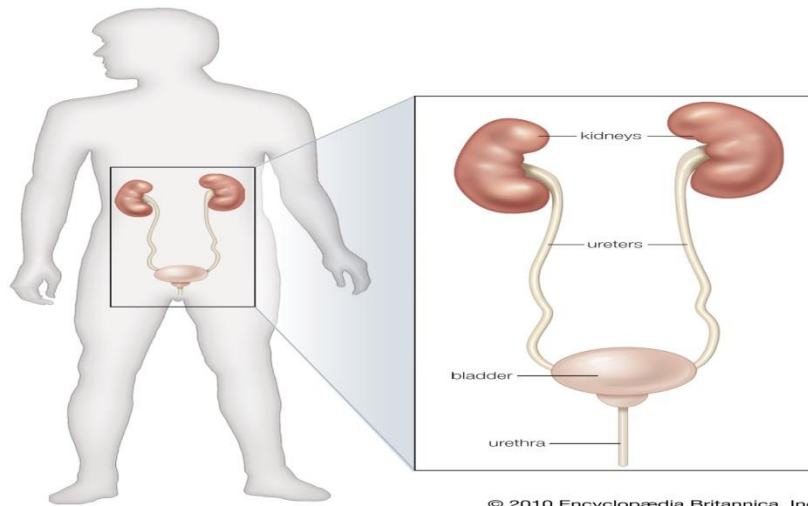


UNIT-3 URINARY SYSTEM

(URETER, URINARY BLADDER, URETHRA)



URETERS

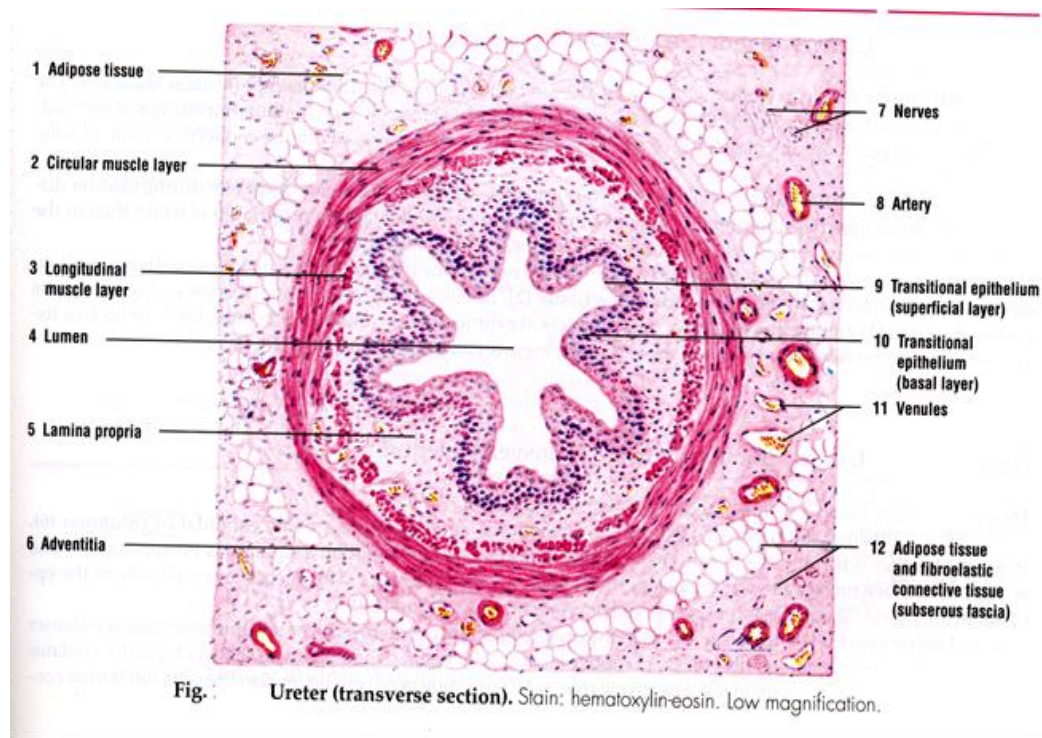
- Each of the two **ureters** transports urine from the renal pelvis of one kidney to the urinary bladder.
- Peristaltic contractions of the muscular walls of the ureters push urine toward the urinary bladder, but hydrostatic pressure and gravity also contribute.
- Peristaltic waves that pass from the renal pelvis to the urinary bladder vary in frequency from one to five per minute, depending on how fast urine is being formed.
- The ureters are 25–30 cm long and are thick-walled, narrow tubes that vary in diameter from 1 mm to 10 mm along their course between the renal pelvis and the urinary bladder.
- The ureters are retroperitoneal.
- At the base of the urinary bladder the ureters curve medially and pass obliquely through the wall of the posterior aspect of the urinary bladder.
- There is no anatomical valve at the opening of each ureter into the urinary bladder.

