RENAL SYSTEM

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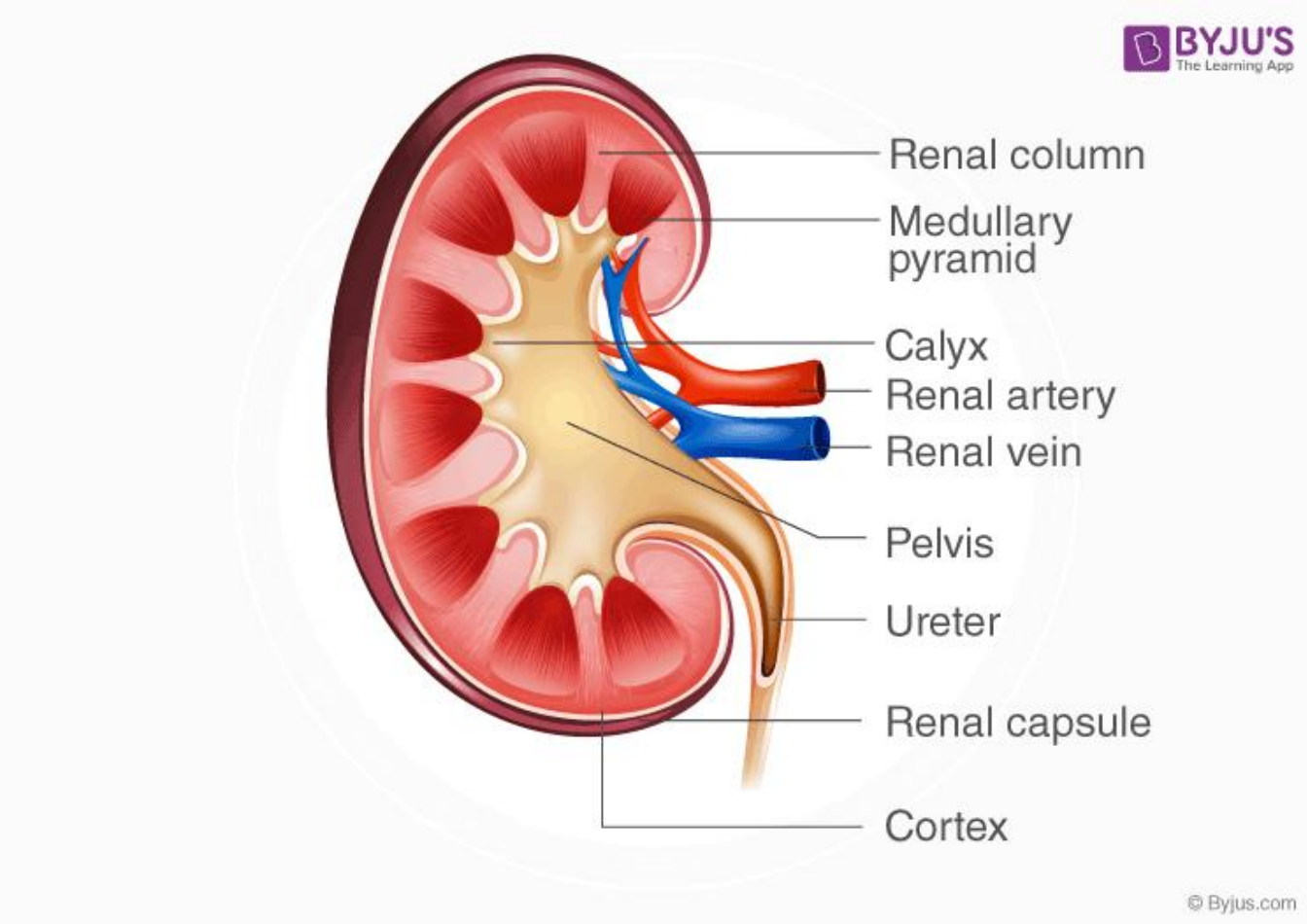
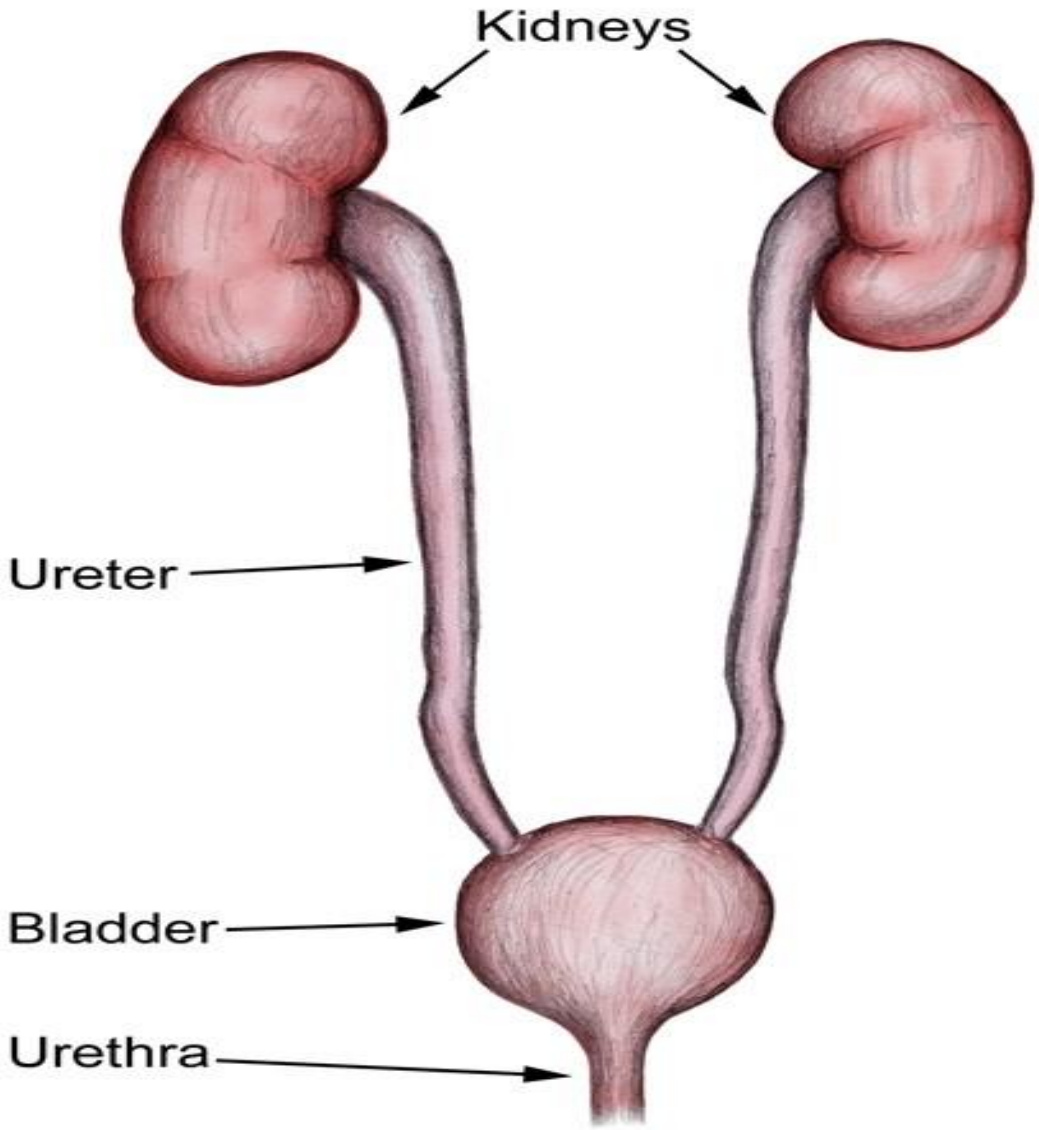
STRUCTURE OF KIDNEY



ANATOMY OF URETER

- The ureters are **bilateral thin (3 to 4 mm) tubular structures that connect the kidneys to the urinary bladder**, transporting urine from the renal pelvis into the bladder. The muscular layers are responsible for the peristaltic activity that the ureter uses to move the urine from the kidneys to the bladder.

STRUCTURE OF URETER



ABOUT RENAL SYSTEM

- **1. KIDNEYS**
  There are two kidneys (right & left) situated at back region. Its main function is to filter blood and throw away waste material in urine Urine formed in kidneys get collected drop by drop fashion in a small bag (part of Kidney itself) called as Pelvis
- **2. URETERS**
  Urine collected in Pelvis gets drained by a urine pipe called as Ureters. Both Ureters (right and left) opens separately into bag like structure called as Bladder.
- **3. BLADDER**
  This is bag like structure which holds the urine. It is a flexible bag. It empties urine when we desire
- **4. URETHRA**
  It is a small tube like structure arising from bladder. It throws urine outside. It goes through penis in male and opens just in front of vagina in female.

- The **ureters** are tubes made of smooth muscle that propel urine from the kidneys to the urinary bladder. In a human adult, the ureters are usually 20–30 cm (8–12 in) long and around 3–4 mm (0.12–0.16 in) in diameter. The ureter is lined by urothelial cells, a type of transitional epithelium, and has an additional smooth muscle layer that assists with peristalsis in its lowest third.

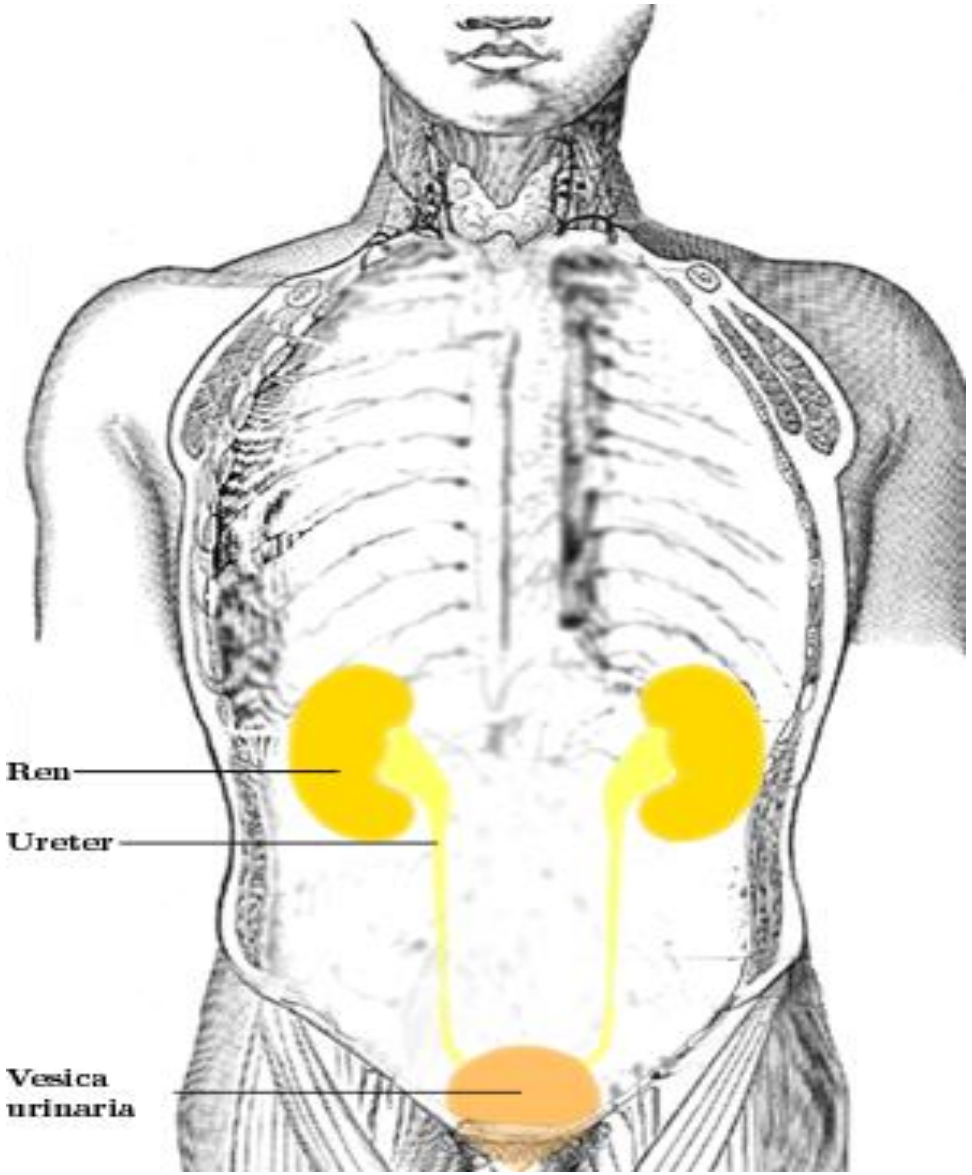
- The ureters are tubular structures, approximately 20–30 cm (7.9–11.8 in) in adults, that pass from the pelvis of each kidney into the bladder. From the renal pelvis, they descend on top of the psoas major muscle to reach the brim of the pelvis. Here, they cross in front of the common iliac arteries. They then pass down along the sides of the pelvis and finally curve forward and enter the bladder from its left and right sides at the back of the bladder.[2] The ureters are 1.5–6 mm (0.059–0.236 in) in diameter[1] and surrounded by a layer of smooth muscle for 1–2 cm (0.39–0.79 in) near their ends just before they enter the bladder

