

The Endocrine System and Reproduction

CALIFORNIA

Standards Preview

S 7.1 All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope. As a basis for understanding this concept:

- f. Students know that as multicellular organisms develop, their cells differentiate.

S 7.5 The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept:

- b. Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.
- d. Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy.
- e. Students know the function of the umbilicus and placenta during pregnancy.

S 7.7 Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

Identical twins form when a fertilized egg splits in two.





Video Preview

Discovery Channel School

*The Endocrine System
and Reproduction*



Focus on the

BIG Idea



S 7.5.d



How do the endocrine and reproductive systems work together to contribute to reproduction?

Check What You Know

Suppose you hear someone say, “She has her father’s eyes,” or “The twins look just like their grandmother.” How do traits pass from one generation to the next? Explain how sexual reproduction results in children that resemble their parents or grandparents. Which body cells play key roles in this process?

Build Science Vocabulary

The images shown here represent some of the Key Terms in this chapter. You can use this vocabulary skill to help you understand the meaning of some key terms in this chapter.

Vocabulary Skill

Identify Related Word Forms

You can increase your vocabulary by learning related forms of a word. For example, if you know the verb *produce* means "to make," you can figure out the meaning of the noun *product*—"something that is made." You can also figure out the meaning of the noun *production*—"the process of making." The table below shows some key terms in this chapter and their related word forms.

Verb	Noun	Adjective
differentiate To change and become specialized in the process of embryo development	differentiation The process in which cells change and become specialized during the development of an embryo	differentiating Undergoing change and specialization
menstruate To lose blood and tissue in a monthly cycle	menstruation The process in which blood and tissue pass from the female body	menstrual Relating to the process in which blood and tissue pass from the body
ovulate To release an egg from an ovary	ovulation The process in which an egg is released from an ovary	ovulating Releasing an egg from an ovary

Apply It!

Review the words related to *ovulation*. Complete the following sentences with the correct form of the word.

1. After _____ occurs, the egg may be fertilized.
2. Women usually _____ about halfway through the menstrual cycle.

embryo



Chapter 16 Vocabulary

Section 1 (page 640)

endocrine gland
hormone
target cell
hypothalamus
pituitary gland
negative feedback

.....

Section 2 (page 648)

egg
sperm
testis
testosterone
scrotum
semen
penis
urethra
ovary
estrogen
fallopian tube
uterus
vagina
menstrual cycle
follicle
ovulation
menstruation

.....

Section 3 (page 656)

embryo
differentiation
fetus
amniotic sac
placenta
umbilical cord
adolescence
puberty



ovulation



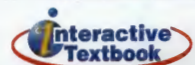
negative feedback



fetus



egg and sperm



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How to Read Science

Reading Skill

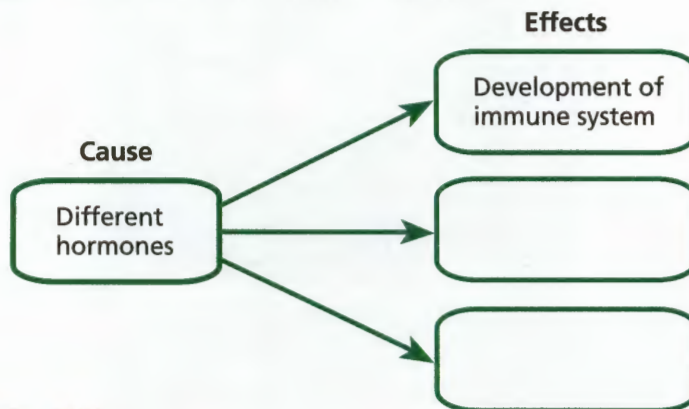


Analyze Cause and Effect

Science involves many cause-and-effect relationships. A cause makes something happen. An effect is what happens. When you recognize that one event causes another, you are relating cause and effect. Words such as *cause*, *because*, *effect*, *affect*, and *result* often signal a cause-and-effect relationship. Other words such as *so*, *since*, and *therefore* may also signal cause-and-effect relationships.

Read the following paragraph, which is about some of the effects of hormones. Then copy the graphic organizer below. Complete it to show some of the effects of hormones.

Chemicals called hormones affect many processes in the body. One hormone, for example, helps cause the immune system to develop. A second hormone regulates growth. In addition, as a result of the combined action of two hormones, the level of glucose in the blood stays fairly constant.



Apply It!

1. Review the completed graphic organizer. Then answer the following question: What are three effects of hormones?
2. After you read Section 1, make a cause-and-effect graphic organizer similar to the one above to show the effects of hormones produced by the adrenal glands.



Taking Shape

As a human embryo develops, differentiation gives rise to many different kinds of cells. This process occurs in all multicellular organisms. In fact, in its early stages, a human embryo develops much like embryos of other vertebrates. Cells divide and differentiate into ever more specialized tissues, organs, and other structures. In this investigation, you'll model the important tissues of an embryo and find out where the different body systems develop.

Your Goal

To design and construct a display showing the tissues of an early embryo and the structures that develop when cells in those tissues undergo differentiation

Your display must

- illustrate the structure of an embryo
- include tissues outside the embryo that help protect and nourish the embryo
- identify the organs, systems, and other body structures that develop from each layer of the embryos
- be made following the safety guidelines in Appendix A

Plan It!




Preview the diagram in the chapter that shows the development of an early embryo and the body systems that arise from each of its tissue layers. Use print and electronic resources to learn the scientific names of the three layers and more details about the body structures that develop from each. Also, identify the roles of four tissues called the amnion, chorion, allantois, and yolk sac.



The Endocrine System

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Standards Focus

S 7.5.b Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.

-  How does the endocrine system control body processes?
-  What are the endocrine glands?
-  How does negative feedback control hormone levels?

Key Terms

- endocrine gland
- hormone
- target cell
- hypothalamus
- pituitary gland
- negative feedback

Lab zone
Standards Warm-Up
What's the Signal?

1. Stand up and move around the room until your teacher says "Freeze!" Then, stop moving immediately. Stay perfectly still until your teacher says "Start!" Then, begin moving again.
2. Anyone who moves between the "Freeze!" command and the "Start!" command has to leave the game.
3. When only one person is left, that person wins.

Think it Over

Inferring Why is it important for players in this game to respond to signals? What types of signals function in the human body?

Imagine that you are trapped in a damp, dark dungeon. Somewhere near you is a deep pit with water at the bottom. Overhead swings a pendulum with a razor-sharp edge. With each swing, the pendulum lowers closer and closer to your body.

The main character in Edgar Allan Poe's story "The Pit and the Pendulum" finds himself in that very situation. Here is his reaction: "A fearful idea now suddenly drove the blood in torrents upon my heart. . . . I at once started to my feet, trembling convulsively in every fibre. . . . Perspiration burst from every pore, and stood in cold, big beads upon my forehead."

Poe's character is terrified. When people are badly frightened, their bodies react in the ways that the character describes. These physical reactions, such as sweating and rapid heartbeat, are caused mainly by the body's endocrine system.





Hormones and the Endocrine System

The human body has two systems that regulate its activities, the nervous system and the endocrine system. The nervous system regulates most activities by sending nerve impulses throughout the body. 🏡 **The endocrine system produces chemicals that control many of the body's daily activities. The endocrine system also regulates long-term changes such as growth and development.**

The endocrine system is made up of glands. A gland is an organ that produces or releases a chemical. Some glands, such as those that produce saliva and sweat, release their chemicals into tiny tubes. The tubes deliver the chemicals to a specific location within the body or to the skin's surface.

Unlike sweat glands, the glands of the endocrine system do not have delivery tubes. **Endocrine glands** (EN duh krin) produce and release their chemical products directly into the bloodstream. The blood then carries those chemicals throughout the body.

Hormones The chemical product of an endocrine gland is called a **hormone**. Hormones turn on, turn off, speed up, or slow down the activities of different organs and tissues. You can think of a hormone as a chemical messenger. Hormones are carried throughout the body by the blood. Therefore, hormones can regulate activities in tissues and organs that are not close to the glands that produce them.

FIGURE 1

Endocrine Control

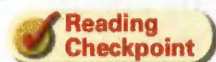
The endocrine system controls the body's response to an exciting situation such as a roller-coaster ride. Endocrine glands also regulate the changes that occur as a baby grows.

Applying Concepts What are the substances produced by endocrine glands called?

Hormone Production What causes the release of hormones? Often, nerve impulses from the brain make that happen. Suppose, for example, a person sees a deadly, knife-edged pendulum. Nerve impulses travel from the person's eyes to the brain. The brain interprets the information and then sends an impulse to the adrenal glands. These glands, in turn, release the hormone adrenaline into the bloodstream. Adrenaline makes the heart rate and breathing rate increase.

Hormone Action In contrast to the body's response to a nerve impulse, hormones usually cause a longer-lasting response. For example, the brain sends a quick, short signal to the adrenal glands, which then release adrenaline. When the adrenaline reaches the heart, it makes the heart beat more rapidly. The heart continues to race until the amount of adrenaline in the blood drops to a normal level.

Target Cells When a hormone enters the bloodstream, it affects some organs but not others. Why? The answer lies in the hormone's chemical structure. A hormone interacts only with specific target cells. **Target cells** are specialized cells that recognize the hormone's chemical structure. A hormone and its target cell fit together the way a key fits into a lock. Hormones will travel through the bloodstream until they find the "lock"—or particular cell type—that they fit.



What is a target cell?

Lab zone Skills Activity

Making Models

Make a model that shows a hormone and a target cell that the hormone affects. Your model should show how the structures of the hormone and target cell enable the two to fit together. Make your model from materials such as construction paper, pipe cleaners, or modeling clay. When you have finished your model, write an explanation of how it shows the relationship between a hormone and its target cell.

Functions of Endocrine Glands

Each endocrine gland releases different hormones and thus controls different processes. ➡ **The endocrine glands include the hypothalamus, pituitary, thyroid, parathyroid, adrenal, thymus, and pancreas. They also include the ovaries in females and testes in males.** Figure 2 shows the locations of the endocrine glands and describes some activities they control.

The Hypothalamus The nervous system and the endocrine system work together. The **hypothalamus** (hy poh THAL uh mus), a tiny part of the brain near the middle of your head, is the link between the two systems. Nerve messages controlling sleep, hunger, and other basic body processes come from the hypothalamus. The hypothalamus also produces hormones that control other endocrine glands and organs. The hypothalamus plays a major role in maintaining homeostasis because of the nerve impulses and hormones it produces.

FIGURE 2

Glands of the Endocrine System

Each of the endocrine glands has an important regulatory role in the body.

Interpreting Diagrams *What are two systems that are regulated by endocrine glands?*

Thyroid Gland

This gland controls the release of energy from food molecules inside cells.

Parathyroid Glands

These tiny glands regulate the amount of calcium in the blood.

Pancreas

The pancreas produces the hormones insulin and glucagon, which control the level of glucose in the blood. (The pancreas also produces enzymes used in digestion.)

Ovaries

The ovaries release female sex hormones. Estrogen controls changes in a female's body. Estrogen and progesterone trigger egg development.

Hypothalamus

The hypothalamus links the nervous and endocrine systems and controls the pituitary gland.

Pituitary Gland

The pituitary gland controls other endocrine glands and regulates growth, blood pressure, and water balance.

Thymus Gland

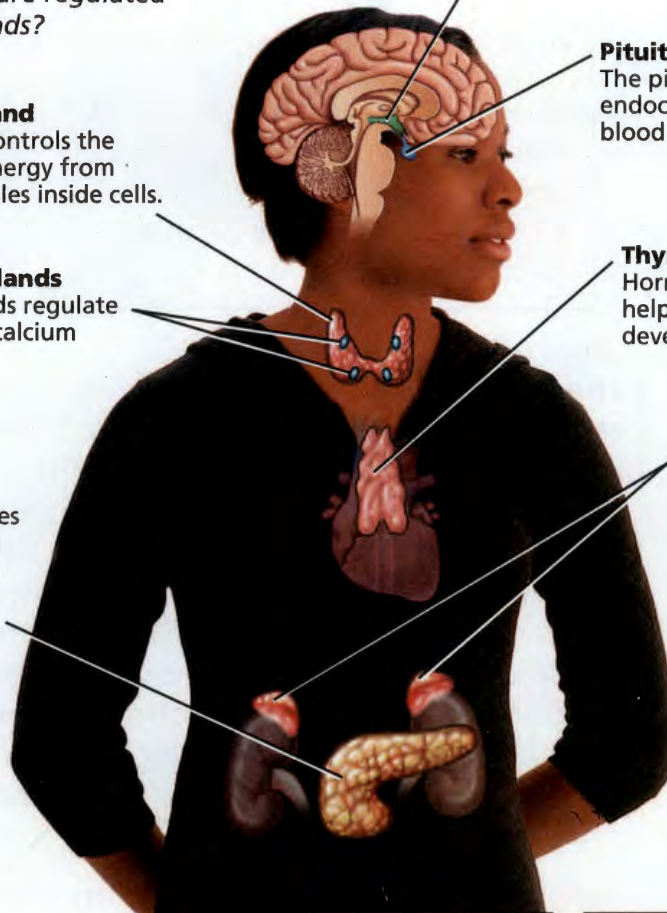
Hormones from this gland help the immune system develop during childhood.

Adrenal Glands

These glands release several hormones. Adrenaline triggers the body's response to emergency situations. Other hormones affect salt and water balance in the kidneys and sugar in the blood.

Testes

The testes release the sex hormone testosterone, which controls changes in a male's body and regulates sperm production.



Female

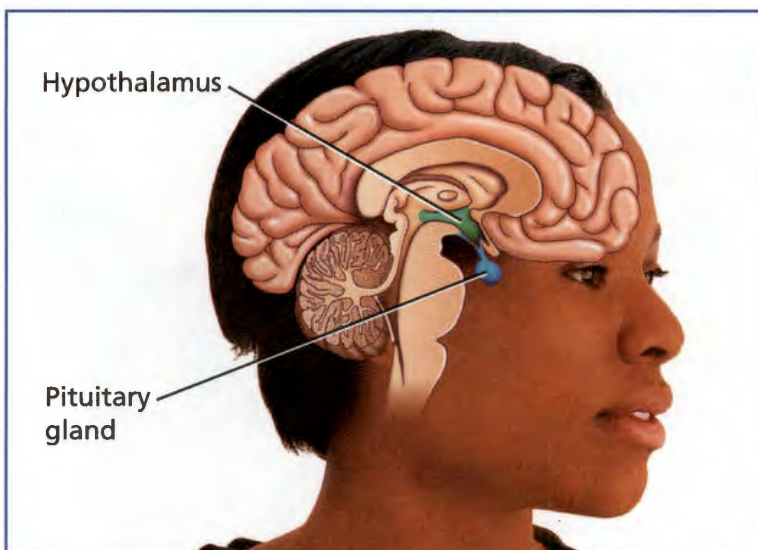


Male

FIGURE 3

The Pituitary Gland

The pituitary gland is located below the hypothalamus. The pituitary controls several important body functions either directly or indirectly by signaling other endocrine glands.



The Pituitary Gland Just below the hypothalamus is an endocrine gland about the size of a pea. The **pituitary gland** (pih TOO ih tehr ee) communicates with the hypothalamus to control many body activities. In response to nerve impulses or hormone signals from the hypothalamus, the pituitary gland releases its hormones. Some of those hormones act as an “on” switch for other endocrine glands. For example, one pituitary hormone signals the thyroid gland to produce hormones. Other pituitary hormones control body activities directly. Growth hormone regulates growth from infancy to adulthood. Another pituitary hormone directs the kidneys to regulate the amount of water in the blood.



**Reading
Checkpoint**

What causes the pituitary gland to release hormones?

Negative Feedback

In some ways, the endocrine system works like a heating system. Suppose you set a thermostat at 20°C. If the temperature falls below 20°C, the thermostat signals the heater to turn on. When the heater warms the area to the proper temperature, information about the warm conditions “feeds back” to the thermostat. The thermostat then gives the heater a signal that turns the heat off. The type of signal used in a heating system is called **negative feedback** because the system is turned off by the condition it produces.

The endocrine system often uses negative feedback to maintain homeostasis. ➡ **Through negative feedback, when the amount of a particular hormone in the blood reaches a certain level, the endocrine system sends signals that stop the release of that hormone.**

You can see an example of negative feedback in Figure 4. Like a thermostat in a cool room, the endocrine system senses when there's not enough thyroxine in the blood. Thyroxine is a thyroid hormone that controls how much energy is available to cells. When there's not enough energy available, the hypothalamus signals the pituitary gland to release thyroid-stimulating hormone (TSH). That hormone signals the thyroid gland to release thyroxine. When the amount of thyroxine reaches the right level, the endocrine system signals the thyroid gland to stop releasing thyroxine.



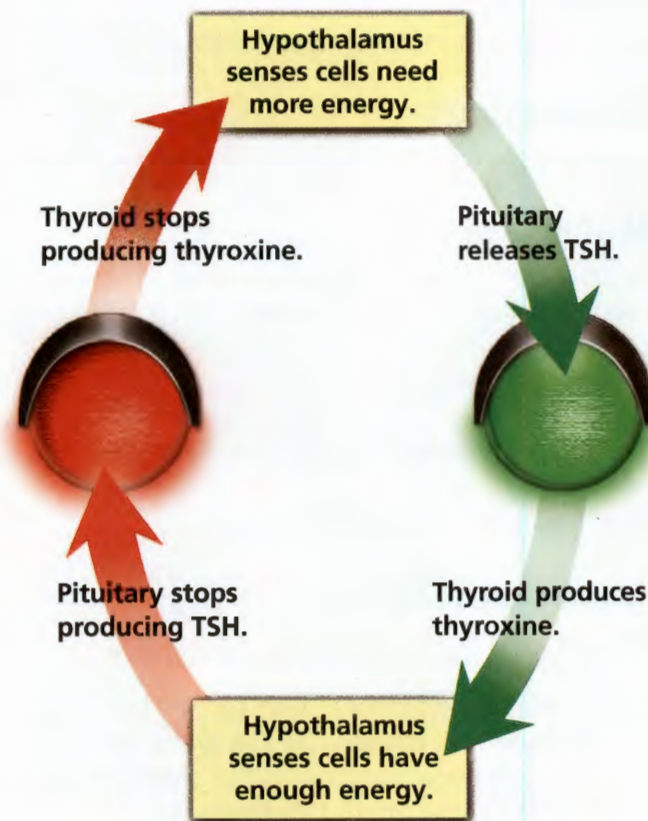
Reading Checkpoint How is thyroxine involved in negative feedback?

FIGURE 4

Negative Feedback

The release of the hormone thyroxine is controlled through negative feedback. When enough thyroxine is present, the system signals the thyroid gland to stop releasing the hormone.

Predicting What happens when the amount of thyroxine becomes too low?



Go Online

active art

For: Negative Feedback activity

Visit: PHSchool.com

Web Code: cep-4071

Section 1 Assessment

S 7.5.b, E-LA: Reading 7.2.3, Writing 7.2.5

Target Reading Skill Analyze Cause and Effect Look at your graphic organizer about the effects of hormones produced by the adrenal glands. Identify three effects of those hormones.

Reviewing Key Concepts

1. a. **Identifying** What is the role of the endocrine system?
- b. **Explaining** How does adrenaline affect the heart?
- c. **Predicting** What could happen if your body continued to release adrenaline into your bloodstream, and the amount of adrenaline did not return to normal?
2. a. **Listing** List the endocrine glands.

- b. **Summarizing** How do the hypothalamus and the pituitary gland interact?
3. a. **Defining** Define negative feedback.
- b. **Applying Concepts** How does negative feedback help to maintain homeostasis?

Writing in Science

Summary In your own words, summarize how the nervous system and endocrine system work together when adrenaline is released. Include main ideas and significant details.

Modeling Negative Feedback



S 7.5.b, 7.7

Problem

How can you model negative feedback?

Skills Focus

observing, making models, evaluating the design

Materials

- duct tape
- round balloon
- scissors
- rubber stopper
- string, 40 cm
- large plastic soda bottle (2-L) with bottom removed
- small plastic soda bottle (1-L)
- plastic tray
- water

Procedure

PART 1 Research and Investigate

1. Figure 1 shows how a flush toilet uses negative feedback to regulate the water level. In your notebook, describe which part of the process involves negative feedback.

FIGURE 1

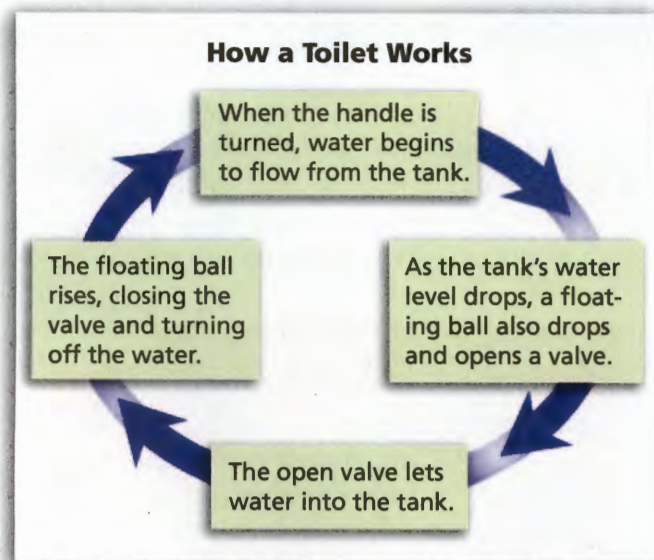


FIGURE 2

PART 2 Design and Build

2. As you hold the open end of a balloon, push its closed end through the mouth of a small plastic bottle. Do not push the open end of the balloon into the bottle. Then, slide a straw partway into the bottle so that the air inside the bottle can escape as you blow up the balloon.
3. Partially blow up the balloon inside the bottle as shown in Figure 2. The partially inflated balloon should be about the size of a tennis ball. Remove the straw. Tie the balloon tightly, then push it into the bottle.
4. Place the large plastic bottle mouth to mouth with the small bottle. Tape the two bottles together. Make sure that the seal is waterproof.



