

Basic Human Anatomy

Lesson 8: Urogenital System

Welcome to Lesson 8 of the Basic Human Anatomy Course. Today, we'll be studying the Human Urogenital System.

I have 7 goals for you in this lesson:

1. Define urogenital systems.
2. Identify the function and major parts of the human urinary system.
3. Describe the kidney, including its gross internal structure and the structure of the nephron.
4. Describe the ureters, the urinary bladder, and the urethra.
5. Identify general characteristics of both the male and female genital systems.
6. Describe the ovaries, the uterine tubes, the uterus, the vagina, the external genitalia, and secondary sexual characteristics of human females.
7. Describe the testes, the epididymis, the ductus deferens, the seminal vesicles, the ejaculatory duct, the prostate gland, the penis, and the secondary sexual characteristics of human males.

DEFINITION

The human urogenital systems are made up of the urinary organs, which produce the fluid called urine, and the genital, or reproductive, organs of male and female humans, which together can produce a new human being.

INTRODUCTION TO THE HUMAN URINARY SYSTEM

a. Proteins are one of the basic foodstuffs that humans consume. When proteins are used by the body, there are residue or waste products which can be poisonous (toxic) if allowed to accumulate in large amounts. The urinary system of the human body is specialized to remove these nitrogenous waste products from the circulating blood.

b. **Major Parts.** See figure 8-1 for the major parts of the human urinary system. This system includes two kidneys, two ureters (one connecting each kidney to the urinary bladder), the urinary bladder, and the urethra.

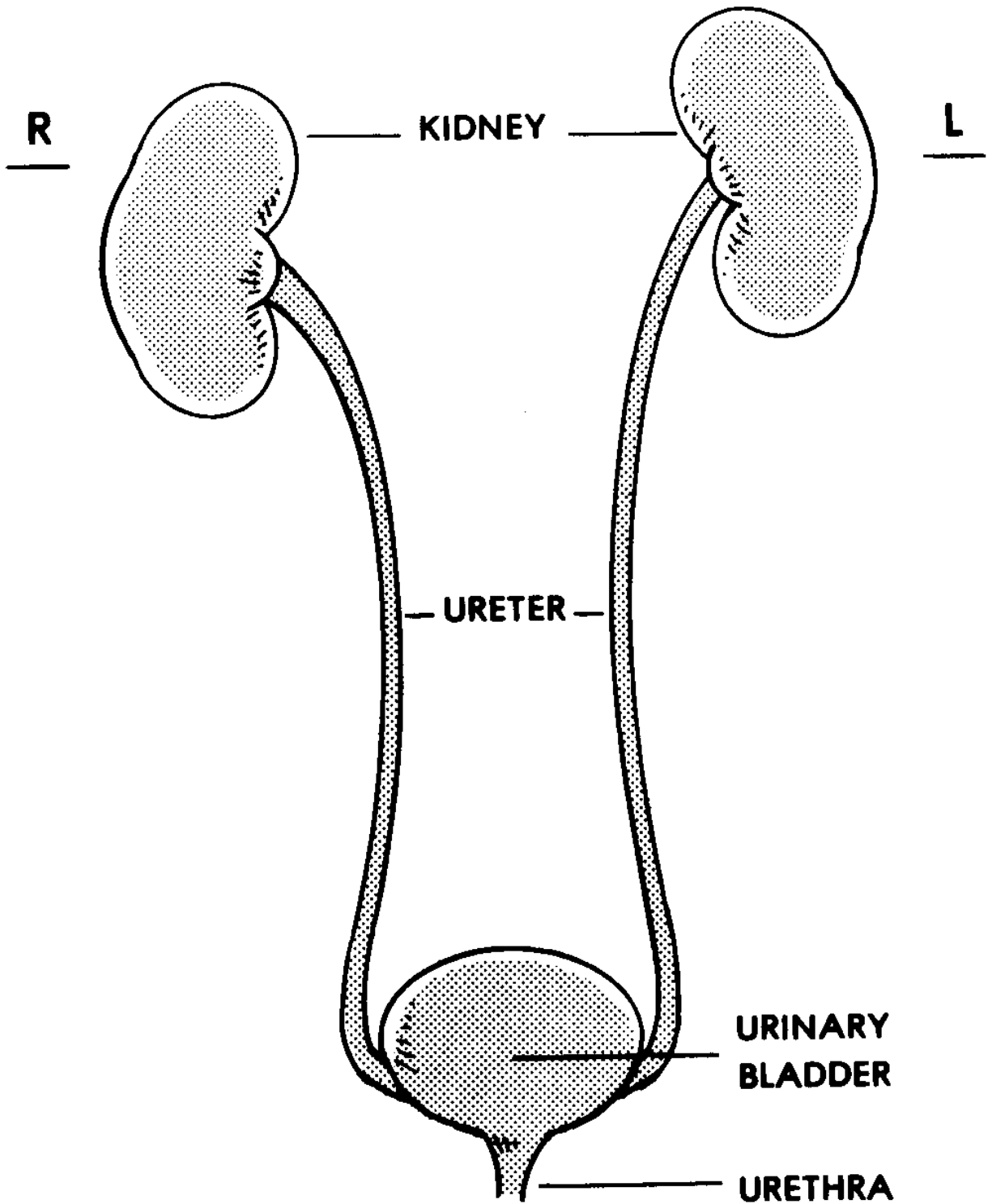


Figure 8-1. The human urinary system.

THE KIDNEY

a. General.

(1) The kidneys have the same shape and color as kidney beans, but are about 8-10 centimeters (3-3 1/2 inches) in length.

(2) Each kidney has a fibrous capsule. On the concave, medial side of each kidney, there is a notch called the hilus. Through this hilus pass the ureter and the NAVL (nerve, artery, vein, and lymphatic) which service the kidney.

(3) Each kidney is attached to the posterior wall of the abdominal cavity, just above the waistline level. Each is held in place by special fascia and fat.

b. **Gross Internal Structure.** If we compare the structure of the kidney with that of a cantaloupe (muskmelon), the renal cortex would correspond to the hard rind, the renal medulla would correspond with the edible flesh of the melon, while the renal sinus would correspond to the hollow center (after the seeds have been removed). The medulla consists of pyramids with their bases at the cortex and forming peaks, papillae, which empty into the sinus.

PAPILLA = pimple, nipple

See figure 8-2 for a section of the kidney showing the inner structure.

