Kidney Failure

The most common causes of kidney failure are infection, diabetes, high blood pressure, and damage to the kidneys by the body's own immune system. Because of their function in excretion, kidneys are often exposed to hazardous chemicals that have entered the body through the lungs, skin, or mouth. Household substances, such as paint, varnishes, furniture oils, glues, aerosol sprays, air fresheners, and lead, can damage kidneys.

Kidneys are vital to maintaining homeostasis, so damage to the kidneys may eventually become life threatening. When kidneys fail, ions and toxic wastes, such as urea, accumulate in the blood plasma and increase to dangerous levels. If one kidney is lost in an accident or by disease, the other may do the work of both. If both kidneys fail, there are two options for treatment.



Figure 15 Kidney dialysis has prolonged the lives of many people who have damaged or diseased kidneys. Like a kidney, the dialysis machine filters urea and excess ions from the blood.

Kidney Dialysis Kidney dialysis is a procedure that uses a machine to filter the blood, as shown in **Figure 15.** Acting like nephrons, a dialysis machine filters small molecules from the blood. Some molecules are kept, and others are discarded. Dialysis is not a permanent solution to kidney failure. A single, healthy kidney can meet the homeostatic needs of the body, but no dialysis machine can. Dialysis patients must carefully manage their salt, protein, and water intake because the dialysis machine cannot regulate these blood components as well as the kidney can.

Kidney Transplant A more permanent solution to kidney failure is a kidney transplant from a healthy donor. As with all organ transplants, a major problem with kidney transplants is rejection. A transplanted organ comes from a different person, so the recipient's immune system may recognize the transplant as a foreign object and attack the organ. To reduce chances of rejection, doctors treat the recipient with drugs that suppress the activity of the immune system.

Reading Check *What are some common causes of kidney failure?*

urine the liquid excreted by the kidneys, stored in the bladder, and passed through the urethra to the outside of the body

ureter one of the two narrow tubes that carry urine from the kidneys to the urinary bladder

urinary bladder a hollow, muscular organ that stores urine

urethra the tube that carries urine from the urinary bladder to the outside of the body

Section 3 Review

KEY IDEAS

1. **Identify** major metabolic wastes that humans produce and the organs that eliminate the wastes from the body.
2. **List** the components of blood that are filtered into the Bowman's capsule.
3. **Summarize** how urine is stored and eliminated from the body.
4. **Describe** two treatment options if both kidneys fail.

CRITICAL THINKING

5. **Relating Concepts** Explain why a high concentration of protein in urine may indicate damaged kidneys.

WRITING FOR SCIENCE

6. **Journal** Imagine that you are a glucose molecule. Write about your journey through the kidney. Begin at the renal artery, and be sure to mention your traveling companions.

Math Skills

Calculating Tell students that the heart pumps about 5 L (1.3 gal) of blood per minute, and one-fourth of this volume travels to the kidneys. Have them calculate the volume of blood that is filtered each day. (5 L/min × 60 min/h × 24 h/day × 0.25 = 1,800 L/day) LS Logical

Teaching Key Ideas

Urinary Tract Infections (UTIs) Tell students that UTIs affect millions of people every year. Urine is normally sterile, but bacteria around the opening of the urethra sometimes travel up into the bladder and even the kidneys. Untreated infections can be serious.

Close

Formative Assessment

Substances that are removed from the body by the excretory system are carried to the kidneys by the _____.

A. nervous system (Incorrect. The nervous system does not carry waste products to the kidney.)
B. respiratory system (Incorrect. The respiratory system removes carbon dioxide.)
C. circulatory system (Correct! Metabolic wastes are carried to the kidney by the circulatory system.)
D. digestive system (Incorrect. The digestive system removes solid waste.)

Answers to Section Review

1. lungs: carbon dioxide and water; kidneys: water, urea, salts, and other substances from blood; skin: water, salts, and small amounts of nitrogenous wastes
2. water, salt, glucose, amino acids, and urea
3. Urine is stored in the urinary bladder. When stretch receptors in the bladder send nerve impulses to the spinal cord, the bladder walls contract and the sphincters relax, and the contents empty through the urethra.
4. Kidney dialysis is a procedure that uses a machine to sort small molecules in the blood, keeping some and discarding others. A kidney transplant is a procedure in which a healthy kidney is implanted into a person with kidney failure.
5. In a healthy kidney, proteins never leave the blood to enter the tubules of the kidney. The urine should contain no proteins.
6. Answers will vary, but should show an understanding of the structure and function of the excretory system.