FIGURE 3

5. Tie one end of a piece of string around the top of a rubber stopper as shown in Figure 3.
6. Place the attached bottles on the tray with the smaller bottle on the bottom. Place the stopper loosely into the mouth of the larger bottle as shown in Figure 4.
7. While one partner holds the bottles upright, add water to the large bottle until it is about three fourths full. Then gently pull the string to remove the stopper. Watch what happens. Pay close attention to the following: What does the balloon do as water rises in the small bottle? Does the small bottle completely fill with water? Record your observations.
8. In your notebook, record which part of your device models negative feedback.

PART 3 Evaluate and Redesign

9. In the human endocrine system, negative feedback occurs as part of a cycle. With your partner, think of one or more ways that you could modify the model from Part 2 to show a cycle.

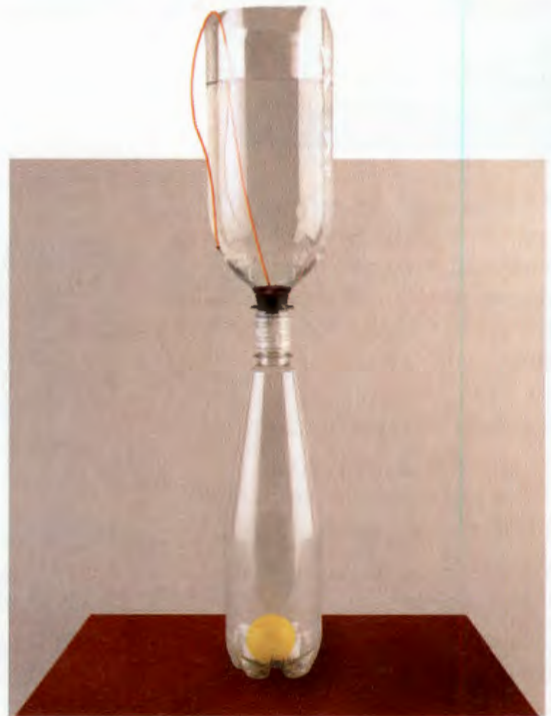


FIGURE 4

Analyze and Conclude

1. **Inferring** Summarize what you learned from Part 1 by describing an example of negative feedback.
2. **Observing** Describe the events you observed in Step 7.
3. **Making Models** In Step 7, which part of the process involves negative feedback? Explain your answer.
4. **Evaluating the Design** Suggest one way that you could change the model to show that negative feedback can be part of a cycle.

Communicating

Suppose you are a TV health reporter preparing a program on human hormones. You need to do a 30-second segment on hormones and negative feedback. Write a script for your presentation. Include references to a model to help viewers understand how negative feedback works in the endocrine system.

The Male and Female Reproductive Systems

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Standards Focus

S 7.5.d Students know how the reproductive organs of the human female and male generate eggs and sperm and how sexual activity may lead to fertilization and pregnancy.

- 🔑 What is sexual reproduction?
- 🔑 What are the structures and functions of the male and female reproductive systems?
- 🔑 What events occur during the menstrual cycle?

Key Terms

- egg • sperm • testis
- testosterone • scrotum
- semen • penis • urethra
- ovary • estrogen
- fallopian tube • uterus
- vagina • menstrual cycle
- follicle • ovulation
- menstruation


Hormones control growth and development.

Lab zone

Standards Warm-Up



What's the Big Difference?

1.  Your teacher will provide prepared slides of eggs and sperm.
2. Examine each slide under the microscope, first under low power, then under high power. Be sure you view more than one example of each kind of cell.
3. Sketch and label each sample.

Think It Over

Observing What differences did you observe between sperm cells and egg cells? How are these differences examples of the complementary nature of structure and function?

Many differences between an adult animal and its young are controlled by the endocrine system. In humans, two endocrine glands—the ovaries and the testes—control many of the changes that occur as a child matures. These glands release hormones that cause the body to develop as a person grows older. They also produce mature sex cells that are part of sexual reproduction.



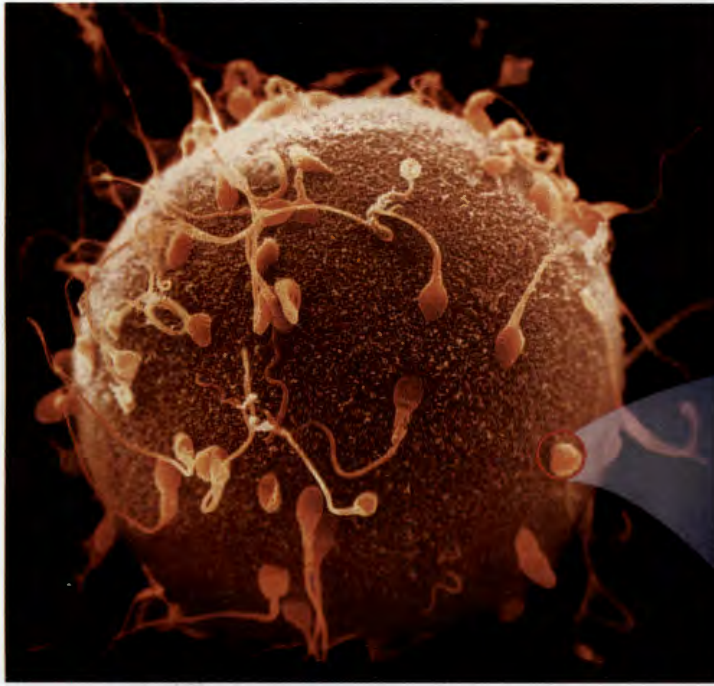


FIGURE 5

Egg and Sperm

An egg is one of the largest cells in the body. A sperm, which is much smaller than an egg, has a head (rounded end) and a tail that allows it to move. In the photograph on the left, sperm are swarming around the large egg. On the right, a sperm, which has been colored blue, has penetrated the egg.

Applying Concepts What structure results when the sperm fertilizes the egg?



Sexual Reproduction

You began life as a single cell. That single cell was produced by the joining of two other cells, an egg and a sperm. An **egg** is the female sex cell. A **sperm** is the male sex cell. It has a tail, or flagellum, that enables it to move.

The joining of a sperm and an egg is called fertilization. Fertilization is an important part of sexual reproduction, the process by which male and female living things produce new individuals. 🍌 **Sexual reproduction involves the production of eggs by the female and sperm by the male. The egg and sperm join together during fertilization.** When fertilization occurs, a fertilized egg, or zygote, is produced. Every one of the trillions of cells in your body is descended from the single cell that formed during fertilization.

Like other cells in the body, sex cells contain rod-shaped structures called chromosomes. Chromosomes carry the information that controls inherited characteristics, such as eye color and blood type. Every cell in the human body that has a nucleus, except the sex cells, contains 46 chromosomes. Each sex cell contains half that number, or 23 chromosomes. During fertilization, the 23 chromosomes in a sperm join the 23 chromosomes in an egg. The result is a zygote with 46 chromosomes. The zygote contains all of the information needed to produce a new human being.



**Reading
Checkpoint**

What happens to the number of chromosomes when a male sex cell and a female sex cell join?

Male Reproductive System

The organs of the male reproductive system are shown in Figure 6. 🗝️ The male reproductive system is specialized to produce sperm and the hormone testosterone. The structures of the male reproductive system include the testes, scrotum, and penis.

The Testes The oval-shaped **testes** (TES teez) (singular *testis*) are the organs of the male reproductive system in which sperm are produced. The testes contain clusters of tiny coiled tubes, called seminiferous tubules. Immature sperm form in the walls of these tubes. As each sperm cell matures, it gains a flagellum. Sperm are then carried to the epididymis. Within this structure, the sperm continue to mature and are stored.

Notice in Figure 6 that the testes are located in an external pouch of skin called the **scrotum** (SKROH tum). This location keeps the testes about 2°C to 3°C below body temperature. Sperm need the slightly cooler conditions to develop normally.

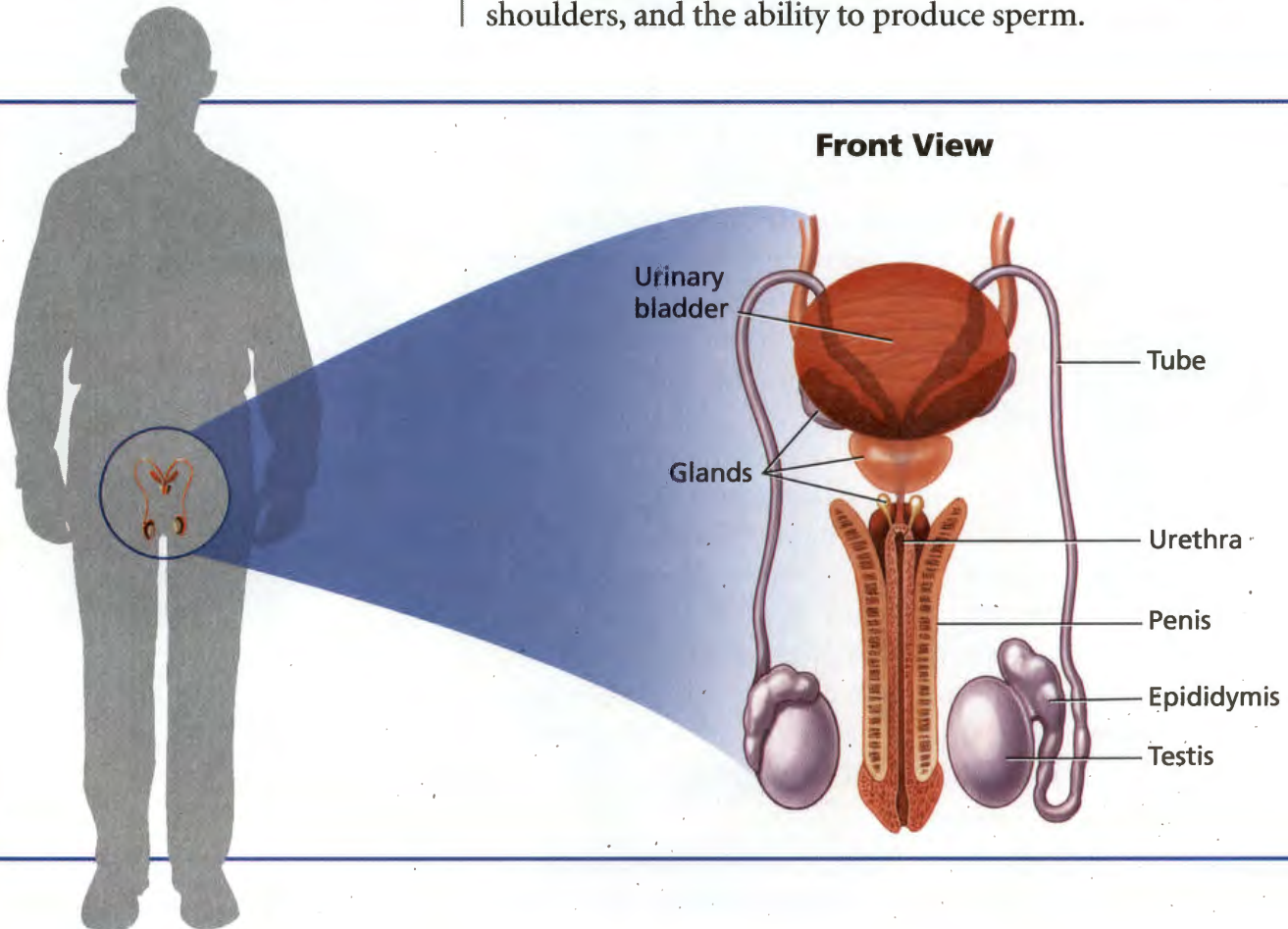
The testes also produce testosterone. **Testosterone** (tes TAHS tuh rohn) is a hormone that controls the development of physical characteristics in mature men. Some of those characteristics include facial hair, deepening of the voice, broadening of the shoulders, and the ability to produce sperm.

FIGURE 6

The Male Reproductive System

In the male reproductive system, the testes produce sperm and the hormone testosterone.

Interpreting Diagrams Trace the pathway of sperm in the male reproductive system. What structures does a sperm cell pass through before exiting the body?



The Path of Sperm Cells The production of sperm cells begins in the testes at some point during the teenage years. Each sperm cell has a head, which contains chromosomes, and a long, whiplike flagellum. Once sperm cells form, they move to the epididymis. From there, sperm travel through other structures in the male reproductive system. As the sperm move, they mix with fluids produced by nearby glands. This mixture of sperm cells and fluids is called **semen** (SEE mun). The fluids in semen provide an environment in which sperm are able to swim. Semen also contains nutrients that the moving sperm use as a source of energy.

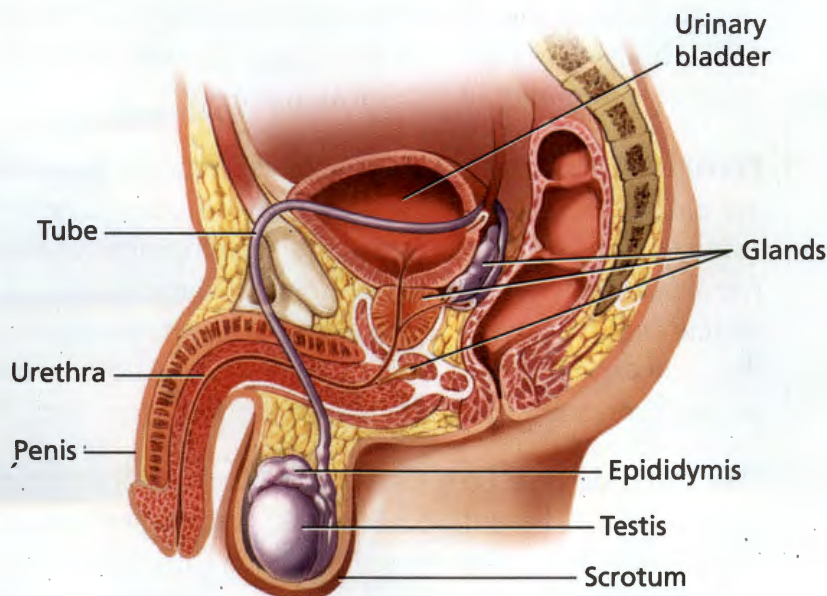
Semen leaves the body through an organ called the **penis**. The tube in the penis through which the semen travels is the **urethra** (yoo REE thruh). Urine also leaves the body through the urethra. However, when semen passes through the urethra, muscles near the bladder contract. Those muscles prevent urine and semen from mixing.

Semen contains a huge number of sperm cells—about 5 to 10 million per drop! Sperm leave the penis in a process called ejaculation, which can release 2 to 3 milliliters of semen. The release of sperm during sexual activity may lead to the fertilization of an egg and pregnancy.



Reading Checkpoint What is the pouch of skin in which the testes are located?

Side View



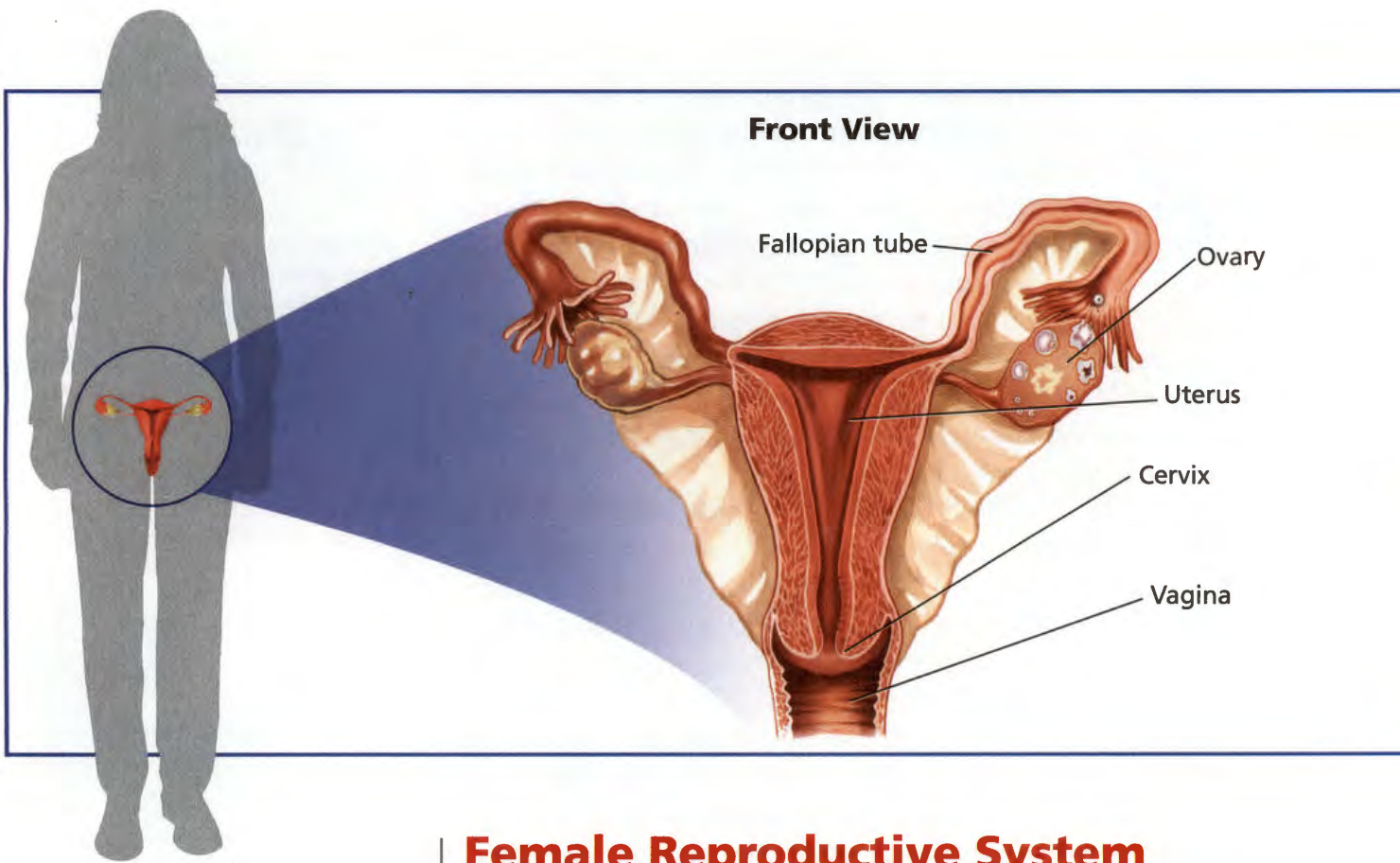


FIGURE 7
The Female Reproductive System

In the female reproductive system, the two ovaries produce eggs and hormones, such as estrogen and progesterone.

Relating Cause and Effect *What changes does estrogen produce in a female's body?*

Female Reproductive System

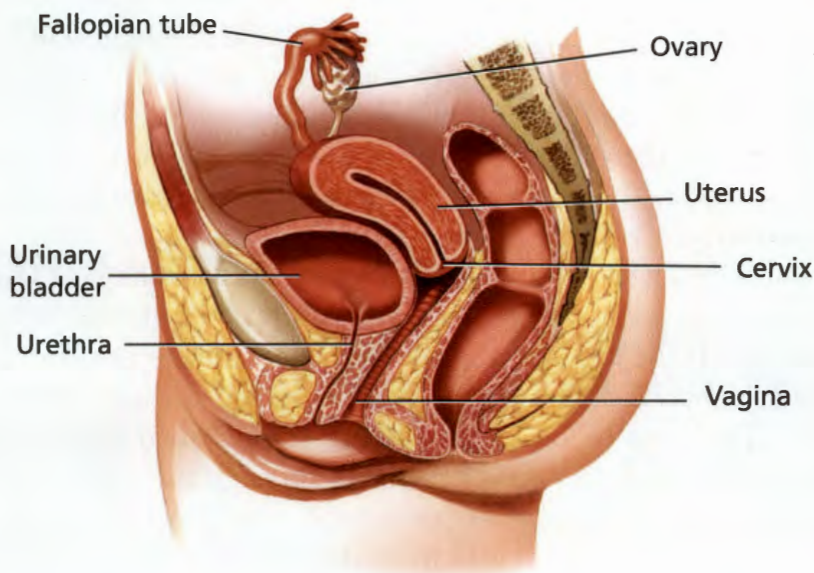
👉 The role of the female reproductive system is to produce eggs and, if an egg is fertilized, to nourish a developing baby until birth. The organs of the female reproductive system include the ovaries, fallopian tubes, uterus, and vagina.

The Ovaries The **ovaries** (OH vuh reez) are the female reproductive structures that produce and store eggs. The ovaries are located slightly below the waist, one ovary on each side of the body. The name for these organs comes from the Latin word *ova* (singular *ovum*), meaning “eggs.”

Female Hormones Like the testes in males, the ovaries also are endocrine glands that produce hormones. One hormone, **estrogen** (ES truh jun), triggers the development of some adult female characteristics. For example, estrogen causes the hips to widen and the breasts to develop. Estrogen also plays a role in the process by which egg cells mature. Another hormone, progesterone, maintains the uterus during pregnancy.

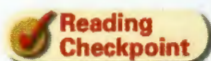
The Path of the Egg Cell Each ovary is located near a fallopian tube. The **fallopian tubes**, also called oviducts, are passageways for eggs as they travel from the ovary to the uterus. Each month, one of the ovaries releases a mature egg, known as an oocyte (OH oh sight). The egg enters the nearest fallopian tube. Fertilization usually occurs within a fallopian tube.

Side View



The egg moves through the fallopian tube, which leads to the uterus. The **uterus** (YOO tur us) is a hollow muscular organ about the size of a pear. If an egg has been fertilized, it becomes attached to the wall of the uterus and pregnancy begins.

An egg that has not been fertilized starts to break down in the uterus. It leaves the uterus through an opening at the base of the uterus, called the cervix. The egg then enters the vagina. The **vagina** (vuh JY nuh) is a muscular passageway leading to the outside of the body. The vagina, or birth canal, is the passageway through which a baby leaves the mother's body.




**Reading
Checkpoint**

What is the role of the fallopian tube?

The Menstrual Cycle

When the female reproductive system becomes mature, usually during the teenage years, there are about 400,000 undeveloped eggs in the ovaries. However, only about 500 of those eggs will actually leave the ovaries and reach the uterus. An egg is released about once a month in a mature woman's body. The monthly cycle of changes that occur in the female reproductive system is called the **menstrual cycle** (MEN stroo ul).

 **During the menstrual cycle, an egg matures in an ovary. At the same time, the lining of the uterus becomes thicker.** In this way, the menstrual cycle prepares the woman's body for pregnancy, which begins after fertilization.

**Lab
zone**

Skills Activity

Calculating

An egg is about 0.1 mm in diameter. In contrast, the head of a sperm is about 0.005 mm. Calculate how much bigger an egg is than a sperm.

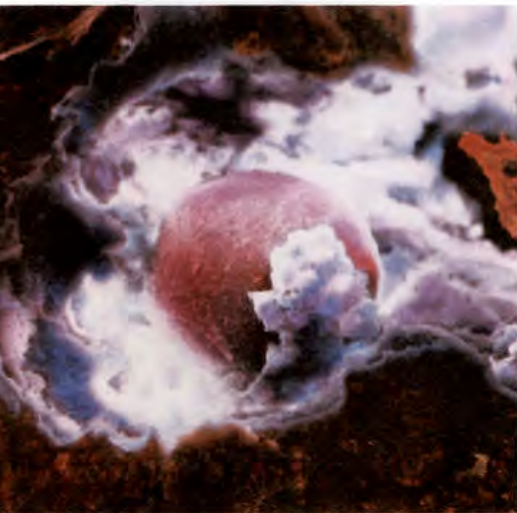


FIGURE 8

Release of an Egg

The ovary releases an egg, shown here in pink. The egg will then travel down the fallopian tube to the uterus. **Applying Concepts** Through what structure does an unfertilized egg pass after leaving the uterus?

Stages of the Menstrual Cycle Follow the stages of the menstrual cycle in Figure 9. Early in the menstrual cycle, an egg starts to mature in one of the ovaries. Each egg matures within its own grouping of cells, called a **follicle** (FAHL ih kuhl). At the same time, the lining of the uterus begins to thicken. About halfway through a typical menstrual cycle, the follicle ruptures and the mature egg is released from the ovary into a fallopian tube. The process in which an egg is released is called **ovulation** (ahv yuh LAY shun).

Once the egg is released, it can be fertilized for the next few days if sperm are in or near the vagina and travel into the fallopian tube. If the egg is not fertilized, or if it fails to implant, it begins to break down. The lining of the uterus also breaks down. The extra blood and tissue of the thickened lining are sloughed off and pass out of the body through the vagina in a process called **menstruation** (men stroo AY shun). On average, menstruation lasts about four to six days. At the same time that menstruation takes place, a new egg begins to mature in the ovary, and the cycle continues.

Endocrine Control The menstrual cycle is controlled by hormones of the endocrine system. Hormones also trigger a girl's first menstruation. Many girls begin menstruation between the ages of 10 and 14 years. Some girls start earlier, while others start later. Women continue to menstruate until about age 50. Then, the production of sex hormones drops. As a result, the ovaries stop releasing mature egg cells.

Math: Algebra and Functions 7.1.5

Math

Analyzing Data

Changing Hormone Levels

A woman's hormone levels change throughout the menstrual cycle. The graph shows the levels of one female hormone, known as LH, which causes the egg to mature.

- Reading Graphs** What does the y-axis show?
- Interpreting Data** What is the level of LH on day 1? On day 17? On day 21?
- Calculating** What is the difference between LH levels on days 9 and 13?
- Drawing Conclusions** On what day does LH reach its highest level? What event do you think takes place at about the same time?

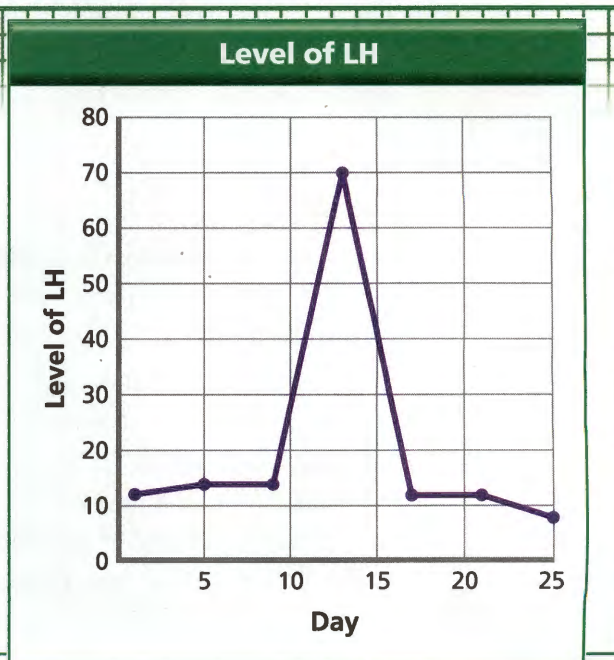
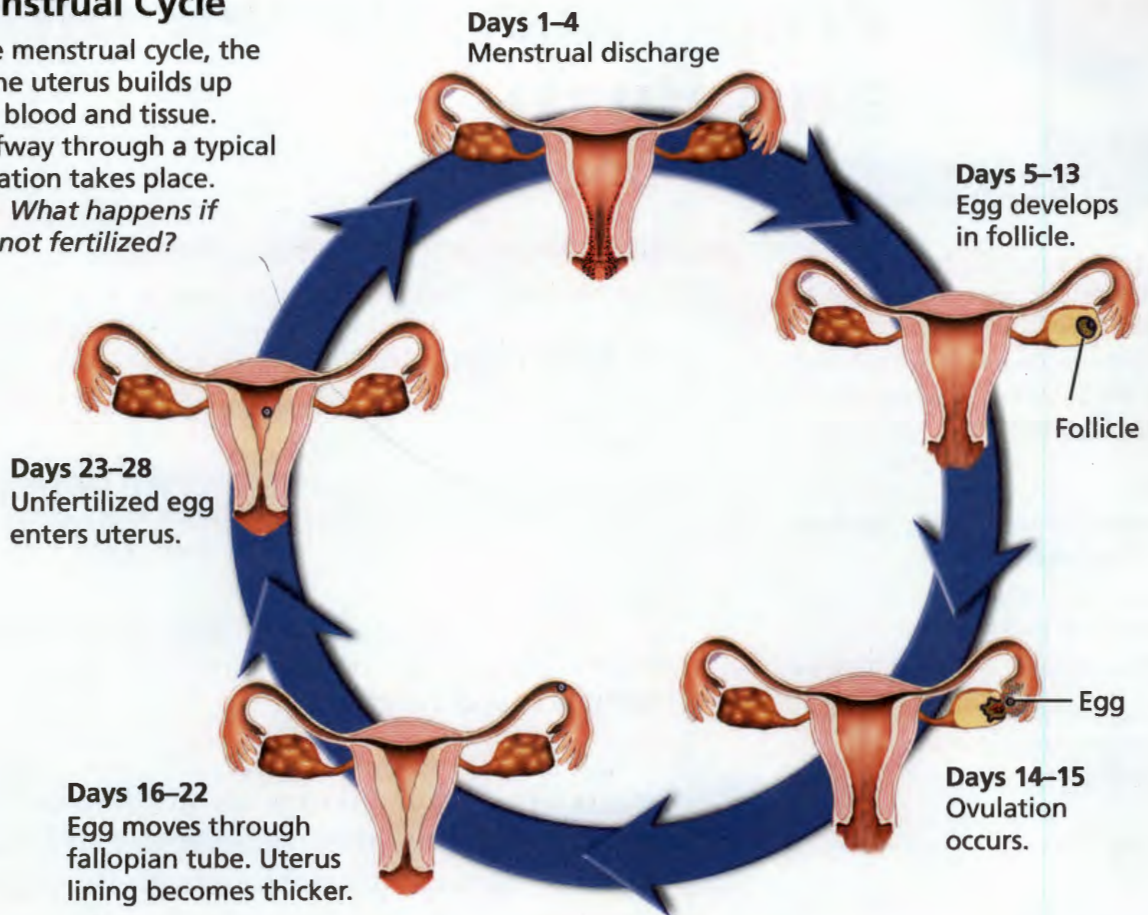


FIGURE 9

The Menstrual Cycle

During the menstrual cycle, the lining of the uterus builds up with extra blood and tissue. About halfway through a typical cycle, ovulation takes place.

Predicting What happens if the egg is not fertilized?



Section 2 Assessment

S 7.5.d, E-LA: Reading 7.1.0, Writing 7.2.0

Vocabulary Skill Identify Related Word

Forms Choose one of the following words—*menstruate*, *menstruation*, or *menstrual*—to complete the following sentence:

The _____ cycle is controlled by hormones.

Reviewing Key Concepts

- Reviewing** What is fertilization?
 - Explaining** Explain how fertilization produces a new individual.
 - Comparing and Contrasting** Contrast the number of chromosomes in sex cells and in a zygote. Explain why the zygote has the number of chromosomes that it does.
- Listing** List the structures of the male and female reproductive systems.
 - Describing** Describe the functions of the structures you named in Question 2a.

- Comparing and Contrasting** In what ways are the functions of the ovaries and the testes similar? How do their functions differ?
- Defining** What is the menstrual cycle?
 - Sequencing** At what point in the menstrual cycle does ovulation occur?
 - Relating Cause and Effect** How is ovulation related to fertilization?

Writing in Science

Explanatory Paragraph Write a paragraph explaining why the ovaries and testes are part of both the endocrine system and the reproductive system.

