16 The Urinary System

Chapter Summary

The kidneys are the primary excretory organs and are part of the urinary system. The kidneys produce urine, and in doing so, serve to remove nitrogenous wastes from the body, maintain blood volume, and regulate the composition and pH of the blood. The kidneys also secrete an enzyme that helps maintain blood pressure and a hormone that stimulates red blood cell production. There are three regions of the kidney: the cortex, medulla, and pelvis. The functional units of the kidneys are nephrons which extend through the cortex and medulla. Nephrons produce urine in three steps. The first step involves filtering water and small molecules like urea out of the blood and is accomplished by a part of the nephron called the glomerular capsule. During the second step nephrons reabsorb nutrients and salt across their proximal convoluted tubules, and during the third step, actively secrete large waste molecules across the distal convoluted tubules into the urine. Urine is a concentrated solution of wastes, and urine production is under the control of antidiuretic hormone, aldosterone, and atrial natriuretic hormone. The other organs of the urinary system are the ureters which transport urine, the urinary bladder which stores urine, and the urethra which eliminates urine from the body. The elimination of urine from the body is called micturition. Problems with kidney function are discussed as are hemodialysis and kidney transplant, two methods of addressing renal failure.

Chapter Outline

I. Urinary System
   - A. Functions of the Urinary System
     1. Excretion of Metabolic Wastes
     2. Maintenance of Water-Salt Balance
     3. Maintenance of Acid-Base Balance
     4. Secretion of Hormones
   - B. Organs of the Urinary System
     1. Kidneys
     2. Ureters
     3. Urinary Bladder
     4. Urethra
   - C. Urination

II. Anatomy of the Kidney and Excretion
   - A. Anatomy of a Nephron
     1. Parts of a Nephron
   - B. Excretion
     1. Glomerular Filtration
     2. Tubular Reabsorption
     3. Tubular Secretion

III. Regulatory Functions of the Kidney
   - A. Fluid and Electrolyte Balance
     1. Reabsorption of Water
        - a. Loop of the Nephron and Collecting Duct
        - b. Antidioretic Hormone
     2. Reabsorption of Electrolytes
        - a. The Electrolytes
        - b. The Kidneys
        - c. Aldosterone
        - d. Atrial Natriuretic Hormone
     3. Diuretics

B. Acid-base Balance
    1. Acid-Base Buffer Systems
    2. Respiratory Center
    3. The Kidneys

IV. Problems with Kidney Function
    A. Hemodialysis
    B. Replacing a Kidney

V. Effects of Aging

VI. Homeostasis

Suggested Student Activities

1. Discuss some dangers associated with the use of diuretics.
2. Locate the organs of the urinary system on a model of the human body.
3. Study the effects of acidosis and alkalosis on the body.
4. Discuss the effects of alcohol consumption on urine formation.

Answers to Objective Questions

1. carbon dioxide
2. glomerulus
3. urethra
4. water
5. distal convoluted tubule
6. urea
7. urea
8. fluid, electrolyte, acid-base
9. aldosterone, antidiuretic hormone
10. buffer
11. gout
12. ureters
13. cortex, medulla

Answers to Medical Terminology Reinforcement Exercise

1. hemat/uria - blood in the urine
2. olig/uria - diminished/scanty amount of urine
3. poly/uria - much urine—passage of a large volume of urine in a given period of time, which is characteristic of diabetes (both mellitus and insipidus)
4. extra/corporal shock wave litho/tripsy - crushing a stone by shock waves from outside the body
5. anti/di/uret/ic - an agent against the passing of urine—medication used to depress urine formation
6. urethr/atresia - absence of opening in the urethra—an imperforate urethra
7. cysto/pyelo/nephr/itis - inflammation of the bladder and kidney pelvis
8. noct/uria - excess voiding at night
9. glomerulo/nephr/itis - inflammation of the capillary loops in the glomeruli of the kidney
10. uretero/vesico/stomy - surgical reimplantation of the ureter at a different site in the bladder wall

Audiovisual Materials

1. Model - Urinary Organs (K-11)(Concept Media)
2. Model - Human Nephron (7800)(Concept Media)
3. Filmstrip - The Urinary System, (Unit 11) (Career Aids)
4. Filmstrip - Urinary System in the Human Body (Career Aids)
5. Film (16mm) - The Story of the Kidney (Encyclopedia Britannica Educational Corp.)