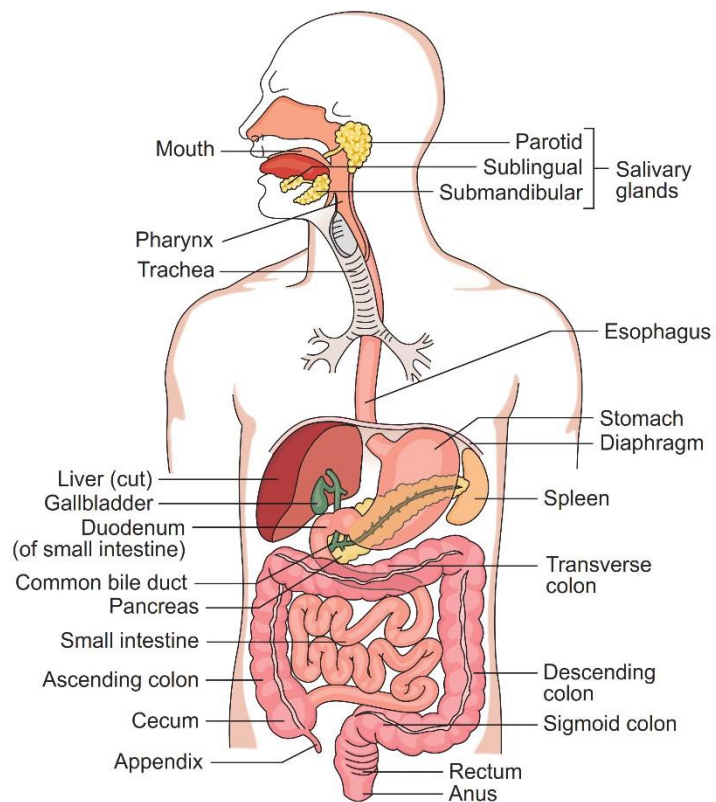


The Digestive System

The digestive system is composed of a continuous tract beginning with the oral cavity and ending at the anus. This tract, called the alimentary canal or the gastrointestinal (GI) tract, is complemented by accessory organs that convert food and fluids into a form that permits the body to absorb nutrients. The GI tract is



divided into two sections: the upper GI tract, which consists of the oral cavity (mouth), oesophagus, and stomach, and the lower GI tract, which consists of the intestines. The three main functions of the digestive system are **digestion**, **absorption**, and **elimination**.

The Upper Gastrointestinal Tract

Digestion begins in the oral cavity where food is broken apart by **mastication**, which is a technical term for chewing. Saliva produced by the salivary glands moistens the food.

From the **pharynx**, the food bolus passes into the oesophagus where it is lubricated with mucus before being carried into the **stomach** by wavelike muscular contractions called **peristalsis** [from the Greek word *peristaltiko*

(clasping and compressing)]. The **cardiac sphincter** [(from the Greek word **sphingein: to bind tight**)] is a ring-like muscle that controls the flow from the oesophagus into the stomach.

The stomach is the center of the system, both physically and functionally. Its first job is to act as a temporary storage place for the food while it does its second job: secreting acid and enzymes to help break down proteins, fats, and carbohydrates.

The partially digested food (**chyme**) passes through the **pyloric sphincter**, a muscle at the distal end of the stomach, and into the **duodenum**.

The Lower Gastrointestinal Tract

The lower GI tract begins with the small intestine, which extends from the pyloric sphincter to the first part of the large intestine. Although it is about 20 feet in length, it is known as the small intestine because it is smaller in diameter than the large intestine.

The small intestine is divided into three parts: the **duodenum** [from the Greek **dodekadaktylon (12 fingers long)**], **jejunum** [from the Latin word **jejunus (empty, fasting, hungry)**], and **ileum** [a Latin word meaning “flank, groin”]. From the duodenum, chyme moves into the jejunum and from there into the ileum. The ileocecal sphincter controls the flow from the ileum into the cecum, the first part of the large intestine.

Accessory Organs

The **salivary glands**, **liver**, **gallbladder**, and **pancreas**, although not part of the alimentary canal, play a key role in the digestive process and are referred to as accessory organs of the digestive system.

Salivary Glands

The senses of taste and smell stimulate the salivary glands to secrete **saliva**, a watery liquid that contains enzymes that begin the digestive process. Saliva also helps eliminate bacteria in the mouth and keeps the teeth and tongue clean.

Liver

The liver, located in the upper right quadrant of the abdomen under the dome of the diaphragm, plays many important roles in digestion, metabolism, and detoxification of harmful substances. One of its main digestive functions is the manufacture and secretion of **bile**. Our bodies need bile to process fats before they are released into the bloodstream. Once bile is produced in the liver, it travels down the **common bile duct** to the **gallbladder** for storage.

Gallbladder

Although the liver produces and recycles bile, the gallbladder, which is located in a depression under the liver, stores, condenses, and delivers the bile to the small intestine. The gallbladder is also sometimes referred to as the **cholecyst**.