Pregnancy, Development, and Birth

CALIFORNIA

Standards Focus

S 7.1.f Students know that as multicellular organisms develop, their cells differentiate.

S 7.5.e Students know the function of the umbilicus and placenta during pregnancy.

- What are the changes that occur to the zygote, embryo, and fetus during development?
- How is the developing embryo protected and nourished?
- What happens during childbirth?
- What changes occur as a person develops from infancy to adulthood?

Key Terms

- embryo
- differentiation
- fetus
- amniotic sac
- placenta
- umbilical cord
- adolescence
- puberty

Lab zone

Standards Warm-Up

Is It Safe From Harm?

1. Place a foam packing peanut in a uninflated balloon. Blow up the balloon and tie it closed.
2. Try to crush or break the peanut without breaking the balloon. You can shake or drop the balloon, or try other approaches that are approved by your teacher.

Think It Over

Drawing Conclusions How easy or difficult was it to crush or break the peanut? How did the presence of the air in the bag contribute to your results?

An egg can be fertilized during the first few days after ovulation. When sexual activity occurs, sperm may be deposited in or near the vagina. Sperm move through the vagina, into and through the uterus, and then into the fallopian tubes. If a sperm fertilizes an egg, pregnancy can occur. One of the earliest signs of pregnancy is that a woman's menstrual cycle stops. About nine months after fertilization, a baby is born.

Development Before Birth

A fertilized egg, or zygote, is no larger than the period at the end of this sentence. Yet after fertilization, the zygote undergoes changes that result in the formation of a new human.

➤ **The zygote develops into an embryo and then into a fetus. Differentiation leads to specialized cells, tissues, and organs.**



Zygote



Eight-Cell Stage



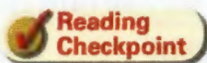
Hollow Ball

From Zygote to Embryo After an egg and sperm join, the zygote moves down the fallopian tube toward the uterus. During this trip, which takes about four days, the zygote begins to divide. The original cell divides to make two cells. These two cells divide to make four, and so on. Eventually, the mass of hundreds of cells forms a hollow ball not very different in size from the zygote. The ball attaches to the lining of the uterus. From the two-cell stage through the eighth week of development, the developing human is called an **embryo** (EM bree oh).

Differentiation of the Embryo Figure 10 shows the early stages that occur when a zygote divides and an embryo develops. Within the first day or two, cell divisions in the 4-cell stage produce 8 cells, 16 cells, and so on. At this point, all the cells still look alike. During the first week after fertilization, these cells rearrange into a hollow ball. Just a few days later, this ball of cells attaches to the wall of the uterus.

At about three weeks, some cells of the embryo begin to fold into the center of the ball. Then other cells fill in spaces between the folds. These changes lead to three layers of cells.

The layer in which a cell is located determines, or fixes, how it will differentiate. **Differentiation** is the process by which cells change and become specialized. For example, cells that will eventually give rise to the stomach and intestines are located in a different layer from cells that will give rise to the central nervous system and eyes. These two types of cells become distinguished from one another at a very early stage. As development continues, some cells become more finely differentiated. For example, certain cells of the retina in the eye become rod cells, and others become cone cells.



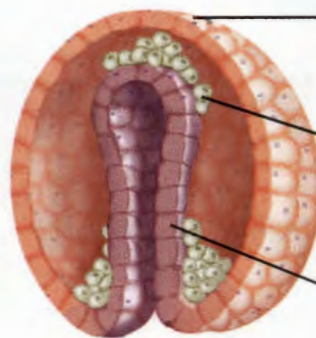
Reading Checkpoint How many layers of cells in the embryo give rise to differentiated cells?

FIGURE 10

Early Changes in an Embryo Cell division occurs rapidly in an embryo. Location helps control how the cells will differentiate. Some of the structures that form from the layers of the embryo are listed below. **Interpreting Diagrams** Which layer gives rise to the skeletal system?



Stage When Folding Begins



Embryo With Three Layers

Outer Layer

Skin, nervous system, pituitary gland, salivary glands

Middle Layer

Heart, bones, muscles, kidneys, lymphatic system, testes, ovaries

Inner Layer

Pancreas, thyroid gland, liver, parts of the digestive system

Four-week embryo
Heart beats in a regular rhythm. Eyes and ears begin to form.



Eight-week embryo
Heart has left and right chambers.



24-week fetus All parts of the eye are present. Fingerprints are forming.



FIGURE 11

Development of the Fetus

As a fetus grows and develops, it gains mass and increases in length. Its body systems also develop.

Applying Concepts *What process leads to the development of the different body systems?*

Development of the Fetus From about the ninth week of pregnancy until birth, the developing human is called a **fetus** (FEE tus). At first the fetus is only the size of a walnut shell, but it now looks more like a human. Many internal organs have formed. The head is about half the body's total size and the brain is developing rapidly. The fetus also has dark eye patches, fingers, and toes. At three months, the fetus is about 9 centimeters long and has a mass of about 26 grams.

Between the fourth and sixth months, bones become distinct. A heartbeat can be heard with a stethoscope. A layer of soft hair grows over the skin. The arms and legs develop more completely. The fetus begins to move and kick, a sign that its muscles are growing. At the end of the sixth month, the mass of the fetus is approaching 700 grams. Its body is about 30 centimeters long.


The final three months prepare the fetus to survive outside the mother's body. The brain surface develops grooves and ridges. The lungs become ready to carry out the exchange of oxygen and carbon dioxide. The eyelids can open. The fetus doubles in length. Its mass may reach 3 kilograms or more.



Reading Checkpoint

At what point during development can a heartbeat be detected in a fetus?

Protection and Nourishment

Just like you, the embryo and fetus need nourishment and protection to develop properly. Soon after the embryo attaches to the uterus, changes take place. In addition to the three layers of the embryo, new membranes form.  **The membranes and other structures that form during development protect and nourish the developing embryo, and later the fetus.**



For: Links on before birth
Visit: www.SciLinks.org
Web Code: scn-0473

Amniotic Sac One membrane surrounds the embryo and develops into a fluid-filled sac called the **amniotic sac** (am NEE aht ik). Locate the amniotic sac in Figure 12. The fluid in the amniotic sac cushions and protects the developing baby.

Placenta and Umbilical Cord Another membrane helps to form the placenta. The **placenta** (pluh SEN tuh) is an organ that develops from fetal tissue during pregnancy. In the placenta, the embryo's blood vessels are located next to the mother's blood vessels. A ropelike structure called the **umbilical cord** forms between the embryo and the placenta. It contains veins and arteries that link the fetus to the mother.

Although the blood systems do not mix, many substances pass between the mother and fetus through the placenta. As blood travels back and forth through the umbilical cord, the fetus receives nutrients, oxygen, and other substances from the mother. Carbon dioxide and other wastes move from the fetus to the mother. The mother's body then releases the wastes through her excretory and respiratory systems.

Keeping the Fetus Healthy The barrier that separates the two blood supplies stops some diseases from spreading from the mother to the fetus. But some infectious viruses can pass through easily. One example is HIV, the virus that causes AIDS. Substances such as alcohol, chemicals in tobacco, and other drugs also can pass through the barrier. For this reason, pregnant women should not smoke, drink alcohol, or take any drug without a doctor's approval.

FIGURE 12

A Vital Link

The placenta provides a link between the mother and fetus. Blood vessels in the umbilical cord carry materials to and from the fetus. The point where the cord enters the fetus's body is the umbilicus. It remains as the navel after the baby is born.

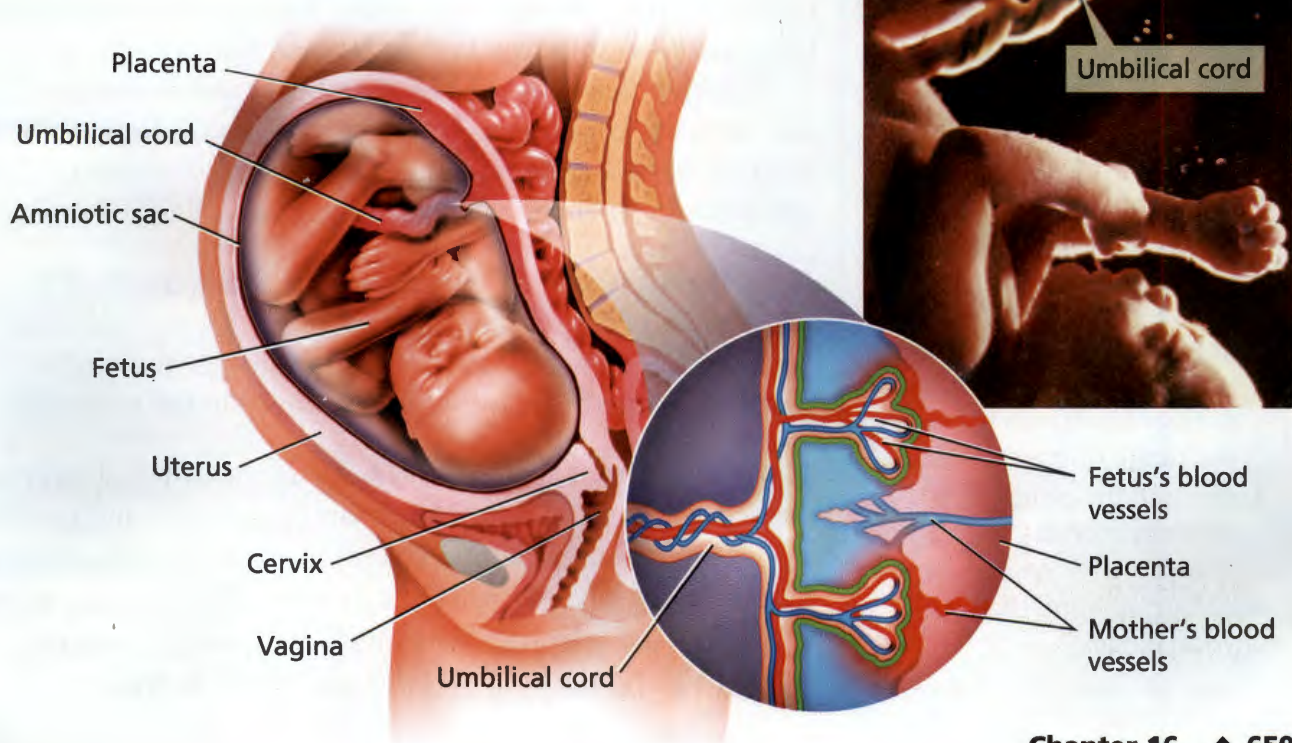


FIGURE 13

Birth

After about nine months of growth and development inside the uterus, a baby is born. You can see where the umbilical cord of this newborn was tied and cut.



Lab zone

Try This Activity

Way to Grow!

The table lists the average mass of a developing baby at each month of pregnancy.

