

Human Reproduction

1
40- to 50-minute session



ACTIVITY OVERVIEW

This reading introduces the functions of the human male and female reproductive systems and structures that accomplish these functions. It provides a context for understanding the role of the male and female reproductive systems and the processes of fertilization and prenatal development.

KEY CONCEPTS AND PROCESS SKILLS

(with correlation to NSE 5–8 Content Standards)

1. Living things demonstrate the complementary nature of structure and function. (LIFE SCIENCE: 1)
2. The human organism has a system for reproduction. (LIFE SCIENCE: 1)
3. Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. (LIFE SCIENCE: 2)
4. In many species, including humans, females produce eggs and males produce sperm. (LIFE SCIENCE: 2)

KEY VOCABULARY

amniotic sac
egg
embryo
estrogen
fallopian tubes
fertilization
fetus
ovaries
penis
semen
sexual reproduction
sperm
testes
testosterone
uterus
vagina
vas deferens
zygote

MATERIALS AND ADVANCE PREPARATION



For each student

- 1 Student Sheet HR.1, “Structures and Functions of the Human Reproductive System”

TEACHING SUMMARY

Getting Started

1. Informally assess students’ knowledge of sexual reproduction.
2. Prepare students for the Reading, including how to respond to Stopping to Think questions.

Doing the Activity

3. Students read the text and answer Stopping to Think questions.

Follow-Up

4. Review the relationship between the structures and functions of the male and female reproductive systems.

BACKGROUND INFORMATION

For additional information about the human reproductive system, go to the *Issues and Life Science* teacher page of the SEPUP website.

TEACHING SUGGESTIONS

■ GETTING STARTED

1. Informally assess students' knowledge of sexual reproduction.

Ask students to brainstorm in their small groups of four what they know about human reproduction. After students have had a chance to share their ideas, start a class list on the board or on chart paper that can be added to as the activity goes on. Avoid correcting any misconceptions at this point or presenting any content. The opportunity to do that will occur after the reading.

Use the introductory text to review the concept of sexual reproduction. Ask, ***What is the purpose of reproduction?*** Students should realize that all species have to reproduce in order for a species to continue. No single organism lives forever so reproduction ensures the continuation of the species. Sexual reproduction is defined in the introductory paragraph. You may wish to differentiate sexual reproduction from asexual reproduction at this point. These concepts are further developed in Unit D: "Our Genes, Our Selves" of *Science and Life Issues*.

2. Prepare students for the Reading, including how to respond to Stopping to Think questions.

The "Stopping to Think" questions interspersed in the reading provide prompts for comprehension of the main ideas in the reading. These questions do not require a written response, and are different from the Analysis Questions found at the end of an activity. "Stopping to Think" questions are intended to focus students' attention on important ideas in the text during reading. For example, they may require students to identify the main idea of a previous paragraph or to synthesize ideas presented in two or more preceding paragraphs. Good readers may have already answered these questions internally while reading, while less capable readers may need to stop and discuss responses. Sample responses to the questions are listed below.

■ DOING THE ACTIVITY

3. Students read the text and answer Stopping to Think questions.

Students may read individually, in pairs or in their small groups of four students.

Stopping to Think 1

What is a zygote and how does it form?

A zygote is a fertilized egg. It forms when a male sex cell, a sperm, and a female sex cell, an egg, join together during fertilization.

Stopping to Think 2

a. Use the diagram above to describe the path of sperm from the testis to the outside of the male body.

Sperm are produced in the testes, then travel through the vas deferens where they mix with other fluids and become semen. The semen moves into the urethra, which is in the penis, and then it leaves the body through the penis.

b. What is the relationship between sperm and semen?

Sperm are the male sex cells and semen is the liquid that sperm swim in. There are millions of sperm in one drop of semen.

c. How do you think a high fever might affect sperm production? Explain.

In order for sperm to be produced, they need to be about two degrees Fahrenheit cooler than normal body temperature. If a male had a high fever, the sperm may become too warm and the production and survival of sperm might be affected during that time.

