Vocabulary Related to the Urinary System

Terms marked with the ❖ symbol are pronounced on the Student Activity CD-ROM that accompanies this text.

KEY WORD PARTS

- ☐ **dia-**
- ☐ **-cele**
- ☐ **cyst/o**
- ☐ **-ectasis**
- ☐ **glomerul/o**
- ☐ **lith/o**
- ☐ **-lysis**
- ☐ **nephr/o**
- ☐ **-pexy**
- ☐ **pyel/o**
- ☐ **ren/o**
- ☐ **-tripsy**
- ☐ **ureter/o**
- ☐ **urethr/o**
- ☐ **-uria**

KEY MEDICAL TERMS

- ☐ **anuria** (ah-**NEW**-ree-ah) ❖
- ☐ **catheterization** (**kath**-eh-ter-eye-**ZAY**-shun) ❖
- ☐ **cystalgia** (sis-**TAL**-jee-ah) ❖
- ☐ **cystectomy** (sis-**TECK**-toh-mee) ❖
- ☐ **cystitis** (sis-**TYE**-tis) ❖
- ☐ **cystocele** (**SIS**-toh-seel) ❖
- ☐ **cystography** (sis-**TOG**-rah-fee) ❖
- ☐ **cystolith** (**SIS**-toh-lith) ❖
- ☐ **cystopexy** (**sis**-toh-**peck**-see) ❖
- ☐ **cystorrhagia** (**sis**-toh-**RAY**-jee-ah) ❖
- ☐ **cystorrhaphy** (sis-**TOR**-ah-fee) ❖
- ☐ **cystoscopy** (sis-**TOS**-koh-pee) ❖
- ☐ **diuresis** (**dye**-you-**REE**-sis) ❖
- ☐ **diuretics** (**dye**-you-**RET**-icks)
- ☐ **dysuria** (dis-**YOU**-ree-ah) ❖
- ☐ **enuresis** (**en**-you-**REE**-sis) ❖
- ☐ **epispadias** (**ep**-ih-**SPAY**-dee-as) ❖
- ☐ **glomerulonephritis** (gloh-**mer**-you-loh-neh-**FRY**-tis) ❖
- ☐ **glomerulus** (gloh-**MER**-you-lus)
- ☐ **hemodialysis** (**hee**-moh-dye-**AL**-ih-sis) ❖
- ☐ **homeostasis** (**hoh**-mee-oh-**STAY**-sis)
- ☐ **hydronephrosis** (**high**-droh-neh-**FROH**-sis) ❖
- ☐ **hydroureter** (**high**-droh-you-**REE**-ter)
- ☐ **hypospadias** (**high**-poh-**SPAY**-dee-as) ❖
- ☐ **incontinence** (in-**KON**-tih-nents)
- ☐ **interstitial cystitis** (**in**-ter-**STISH**-al sis-**TYE**-tis)
- ☐ **lithotomy** (lih-**THOT**-oh-mee)
- ☐ **lithotripsy** (**LITH**-oh-**trip**-see) ❖
- ☐ **meatotomy** (**mee**-ah-**TOT**-oh-mee) ❖
- ☐ **micturition** (**mick**-too-**RISH**-un)
- ☐ **nephrectasis** (neh-**FRECK**-tah-sis) ❖
- ☐ **nephritis** (neh-**FRY**-tis)
- ☐ **nephrolith** (**NEF**-roh-lith) ❖
- ☐ **nephrolithiasis** (**nef**-roh-lih-**THIGH**-ah-sis) ❖
- ☐ **nephrolithotomy** (**nef**-roh-lih-**THOT**-oh-mee) ❖
- ☐ **nephrologist** (neh-**FROL**-oh-jist)
- ☐ **nephrolysis** (neh-**FROL**-ih-sis) ❖
- ☐ **nephropathy** (neh-**FROP**-ah-thee)
- ☐ **nephropexy** (**NEF**-roh-**peck**-see) ❖
- ☐ **nephroptosis** (**nef**-rop-**TOH**-sis) ❖
- ☐ **nephropyosis** (**nef**-roh-pye-**OH**-sis) ❖
- ☐ **nephrosis** (neh-**FROH**-sis) ❖
- ☐ **nephrostomy** (neh-**FROS**-toh-me)
- ☐ **nephrotic syndrome** (neh-**FROT**-ick) ❖
- ☐ **nocturia** (nock-**TOO**-ree-ah) ❖
- ☐ **oliguria** (**ol**-ih-**GOO**-ree-ah) ❖
- ☐ **paraspadias** (**par**-ah-**SPAY**-dee-as) ❖
- ☐ **peritoneal dialysis** (**pehr**-ih-toh-**NEE**-al dye-**AL**-ih-sis) ❖
- ☐ **polyuria** (**pol**-ee-**YOU**-ree-ah) ❖
- ☐ **pyelitis** (**pye**-eh-**LYE**-tis) ❖
- ☐ **pyelogram** (**PYE**-eh-loh-**gram**) ❖
- ☐ **pyelonephritis** (**pye**-eh-loh-neh-**FRY**-tis) ❖
- ☐ **pyeloplasty** (**PYE**-eh-loh-**plas**-tee) ❖
- ☐ **pyelotomy** (**pye**-eh-**LOT**-oh-mee) ❖
- ☐ **suprapubic** (**soo**-prah-**PYOU**-bick)
- ☐ **uremia** (you-**REE**-mee-ah) ❖
- ☐ **ureterectasis** (you-**ree**-ter-**ECK**-tah-sis) ❖
- ☐ **ureterectomy** (**you**-ree-ter-**ECK**-toh-mee) ❖
- ☐ **ureterolith** (you-**REE**-ter-oh-**lith**) ❖
- ☐ **ureteroplasty** (you-**REE**-ter-oh-**plas**-tee) ❖
- ☐ **ureterorrhagia** (you-**ree**-ter-oh-**RAY**-jee-ah) ❖
- ☐ **ureterorrhaphy** (**you**-ree-ter-**OR**-ah-fee)
- ☐ **ureterostenosis** (you-**ree**-ter-oh-steh-**NOH**-sis) ❖
- ☐ **urethralgia** (**you**-ree-**THRAL**-jee-ah) ❖
- ☐ **urethritis** (**you**-reh-**THRIGH**-tis) ❖
- ☐ **urethropexy** (you-**REE**-throh-**peck**-see) ❖
- ☐ **urethroplasty** (you-**REE**-throh-**plas**-tee) ❖
- ☐ **urethrorrhagia** (you-**ree**-throh-**RAY**-jee-ah) ❖
- ☐ **urethrorrhaphy** (**you**-reh-**THROR**-ah-fee) ❖
- ☐ **urethrorrhea** (you-**ree**-throh-**REE**-ah) ❖
- ☐ **urethrostenosis** (you-**ree**-throh-steh-**NOH**-sis) ❖
- ☐ **urethrostomy** (**you**-reh-**THROS**-toh-mee) ❖
- ☐ **urethrotomy** (**you**-reh-**THROT**-oh-mee) ❖
- ☐ **urography** (you-**ROG**-rah-fee) ❖
- ☐ **vesicovaginal fissure** (**ves**-ih-koh-**VAG**-ih-nahl)

Objectives

Upon completion of this chapter, you should be able to:

1. Describe the major functions of the urinary system.
2. Name and describe the structures of the urinary system.
3. Recognize, define, spell, and pronounce terms related to the pathology and diagnostic and treatment procedures of the urinary system.