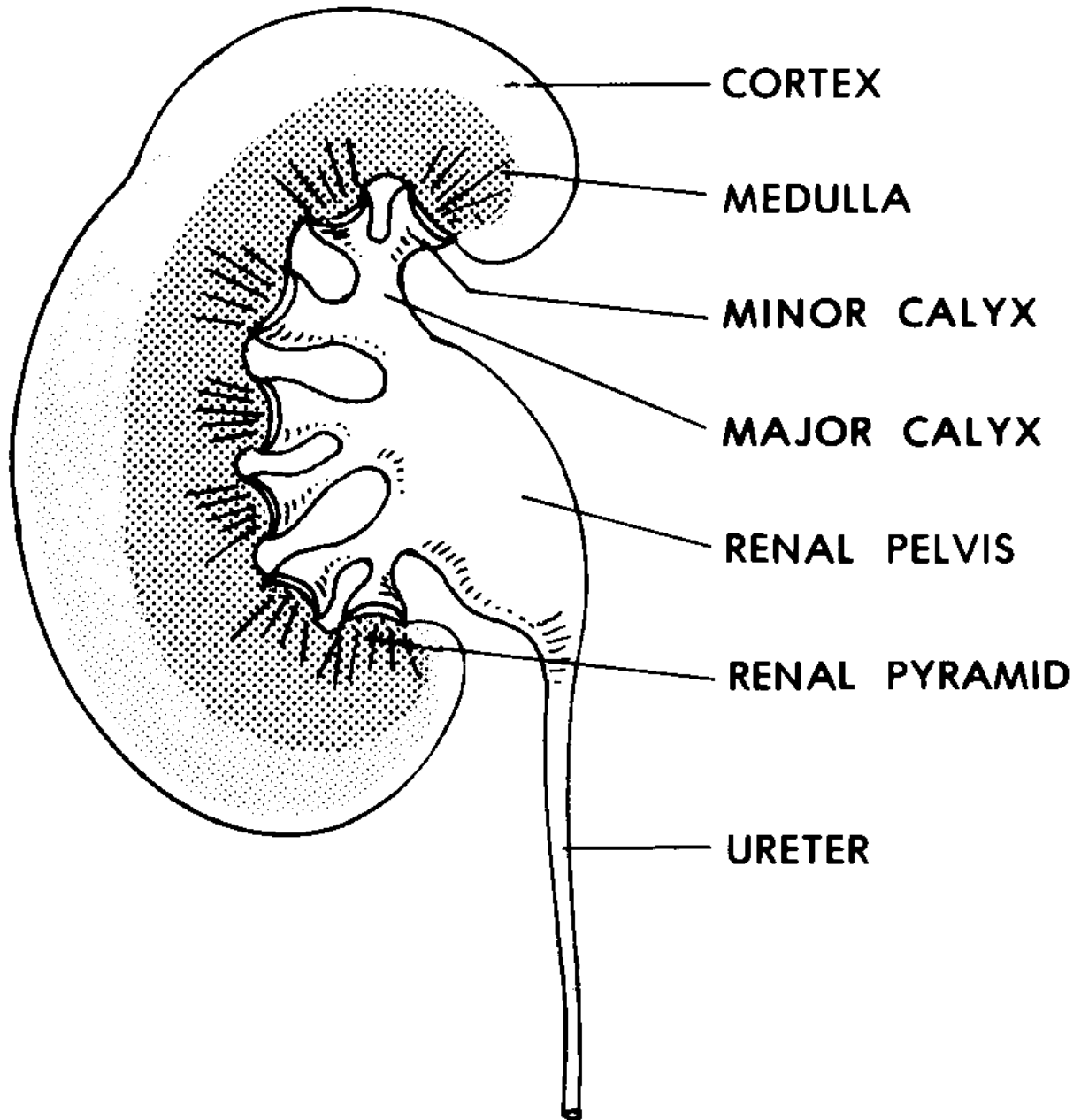


Figure 8-2. A section of a human kidney.

c. **The Nephron.** See figure 8-3 for an illustration of a nephron. Nephrons are the functional units of the human kidney. Their primary function is to remove the wastes of protein usage from the blood. In addition, they serve to conserve water and other materials for continued use by the body. The end result of nephron

function is a more or less concentrated fluid called urine. The kidneys contain great numbers of nephrons, about a million for each kidney. The main subdivisions of a nephron are the renal corpuscle and a tubular system.

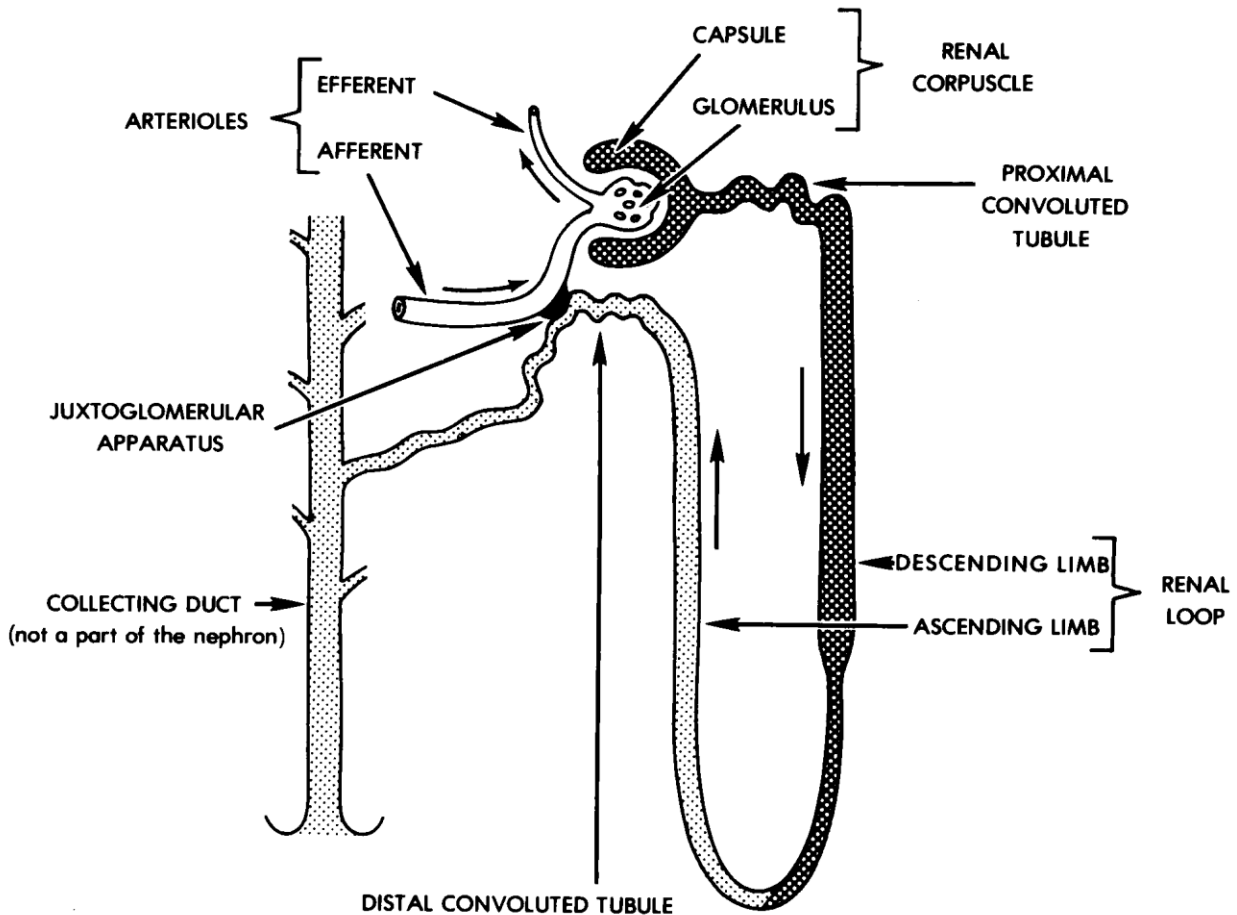


Figure 8-3. A "typical" nephron.

(1) Renal corpuscle. The renal corpuscle has a hollow double-walled sac called the renal capsule ("Bowman's capsule"). Leading into the capsule is a very small artery called the afferent arteriole. Within the capsule, this artery becomes a mass of capillaries known as the glomerulus. An efferent arteriole drains the blood away from the capsule. The capsule and the glomerulus together are known as the renal corpuscle.

(2) Tubules. Each renal capsule is drained by a renal tubule. The first part of this tubule runs quite a distance in a coiled formation and is called the proximal convoluted tubule. A long loop, the renal loop (of Henle), extends down into the medulla with two straight parts and a sharp bend at the bottom. As the tube returns to the cortex layer, it once again becomes coiled and here is known as the distal convoluted tubule.

(3) Filtration/reabsorption. Except for the blood cells and the larger proteins, the fluid portion of the blood passes through the walls of the glomerulus into the cavity between the two layers of the renal capsule. This fluid is called the glomerular filtrate. By a process of taking back (resorption), the majority of the fluid is removed from the tubules and the concentrated fluid is called the urine.

d. **The Collecting Tubule.** The distal convoluted tubules of several nephrons empty into a collecting tubule. The urine is then passed from the collecting tubule at the papilla of the medullary pyramid. Several collecting tubules are present in each pyramid.

e. **Renal Pelvis.** The renal pelvis is a hollow sac within the sinus of the kidney. Urine from the pyramids collects into the funnel-shaped renal pelvis. The ureter then drains the urine from the renal pelvis.

URETERS

The ureters are tubes which connect the kidneys to the urinary bladder. The smooth muscle walls of the ureters produce a peristalsis (wave-like movement) that moves the urine along drop by drop.

URINARY BLADDER

a. The urinary bladder is a muscular organ for storing the urine. Near the inferior posterior corners of the urinary bladder are openings where the ureters empty into the bladder. Also at the inferior aspect of the urinary bladder is the exit, the beginning of the urethra. The triangular area, between the openings of the ureters and the urethra, is called the trigone, or base of the urinary bladder.

b. The urinary bladder wall is stretchable to accommodate varying volumes of urine.

c. Nerve endings called stretch receptors are found in the wall of the urinary bladder. Usually, the pressure within the urinary bladder is low. However, as the volume of the enclosed urine approaches the bladder's capacity, stretching of the wall stimulates the stretch receptors. The cycle of events controlling urination (voiding or emptying of the urinary bladder) is known as the voiding reflex.

URETHRA

The urethra is a tube which conducts the urine from the urinary bladder to the outside of the body. It begins at the anterior base of the urinary bladder.

a. **Urethral Sphincters.** The urethral sphincters are circular muscle masses which control the passage of the urine through the urethra. There are two urethral sphincters--an internal urethral sphincter and an external urethral sphincter.

(1) The internal urethral sphincter is located in the floor of the urinary bladder. It is made of smooth muscle tissue. It is controlled by nerves of the autonomic nervous system (lesson 11).

(2) The external urethral sphincter is more inferior around the urethra in the area of the pelvic floor. It is made up of striated muscle tissue. It is controlled by the peripheral nervous system (lesson 11).

b. **Male-Female Differences.** The female urethra is short and direct. The male urethra is much longer and has two curvatures. Whereas the female urethra serves only a urinary function, the male urethra serves both the urinary and reproductive functions.

INTRODUCTION TO HUMAN GENITAL (REPRODUCTIVE) SYSTEMS

SEXUAL DIMORPHISM

The human male and human female each has a system of organs specifically designed for the production of new humans. These systems are known as reproductive or genital systems. Since there are different systems for males and females, the genital systems are an example of sexual dimorphism.