Stopping to Think 3

a. Use the diagram to describe the path of an egg from the ovary to the outside of the female body.

An egg matures and is released from an ovary. It travels to a fallopian tube and then to the uterus. If it is not fertilized it passes through the cervix, into the vagina and out of the body.

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b. Look at the photograph of a sperm at the beginning of this reading. How does a sperm's structure help it get to the egg in the fallopian tube?

The sperm has a tail that helps propel it through the female's reproductive system to the fallopian tube.

Stopping to Think 4

a. What is the difference between a zygote and an embryo?

A zygote is a fertilized egg before it attaches to the uterus. Once the fertilized egg attaches to the wall of the uterus, it is an embryo.

b. Why is it important for a mother to take good care of herself when she is pregnant?

Everything that she takes into her body can cross the placenta and affect the developing fetus. She needs to have a healthy diet so the developing fetus gets all of the nutrients it needs. If she takes in something harmful, like alcohol or drugs, it can harm the fetus.

■ FOLLOW-UP

4. Review the relationship between the structure and function in the male and female reproductive systems.

Review the class list that was generated at the beginning of the activity. Ask students if they agree with the statements that are written or if they would like to make any changes. This is an opportunity to discuss statements that were incorrect or partially correct.

Distribute Student Sheet HR.1, "Structures and Functions of the Human Reproductive System." Analysis Question 1 asks students to complete this table to compare the structure and functions of the male and female reproductive systems.

In Question 2, students can use the table they completed to compare the male and female reproductive systems. Questions 3, 4, and 5 ask students to review what happens during fertilization and pregnancy. Question 6 asks students to synthesize what they have learned about the placenta during pregnancy and make a recommendation to a pregnant woman about taking care of her health.

SUGGESTED ANSWERS TO QUESTIONS

1. Complete Student Sheet 57a.1, "Structures and Functions of the Human Reproductive System," by listing the organ or structure that matches each function or structure.

2. In what ways are the female and male reproductive systems similar? In what ways are they different?

Similarities:

- Both reproductive systems have a pair of structures that produce the sex hormones and the sex cells (ovaries for females and testes for males).
- The hormones produced by these structures are responsible for the sex characteristics such as a deep voice (in males) or wider hips (in females).
- They both have tubes that the sex cells travel through after they are produced or ripen (fallopian tubes for females and vas deferens for males).

Differences:

- Fertilized eggs can only grow inside the female so all of the structures necessary to support a developing fetus, such as a uterus and placenta, are only found in females.
- Most of a male's reproductive system is outside his body while most of the female's reproductive system is inside her body.
- A male produces sex cells from puberty until the end of his life, while a female is born with all of the sex cells she will ever have.

3. Describe the stages an egg goes through from fertilization to the birth of a baby.

An egg that has been released from an ovary travels through a fallopian tube. If there are sperm in the fallopian tube, they will likely become fertilized and then it is a zygote. Once the zygote embeds itself in the uterine wall, it is called an embryo. At the ninth week of pregnancy, it is called a fetus. At about the ninth month of development, the fetus is born, becoming a baby.

4. Describe the function of each of the following structures in the development of a fetus.
- Amniotic sac**
The amniotic sac is filled with liquid, to protect the embryo and later the fetus.
 - Placenta**
The placenta is the area between the umbilical cord and the uterus where the exchange of nutrients and wastes between the developing fetus and the mother takes place.
 - Umbilical cord**
The umbilical cord connects the fetus to the placenta, through which the developing fetus receives oxygen and nutrients and gets rid of wastes.
5. Imagine you are a doctor and one of your patients just found out she was pregnant. Knowing that anything she takes into her body can cross the placenta and affect the developing fetus, what will you recommend to her in order to have a healthy baby?
- Answers will vary but should include:
- Eat a healthy diet so the fetus gets all of the nutrients it needs.
 - Do not smoke, because cigarette smoke can cross the placenta and hurt the fetus.
 - Do not take drugs, because drugs can cross the placenta and hurt the fetus. Even many prescription drugs and over the counter drugs may hurt the fetus, so be sure to check with your doctor before you take anything.
 - Do not drink alcohol because alcohol can hurt the developing fetus.