FUNCTIONS OF THE URINARY SYSTEM

The urinary system performs many functions that are important in maintaining **homeostasis** (**hoh**-mee-oh-**STAY**-sis), a state of equilibrium that produces a constant internal environment throughout the body (**home/o** means sameness and **-stasis** means control). To achieve this, the urinary system

- Maintains the proper balance of water, salts, and acids in the body fluids by removing excess fluids from the body or reabsorbing water as needed.
- Constantly filters the blood to remove urea and other waste materials from the bloodstream. **Urea** (you-**REE**-ah) is the major waste product of protein metabolism.
- Converts these waste products and excess fluids into **urine** in the kidneys and excretes them from the body via the urinary bladder.

STRUCTURES OF THE URINARY SYSTEM

The urinary system consists of two kidneys, two ureters, one bladder, and a urethra (Figure 9.1). The adrenal glands, which are part of the endocrine system, are located on the top of the kidneys.

THE KIDNEYS

The kidneys constantly filter the blood to remove waste products and excess water. These are excreted as urine, which is 95 percent water and 5 percent other wastes.

- The two kidneys are located retroperitoneally with one on each side of the vertebral column below the diaphragm. *Retroperitoneally* means located behind the peritoneum, which is the membrane that lines the abdominal cavity.
- Each kidney consists of two layers that surround the **renal pelvis** (Figure 9.2A). *Renal* (**REE**-nal) means pertaining to the kidneys.
- The **renal cortex** (**KOR**-tecks) is the outer layer of the kidney. It contains over one million microscopic units called **nephrons.**
- The **medulla** (meh-**DULL**-ah) is the inner layer, and it contains most of the urine-collecting tubules. (A *tubule* is a small tube.)

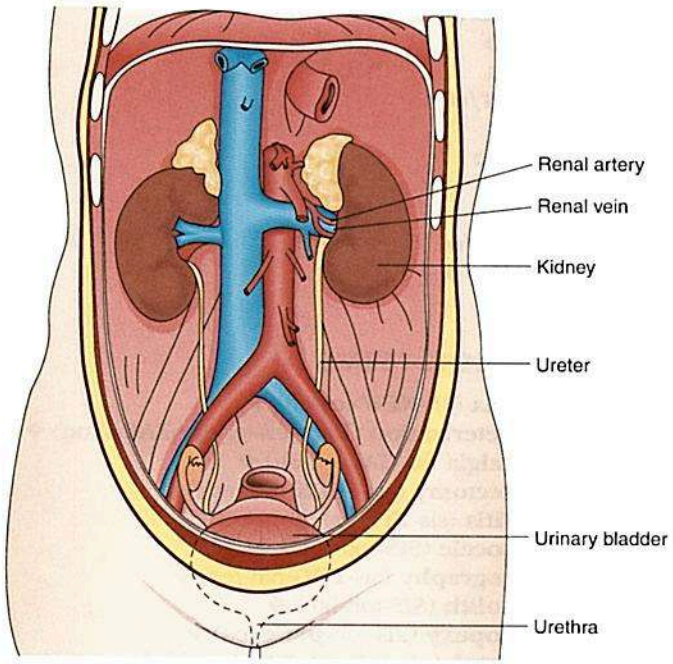


FIGURE 9.1 The primary structures of the urinary system: the kidneys, ureters, urinary bladder, and urethra.

The Nephrons

Nephrons (**NEF**-rons) are the functional units of the kidneys. They form urine by the processes of filtration, reabsorption, and secretion (Figure 9.2B).

- Each nephron contains a **glomerulus** (gloh-**MER**-you-lus), which is a cluster of capillaries surrounded by a membrane called the Bowman's capsule (plural, **glomeruli**).
- Blood flows into the kidney through the renal artery. It is filtered in the capillaries of the glomerulus and leaves the kidney through the renal vein.
- Waste products pass through a series of urine-collecting tubules and are transported to the **renal pelvis** before entering the ureters.
- **Urochrome** (**YOU**-roh-krome) is the pigment that gives urine its normal yellow-amber or straw color (**ur/o** means urine and **-chrome** means color). The color of urine can be influenced by normal factors such as the amount of liquid consumed or by diseases and medications.

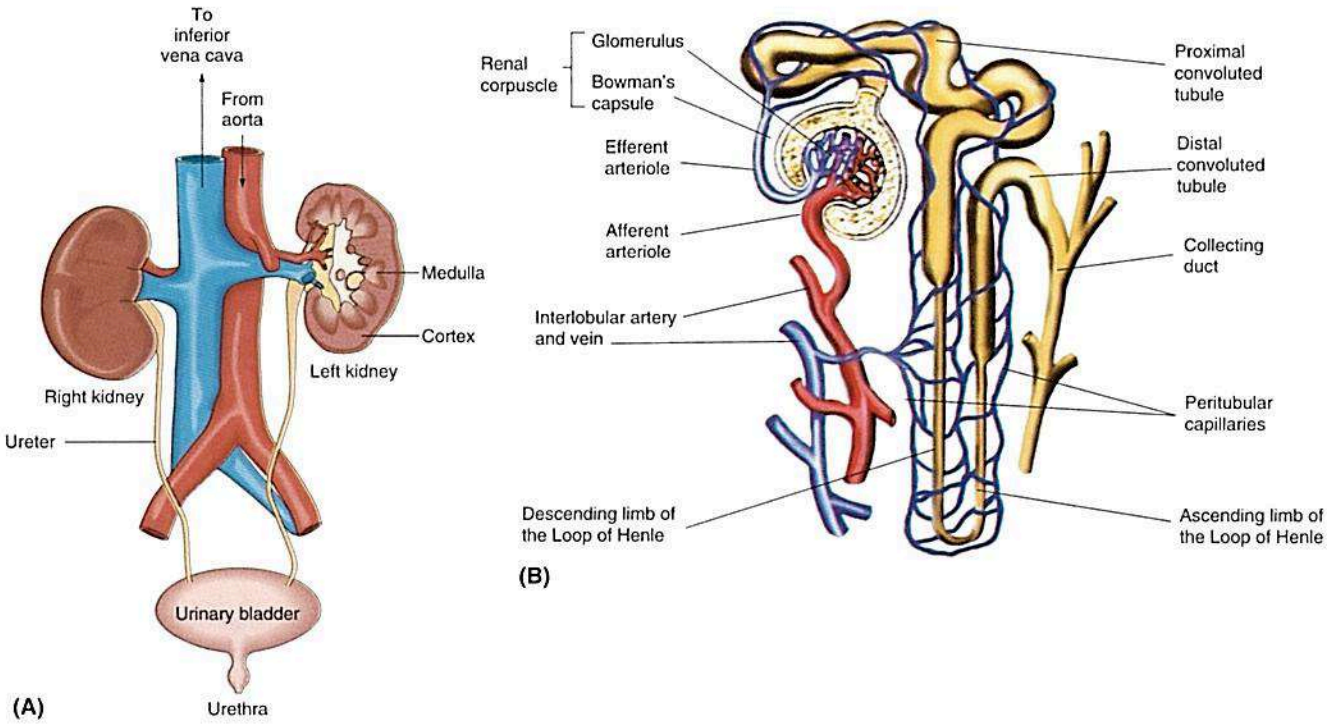


FIGURE 9.2 Structures and blood flow of the kidneys. (A) The kidneys, ureters, and bladder. (B) A nephron unit and its associated structures. The small arrows indicate the flow of blood through the nephron.

THE URETERS

The **ureters** (you-**REE**-ters) are narrow tubes, each about 10 to 12 inches long. Each ureter carries urine from a kidney to the urinary bladder.

THE URINARY BLADDER

The **urinary bladder** (Figure 9.3) is a hollow muscular organ that is a reservoir for urine. It is located in the anterior portion of the pelvic cavity behind the pubic symphysis and stores about one pint of urine. In a pregnant woman the uterus rests on the bladder and this pressure may decrease its capacity.

THE URETHRA

The **urethra** (you-**REE**-thrah) is the tube extending from the bladder to the outside of the body. (*Caution:* The spellings of *ureter* and *urethra* are very similar!)

- Two **urinary sphincters,** one located at either end of the urethra, control the flow of urine from the bladder into the urethra and out of the urethra through the urethral meatus. (A *sphincter* is a ringlike muscle that closes a passageway.)
- The **urethral meatus** (you-**REE**-thrahl mee-**AY**-tus), also known as the **urinary meatus,** is the external opening of the urethra.
- The **female urethra** is approximately 1.5 inches long. The urethral meatus is located between the clitoris and the opening of the vagina. In the female, the urethra conveys only urine (see Figure 9.3).

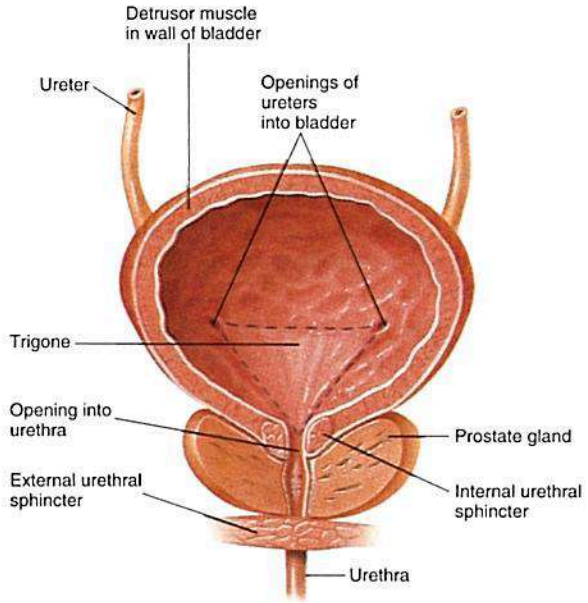


FIGURE 9.3 The anatomy of the urinary bladder in the male.

- The **male urethra** is approximately eight inches long, and the urethral meatus is located at the tip of the penis. In the male, the urethra conveys both urine and semen. The neck of the urethra is surrounded by the prostate gland (see Figure 9.3), which is part of the reproductive system and is discussed further in Chapter 14.

THE EXCRETION OF URINE

As the bladder fills up, pressure is placed on the base of the urethra, resulting in the urge to **urinate** or **micturate.**

- **Urination,** also known as **micturition** (**mick**-too-**RISH**-un) or **voiding,** is the normal process of excreting urine.
- Urination requires the coordinated contraction of the bladder muscles and relaxation of the sphincters. This action forces the urine through the urethra and out through the urinary meatus.

MEDICAL SPECIALTIES RELATED TO THE URINARY SYSTEM

- A **nephrologist** (neh-**FROL**-oh-jist) specializes in diagnosing and treating diseases and disorders of the kidneys (**nephr** means kidney and **-ologist** means specialist).
- A **urologist** (you-**ROL**-oh-jist) specializes in diagnosing and treating diseases and disorders of the urinary system of females and the genitourinary system of males (**ur** means urine and **-ologist** means specialist).

PATHOLOGY OF THE URINARY SYSTEM

RENAL FAILURE

Renal failure, also known as **kidney failure,** is the inability of the kidney or kidneys to perform their functions. The body cannot replace damaged nephrons. When too many nephrons have been destroyed, the result is kidney failure.

- **Anuria** (ah-**NEW**-ree-ah), also known as **anuresis** (**an**-you-**REE**-sis), is the complete suppression (stopping) of urine formation by the kidneys (**an-** means without and **-uria** means urination).
- **Uremia** (you-**REE**-mee-ah), also known as **uremic poisoning,** is a toxic condition caused by excessive amount of urea and other waste products in the bloodstream (**ur** means urine and **-emia** means blood condition).
- **Acute renal failure (ARF)** has sudden onset and is characterized by uremia. ARF may be caused by many factors, including a drop in blood volume or blood pressure due to injury or surgery.
- **Chronic renal failure (CRF)** is a progressive disease that may be caused by a variety of conditions. When kidney function is insufficient, dialysis or transplantation is required.
- **End-stage renal disease (ESRD)** refers to the late stages of chronic renal failure.

NEPHROTIC SYNDROME

Nephrotic syndrome (neh-**FROT**-ick) **(NS)** is a general group of kidney diseases (**nephr/o** means kidney and **-tic** means pertaining to). The following are characteristics of kidney malfunction diseases:

- **Edema** (excessive fluid in the body tissue)
- **Hyperproteinuria** (abnormally *high* concentrations of protein [albumin] in the urine)
- **Hypoproteinemia** (abnormally *low* concentrations of protein [albumin] in the blood)
- **Hyperlipidemia** (abnormally *large* amount of lipids in the blood)

Nephrosis

- **Nephrosis** (neh-**FROH**-sis) and **nephropathy** (neh-**FROP**-ah-thee) both mean diseases of the kidney, and these terms are used interchangeably with nephrotic syndrome (**nephr** means kidney and **-osis** means abnormal condition).
- **Diabetic nephropathy** is a result of the damage to the kidney's capillary blood vessels that is caused by long-term diabetes mellitus (**nephr/o** means kidney and **-pathy** means disease).

