The endocrine system consists of glands that release secretions into the bloodstream. The secretions are called hormones. Hormones are chemicals released in one part of the body that travel throughout the body and affect cells elsewhere. Hormones bind to specific chemical receptors on cells called target cells. A gland is an organ that produces and releases a secretion. In addition to endocrine glands, there are exocrine glands, such as sweat glands. Exocrine glands release their secretions through ducts directly to tissues and organs.

There are two types of hormones. Steroid hormones can cross cell membranes of target cells, enter the nucleus, and turn genes on or off. Nonsteroid hormones cannot cross cell membranes. Compounds called secondary messengers carry the messages of nonsteroid hormones inside target cells. All cells also produce hormonelike substances called prostaglandins that affect only nearby cells.

The endocrine system is regulated by feedback mechanisms that help maintain homeostasis. For example, the level of a hormone in the blood may be the feedback that signals a gland to produce more or less of the hormone. Two hormones with opposite effects may work together to maintain homeostasis. This is called complementary hormone action.

39–2 Human Endocrine Glands

Human endocrine glands include the pituitary gland, hypothalamus, thyroid gland, parathyroid glands, adrenal glands, pancreas, and reproductive glands.

The nine pituitary hormones either directly regulate body functions or control the actions of other endocrine glands. Hormones from the hypothalamus control the pituitary gland. The thyroid gland regulates metabolism. Hormones produced in the parathyroid gland help regulate calcium levels in the blood. The adrenal gland produces hormones that help the body deal with stress. Insulin produced by the pancreas keeps the level of sugar in the blood stable. Without insulin, diabetes mellitus occurs. Reproductive glands, or gonads, produce gametes. Gonads also secrete sex hormones that produce male and female physical characteristics.

39–3 The Reproductive System

Sex hormones produced by the gonads of an embryo cause the embryo to develop into either a female or a male. Sex hormones also cause puberty to occur. Puberty is a period of rapid growth and sexual maturation that usually begins between ages 9 and 15. At the end of puberty, the male and female reproductive organs are fully developed and able to function.

The main function of the male reproductive system is to produce and deliver sperm. The main organs of the male reproductive system are the testes, which are held in a sac called the scrotum. In the testes, sperm are produced in tiny tubes called seminiferous tubules. Sperm then mature in a structure known as the epididymis. They leave the body through a tube called the vas deferens and then through the urethra. The urethra is the tube in the penis that leads to the outside. Sperm are ejected from the penis by contractions. This is called ejaculation.

The main function of the female reproductive system is to produce eggs and prepare the female body to nourish an embryo. The main organs of the female reproductive system are the ovaries. Each ovary contains thousands of follicles. A follicle is a cluster of cells surrounding a single egg. The follicle helps the egg mature. About once a month, an egg matures and is released from the ovary. The egg moves through the Fallopian tube, where it can be fertilized if sperm are present.
After a few days, the egg reaches the uterus. The uterus is connected to the outside of the body by a canal called the vagina. One egg develops each month during the menstrual cycle. The cycle is controlled by hormones. It has four phases: follicular phase, ovulation, luteal phase, and menstruation. During the follicular phase, an egg matures in its follicle and the uterus is prepared to receive a fertilized egg. Then, the egg is released from the ovary. This is called ovulation. The luteal phase follows. During the luteal phase, the follicle turns into a structure called the corpus luteum. If the egg has been fertilized, it implants in the lining of the uterus. If the egg has not been fertilized, it passes through the uterus without implanting, and menstruation occurs. During menstruation, the lining of the uterus falls away and leaves the body through the vagina.

Diseases that are spread during sexual contact are called sexually transmitted diseases (STDs). STDs can be caused by bacteria and viruses. Common STDs include chlamydia, syphilis, gonorrhea, and AIDS. Abstinence is the only sure way to avoid being infected with STDs.

39–4 Fertilization and Development

Fertilization is the process of a sperm joining an egg. A fertilized egg is called a zygote. The zygote undergoes repeated mitosis and soon develops into a hollow ball of cells called a blastocyst. About a week after fertilization, the blastocyst imbeds itself in the lining of the uterus. This is called implantation.

The cells of the blastocyst begin to specialize in a process called differentiation. Some cells migrate to form three cell layers. This process is called gastrulation. The three layers eventually develop into the different organs of the embryo. Researchers are just beginning to understand what controls the development of specialized cells and organs. Gastrulation is followed by neurulation, or the development of the nervous system. As the embryo develops, membranes also form to protect and nourish it. One of these membranes develops into the placenta. The mother and embryo exchange gases, food, and waste products across the placenta.