MORPH = form, shape

DI = two

SEXUAL = according to sex (gender)

SEXUAL DIMORPHISM = having two different forms according to sex

ADVANTAGES OF DOUBLE PARENTING

The existence of two parents for each child means that genetic materials are recombined to produce a new type. This new type may be an improvement over

previous generations.

MAJOR COMPONENT CATEGORIES OF THE GENITAL SYSTEMS

Components of the genital systems may be considered in the following categories:

a. **Primary Sex Organs (Gonads).** Primary sex organs produce sex cells (gametes). A male gamete and a female gamete may be united to form the one-cell beginning of an embryo (the process of fertilization). Primary sex organs also produce sex hormones.

b. **Secondary Sex Organs.** Secondary sex organs care for the product of the primary sex organ.

c. **Secondary Sexual Characteristics.** Secondary sexual characteristics are those traits that tend to make males and females more attractive to each other. Secondary sexual characteristics help to ensure mating. These characteristics first appear during puberty (10-15 years of age).

THE HUMAN FEMALE GENITAL (REPRODUCTIVE) SYSTEM

PRIMARY SEX ORGANS (OVARIES)

The primary sex organ in the human female is the ovary. See figure 8-4 for an illustration of the female genital system. The ovaries are located to the sides of the upper end of the uterus. They are anchored to the posterior surface of the broad ligaments. (The broad ligaments are sheets or folds of peritoneum enclosing the uterus and uterine tubes and extending to the sides of the pelvis.)

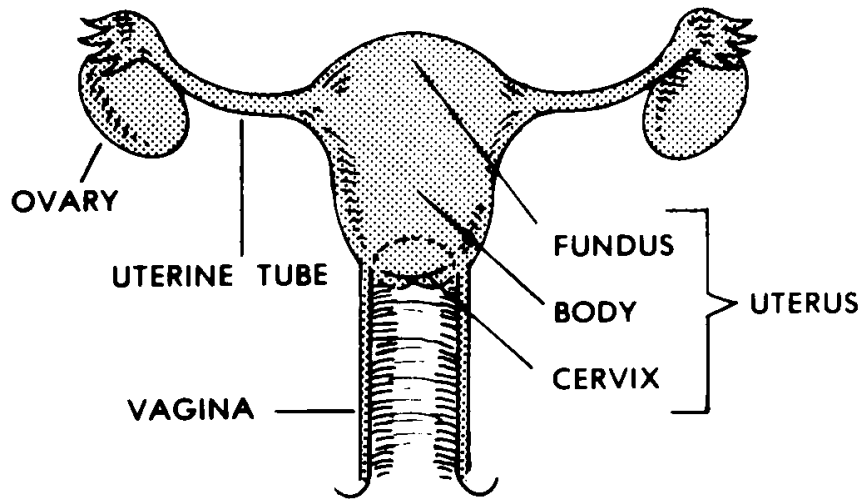
a. The ovary produces the egg cell or ovum (ova, plural).

- b. The ovary produces female sex hormones (estrogens and progesterone).
- c. The production of ova is cyclic. One ovum is released in each menstrual period, about 28 days.