- The ureters enter the bladder from its back surface, traveling 1.5–2 cm (0.59–0.79 in) before opening into the bladder at an angle on its outer back surface at the slit-like *ureteric orifices*. This location is also called the vesicoureteric junction. In the contracted bladder, they are about 25 mm (1 in) apart and about the same distance from the internal urethral orifice; in the distended bladder, these measurements may be increased to about 50 mm

BLOOD SUPPLY

- The arteries which supply the ureter vary along its course. The upper third of the ureter, closest to the kidney, is supplied by the renal arteries.[2] The middle part of the ureter is supplied by the common iliac arteries, direct branches from the abdominal aorta, and gonadal arteries;[1] the gonadal arteries being the testicular artery in men and the ovarian artery in women.[2] The lower third of the ureter, closest to the bladder, is supplied by branches from the internal iliac arteries, mainly the superior and inferior vesical arteries.[1] The arterial supply can be variable, with arteries that contribute include the middle rectal artery, branches directly from the aorta,[1] and, in women, the uterine and vaginal arteries.[

GENERAL UNDERSTANDING



NERVE SUPPLY

- The ureters are richly supplied by nerves that form a network (*plexus*) of nerves, the ureteric plexus that lies in the adventitia of the ureters.[2] This plexus is formed from a number of nerve roots directly (T9-12, L1, and S2-4), as well as branches from other nerve plexuses and nerves; specifically, the upper third of the ureter receives nerve branches from the renal plexus and aortic plexus, the middle part receives branches from the upper hypogastric plexus and nerve, and the lower ureter receives branches from the lower hypogastric plexus and nerve.[2] The plexus is in the adventitia. These nerves travel in individual bundles and along small blood vessels to form the ureteric plexus.[2] Sensation supplied is sparse close to the kidneys and increases closer to the bladder.[2]
- Sensation to the ureters is provided by nerves that come from T11 - L2 segments of the spinal cord.[2] When pain is caused, for example by spasm of the ureters or by a stone, the pain may be referred to the dermatomes of T11 - L2, namely the back and sides of the abdomen, the scrotum (males) or labia majora (females) and upper part of the front of the thigh