- There is a physiological valve which is quite effective. As the urinary bladder fills with urine, pressure within it compresses the oblique openings into the ureters and prevents the backflow of urine.
- When this physiological valve is not operating properly, it is possible for microbes to travel up the ureters from the urinary bladder to infect one or both kidneys.

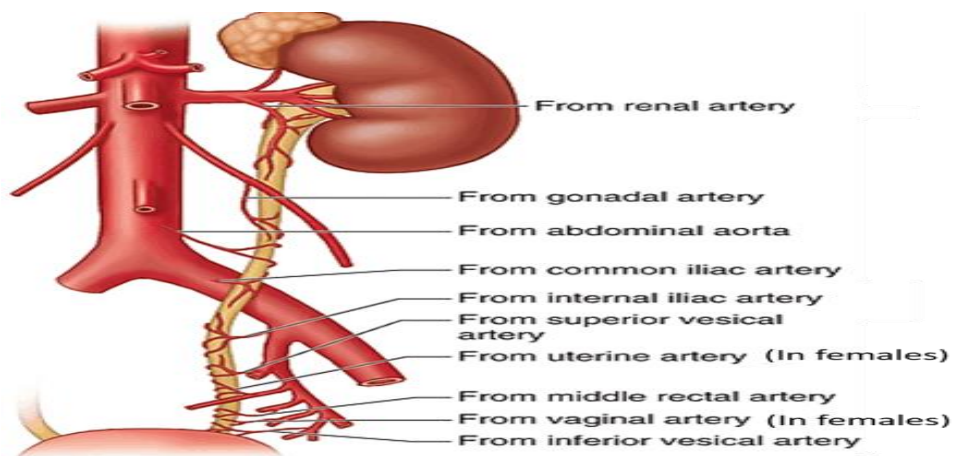
The ureters are formed of three coats or layers.

1. Mucosa – innermost layer 2. Muscularis – intermediate layer 3. Adventitia – outermost layer

- The deepest coat, or **mucosa**, is a mucous membrane with **transitional epithelium** and an underlying **lamina propria** of areolar connective tissue with considerable collagen, elastic fibers, and lymphatic tissue. Transitional epithelium is able to stretch—a marked advantage for any organ that must accommodate a variable volume of fluid.
- Mucus secreted by the mucosa prevents the cells of the walls of the ureter from coming in contact with urine, which is important because the solute concentration and pH of urine may differ drastically from those of the cytosol of the cells of the ureter walls.

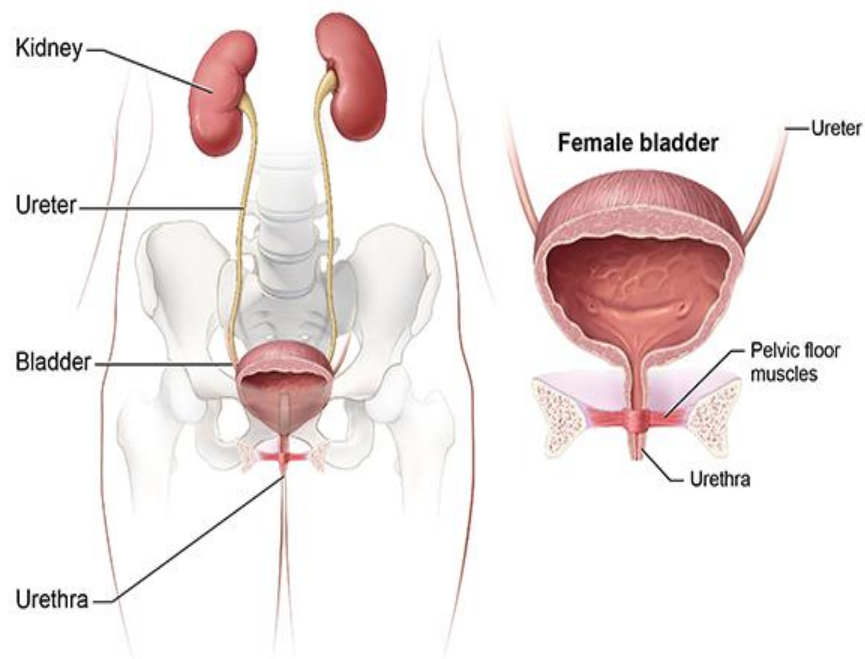


- Throughout most of the length of the ureters, the intermediate coat, the **muscularis**, is composed of inner longitudinal and outer circular layers of smooth muscle fibers, an arrangement opposite that of the gastrointestinal tract, which contains inner circular and outer longitudinal layers.
- The muscularis of the distal third of the ureters also contains a third, outer layer of longitudinal muscle fibers.
- Peristalsis is the major function of the muscularis.
- The superficial coat of the ureters is the **adventitia**, a layer of areolar connective tissue containing blood vessels, lymphatic vessels, and nerves that serve the muscularis and mucosa.
- The adventitia blends in with surrounding connective tissue and anchors the ureters in place.
- The arterial supply of the ureters is from the renal, testicular or ovarian, common iliac, and inferior vesical arteries (arising from the internal iliac artery, a trunk with the internal pudendal and superior gluteal arteries, or a branch of the internal pudendal artery).
- The veins have names corresponding to those of the arteries and eventually terminate in the inferior vena cava.
- The ureters are innervated by the renal plexuses, which are supplied by sympathetic and parasympathetic fibers from the lesser and lowest splanchnic nerves.



URINARY BLADDER

- The **urinary bladder** is a hollow, distensible muscular organ situated in the pelvic cavity posterior to the pubic symphysis.
- In males, it is directly anterior to the rectum and in females it is anterior to the vagina and inferior to the uterus.
- It is held in position by folds of the peritoneum.
- The shape of the urinary bladder depends on how much urine it contains. When empty, it is collapsed. When slightly distended it becomes spherical, as urine volume increases it becomes pear-shaped and rises into the abdominal cavity.
- Urinary bladder capacity averages 700–800 mL.
- It is smaller in females because the uterus occupies the space just superior to the urinary bladder.



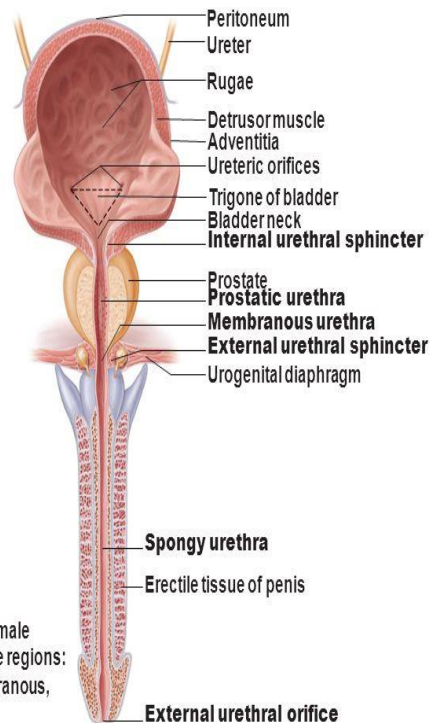
- In the floor of the urinary bladder is a small triangular area called the **trigone**.

- The two posterior corners of the trigone contain the two ureteral openings; the opening into the urethra, the **internal urethral orifice**, lies in the anterior corner.
- Because its mucosa is firmly bound to the muscularis, the trigone has a smooth appearance.
- Three coats make up the wall of the urinary bladder.
- The deepest is the **mucosa**, a mucous membrane composed of **transitional epithelium** and an underlying **lamina propria** similar to that of the ureters. Rugae (folds in the mucosa) are also present.
- Surrounding the mucosa is the intermediate **muscularis**, also called the **detrusor muscle**, which consists of three layers of smooth muscle fibers: the inner longitudinal, middle circular, and outer longitudinal layers.
- Around the opening to the urethra the circular fibers form an **internal urethral sphincter**; inferior to it is the **external urethral sphincter**, which is composed of skeletal muscle.
- The most superficial coat of the urinary bladder on the posterior and inferior surfaces is the **adventitia**, a layer of areolar connective tissue that is continuous with that of the ureters.
- Over the superior surface of the urinary bladder is the **serosa**, a layer of peritoneum.
- The arteries of the urinary bladder are the superior vesical (arises from the umbilical artery), the middle vesical (arises from the umbilical artery or a branch of the superior vesical), and the inferior vesical (arises from the internal iliac artery, a trunk with the internal pudendal and superior gluteal arteries, or a branch of the internal pudendal artery). The veins from the urinary bladder pass to the internal iliac vein.
- The nerves supplying the urinary bladder arise partly from **the hypogastric sympathetic plexus and partly from the second and third sacral nerves (pelvic splanchnic nerve)**.