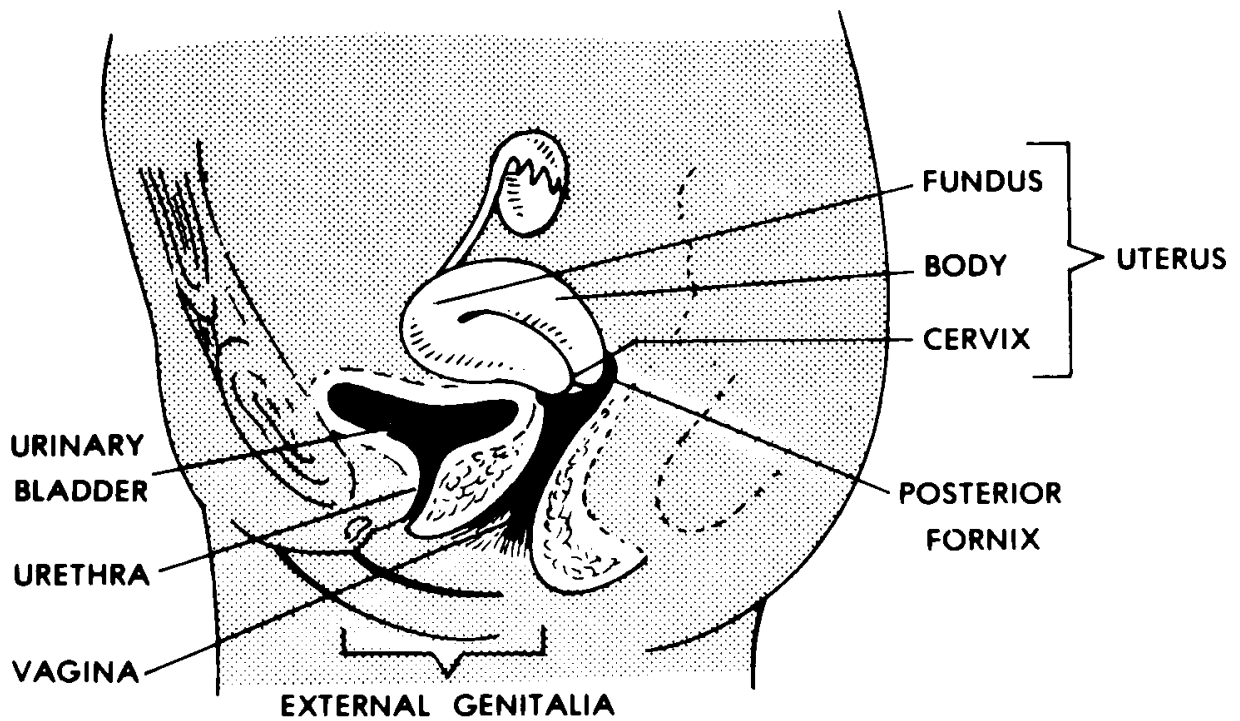
SECONDARY SEX ORGANS

a. **Uterine Tubes (Fallopian Tubes, Oviducts)**. Extending to either side of the uterus are two muscular tubes which open at the outer ends like fringed trumpets. The fringe-like appendages encircle the ovaries. At their medial ends, the uterine tubes open into the uterus. The function of the uterine tubes is to pick up the ovum when released from the ovary and hold it UNTIL one of the following happens:

- (1) It is fertilized. After fertilization, the initial stages of embryo development take place. The developing embryo is eventually moved into the uterus.
- (2) The nutrient stored within the ovum is used up and the ovum dies. This may take three to five days.



A. ANTERIOR VIEW



B. MIDSAGITTAL SECTION

Figure 8-4. The human female genital system.

b. **Uterus.** The uterus is the site where all but the first few days of embryo development takes place. After eight weeks of embryonic development, it is known as the fetus.

(1) Main subdivisions. The uterus is shaped like a pear, with the stem (cervix) facing downward and toward the rear. The fundus is the portion of the uterus above the openings of the uterine tubes. The main part, or body, is the portion between the cervix and the fundus. The uterus usually leans forward with the body slightly curved as it passes over the top of the urinary bladder. The cervix opens into the upper end of the vagina.

(2) Wall structure. The inner lining of the uterus is called the endometrium. Made up of epithelium, it is well supplied with blood vessels and glands. The muscular wall of the uterus is called the myometrium. In the body of the uterus, the muscular tissue is in a double spiral arrangement. In the cervix, it is in a circular arrangement.

(3) Age differences. The uterus of an infant female is undeveloped. During puberty, the uterus develops. The uterus of an adult is fully developed. The uterus of an old woman is reduced in size and nonfunctional.

c. **Vagina.** The vagina is a tubular canal connecting the cervix of the uterus with the outside. It serves as a birth canal and as an organ of copulation. It is capable of stretching during childbirth. The lower opening of the vagina may be partially closed by a thin membrane known as the hymen.

d. **External Genitalia.** Other terms for the external genitals of the human female are vulva and pudendum. Included are the:

(1) Mons pubis. The mons pubis is a mound of fat tissue covered with skin and hair in front of the symphysis pubis (the joint of the pubic bones).

(2) Labia majora. Extending back from the mons pubis and encircling the vestibule (discussed below) are two folds known as the labia majora. Their construction is similar to the mons pubis, including fatty tissue and skin. The outer surfaces are covered with hair. The inner surfaces are moist and smooth. The corresponding structure in the male is the scrotum.

LABIA = lips (LABIUM, singular)

(3) Labia minora. The labia minora are two folds of skin lying within the labia majora and also enclosing the vestibule. In front, each labium minus (minus = singular of minora) divides into two folds. The fold above the clitoris (discussed below) is called the prepuce of the clitoris. The fold below is the frenulum.

(4) Clitoris. The clitoris is a small projection of sensitive erectile tissue which corresponds to the male penis. However, the female urethra does not pass through the clitoris.

(5) Vestibule. The cleft between the labia minora and behind the clitoris is called the vestibule. It includes the urethral opening in front and the vaginal opening slightly to the rear.

e. **Pregnancy and Delivery.** When an embryo forms an attachment to the endometrium, a pregnancy exists. The attachment eventually forms a placenta, an organ joining mother and offspring for such purposes as nutrition of the offspring. The fetal membranes surround the developing individual (fetus) and are filled with amniotic fluid.

(1) During the first eight weeks, the developing organism is known as an embryo. During this time, the major systems and parts of the body develop.

(2) During the remainder of the pregnancy, the developing organism is known as the fetus. During this time, growth and refinement of the body parts occur.

(3) Parturition is the actual delivery of the fetus into a free- living state. The delivery of the fetus is followed by a second delivery-- that of the placenta and fetal membranes.

f. **Menstruation and Menopause.** About two weeks after an ovum is released, if it is not fertilized, menstruation occurs. Menstruation involves the loss of all but the basal layer of the endometrium. This process includes bleeding. It first occurs at puberty and lasts until menopause (45 to 55 years of age). After menopause, pregnancy is no longer possible.

SECONDARY SEXUAL CHARACTERISTICS

The secondary sexual characteristics of females include growth of pubic hair, development of mammary glands, development of the pelvic girdle, and deposition of fat in the mons pubis and labia majora.

MAMMARY GLANDS

The mammary glands were previously mentioned in Lesson 3. Secretion of milk begins after parturition. Stimulation from suckling helps to maintain the normal rate of milk secretion. At the time of menopause, breast tissue becomes less prominent.

THE HUMAN MALE GENITAL (REPRODUCTIVE) SYSTEM

PRIMARY SEX ORGANS (TESTES)

The primary sex organ of the human male is the testis. See figure 8-5 for an illustration of the male genital system. The testes are egg-shaped.