Month of Pregnancy	Mass (grams)
1	0.02
2	2.0
3	26
4	150
5	460
6	640
7	1,500
8	2,300
9	3,200

1. Use a balance to identify an everyday object with a mass approximately equal to each mass listed in the table. You may need to use different balances to cover the range of masses listed.
2. Arrange the objects in order by month.

Making Models What did you learn by gathering these physical models?

Birth

After about 40 weeks of development inside the uterus, the baby is ready to be born. 🏠 **The birth of a baby takes place in three stages—labor, delivery, and afterbirth.**

Labor During the first stage of birth, strong muscular contractions of the uterus begin. These contractions are called labor. The contractions cause the cervix to open, eventually allowing the baby to fit through the opening. Labor may last from about 2 hours to more than 20 hours.

Delivery The second stage of birth is called delivery. During normal delivery, the baby is pushed completely out of the uterus, through the vagina, and out of the mother's body. At this time, the baby is still connected to the placenta by the umbilical cord. Delivery of the baby usually takes less time than labor does—from several minutes to an hour or so.

Shortly after delivery, the umbilical cord is clamped, then cut about 5 centimeters from the baby's abdomen. Within seven to ten days, the remainder of the umbilical cord dries up and falls off, leaving a scar called the navel, or belly button.

Afterbirth About 15 minutes after delivery, the third stage of the birth process begins. Contractions push the placenta and other membranes out of the uterus through the vagina. This stage, called afterbirth, is usually completed in less than an hour.

Birth and the Baby As the baby is pushed and squeezed, muscle contractions put pressure on the placenta and umbilical cord. This pressure briefly decreases the baby's supply of oxygen. In response, the baby's heart rate increases. Within a few seconds of delivery, the baby begins breathing with a cry or a cough. This action helps rid the lungs of fluid and fills them with air.

Multiple Births The delivery of more than one baby from a single pregnancy is called a multiple birth. In the United States, about 1 out of every 30 babies born each year is a twin. Multiple births of more than two babies, such as triplets and quadruplets, occur less frequently than do twin births.

There are two types of twins: identical twins and fraternal twins. Identical twins develop from a single fertilized egg, or zygote. Early in development, the embryo splits into two identical embryos. The two embryos have identical inherited traits and are the same sex. Fraternal twins develop when two eggs are released from the ovary and are fertilized by two different sperm. Fraternal twins are no more alike than any other brothers or sisters. Fraternal twins may or may not be the same sex.

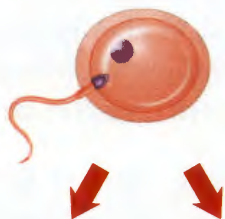


Reading Checkpoint

What are the two types of twins?

Identical Twins

A sperm fertilizes a single egg.



The single egg splits and forms two identical embryos.

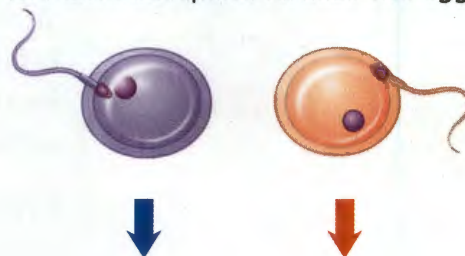


Identical twins result.



Fraternal Twins

Two different sperm fertilize two eggs.



Each of the eggs develops into an embryo.



Fraternal twins result.



FIGURE 14

Twins

Identical twins (left) develop from the same fertilized egg. They share identical characteristics. Fraternal twins (right) develop from two different fertilized eggs. **Applying Concepts** Why can fraternal twins be different sexes while identical twins cannot?

FIGURE 15

Development

You can see the changes in development from infancy through adolescence.

Applying Concepts What mental development takes place during childhood?



▲ Infancy



▲ Childhood



▲ Adolescence

Growth and Development

You've changed a lot since you were a baby. And more changes are yet to come. 🗝️ The changes that take place between infancy and adulthood include physical changes, such as an increase in size and coordination, and mental changes, such as the ability to communicate and solve complex problems.

Infancy During infancy—the first two years of life—a baby grows quickly. Its weight may double within just the first year! The baby's nervous and muscular systems become better coordinated. After about 3 months, a baby can hold its head up and reach for objects. Within the next 4 to 14 months, most infants begin to crawl, and then walk, by themselves. They also learn to speak. By two years old, children can do many things for themselves, such as understand simple directions, feed themselves, and play with toys.

Childhood Infancy ends and childhood begins at about two years of age. Children grow taller and heavier as their bones and muscles increase in size. They become more coordinated as they practice such skills as walking, using a pencil, and playing games. Children show a growing curiosity and increased mental abilities. Skills improve rapidly, as children learn to read, carry on conversations, and solve problems.

Adolescence The stage of development during which children mature into adults physically and mentally is called **adolescence** (ad ul ES uns). Adolescents gradually become able to think like adults and take on adult responsibilities. The bodies of adolescents also undergo specific physical changes.



Video Field Trip

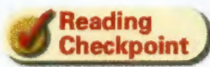
Discovery Channel School
The Endocrine System
and Reproduction

Between the ages of 9 and 15 years, girls and boys enter puberty. **Puberty** (PYOO bur tee) is the period of development in which the body becomes able to reproduce. Girls begin to menstruate, and boys produce sperm. Other physical changes in girls include enlargement of the breasts and widening of the hips. In boys, facial and chest hair appears, and the voice deepens.

Adulthood Mental and emotional growth continue after adolescence. It is difficult to say when adolescence ends and adulthood begins. As adults, people continue to learn new things. After about age 30, a process known as aging begins. As people age, the skin becomes wrinkled and muscle strength decreases. The eyes may lose their ability to focus on close objects, and hair may lose its coloring. Aging becomes more noticeable between the ages of 40 and 65. However, the effects of aging can be slowed if people follow sensible diets and good exercise plans. Many adults can remain active throughout their lives. Older people have learned a lot from their experiences. Because of this learning, many older people have a great deal of wisdom they can share with younger people.



FIGURE 16
Adulthood
Young adults often enjoy helping older adults.



What are the physical effects of aging?

Section 3 Assessment

S 7.1.f, 7.5.e,
E-LA: Reading 7.1.0

Vocabulary Skill Identify Related Word Forms

Which word—*differentiate* or *differentiation*—correctly completes the following sentence? During _____, cells in an embryo change and become specialized.

Reviewing Key Concepts

- Identifying** What three stages of development does a fertilized egg go through before birth?
 - Describing** How does differentiation change an embryo as it develops?
 - Interpreting Diagrams** Using Figure 10, predict which cell layer of the embryo will likely differentiate into brain cells.
- Reviewing** What is the general function of the membranes that surround a fetus?
 - Explaining** What are the specific functions of the placenta and the umbilical cord?
 - Relating Cause and Effect** Why is it dangerous for a pregnant woman to drink alcohol or to smoke cigarettes?

- Listing** What are the three stages of birth?
 - Summarizing** What happens during labor?
- Identifying** Identify two general kinds of change that occur between infancy and adulthood. Give an example of each.
 - Describing** Describe physical changes that happen in males and females during puberty.

Lab
zone

At-Home Activity

Understanding Risk Check the labels on nonprescription drugs that may be in your home to see if they carry warnings about use during pregnancy. Show the warnings to a family member, and explain why these labels are important.



The **BIG Idea**

Hormones regulate the functions of the female and male reproductive systems. The reproductive organs produce sex cells and enable fertilization and pregnancy to occur.

1 The Endocrine System

Key Concepts

S 7.5.b

- The endocrine system produces chemicals that control many of the body's daily activities as well as growth and development.
- The endocrine glands include the pituitary, hypothalamus, thyroid, parathyroid, adrenal, thymus, and pancreas. They also include ovaries in females and testes in males.
- Through negative feedback, when the amount of a particular hormone in the blood reaches a certain level, the endocrine system sends signals that stop the release of that hormone.

Key Terms

- endocrine gland • hormone • target cell
- hypothalamus • pituitary gland
- negative feedback

2 The Male and Female Reproductive Systems

Key Concepts

S 7.5.d

- Sexual reproduction involves the production of eggs by the female and sperm by the male. The egg and sperm join during fertilization.
- The male reproductive system produces sperm and the hormone testosterone. The structures include the testes, epididymis, scrotum, and penis.
- The female reproductive system produces eggs and nourishes a developing baby until birth. The structures include the ovaries, fallopian tubes, uterus, and vagina.
- During the menstrual cycle, an egg develops in an ovary. At the same time, the uterus prepares for the arrival of an embryo.

Key Terms

- egg • sperm • testis • testosterone
- scrotum • semen • penis • urethra
- ovary • estrogen • fallopian tube • uterus
- vagina • menstrual cycle • follicle
- ovulation • menstruation

3 Pregnancy, Development, and Birth

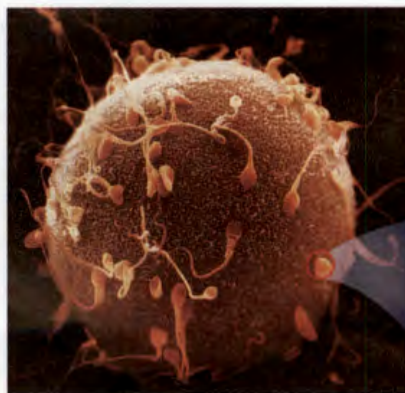
Key Concepts

S 7.1.f, 7.5.e

- The zygote develops into an embryo and then into a fetus. Differentiation leads to specialized cells, tissues, and organs.
- The membranes and other structures that form during development protect and nourish the developing embryo, and later the fetus.
- The birth of a baby takes place in three stages—labor, delivery, and afterbirth.
- The changes that take place between infancy and adulthood include physical changes, such as an increase in size and coordination, and mental changes, such as the ability to communicate and solve complex problems.

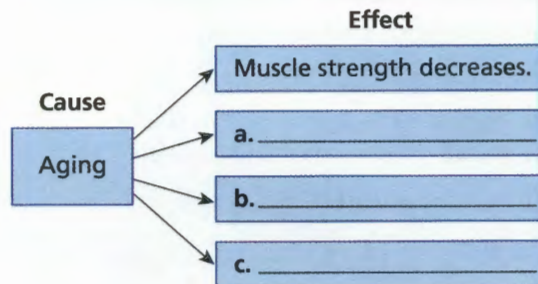
Key Terms

- embryo
- differentiation
- fetus
- amniotic sac
- placenta
- umbilical cord
- adolescence
- puberty



Target Reading Skill

Analyze Cause and Effect To review part of Section 3, copy and complete the graphic organizer to the right, which describes some effects of aging.



Reviewing Key Terms

Choose the letter of the best answer.