URETHRA

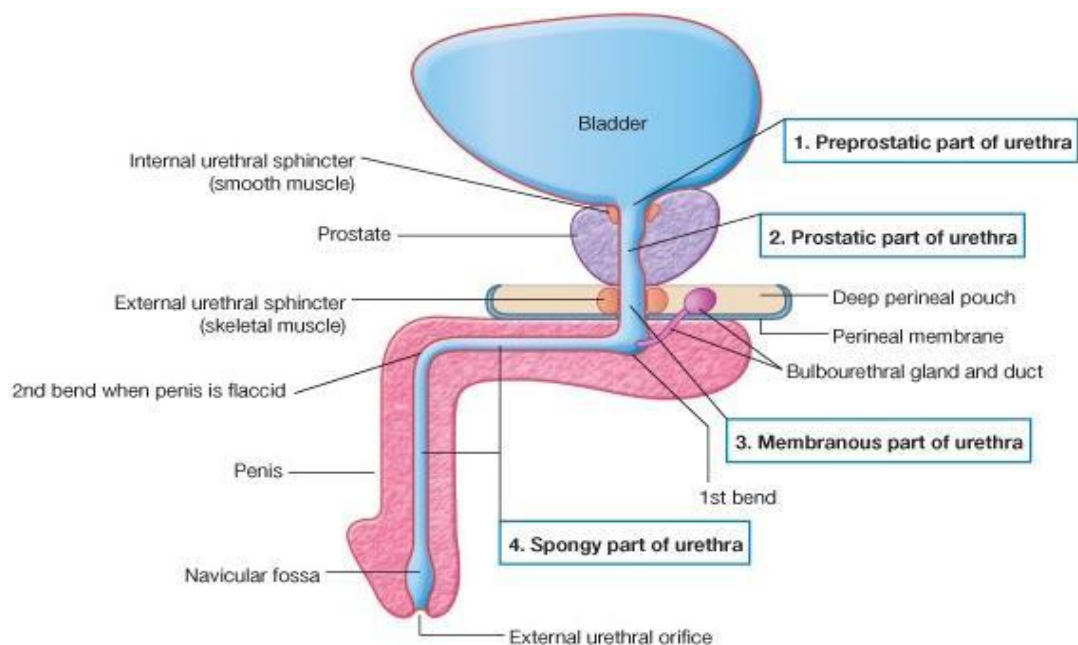
- The **urethra** is a small tube leading from the internal urethral orifice in the floor of the urinary bladder to the exterior of the body.
- In both males and females, the urethra is the terminal portion of the urinary system and the passageway for discharging urine from the body; in males it discharges semen as well.
- In females, the urethra lies directly posterior to the pubic symphysis, is directed obliquely inferiorly and anteriorly, and has a length of 4 cm.
- The opening of the urethra to the exterior, the **external urethral orifice**, is located between the clitoris and the vaginal opening.
- The wall of the female urethra consists of a deep **mucosa** and a superficial **muscularis**.

Structure of the Urinary Bladder and Urethra



(a) Male. The long male urethra has three regions: prostatic, membranous, and spongy.

- The mucosa is a mucous membrane composed of **epithelium** and **lamina propria** (areolar connective tissue with elastic fibers and a plexus of veins).
- The muscularis consists of circularly arranged smooth muscle fibers and is continuous with that of the urinary bladder.
- Near the urinary bladder, the mucosa contains transitional epithelium that is continuous with that of the urinary bladder; near the external urethral orifice the epithelium is non-keratinized stratified squamous epithelium.
- Between these areas, the mucosa contains stratified columnar or pseudostratified columnar epithelium.
- In males, the urethra also extends from the internal urethral orifice to the exterior, but its length and passage through the body are considerably different than in females.



- The male urethra first passes through the prostate, then through the deep perineal muscles, and finally through the penis, a distance of about 20 cm.
- The male urethra, which also consists of a deep **mucosa** and a superficial **muscularis**, is subdivided into three anatomical regions:

- The **prostatic urethra** passes through the prostate;
- the **membranous (intermediate) urethra**, the shortest portion, passes through the deep perineal muscles; and
- The **spongy urethra**, the longest portion, passes through the penis.

- The mucosa of the prostatic urethra is continuous with that of the urinary bladder and consists of transitional epithelium that becomes stratified columnar or pseudostratified columnar epithelium more distally.

- The mucosa of the membranous urethra contains stratified columnar or pseudostratified columnar epithelium.

- The epithelium of the spongy urethra is stratified columnar or pseudostratified columnar epithelium, except near the external urethral orifice, which is nonkeratinized stratified squamous epithelium.

- The **lamina propria** of the male urethra is areolar connective tissue with elastic fibers and a plexus of veins.

- The muscularis of the prostatic urethra is composed of wisps of mostly circular smooth muscle fibers superficial to the lamina propria; these circular fibers help form the internal urethral sphincter of the urinary bladder

- The muscularis of the membranous urethra consists of circularly arranged skeletal muscle fibers of the urogenital diaphragm that help form the external urethral sphincter of the urinary bladder.

- Several glands and other structures associated with reproduction deliver their contents into the male urethra.