Sample Responses to Student Sheet 57a.1, “Structures and Functions of the Human Reproductive System”

Structure or Function	Male Reproductive System	Female Reproductive System
Type of sex cell	<i>sperm</i>	<i>egg</i>
Where sex cells are produced/stored	<i>testes</i>	<i>ovaries</i>
Tube that sex cells travel through once they are produced	<i>Vas deferens</i>	<i>fallopian tubes</i>
Where sex cells exit the body	<i>penis</i>	<i>vagina</i>
Structure where the primary sex hormone is produced	<i>testes</i>	<i>ovaries</i>
Primary sex hormone produced	<i>testosterone</i>	<i>estrogen</i>
Where an egg is fertilized	—	<i>fallopian tube</i>
Where a fertilized egg will grow	—	<i>uterus</i>
Where the exchange of nutrients occurs between mother and developing fetus	—	<i>placenta</i>

Structures and Functions of the Human Reproductive System

Structure or Function	Male Reproductive System	Female Reproductive System
Type of sex cell		
Where sex cells are produced/stored		
Tube that sex cells travel through once they are produced		
Where sex cells exit the body		
Structure where the primary sex hormone is produced		
Primary sex hormone produced		
Where an egg is fertilized		
Where a fertilized egg will grow		
Where the exchange of nutrients occurs between mother and developing fetus		

Human Reproduction



All living things have the ability to reproduce offspring—this is how a species survives. Many species, including humans, reproduce by a process known as **sexual reproduction**. This means that offspring receive half of their genetic information from one parent and half of their genetic information from the other parent. This results in a unique individual, different from either parent. Other species reproduce by a process known as asexual reproduction. In asexual reproduction only one parent is needed and the offspring produced are identical to that single parent. In this activity you will read about sexual reproduction and the process that leads to the development of a human.



CHALLENGE

What are the structures involved in the process of human sexual reproduction?

MATERIALS

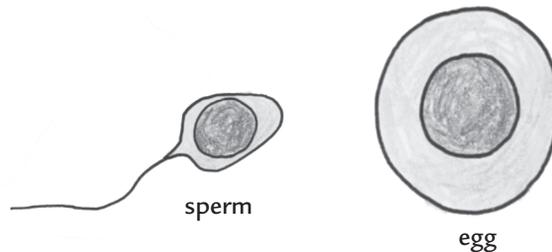


For each student

- 1 Student Sheet HR.1, “Structures and Functions of the Human Reproductive System”

READING

You began life as a single cell. A male sex cell, called a **sperm**, joined with a female sex cell, called an **egg**, during a process called **fertilization** (fur-tuh-lih-ZAY-shun). These sex cells contained half of the normal amount of information in a human body cell, so that when they combined, the full amount of information was present in the offspring. The new cell formed by fertilization, called a **zygote** (ZYE-goat), contained all of the information needed to grow into you—a complex organism made up of trillions of cells. All organisms that reproduce by the process of sexual reproduction begin life this way. Let's take a closer look at the organs of the human body that make this process possible.



STOPPING TO THINK 1

What is a zygote and how does it form?

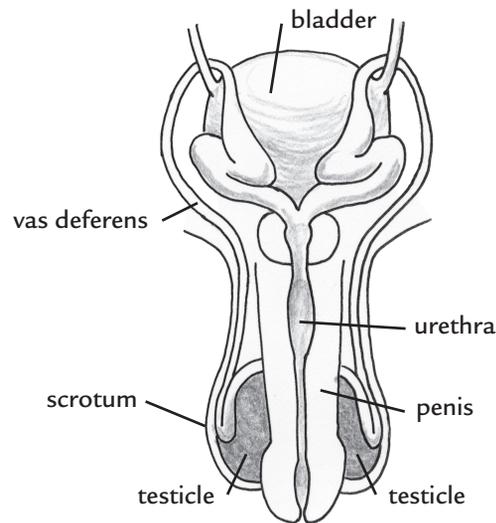
The Male Reproductive System

Males have two sex organs on the outside of their body, the **testes** (singular testis) and the **penis**. The testes contain clusters of tiny, coiled tubes which produce sperm and testosterone. The testes are contained in a sac called the scrotum. They are outside of the human body because sperm cannot develop properly at the normal body temperature of 98.6°F or 37°C. They must be kept about two degrees cooler in order to develop properly.

