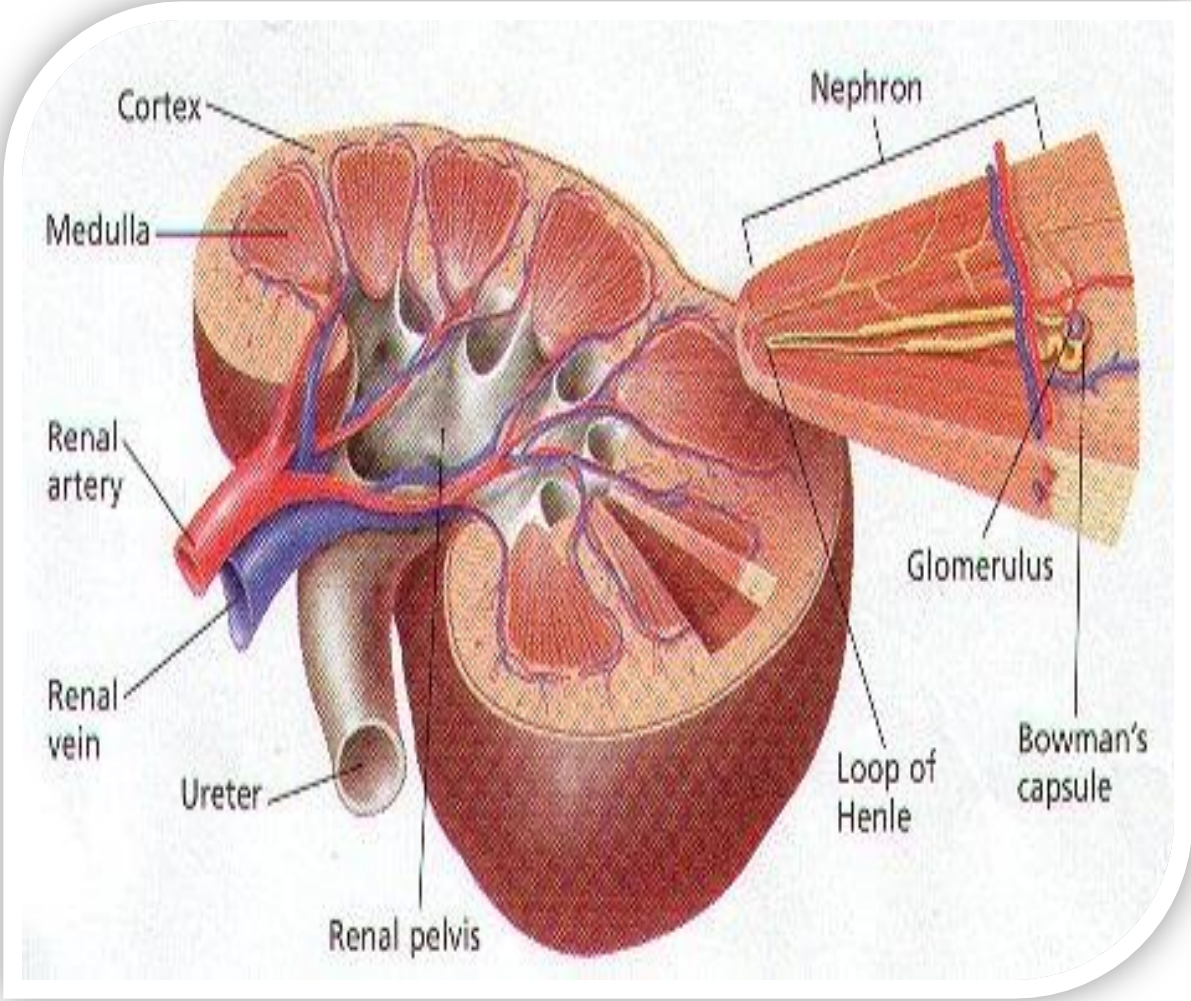
- Kidneys
- Ureters
- Urinary bladder
- Urethra



Kidneys

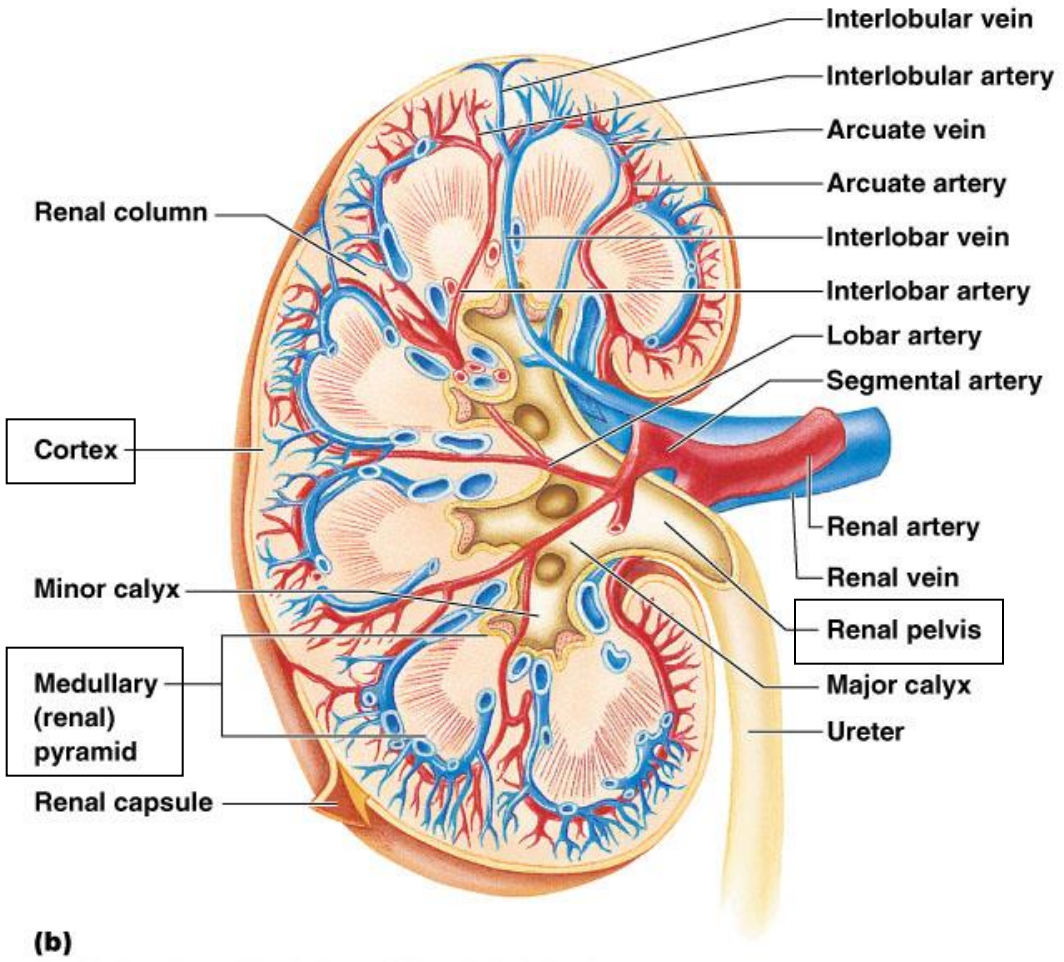
- Primary organs of the urinary system
- Located between the 12^{th} thoracic and 3^{rd} lumbar vertebrae.
- Right is usually lower due to liver.
- Held in place by connective tissue [renal fascia] and surrounded by thick layer of adipose [perirenal fat]

Each kidney is approx. **3 cm thick**, **6 cm wide** and **12 cm long**



Regions of the Kidney

- *Renal cortex*: outer region
- *Renal medulla*: pyramids and columns
- *Renal pelvis:* collecting system

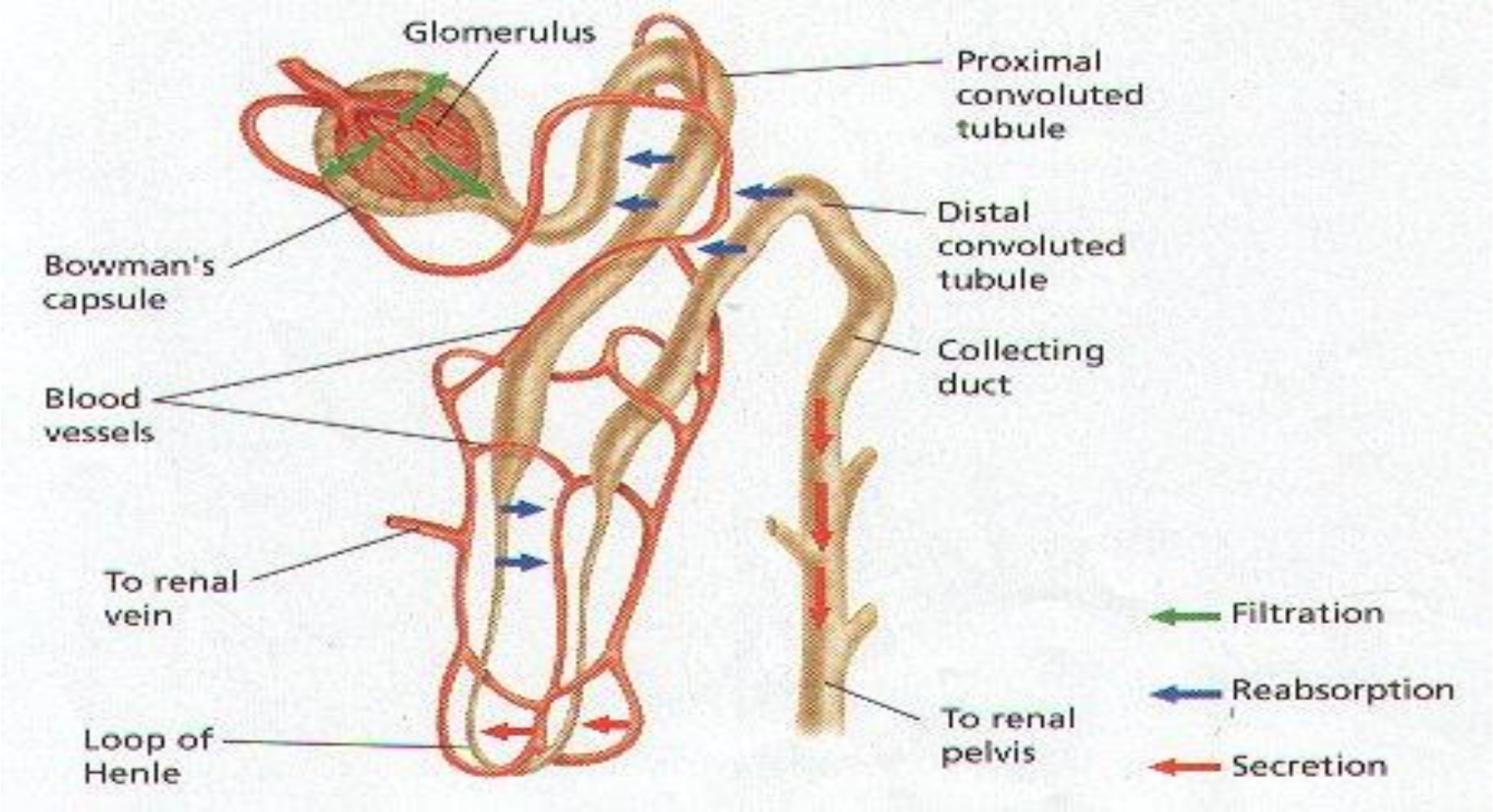


Kidneys protected by three connective tissue layers

- **Renal fascia**
  - -Attaches to abdominal wall
- **Renal capsule:**
  - -Surrounds each kidney
  - -Fibrous sac
  - -Protects from trauma and infection
- **Adipose capsule**
  - -Fat cushioning kidney

Nephrons

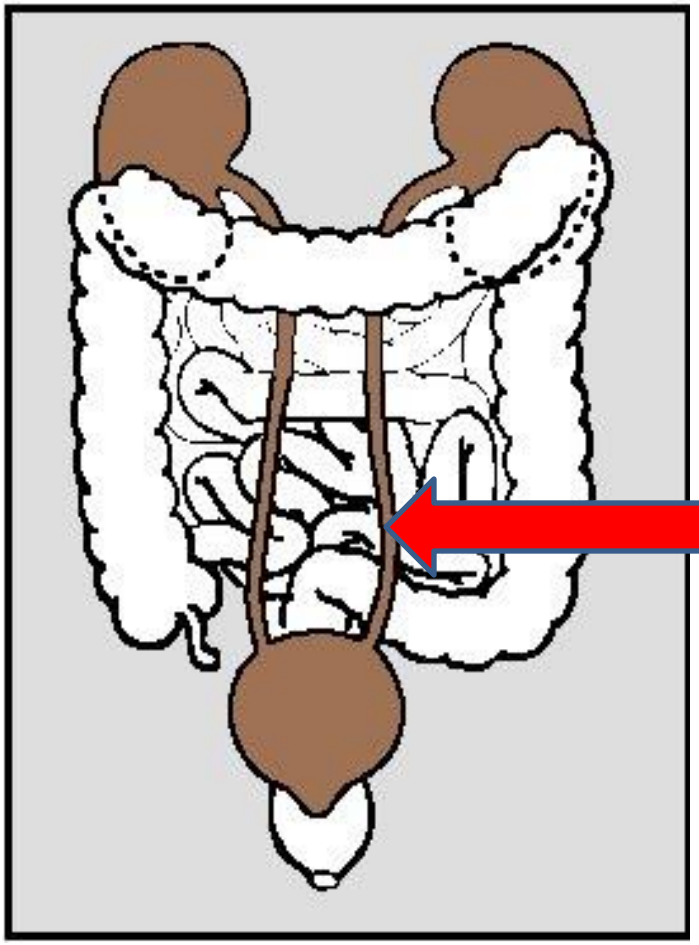
Each kidney contains over a million nephrons [functional structure]



- Blood enters the nephron from a network that begins with the renal artery.
- This artery branches into smaller and smaller vessels and enters each nephron as an afferent arteriole.
- The afferent arteriole ends in a specialized capillary called the Glomerulus.

- Each kidney has a glomerulus contained in Bowman’s Capsule.
- Any cells that are too large to pass into the nephron are returned to the venous blood supply via the efferent arteriole.

Ureters



Each ureter is about **25** cm long and carries urine from the renal pelvis to the urinary bladder.

