THE URINARY SYSTEM

LEARNING OBJECTIVE:

Describe the parts of the urinary system and their function(s).

The urinary system is the primary filtering system of the body (Fig. 6-84). This system is composed of two main organs, the kidneys and urinary bladder. The kidneys produce urine, which is drained from the kidneys by two tubes called ureters. Urine flows down both ureters to the bladder. The urinary bladder is a large reservoir where the urine is temporarily stored before excretion from the body. A tube called the urethra carries the urine from the bladder to the outside of the body. The length of the urethra differs in males and females, the female’s being shorter.

KIDNEYS

The bladder, ureters, and urethra store and pass the products of the kidneys.

The kidneys are two large, bean-shaped organs approximately 11cm by 7cm by 3cm, designed to filter waste materials from the blood (Figs. 6-85 and 6-86). They assist in controlling the rate of red blood cell formation and in the regulation of blood pressure; the absorption of calcium ions; and the volume, composition, and pH of body fluids. The kidneys are located in the upper posterior part of the abdominal cavity, one on each side of the spinal column. The upper end of each kidney reaches above the level of the 12th rib. The suprarenal (adrenal) gland sits like a cap on top of each kidney. The kidneys are protected by a considerable amount of fat and supported by connective tissue and the peritoneum. Attached to the hollow side of each kidney is the dilated upper end of the ureter, forming the renal pelvis.

Figure 6-84.—Location of urinary system organs. A, Anterior view of the urinary organs with the peritoneum and visceral organs removed. B, Surface markings of the kidneys, eleventh and twelfth ribs, spinous processes of L1 to L4, and lower edge of the pleura (posterior view). C, Horizontal (transverse) section of the abdomen showing the retroperitoneal position of the kidneys. (A: Barbara Cousins. B: From Abrahams P, Marks S, Hutchings R: McMinn's color atlas of human anatomy, ed 5, Philadelphia, 2003, Mosby.)


Figure 6-86.—Circulation of blood through the kidney. A, Diagram showing the major arteries and veins of the renal circulation. B, Renal arteriogram. Arcuate arteries (1) are seen near the junction of the cortex and medulla, interlobar arteries (2) are present between the medullary pyramids, and lobar arteries (3) and segmental arteries (4) are seen branching from the main renal artery (5). Note the tip of the catheter used to inject contrast material (6) into the proximal part of the main renal artery. (B: From Weir J, Abrahams P: Imaging atlas of the human anatomy, ed 2, Philadelphia, 1997, Mosby.)

Structure

The lateral surface of the kidneys is convex in shape, and the medial side is deeply concave. The medial side of each kidney possesses a depression that leads to a hollow chamber called the renal sinus (Fig. 6-85). The entrance of the renal sinus is referred to as the hilum (Fig. 6-85). Blood vessels, nerves, lymphatic vessels, and the ureters pass through the hilum.

The superior end of the ureter forms a funnel-shaped sac called the renal pelvis (Fig. 6-85). The renal pelvis is divided into two or three tubes, called major calyces. The major calyces (sing. calyx) are further subdivided into minor calyces.

There are groups of elevated projections in the walls of the renal pelvis. These projections are called renal papillae. The renal papillae connect to the minor calyces through tiny openings in the minor calyces (Fig. 6-87).

The principal portion of the kidney is divided into two distinct regions: an inner medulla and outer cortex (Fig. 6-85). The renal medulla is composed of pyramid-shaped masses of tubes and tubules called renal pyramids. Renal pyramids drain the urine to the renal pelvis. The renal cortex forms a shell over the renal medulla. Renal cortex tissue dips down, like fingers, between the renal pyramids, and forms renal columns. The cortex possesses very small tubes associated with nephrons. Nephrons are the functional units of the kidneys.

**RENALE BLOOD VESSELS.**—The renal artery supplies blood to the kidneys. The renal artery enters the kidneys through the hilum and sends off branches to the renal pyramids. These arterial branches are called interlobar arteries. At the border between the medulla and cortex, the interlobar arteries branch to form the arcuate arteries. The arcuate arteries branch and form the interlobular arteries.

The venous system of the kidneys generally follows the same paths as the arteries. Venous blood passes through the interlobular, arcuate, interlobar, and renal veins.

**NEPHRONS.**—The functional units of the kidneys are called nephrons. There are about 1 million nephrons in each kidney. Each nephron consists of a renal corpuscle and a renal tubule.

The renal corpuscle (Malpighian corpuscle) is composed of a tangled cluster of blood capillaries called a glomerulus. The glomerulus is surrounded by a sac-like structure referred to as the glomerulus capsule or Bowman's capsule (Fig. 6-88).

Leading away from the glomerulus is the renal tubule. The initial portion of the renal tubule is coiled and called the proximal convoluted (meaning coiled or twisted) tubule. The proximal convoluted tubule dips down to become the descending loop of Henle. The tubule then curves upward toward the renal corpuscle and forms the ascending loop of Henle.
Function

The kidneys are effective blood purifiers and fluid balance regulators. In addition to maintaining a normal pH of the blood (acid-base balance), the kidneys keep the blood slightly alkaline by removing excess substances from it. The end product of these functions is the formation of urine, which is excreted from the body.

Urine is formed through a series of processes in the nephron. These processes are filtration, reabsorption, and secretion.

**FILTRATION.**—Urine formation begins when water and various dissolved substances are filtered out of blood plasma from a glomerular capillary into the glomerular capsule. The filtered substance (glomerular filtrate) leaves the glomerular capsule and enters the renal tubule.

**REABSORPTION.**—As glomerular filtrate passes through the renal tubule, some of the filtrate is reabsorbed into the blood of the peritubular capillary. The filtrate entering the peritubular capillary will repeat the filtration cycle. This process of reabsorption changes the composition of urine. For instance, the filtrate entering the renal tubule is high in sugar content, but because of the reabsorption process, urine secreted from the body does not contain sugar.

**SECRETION.**—Secretion is the process by which the peritubular capillary transports certain substances directly into the fluid of the renal tubule. These substances are transported by similar mechanisms as used in the reabsorption process, but done in reverse. For example, certain organic compounds, such as penicillin and histamine, are secreted directly from the proximal convoluted tubule to the renal tubule. Large quantities of hydrogen ions are secreted in this same manner. The secretion of hydrogen ions plays an important role in regulating pH of body fluids.

Once the ascending limb reaches the region of the renal corpuscle, it is called the distal convoluted tubule. Several distal convoluted tubules merge in the renal cortex to form a collecting duct. The collecting duct begins to merge within the renal medulla. The collecting ducts become increasingly larger as they are joined by other collecting ducts. The resulting tube is called the papillary duct. The papillary duct empties into the minor calyx through an opening in the renal papilla.

Figure 6-88.—Nephron. The nephron is the basic functional unit of the kidney. Arrows show the direction of flow within the nephron. (Adapted from Brundage DJ: Renal disorders. Mosby's clinical nursing series, St Louis, 1992, Mosby.)

The glomerulus filters an estimated 1,200 ml of blood through the kidneys each minute (or 2,500 gallons in 24 hours) and about 80 gallons of glomerular filtrate in 24 hours. All the water from this filtrate is reabsorbed in the renal tubules except those containing the concentrated waste products.

The function of the ureters is to carry urine from each kidney to the urinary bladder. The ureters are two membranous tubes 1 mm to 1 cm in diameter and about 25 cm in length. Urine is transported through the ureters by peristaltic waves (produced by the ureter's muscular walls).

URINARY BLADDER

The urinary bladder functions as a temporary reservoir for urine. The bladder possesses features that enable urine to enter, be stored, and later be evacuated from the body.

Structure

The bladder is a hollow, expandable, muscular organ located in the pelvic girdle. Although the shape of the bladder is spherical, its shape is altered by the pressures of surrounding organs. When it is empty, the inner walls of the bladder form folds. As the bladder fills with urine, the walls become smoother.

The internal floor of the bladder includes a triangular area called the trigone (Fig. 6-89). The trigone has three openings at each of its angles. The ureters are attached to the two posterior openings. The anterior opening, at the apex of the trigone, contains a funnel-like continuation called the neck of the bladder. The neck leads to the urethra.