Once sperm are produced in the testes, they travel through one of two muscular tubes inside the body called the **vas deferens** (VASS deaf-uh-RENS). As sperm travel through this system of tubes, they mix with several fluids produced by the male reproductive system. This mixture of fluids is called **semen**. Besides providing a watery environment for

sperm, semen also contains nutrients for the sperm cells. There are 5 to 10 million sperm in a single drop of semen!

From these tubes the sperm-rich semen passes into the urethra within the penis. This is the same tube that urine travels through. However, when semen passes through the urethra, muscles near the bladder contract so semen and urine do not travel through the urethra at the same time. Finally, semen leaves the body through the opening of the penis.



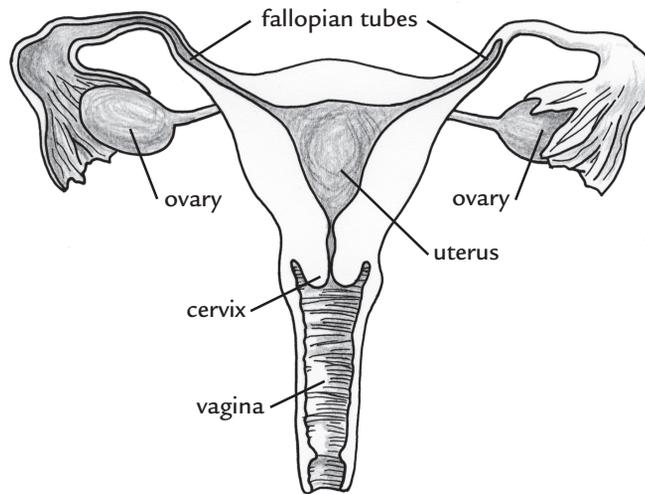
STOPPING TO THINK 2

- Use the diagram above [check layout], to describe the path of sperm from the testis to the outside of the male body.
 - What is the relationship between sperm and semen?
 - How do you think a high fever might affect sperm production? Explain.
-

Besides sperm, the testes produce the hormone testosterone. Although males produce testosterone before birth, they start producing greater quantities at the beginning of puberty, usually in the early teenage years. This hormone influences the development of a male before birth and is responsible for the physical characteristics in males such as facial hair, a deep voice and developed muscles.

The Female Reproductive System

Almost all of a female's sexual organs are located inside the body. Just as a male has a pair of testes, a female has a pair of **ovaries** (singular ovary). The **ovaries** contain the female sex cells (eggs) and produce the hormone estrogen. Ovaries are located in a female's abdomen as shown in the image below.



Once a male reaches puberty, the reproductive system will produce sperm almost continuously, until the end of his life. Females, however, are born with all of the potential eggs they will ever have—about 400,000. After puberty, one egg matures a month. This means that during a female's lifetime, only about 500 eggs will mature and be released from the ovaries.

When a mature egg is released from an ovary, it travels through one of the **fallopian tubes**, which are shown in the diagram above. If an egg meets sperm while in the fallopian tube, fertilization is likely to result. Although an egg may be surrounded by millions of sperm, only one sperm can successfully fertilize the egg. The egg continues through the fallopian tube until it reaches the uterus. The **uterus** (YEW-tur-uss) is a hollow, muscular organ that is normally smaller than an average size fist. The fertilized egg attaches to the wall of the uterus, where it continues to develop for nine months. During pregnancy, the uterus can stretch to the size of a basketball!