After eight weeks of development, the embryo is called a fetus. By the end of three months, most of the major organs are fully formed. During the remaining six months before birth, the organ systems mature, and the fetus grows in size and mass. Childbirth occurs when hormones stimulate the mother’s uterus to contract. The contractions push the baby from the uterus and out through the vagina. Twins are born if more than one egg was fertilized or if one zygote split into two embryos during early development.

Growth and development continue throughout infancy and childhood. Adolescence begins with puberty and ends with adulthood. Development continues during adulthood. The first signs of aging usually appear in the thirties.
Chapter 39 Endocrine and Reproductive Systems

Section 39–1 The Endocrine System (pages 997–1002)

This section describes the function of the endocrine system and explains how it maintains homeostasis.

Introduction (page 997)
1. What makes up the endocrine system? 

2. What do the products of the endocrine system do?

Hormones (page 997)
3. Chemicals released in one part of the body that travel through the bloodstream and affect the activities of cells in other parts of the body are called ____________________.

4. How do hormones affect the activities of other cells? ____________________

5. Cells that have receptors for a particular hormone are referred to as ____________________.

6. Is the following sentence true or false? Cells without receptors are not affected by hormones. ____________________

7. Is the following sentence true or false? Generally, the body’s responses to hormones are quicker and shorter lasting than the responses to nerve impulses. ____________________

Glands (page 998)
8. An organ that produces and releases a substance, or secretion, is called a(an) ____________________.

9. Complete the Venn diagram by adding titles.

- Releases secretions into ducts
- Releases secretions into blood

- Releases secretions
10. What is the function of the parathyroid glands? Their function is to regulate the level of calcium in the blood.

Match the endocrine gland with the hormone it produces.

<table>
<thead>
<tr>
<th>Endocrine Gland</th>
<th>Hormone It Produces</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Pineal</td>
<td>a. Glucagon</td>
</tr>
<tr>
<td>12. Thyroid</td>
<td>b. Melatonin</td>
</tr>
<tr>
<td>13. Pancreas</td>
<td>c. Epinephrine</td>
</tr>
<tr>
<td>14. Thymus</td>
<td>d. Thryoxine</td>
</tr>
<tr>
<td>15. Adrenal</td>
<td>e. Thymosin</td>
</tr>
<tr>
<td>16. Ovary</td>
<td>f. Testosterone</td>
</tr>
<tr>
<td>17. Testis</td>
<td>g. Estrogen</td>
</tr>
</tbody>
</table>

18. The hormone that regulates metabolism is ________________.

**Hormone Action** (page 999)

19. List the two general groups into which hormones may be classified.
   a. ____________________________
   b. ____________________________

20. Circle the letter of each sentence that is true about steroid hormones.
   a. They are lipids.
   b. They cannot cross cell membranes.
   c. They help regulate gene expression.
   d. They can enter the nucleus.

21. Is the following sentence true or false? Steroid hormones are produced from cholesterol. ________________

22. Circle the letter of each sentence that is true about nonsteroid hormones.
   a. They are proteins, small peptides, or modified amino acids.
   b. They can cross cell membranes.
   c. They rely on secondary messengers.
   d. They cannot enter the nucleus.

23. Is the following sentence true or false? Secondary messengers may include calcium ions, cAMP, nucleotides, and fatty acids. ________________

**Prostaglandins** (page 1000)

24. Hormonelike substances produced by other kinds of cells and tissues are called ________________.
25. Why are prostaglandins known as “local hormones”? ________________

26. Is the following sentence true or false? Some prostaglandins cause smooth muscles to contract. ________________

Control of the Endocrine System (pages 1000–1001)

27. When does feedback inhibition occur? ________________

28. Fill in the missing labels in the diagram to show how the thyroid gland is regulated by feedback controls.

```
Inhibition

TRH → Anterior pituitary → Thyroid
```

29. Circle the letter of each event that occurs when core body temperature begins to drop.
   a. The hypothalamus produces less TRH.
   b. More TSH is released.
   c. Less thyroxine is released.
   d. Metabolic activity increases.

30. Is the following sentence true or false? As you lose water, the concentration of dissolved materials in the blood falls. ________________

Complementary Hormone Action (page 1002)

31. What is complementary hormone action? ________________

32. Is the following sentence true or false? Calcitonin increases the concentration of calcium in the blood. ________________

33. If calcium levels drop too low, the parathyroid glands release ________________.

34. How does PTH increase calcium levels? ________________

35. Why is the regulation of calcium levels so important? ________________
Section 39–2 Human Endocrine Glands (pages 1003–1008)

This section describes the functions of the major endocrine glands.