THE KIDNEYS

- **Glomerulonephritis** (gloh-**mer**-you-loh-neh-**FRY**-tis) is an inflammation of the kidney involving primarily the glomeruli (**glomerul/o** means glomeruli, **nephr** means kidney, and **-itis** means inflammation). In acute glomerulonephritis, the urine is dark brown or black. This condition is often related to an autoimmune problem.
- **Hydronephrosis** (**high**-droh-neh-**FROH**-sis) is the dilation (enlargement) of the renal pelvis of one or both kidneys (**hydr/o** means water, **nephr** means kidney, and **-osis** means abnormal condition). This is the result of an obstruction of the flow of urine (Figure 9.4).
- **Nephrectasis** (neh-**FRECK**-tah-sis) is the distention of a kidney (**nephr** means kidney and **-ectasis** means enlargement or stretching. *Distention* means the state of being enlarged).
- **Nephritis** (neh-**FRY**-tis) is an inflammation of the kidney (**nephr** means kidney and **-itis** means inflammation).
- **Nephroptosis** (**nef**-rop-**TOH**-sis), also known as a **floating kidney,** is the downward displacement of the kidney (**nephr/o** means kidney and **-ptosis** means or dropping down).
- **Nephropyosis** (**nef**-roh-pye-**OH**-sis) is suppuration of the kidney (**nephr/o** means kidney, **py** means pus, and **-osis** means condition). *Suppuration* means the formation or discharge of pus.
- **Pyelitis** (**pye**-eh-**LYE**-tis) is an inflammation of the renal pelvis (**pyel** means renal pelvis and **-itis** means inflammation).

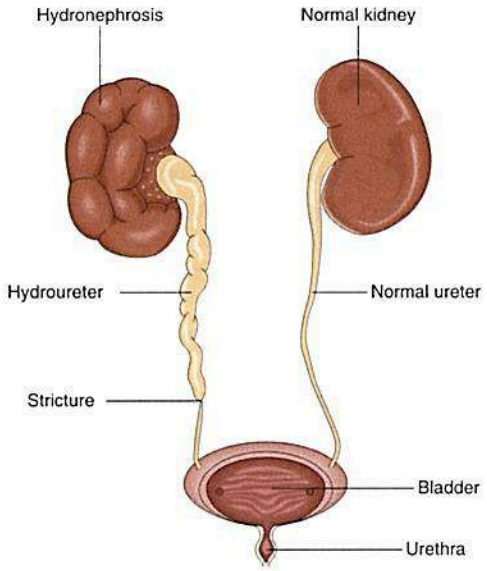


FIGURE 9.4 Hydroureter and hydronephrosis resulting from a urethral stricture.

- **Pyelonephritis** (**pye**-eh-loh-neh-**FRY**-tis) is an inflammation of the renal pelvis and of the kidney (**pyel/o** means renal pelvis, **nephr** means kidney, and **-itis** means inflammation).
- **Renal colic** (**REE**-nal **KOLL**-ick) is an acute pain in the kidney area that is caused by blockage during the passage of a kidney stone.

STONES

A **stone,** also known as **calculus** (**KAL**-kyou-luhs), is an abnormal mineral deposit (plural, **calculi**). These stones vary in size from small sandlike granules to the size of marbles and are named for the organ or tissue where they are located. See Figure 9.5 and Table 9.1.

- **Nephrolithiasis** (**nef**-roh-lih-**THIGH**-ah-sis) is a disorder characterized by the presence of stones in the kidney (**nephr/o** means kidney and **-lithiasis** means the presence of stones).

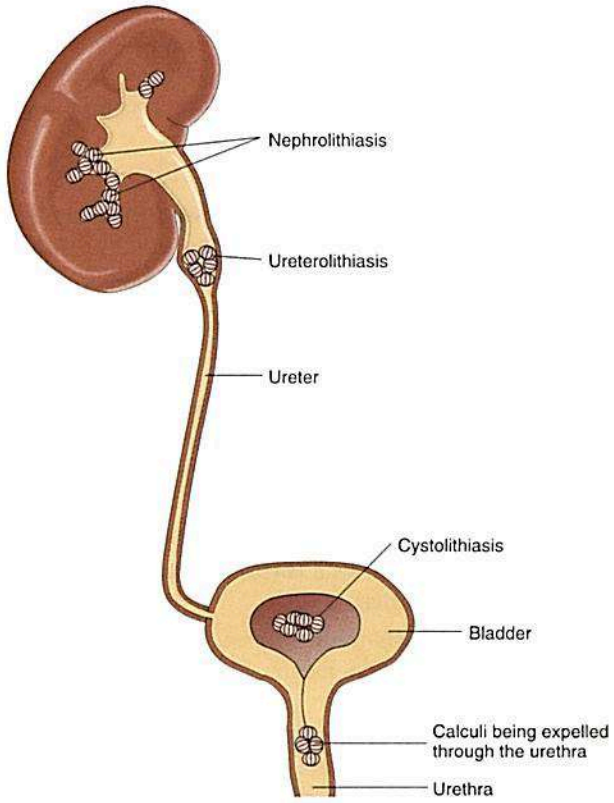


FIGURE 9.5 Calculi of the urinary system.

THE URETERS

- **Hydroureter** (**high**-droh-you-**REE**-ter) is the distention (stretching out) of the ureter with urine that cannot flow because the ureter is blocked (**hydr/o** means water and **-ureter** means ureter). See Figure 9.4.
- **Ureterectasis** (you-**ree**-ter-**ECK**-tah-sis) is the distention of a ureter (**ureter** means ureter and **-ectasis** means enlargement).
- **Ureterorrhagia** (you-**ree**-ter-oh-**RAY**-jee-ah) is the discharge of blood from the ureter (**ureter/o** means ureter and **-rrhagia** means bleeding).

Table 9.1

TYPES AND LOCATIONS OF URINARY STONES

Type of Stone	Word Parts	Location
Cystolith (**SIS**-toh-lith)	**cyst/o** means bladder and **-lith** means stone	Urinary bladder
Nephrolith (**NEF**-roh-lith), also known as **renal calculus** or a **kidney stone**	**nephr/o** means kidney and **-lith** means stone	Kidney
Ureterolith (you-**REE**-ter-oh-**lith**)	**ureter/o** means ureter and **-lith** means stone	Ureter

- **Ureterostenosis** (you-**ree**-ter-oh-steh-**NOH**-sis) is a stricture of the ureter (**ureter/o** means ureter, and **-stenosis** means abnormal narrowing). A *stricture* is an abnormal band of tissue narrowing a body passage.

THE URINARY BLADDER

- **Cystalgia** (sis-**TAL**-jee-ah) and **cystodynia** (**sis**-toh-**DIN**-ee-ah) both mean pain in the urinary bladder (**cyst** means bladder and **-algia** means pain).
- **Cystitis** (sis-**TYE**-tis) is an inflammation of the bladder (**cyst** mean bladder and **-itis** means inflammation).
- **Interstitial cystitis** (**in**-ter-**STISH**-al sis-**TYE**-tis) is an inflammation within the wall of the bladder. This is a chronic condition with symptoms similar to those of cystitis.
- A **cystocele** (**SIS**-toh-seel) is a hernia of the bladder through the vaginal wall (**cyst/o** means bladder and **-cele** means hernia).
- **Cystorrhagia** (**sis**-toh-**RAY**-jee-ah) is bleeding from the bladder (**cyst/o** means bladder and **-rrhagia** means bleeding).
- **Urinary tract infections (UTIs)** usually begin in the bladder. These infections occur more frequently in women because of the shortness of the urethra and the proximity of its opening to the vagina and rectum.
- A **vesicovaginal fissure** (**ves**-ih-koh-**VAG**-ih-nahl) is an abnormal opening between the bladder and vagina (**vesic/o** means bladder, **vagin** means vagina, and **-al** means pertaining to).

THE URETHRA

- Blockage of the urethra can cause urine to back up into the ureters. This condition, which is called **reflux,** can eventually result in damage to the kidneys.
- **Urethralgia** (**you**-ree-**THRAL**-jee-ah) is pain in the urethra (**urethr** means urethra and **-algia** means pain).
- **Urethritis** (**you**-reh-**THRIGH**-tis) is an inflammation of the urethra (**urethr** means urethra and **-itis** means inflammation).
- **Urethrorrhagia** (you-**ree**-throh-**RAY**-jee-ah) is bleeding from the urethra (**urethr/o** means urethra and **-rrhagia** means bleeding).
- **Urethrorrhea** (you-**ree**-throh-**REE**-ah) is an abnormal discharge from the urethra (**urethr/o** means urethra and **-rrhea** means abnormal flow).
- **Urethrostenosis** (you-**ree**-throh-steh-**NOH**-sis) is the stricture or stenosis of the urethra (**urethr/o** means urethra and **-stenosis** means tightening or narrowing).

Abnormal Urethral Openings

- **Epispadias** (**ep**-ih-**SPAY**-dee-as) in the male is a congenital abnormality in which the urethral opening is located on the dorsal (upper surface) of the penis (**epi-** means over). In the female with epispadias, the urethral opening is in the region of the clitoris.
- **Hypospadias** (**high**-poh-**SPAY**-dee-as) in the male is a congenital abnormality in which the urethral opening is on the undersurface of the penis (**hypo-** means below). In the female with hypospadias the urethral opening is into the vagina.
- **Paraspadias** (**par**-ah-**SPAY**-dee-as) is a congenital abnormality in males in which the urethral opening is on one side of the penis (**para-** means beside).

URINATION

- **Diuresis** (**dye**-you-**REE**-sis) is the increased excretion of urine (**diur** means increasing the output of urine and **-esis** means an abnormal condition).
- **Dysuria** (dis-**YOU**-ree-ah) is difficult or painful urination (**dys-** means painful and **-uria** means urination). This condition is frequently associated with UTIs.
- **Enuresis** (**en**-you-**REE**-sis) is the involuntary discharge of urine. **Nocturnal enuresis,** which occurs during sleep, is also known as **bed-wetting.** (*Nocturnal* means night.)
- **Nocturia** (nock-**TOO**-ree-ah) is excessive urination during the night (**noct** means night and **-uria** means urination).
- **Oliguria** (**ol**-ih-**GOO**-ree-ah) means scanty urination (**olig** means scanty and **-uria** means urination).
- **Polyuria** (**pol**-ee-**YOU**-ree-ah) means excessive urination (**poly-** means many and **-uria** means urination).
- **Urinary retention** is the inability to void or empty the bladder.

Incontinence

- **Incontinence** (in-**KON**-tih-nents) means the inability to control excretory functions.
- **Urinary incontinence** is the inability to control the voiding of urine.
- **Urinary stress incontinence** is the inability to control the voiding of urine under physical stress such as running, sneezing, laughing, or coughing.
- **Urge incontinence** is when urination occurs involuntarily as soon as an urgent desire to urinate is felt. This urge may be triggered by a physical movement rather than by a full bladder.

DIAGNOSTIC PROCEDURES OF THE URINARY SYSTEM

- **Catheterization** (**kath**-eh-ter-eye-**ZAY**-shun) is the insertion of a sterile catheter through the urethra and into the urinary bladder. This is most commonly performed to withdraw urine, relieve urinary retention pressures, or prevent incontinence during surgical procedures. A catheter may also be used to place fluid, such as a chemotherapy solution, into the bladder.
- **Cystoscopy** (sis-**TOS**-koh-pee), which is also known as **cysto,** is the visual examination of the urinary bladder using a cystoscope (**cyst/o** means bladder and **-scopy** means visual examination). A **cystoscope** (**SIS**-toh-**skope**) also is used for treatment procedures such as the removal of tumors (Figure 9.6).
- An **intravenous pyelogram** (**PYE**-eh-loh-**gram**) **(IVP)** is a radiographic (x-ray) study of the kidneys and ureters in which iodine is injected into a vein as a contrast medium to define these structures more clearly (**pyel/o** means renal pelvis and **-gram** means record).
- A **KUB** (kidneys, ureters, bladder) is a radiographic study of these structures without the use of a contrast medium. This study is also referred to as a **flat-plate of the abdomen.**
- **Intravenous urography** (you-**ROG**-rah-fee) is the radiographic visualization of the urinary tract with the use of a contrast medium (Figure 9.7). The resulting record is called a **urogram** (**ur/o** means urine and **-gram** means record).
- **Excretory urography** is so named because it traces the action of the kidney as it processes and excretes dye injected into the bloodstream.
- **Retrograde urography** is a radiograph of the urinary system taken after dye has been placed in the urethra through a sterile catheter and caused to flow upward (backward) through the urinary tract.
- **Cystography** (sis-**TOG**-rah-fee) is a radiographic examination of the bladder after instillation of a contrast medium via a urethral catheter. The resulting film is called a **cystogram** (**cyst/o** means bladder, and **-gram** means record).

