22.2: Introduction to the Reproductive System

It's All about Sex

A tiny sperm from dad breaks through the surface of a huge egg from mom. Voilà! In nine months, a new son or daughter will be born. Like most other multicellular organisms, human beings reproduce sexually. In human sexual reproduction, males produce sperm and females produce eggs, and a new offspring forms when a sperm unites with an egg. How do sperm and eggs form? And how do they arrive together at the right place and time so they can unite to form a new offspring? These are functions of the reproductive system.

What Is the Reproductive System?

The reproductive system is the human organ system responsible for the production and fertilization of gametes (sperm or eggs) and, in females, the carrying of a fetus. Both male and female reproductive systems have organs called gonads that produce gametes. A gamete is a haploid cell that combines with another haploid gamete during fertilization.
fertilization, forming a single diploid cell called a zygote. Besides producing gametes, the gonads also produce sex hormones. **Sex hormones** are endocrine hormones that control the development of sex organs before birth, sexual maturation at puberty, and reproduction once sexual maturation has occurred. Other reproductive system organs have various functions, such as maturing gametes, delivering gametes to the site of fertilization, and providing an environment for the development and growth of an offspring.

**Sex Differences in the Reproductive System**

The reproductive system is the only human organ system that is significantly different between males and females. Embryonic structures that will develop into the reproductive system start out the same in males and females, but by birth, the reproductive systems have differentiated. How does this happen?

**Sex Differentiation**

Starting around the seventh week after conception in genetically male (XY) embryos, a gene called SRY on the Y chromosome (shown in the figure below) initiates the production of multiple proteins. These proteins cause undifferentiated gonadal tissue to develop into male gonads (testes). The male gonads then secrete hormones — including the male sex hormone testosterone — that trigger other changes in the developing offspring (now called a fetus), causing it to develop a complete male reproductive system. Without a Y chromosome, an embryo will develop female gonads (ovaries) that will produce the female sex hormone estrogen. Estrogen, in turn, will lead to the formation of the other organs of a normal female reproductive system.

Figure \(\PageIndex{2}\): The SRY gene on the short arm of the Y chromosome causes the undifferentiated gonads of an embryo to develop into testes. Otherwise, the gonads develop into ovaries. (CC BY-NC 3.0; National Center for Biotechnology Information)

**Homologous Structures**

Undifferentiated embryonic tissues develop into different structures in male and female fetuses. Structures that arise from the same tissues in males and females are called **homologous structures**. The male testes and female ovaries, for example, are homologous structures that develop from the undifferentiated gonads of the embryo. Likewise, the male penis and female clitoris are homologous structures that develop from the same embryonic tissues.
Sex Hormones and Maturation

Male and female reproductive systems are different at birth, but they are immature and incapable of producing gametes or sex hormones. Maturation of the reproductive system occurs during puberty when hormones from the hypothalamus and pituitary gland stimulate the testes or ovaries to start producing sex hormones again. The main sex hormones are testosterone in males and estrogen in females. Sex hormones, in turn, lead to the growth and maturation of the reproductive organs, rapid body growth, and the development of secondary sex characteristics, such as hair in males and breasts in females.

Male Reproductive System

![The main organs of the male reproductive system](https://bio.libretexts.org/Bookshelves/Human_Biology/Book%3A_Human_Biology_(Wakim_and_Grewal)/22%3A_Reproductiv…)

The main structures of the male reproductive system are external to the body and illustrated in the figure below. The two testes (singular, testis) hang between the thighs in a sac of skin called the scrotum. The testes produce both sperm and testosterone. Resting atop each testis is a coiled structure called the epididymis (plural, epididymides). The function of the epididymides is to mature and store sperm. The penis is a tubular organ that contains the urethra and has the ability to stiffen during sexual arousal. Sperm passes out of the body through the urethra during a sexual climax (orgasm). This release of sperm is called ejaculation.

In addition to these organs, the male reproductive system consists of several ducts and glands that are internal to the body. The ducts, which include the vas deferens (also called the ductus deferens), transport sperm from the epididymis to the urethra. The glands, which include the prostate gland and seminal vesicles, produce fluids that become part of semen. Semen is the fluid that carries sperm through the urethra and out of the body. It contains substances that control pH and provide sperm with nutrients for energy.
Female Reproductive System

The main structures of the female reproductive system are internal to the body and shown in the following figure. They include the paired ovaries, which are small, ovoid structures that produce eggs and secrete estrogen. The two Fallopian tubes start near the ovaries and end at the uterus. Their function is to transport eggs from the ovaries to the uterus. If an egg is fertilized, it usually occurs while it is traveling through a Fallopian tube. The uterus is a pear-shaped muscular organ that functions to carry a fetus until birth. It can expand greatly to accommodate a growing fetus, and its muscular walls can contract forcefully during labor to push the baby out of the uterus and into the vagina. The vagina is a tubular tract connecting the uterus to the outside of the body. The vagina is where sperm are usually deposited during sexual intercourse and ejaculation. The vagina is also called the birth canal because a baby travels through the vagina to leave the body during birth.

The external structures of the female reproductive system are referred to collectively as the vulva. They include the clitoris, which is homologous to the male penis. They also include two pairs of labia (singular, labium), which surround and protect the openings of the urethra and vagina.

Summary

- The reproductive system is the human organ system responsible for the production and fertilization of gametes and, in females, the carrying of a fetus.
- Both male and female reproductive systems have organs called gonads (testes in males, ovaries in females) that produce gametes (sperm or eggs) and sex hormones (such as testosterone in males and estrogen in females). Sex hormones are endocrine hormones that control the prenatal development of reproductive organs, sexual maturation at puberty, and reproduction after puberty.
- The reproductive system is the only organ system that is significantly different between males and females. A Y-chromosome gene called SRY is responsible for undifferentiated embryonic tissues developing into a male reproductive system. Without a Y chromosome, the undifferentiated embryonic tissues develop into a female reproductive system.
• Male reproductive system organs include the testes, epididymis, penis, vas deferens, prostate gland, and seminal vesicles.

• Female reproductive system organs include the ovaries, Fallopian tubes, uterus, vagina, clitoris, and labia.

Review

1. What is the reproductive system?

2. Define gonad.

3. What are sex hormones? What are their general functions?

4. Distinguish between male and female sex hormones.

5. How does the differentiation of the reproductive system occur in males and females?

6. In the context of the human male and female reproductive systems, what are homologous structures?

7. When and how does the human reproductive system mature?

8. List organs of the male reproductive system.

9. List organs of the female reproductive system.

10. Female gametes are called ________ and male gametes are called ________.

11. True or False: The vagina is the homologous structure to the penis.

12. True or False: In the absence of a Y chromosome in humans, ovaries will develop.

13. Which are secondary sex characteristics?

   A. Fallopian tubes
   B. ovaries
   C. breasts
   D. all of the above

14. Fertilization usually occurs in the _________________.

   A. ovary
   B. Fallopian tube
   C. uterus
People's sense of gender identity does not always match their anatomy. Some people do not identify as either male or female, and instead, they identify as non-binary, or genderqueer. Others may identify as a gender that is the opposite of what is typically associated with their chromosomes or reproductive organs. These people are called transgender, and they may choose to transition to the opposite gender, a process which may or may not involve physical modifications. Watch the video below to learn about the use of hormones in gender transitioning.

Sex determination may be more complicated than originally thought. Check out this video to learn more: