

# MODULE 11: URINARY AND REPRODUCTIVE SYSTEM ANATOMY

The Urinary and Reproductive Systems are the focus of this anatomy module. The tables below includes a list of terms that you will be expected to identify on pictures, models and images. There will likely be images on the exam that you have not seen or studied before, so it is important for you to learn anatomical structures by their characteristics and avoid just memorizing the pictures you have available.

## List of Terms

Spend as much time as you need reviewing. Practice identifying all of the structures listed in the tables below. Use your online resources, open lab, and any other tool that you have to become confident in your identification skills. Even though the practice exam will be multiple choice, the real lab exams will ask you to identify and then write in (Fill in the Blank) the correct term for your identification. The tables below include a comprehensive list of all the terms from this section that we would consider asking about on an exam.

### LIST OF TERMS FOR THE URINARY SYSTEM

#### Renal System Anatomy

- **Kidney**
- **Ureter**
- **Urinary Bladder**
  - **Trigone**
- **Urethra**
  - **Internal Urethral Sphincter**
  - **External Urethral Sphincter**

The **kidneys** are located at the posterior aspect of the superior abdominal cavity. The right kidney is generally slightly lower than the left. The upper parts of the kidneys are protected by the last two ribs. **Ureters** are tubes made of smooth muscle that carry urine from the kidneys to the bladder. The **bladder** sits on the pelvic floor and between the rectum and the pubic symphysis. The **trigone** of the urinary bladder is a smooth triangular region that is found on the posterior bladder wall. The trigone is very sensitive to stretch and helps trigger a urination reflex when the bladder fills. The **urethra** is a tube that connects the bladder to the outside of the body. It is much longer in the male than the female as it runs through the penis. The **internal urethral sphincter** is a smooth muscle ring of smooth muscle that wraps around the urethra near the bladder. The contraction of this sphincter is involuntary and helps control leakage from the bladder. There is another sphincter called the **external urethral sphincter**. This muscle is skeletal muscle and is under voluntary control.

### External Anatomy of the Urinary System

- **Hilum**
- **Renal Capsule**
- **Renal Sinus**

The renal **hilum** is a recess in the center of the kidney where the blood vessels and ureter pass into the kidney. The **renal capsule** is a tough fibrous tissue that surrounds the kidney. The **renal sinus** is a cavity in the kidney that contains the renal pelvis, renal calyces and blood vessels entering the deep kidney tissue.

### Internal Anatomy of the Kidneys

- **Cortex**
- **Medulla**
  - **Renal Column**
  - **Renal Pyramid**
  - **Renal Papilla**
- **Minor Calyx**
- **Major Calyx**
- **Renal Pelvis**

The **renal cortex** is the outer area of the kidney. It forms an outer layer of the kidney that has numerous projections (called **renal columns**) extending between structures called **pyramids**. **Renal papilla** refers to the rounded tip of the pyramid where the pyramid contacts a minor calyx. **The minor calyx** surrounds the apex of a pyramid and collects urine. Two or more minor calyces join to form **major calyces**. Major calyces drain urine into the **renal pelvis**. The renal pelvis narrows at the renal hilum to become the ureter.

### Circulation

- **Renal Vein**
- **Renal Artery**
- **Segmental Arteries**
- **Interlobar Arteries**
- **Arcuate Arteries**
- **Interlobular Arteries**
- **Afferent Arteriole**
- **Glomerulus**
- **Efferent Arteriole**
- **Peritubular Capillaries**
- **Vasa Recta**

The **renal vein** and **renal artery** are the major blood vessels entering and exiting the kidney through the renal hilum. Once the renal artery enters the kidney it branches and forms the segmental arteries. The **segmental arteries** carry blood to particular "segments" of the kidney. Then, segmental arteries branch into **interlobar arteries**. Interlobar arteries extend up the renal columns bordering each side of the pyramids. At the top of the pyramids, the interlobar arteries become the **arcuate arteries** that arch over the top of the pyramids. Rising from the arcuate arteries are branches that extend outward from the arcuate arteries called the **interlobular arteries** (not to be confused with the interlobar arteries). The interlobular arteries give rise to **afferent arterioles** which carry blood to individual renal corpuscles. Inside the corpuscle is a capillary bed called the **glomerulus**. The glomerulus filters blood into the nephrons of the kidney and then blood exits this capillary bed through the **efferent arterioles**. Efferent arterioles then branch and associate with the nephron through two capillary beds. The peritubular capillaries and the vasa recta. The **vasa recta** refers to the capillaries next to the loop of henle and the **peritubular capillaries** are found next to the nephron everywhere else.

## **Nephron**

- **Renal Corpuscle**
  - **Glomerulus**
  - **Bowman's Capsule**
- **Proximal Convoluted Tubule**
- **Loop of Henle**
  - **Ascending Limbs**
  - **Descending Limbs**
- **Distal Convoluted Tubule**
- **Collecting Duct**
- **Juxtaglomerular Apparatus**
  - **Macula Densa**
  - **Granular Cells (Juxtaglomerular Cells)**
- **Juxtamedullary Nephron**
- **Cortical Nephron**

The nephron receives fluid from capillaries called the glomerulus. These capillaries are under relatively high pressure and fluid is squeezed out into Bowman's capsule. Bowman's capsule wraps around the glomerulus. Together, Bowman's capsule and the glomerulus make up the renal corpuscle. Extending from Bowman's capsule is the rest of the nephron. The nephron tube leaving Bowman's capsule is called the proximal convoluted tubule. Convoluted refers to the multiple bends, twists and wrapping around that the tubule does before descending down towards the renal medulla. The portion of the nephron tubule that descends down towards the medulla is called the thick and thin descending limbs. Thick and thin refer to the size of the tubule. The thick tubule tends to have cuboidal shaped cells and be thicker. The thin portion has squamous shaped cells and is thinner. The descending limbs curl at an apex and form a loop. The tubule then ascends through portions called the thin and thick ascending limbs. The descending and ascending limbs together are called the loop of henle. The ascending limbs of the loop of henle rise back towards the renal cortex and become the distal convoluted tubule. The distal convoluted tubule joins the collecting duct which is a tube that receives connections from multiple distal convoluted tubules. The collecting duct descends down towards the renal pelvis and ends at the papilla of the pyramid. The juxtaglomerular apparatus refers to an area where distal convoluted tubule cells contact afferent arteriole cells. The tubule cells of this area are called macula densa and the afferent arteriole cells of this region are called Granular cells (or juxtaglomerular cells). Cortical nephrons are nephrons that are found towards the cortex, the loop of henle for cortical nephrons extends very little into the renal medulla. The juxtamedullary nephrons have a loops of henle that extend very deep into the renal medulla.

## LIST OF TERMS FOR THE REPRODUCTIVE SYSTEM

### Male Reproductive System

#### Penis

- **Glans Penis**
  - **Prepuce**
  - **External Urethral Orifice**
- **Shaft**
- **Urethra**
  - **Prostatic Urethra**
  - **Membranous Urethra**
  - **Penile Urethra**
  - **Corpus Spongiosum**
  - **Copora Cavernosum**
  - **Dorsal Vein**

The **Glans Penis** is the tip of the penis and it is contained within a loose fold of skin called the **Prepuce**. It is this prepuce that is removed in the procedure called circumcision. The **External Urethral Orifice** is the termination of the urethra. The Urethra has different names along its length depending on where it is at. The **Prostatic Urethra** is the part of the urethra that pass through the prostate gland. The **Membranous Urethra** is just below the prostate. The **Penile Urethra** passes through the shaft of the penis. The **Corpus Spongiosum** is a mass of spongy tissue that surrounds the penile urethra. The **Copora Cavernosum** is a pair of spongy tissue structures that lie dorsal to the penile urethra and corpus spongiosum. These spongy tissues of the penis are important for proper erectile functions. The **Dorsal Vein** carries blood from the penis.

#### Testes

- **Scrotum**
  - **Median (Scrotal) Septum**
  - **Dartos Muscles**
- **Tunica Albuginea**
- **Lobule**
  - **Seminiferous Tubules**
- **Rete Testes**
- **Efferent Ductules**
- **Epididymis**

The **Testes** (also referred to as the male gonads) are located outside the body in a sac like protuberance of skin and muscle (the **Scrotum**). The muscle tissue is called **Dartos Muscles**. This muscular tissue helps control the distance that the testes are from the body. The **Tunica Albuginea** (literally means "white covering") is a layer of connective tissue kind of white in appearance that covers the testicles. Within the testicles are **Lobules**. **Lobules** are areas surrounded by connective tissue septa that contain **seminiferous tubules**. **Seminiferous Tubules** are long microscopic tubes that are highly condensed in their packaging within the lobules (Nearly a half a mile long if stretched out to one continuous length). The **seminiferous tubules** are the location of sperm cell development. The **Rete Testes** is a network of delicate tubules that carry sperm cells from the **seminiferous tubules** to the **efferent ducts**. The **Efferent Ductules** connect the **rete testis** to the **epididymis**. The **Epididymis** is a tightly coiled tube that lies like a comma on the outside of the testicle. Sperm cells make their way along this tube continuing to mature and the proximal end of the **epididymis** acts as a storage reservoir for sperm before they are ejaculated.

### **Male Genitalia Internal Anatomy**

- **Spermatic Cord**
  - **Spermatic Artery**
  - **Spermatic Vein**
  - **Ductus Deferens (Vas Deferens)**
  - **Cremasteric Muscle**
- **Seminal Vessicles**
- **Ejaculatory Ducts**
- **Prostate Gland**
- **Bulbourethral Gland**

The male reproductive system includes many structures that are not part of the genitalia that can be seen. These will be references as internal anatomy as many of these structures are actually inside the pelvic cavity. The Spermatic Cord starts in the pelvic cavity but then extends down into the scrotum. The spermatic cord contains an artery called the Spermatic Artery and some veins called Spermatic Veins. The tube that carries sperm cells from the epididymis to the penis is called the Ductus Deferens also called the Vas Deferens. It is also located in the spermatic cord and actually traverses up over the top of the bladder in the pelvic cavity before joining the urethra of the penis. The rest of the structures in this list are glandular tissues that contribute secretions to semen. The Seminal Vessicles are a pair of glands posterior and inferior to the bladder. The Ejaculatory Ducts are paired ducts that start at the seminal vesicles, pass through the Prostate Gland and join the penile urethra. The Prostate Gland sits just below the bladder and the urethra passes right through it. The Bulbourethral Gland is also called Cowper's Gland. They are located posterior and lateral to the base of the penis.

## **Female Reproductive System**

### **External Genitalia**

- **Vulva**
  - **Labia Majora**
  - **Labia Minora**
  - **Vestibule**
  - **Vestibular Glands**
  - **Clitoris**
  - **Prepuce of Clitoris**
  - **Urethral Orifice**
  - **Urethra**
- **Mons Pubis**
- **Symphysis Pubis**
- **Clinical Perineum**

The **Vulva** consists of the female external genitalia. The **Labia Majora** are a pair of longitudinal skin folds that would have fatty tissue giving them form and pubic hairs on the surface. The labia majora enclose the labia minora. The **Labia Minora** are thin skin folds with no pubic hair. The labia minora form the border of an area called the vestibule. The **Vestibule** contains the openings of the urethra and the vagina. There are glandular cells within the vestibule as well called **Vestibular Glands**. These cells keep the area moist. The **Clitoris** is located on the anterior margin of the vestibule. The two labia minora combine to form a **Prepuce of the Clitoris**. The **Urethra** ends at the **Urethral Orifice** in the vestibule.

The **Mons Pubis** is a soft tissue mound that forms where the two labia majora meet anteriorly. The **Symphysis Pubis** is where the two os coxae bones join anteriorly.

The **perineum** is a region that lies between, and may include, the genitals and the anus. There is certainly variability in anatomy text books as to where this region has its exact boundaries. However, there is general agreement on a term called the "**Clinical Perineum**". The clinical perineum generally refers to an area between the vulva and the anus. Sometimes during child birth the doctor may make an incision in the area known as the clinical perineum to increase the size of the birth canal opening (this surgery is called an **episiotomy**). This incision can keep the birth canal from tearing in the same area during child birth.

#### **Female Genitalia Internal Anatomy**

- **Vagina**
  - **Vaginal Orifice**
  - **Hymen**
  - **Rugae**
  - **Fornix**
- **Uterus**
  - **Perimetrium**
  - **Myometrium**
  - **Endometrium**
  - **Uterine Cavity**
  - **Fundus**
  - **Body**
  - **Cervix**
- **Uterine (Fallopian) Tubes**
  - **Infundibulum**
  - **Fimbriae**
- **Ovary**
- **Ovarian Ligament**
  - **Round Ligament**

The **vagina** receives the penis during sexual intercourse. The **vaginal orifice** is the opening to the vaginal canal. The **hymen** is a thin membrane that covers the vaginal orifice. It generally does not completely occlude the vaginal orifice but is often perforated with holes. Sexual intercourse greatly enlarges the hymen membrane. Vaginal **rugae** are horizontal ridges that span the vaginal canal. The **fornix** is found on the sides of the cervix and marks the boundary where the cervix protrudes into the vaginal canal. The **uterus** is the size and shape of a pear. The larger, more round part is situated superiorly and is called the **fundus**. The smaller, narrower end is situated inferiorly and is called the **cervix**. In between the fundus and the cervix is the **body** of the uterus. The **uterine cavity** is a thin space between the uterine walls. The Uterus has three layers of tissue. The **perimetrium** is the outer surface of the uterus and is where the serous layer of the peritoneum is. The **myometrium** is the muscular layer or thick layer of smooth muscle that accounts for the bulk of the uterine wall. The **endometrium** is the lining in the uterine cavity. Part of the endometrium sloughs off each month as part of the menstrual cycle. The **uterine or fallopian tubes** extend from the uterus out laterally and ends at each ovary. The **infundibulum** is the expanded part of the fallopian tube at the neck of the tube just before it branches into fimbriae. **Fimbriae** are long, thin processes that open up towards the ovary. The **round ligament** extends from the uterus to the **labia majora**. The **ovary** is the female gonad and contains the germ cells that produce oocytes or "eggs" that can be fertilized by male sperm. There are two ovaries that sit just below the fimbriae of the uterine tubes. The **ovarian ligament** connects the ovary to the superior uterus.

## **Breast**

- **Areola**
- **Nipple**
- **Lactiferous Duct**
- **Lactiferous Sinus**

Externally the breasts of males and females have a raised area called a **nipple**. The nipple is surrounded by a pigmented area called the **areola**. The female nipple has well developed and modified sweat glands called the **mammary glands**. The mammary glands are comprised of the **lactiferous ducts** and the **lactiferous sinuses**. The ducts convey milk to the surface and the sinuses is where milk accumulates during lactation.