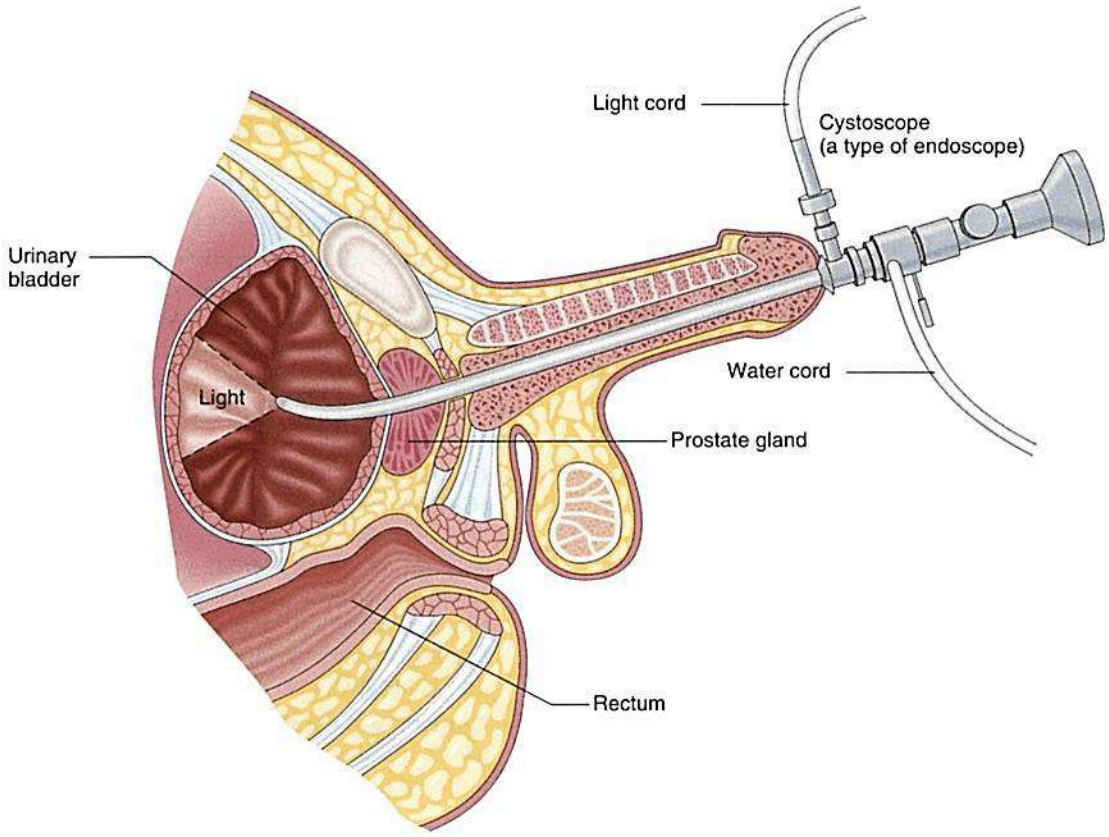


FIGURE 9.6 Use of a cystoscope to examine the interior of the bladder in a male.

FIGURE 9.7 An intravenous urogram showing the internal structures of the kidneys and ureters.

- **Voiding cystourethrography** (**sis**-toh-you-ree-**THROG**-rah-fee) **(VCUG)** may be performed after cystography. In this diagnostic procedure, a fluoroscope is used to examine the flow of urine from the bladder and through the urethra (**cyst/o** means bladder, **urethr/o** means urethra, and **-graphy** means process of recording).
- **Urinalysis** (**you**-rih-**NAL**-ih-sis) is the examination of urine to determine the presence of abnormal elements. These tests are discussed further in Chapter 15.

TREATMENT PROCEDURES OF THE URINARY SYSTEM

MEDICATIONS

Diuretics (**dye**-you-**RET**-icks) are medications administered to increase urine secretion to rid the body of excess sodium and water.

DIALYSIS

Dialysis (dye-**AL**-ih-sis) is a procedure to remove waste products from the blood of patients whose kidneys no longer function (**dia-** means complete or through and **-lysis** means separation). The two types of dialysis in common use are hemodialysis and peritoneal dialysis.

Hemodialysis

Hemodialysis (**hee**-moh-dye-**AL**-ih-sis) **(HD)** filters waste products from the patient's blood. A shunt implanted in the patient's arm is connected to the artifical kidney machine, and arterial blood flows through the filters. The filters contain **dialysate,** a solution made up of water and electrolytes, which removes excess fluids and waste from the blood. After these are removed, the blood is returned to the body through a vein (Figure 9.8).

FIGURE 9.8 Hemodialysis filters waste from the patient's blood. A shunt implanted in the patient's arm allows blood to leave the body via an artery, be filtered by the dialysis machine, and returned via a vein.

Peritoneal Dialysis

In **peritoneal dialysis** (**pehr**-ih-toh-**NEE**-al dye-**AL**-ih-sis), the lining of the peritoneal cavity acts as the filter to remove waste from the blood. Dialysate solution is run into the peritoneal cavity, and the fluid is exchanged through a catheter implanted in the abdominal wall. This type of dialysis is used for renal failure and certain types of poisoning (Figure 9.9).

- **Continuous ambulatory peritoneal dialysis (CAPD)** provides ongoing dialysis as the patient goes about his daily activities. In this procedure, a dialysate solution is instilled from a plastic container worn under the patient's clothing. Every six to eight hours, the used solution is drained back into this bag and the bag is discarded. A new bag is then attached, the solution is instilled, and the process continues.
- **Continuous cycling peritoneal dialysis (CCPD)** uses a machine to cycle the dialysate fluid during the night while the patient sleeps.

KIDNEYS

- A **renal transplantation,** also known as a **kidney transplant,** is the grafting of a donor kidney into the body to replace the recipient's failed kidneys (see Figure 9.10 on page 170).

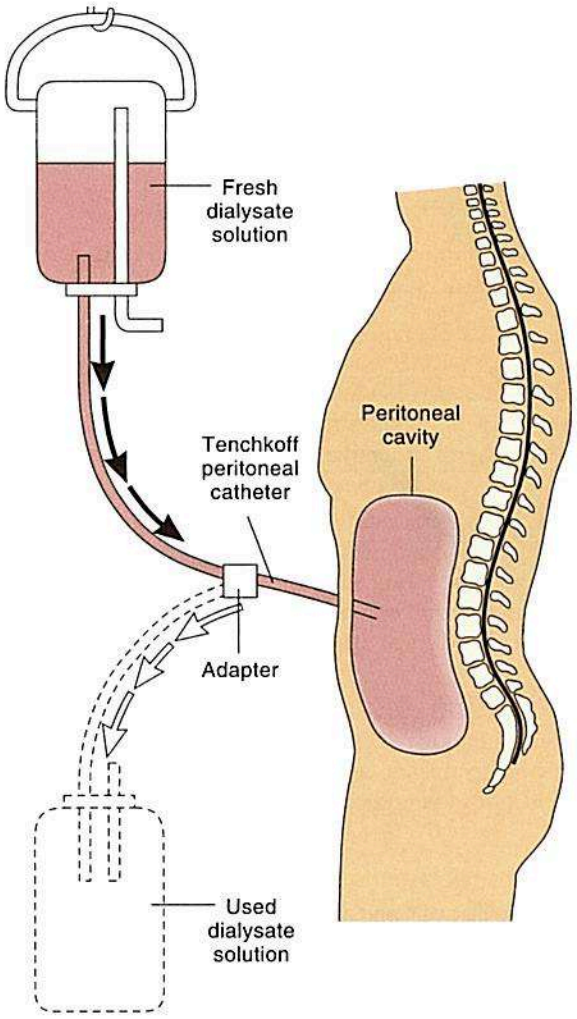


FIGURE 9.9 Peritoneal dialysis removes waste through a fluid exchange in the peritoneal cavity.

- **Nephrolysis** (neh-**FROL**-ih-sis) is the freeing of a kidney from adhesions (**nephr/o** means kidney and **-lysis** means setting free). An **adhesion** (ad-**HEE**-zhun) is a band of fibers that holds structures together abnormally.

  Note: The suffix **-lysis** means setting free; however, it also means destruction. Therefore, the term *nephrolysis* can also describe a pathologic condition in which there is the destruction of kidney substance.
- **Nephropexy** (**NEF**-roh-**peck**-see) is the surgical fixation of a floating kidney (**nephr/o** means kidney and **-pexy** means surgical fixation).
- A **nephrostomy** (neh-**FROS**-toh-mee) is the establishment of an opening between the pelvis of the kidney through its cortex to the exterior of the body (**nephr** means kidney and **-ostomy** means creating an opening).
- **Pyeloplasty** (**PYE**-eh-loh-**plas**-tee) is the surgical repair of the renal pelvis (**pyel/o** means the renal pelvis and **-plasty** means surgical repair).
- A **pyelotomy** (**pye**-eh-**LOT**-oh-mee) is a surgical incision into the renal pelvis (**pyel** means the renal pelvis and **-otomy** means surgical incision).