Pancreas

The pancreas [from the Greek words **pan** (all) and **kreas** (flesh, meat)] is an elongated feather-shaped organ that lies posterior to the stomach. It has both

digestive and endocrine functions. It produces digestive enzymes that aid in processing carbohydrates and fats in foods as well as secreting hormones directly into the bloodstream.

Disorders of the Upper Gastrointestinal Tract

- **Parotitis**: is an inflammation of the parotid gland.
- **Dysphagia** [*dys-* (diffi culty); *phag/o* (eating, swallowing); *-ia* (condition of)]: difficulty in swallowing.
- **Esophagitis**: inflammation of the oesophagus.
- **Hiatus** [*from the Latin word hiatus* (opening); *-al* (adjective suffix)] **hernia** [*the Latin word hernia* (rupture)]: stomach protruding into the thoracic cavity.
- **Gastroesophageal reflux disease**: upward flow of stomach acid into the oesophagus.
- **Gastritis** [*gastr/o* (stomach); *-itis* (inflammation)]: inflamed gastric mucosa.

Disorders of the Lower Gastrointestinal Tract

- **Appendicitis** [*from the Latin word appendix* (something attached); *-itis* (inflammation)]: a common acute inflammatory disease. The appendix can become abscessed and may rupture, causing **peritonitis** (an inflammation of the peritoneum, which is the sac that lines the abdominal cavity).
- **Cholelithiasis** [*chol/e* (bile, gall); *-lithiasis* (condition of having stones)]: a condition in which stones reside in the gallbladder or bile ducts.
- **Cholecystitis** [*cholecyst/o* (gallbladder); *-itis* (inflammation)]: inflammation of the gallbladder.

- **Hepatitis** [hepat/o (liver); -itis (inflammation)]: inflammation of the liver
- **Jaundice** [from Middle French word jaunisse (yellow)]: a symptom of hepatitis characterized by a yellow appearance of skin or eyes.
- **Cirrhosis** of the liver: chronic liver disease.

Colonoscopy [colon/o (colon); -scopy (viewing)]: visual examination of the colon with a colonoscope.

The Urinary System

The urinary system is composed of the **kidneys, ureters, urinary bladder, and urethra**. The primary function of the urinary system is to remove wastes and toxins from the body.

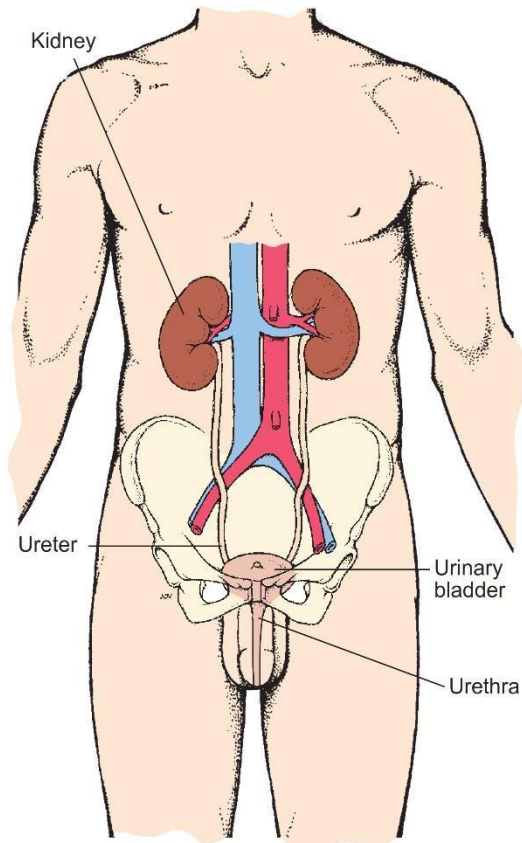
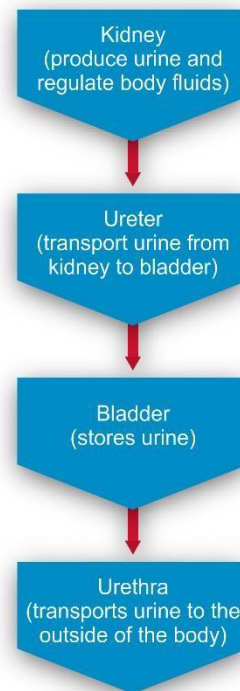


