Urinary System
Urinary System

- Excretory system
- Removes certain wastes and excess water from the body
- Maintains homeostasis
- Maintains acid-base balance
- 2 kidneys, 2 ureters, bladder, and urethra
The Urinary System

- Kidneys
- Ureters
- Urinary bladder
- Urethra
Kidneys

- Bean-shaped organs
- Location: retroperitoneal: behind the upper part of the cavity, separated by peritoneum
- Protection: by ribs and fat
- Structure:
  - Cortex: outer section, has most of the nephrons that aid in production of urine
  - Medulla: inner section, has most of the collecting tubules that carry urine
  - Hilum: notched area through which the ureter, nerves, blood and lymph vessels enter and leave
  - Nephrons: microscopic filtering units in the kidneys, more than 1 million per kidney
    - Each nephron consists of: glomerulus, Bowman’s capsule, proximal convoluted tubule, distal convoluted tubule, and a collecting duct/tubule
Kidney Anatomy

- Renal capsule
- Cortex
- Medulla
- Segmental artery
- Hilum (indentation)
- Renal sinus (space)
- Renal pyramid
- Artery and vein in the renal sinus
- Major calyx
- Minor calyx
- Renal papilla
- Renal column
- Medullary rays
- Renal artery
- Renal vein
- Renal pelvis
- Ureter
The diagram illustrates the renal processes:

**Proximal convoluted tubule**
- Reabsorption of water, ions, and all organic nutrients.

**Distal convoluted tubule**
- Secretion of ions, acids, drugs, and toxins.
- Variable reabsorption of water, sodium ions, and calcium ions (under hormonal control).

**Nephron**
- Capsular space
- Glomerulus
- Efferent arteriole
- Afferent arteriole
- Bowman's capsule

**Renal corpuscle**
- Production of filtrate

**Collecting system**
- Collecting duct
- Papillary duct
- Delivery of urine to minor calyx

**Loop of Henle**
- Further reabsorption of water (descending limb) and both sodium and chloride ions (ascending limb).

**KEY**
- Water
- Solutes
- Filtrate
- Variable reabsorption or secretion

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Ureters

- Muscular tubes about 10–12 inches long
- Extend from renal pelvis (funnel-shaped structure that is the first section of the ureter) of each kidney to bladder
- Peristalsis moves urine through each ureter to bladder
Bladder

- Muscular sac
- Lined with mucous membranes, arranged in folds, called rugae.
- Three layers of visceral muscle form walls
- Functions:
  - Urge to void (urinate, micturate) (when has about 250 mL or 1 cup of urine, but can hold more)
  - Receives urine from ureters, and stores urine until excreted
Bladder

- Contains circular sphincter muscles
- Functions of muscles:
  - Controls the bladder opening to prevent emptying
  - When the bladder is full, receptors in bladder wall send out a reflex action that opens these muscles
  - Reflex action cannot be controlled by infants, but is learned with aging
Urethra

- Carries urine from bladder to the outside
- Urinary meatus - external opening
- Female and male systems:
  - Female carries only urine, shorter, about 3.75 cm (1.5 in.)
  - Male: longer, about 20 cm (8 inches) and can carry both urine and semen, but not at the same time. Passes through prostate gland
- Urine - liquid waste, 95% water
- 1,500-2,000 mL (1.5-2 quarts) of urine are produced daily from the 150 quarts of liquid that is filtered through the kidneys.
Terms for conditions that affect urination

- Polyuria - excessive urination
- Oliguria - below normal amounts of urination
- Anuria - absence of urination
- Hematuria - blood in the urine
- Pyuria - pus in the urine
- Nocturia - urination at night
- Dysuria - painful urination
More Terms for conditions that affect urination

- Retention - inability to empty the bladder
- Incontinence - involunary urination
- Proteinuria - protein in the urine
- Albuminuria - albumin (a blood protein) in the urine
- Frequency - needing to void frequently
- Urgency - needing to void NOW
Diseases and Abnormal Conditions

- Cystitis
- Glomerulonephritis or nephritis
- Pyelonephritis
- Renal calculus or urinary calculus - kidney stone
- Renal failure
- Chronic renal failure
- Uremia, azotemia
- Urethritis