Figure 6-89.—Structure of the urinary bladder. Frontal view of a dissected urinary bladder (male) in a fully distended state. Inset shows a cross section of the bladder wall, which has layers similar to those in other hollow abdominopelvic organs (compare to Figure 25-2).

The wall of the bladder consists of four bundles of smooth muscle fibers. These interlaced muscle fibers form the detrusor muscle (which surrounds the bladder neck) and comprise what is called the internal urethral sphincter. The internal urethral sphincter prevents urine from escaping the bladder until the pressure inside the bladder reaches a certain level. Parasympathetic nerve fibers in the detrusor muscle function in the micturition (urination) process. The outer layer (serous coat) of the bladder wall consists of two types of tissue, parietal peritoneum and fibrous connective tissue.

**Micturition (Urination)**

*Micturition* is the process by which urine is expelled from the bladder. It involves the contraction of the detrusor muscle and pressure from surrounding structures to expel the urine. Urination also involves the relaxation of the external urethral sphincter. The external urethral sphincter surrounds the urethra about 3 centimeters from the bladder, and is composed of voluntary muscular tissue.

 Urination is usually stimulated by the distention of the bladder as it fills with urine. When the walls of the bladder contract, nerve receptors are stimulated and the urination reflex is triggered. The urination reflex causes the internal urethral sphincter to open and the external urethral sphincter to relax. This relaxation allows the bladder to empty. The bladder can hold up to 600 ml of urine. The desire to urinate may not occur until the bladder contains 250-300 ml.

**URETHRA**

The urethra is the tube that carries urine from the bladder to the outside of the body. The urinary meatus is the external urethral orifice. In the male, the urethra is common to the urinary and reproductive systems; in the female, it belongs only to the urinary system.

**Female Urethra**

The female urethra is about 4 cm long, extending from the bladder to the external orifice.

**Male Urethra**

The male urethra is about 20 cm long and is divided into three parts: the prostatic, membranous, and penile portions.

**PROSTATIC URETHRA**—The prostatic urethra is surrounded by the prostate gland; it contains the orifices of the prostatic and ejaculatory ducts. This portion of the male urethra is about 2.5 cm long.

**MEMBRANOUS URETHRA**—The membranous urethra is about 2 cm in length and is surrounded by the external urethral sphincter.

**PENILE URETHRA**—The penile urethra, the longest portion, is about 15 cm long. It lies in the ventral portion of the penis. The urethra terminates with the external orifice at the tip of the penis.
MALE REPRODUCTIVE SYSTEM

LEARNING OBJECTIVE:

Identify the parts of the male reproductive system and their function(s).

The gonads of the male and female reproductive systems are concerned with the process of reproducing offspring, and each organ is adapted to perform specialized tasks. The primary male sex organs of the reproductive system are the testes. The other structures of the male reproductive system are termed accessory reproductive organs.

The accessory organs include both internal and external reproductive organs. See Figure 6-90 for an illustration of the male reproductive system.

The testes, as stated earlier, are the primary male reproductive organs. They produce sperm cells (spermatozoa) and male hormones, both necessary for reproduction.

Figure 6-90.—The male reproductive system. Illustration shows the testes, epididymis, vas (ductus) deferens, and glands of the male reproductive system in an isolation/dissection format. (Barbara Cousins.)

Structure

The testes are oval glands suspended inside a sac (the scrotum) by a spermatic cord. The spermatic cords are formed by the vas deferens, arteries, veins, lymphatics, and nerves, all bound together by connective tissue.

Each testis is encapsulated by a tough, white, fibrous tissue called the tunica albuginea. The interior of the testis is divided into 200 or more cone shaped lobules (small lobes). Each lobule contains 1 to 3 highly coiled, convoluted tubules called seminiferous tubules. These tubules unite to form a complex network of channels called the rete testis. The rete testis give rise to several efferent ductules that join a tube called the epididymis (Fig. 6-91).

Functions

The testes perform two functions: to produce sperm cells and to secrete male sex hormones. The process by which sperm cells are produced is called spermatogenesis. Spermatogenesis occurs in the seminiferous tubules of the testes. Once the sperm cells are formed, they collect in the lumen of each seminiferous tubule. When the sperm cells are ready, they pass through the rete testis to the epididymis, where they remain to mature. The production of sperm cells occurs continually throughout the reproductive life of a male.

The male hormone testosterone is produced in the testes. This hormone is initially responsible for the formation of the male reproductive organs. During puberty, testosterone stimulates the enlargement of the testes and various other accessory reproductive organs.

Figure 6-91.—Tubules of the testis and epididymis. A, Transilluminated photograph; the testis is the darker sphere in the center. B, Illustration showing epididymis lifted free of testis. The ducts and tubules are exaggerated in size. (A: Lennart Nilsson.)

It causes the development and maintenance of the male secondary sexual characteristics and accessory organs such as the prostate, seminal vesicles; and adult male behavior. Refer to the section titled "The Endocrine System" for more detailed discussion on male secondary sexual characteristics.

Other actions of testosterone include increasing the production of red blood cells. As a result, the average number of red blood cells in blood is usually greater in males than in females. Testosterone promotes the growth of skeletal muscles, which has tempted people to use them in a dangerous way.

INTERNAL ACCESSORY ORGANS

The internal accessory organs of the male reproductive system include the epididymis, vas deferens, ejaculatory ducts, seminal vesicle, urethra, prostate gland, bulbourethral glands, and semen (Figs. 6-90 and 6-91).

Epididymis

Each epididymis is a tightly coiled, thread-like tube that is approximately 6 meters long. This tube is connected to the ducts within the testis. The epididymis covers the top of the testis, runs down the testis' posterior surface, and then ascends to form the vas deferens.

The epididymis secretes the hormone glycoprotein, which helps sustain the lives of stored sperm cells and promotes their maturation. When immature sperm cells enter the epididymis, they are not mobile. They spend 1 to 3 weeks maturing; immature and unused cells will breakdown to be reabsorbed by the body. As the sperm cells travel through the epididymis, they mature and become mobile. Once the sperm cells are mature, they leave the epididymis and enter the vas deferens.

Vas Deferens

The vas deferens is a small tube that connects the epididymis and ejaculatory duct. It can be palpated through the scrotal sac as a smooth movable cord. It ascends as part of the spermatic cord through the inguinal canal of the lower abdominal wall into the pelvic cavity and transmits the sperm to the ejaculatory ducts. The sperm can stay here up to a month without any loss of fertility depending upon sexual activity.

Ejaculatory Ducts

The vas deferens and the seminal vesicles converge, just before the entrance of the prostate gland, to form the ejaculatory ducts (Fig. 6-90). The ejaculatory ducts open into the prostatic urethra. Its function is to convey sperm cells to the urethra.

Seminal Vesicles

The seminal vesicles are two pouches attached to the vas deferens near the base of the urinary bladder. The lining of the inner walls of the seminal vesicles secrete an alkaline, viscous, creamy-yellow liquid that contributes about 60% of the semen volume. This fluid is thought to help regulate the pH of the tubular contents as sperm cells are conveyed to the outside. The secretion produced by the seminal vesicles also contains a variety of nutrients, such as fructose (simple sugar) that provides the sperm cells an energy source. At the time of ejaculation, the contents of the seminal vesicles are emptied into the ejaculatory ducts. This action greatly increases the volume of fluid that is discharged by the vas deferens.

Urethra

The urethra is an important organ of both the urinary and reproductive systems. The role of the urethra, in the reproductive system, is to transport sperm through the penis to outside the body. See "The Urinary System" section for information on the structure of the urethra.
Prostate Gland

The prostate gland, made of smooth muscle and glandular tissue, surrounds the first part of the urethra. It resembles a chestnut in shape and size, and secretes a watery, milky-looking, and slightly acidic fluid to keep the sperm mobile. This substance is discharged into the urethra as part of the ejaculate, or semen, during the sexual act and constitutes about 30% of the fluid. Many older men suffer from an enlarged prostate which can squeeze the urethra to complete closure making it impossible to urinate.

Bulbourethral Glands

Bulbourethral glands, also known as Cowper’s glands, are two pea-sized bodies located below the prostate gland and lateral to the membranous urethra (Fig. 6-90). These glands are enclosed by fibers of the external urethral sphincter. They secrete an alkaline fluid that is important for counteracting the acid present in the male urethra and the female vagina. Mucus produced here help with lubrication of the urethra to protect it from damage during ejaculation.

Semen is composed of sperm and secretions from the seminal vesicles, prostate, and bulbourethral glands. It is discharged as the ejaculate during sexual intercourse. There are millions of sperm cells in the semen of each ejaculation, but only one is needed to fertilize the ovum. It is generally considered that fertilization of the ovum occurs while it is still in the fallopian tubes. Therefore, it is apparent that sperm cells can move actively in the seminal fluid deposited in the vagina and through the layers of the secretion lining the uterus and fallopian tubes.

EXTERNAL ACCESSORY ORGANS

The external accessory organs of the male reproductive system include the scrotum and penis (Fig. 6-90).

Scrotum

The scrotum is a cutaneous pouch containing the testes and part of the spermatic cord. Immediately beneath the skin is a thin layer of muscular fibers (the cremaster), which is controlled by temperature and contracts or relaxes to lower or raise the testes in relation to the body. This muscular activity is necessary to regulate the temperature of the testes, which is important in the maturation of sperm cells.

Penis

The penis is a cylindrical organ that conveys urine and semen through the urethra to the outside. The penis is composed of three columns of spongy cavernous tissue, bound together by connective tissue and loosely covered by a layer of skin. Two of the columns, the corpora cavernosa, lie superiorly side by side; the third column smaller in size is the corpus spongiosum, lies below the other two columns. The urethra is located in the corpus spongiosum. The dilated distal end of the corpus spongiosum is known as the glans penis (Fig. 6-90). The urethra terminates at the glans penis.

The cavernous tissue becomes greatly distended with blood during sexual excitement, causing an erection of the penis. The loose skin of the penis folds back on itself at the distal end (forming the prepuce, or foreskin) and cover the glans. The prepuce is sometimes removed by a surgical procedure called a circumcision.
FEMALE REPRODUCTIVE SYSTEM

LEARNING OBJECTIVE:

Identify the parts of the female reproductive system and their function(s).

The organs of the female reproductive system are specialized to produce and maintain the female sex cells, or egg cells; to transport these cells to the site of fertilization; to provide an environment for a developing offspring; to move the offspring outside; and to produce female sex hormones. The primary female reproductive organs are the ovaries. The other structures of the female reproductive system are considered accessory reproductive organs. The accessory organs include both internal and external reproductive organs (Fig. 6-92).

OVARIES

The ovaries are the primary female reproductive organs and produce the female sex cells and sex hormones (Figs. 6-92 and 6-93).

Structure

The ovaries, or female gonads, are two almond-shaped glands suspended by ligaments in the upper pelvic cavity. One ovary on each side of the uterus. The ligaments that suspend the ovaries contain ovarian blood vessels and nerves.

The tissues of an ovary are divided into two regions, an inner medulla and an outer cortex. The ovarian medulla is largely composed of loose connective tissue, numerous blood vessels, lymph vessels, and nerves.

Figure 6-92.—Female reproductive organs. A, Diagram (sagittal section) of pelvis showing location of female reproductive organs.


6-117
surround a developing egg cell and secrete female sex hormones. There are approximately 400,000 primordial follicles at puberty. Fewer than 500 will be released from the ovary during the reproductive life of a female.

At puberty, the anterior pituitary gland secretes increased amounts of FSH (follicle-stimulating hormone). In response, ovaries enlarge and many primordial follicles begin to mature. During this maturation process, the oocyte enlarges and the follicle cells multiply until there are 6 to 12 layers. Fluid-filled spaces begin to appear among the follicle cells. These spaces join to form a single cavity called the antrum. Ten to fourteen days after this process begins, the primordial follicle reaches maturity. The mature primordial follicle (preovulatory or graafian follicle) and its fluid-filled cavity bulges outward on the surface of the ovary, like a blister.

**Ovulation**

Ovulation is the process by which the mature oocyte is released from the primordial follicle. Ovulation is stimulated by hormones from the anterior pituitary gland. These hormones cause the mature follicle to swell rapidly and its walls to weaken. Eventually the wall ruptures, permitting the oocyte and 1 or 2 layers of follicle cells to be released from the ovary's surface.

After ovulation, the oocyte is usually propelled to the opening of a nearby fallopian tube. If the oocyte is not fertilized by a sperm cell within a relatively short time, it degenerates.

The process of ovulation occurs once a month. Each ovary normally releases an ovum every 26 days. The right and left ovary alternately discharges an ovum approximately every 28 days. The menstrual cycle in most women is approximately 28 days (Fig. 6-93).
Female Sex Hormones

Female sex hormones of estrogen and progesterone are produced by the ovaries and various other tissues, such as the adrenal glands, pituitary gland, and placenta (during pregnancy). The primary source for estrogen is the ovaries. At puberty, estrogen stimulates enlargement of various accessory organs, which include the vagina, uterus, fallopian tubes, and external structures. Estrogen is also responsible for the development and maintenance of female secondary sexual characteristics. See section titled “Endocrine System” for listing of secondary female sexual characteristics.

The ovaries are the primary source of progesterone (in a nonpregnant female). This hormone promotes changes that occur in the uterus during the female reproductive cycle. Progesterone stimulates the enlargement of mammary glands and ducts, and increases fat deposits in female breasts during puberty.

INTERNAL ACCESSORY ORGANS

The internal accessory organs of the female reproductive system include a pair of fallopian tubes, the uterus, and the vagina (Fig. 6-94).

Fallopian Tubes (uterine tubes)

The fallopian tubes serve as ducts for the ovaries providing a passageway to the uterus. The fallopian tubes are composed of three tissue layers. These tissue layers include an inner mucosal layer, middle muscular layer, and outer serous layer. They are continuous with the layers of the uterus. The fallopian tubes are in contact with the ovaries but are not continuous with them. Their funnel-shaped openings, called free openings, are fringed with fingerlike processes that pick up an ovum and draw it into the fallopian tubes. As the ovum enters the fallopian tubes, it is transported to the uterus by peristalsis and gravity. Fertilization of an ovum normally takes place in the fallopian tubes.

Figure 6-94.—Female reproductive organs. B, MRI scan (sagittal view) of female pelvic viscera. (B: From Moses K, Nava P, Banks J, Petersen D: Moses atlas of clinical gross anatomy, Philadelphia, 2005, Mosby.)

Uterus (Womb)

The function of the uterus is to receive the embryo that results from the fertilization of an egg cell and to sustain its life during development. The uterus is a hollow, pear-shaped organ with thick, muscular walls. The uterus is divided into two main regions, the body and cervix (Figs. 6-92 and 6-94). The body of the uterus consists of the upper two-thirds of the uterus. The cervix is the lower one-third portion of the uterus that projects into the upper part of the vagina. The cervical opening into the vagina is called the **external os**.

The uterine wall is composed of three layers: endometrium, myometrium, and perimetrium. The inner lining consists of specialized epithelium, called endometrium, which undergoes partial destruction approximately every 28 days in the non-pregnant female. The middle layer, myometrium, consists of bundles of interlaced muscular fibers. The muscular layer produces powerful rhythmic contractions important in the expulsion of the fetus at birth. The perimetrium consists of an outer serosal layer that covers part of the uterine body and none of the cervix. The uterus also has three openings: superiorly and laterally, two openings connect the fallopian tubes to the uterus, and inferiorly, an opening leading to the vagina.

Vagina

The vagina receives the male sperm during intercourse. It forms the lower portion of the birth canal, stretching widely during delivery. In addition, it serves as an excretory duct for uterine secretions and menstrual flow.

The vagina is a fibromuscular tube capable of great distention. The canal is approximately 7-8 cm long extending from the uterus to the outside. The vaginal orifice is partially closed by a thin membrane of tissue called the hymen. The wall of the vagina consists of three layers. The inner mucosal layer does not have mucus glands; mucus found in the vagina comes from the glands of the cervix. The middle muscular layer consists mainly of smooth muscles fibers. At the lower end of the vagina is a thin band of smooth muscle that helps close the vaginal opening. The outer fibrous layer consists of dense fibrous connective tissue interlaced with elastic fibers. These fibers attach the vagina to the surrounding organs.

**EXTERNAL ACCESSORY ORGANS**

Many of the external accessory organs of the female reproductive system are referred to collectively as the **vulva**. The vulva includes the labia majora, the labia minora, the clitoris, and the vestibular glands (Fig. 6-95). The mammary glands are also considered an accessory organ of the female reproductive system.
Figure 6-95.—Vulva (pudendum). A, Sketch showing major features of the external female genitals (genitalia). Compare to Figure 32-2.


Labia Majora

The function of the labia majora is to enclose and protect the other external reproductive organs. The labia majora are composed of two round folds of fat tissue and a thin layer of smooth muscle, covered by skin. On the outer portion of the labia majora, the skin has numerous hairs, sweat glands, and sebaceous glands. The inner portion of skin is thin and hairless. The labia majora extend from the mons pubis anteriorly to the perineum (the region between the vaginal orifice and the anus). The mons pubis is the pad of fatty tissue beneath the skin, which overlies the symphysis pubis.

Labia Minora

Within the labia majora folds are two smaller folds, called the labia minora. The labia minora extend from the clitoris to either side of the vaginal orifice.

Clitoris

The clitoris is a small projectile at the anterior end of the vulva between the labia minora. It is richly endowed with sensory nerves that are associated with the feeling of pleasure during sexual stimulation.

Vestibule

The vestibule is the area enclosed by the labia minora that includes those vaginal and urethral openings. The vestibule contains a pair of vestibular glands, more commonly known as the Bartholin's glands. The Bartholin's glands lay on each side of the vaginal opening. The ducts of these glands secrete fluid that moistens and lubricates the vestibule. There are also the Skene's glands that are near the opening of the urinary meatus by way of two small ducts.
Mammary Glands (Breasts)

The mammary glands are accessory organs of the female reproductive system. They develop during puberty under the influence of the hormones estrogen and progesterone. The breasts are responsible for the secretion of milk (lactation) for the nourishment of newborn infants.

Structurally, the breasts resemble sweat glands. At the center is a nipple containing 15 to 20 depressions into which ducts from the lobes of the gland empty. During pregnancy, placental estrogen and progesterone stimulate further development of the mammary glands in preparation for lactation. After childbirth, hormones secreted by the anterior lobe of the pituitary gland stimulate production for 6 to 9 months.

FEMALE REPRODUCTIVE CYCLE

Females around age 11 begin to experience the female reproductive cycle and continue into middle age, after which it ceases. The female reproductive cycle, or menstrual cycle, is characterized by regular, recurring changes in the uterine lining, resulting in menstrual bleeding (menses).

The first phase of the recurring reproductive cycle is menstrual bleeding. Menstrual bleeding begins when the endometrial lining starts to slough off from the walls of the uterus, and it is characterized by bleeding from the vagina. This is day 1 of the cycle, and this phase usually lasts through day 5.

The time between the last day of the menses and ovulation is known as the postmenstrual phase. It lasts from day 6 through day 13 or 14 and is characterized by proliferation of endometrial cells in the uterus, which develop under the influence of the hormone estrogen.

Ovulation is the rupture of a primordial follicle with the release of a mature ovum into the fallopian tubes. It usually occurs on day 14 or 15 of the cycle. The postovulatory (premenstrual) phase is the time between ovulation and the onset of the menstrual bleeding and normally lasts 14 days. During this phase the ovum travels through the fallopian tubes to the uterus. If the ovum becomes fertilized during this passage, it will become implanted in and nurtured by the newly developed endometrial lining. If fertilization does not take place, the lining deteriorates and eventually sloughs off, marking day 1 of the next cycle.

SUMMARY

This chapter reviewed the basic structures of the cell to the many complex systems of the human body. It outlined how each body system functions and how each system is interdependent upon each other. Anatomical terminology is used in describing location of injuries or conditions. The HM will use this knowledge of human anatomy and physiology when performing patient assessments.