- The structure that links the nervous system and the endocrine system is the
 - thyroid gland.
 - target cell.
 - umbilical cord.
 - hypothalamus.
- The male sex cell is called the
 - testis.
 - sperm.
 - egg.
 - ovary.
- The release of an egg from an ovary is known as
 - ovulation.
 - fertilization.
 - menstruation.
 - negative feedback.
- In which stage of development does differentiation lead to specialized cells?
 - unfertilized egg
 - fertilized egg
 - zygote
 - embryo
- The structure that transports materials between the fetus and the placenta is called the
 - umbilical cord.
 - scrotum.
 - amniotic sac.
 - ovary.

Complete the following sentences so that your answers clearly explain the key term.

- The decrease in release of the hormone thyroxine occurs as a result of **negative feedback**, which is _____.
- Sexual reproduction depends on **fertilization**, which is _____.
- After an egg is fertilized and begins to develop, it becomes attached to the inner wall of the **uterus** which is _____.
- Differentiation** leads to the development of organ systems because _____.
- The mother's body can provide nourishment to the fetus through the **placenta** which is _____.

Writing in Science

Creative Writing Imagine you just found out that you have an identical twin who was raised in another country. Write a description of what you think your twin would be like. Be sure to include information about what your twin looks like, his or her interests, and unique characteristics of your twin.

Video Assessment



Discovery Channel School
The Endocrine System
and Reproduction

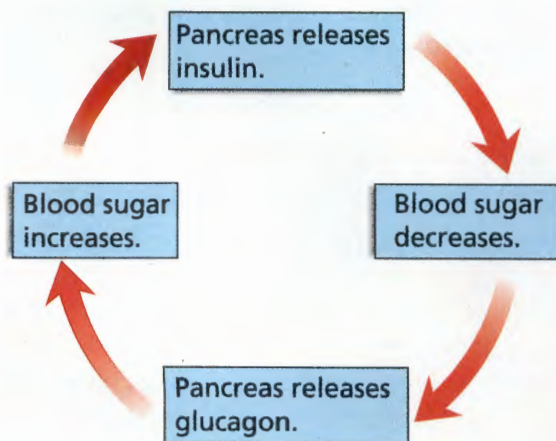
Review and Assessment

Checking Concepts

11. What is the function of the pituitary gland?
12. When enough thyroxine has been released into the blood, what signal is sent to the thyroid gland? How is that signal sent?
13. Identify two functions of the testes.
14. Describe the path of an unfertilized egg, beginning with its release and ending when it leaves the body.
15. What changes occur in the uterus during the menstrual cycle?
16. How does a zygote form? What happens to the zygote during the first four days after it forms?
17. How are the cell layers of an embryo related to the way the cells differentiate? Give an example.
18. Describe how a fetus receives food and oxygen and gets rid of wastes.

Thinking Critically

19. **Inferring** Study the diagram below. Then, suggest how the two hormones, glucagon and insulin, might work together to maintain homeostasis in the body.



20. **Calculating** The average menstrual cycle is 28 days in length but can vary from 24 to 32 days. Ovulation usually occurs 14 days before the end of the cycle. How long after the start of a 24-day cycle will ovulation occur? A 32-day cycle?

21. **Comparing and Contrasting** Contrast the ways in which identical twins and fraternal twins form.
22. **Applying Concepts** Why is the umbilical cord not necessary after a baby is born?

Applying Skills

Use the table to answer Questions 23–25.

The data table below shows how the length of a developing baby changes during pregnancy.

Length of Fetus

Week of Pregnancy	Average Length (mm)	Week of Pregnancy	Average Length (mm)
4	4	24	300
8	30	28	350
12	75	32	410
16	180	36	450
20	250	38	500

23. **Measuring** Use a metric ruler to mark each length on a piece of paper. During which four-week period did the greatest increase in length occur?
24. **Graphing** Graph the data by plotting time on the x -axis and length on the y -axis.
25. **Interpreting Data** At the twelfth week, a developing baby measures about 75 mm. By which week has the fetus grown to four times that length? Six times that length?

Lab zone

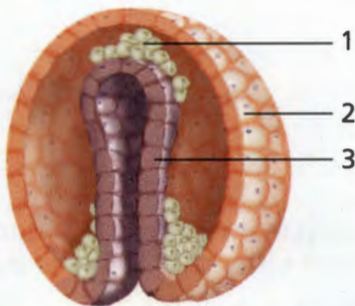
Standards Investigation

Performance Assessment You should now be ready to present your display. Be prepared to summarize what you learned from your research and to discuss the different parts of your model and their functions.

Choose the letter of the best answer.

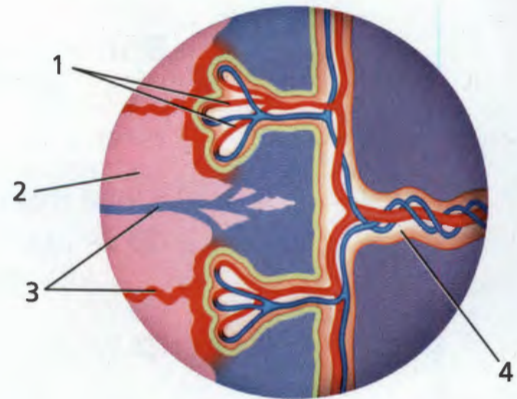
- You are riding your bike when a small child suddenly darts out in front of you. Which of your endocrine glands is most likely to release a hormone in response to this situation?
A pituitary gland
B adrenal glands
C thyroid gland
D parathyroid gland **S 7.5.b**
- In what part of the male reproductive system are sperm cells produced?
A epididymis
B testes
C penis
D urethra **S 7.5.d**
- On day 10 of a woman's menstrual cycle, the egg is most likely
A moving through the fallopian tube.
B in the uterus.
C in the ovary.
D leaving the body **S 7.5.d**

Use the figure below to answer Question 4.



- In the figure above, what process will begin to occur in areas 1, 2, and 3?
A fertilization
B ovulation
C menstruation
D differentiation **S 7.1.f**
- Which of the following is the correct sequence in the development of a fetus?
A fertilization, zygote, embryo, differentiation
B zygote, embryo, fertilization, differentiation
C differentiation, fertilization, embryo, zygote
D fertilization, embryo, zygote, differentiation **S 7.1.f**

Use the figure below to answer Question 6.



- Which structure in the figure above connects the fetus to the placenta?
A Structure 1
B Structure 2
C Structure 3
D Structure 4 **S 7.5.e**
- Which statement is true about the placenta?
A The blood supplies must mix.
B Carbon dioxide passes from the mother to the fetus.
C Oxygen passes from the fetus to the mother.
D Viruses can pass from the mother to the fetus. **S 7.5.e**

Apply the BIG Idea

- Identify the structures in the female and male reproductive systems that are also part of the endocrine system. Tell how the endocrine function and the reproductive function of each structure are related. **S 7.5.d**

Structure and Function

Unit 4 Review in the Human Body



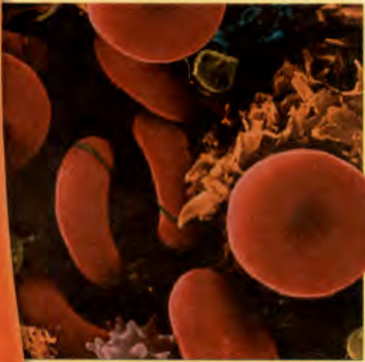
Chapter 13

Bones and Muscles

The BIG Idea

When muscles contract, they exert a force that pulls on a bone and makes it move. Many bones act as levers by rotating around a joint that acts as a fulcrum.

- What systems are in the human body, and what are their functions?
- What are the functions of the skeleton?
- What joints are examples of fulcrums for levers in the body?



Chapter 14

Circulation and Respiration

The BIG Idea

The circulatory and respiratory systems move blood through the body and enable the exchange of gases.

- What are the functions of the cardiovascular system?
- What are the components of the blood?
- What are the functions of the respiratory system?
- What are some diseases of the cardiovascular system?



Chapter 15

The Nervous System

The BIG Idea

Structures that enable the nervous system to function include the brain, spinal cord, neurons, and sense organs, such as the eye and ear.

- What are the functions of the nervous system?
- What are the structures and functions of the central nervous system?
- How do your eyes enable you to see?
- How do your senses of smell and taste work together?



Chapter 16

The Endocrine System and Reproduction

The BIG Idea

Hormones regulate the functions of the female and male reproductive systems. The reproductive organs produce sex cells and enable fertilization and pregnancy to occur.

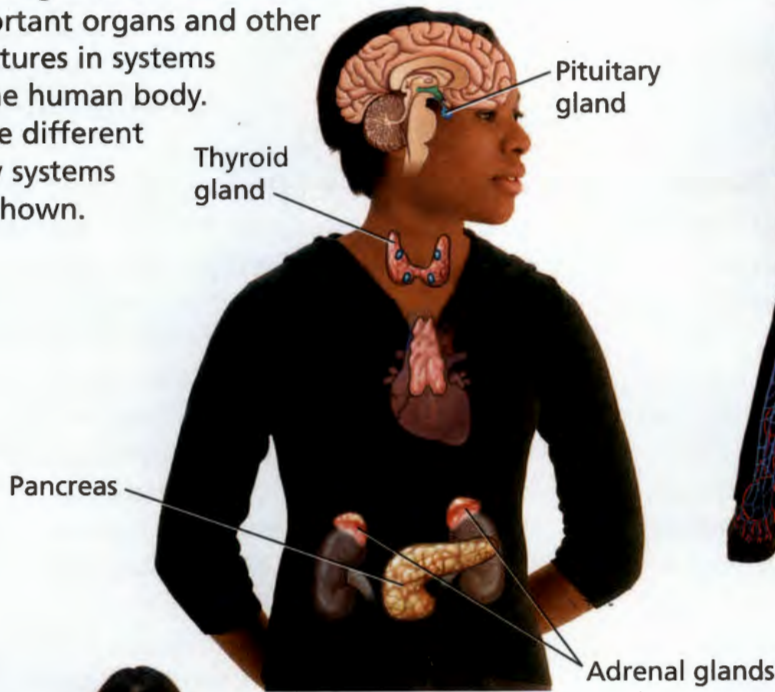
- What are the structures and functions of the male and female reproductive systems?
- What are the changes that occur to the zygote, embryo, and fetus during development?

Unit 4 Assessment



Connecting the BIG Ideas

The diagrams show some of the important organs and other structures in systems of the human body. Three different body systems are shown.



- Which of the following is a ball-and-socket joint that acts as the fulcrum in a third-class lever? (*Chapter 13*)
 - neck
 - shoulder
 - elbow
 - knee
- Which of the following carries blood away from the heart? (*Chapter 14*)
 - arteries
 - lymphatic vessels
 - veins
 - ventricles
- Which structure connects the brain and the peripheral nervous system? (*Chapter 15*)
 - spinal cord
 - cerebrum
 - spine
 - neuron
- Which endocrine gland or glands are also part of the reproductive system? (*Chapter 16*)
 - pancreas
 - adrenal gland
 - ovaries
 - thyroid
- Summary** Summarize how individual body systems work together when a person runs to catch a bus.