Removal of Kidney Stones

- **Lithotripsy** (**LITH**-oh-**trip**-see), also known as **extracorporeal shockwave lithotripsy** or **ESWL**, is the destruction of a kidney stone with the use of ultrasonic waves traveling through water (**lith/o** means stone and **-tripsy** means to crush). *Extracorporeal* means situated or occurring outside the body.
- A **nephrolithotomy** (**nef**-roh-lih-**THOT**-oh-mee) is the surgical removal of a kidney stone through an incision in the kidney (**nephr/o** means kidney, **lith** means stone, and **-otomy** means surgical incision).

THE URETERS

- A **ureterectomy** (**you**-ree-ter-**ECK**-toh-mee) is the surgical removal of a ureter (**ureter** means ureter and **-ectomy** means surgical removal).
- **Ureteroplasty** (you-**REE**-ter-oh-**plas**-tee) is the surgical repair of a ureter (**ureter/o** means ureter and **-plasty** means surgical repair).
- **Ureterorrhaphy** (**you**-ree-ter-**OR**-ah-fee) is the suturing of a ureter (**ureter/o** means ureter and **-rrhaphy** means to suture).

THE URINARY BLADDER

- A **cystectomy** (sis-**TECK**-toh-mee) is the surgical removal of all or part of the urinary bladder (**cyst** means bladder and **-ectomy** means surgical removal).
- **Cystopexy** (**sis**-toh-**peck**-see) is the surgical fixation of the bladder to the abdominal wall (**cyst/o** means bladder and **-pexy** means surgical fixation).
- **Cystorrhaphy** (sis-**TOR**-ah-fee) means suturing of the bladder (**cyst/o** means bladder and **-rrhaphy** means to suture).
- A **lithotomy** (lih-**THOT**-oh-mee) is a surgical incision for the removal of a stone, usually from the bladder (**lith** means stone and **-otomy** means surgical incision). This term also is used to describe a physical examination position, as discussed further in Chapter 15.
- A **suprapubic catheter** (**soo**-prah-**PYOU**-bick) is an indwelling catheter placed into the bladder through a small incision made through the abdominal wall just *above* (**supra-** means above) the pubic bone. (*Indwelling* means something that remains inside the body for a prolonged time.) See Figure 9.11.

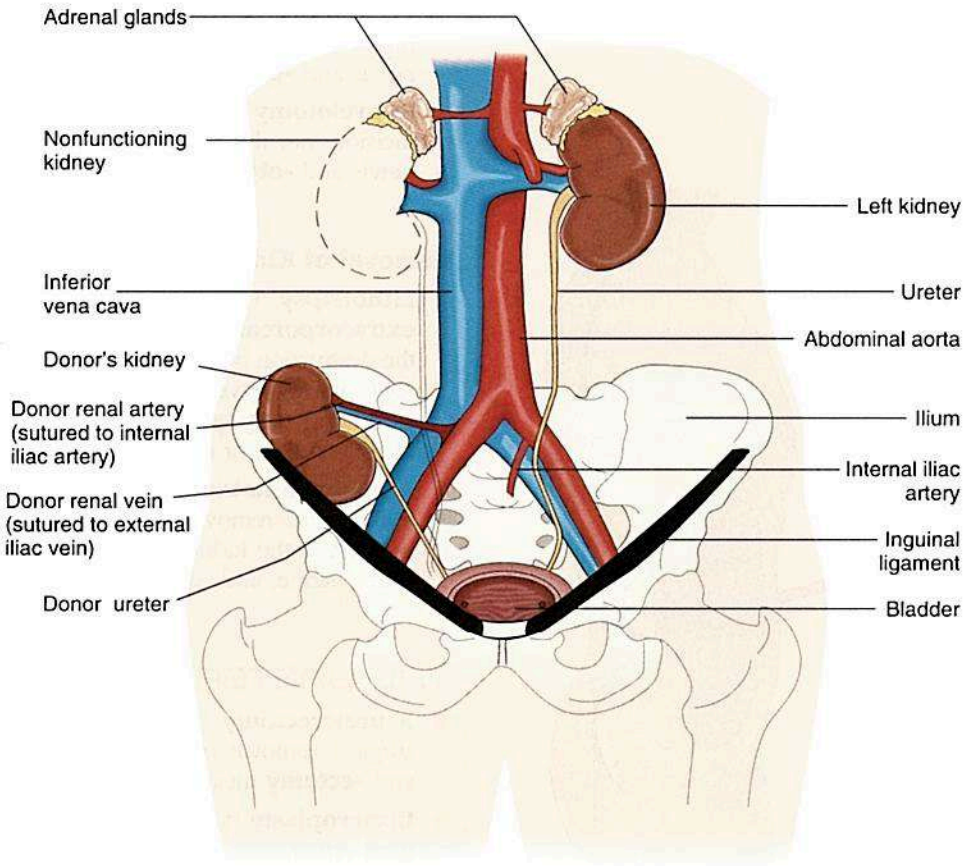
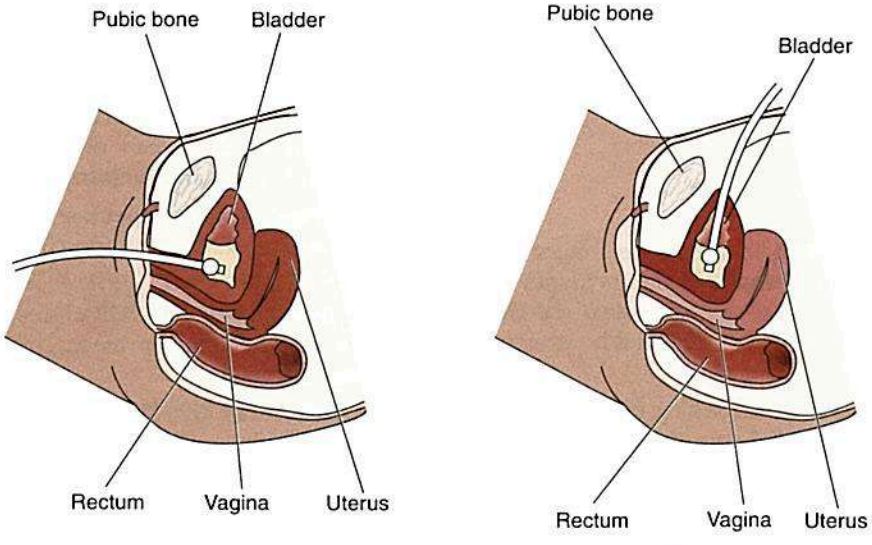


FIGURE 9.10 In a kidney transplant, the donor kidney is sutured to the iliac vein and artery at a lower point than the nonfunctioning kidney, which is not removed.



(A) Indwelling catheter **(B) Suprapubic catheter**

FIGURE 9.11 Types of urinary catheterization. (A) An indwelling catheter. (B) A suprapubic catheter.