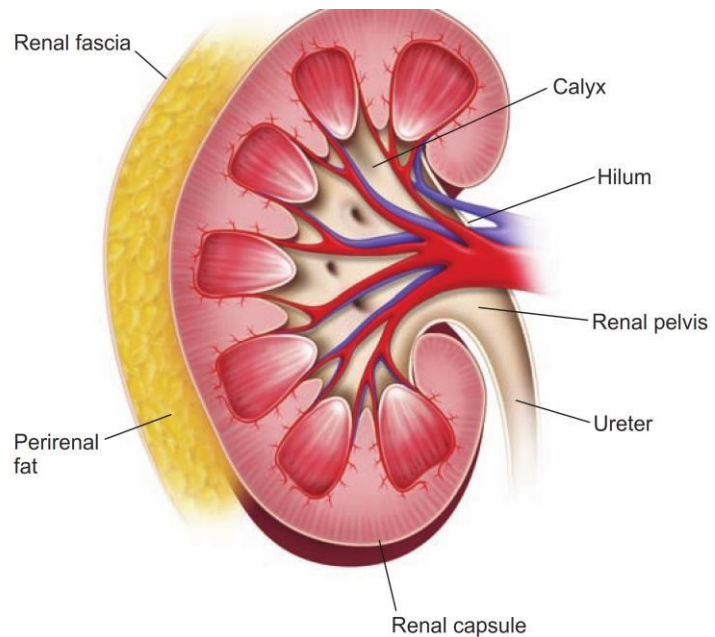
FIGURE 13-1 Primary structures of the urinary system. Anterior view of the kidneys, ureters, bladder, and urethra (male). From *Stedman's Medical Dictionary*, 27th ed. Baltimore, MD: Lippincott Williams & Wilkins; 2000.



Flow chart illustrating the process of urine formation and excretion. The process of urine formation begins in the kidneys. The kidneys filter waste products from the blood and convert them to urine. The urine is transported from the kidneys by the ureters to the bladder, where it is stored until it is expelled through the urethra via the process of urination.

The kidneys

The kidneys are bean-shaped organs and are about the size of a man's fist; they lie at the back of the abdominopelvic cavity, along each side of the spinal column. Each kidney is covered by a thin membrane called the **renal capsule**. A thicker layer of fatty tissue, called the **perirenal fat**, surrounds the renal capsule and thus provides protection for this vital organ. Finally, a thin layer of connective tissue, called the **renal fascia**, forms each kidney's outer covering.



The kidneys produce **urine**

[from the Greek word *ouron* (urine)] and remove two

natural products of metabolism, **urea** and **uric acid**, along with other waste products from the blood. The kidneys also filter, reabsorb, and secrete nonwaste products back into the system.

Filtration and the urine production process begin in the **nephrons**

[from the Greek word **nephros**

(**kidney**)], which are the functional units of the kidneys. Each kidney has approximately 1

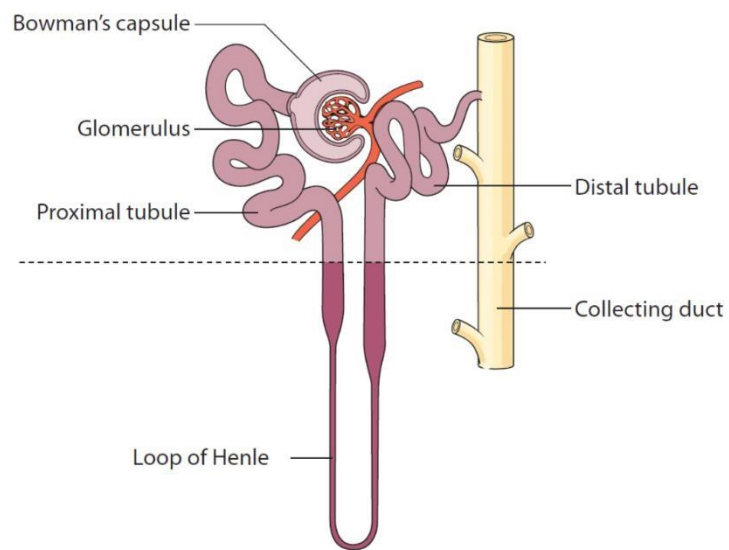
million nephrons, and each nephron

contains a tiny filtration unit called the **glomerulus** [a Latin word meaning “small ball,” “round knot”], which consists of a cluster of capillaries. Blood travels through the capillaries, which permit waste products within the urine to enter the ureter, where it is carried to and stored in the urinary bladder.

The bladder collects the urine until the volume triggers the urge to urinate, an event known as the **micturition reflex**. Urination is regulated by two **sphincters**, the circular muscles that surround the urethra. They are the internal urethral sphincter, which is located at the entrance to the urethra and is involuntarily controlled, and the external urethral sphincter, which is located at the distal end of the urethra and is under conscious control.

Disorders of the Renal System

- **Dysuria** [dys- (difficult); ur/o (urine); -ia (condition)]: painful, difficult urination.
- **Incontinence**: the loss of urinary control.



- **Retention:** the inability to empty the bladder.
- **Cystitis** [*cyst/o (bladder); -itis (inflammation)*]: inflammation of the bladder.
 - **Pyelonephritis:** [*pyel/o (pelvis); nephr/o (kidney); -itis (inflammation)*]: inflammation of the renal or kidney pelvis due to local bacterial infection.
- **Glomerulonephritis** [*glomerul/o (glomerulus); nephr/o (kidney); -itis (inflammation)*]: renal disease characterized by inflammation of glomeruli.
- **Renal failure:** kidneys cease urine production.