

CONCEPT 5

Some inherited traits are due to alleles on the sex chromosomes.

Activity

Colour Perception

Some people's perception of colour differs from other people. One form of colour vision deficiency involves difficulty distinguishing between the colours red and green. Your teacher may provide a red-green colour vision deficiency test or data from such a test. Based on the data, what conclusions about the pattern of inheritance for red-green colour vision deficiency can you make?



sex-linked trait a trait controlled by genes on sex chromosomes

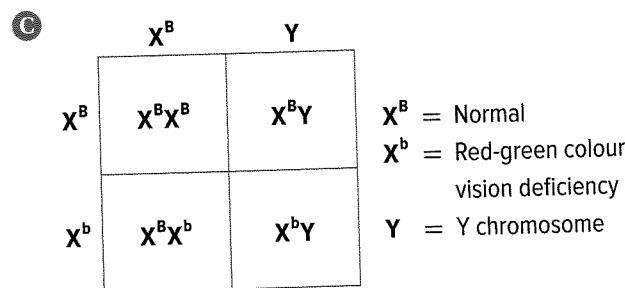
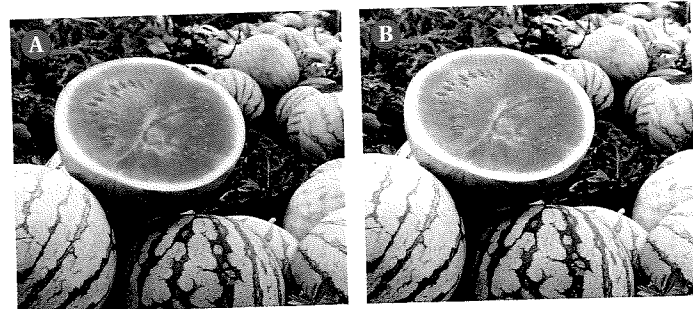
Traits controlled by genes located on the sex chromosomes are called **sex-linked traits**. Traits controlled by genes on the X chromosome are called **X-linked traits**. Because genetic males have only one X chromosome, they are affected by recessive X-linked traits more often than are genetic females. Females are less likely to express a recessive X-linked trait, because the other X chromosome may mask the effect of the trait.

Red-Green Colour Vision Deficiency

Figure 1.20 As an X-linked trait, colour vision deficiency occurs more often in males than in females. **A** A person who is not colour vision deficient can see all colours. **B** People with red-green colour vision deficiency view red and green as shades of grey. **C** The Punnett square shows how the sex-linked trait is inherited.

The trait for red-green colour vision deficiency is a recessive X-linked trait. **Figures 1.20A and 1.20B** show how a person with red-green colour vision deficiency might view colours compared to a person who does not.

Use the Punnett square in **Figure 1.20C** to study colour vision deficiency further. The mother is a *carrier* for the trait, because she has the recessive allele on one of her X chromosomes. The father is not colour vision deficient, because he does not have the recessive allele. Notice that the only offspring that can have red-green colour vision deficiency is a male child. As a result of it being an X-linked trait, red-green colour vision deficiency is very rare in females.



Before you leave this page . . .

1. What are sex-linked traits?
2. Use vocabulary terms to describe the genotype of a male who is red-green colour vision deficient.

AT ISSUE

Hemophilia

What's the Issue?

One way to examine how a trait is inherited in different generations is to use a pedigree. A *pedigree* is a type of flowchart that uses symbols to show patterns of relationships and traits in a family over many generations. The well-studied pedigree shown below represents the family of Queen Victoria of England, who lived from 1819–1901. Her son Leopold died of hemophilia. *Hemophilia* is a recessive X-linked disorder. Blood does not clot properly in people with hemophilia. As a result, they may bleed to death if they are cut or injured.

Use the pedigree to determine whether Alice—the daughter of Leopold, Duke of Albany—had hemophilia, was a carrier, or did not have the illness. Genetic females are carriers of a recessive sex-linked disorder if they inherit the allele for the disorder on one X chromosome.

Dig Deeper

Collaborate with your classmates to explore one or more of these questions—or generate your own questions to explore.

1. Use a Punnett square to determine whether Alice (the daughter of Leopold, Duke of Albany) had hemophilia, was a carrier, or did not have the illness. (Hint: What is Alice's genotype?)
2. If Alice had a son with hemophilia, would that change or confirm your decision? Explain why. (Assume the father did not have hemophilia.)