If an egg has not been fertilized, it starts to break down as it enters the uterus. The lining of the uterus, which has been thickening with blood and extra tissue to support the fertilized egg, also breaks down. The

unfertilized egg and extra tissue leave the uterus through an opening called the cervix. As they pass through the cervix, they enter the vagina, the outer opening of the female reproductive system, and leave the body. This process is called menstruation and generally lasts four to six days. The vagina is also called the birth canal because it is the path a baby travels through as it leaves the mother's body during childbirth.

STOPPING TO THINK 3

- a. Use the diagram above to describe the path of an egg from the ovary to the outside of the female body.
 - b. Look at the photograph of a sperm at the beginning of this reading. How does a sperm's structure help it get to the egg in the fallopian tube?
-

Besides eggs, the ovaries produce the hormone estrogen. Although estrogen, like testosterone in males, is produced before birth, it is produced in greater quantities starting at the beginning of puberty, usually in the pre-teen years. This hormone influences the development of a female before birth and is responsible for the female physical characteristics such as breasts and wider hips.

From Fertilized Egg to Birth

The fertilized egg, called a **zygote**, is very small, about the size of the period at the end of this sentence. At the moment of fertilization, it is only one cell but it begins dividing immediately. Approximately four days later, it reaches the uterus and attaches itself to the lining of the uterus. It is now a tiny ball made of hundreds of cells and is called an **embryo** (EM-bree-oh).

A structure called the amniotic sac forms around the developing embryo. It is filled with fluid and protects the embryo during the next nine months. The amniotic sac is attached to the uterus by another struc-



ture called the placenta. A ropelike cord called the umbilical cord forms between the placenta and the developing fetus. You still have a scar from your umbilical cord—it is your belly button!

In the placenta, blood vessels from the developing fetus are very close to the blood vessels of the mother. Although the circulatory systems of the mother and the fetus do not mix, the blood vessels are close enough that nutrients, oxygen, and other chemicals can pass from the mother's blood vessels to the fetus's blood vessels. This is why it is extremely important that pregnant women are careful to eat healthy foods and not smoke, drink alcohol, or take any drugs, because these substances can be transferred from the mother's blood to the fetus's blood and they might harm the developing fetus. Chemicals, mostly wastes, also pass from the fetus to the mother through the placenta.

STOPPING TO THINK 4

- a. What is the difference between a zygote and an embryo?
 - b. Why is it important for a mother to take good care of herself when she is pregnant?
-

When an embryo has been developing for nine weeks, it is a little bigger than your thumbnail, but you would recognize it as a developing human. Most of the internal organs have formed. At this point, it is called a **fetus** (FEE-tuss).

Tissues in the fetus continue to develop. Between four and six months, bones can be seen on an X-ray, a heartbeat can be heard with a stethoscope, and the developing fetus begins to move and kick. Between six and nine months, the brain develops grooves and the lungs develop so that the newborn baby will be able to breathe. This is also the time when the developing fetus gains the most weight. When the fetus is at about nine months of development, it will undergo another event in development, birth. The amniotic sac surrounding the fetus breaks and the fetus moves through the vagina, or birth canal. After leaving the warm, watery environment of the uterus and amniotic sac, the newborn baby will take its first breaths.

ANALYSIS

1. Complete Student Sheet HR.1, “Structures and Functions of the Human Reproductive System,” by listing the organ or structure that matches each function or structure.
2. In what ways are the female and male reproductive systems similar? In what ways are they different?
3. Describe the stages an egg goes through from fertilization to the birth of a baby.
4. Describe the function of each of the following structures in the development of a fetus
 - a. Amniotic sac
 - b. Placenta
 - c. Umbilical cord
5. Imagine you are a doctor and one of your patients just found out she is pregnant. Knowing that anything she takes into her body can cross the placenta and affect the developing fetus, what will you recommend to her in order to have a healthy baby?



EXTENSION

Learn more about the human reproductive system by visiting the *Issues and Life Science* page of the SEPUP website.