THE URETHRA

- A **meatotomy** (**mee**-ah-**TOT**-oh-mee) is an incision of the urinary meatus to enlarge the opening (**meat** means meatus and **-otomy** means surgical incision).
- **Urethropexy** (you-**REE**-throh-**peck**-see) is the surgical fixation of the urethra usually for the correction of urinary stress incontinence (**urethr/o** means urethra and **-pexy** means surgical fixation).
- **Urethroplasty** (you-**REE**-throh-**plas**-tee) is the surgical repair of the urethra (**urethr/o** means urethra and **-plasty** means surgical repair).
- A **urethrostomy** (**you**-reh-**THROS**-toh-mee) is the surgical creation of a permanent opening between the urethra and the skin (**urethr** means urethra and **-ostomy** means creating an opening).
- A **urethrotomy** (**you**-reh-**THROT**-oh-mee) is a surgical incision into the urethra for relief of a stricture (**urethr** means urethra and **-otomy** means surgical incision).

Career Opportunities

In addition to the medical specialties already discussed, some of the health occupations involving the treatment of the urinary system include

- **Dialysis technician:** operates the hemodialysis machine; also provides emotional support and nutritional counseling for dialysis patients
- **Urology/nephrology (**or **renal) licensed practical nurse** or **certified nursing assistant:** provides care and information to patients with urinary and kidney problems

STUDY BREAK

Most human infants are potty trained at around age two or three. Until that time, babies are clothed in diapers to absorb their *urinary output* and other excretions. The average baby will go through 5,000 to 6,000 diaper changes! The majority of parents today use disposable diapers, so we tend to forget that these are a somewhat recent invention.

Over the course of time, many different methods of diapering a baby have been used:

- Native Americans packed the soft insides of milkweed around their babies' bottoms before strapping them into papoose boards.
- Eskimos gathered moss during the summer and placed it inside the animal skins in which the mothers carried their babies.
- Cotton diapers, still in use today, are what our term *diaper* (meaning a diamond-patterned fabric) comes from.

Health Occupation Profile: UROLOGIST

Dr. Arthur Sonneland, MD, is a urologist specializing in diseases of the urogenital system. "About half of my work time is spent performing surgery on the prostate, bladder, or kidneys. I also do surgical repairs to help control female incontinence. The other half of my practice is consulting with patients in the office."

"My father was also a urologist, so it was probably natural for me to follow in his footsteps. Urology may not be the most popular field for medical students looking for a possible career. But I've found it to be a fascinating surgical specialty, with a wide variety of diseases to treat and yet a 'sane' lifestyle (most of the time), with very little nighttime emergency duty."

Review Time

Write the answers to the following questions on a separate piece of paper or in your notebook. In addition, be prepared to take part in the classroom discussion.

1. **Written assignment:** Using terms a physician would understand, describe the difference between **hemodialysis** and **peritoneal dialysis.**

   Discussion assignment: How would being on dialysis affect the quality of life of the patient?

2. **Written assignment:** Using terms a patient would understand, describe the difference between a **nephrolithotomy** and **ESWL** for the removal of a kidney stone.

   Discussion assignment: Mr. Morrison has a kidney stone and is in a lot of pain. Which type of treatment do you think Mr. Morrison would prefer for the removal of this stone?

3. **Written assignment:** Describe the difference between **epispadias** and **hypospadias** in the male.

   Discussion assignment: How do these two conditions affect the female?

4. **Written assignment:** Describe the difference between **acute renal failure** and **chronic renal failure.**

   Discussion assignment: What are some of the causes of these two conditions?

5. **Written assignment:** Describe the difference between a **cystocele** and a **vesicovaginal fissure.**

   Discussion assignment: What are some of the possible complications that might result from either of these conditions if it has not been repaired?

Optional Internet Activity

The goal of this activity is to help you learn more about medical terminology while improving your Internet skills. Select ***one*** *of these two options and follow the instructions.*

1. **Internet Search:** Search for information about a **kidney transplant.** Write a brief (one- or two-paragraph) report on something new you learned here and include the address of the web site where you found this information.

2. **Web Site:** To learn more about **bladder diseases,** go to this web address: **http://www.bladderdiseases.com/**. Write a brief (one- or two-paragraph) report on something new you learned here.

The Human Touch: Critical Thinking Exercise

The following story and questions are designed to stimulate critical thinking through class discussion or as a brief essay response. There are no right or wrong answers to these questions.

"Guess what—my baby sister is getting married, and she wants me to give her away!" Cody Gantry let out a whoop as he read the e-mail out loud to his wife. He could imagine his sister's smiling face as she sat at her computer on the other side of the Atlantic. Cody and Billie Jean were only two years apart, and she had followed in her big brother's footsteps and joined the Army when she graduated from high school. Stationed in Germany, she worked on sensitive computerized targeting systems. Now he knew why she so often mentioned a fellow officer named Jon Vorheese.

Cody's mind drifted back to his own military career in South Korea. It had been cut short when a nephrolith led to hydronephrosis. Severe nephropyosis developed, and the Army doctors were forced to perform a nephrectomy. He had received a medical discharge and been sent stateside just three days shy of his twenty-fifth birthday.

Back at home, Cody married his high school sweetheart and went to work in the local garage. Now, Cody was almost 30 and needed dialysis weekly as the result of kidney failure. He was on a waiting list for a kidney transplant, but there was a chronic shortage of donor organs.

Cody certainly felt well enough to make a short trip to Germany for Billie Jean's wedding. But what if a donor kidney finally became available right before he was scheduled to leave or while he was away? Would his urologist approve of his leaving the country while on dialysis? He was certain there were hospitals in Berlin with dialysis facilities, but he'd heard that in some countries, a shortage of dialysis equipment meant that the procedure was available only to residents. He'd do almost anything for the chance to walk his sister down the aisle on her big day.

Suggested Discussion Topics

1. Explain the two types of dialysis procedures in terms that your mother or father would understand.
2. Discuss what could happen to Cody if he skipped one or more of his dialysis treatments.
3. Dialysis is not as common in many countries as it is in the United States. Discuss the possible reasons.
4. Cody is a veteran with a medical discharge. Is his health care covered as a veteran's benefit or by a private insurance company? Would a private insurance company pay for his treatment while overseas?
5. Cody needs a kidney transplant. Discuss your views on ethical ways in which recipients should be selected. What could be done to improve the supply of donor organs?

Student Workbook and Student Activity CD-ROM

1. Go to your **Student Workbook** and complete the Learning Exercises for this chapter.
2. Go to the **Student Activity CD-ROM** and have fun with the exercises and games for this chapter.

CHAPTER

10 The Nervous System

Overview of Structures, Word Parts, and Functions of the Nervous System

Major Structures	Related Word Parts	Primary Functions
Brain	**encephal/o**	Coordinates all activities of the body and receives and transmits messages throughout the body.
Spinal cord	**myel/o**	Transmits nerve impulses between the brain, limbs, and lower part of the body.
Nerves	**neur/i, neur/o**	Receive and transmit messages to and from all parts of the body.
Sensory Organs:		Receive external stimulation and transmit it to the sensory neurons. The eyes and ears are discussed further in Chapter 11.
Ears (hearing)		
Eyes (sight)		
Nose (smell)		
Skin (touch)		
Tongue (taste)		