Summary of Key Concepts

Concept 32.1  Homeostasis depends on mechanisms of regulation. (pp. 698–700)

The body has internal processes that maintain homeostasis, the stable internal environment in the body. For example, when you are cold, you shiver. When you are hot, you sweat. When body temperature goes above a set point, the body responds in a way that lowers the temperature. When body temperature goes below a set point, the body responds in a way that raises the temperature. This type of regulation is called negative feedback. In negative feedback, a change triggers a response that counteracts the change.

The body also regulates the chemical makeup of body fluids by removing waste products and balancing the intake and loss of water. Cells produce wastes as a result of their normal activities. For example, when cells break down amino acids, a toxic nitrogen-containing substance called ammonia is produced. In the liver, ammonia combines with carbon dioxide, forming urea. The removal of nitrogen-containing wastes such as urea from the body is called excretion.

Chemical messengers called hormones trigger many of the responses that maintain homeostasis. Hormones are secreted by organs of the endocrine system called endocrine glands. Hormones regulate blood pressure, heart rate, digestion, and other body functions. Hormones are secreted into body fluids and may reach all parts of the body. However, hormones affect only certain cells, called target cells.

1. What is negative feedback? ____________________________________________

2. How are target cells related to hormones? _______________________________

Concept 32.2  The kidneys function in excretion and water balance. (pp. 701–706)

The two kidneys are the main organs of the excretory system. The kidneys filter blood and produce urine. Urine is a liquid made of water, urea, and other waste products. Urine leaves each kidney through a tube called the ureter, which carries urine to the urinary bladder. The urinary bladder is a sac that stores urine until it leaves the body. Urine leaves the urinary bladder through another tube called the urethra. The urethra goes to an opening in the body near the vagina in females and in the penis in males.

Each kidney contains tiny tubes called nephrons that filter blood and excrete urine in a four-step process. The first step, filtration, occurs at a tiny ball of capillaries at the beginning of the nephron called the glomerulus. In the glomerulus, blood pressure forces fluid through the capillary walls. This fluid is called filtrate. In the second step, reabsorption, water and dissolved nutrients are reabsorbed from the filtrate into the blood. In the third step,
secretion, certain substances are removed from the blood and added to the filtrate. In the final step, excretion, urine leaves the body.

When the water level in your body falls below normal, the hypothalamus detects the change in the blood. The hypothalamus, in turn, makes you thirsty. The hypothalamus also produces a hormone called antidiuretic hormone (ADH). ADH stimulates the kidneys to produce more concentrated urine. As a result, you lose less water in urine.

Kidneys may be damaged by disease, injury, or poisoning. A person can survive with only one working kidney. However, if both kidneys stop working, toxic wastes build up in the body. One treatment for people without working kidneys is dialysis. In dialysis, the patient’s blood is pumped through a machine that functions like a kidney in removing wastes. Another treatment is a kidney transplant.

3. Identify the two functions of the kidney. _______________________________

4. What is dialysis? ____________________________________________________

Concept 32.3 The liver helps maintain homeostasis. (pp. 707–708)

The liver plays a central role in homeostasis. For example, the liver changes ammonia to urea, helps digest fats by producing bile, and makes fibrin that clots blood. The liver also changes excess glucose to a substance called glycogen. The liver then stores glycogen, which can be broken down to glucose whenever it is needed. The liver may be damaged by infections, injury, or abuse of alcohol or another chemical. Hepatitis is a liver disease that is often caused by a virus. The disease can be spread through sexual contact and shared drug needles. Both hepatitis and alcohol abuse may cause cirrhosis of the liver. Cirrhosis occurs when the liver is so scarred that it can no longer function effectively. Symptoms of liver disease include internal bleeding and difficulty digesting fats.

5. How does the liver help maintain homeostasis? ________________________

6. What is hepatitis? ___________________________________________________

Concept 32.4 Hormones function in growth, development, reproduction, and homeostasis. (pp. 709–715)

Many hormones help regulate human body functions. Hormones can be classified as steroid or nonsteroid. Steroid hormones can cross plasma membranes and influence genes and the production of proteins. Nonsteroid hormones cannot cross plasma membranes. Instead, nonsteroid hormones influence cell activities indirectly through other molecules inside the cell, called secondary messengers.

The hypothalamus makes hormones that direct the activities of many endocrine glands, especially the pituitary gland. The hypothalamus controls the pituitary gland through releasing hormones. Releasing hormones stimulate the pituitary to secrete its own hormones. The pituitary gland secretes
hormones that influence other glands and body functions. For example, a releasing hormone from the hypothalamus signals the pituitary gland to secrete growth hormone (GH). GH, in turn, stimulates body cells and promotes growth. The hypothalamus also receives and sends nerve signals, so it links the nervous and endocrine systems.

The thyroid secretes hormones that affect almost every tissue in the body. Thyroid hormones help maintain normal blood pressure, heart rate, digestion, and reproductive functions, and also regulate calcium levels in the body.

The pancreas secretes two hormones that regulate the amount of glucose in the blood: insulin and glucagon. Insulin decreases blood glucose by increasing the amount of glucose that enters body cells. Glucagon increases blood glucose by stimulating liver cells to break down glycogen into glucose. Diabetes is a disease in which body cells are unable to absorb glucose from the blood. It can occur when there is not enough insulin in the blood or when body cells do not respond normally to insulin.

The two adrenal glands produce hormones in response to stress. Some of the hormones are fast-acting and have a short-term effect. For example, epinephrine stimulates faster breathing and heart rate. Other adrenal hormones, called corticosteroids, provide a slower, longer-acting response to stress.

7. How does the hypothalamus control much of the rest of the endocrine system?

8. What is diabetes? ____________________________________________________________________

Reading Skills Practice

Creating a flowchart  Create a flowchart to show how the hypothalamus controls body growth through its influence on the pituitary gland.

Vocabulary Review and Reinforcement

In 1–4, fill in the blanks with the appropriate terms from the chapter.

<table>
<thead>
<tr>
<th>ORGANS OF THE EXCRETORY SYSTEM</th>
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<tr>
<td>Organ</td>
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In 5–10, write the letter of the correct definition on the line next to each term.

5. urea
6. excretion
7. endocrine gland
8. urine
9. nephron
10. glomerulus

a. removal of nitrogen wastes from the body
b. liquid made of water, urea, and other waste products
c. substance made in the liver from ammonia and carbon dioxide
d. organ of the endocrine system
e. part of a nephron where filtration occurs
f. tiny tube in the kidney that filters blood and excretes urine

WordWise
Match each definition in the left column with the correct Key Term in the right column. Then write the number of each Key Term in the appropriate box below. When you have filled in all the boxes, add up the numbers in the columns, rows, and two diagonals. All the sums should be the same.

A. Gland that secretes epinephrine
B. Disease characterized by scarring of the liver
C. Type of cell affected by a hormone
D. How the body regulates its internal temperature
E. Gland that secretes glucagon
F. Type of hormone produced by the hypothalamus
G. Gland that secretes growth hormone
H. Chemical messenger produced by an endocrine gland
I. Gland that secretes calcitonin

1. cirrhosis
2. pituitary gland
3. releasing hormone
4. thyroid
5. pancreas
6. adrenal gland
7. negative feedback
8. target cell
9. hormone

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