Introduction (page 1003)
1. List seven major glands of the endocrine system.
   a. 
   b. 
   c. 
   d. 
   e. 
   f. 
   g. 

Pituitary Gland (page 1003)
2. Describe the pituitary gland and its location.
   __________________________________________
3. List the two parts of the pituitary gland.
   a. 
   b. 
4. In general, what is the role of pituitary gland hormones?
   __________________________________________

Hypothalamus (page 1004)
5. Is the following sentence true or false? The hypothalamus controls the secretions of the pituitary gland. 
   6. What influences the activity of the hypothalamus?
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
7. In what way is the posterior pituitary an extension of the hypothalamus?
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
8. Is the following sentence true or false? The hypothalamus has direct control of the anterior pituitary. 

Match each pituitary hormone with its action.

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. ADH</td>
<td>a. Stimulates ovaries and testes</td>
</tr>
<tr>
<td>10. FSH</td>
<td>b. Stimulates production of eggs and sperm</td>
</tr>
<tr>
<td>11. LH</td>
<td>c. Stimulates release of hormones from adrenal cortex</td>
</tr>
<tr>
<td>12. GH</td>
<td>d. Stimulates protein synthesis and growth in cells</td>
</tr>
<tr>
<td>13. ACTH</td>
<td>e. Stimulates the kidneys to reabsorb water</td>
</tr>
</tbody>
</table>
14. What are releasing hormones, and what do they do? 

Provides control over the anterior pituitary gland by secreting hormones directly into blood vessels for transport via the circulatory system.

Thyroid Gland (page 1005) 
15. Where is the thyroid gland located? 

Located at the base of the neck and wraps around the upper part of the trachea.

16. Is the following sentence true or false? The thyroid gland regulates reproduction. 

False.

17. List the two hormones produced by the thyroid. 

Calcitonin and Thyroxine.

18. What does thyroxine do in the body? 

Regulates metabolic rates of nearly all the cells of the body.

19. Production of too much thyroxine leads to a condition called. 

Hyperthyroidism.

20. Circle the letter of each choice that is a symptom of too much thyroxine. 

b. weight loss

c. lack of energy

d. goiter

An enlargement of the thyroid gland is called a(an) _________________.

Goiter.

22. Infants who lack enough iodine to produce normal amounts of thyroxine suffer from a condition called _________________.

Cretinism.

23. How can cretinism usually be prevented? 

It can usually be prevented by the addition of small amounts of iodine to table salt or other items in the food supply.

Parathyroid Glands (page 1005) 
24. How does parathyroid hormone regulate calcium levels in the blood? 

It increases the reabsorption of calcium in the kidneys and the uptake of calcium from the digestive system.

Adrenal Glands (page 1006) 
25. What is the general role of the adrenal glands? 

The general role is to help the body prepare for and deal with stress.

26. The outer part of the adrenal gland is called the ________________, and the inner part is called the _________________.

Adrenal Cortex and Adrenal Medulla.

27. Is the following sentence true or false? The release of hormones from the adrenal medulla is regulated by the sympathetic nervous system. 

True.
28. Complete the table about adrenal gland hormones.

**HORMONES OF THE ADRENAL GLAND**

<table>
<thead>
<tr>
<th>Part of Adrenal Gland</th>
<th>Hormones It Produces</th>
<th>Role of the Hormones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenal cortex</td>
<td>Corticosteroids</td>
<td>Regulating minerals, metabolism</td>
</tr>
<tr>
<td>Adrenal medulla</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pancreas (pages 1007–1008)**

29. Is the following sentence true or false? The pancreas is both an endocrine gland and an exocrine gland. ________________

30. What is the role of insulin and glucagon? ________________

31. When the pancreas fails to produce or properly use insulin, a condition known as ________________ occurs.

32. Is the following sentence true or false? Type I diabetes usually develops in people before the age of 15. ________________

33. Circle the letter of each sentence that is true about Type II diabetes.
   a. It most commonly develops before age 40.
   b. Type II diabetics produce low to normal amounts of insulin.
   c. It is also called juvenile-onset diabetes.
   d. It is an autoimmune disorder.

**Reproductive Glands (page 1008)**

34. List the two important functions served by the gonads.
   a. ___________________________  b. ___________________________

35. The female gonads are the ________________, and the male gonads are the ________________.

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**Reading Skill Practice**

Taking notes can help you identify and remember the most important information in a section. Take notes on Section 39–2 by writing the main headings and under each heading listing the most important points. Do your work on a separate sheet of paper.