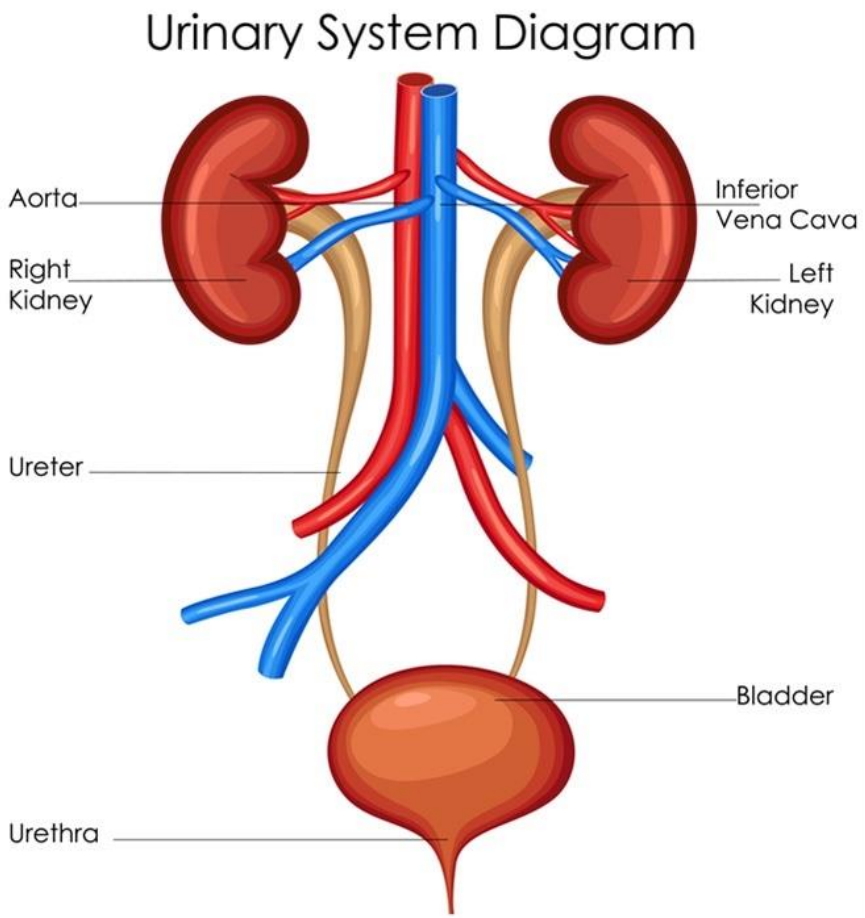
ANATOMY OF BLADDER

- This **triangle-shaped, hollow organ** is located in the lower abdomen. It is held in place by ligaments that are attached to other organs and the pelvic bones. The bladder's walls relax and expand to store urine, and contract and flatten to empty urine through the urethra.

SHAPE

- The empty bladder is about the size and shape of a pear. It is located in the lower pelvic cavity. Urine drains from the kidneys into the bladder through the ureters.

URINARY SYSTEM



- **Features and Structure of the Bladder**
- The transitional epithelium layer is the first layer on the inside of the –bladder. This acts as a lining that expands as the bladder fills.
- The surrounding layer is the lamina propria, which is comprised of adipocytes, fibroblasts, nerve endings, and interstitial cells, which form an extracellular matrix. Encompassing this, is the muscularis propria layer (destrusor muscle) made up of thick, smooth muscle bundles.
- The outermost layer is the perivesical soft tissue, made up of fat, fibrous tissue, and blood vessels. This layer separates the bladder from neighboring organs such as the kidneys and the prostate.

- **Ureter**
- The ureters are tubes which expel urine from the kidneys. Within the human body there are two ureters, one connected to each kidney.
- The upper half of the structure is situated in the abdomen and the lower half in the pelvic area.
- In the average adult, the ureter is 10 to 12 inches long. The tubes are able to contract due to fibrous and muscular walls coated in mucus.

