

Using Punnett Squares to follow the Inheritance of Sex

Prerequisites: Monohybrid Cross and an understanding of sex determination in humans

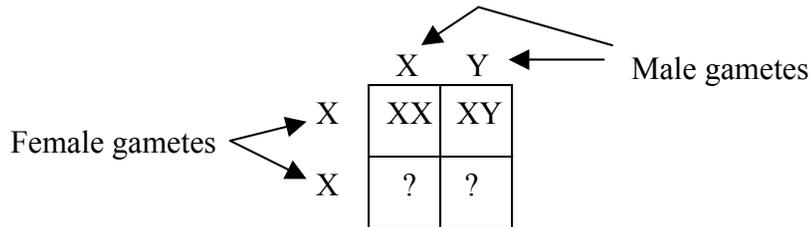
Remember from the last unit how sex is determined in humans? When a sperm meets an egg, they each have one copy of all of the chromosomes (they are haploid). After they fuse, the fertilized egg (zygote) has two copies of each chromosome and is now diploid.

There is one pair of chromosomes that determines whether the resulting baby is a boy or girl. Because of their role in determining the sex of a baby, these two chromosomes are called sex chromosomes. There are two variations of the sex chromosome: the X chromosome which is a large, full-sized chromosome; and the Y chromosome, which is a runty little chromosome. If the zygote ended up with two X chromosomes, then the resulting baby would be a girl. If the zygote ended up with an X and a Y, this XY individual would be a boy.

Jog your brain some more... Guys are XY and girls are XX. So what kinds of gametes (sperm) can a male make? What kinds of eggs can a female make? So which person, the man or the woman, “determines” the sex of their children?

Problem: Show how sex is inherited using a Punnett Square.

- A female’s sex chromosomes are XX. Therefore, when she produces gametes (eggs), each gamete will have one X chromosome.
- A male’s sex chromosomes are XY. Therefore, when he produces gametes (sperms), half of the gametes will have one X chromosome and the other half will have one Y chromosome.



What do you get when you fill in the bottom row of this Punnett Square? If you do it correctly, you’ll get the same as the top row – one XX zygote and one XY zygote.

Try this: By using a Punnett Square, show why we expect an equal number of boy babies and girl babies to be conceived. Explain your answer.

Answer: The male is XY so male gametes are X and Y. The female is XX, so female gametes are X and X.

	X	Y
X	XX	XY
X	XX	XY

From looking at the Punnett Square, you see that 2 out of 4 zygotes are genotype XY. Genotype XY are males. Therefore, 2/4 or 50% are boys.

Similarly, 2/4 zygotes have the XX genotype and are female. Therefore, we see that the number of boys conceived equals the number of girls conceived.

What about other organisms?

Many organisms determine gender by the same XX / XY system that humans do. For example, the common fruit fly (*Drosophila melanogaster*), which is used a great deal in genetic research, has the same method of gender determination as humans.

It should also be noted, however, that not all organisms determine gender the way humans do! There are many types of organisms that have different means of determining gender such as birds, butterflies, and bees. Later on in this unit you may learn about other types of sex determination.