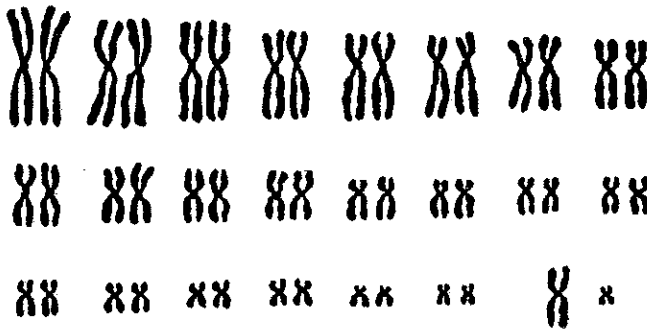


How is sex determined?

Objective ▶ Explain how chromosomes in a sperm cell determine the sex of offspring.

X and Y All human traits are determined by 23 pairs of chromosomes. Look at the 23 pairs of chromosomes below.



Do you see the difference between the two chromosomes in pair 23? In the male, the chromosomes of this pair are not alike. These different chromosomes are called X and Y. Male cells have one X chromosome and one Y chromosome. Female cells have two X chromosomes. The X and Y chromosomes determine the sex of an organism.

▶ **Identify:** Which chromosomes determine sex?

Sperm Cells Male cells have an XY pair of chromosomes. During meiosis, each sperm cell receives only one chromosome from each pair. One-half of the sperm cells receive an X chromosome. The other half receive a Y chromosome. Every sperm contains either an X or a Y chromosome.

▶ **Explain:** Why do some sperm cells have an X chromosome while other sperm cells have a Y chromosome?

Egg Cells Female egg cells have an XX pair of chromosomes. During meiosis, each egg cell re-

ceives one chromosome from each pair of chromosomes. Therefore, each egg cell receives one X chromosome. All egg cells contain X chromosomes.

▶ **Relate:** Why do egg cells contain only one X chromosome?

Sex of Offspring The sex of offspring is controlled by chromosomes in male sperm cells. As a result, all children inherit their sex from their fathers. During fertilization, if the egg cell is fertilized by a sperm cell carrying an X chromosome, the fertilized egg will have two X chromosomes (XX). It will develop into a female. If the sperm is carrying a Y chromosome, the zygote will have one X chromosome and one Y chromosome (XY). It will develop into a male. Half the sperm cells carry the X chromosome. The other half carry the Y chromosome. Therefore, over a large number of births, half will be female and half will be male.

$X + X \rightarrow$



$X + Y \rightarrow$



▶ **Identify:** Which parent is responsible for the sex of the offspring?

LESSON SUMMARY

- ▶ Male cells are XY, while female cells are XX.
- ▶ Each sperm cell has either an X or a Y chromosome.
- ▶ Each egg cell always has one X chromosome.
- ▶ When a sperm cell fertilizes an egg cell, the zygote becomes a female if it is XX or a male if it is XY.

CHECK Write true if the statement is true. If the statement is false, change the underlined term to make the statement true.

1. The sex of offspring is controlled by chromosomes in the female.
2. A female cell contains two X chromosomes.
3. An egg cell can contain either an X or a Y chromosome.
4. A zygote that has two X chromosomes will develop into a male.
5. A zygote that has an X and a Y chromosome will develop into a male.

APPLY Answer the following.

6. **Hypothesize:** Which are more alike, sperm cells or egg cells?

7. **Calculate:** Last year, 250 babies were born at a certain hospital. Estimate the number of males born there during the year. Enter your answer.

InfoSearch

Read the passage. Ask two questions that you cannot answer from the information in the passage.

Sex Chromosomes In birds, moths, butterflies, and some fish, the sex chromosomes are the reverse of human sex chromosomes. In these animals, the male has two identical (XX) chromosomes, and the female has two different ones (XY). In these animals, it is the egg cell, not the sperm cell, that determines the sex of the offspring.

SEARCH: Use library references to find answers to your questions.



TECHNOLOGY AND SOCIETY

AMNIOCENTESIS

Amniocentesis (am-nee-oh-sen-TEE-sis) is a test performed during a woman's pregnancy. The test involves inserting a needle through the woman's abdomen and into her uterus. Some of the amniotic fluid that surrounds the fetus is removed through the needle. The amniotic fluid contains cells that have been shed by the fetus. Doctors can learn about fetal chromosomes and enzyme levels by studying the cell cultures.

More than 175 different genetic disorders can be identified by amniocentesis. In addition, the test reveals the sex of the fetus. This knowledge is important when looking for inherited diseases that are passed to one sex only. Amniocentesis usually is recommended for pregnant women who are 35 or older. Women over 35 have the greatest risk of having a baby with an abnormal number of chromosomes. Down's syndrome is one genetic disorder that is caused by an abnormal number of chromosomes. Almost half of the babies born with Down's syndrome have mothers who are over 35 years old.