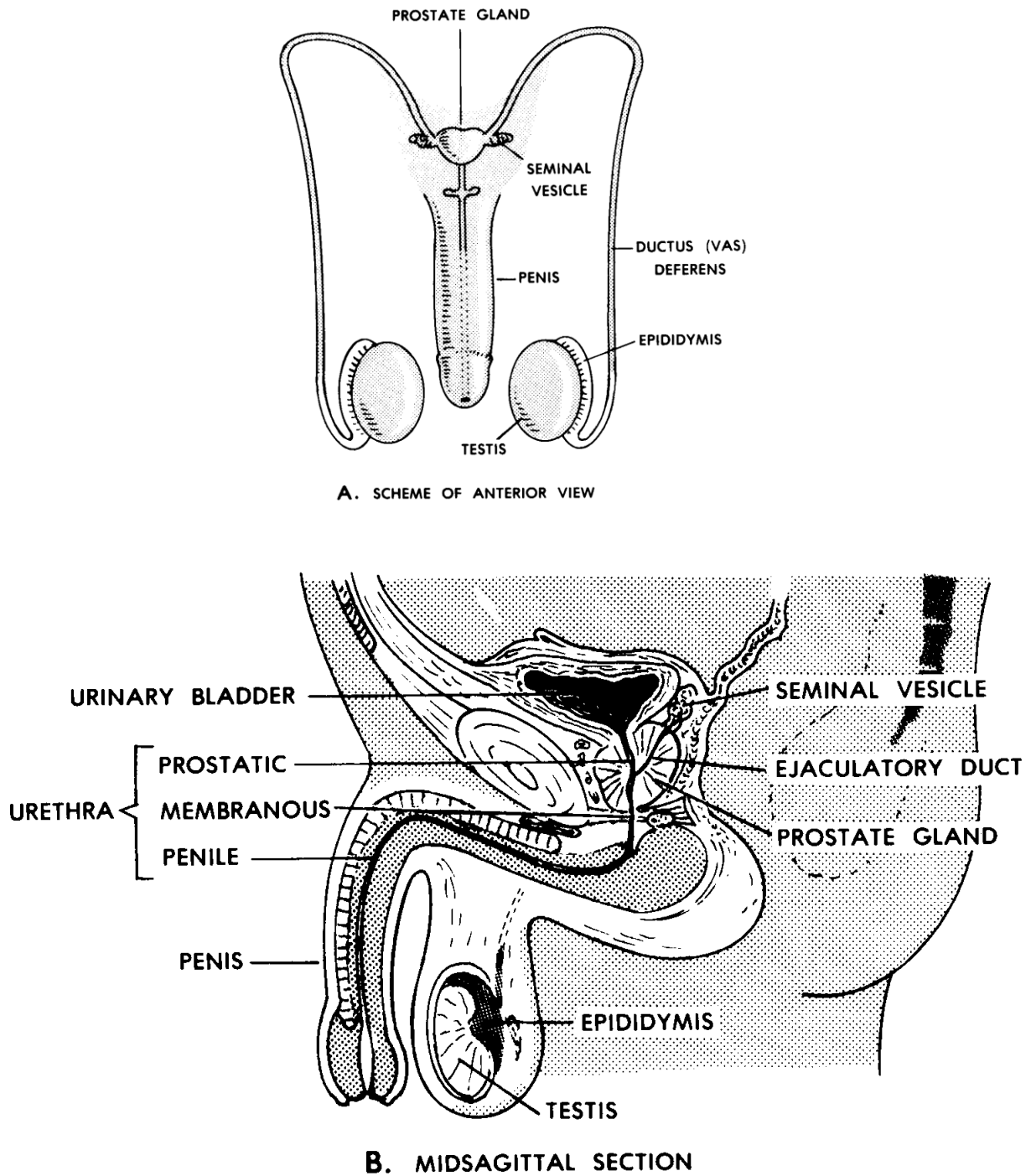


Figure 8-5. The human male genital system.

a. **Location.** The paired testes lie within the scrotum. The scrotum is a sac of loose skin attached in the pubic area of the lower abdomen. The scrotum provides a site cooler than body temperature to maintain the viability of the spermatozoa. However, when the air is too cold, muscles and muscular fibers draw the testes and scrotum closer to the body to maintain warmth. Otherwise, the scrotum hangs loosely. The tunica vaginalis is a serous cavity surrounding each testis.

b. **Functions.** The testis produces the male sex cells called spermatozoa (spermatozoon, singular). The spermatozoa are continuously produced by the millions. One such cell may eventually fertilize an ovum of a human female. The testes also produce male sex hormones called androgens.

SECONDARY SEX ORGANS

a. **Epididymis.** The epididymis is a coiled tube whose function is to aid in the maturation of spermatozoa. Its coiled length is only about one and one-half inches. Its uncoiled length is about 16 feet. When coiled, it extends downward along the posterior side of each testis. Its lining secretes a nutritive medium for spermatozoa. It receives spermatozoa from the testes in an immature state. As the spermatozoa pass through the nutrient, they mature.

b. **Ductus (Vas) Deferens.** The ductus deferens is a transporting tube which carries the mature sperm from the epididymis to the prostate. Each tube enters the abdomen through the inguinal canal. Each passes over a ureter to reach the back of the urinary bladder and then down to the prostate gland.

c. **Seminal Vesicles.** Lying alongside each ductus deferens as it crosses the back of the bladder is a tubular structure called the seminal vesicle. The seminal vesicle produces a fluid which becomes part of the ejaculate.

d. **Ejaculatory Duct.** Each ductus deferens and its corresponding seminal vesicle converge to form a short tube called the ejaculatory duct. The ejaculatory duct opens into the urethra within the prostate gland. The ejaculatory duct carries both spermatozoa and seminal vesicle fluid.

e. **Prostate Gland.** As the urethra leaves the urinary bladder, its first inch is surrounded by a chestnut-size gland called the prostate gland. The prostate gland provides an additional fluid to be added to the spermatozoa and seminal vesicle fluid.

f. **Penis.** As the urethra leaves the abdomen, it passes through the penis, the male organ of copulation.

(1) Surrounding the urethra is a central cylinder of erectile tissue called the corpus spongiosum. This cylinder is bulb-shaped at each end. The posterior end is attached to the base of the pelvis. The sensitive anterior end is known as the glans.

CORPUS SPONGIOSUM = spongy body

(2) Overlying the corpus spongiosum is a pair of cylinders of erectile tissue called the corpora cavernosa. These two cylinders are separate in their proximal fourth and joined in their distal three-fourths. They are attached to the pubic bones. Together, the corpus spongiosum and the corpora cavernosa combine to form the shaft of the penis.

CORPUS CAVERNOSUM = cavernous body

(3) The prepuce, or foreskin, is a covering of skin for the glans. It may be removed in a surgical procedure called circumcision.

SECONDARY SEXUAL CHARACTERISTICS

The secondary sexual characteristics of male include growth of facial, pubic, and chest hair; growth of the larynx to deepen the the voice; and deposition of protein to increase muscularity and general body size.

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