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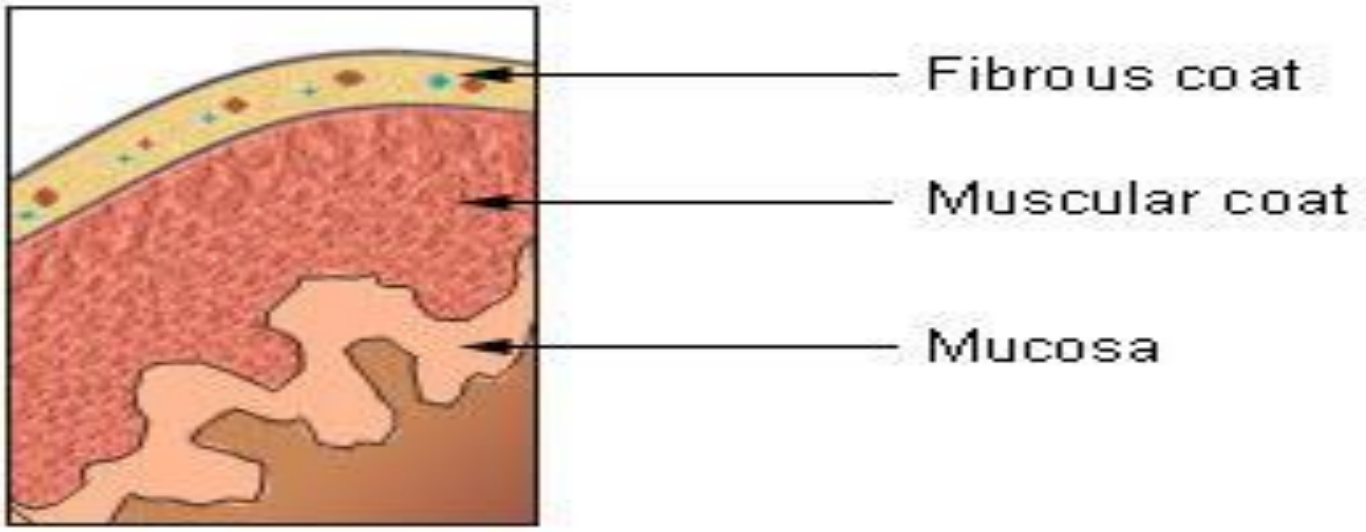
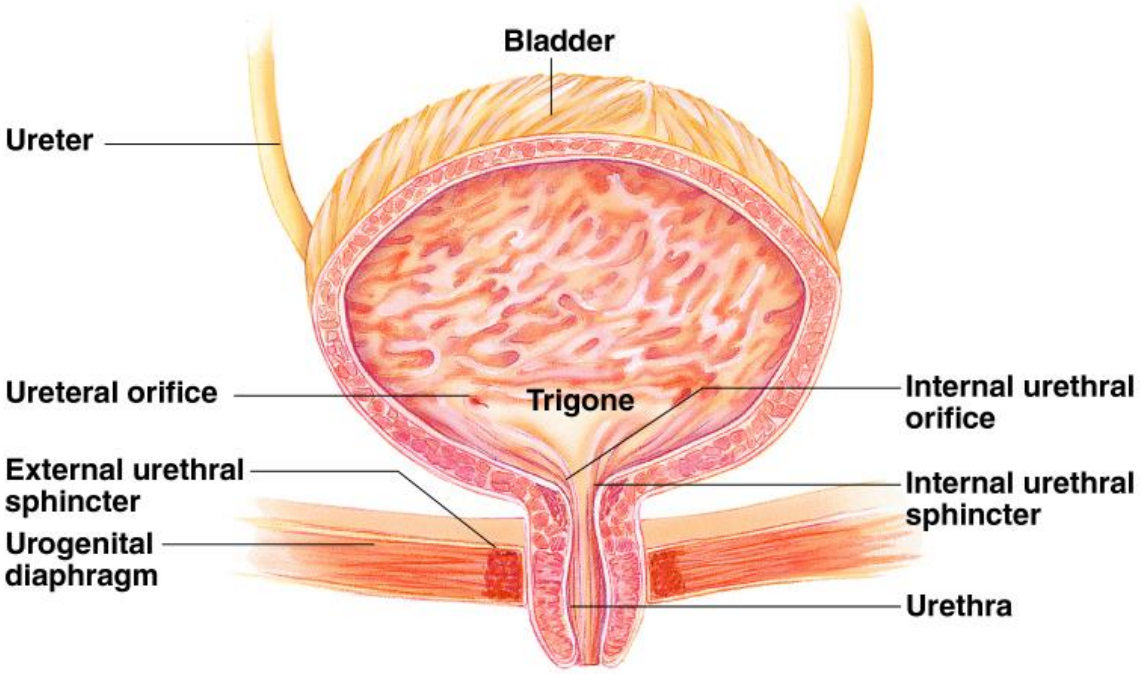
- The wall of the ureter consists of three layers. **The outermost is a fibrous coat**, **middle layer is muscular [circular & longitudinal]** and the **innermost layer is called the mucosa, a transitional epithelium** that is continuous with the lining of the renal pelvis and bladder, also secretes a protective mucus.