URETHRAL SPHINCTER

- There are two types of urethral sphincters: the internal urethral sphincter (IUS), characterized by smooth muscle and is under involuntary control, and the external urethral sphincter (EUS), where control is voluntary and consists of striated muscle.
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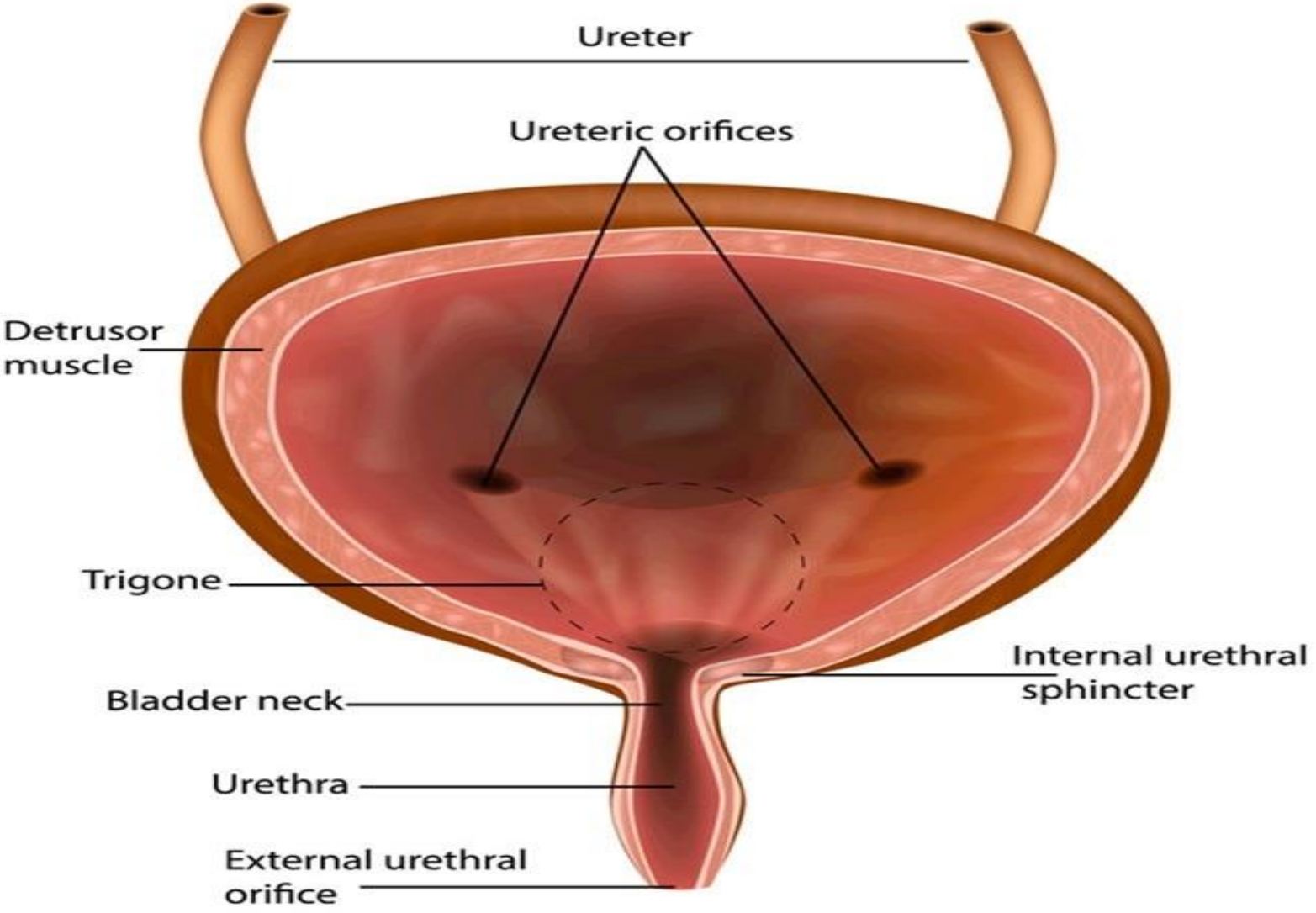
- Both structures are essential for urinary continence. During urination, the destrusor muscles of the bladder contract, and the sphincters relax and open in an antagonistic style, to allow the urine to exit the bladder into the urethra and out of the body.
- When comparing the structure in men and women, there are a few notable differences. In women, the EUS tends to be more intricate compared to in men. Furthermore, the muscles in the EUS in women are involved in the constriction of the urethra and vagina.

BLADDER WHEN EXPANDING



STRUCTURE OF BLADDER WHEN EXPANDING

- **Structure of the Bladder when Expanding**
- When the ureters remove urine from the kidneys to the bladder and the bladder begins to fill, the bladder's muscles wall begin to thin, moving the bladder upwards and towards the abdominal cavity.
- In contrast, when the bladder is empty, the muscle wall is thicker and the bladder as a whole becomes firmer.
- The ability of the bladder to expand enables its size to increase from approximately two inches to over six inches long. For most individuals, their bladder reaches its upper capacity when storing between 400-600 ml.

ANATOMY URETHRA

- The urethra is a passageway located in your body's pelvic region. **The walls of the tube are thin and made up of epithelial tissue, smooth muscle cells and connective tissue**. The urethra has two different types of sphincters, or muscles that act as valves that open or close.

URETHRA

- The **urethra** is a tube that connects the urinary bladder to the urinary meatus for the removal of urine from the body of both females and males. In human females and other primates, the urethra connects to the urinary meatus above the vagina, whereas in marsupials, the female's urethra empties into the urogenital sinus.
- The urethra is a fibrous and muscular tube which connects the urinary bladder to the external urethral meatus. Its length differs between the sexes, because it passes through the penis in males.

- **Male**
- The human male urethra laid open on its anterior (upper) surface In the human male, the urethra is on average 18 to 20 centimeters (7.1 to 7.9 inches) long and opens at the end of the external urethral meatus.
- **Female**
- In the human female, the urethra is about 4 cm long and exits the body between the clitoris and the vagina, extending from the internal to the external urethral orifice. The meatus is located below the clitoris. It is placed behind the symphysis pubis, embedded in the anterior wall of the vagina, and its direction is obliquely downward and forward; it is slightly curved with the concavity directed forward. The proximal two-thirds of the urethra is lined by transitional epithelial cells, while the distal third is lined by stratified squamous epithelial cells.
- Between the superior and inferior fascia of the urogenital diaphragm, the female urethra is surrounded by the urethral sphincter.

URINARY BLADDER

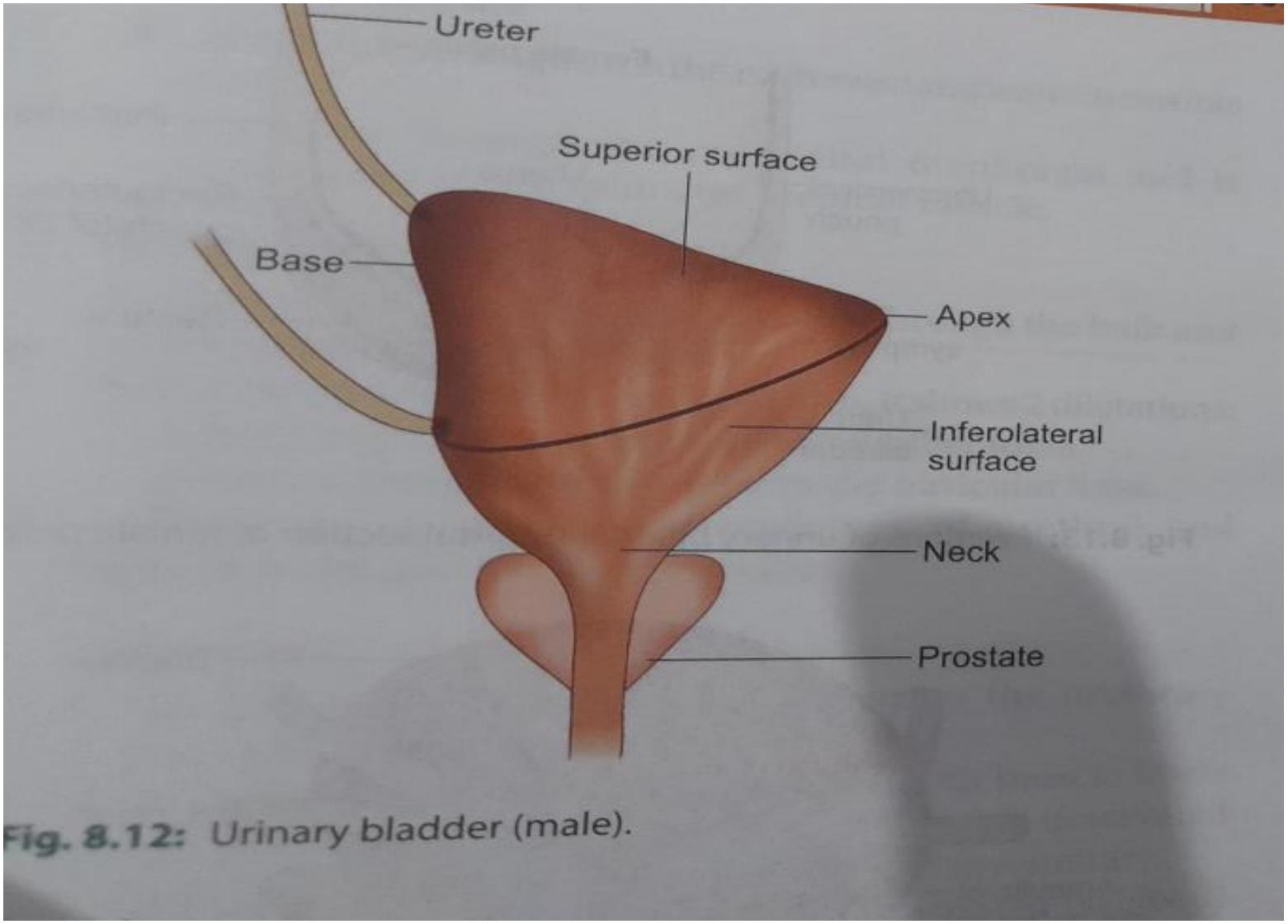


Fig. 8.12: Urinary bladder (male).

STRUCTURE OF URETHRA IN MALE

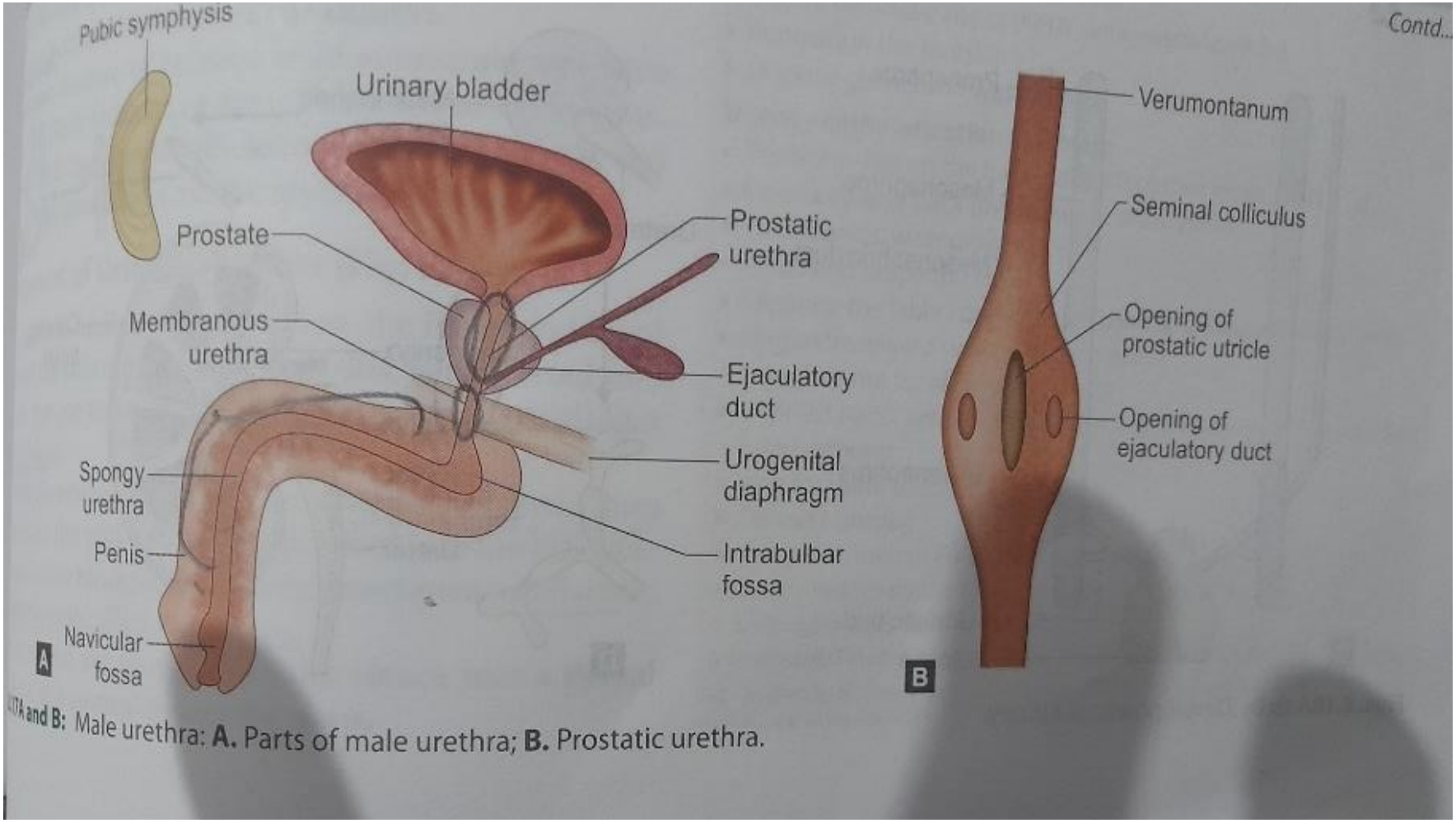


Fig. 10.7A and B: Male urethra: **A.** Parts of male urethra; **B.** Prostatic urethra.