Wall of the Ureter



Urinary Bladder

- Smooth, collapsible, muscular sac
- Temporarily stores urine



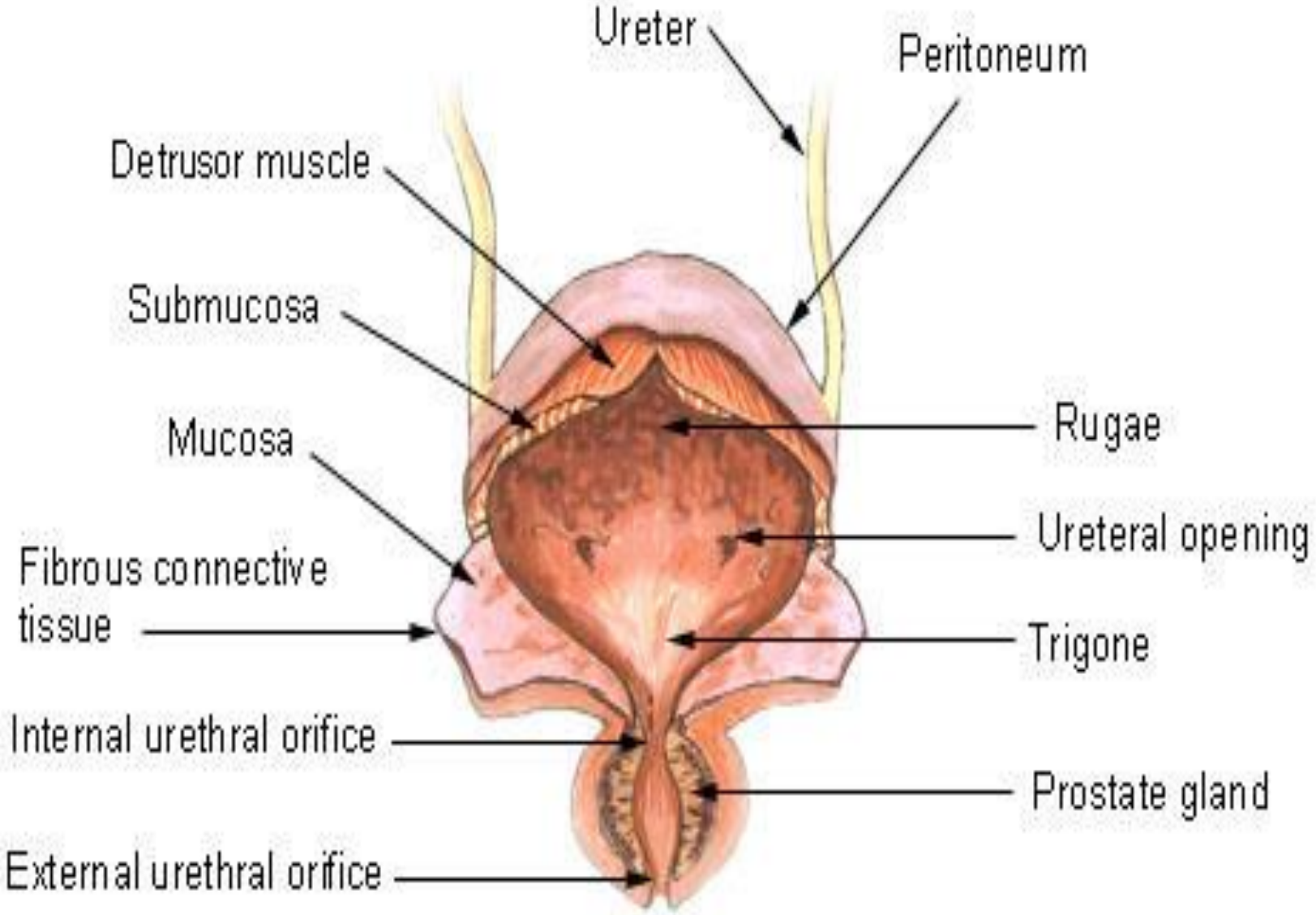
❖The innermost lining of the urinary bladder is a **mucous membrane layer**, continuous with the ureters. (This layer covers the transitional epithelium. When empty, the mucosa forms folds called rugae).

❖The second layer is called the submucosa. It contains **elastic connective tissue fibers**.

❖The third layer is the muscularis: this collection of **smooth muscle** is known as the detrusor muscle. Contraction of this muscle expels urine from the bladder.

❖The outermost layer is **dense connective tissue.**

Urinary Bladder



- Trigone – three openings
  - Two from the ureters
  - One to the urethra

Urethra

-Thin walled tube (**conveys urine from bladder to external environment**).

-Similar structure to ureter.

-Sphincters (Release of urine) is controlled by : **internal urethral [involuntary]** & **external urethral [voluntary]**

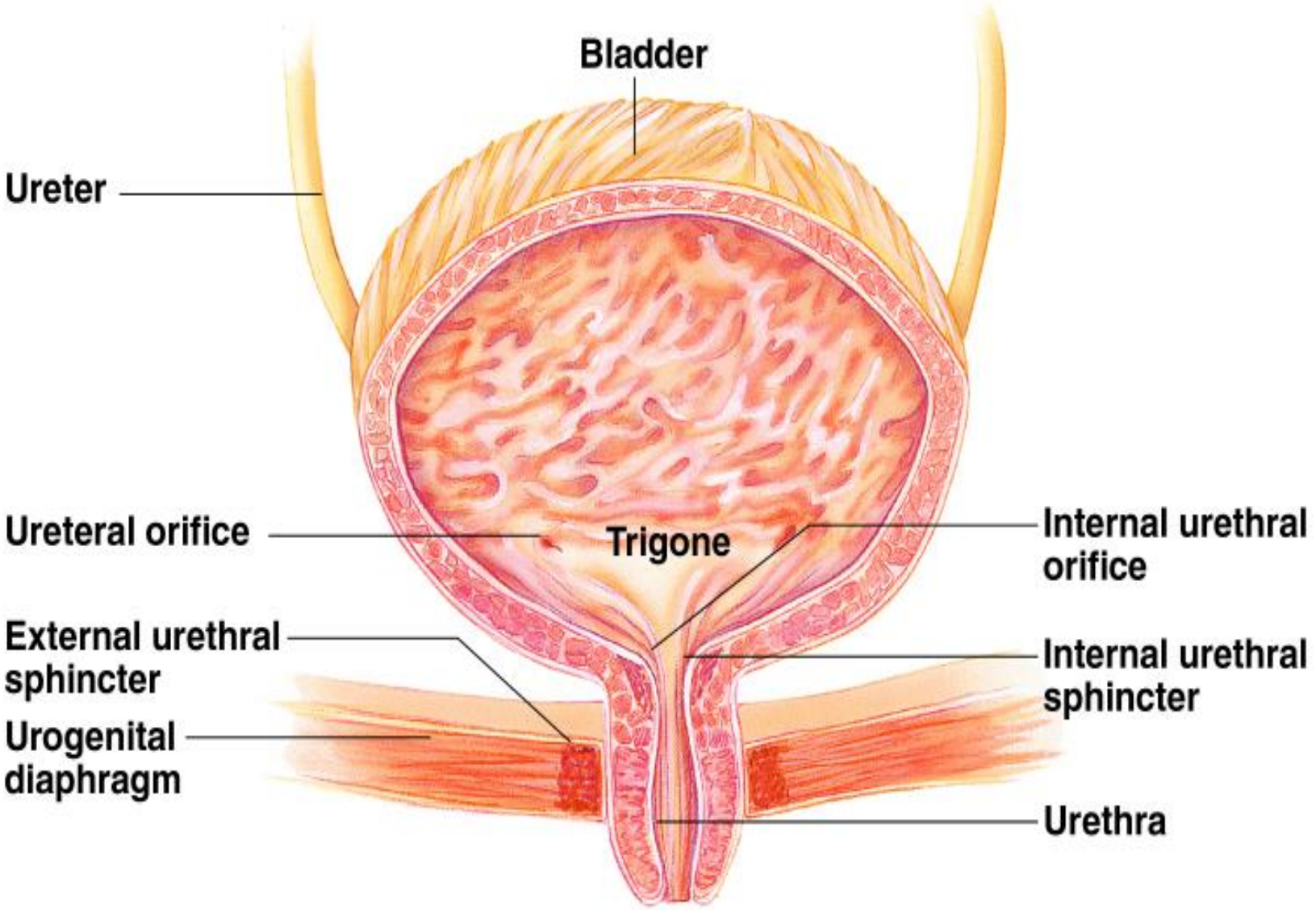
Male Urethra

- 20 cm long [7-8 in]
- Transports both urine & semen

EXternal urethral orifice opens at tip of penis

Female Urethra

- 3-4 cm long [1.5 in]
- External urethral orifice opens just anterior to the vaginal opening



Thank you